PNWD-3239
WTP-RPT-024, Rev 0

Radiation Stability Testing of SuperLig®639 and SuperLig®644 Resins

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Prepared for Bechtel National Inc.
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Test specification: TSP-W375-00-00009, Rev. 1
Test plan: TP-RPP-WTP-021, Rev. 0
Test exceptions: 24590-WTP-TEF-RT-02-044
R&T focus area: Pretreatment
Test Scoping Statement(s): B-51 and B-52

Battelle, Pacific Northwest Division
Richland, Washington 99352

Completeness of Testing

This report describes the results of work and testing specified by TSP-W375-00-00009, Rev. 1 and TP-RPP-WTP-021, Rev. 0. The work and any associated testing followed the quality assurance requirements outlined in the Test Specification/Plan. The descriptions provided in this test report are an accurate account of both the conduct of the work and the data collected. Test plan results are reported. Also reported are any unusual or anomalous occurrences that are different from expected results. The test results and this report have been reviewed and verified.

Approved:

_____ _____

Gordon H. Beeman, Manager Date
WTP R&T Support Project

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G. Todd Wright, Manager Date
Research and Technology

Summary

Battelle, Pacific Northwest Division (PNWD) is contracted to Bechtel National Inc. (BNI) on the River Protection Project – Waste Treatment Plant (RPP-WTP) project to perform research and development activities. Unit operations of the WTP process include the separation of ^{137}Cs and ^{99}Tc by ion exchange from the liquid portion of the waste. SuperLig® 644 (SL-644) and SuperLig® 639 (SL-639) ion exchange resins were selected by the project to perform ^{137}Cs and ^{99}Tc separations, respectively.

Objectives

The RPP-WTP is evaluating the cesium (SL-644) and technetium (SL-639) resins to determine their replacement frequency and the potential formation of hazardous or regulated organic compounds for flowsheet development and spent resin disposal requirements, respectively. This investigation was conducted according to the test plan prepared by Blanchard (2001) in response to the test requirements to investigate ion exchange resin degradation delineated by Barnes et al. (2002) in Section 3.7.2.3 of the Research and Technology Plan and Johnson (2000) and test scoping statements B-51 and B-52. Objectives were:

- Perform irradiation experiment from 0 to 10^8 R with the following combinations of resin and solutions.
  - SL-639/simulated AN-105 low activity waste (LAW) (mimic column feeding)
  - SL-639/water (mimic elution)
  - SL-644/simulated AN-105 LAW (mimic column feeding)
  - SL-644/0.5 M nitric acid (mimic elution)
  - SL-644/inert gas (reference test; irradiated to 10^8R)
  - No resin/simulated AN-105 LAW (reference test)
  - SL-644/AN-105 simulated AN-105 LAW at increased liquid-to-resin phase ratio
  - SL-644/AN-105 simulated AN-105 LAW at 7E+08 R (expected complete degradation of resin)

- Determine the decrease in resin capacity as a function of radiation dose and contact solution by measuring batch-distribution coefficients of the irradiated and control resin samples.

- Determine the quantity and generation rate, and identify gaseous and volatile organic compounds evolved during irradiation tests

- Determine the concentration of semi-volatile organic compounds present in the liquid phase present after sample irradiation

- Qualify the corrosion of stainless steel vessels used in 1E+08 R irradiation tests

All objectives were satisfied. Test exception 24590-WTP-TEF-RT-02-044 deleted the analysis for formate. In previous tests by Oji and McCabe (2000), formate was observed to behave very similarly to oxalate and the total organic carbon content and, therefore, was not expected to provide any additional information about the degradation mechanism of SL-644. Formate is not on the Characteristic or Listed Waste lists of compounds that must be determined in the spent resin for land disposal restriction (LDR)

compliance. Therefore, formate analysis was deleted from the scope to expedite schedule and avoid extra cost.

Conduct of Testing

Approximately 4-mL samples of SL-639 and SL-644 ion exchange resins were heated and irradiated immersed in simulated AN-105 LAW or their respective elution reagents (0.5 M nitric acid or water) sealed in stainless steel reaction vessels. The vessels were connected to a gas manifold, and off-gas sampling facilitated identification and quantification of off-gases. Heating the vessels using heating tape wrapped around the vessels enabled the effect of temperature to be assessed. Irradiation of the samples was undertaken by exposing the reaction vessels to a ^{60}Co source delivering a dose rate of 5.5×10^5R/h.

The resin and associated liquids were removed from the vessels and visually examined after irradiation. Batch-contact experiments were then performed on selected samples to determine the ion exchange capacities. The liquids were chemically analyzed to quantify anions, carbon, and semi-volatile and volatile organic compounds.

Results and Performance Against Objectives

A visual inspection of the irradiated and heated SL-644 and SL-639 resins showed no significant agglomeration.

The SL-644 dissolved in the simulated LAW with the rate increasing with increasing dose and temperature. However, irradiation had no significant impact on the dissolution rate when the SL-644 was immersed in 0.5 M HNO_3, although it did increase with increasing temperature at constant dose. There appeared to be only a small effect of dose on the SL-639 resin dissolution rate and no discernible impact from temperature in either simulated LAW or water.

Visual inspection of the reaction vessels did not indicate any corrosion for either SL-644 or SL-639.

The separation performance of the irradiated resins was assessed by determining the batch-equilibrium coefficients. No change in the SL-639 Tc batch-equilibrium coefficient was observed until it was exposed to doses of greater than 10^7 R, and the changes were relatively minor even up to 10^8 R. This result is similar to that reported in the previous radiolysis study by Oji (1997).

An appreciable reduction in the Cs batch-equilibrium coefficient of SL-644 was observed after doses of 10^6 R were attained; with the batch-equilibrium coefficient decreasing by ~ 70% by the time a total dose of 10^8 R was delivered. Brown et al (1995) and Oji (2000) observed insignificant and 30% reductions in the batch equilibrium coefficients at a dose of 10^8 R, respectively. Therefore, the resin batch tested in this work appears to be less stable to irradiation than previous tested batches up to 10^8 R. However, there were differences in the experimental methods that may contribute to the discrepancies. For example, Brown et al (1995) irradiated their resins immersed in Envelope B LAW at a dose rate of 1.6×10^6 R/h and used the same simulated LAW in performing the batch contacts.

Nitrogen, oxygen, and carbon dioxide were the major constituents in the gas evolved from only heating the resins and matrices. These gases were probably associated with air in-leakage during sampling and

displacement from the resin. The absence of oxygen in the off-gas from heating SL-644 further confirms that it is consumed in oxidizing the resin. Nitrous oxide and hydrocarbons also became significant at high temperatures, perhaps indicating thermal breakdown of the resins. Water radiolysis probably accounted for hydrogen generally becoming the major constituent when the resins and matrices were irradiated with oxygen being consumed in oxidizing the resins or organic degradation products. The concentrations of carbon dioxide and hydrocarbons increased with increasing dose to both resins, confirming that irradiation increased the resin dissolution rate. The rate of gas generation from SL-644 generally exhibited greater temperature dependence, and there was greater temperature dependence on rates when the resin was immersed in simulated LAW. The G-values suggest that the radiolytic gas-generation rates were greater for SL-639 than SL-644 and lower when the SL-639 resin was immersed in LAW.

Concentrations of benzene, toluene and xylene VOCs positively identified in the gases generated from the SL-639 resin increased with increasing temperature but there was no trend with dose. Silane methyl, propanal, propene and benzene VOCs were tentatively identified.

As for SL-639, concentrations of benzene compounds, toluene, xylenes and 1,2-dichloropropane positively identified in the gases generated from SL-644 increased with increasing temperature but there were again no trends with dose. In contrast, concentrations of butane, pentane, propanal and propanol VOCs tentatively identified generally increased with increasing dose but there was no trend with temperature.

Phenol and phthalate compounds were the semi-volatile organic compounds positively identified in the liquids in contact with both resins. However, these compounds were most likely contaminants since phthalate compounds are used in a variety of plastics and tend to be ubiquitous while the phenol compounds were only detected at trace concentrations.

A number of organic compounds of regulatory concern were targeted for identification in the liquids and gases. No semi-volatile organic compounds of regulatory concern were positively detected in the liquids in which the resins were immersed. However, the volatile organic compounds benzene, toluene and xylene of regulatory concern were positively identified in the gases generated in both SL-644 and SL-639 tests at concentrations above land disposal restriction standards. Carbon disulfide, acetone and methyl isobutyl ketone were also tentatively identified although the latter two were also identified in the liquids alone and at concentrations below land disposal restriction standards.

There generally appeared to be no impact of dose on the SO_4^-, PO_4^-, Cl^- or F^- concentrations in the simulated LAW in contact with SL-644 at 25°C. The oxalate concentration appeared to increase with increasing dose perhaps because it was a product from radiolytic degradation of the resin or organic compounds in the simulated LAW. Hydroxide and NO_3^- anions were increasingly consumed with increasing dose while the NO_2^- anion was generated especially at doses greater than 10^8 R. Both the organic and inorganic carbon concentrations increased with increasing dose. Irradiation appeared to increase the dissolution rate of the resin evident from the reduction in resin mass and the increase in organic carbon in solution. The organic compounds were apparently oxidized to CO_2 that either evolved as gas or dissolved as carbonate, as indicated by the increase in inorganic carbon concentration.

A preliminary analysis was performed to estimate the resin service life based on radiolytic degradation only (i.e. chemical degradation was not considered). Note that this analysis is conservative because it

uses results from the batch irradiation tests in which reactive radiolytic products would have accumulated. In contrast, such products would be continuously extracted in a column system leading to a lower degradation rate. To facilitate the analysis, a model was developed to calculate the radiation dose to ion exchange resin beds of 1 m diameter and height using the MCNP™ Monte Carlo radiation transport code described by Briesmeister (2000) and considered the bed in cross-sectional slices. The calculations were based on operating assumptions typical of those expected in the WTP.

The SL-639 resin was calculated to become exposed to a dose of 2.77×10^4 R every cycle from processing envelope A LAW containing ^{99}Tc at a concentration of 64 μCi/L for 170 hours (the maximum duration assumed by Olson (2001a)) through a bed 1 m diameter and 1 m high. A dose of 3.42×10^4 R every cycle was calculated when processing envelope B LAW containing ^{99}Tc at a concentration of 375 μCi/L for 210 hours (the maximum duration assumed by Olson (2001a). The resin was assumed to receive no dose when the bed was in the second and lag positions. On the basis of the results from this report, the resin would only begin to show signs of deterioration in performance after 10,700 or 8,770 cycles processing envelope A or B LAW, respectively. Therefore, the resin replacement frequency is projected to be much lower than the current assumption of 10 cycles.

The SL-644 resin was calculated to become exposed to a dose of 2.05×10^6 R every cycle from processing envelope A LAW containing ^{137}Cs at a concentration of 180 mCi/L for 66 hours (the maximum duration assumed by Olson (2001b)) through a bed 1 m diameter and 1 m high. A dose of 5.56×10^6 R every cycle was calculated when processing envelope B LAW containing ^{137}Cs at a concentration of 2 Ci/L for 40 hours (the maximum duration assumed by Olson (2001b). The resin was assumed to receive no dose when the bed was in the lag and polishing positions. On this basis for the tested batch of resin, a resin bed in the WTP would require replacement every 75 and 28 cycles assuming it processes envelope A and B LAW, respectively, until complete loss of capacity. The current design basis assumes a bed is replaced every 10 cycles and so is broadly consistent with these test results.

In general under conditions applicable to normal WTP operations, the resins are most unstable when immersed in LAW so their contact with the waste should be minimized to maximize their useful operating life.

Quality Requirements

PNWD implemented the RPP-WTP quality requirements in a quality assurance project plan (QAPjP) as approved by the RPP-WTP quality assurance (QA) organization. Test preparation activities and monitoring of the first 6 of the 66 irradiation tests were conducted in accordance with PNWD's quality assurance project plan, CHG-QAPjP, Rev.0, which invoked PNWD's Standards Based Management System (SBMS), compliant with DOE Order 414.1A Quality Assurance and 10 CFR 830, Energy/Nuclear Safety Management, Subpart A -- Quality Assurance Requirements. Due to a change in the contract QA requirements, the remainder of the irradiation tests, batch contacts, and analytical activities were conducted in accordance with PNWD's quality assurance project plan, RPP-WTP-QAPjP, Rev.0, which invoked NQA-1-1989 Part I, Basic and Supplementary Requirements, and NQA-2a-1990, Subpart 2.7. These quality requirements were implemented through PNWD's Waste Treatment Plant Support Project Quality Assurance Requirements and Description Manual (WTPSP).

PNWD addressed verification activities by conducting an Independent Technical Review of the final data report in accordance with procedure QA-RPP-WTP-604. This review verified that the reported results were traceable, that inferences and conclusions were soundly based, and the reported work satisfied the Test Plan objectives. The review procedure is part of PNWD's WTPSP Manual.

Issues

None.

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Acronyms, Abbreviations, and Definitions

BNI	Bechtel National, Inc.
BV	Bed volume
DI	De-ionized
HLW	High level waste
IC	Ion chromatography
LAW	Low activity waste
LDR	Land disposal restriction
LSC	Liquid scintillation counting
PIVOC	Positively identified volatile organic compound
PNWD	Pacific Northwest Division
QA	Quality Assurance
QAPjP	Quality Assurance Project Plan
RPP-WTP	River Protection Project – Waste Treatment Plant
SBMS	Standards Based Management System
SD	Standard deviation
SL	SuperLig®
SRTC	Savannah River Technology Center
SVOC	Semi-volatile organic compound
TIVOC	Tentatively identified volatile organic compound
VOC	Volatile organic compound
WTPSP	Waste Treatment Plant Support Project Quality Assurance Requirements and Description Manual

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1.0 Introduction

1.1 Background

Battelle, Pacific Northwest Division (PNWD) is contracted to Bechtel National Inc. (BNI) on the River Protection Project – Waste Treatment Plant (RPP-WTP) project to perform research and development activities. The purpose of the RPP-WTP project is to design, construct, and commission a plant to treat and immobilize high level waste (HLW) and low activity waste (LAW) stored in underground storage tanks at the Hanford Site. Unit operations of the LAW treatment process include the separation of ^{137}Cs and ^{99}Tc by ion exchange from the liquid portion of the waste. SuperLig® 644 (SL-644) and SuperLig® 639 (SL-639) ion exchange resins were selected by the project to perform ^{137}Cs and ^{99}Tc separations, respectively, and are available from IBC Advanced Technologies, Inc., American Fork, UT. PNWD and the Savannah River Technology Center (SRTC) have tested these resins with actual waste and have shown that they satisfy the performance criteria delineated by the RPP-WTP project.

The deterioration in performance of an ion exchange resin over repeated cycles of waste processing and elution is an important characteristic required for design and operational purposes. The rate of deterioration will determine the useful life of the resin and thereby the rate of its consumption and the quantity of spent resin for disposal. Performance deterioration is directly attributable to the changes in the resin structure caused by chemical and radiolytic attack. The radiolytic degradation of the SL-639 and SL-644 resins was investigated in a parallel suite of tests.

1.2 Objectives

The RPP-WTP is evaluating the cesium (SuperLig® 644) and technetium (SuperLig® 639) resins to determine replacement frequency and the potential formation of hazardous/regulated gaseous compounds for flowsheet development and spent resin disposal requirements, respectively. This investigation was conducted according to the test plan prepared by Blanchard (2001) in response to the test requirements to investigate ion exchange resin degradation delineated by Johnson (2000) and Barnes et al. (2002) in Section 3.7.2.3 of the Research and Technology Plan and test scoping statements B-51 and B-52. Objectives were:

- Perform irradiation experiment from 0 to 10^8 R with the following combinations of resin and solutions.
  - SL-639/simulated LAW (mimic column feeding)
  - SL-639/water (mimic elution)
  - SL-644/simulated LAW (mimic column feeding)
  - SL-644/0.5 M nitric acid (mimic elution)
  - SL-644/inert gas (reference test; irradiated to 10^8 R)
  - No resin/simulated LAW (reference test)
  - SL-644/simulated LAW at increased liquid to resin phase ratio
  - SL-644/simulated LAW at 7×10^8 R (expected complete degradation of resin)

- Determine the decrease in resin capacity as a function of radiation dose and contact solution by measuring Batch-equilibrium coefficient's of the irradiated and control resin samples.

- Determine the quantity and generation rate, and identify gaseous and volatile organic compounds evolved during irradiation tests.

- Determine the concentration of semi-volatile organic compounds present in the liquid phase present after sample irradiation.

- Qualify the corrosion of stainless steel vessels used in 10^8 R irradiation tests.

1.3 Purpose

This report documents testing, results, and analysis associated with the SL-644 and SL-639 radiolytic degradation investigation. The report is intended to aid the RPP-WTP project in decisions regarding the design and operation of the Cs and Tc ion exchange systems in the WTP.

1.4 Quality Assurance

PNWD implemented the RPP-WTP quality requirements in a quality assurance project plan (QAPjP) as approved by the RPP-WTP quality assurance (QA) organization. Test preparation activities and monitoring of the first 6 of the 66 irradiation tests were conducted in accordance with PNWD's quality assurance project plan, CHG-QAPjP, Rev.0, which invoked PNWD's Standards Based Management System (SBMS), compliant with DOE Order 414.1A Quality Assurance and 10 CFR 830, Energy/Nuclear Safety Management, Subpart A -- Quality Assurance Requirements. Due to a change in the contract QA requirements, the remainder of the irradiation tests, batch contacts, and analytical activities were conducted in accordance with PNWD's quality assurance project plan, RPP-WTP-QAPjP, Rev.0, which invoked NQA-1-1989 Part I, Basic and Supplementary Requirements, and NQA-2a-1990, Subpart 2.7. These quality requirements were implemented through PNWD's Waste Treatment Plant Support Project Quality Assurance Requirements and Description Manual (WTPSP).

PNWD addressed verification activities by conducting an Independent Technical Review of the final data report in accordance with procedure QA-RPP-WTP-604. This review verified that the reported results were traceable, that inferences and conclusions were soundly based, and the reported work satisfied the Test Plan objectives. The review procedure is part of PNWD's WTPSP Manual.

2.0 Experimental Procedures

This section discusses experimental procedures. The procedures for preparing stock solutions and simulated LAW are explained as well as preparing, storing, and conditioning SL-644 and SL-639 resins. The methods are discussed for irradiating resins, sampling and analyzing off-gases, analyzing for semi-volatile and volatile organic compounds, and determining batch contacts and F-factors.

2.1 Overview

Resin irradiation studies and the associated batch-contact and gas-generation measurements on SuperLig® ion exchange resins were conducted at Battelle's Gamma Irradiation Facility within the 3730 Building and Radiochemical Processing Laboratory (325 Building). Table 1 contains the test matrix for the irradiation tests.

The SL-639 resin was in contact with simulated Tank 241-AN-105 LAW or water during irradiation at four dose levels. The SL-644 resin was in contact with simulated Tank 241-AN-105, 0.5 M HNO_3, or used in dry form during irradiation at various dose levels. The applied radiation doses ranged up to 7×10^8 R and were selected for consistency with those expected in the WTP. In general, the phase ratio of liquid to resin was 3:1 with ratios of 10:1 investigated in limited tests. As directed by the client, Johnson (2000), the ratio of 3:1 was selected based on the ratio expected to exist in the WTP ion exchange columns.

For each resin in contact with a reagent liquid, a control was run that received no irradiation. In addition, for each reagent liquid, there was an irradiated blank containing no resin. Fixed gas and volatile organic compound (VOC) and semi-VOC generation was monitored in the presence and absence of the gamma doses. The effect of temperature on the gas-generation rates was assessed by irradiating each of the four resin/solution combinations at three different temperatures.

Batch-contact experiments were performed on the irradiated resin samples to determine the deterioration in equilibrium performance.

Table 1 Test Matrix For Irradiation of SuperLig 639 and 644 Resins

Test Number	Resin	Resin Mass[c] (g)	Reagent	Irradiation Exposure (R)	S/VOC Analysis of Residual Liquid	Temperature (ºC)
1	None	None	Simulated LAW	1E+08	Yes	25 ± 5
2	None	None	Simulated LAW	1E+07	Yes	25 ± 5
3	None	None	0.5 M Nitric Acid	1E+08	No	25 ± 5
4	None	None	Water	1E+08	Yes	65 ± 5
5	SL-644[b]	1.00±0.05	None	1E+08	No	25 ± 5
6	SL-639	2.0±0.1	Simulated LAW	0[a]	Yes	25 ± 5
7	SL-639	2.0±0.1	Simulated LAW	1E+05	No	25 ± 5
8	SL-639	2.0±0.1	Simulated LAW	1E+06	No	25 ± 5
9	SL-639	2.0±0.1	Simulated LAW	1E+07	Yes	25 ± 5
10	SL-639	2.0±0.1	Simulated LAW	1E+08	Yes	25 ± 5
11	SL-639 (Replicate test for statistical assessment of data)	2.0±0.1	Simulated LAW	1E+08	Yes	25 ± 5
12	SL-639	2.0±0.1	Water	0[a]	Yes	65 ± 5
13	SL-639	2.0±0.1	Water	1E+05	No	65 ± 5
14	SL-639	2.0±0.1	Water	1E+06	No	65 ± 5
15	SL-639	2.0±0.1	Water	1E+07	Yes	65 ± 5
16	SL-639	2.0±0.1	Water	1E+08	Yes	65 ± 5
17	SL-639 (Replicate test for statistical assessment of data)	2.0±0.1	Water	1E+08	Yes	65 ± 5
18	SL-644	1.00±0.05	Simulated LAW	0[a]	Yes	25 ± 5
19	SL-644	1.00±0.05	Simulated LAW	1E+06	No	25 ± 5
20	SL-644	1.00±0.05	Simulated LAW	1E+07	Yes	25 ± 5
21	SL-644	1.00±0.05	Simulated LAW	1E+08	Yes	25 ± 5
22	SL-644 (Replicate test for statistical assessment of data)	1.00±0.05	Simulated LAW	1E+08	Yes	25 ± 5
23	SL-644	1.00±0.05	Simulated LAW	7E+08	Yes	25 ± 5
24	SL-644	0.250±0.01	Simulated LAW 10:1 Liquid to Resin Phase Ratio	1E+08	Yes	25 ± 5
25	SL-644	0.250±0.01	Simulated LAW 10:1 Liquid to Resin Phase Ratio	1E+08	Yes	25 ± 5
26	SL-644	1.00±0.05	0.5 M Nitric Acid	0[a]	Yes	25 ± 5
27	SL-644	1.00±0.05	0.5 M Nitric Acid	1E+06	No	25 ± 5
28	SL-644	1.00±0.05	0.5 M Nitric Acid	1E+07	Yes	25 ± 5
29	SL-644	1.00±0.05	0.5 M Nitric Acid	1E+08	Yes	25 ± 5
30	SL-644 (Replicate test for statistical assessment of data)	1.00±0.05	0.5 M Nitric Acid	1E+08	Yes	25 ± 5

Table 1 (Continued)

Test Number	Resin	Resin Mass[c] (g)	Reagent	Irradiation Exposure (R)	S/VOC Analysis of Residual Liquid	Temperature (°C)
31 [d]	None	None	Simulated LAW	1E+08	No	65 ± 5
32	None	None	Simulated LAW	1E+08	No	90 ± 5
33	None	None	0.5 M Nitric Acid	1E+08	No	65 ± 5
34	None	None	0.5 M Nitric Acid	1E+08	No	90 ± 5
35	None	None	Water	1E+08	No	25 ± 5
36	None	None	Water	1E+08	No	90 ± 5
37	SL-639	2.0±0.1	Simulated LAW	0[a]	No	65 ± 5
38	SL-639	2.0±0.1	Simulated LAW	0[a]	No	90 ± 5
39	SL-639	2.0±0.1	Simulated LAW	1E+08	No	65 ± 5
40	SL-639	2.0±0.1	Simulated LAW	1E+08	No	90 ± 5
41	SL-639	2.0±0.1	Water	0[a]	No	25 ± 5
42	SL-639	2.0±0.1	Water	0[a]	No	90 ± 5
43	SL-639	2.0±0.1	Water	1E+08	No	25 ± 5
44	SL-639	2.0±0.1	Water	1E+08	No	90 ± 5
45	SL-644	1.00±0.05	Simulated LAW	0[a]	No	65 ± 5
46	SL-644	1.00±0.05	Simulated LAW	0[a]	No	90 ± 5
47	SL-644	1.00±0.05	Simulated LAW	1E+08	No	65 ± 5
48	SL-644	1.00±0.05	Simulated LAW	1E+08	No	90 ± 5
49	SL-644	1.00±0.05	0.5 M Nitric Acid	0[a]	No	65 ± 5
50	SL-644	1.00±0.05	0.5 M Nitric Acid	0[a]	No	90 ± 5
51	SL-644	1.00±0.05	0.5 M Nitric Acid	1E+08	No	65 ± 5
52[d]	SL-644	1.00±0.05	0.5 M Nitric Acid	1E+08	No	90 ± 5
53	SL-639	2.0±0.1	None	1E+08	No	25 ± 5
54	None	None	0.5 M Nitric Acid	0	No	25 ± 5
55	None	None	0.5 M Nitric Acid	0	No	65 ± 5
56	None	None	0.5M Nitric Acid	0	No	90 ± 5
57	SL-644	1.00±0.05	0.5M Nitric Acid	0	No	45 ± 5
58	SL-644	1.00±0.05	0.5M Nitric Acid	0	No	45 ± 5
59	SL-644	1.00±0.05	0.5M Nitric Acid	0	No	65 ± 5
60	None	None	Water	0	No	25 ± 5
61	None	None	Water	0	No	65 ± 5
62	None	None	Water	0	No	90 ± 5
63	None	None	Simulated LAW	0	No	25 ± 5
64	None	None	Simulated LAW	0	No	65 ± 5
65	None	None	Simulated LAW	0	No	90 ± 5

(a) Samples of SL-639 and SL-644 resin that were not irradiated remained in contact with the test reagent for the same duration as that for resin samples irradiated to maximum dose.
(b) No gas analyses for this sample of SL- 644 resin. K_d tests were conducted.
(c) SL-644 in acid form after drying; SL-639 after washing and drying; details in text.
(d) No K_d determination for samples 31 through 52.

2.2 Preparation of Stock Solutions and Simulated LAW

2.2.1 Preparation of Non-Radioactive Stock Solutions

Chemicals were obtained from standard commercial sources unless indicated otherwise. De-ionized (DI) water was purified by passing in-house DI water through a commercial water purifier and was stored in plastic containers until used. The hydroxide concentrations of the 4.75 M $NaNO_3$/0.25 M NaOH test

solution were determined by dilution of stock NaOH solutions whose hydroxide concentration had been previously internally assayed.

2.2.2 Preparation of Pertechnetate Stock Solutions

The stock solution was prepared based on the information reported in Kolthoff and Elving (1964). A 2.3-g quantity of solid TcO_2 (obtained from in-house stores) was suspended in ca. 10 mL of concentrated ammonium hydroxide. Hydrogen peroxide (30% in water) was added until the bulk of the solids dissolved. The solution was evaporated using gentle heating to dryness; this procedure was repeated twice more. The final residue was taken up in ca. 35 mL of DI water and filtered through a 0.45-micron Nylon® syringe filter. An assay of the stock solution indicated a concentration of 0.0411 g Tc/mL or 0.415 M pertechnetate (1.55E+09 dpm/mL).

2.2.3 Preparation of Cesium Stock Solutions

An aliquot of ^{137}Cs solution in dilute HCl (obtained from in-house stores) of approximately 5-mCi activity was removed and evaporated to dryness. To a 5-mL volumetric flask, 0.975 g (5.00 mmol) cesium nitrate was added. The ^{137}Cs vial was rinsed with DI water, and these rinses were used to fill the volumetric flask to the 5-mL mark. Analysis of a sample aliquot gave a solution activity of approximately 0.5 mCi/mL and analysis by inductively coupled phosphorescence – mass spectrometry gave a total Cs concentration of 0.99M.

2.2.4 Preparation of Simulated AN-105 LAW

The LAW in Tank 241-AN-105 was selected to simulate and test since its composition is representative of the Envelope A waste to be treated in the WTP, and relatively extensive testing has been previously performed. Table 2 presents the simulated AN-105 LAW recipe and shows the major constituents to be sodium salts with smaller concentrations of potassium and aluminum, typical of Hanford LAW.

Table 2 Simulated AN-105 LAW Component List

Species	Final Target Concentration (M)
Metals	
Aluminum	7.36E-1
Cadmium	1.47E-5
Calcium	4.99E-4
Chromium	1.30E-2
Lead	1.28E-4
Magnesium	1.11E-4
Molybdenum	4.27E-4
Potassium	9.51E-2
Selenium	6.27E-6
Silicon	3.76E-3
Silver	7.56E-5
Sodium	5.34E00
Zinc	7.72E-5
Cations	
Ammonium	3.33E-3
Boron	2.36E-3
Anions	
Carbonate	1.04E-1
Chloride	1.28E-1
Fluoride	5.00E-3
Hydroxide	1.72E00
Nitrate	1.33E00
Nitrite	1.21E00
Phosphate	3.00E-3
Sulfate	4.01E-3
Organic compounds	
Glycolic acid	1.09E-2
Acetate	1.75E-2
Formate	3.20E-2
Oxalate	3.47E-3

2.3 SL-644 Resin Preparation, Storage, and Conditioning

2.3.1 SL-644 Resin Preparation and Storage

SL-644 Cs ion exchange resin from Batch 010319SMC-IV-73 was received in late March of 2001 and immediately sieved to produce fractions with defined size ranges that were stored in plastic bottles. The resin initially appears as purple irregular chips of varying sizes. Table 3 presents the weight distribution determined from the sieving operation previously reported by Fiskum (2002).

Table 3 Dry Weight Distribution of SL644 Resin Batch 010319SMC-IV-73

ASTM Sieve Size	Particle Size (μm)	Weight Fraction (%)
18	>1000	0.06
30	600 – 1000	37.27
40	425 – 600	38.23
50	300 – 425	18.01
70	212 – 300	6.08
100	150 – 212	0.26
140	106 – 150	0.06
>140	<106	0.03

The fraction defined by a particle-size range of 212 μm to 425 μm, or 24.09% of the total weight, was used throughout these tests for consistency with the size range used by Kurath et al. (2000). Table 4 presents various properties of the as-received resin and the resin in the size range from 212 to 425 μm, previously reported by Fiskum (2002).

Table 4 Physical Properties of Batch 010319SMC-IV-73 SL644 Resin

Property	Value (as-received)	Value (212 – 425 μm)
Bulk density (as-received form)	0.84 g/mL	0.70 g/mL
F factor (for water loss)	0.871	0.877
L factor (solids fraction remaining after conversion to H^+ form)	0.556	0.538
I factor (mass increase from H^+ form to Na^+ form)	1.22	1.25

The F factor indicates the loss in mass from drying the as-received resin at 50°C under vacuum to constant mass and is defined by the equation

$$F = \frac{m_d}{m_i} \tag{1}$$

where m_d = mass of as-received resin dried at 50°C under vacuum
m_i = initial mass of as-received resin.

The L factor indicates the loss in mass from acid washing (corrected for water loss) and is determined from the equation

$$L = \frac{(m_H F_H)}{(m_i F)} \tag{2}$$

where F_H = F factor for the H^+ form resin
m_i = initial mass of the as-received resin
F = F factor of the as-received resin.

The I factor defines the mass increase upon conversion from the H^+ form to the Na^+ form and is determined from the following equation

$$I = \frac{m_{Na}}{m_H F_H} \tag{3}$$

where m_{Na} is the dry mass of the Na^+ form resin.

2.3.2 SL-644 Resin Conditioning

The SL-644 resin was initially conditioned starting with a contact with DI water in approximately a 10:1 (mL liquid/g resin) ratio, which was also performed in a polypropylene bottle. For each contact, the suspension was agitated in a rotary shaker sufficient to achieve a vortex for at least 2 h. At the conclusion of each conditioning contact, the shaking was stopped and the solids isolated by filtration through a 0.45-micron Nylon® filter. The solids were then sluiced back into the bottle with the next contact solution. Following the initial conditioning contact, three contacts with 0.5 M HNO_3 were performed, followed by four contacts with DI water. Using broad-range pH paper as an indicator, the filtrate from the final DI water contact appeared identical to DI water itself, so further DI water washings were deemed unnecessary. The resin was then air dried for several days and placed in a plastic bottle until needed. This air-dried material was stored under ambient conditions for several months before use.

2.4 SL-639 Resin Preparation, Storage and Conditioning

2.4.1 SL-639 Resin Preparation and Storage

SL-639 Tc ion exchange resin from batch 010227CTC-9-23 was received in late March of 2001 and stored dry in a plastic bottle. The SL-639 resin appears visually as beige beads of varying sizes. No attempt was made to sieve the material to a uniform particle size or to measure the particle-size distribution of the resin.

2.4.2 SL-639 Resin Conditioning

The SL-639 resin was initially conditioned in the following manner: an initial contact with 5 M $NaNO_3$/0.1 M NaOH in approximately a 10:1 (mL liquid/g resin) ratio was performed in a polypropylene bottle. For this and all subsequent contacts, the suspension was agitated in a rotary shaker

sufficient to achieve a vortex for at least 2 h. At the conclusion of each conditioning contact, the shaking was stopped and the solids isolated by filtration through a 0.45-micron Nylon® filter. The solids were then sluiced back into the bottle with the next contact solution. Following the initial 5 M $NaNO_3$/0.1 M NaOH conditioning contact, three further 5 M $NaNO_3$/0.1 M NaOH contacts were performed, followed by four contacts with DI water. Using broad-range pH paper as an indicator, the filtrate from the final DI water contact appeared identical to DI water itself, so further DI water washings were deemed unnecessary. The resin was then air dried for several days and placed in a plastic bottle until needed. This air-dried material was stored under ambient conditions for several months before use.

2.5 Methods for Resin Irradiation and Off-Gas Sampling and Analysis

Resin irradiation and heating was performed using reaction vessels similar to those used in earlier studies with simulated waste (Bryan and Pederson 1995) and described in earlier reports detailing work with actual waste (Bryan et al. 1996a and 1996b; King et al. 1997).

The entire surface of the reaction system exposed to the sample is 316L stainless steel, except for a gold-plated copper gasket sealing the flange at the top of the reaction vessel. Figure 2-1 is a drawing of the reaction vessel showing the placement of the thermocouples within the reaction vessel and at various locations on the outside of the reaction vessel. The reaction space of the vessel is approximately ¾ in. in diameter and 10 in. high. Each vessel was wrapped in heating tape and insulated. Two thermocouples were attached to the external body of the reaction vessel, one for temperature control and one for over-temperature protection. Two thermocouples were inserted through the lid. The thermocouple centered in the lower half of the vessel monitors the temperature of the liquid phase; the one centered in the upper half monitors the gas phase temperature within the reaction vessel. Approximately 4 mL of conditioned resin (~2 g SL-639 in the base form or ~1 g SL-644 in the acid form) with the requisite matrix volume were placed into the reaction vessels and sealed. Thorough shaking of the resin stocks was considered sufficient to homogenize them and provide representative samples since they were of relatively small volume (less than 500 mL in all cases).

The reaction vessels for the irradiated samples were placed within the gamma pit and connected by a thin (0.0058-cm inside diameter) tube to a gas manifold outside the gamma pit. Each vessel had a separate pressure transducer on the gas manifold line.

The gamma dose rate was verified by standard Fricke dosimetry experimental methods (Draganic and Draganic 1971). Fricke dosimetry solutions were inserted within blank reaction vessels used for resin irradiation studies. The measured dose rate of 5.5×10^5 was consistent with the established calculated dose rate maintained by the PNNL Gamma Facility.

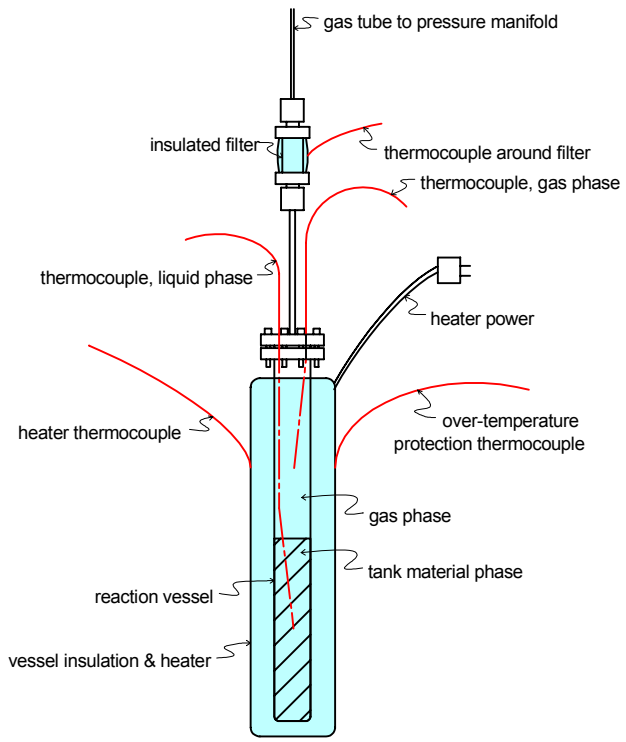


Figure 2-1 Reaction Vessel Used in Small-Scale Gas-Generation Tests

Figure 2-2 is a schematic diagram of the gas manifold system. Temperatures and pressures were recorded every 10 sec on a Campbell Scientific CR10 data-logger; an average of the data was taken every 20 min and saved in a computer file. Samples were irradiated for up to 150 h from a ^{60}Co source delivering a dose rate of 5.5×10^5 R/h.

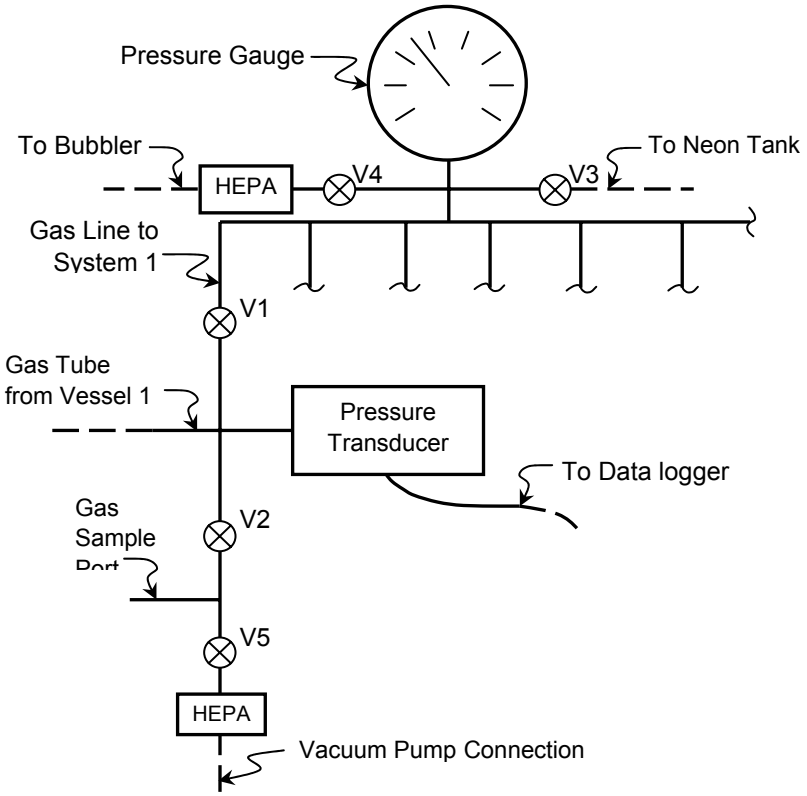


Figure 2-2 Diagram of Pressure Manifold System Used in Gas-Generation Tests

The total amount of gas in the system was calculated using the ideal gas law relationship from the pressure, temperature, and volume of the parts of the apparatus having different gas-phase temperatures: $\text{moles}_{\text{total}} = \text{moles}_{\text{vessel}} + \text{moles}_{\text{manifold and tubing}}$. The manifold volumes were determined from pressure/volume relationships using a calibrated gas-manifold system. The manifold volume (the pressure sensor, valves, and miscellaneous fittings) was 3.99 mL; the filter volume was 1.34 mL; and the tubing volume was 1.715 mL (by calculation). The cap stem (the tube from vessel to filter) had a volume of 0.20 mL; half of that was added to the filter volume, giving 1.44 mL, and half was added to the vessel volumes. The volume of each vessel was determined gravimetrically by filling it with water.

It has been shown that gases in the reaction system are well mixed (Bryan et al 1996). Samples were withdrawn through the capillary line into an evacuated gas-sampling bulb. The volume of the capillary line was small, less than 2 mL, whereas the gas phase of the reaction vessel volume was approximately 45 mL in all cases, and the collection-bulb volume was 50 mL. No significant fractionation of the gas was expected because gases would move by viscous flow through the capillary tube in this pressure regime.

Analyses of the composition of the gas phase of each reaction vessel after each reaction were performed according to analytical procedure PNNL-MA-599 ALO-284, Rev 1, by the Mass Spectroscopy Facility staff operated by PNNL and located in the 325 Building. The amount of a specific gas formed during heating is given by the mole percent of that gas present multiplied by the total moles of gas present in a system.

A verification of the gas-generation system reliability was performed. The result of this study is attached in Appendix A. The ability to accurately measure gas quantities over the temperature range and times used within this study were experimentally verified.

2.6 Analysis for Semi-Volatile and Volatile Organic Compounds

The solutions remaining after irradiation were analyzed for semi-volatile organic compounds (SVOCs) while gas samples were analyzed for VOCs to provide data for making decisions for the management of spent resin. Sampling and analyses were performed using laboratory procedures based on SW-846 protocols and gas chromatography / mass spectrometry. Quality control was performed for a target list of compounds and these are reported as positively identified when detected. Tentatively identified compounds are those detected for which quality control procedures were not performed.

The organic compounds of regulatory concern are listed in Table 5 and were included in the target list.

Table 5 Organic Compounds Applicable to LDR Compliance Evaluation

Compound	Classification	LDR treatment standard (mg/kg)
Acetone	VOC	160
Benzene	VOC	10
n-Butyl alcohol	VOC	2.6
Carbon disulfide	VOC	N/A
Carbon tetrachloride	VOC	6
Chlorobenzene	VOC	6
o-Cresol	SVOC	5.6
m-Cresol	SVOC	5.6
p-Cresol	SVOC	5.6
Cresol	SVOC	11.2
Cyclohexanone	SVOC	N/A
o-Dichlorobenzene	VOC	6
Ethyl acetate	VOC	33
Ethyl benzene	VOC	10
Ethyl ether	VOC	160
Isobutyl alcohol	VOC	170
Methanol	VOC	N/A
Methylene chloride	VOC	30
Methyl ethyl ketone	VOC	36
Methyl isobutyl ketone	VOC	33
Nitrobenzene	SVOC	14
Pyridine	SVOC	16
Tetrachloroethylene	VOC	6
Toluene	VOC	10
1,1,1–Trochloroethane	VOC	6
1,1,2–Trichloroethane	VOC	6
1,1,2–Trochloro-; 1,2,2-Trifluoroethane	VOC	30
Trichloroethylene	VOC	6
Trichloromono-fluormethane	VOC	30
Xylenes	VOC	30

2.7 Methods for Batch Contact and F-Factor Determination

2.7.1 Preparation of SuperLig® Resins for Batch Contacts

Following resin irradiation or heating, the residual solids were sluiced from the reaction vessel with DI water. A conditioning step for the resin as described in Sections 2.3.2 and 2.4.2 was applied. The resin was air-dried and an aliquot removed for F-factor measurements as noted below.

2.7.2 Procedure for F-Factor Measurements

In duplicate, approximately 0.1-g samples of the pre-equilibrated resins were placed in tared, 20-mL glass vials and re-weighed. These open vials were placed in a vacuum oven and heated to 50 ± 2°C. The samples were dried until the observed weight change was less than 5% of the resin weight after about 24 h of drying. The F-factor is simply the ratio of the final 50°C/vacuum-dried resin weight to the air-dried resin weight.

2.7.3 Batch Contact Measurements

Step 1. Approximately 0.1 g of the conditioned, air-dried resin was placed in a tared 20-mL glass liquid scintillation counting (LSC) vial and re-weighed. Thorough shaking prior to resin sub-sampling was considered sufficient to homogenize the samples.

Step 2. A before-contact assay of the spiked test solution was collected. For SL-639 tests, a 0.1-mL aliquot was removed and added to a tared LSC vial containing 10 mL of Ultima Gold® LSC cocktail. For SL-644 tests, 1 mL was placed in a 2-dram vial.

Step 3. Ten mL of the appropriate stock test solution were added to each resin-containing vial, taking care not to disturb the resin and splash it above the liquid. For SL-639 testing, this solution consisted of 4.75 M $NaNO_3$/0.25 M NaOH/1.5 mM in [TcO_4^-]. For SL-644 testing, the solution consisted of 4.75 M $NaNO_3$/0.25 M NaOH/0.5 mM in [Cs^+]. The vials were then sealed, placed in an orbital shaker, and stirred at 225 rpm at ambient temperature (25 ± 5°C).

Step 4. At the conclusion of the shaking (72 h), the vials were removed, and the liquids were separated from the resin by filtration through a 0.2-µm Nylon® syringe filter.

Step 5. Sample aliquots were removed for an activity assay as described in Step 2 above.

Step 6. In the case of technetium, the sample's beta activity was measured on a Packard Instruments liquid scintillation counter using an 18-nanosecond coincidence time from the region of 200 to 800 KeV. In the case of cesium, the area under the 661.7-MeV photopeak of the ^{137m}Ba daughter determined the concentration. Activity was measured using a liquid-nitrogen-cooled Ge detector.

Step 7. Batch-equilibrium coefficient measurements were obtained according to the standard formula shown below (Brown et al. 1995):

$$K_d = \frac{(C_o - C_i)}{C_i} \frac{V}{MF} \tag{4}$$

Where:

K_d = batch distribution coefficient (mL solution/g dried resin)
C_0 = initial activity
C_i = final activity

M = mass of resin (g) used in the batch contact experiment
V = volume of test solution (mL) used in the batch contact experiment
F = F-factor.

Each experimental condition was examined in duplicate. Uncertainties are presented as one standard deviation of the average batch-equilibrium coefficient.

3.0 Results and Discussion

This section discusses the results of the experimental procedures. Visual inspections of resins, solutions, and reaction vessels are reported. Results are provided for batch-contacts, gas-generation, and the chemical analyses of matrices.

3.1 Visual Inspection of Resins, Solutions, and Reaction Vessels

3.1.1 Inspection of Resins and Solutions

Appendix B contains photographs of the solutions and resins.

3.1.1.1 SL-644 Tests

No visual changes in the resin were observed, and only the resin immersed in simulated LAW at 25°C and irradiated to 10^6 R appeared to clump when wet. The latter appears to be an anomalous observation since clumping was not observed at other irradiations or temperatures. As shown in Table 6, the dissolution rate of the resin increased with increasing dose and temperature when immersed in simulated LAW. For example, at 25°C, 94% of the resin remained after no irradiation, but only 59% after irradiation to 7×10^8 R. However, at 90°C, there appears to be an insignificant impact from irradiation with ~60% of the resin remaining after exposure to doses of zero and 10^8R. The small difference between 0 and 10^8R may be due to small mass losses in resin recovery from the irradiation vessel and losses during resin reconditioning. There was no discernible impact of dose on the rate of dissolution of resin immersed in 0.5 M HNO_3, but the rate did increase with increasing temperature at constant dose. For example, at zero dose, 94% of the resin remained at 25°C, and 84% remained at 90°C. In summary, immersion in simulated LAW appears to result in a greater resin dissolution rate than when the resin is immersed in 0.5M nitric acid.

The simulated LAW turned from yellow to increasingly brown with increasing dose and temperature while in contact with resin. No changes were observed when only the simulated LAW was irradiated or heated. No changes in the resin or nitric acid were observed for increasing dose. However, the acid turned increasingly yellow with increasing temperature at a dose of 10^8 R.

Table 6 SL-644 Resin Dissolution

Matrix	Test #	Dose (R)	Temperature (^oC)	Proportion of resin remaining wt%[(a)]
0.5 M HNO_3	26	0	25	94
0.5 M HNO_3	27	10^6	25	94
0.5 M HNO_3	28	10^7	25	93
0.5 M HNO_3	29	10^8	25	95
0.5 M HNO_3	30	10^8	25	95
0.5 M HNO_3	57	0	45	94
0.5 M HNO_3	58	0	45	94
0.5 M HNO_3	49	0	65	87
0.5 M HNO_3	59	0	65	94
0.5 M HNO_3	51	10^8	65	88
0.5 M HNO_3	52	0	90	84
0.5 M HNO_3	52	5×10^6	90	87
None	5	10^8	25	94
Simulated LAW	18	0	25	94
Simulated LAW	19	10^6	25	94
Simulated LAW	20	10^7	25	91
Simulated LAW	21	10^8	25	86
Simulated LAW	22	10^8	25	86
Simulated LAW	24	10^8	25	88
Simulated LAW	25	10^8	25	90
Simulated LAW	23	7×10^8	25	59
Simulated LAW	45	0	65	90
Simulated LAW	47	10^8	65	86
Simulated LAW	46	0	90	56
Simulated LAW	48	10^8	90	64

a. Defined as $100\times\frac{m_{fc}F_{fc}}{m_{ic}F_{ic}}$,
where m_{fc} and m_{ic} are the final and initial conditioned masses of resin, respectively; F_{fc} and F_{ic} are the F factors for the final and initial resin masses, respectively. F_{ic} is assigned a value of unity.

3.1.1.2 SL-639 Tests

No changes in the resin were observed, and only the resin immersed in simulated LAW at the highest temperature of 90°C and exposed to the highest dose of 10^8 R appeared to clump when wet. As shown in Table 7, dissolution rates of resin immersed in simulated LAW appeared to increase only slightly with increasing temperature and dose. For example, at 25°C, 99% of the resin remained after no irradiation and 96% after irradiation to 10^8 R. The drop to 77% is likely due to experimental error resulting in either poor mass recovery from the irradiation vessel and/or losses during resin reconditioning. Increasing dose appeared to increase the dissolution rate of the resin immersed in water but there was no discernible

impact of temperature. For example, at 65°C, 98% of the resin immersed in water remained after no irradiation and 94% after irradiation to 10^8 R.

Both the simulated LAW and water became increasingly opaque with increasing dose. However, the solutions became increasingly transparent again with increasing temperature.

Table 7 SL-639 Resin Dissolution

Matrix	Test #	Dose (R)	Temperature (°C)	Proportion of resin remaining wt%[(a)]
Water	41	0	25	98
Water	43	10^8	25	95
Water	12	0	65	99
Water	13	10^5	65	77
Water	14	10^6	65	98
Water	15	10^7	65	98
Water	16	10^8	65	94
Water	17	10^8	65	94
Water	42	0	90	98
Water	44	10^8	90	94
None	53	10^8	25	94
Simulated LAW	6	0	25	99
Simulated LAW	7	10^5	25	99
Simulated LAW	8	10^6	25	98
Simulated LAW	9	10^7	25	99
Simulated LAW	10	10^8	25	95
Simulated LAW	11	10^8	25	96
Simulated LAW	37	0	65	97
Simulated LAW	39	10^8	65	95
Simulated LAW	38	0	90	96
Simulated LAW	40	10^8	90	94

a. Defined as $100 \times \frac{m_{fc} F_{fc}}{m_{ic} F_{ic}}$,

where m_{fc} and m_{ic} are the final and initial conditioned masses of resin, respectively; F_{fc} and F_{ic} are the F factors for the final and initial resin masses, respectively. F_{ic} is assigned a value of unity.

3.1.2 Inspection of Reaction Vessels

Five vessels were inspected containing each resin in simulated LAW and their respective eluants (water and 0.5 M HNO_3) irradiated to a dose of 10^8 R and simulated LAW only at 25°C. Inspection was performed using a boroscope. Only in the two vessels containing SL-639 resin was fouling observed, and there appeared to be no corrosion in any vessel. A ring of a white deposit corresponding to the liquid surface was observed in both vessels. Spots of a white deposit were also observed in the base of the vessel containing SL-639 and water.

3.2 Impact of Irradiation on Separation Performance

3.2.1 Batch Contact Results

Table 8 shows the batch contact results for SL-639 derived from the data in Appendix C. The batch-equilibrium coefficient and dose results for SL-639 in simulated LAW at 25°C and in DI water at 65°C are plotted in Figure 3-1. Note that a dose of 1 R is ascribed to the results for zero irradiation to facilitate plots on a logarithmic scale and the batch-equilibrium coefficients.

Table 9 shows the batch contact results for SL-644 derived from the data in Appendix D. The batch-equilibrium coefficient and dose results for SL-644 irradiated in simulated LAW at 25°C and in 0.5 M nitric acid at 25°C are plotted in Figure 3-2. Note that a dose of 1 R is ascribed to the results for zero irradiation to facilitate plots on a logarithmic scale and the batch-equilibrium coefficients are based on the initial mass of resin.

The batch distribution coefficients were adjusted to account for the loss in capacity arising from resin dissolution, discussed in Section 3.1.1, to derive effective batch-equilibrium coefficients. The effective batch-equilibrium coefficient, ΔK_d, is defined as

$$\Delta K_d = K_d \times \frac{m_{fc} F_{fc}}{m_{ic} F_{ic}} \tag{5}$$

Here m_{fc} and m_{ic} are the final and initial conditioned masses of resin, respectively; F_{fc} and F_{ic} are the F factors for the final and initial resin masses, respectively; K_d is the measured batch equilibrium coefficient. The F-factors for the initial conditioned resin used for these tests were not measured and are assumed to be unity. This is reasonable since all of the F-factors measured after testing were found to be 0.95 or higher.

The effective batch-equilibrium coefficients as a function of dose for the SL-639 in simulated LAW at 25°C and in DI water at 65°C are plotted in Figure 3-3. The effective batch-equilibrium coefficients as a function of dose for the SL-644 in simulated LAW at 25°C and in 0.5 M nitric acid at 25°C are plotted in Figure 3-4.

Table 8 Summary of SL-639 batch contact results. Contact Solution 4.75 M $NaNO_3$/0.25 M NaOH

Conditions	Test #[(a)]	Initial Resin Mass (g)	Final Resin Mass (g)[(b)]	Ave. TcO_4^- K_d (SD)[(c)]
Simulated LAW, 25°C, 0R	6	1.8	1.78	238 (6)
DI Water, 25°C, 0R	12	1.8	1.78	241 (2)
Simulated LAW, 65°C, 0R	37	1.8	1.75	235 (5)
Simulated LAW, 90°C, 0R	38	1.8	1.73	231 (2)
DI Water, 65°C, 0R	41	1.8	1.77	242 (3)
DI Water, 90°C, 0R	42	1.8	1.76	238 (1)
Simulated LAW, 25°C, 10^5 R	7	1.8	1.77	244 (1)
Simulated LAW, 25°C, 10^6 R	8	1.8	1.77	244 (2)
DI Water, 25°C, 10^5 R	13	1.8	1.39	249 (1)
DI Water, 25°C, 10^6 R	14	1.8	1.77	249 (1)
Simulated LAW, 25°C, 10^8 R	10	1.8	1.71	182 (1)
Simulated LAW, 25°C, 10^8 R	11	1.8	1.74	182 (2)
DI Water, 65°C, 10^7 R	15	1.8	1.76	239 (1)
DI Water, 65°C, 10^8 R	16	1.8	1.70	215 (1)
DI Water, 65°C, 10^8 R	17	1.8	1.70	217 (4)
Simulated LAW, 65°C, 10^8 R	39	1.8	1.70	179 (3)
Simulated LAW, 90°C, 10^8 R	40	1.8	1.70	187 (1)
DI Water, 25°C, 10^8 R	43	1.8	1.72	209 (3)
Simulated LAW, 25°C, 10^7 R	9	1.8	1.78	229 (14)
DI Water, 25°C, 10^8 R	44	1.8	1.69	208 (1)
No solution, 25°C, 10^8 R	53	1.8	1.71	202 (3)

(a) Taken from Table 1
(b) Conditioned resin, uncorrected by the F-factor
(c) SD = standard deviation

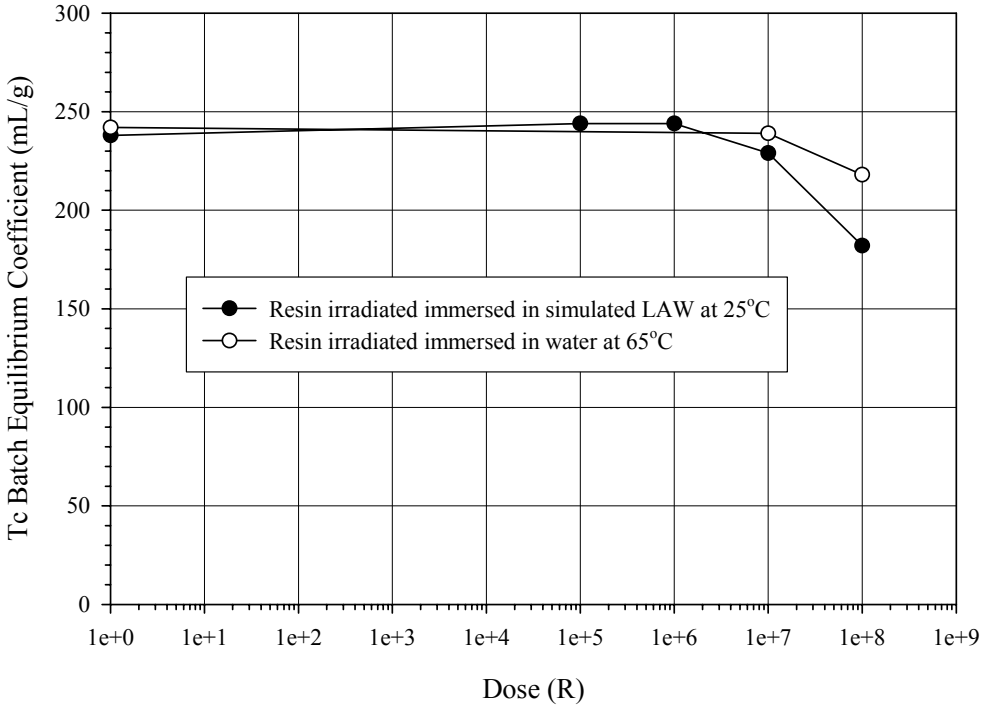


Figure 3-1 Pertechnetate Batch-Equilibrium Coefficients for SL-639 Irradiated in Simulated LAW (25°C) and DI Water (65°C). Note that a dose of 1 R is ascribed to the results for zero irradiation to facilitate plots on a logarithmic scale.

Table 9 Summary of SL-644 batch contact results

Conditions	Test #[a]	Initial Resin Mass (g)	Final Resin Mass (g) [b]	Average K_d (SD[e])
Simulated LAW, 25°C, 0R	18	0.9	0.85	327 (58)
0.5 M Nitric Acid, 25°C, 0R	26	0.9	0.86	625 (12)
Simulated LAW, 65°C, 0R	45	0.9	0.81	404 (8)
Simulated LAW, 90°C, 0R	46	0.9	0.50	204 (37)
0.5 M Nitric Acid, 65°C, 0R	49	0.9	0.79	346 (11)
0.5 M Nitric Acid, 90°C, 0R	50	0.9	0.76	449 (14)
Simulated LAW, 25°C, 1E+06R	19	0.9	0.85	350 (14)
0.5 M Nitric Acid, 25°C, 1E+06R	27	0.9	0.85	475 (60)
No Solution, 1E+08R	5	0.9	0.85	483 (28)
Simulated LAW, 25°C, 1E+08R	21	0.9	0.77	151 (48) [c]
Simulated LAW, 25°C, 1E+08R	22	0.9	0.78	11 (5)[c]
0.5 M Nitric Acid, 25°C, 1E+08R	29	0.9	0.85	401 (4)
0.5 M Nitric Acid, 25°C, 1E+08R	30	0.9	0.86	371 (6)
Simulated LAW, 65°C, 1E+08R	47	0.9	0.77	254 (32)
0.5 M Nitric Acid, 65°C, 1E+08R	51	0.9	0.80	323 (14)
Simulated LAW, 25°C, 1E+07R	20	0.9	0.82	263 (17)
Simulated LAW, 25°C, 7E+08R	23	0.9	0.54	68 (17)
Simulated LAW, 25°C, 1E+08R[d]	24	0.9	0.29	111 (6)
Simulated LAW, 25°C, 1E+08R[d]	25	0.9	0.29	104 (16)
0.5 M Nitric Acid, 25°C, 1E+07R	28	0.9	0.84	326 (63)
Simulated LAW, 90°C, 1E+08R	48	0.9	0.43	240 (31)
0.5 M Nitric Acid, 90°C, 1E+08R	52	0.9	0.78	252 (70)
0.5 M Nitric Acid, 45°C, 0R	57	0.9	0.85	397 (23)
0.5 M Nitric Acid, 45°C, 0R	58	0.9	0.85	338 (75)
0.5 M Nitric Acid, 65°C, 0R	59	0.9	0.85	300 (63)

(a) Taken from Table 1
(b) Conditioned resin, uncorrected by the F-factor
(c) From four independent batch-equilibrium coefficient measurements
(d) 10:1 liquid to solid phase ratio present during irradiation
(e) Standard deviation.

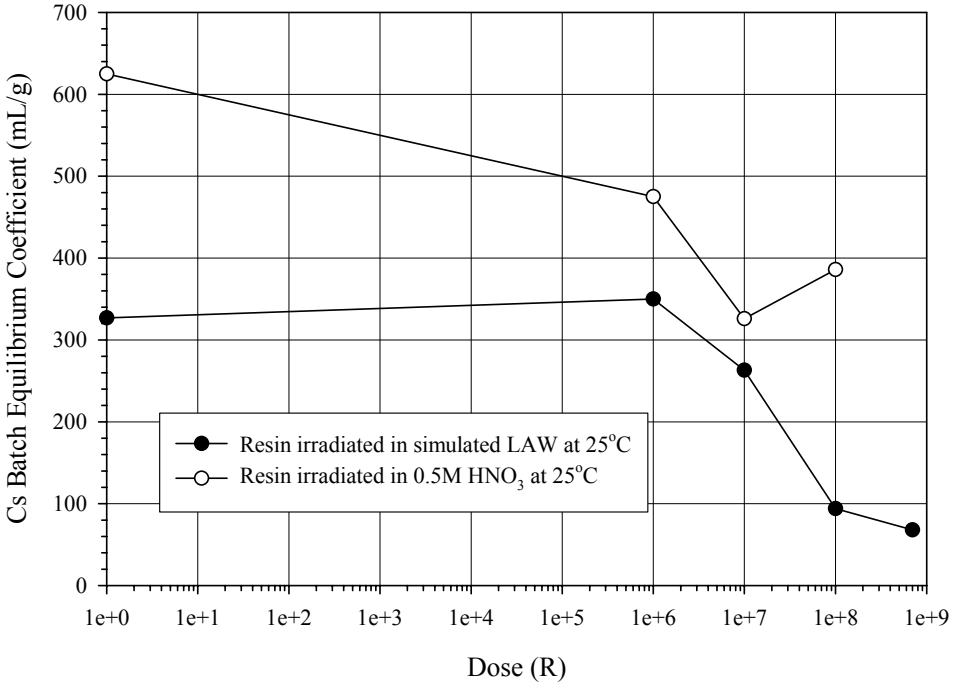


Figure 3-2 Cs Batch-Equilibrium Coefficients for SL-644 Irradiated in Simulated LAW (25°C) and 0.5 M Nitric Acid (25°C). Note that a dose of 1 R is ascribed to the results for zero irradiation to facilitate plots on a logarithmic scale.

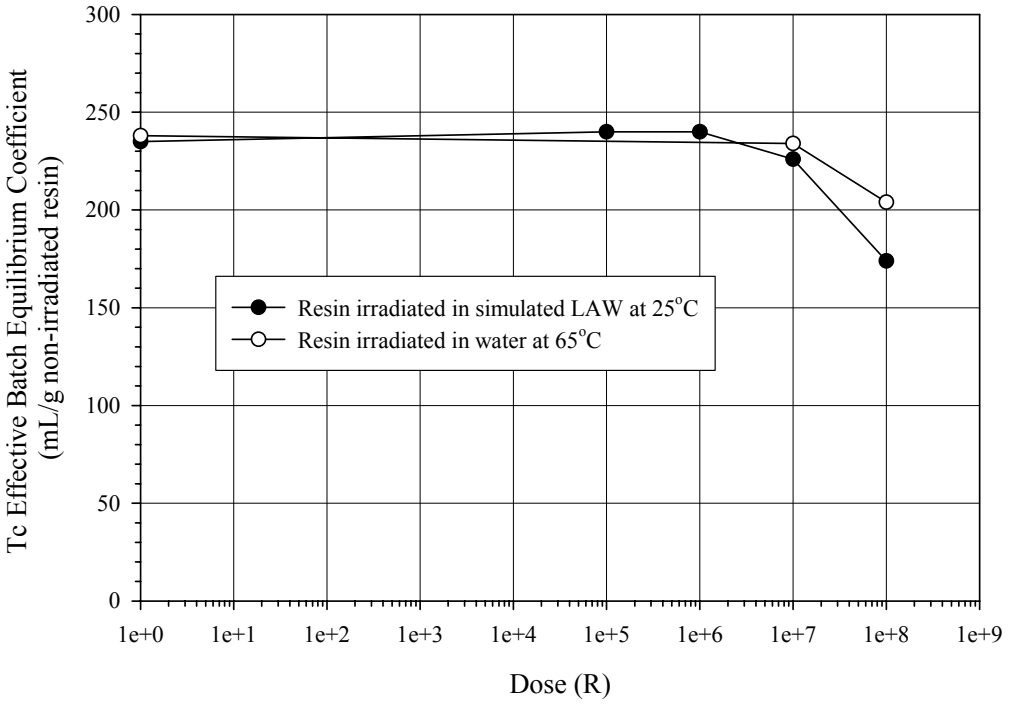


Figure 3-3 "Effective" Pertechnetate Batch-Equilibrium Coefficient for SL-639 Irradiated in Simulated LAW (25°C) and DI Water (65°C). Note that a dose of 1 R is ascribed to the results for zero irradiation to facilitate plots on a logarithmic scale.

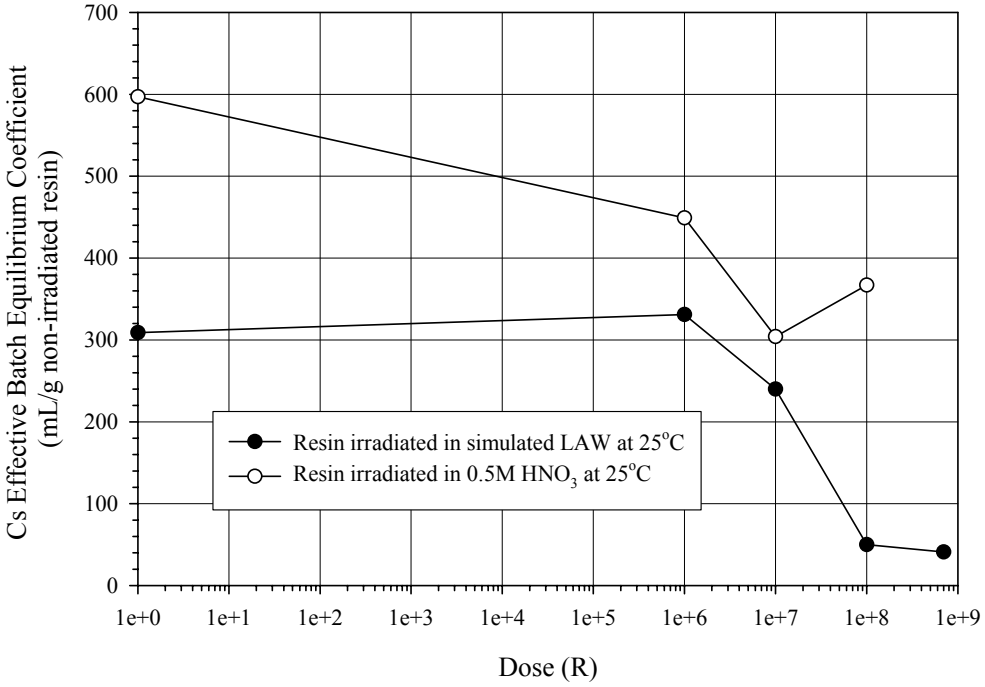


Figure 3-4 "Effective" Batch-Equilibrium Coefficients for SL-644 Irradiated in Simulated LAW (25°C) and 0.5 M Nitric Acid (25°C). Note that a dose of 1 R is ascribed to the results for zero irradiation to facilitate plots on a logarithmic scale.

Several points are readily apparent from the above data. First, for SL-639, little changes are observed by contact or irradiation under either the loading (simulated LAW, 25°C) or elution (water, 65°C) conditions until a total dose of greater than 10^7 R is reached. Until then, little change in the batch-equilibrium coefficient is observed. Exposure to a total dose of 10^8 R resulted in a 10 to 20% reduction in the batch-equilibrium coefficient. The excellent agreement for the SL-639 batch equilibrium results for both batch contact duplicates and irradiation duplicates indicates that the resin stock was sufficiently homogenized by shaking and that representative samples were extracted.

These results are consistent with a previous radiolysis study of SL-639 by Oji (1997). In this earlier study, SL-639 resin was placed in a stainless steel tube containing a Pyrex glass insert and was irradiated while in contact with strongly alkaline simulated LAW solution. Following radiolysis, a sample was removed and a batch contact performed with DI water at a volume to mass ratio of 10. At doses of 1×10^8R or greater, marked decreases in the distribution coefficient for perrhenate (a pertechnetate analog) were observed. This behavior is consistent with that reported here either when contacted with a simulated envelope A LAW at ambient temperature or DI water at 65°C. However, the magnitude of the decrease observed here was approximately half of that observed by Oji (1997).

For SL-644, the changes are more varied and dramatic. When contacted with the simulated LAW at 25°C, decreases in the batch-equilibrium coefficient are observed for SL-644 after irradiation to only 10^6 R. The batch-equilibrium coefficient reduced by ~ 70% by the time a total dose of 10^8 R was delivered. Differences between the SL-644 batch contact duplicates are larger than for SL-639 and may

indicate that the 0.1 g samples used were too small to be representative. Results for duplicate irradiation tests were good for two of three sets. One of the batch equilibrium coefficients in the last set appears anomalously low. One possible explanation is that some of the resin was not in contact with the solution during the test and so underwent less deterioration, leaving a composite batch-equilibrium coefficient from the less deteriorated resin and the greater deteriorated resin. The good agreement otherwise suggests that the samples for the irradiation tests (generally 1 g) were large enough to provide homogeneous samples.

Brown et al (1995) and Oji (2000) observed insignificant and 30% reductions in the batch equilibrium coefficients at a dose of 10^8 R, respectively. Therefore, the resin batch tested in this work appears to be less stable to irradiation than previous tested batches up to 10^8 R although there were differences in the experimental methods that may contribute to the discrepancies. For example, Brown et al (1995) irradiated their resins immersed in simulated Envelope B LAW at a dose rate of 1.6×10^6 R/h and used the same simulated LAW in performing the batch contacts. Brown et al (1995) and Oji (2000) then observed reductions of 70% and 90% at doses of 10^9 R and $7\text{x}10^8$ R, respectively, compared to a reduction of 80% observed here. Notwithstanding the differences in test methods, the stability of the resin batch tested here therefore appears to be better than the batch tested by Oji (2000) at the highest doses greater than 10^8 R. The batch equilibrium coefficient decreases by ~60% when the resin is contacted with 0.5M HNO_3 at 25°C and exposed to a dose of 10^8 R.

3.2.2 Implications of Results for WTP Design and Operations

3.2.2.1 Dose Model Overview

A preliminary analysis was performed to estimate the resin service life based on radiolytic degradation only (i.e. chemical degradation was not considered). Note that this analysis is conservative because it uses results from the batch irradiation tests in which reactive radiolytic products would have accumulated. In contrast, such products would be continuously extracted in a column system leading to a lower degradation rate. To facilitate the analysis, a model was developed to calculate the radiation dose to ion exchange resin beds of 1 m diameter and height using the MCNP™ Monte Carlo radiation transport code described by Briesmeister (2000) and considered the bed in cross-sectional slices. The calculations were based on operating assumptions typical of those expected in the WTP. The resins were assumed to receive no dose when the bed was in the lag and polishing positions.

3.2.2.2 Performance of SL-639 Resin

The preliminary analysis showed that the SL-639 resin would become exposed to total doses of 3.42×10^4 R and 2.80×10^4 R every cycle processing envelope B and envelope A LAW, respectively. Little deterioration would be expected before ~8770 or ~10,700 cycles processing Envelope B and A LAW, respectively, on the basis of these results. Olson (2001a) assumes the ion exchange resin is replaced after completing the 10th cycle and the results of this work appear to show this assumption as conservative. The assumptions used in deriving these results are provided in Table 10 below.

Table 10 Assumptions used in SL-639 Service Life Preliminary Analysis

Parameter	Assumption	Basis for assumption
General operation		
Feed displacement duration	1.4 hours	Olson (2001a)
Pre-elution water rinse duration	1.4 hours	Olson (2001a)
Duration of resin irradiation during elution	8 hours	Blanchard et al (2000a)
Envelope A LAW		
Envelope A LAW ^{99}Tc concentration	64 μCi/L	Blanchard et al (2000b)
Maximum envelope A LAW processing duration	170 hours	Olson (2001a)
Envelope B LAW		
Envelope B LAW ^{99}Tc concentration	375 μCi/L	Concentration in AZ-102 LAW sample processed by PNWD in 2002
Maximum envelope B LAW processing duration	210 hours	Olson (2001a)

3.2.2.3 Performance of SL-644 Resin

Two performance models were considered. The first model assumes constant ion exchange capacity until the resin receives a cumulative dose of 1×10^8 R when the resin is assumed to be totally destroyed. Cs is loaded onto the same portion of the bed in each LAW processing cycle until it becomes destroyed and then the subsequent portion is loaded in subsequent cycles. Table 11 presents the results from this model and shows that for the longest LAW processing durations assumed by Olson (2001b), the bed would require replacement after completing the 75th and 28th cycles processing envelope A and B LAW, respectively. Olson (2001b) assumes the bed is replaced after every 10 cycles and these results appear to confirm that assumption.

Table 11 Results from Constant Capacity Performance Model

Envelope	Dose to loaded section of bed every cycle (R)	LAW processing duration (hours) from Olson (2001b)	Number of cycles operated before bed destruction	Fraction of bed destroyed per cycle (%)
A	1.20×10^6	33	240	0.4
A	2.05×10^6	66	75	1.3
B	3.32×10^6	17	120	0.8
B	5.56×10^6	40	28	3.6

The assumptions used in deriving these results are provided in Table 12 below.

Table 12 Assumptions used in SL-644 Service Life Preliminary Analysis

Parameter	Assumption	Basis for assumption
General Operation		
Feed displacement duration	1.4 hours	Olson (2001b)
Pre-elution water rinse duration	1.4 hours	Olson (2001b)
Duration of resin irradiation during elution	11 hours	Kurath et al (2000)
Envelope A LAW		
Normal envelope A LAW processing duration	33 hours	Olson (2001b)
Maximum envelope A LAW processing duration	66 hours	Olson (2001b)
Envelope A LAW ^{137}Cs concentration	180 mCi/L	Kurath et al (2000)
Ion exchange capacity	0.05 meq/g	From Kurath et al (2000) and Fiskum (2002)
Envelope B LAW		
Normal envelope B LAW processing duration	17 hours	Olson (2001b)
Maximum envelope B LAW processing duration	40 hours	Olson (2001b)
Envelope B LAW ^{137}Cs concentration	2 Ci/L	Hassan et al (2001)
Ion exchange capacity	0.2 meq/g	From results of PNWD processing AZ-102 LAW sample in 2002

A second model was developed in which the ion exchange capacity was reduced according to the reduction in the batch equilibrium coefficient presented in Figure 3-4 and using the assumptions in Table 12 for the first cycle (except for the general operating parameters that are cycle independent). In addition, LAW processing was assumed terminated upon 50% breakthrough from the lead column such that it becomes fully loaded every cycle. The results from the model assuming envelope A LAW is processed for 33 hours in cycle 1 are presented in Figure 3-5 and the loading duration decreases to ~27 hours after 50 cycles. One criterion for bed replacement might be to replace the bed when the loading duration decreases to the same duration required for feed displacement, rinse and elution, or ~25 hours according to Olson (2001b) to maintain continuous operation. In this case, the bed would require replacement after more than 50 cycles and the design assumption is satisfied.

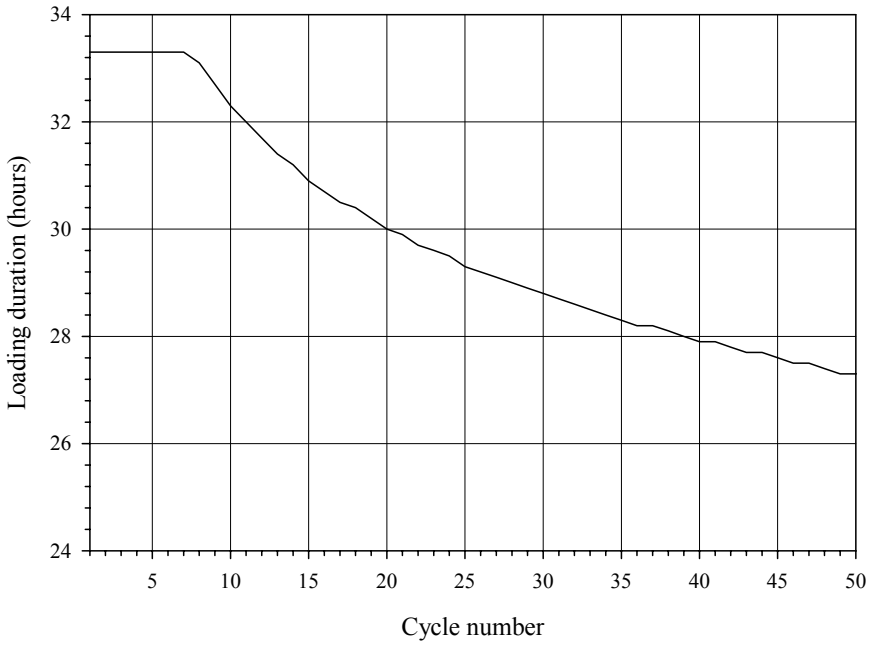


Figure 3-5 Results from Variable Capacity Model for Envelope A LAW

Figure 3-7 presents the results for processing envelope B LAW. For normal operation, the LAW processing duration is always less than the rinse and elution duration although there is very little reduction over 10 cycles. Bed replacement would be required after the 8th cycle for the maximum LAW processing duration in cycle 1 to maintain continuous operation.

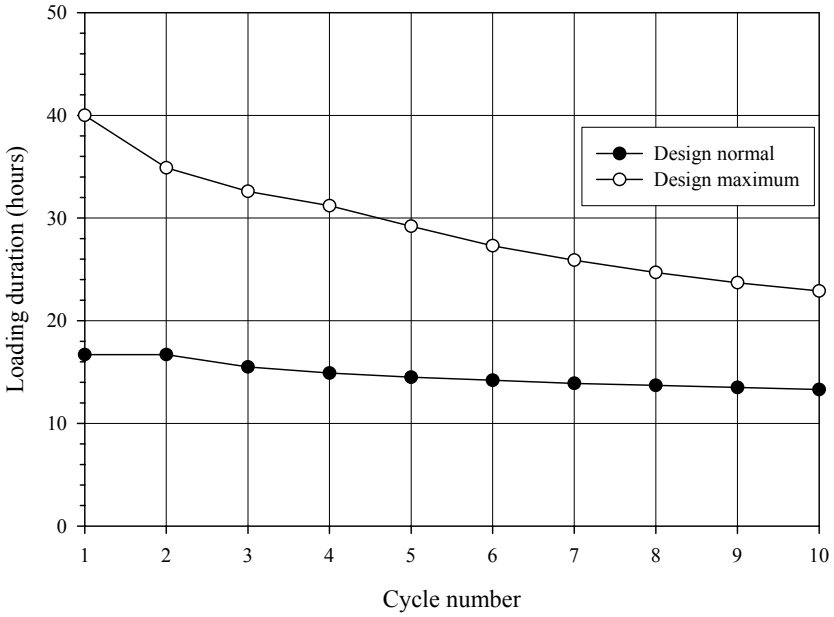


Figure 3-6

Figure 3-7 Results from Variable Capacity Model for Envelope B LAW

In general, both resins appear to lose most mass and experience lower batch equilibrium coefficients when in contact with the simulated LAW as opposed to the eluants or dry. This implies that contact time between the waste and the resins should be minimized to extend the useful resin life and minimize resin bed replacement frequency. However, other factors such as separation performance need also to be considered in optimizing the flow rate through the resin bed.

3.3 Results from Chemical Analysis of Liquids

3.3.1 Analysis for Semi-volatile Organic Compounds

Note that concentrations are reported on an acid form resin weight basis in the following discussion.

The positively identified SVOCs are presented in Appendix F. Phthalate compounds of concentration up to ~1 mg/kg were positively identified but these SVOCs were probably contaminants since they tend to be ubiquitous being used in a variety of plastics and are evident in the liquids alone. Phenol compounds were detected but only at trace concentrations and were most likely also contaminants. No SVOCs of regulatory concern, as listed in Table 5, were positively identified. The tentatively identified SVOCs are not presented in this report since the analysis identified compounds of a proprietary nature.

3.3.2 Analysis for Anions and Carbon

Anion concentrations in simulated LAW from selected SL-644 tests at 25°C were determined by ion chromatography (IC), and the results are presented in Table 13. Hydroxide concentrations were determined by titration. Appendix I contains the chemical analysis reports. Comparison of results from the same runs is more appropriate, although the results were normalized to the average laboratory-control-sample recoveries.

In general, there appears to be no impact of dose on the SO_4^-, PO_4^-, Cl^-, or F^- concentrations. The F^- concentration may apparently increase in the presence of resin due to the analytical interference from organic compounds leached from the resin. The oxalate concentration appears to increase with increasing dose perhaps because it is a product from radiolytic degradation of the resin or organic compounds in the simulated LAW. As also presented in Figure 3-8, hydroxide and NO_3^- anions are increasingly consumed with increasing dose while NO_2^- is generated especially at doses greater than 10^8 R. These results are broadly consistent with those of Oji and McCabe (2000). The reason for the significant difference in the hydroxide concentrations in the presence and absence of resin is perhaps due to its reaction with the resin.

Inorganic, organic, and total C concentrations were determined by hot persulfate and furnace oxidation methods. The hot persulfate method typically determines the most accurate inorganic C concentrations while the furnace method yields the better total C concentrations. Therefore, the total organic C concentration was determined by the difference between these two determinations. The results are presented in Table 14 and Figure 3-9, and Appendix I contains the chemical analysis reports.

Both the organic and inorganic C concentrations increase with increasing dose consistent with the results of Oji and McCabe (2000). Irradiation appears to increase the dissolution rate of the resin evident from the reduction in resin mass noted in Section 3.1.1.1, the visual appearance of the solutions and the

increase in organic C in solution. The organic compounds are apparently oxidized to CO_2 that either evolves as gas (as noted in Section 3.4.4.2) or dissolves as carbonate, evident from the increase in inorganic C concentration.

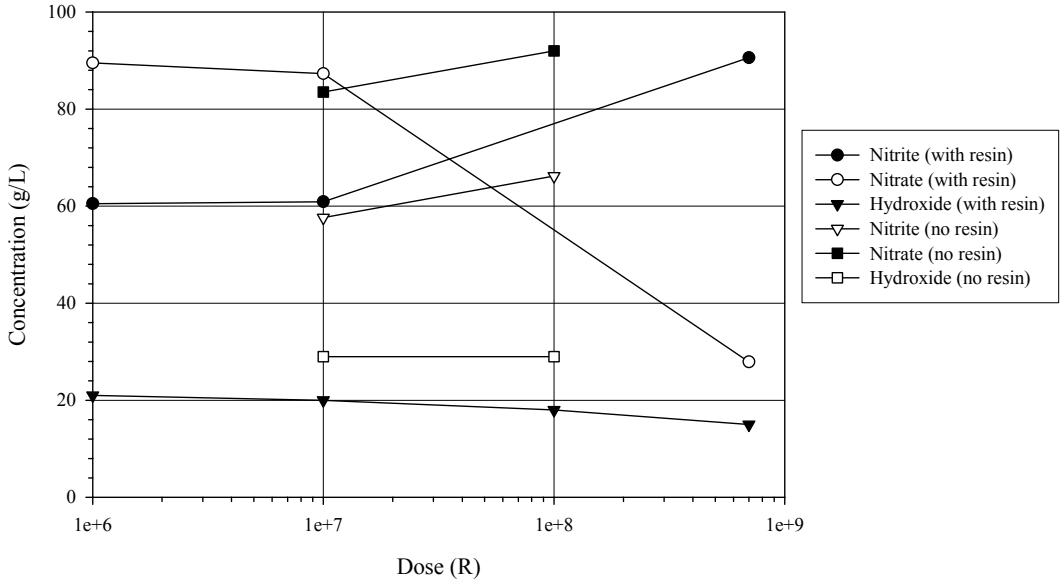


Figure 3-8 Variation of Nitrite and Nitrate Concentrations in Simulated LAW in Contact with SL-644 at 25°C with Radiation Dose

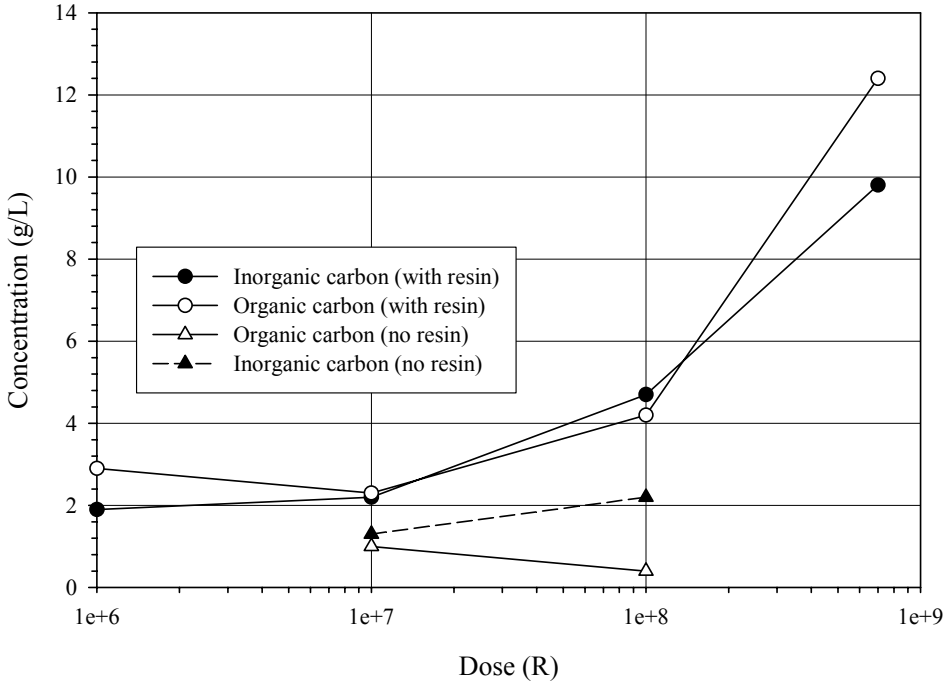


Figure 3-9 Variation of Inorganic and Organic Carbon in Simulated LAW in Contact with SL-644 at 25°C with Radiation Dose

Table 13 Concentrations of Anions in Simulated AN-105 LAW from Irradiation of SL-644 at 25°C

Test Number (Table 1)	Conditions	Concentration (g/L)								
		F^- (1)	Cl^- (1)	NO_2^- (1)	Br^- (1)	NO_3^- (1)	PO_4^- (1)	SO_4^- (1)	$C_2O_4^-$ (1)	OH^-
N/A	Expected in simulated LAW	0.095	4.5	56	0.0	76	0.28	0.13	0.31	29
2	No resin, 10^7R	0.74	5.0	57.6	<0.5	83.5	0.6	1.0	0.5	29
1	No resin, 10^8R	*0.37*	*5.0*	*66.2*	*<0.06*	*92.0*	*0.5*	*0.6*	*0.3*	29
18	0R	1.0	5.2	56.7	<0.5	84.0	0.6	1.2	0.7	21
19	10^6R	0.94	5.0	60.5	<0.5	89.5	0.6	0.8	0.7	21
20	10^7R	0.95	5.2	60.9	<0.5	87.3	0.6	0.9	0.8	20
21	10^8R	*0.89*	*5.9*	*87.3*	*<0.06*	*101*	*0.5*	*1.1*	*0.7*	18
22	10^8R	*0.46*	*4.9*	*66.3*	*<0.06*	*83.3*	*0.4*	*0.8*	*0.6*	(3)
24(2)	10^8R	*0.94*	*5.6*	*80.1*	*<0.06*	*95.7*	*0.5*	*0.8*	*1.5*	25
25(2)	10^8R	*0.50*	*4.8*	*65.7*	*<0.06*	*84.0*	*0.5*	*0.7*	*0.6*	24
23	$7x10^8$R	0.93	5.0	90.6	<0.13	27.9	0.6	0.9	1.6	15

Notes:

1. IC results normalized to average laboratory control sample recoveries. Values in normal and italicized types obtained from different IC analysis runs. Uncertainty is less than 15%.
2. 10:1 liquid to resin phase ratio, other tests at 3:1 ratio.
3. Not measured.

Table 14 Concentrations of Carbon in Simulated AN-105 LAW from Irradiation of SL-644 at 25°C

Test Number (Table 1)	Conditions	Inorganic Carbon (Hot persulfate) (g/L)	Total Carbon (Furnace) (g/L)	Organic Carbon (Difference) (g/L)
N/A	Expected in simulated LAW	1.2	2.3	1.1
2	No resin, 10^7R	1.3	2.3	1.0
1	No resin, 10^8R	2.2	2.6	0.4
18	0R	1.8	4.9	3.1
19	10^6R	1.9	4.8	2.9
20	10^7R	2.2	4.5	2.3
21	10^8R	4.7	8.9	4.2
24(1)	10^8R	2.8	3.4	0.6
25(1)	10^8R	2.9	3.8	0.9
23	$7x10^8$R	9.8	22.2	12.4

Notes:
1. 10:1 liquid to resin phase ratio, other tests at 3:1 ratio.

3.4 Gas-Generation Results

3.4.1 Overview

Organic ion exchange resins in contact with simulated Hanford wastes or elution solutions have been shown to produce gas as a result of thermal and radiolytic exposure. To assess the relative contributions of the thermal and radiolytic components, gas generation was measured from SL-639 and SL-644 resins under both thermal and radiolytic conditions.

The composition and generation rates for gas generation from SL-639 material under thermal and radiolytic conditions in contact with both AN-105 simulated waste and with water are described in Section 3.4.3. Section 3.4.4 describes the composition and generation rates for gas generation from SL-644 material under thermal and radiolytic conditions in contact with 0.5 M HNO_3 and AN-105 simulated waste. Gas-generation rates from only AN-105 simulated waste, water, and 0.5 M HNO_3 are detailed in Section 3.4.2. The thermal-activation parameters from standard Arrhenius treatment of the thermal experiments and G-value determinations from the radiolytic experiments are reported in Section 3.4.5.

The general methodology for calculating gas-generation rates from these thermal and radiolytic experiments is as follows. The total amount of gas produced as a function of heating time is calculated for each reaction vessel as outlined in Section 2.5. Gas samples were analyzed by mass spectroscopy to obtain separate rates for each gas present. The molar composition of these gas samples was calculated from the total moles of gas measured in each vessel at sampling time and the composition of that sample (from mass spectral data). The composition of gas that is generated, less the neon cover gas, is derived from the composition of sampled gas by excluding the neon cover gas. For example, if analysis found 80% neon, 15% nitrous oxide, and 5% hydrogen, the composition of gas formed by excluding neon would be 75% N_2O and 25% H_2.

In the tables of composition and gas generation rates (Sections 3.4.2 and 3.4.3), the test number is used to identify the experiment condition. Test numbers coincide with those used in Table 1.

Argon was originally to be used as an indicator of atmospheric contamination because it was not present in the cover gas and is not produced from the resin decomposition. Any nitrogen present could have been generated by the waste or could have come from atmospheric contamination. However, from inspection of the argon composition relative to nitrogen values, it was apparent that argon was present in sufficient quantities to rule out using the argon value as a means to correct the gas compositions from trace atmospheric contamination. The source of argon from the samples is presumably from its use as an inert cover gas during the synthesis of the SuperLig® resins. The presented gas compositions are therefore uncorrected for nitrogen and oxygen contamination.

3.4.2 Composition and Rates of Gas Generation from Systems Containing only AN-105 Simulated Waste, 0.5 M HNO_3, and Water

Gas-generation tests were performed with AN-105 simulated waste, 0.5 M HNO_3, and water. These tests serve as "blank" measurements for the systems containing the resins in contact with these solutions. Two sets of measurements were made on the blank solutions in the presence and absence of external radiation. These are referred to as radiolytic and thermal measurements, respectively. For experiments with only (i.e. with no resin) AN-105 simulated waste, 0.5 M HNO_3 and water, the thermal and radiolytic measurements were made at 25°, 65°, and 90°C. These experiments are detailed in Table 1. Each reaction vessel was loaded with the resin and the test solution indicated in Table 1. Gas samples were taken from the vessels at the end of the experiment. Gas generation rates were determined for each gas sample from the heating time, the composition of the gas, the total number of moles of gas in each system when the sample was taken, and from the mass of solution present in each reaction vessel.

This section is divided into two parts. Section 3.4.2.1 presents the thermal results, and Section 3.4.2.2 presents the radiolytic results of AN-105 simulated waste, 0.5 M HNO_3, and water.

3.4.2.1 Thermal Gas Generation from AN-105 Simulated Waste, 0.5 M HNO_3, and Water

This section contains the thermal gas-generation data produced by heating only simulated LAW, 0.5 M HNO_3, and water in reaction vessels in the absence of radiation. Figure 3-10, Figure 3-11, and Figure 3-12 show that little gas was evolved from heating the matrices. To obtain separate rates for each gas present, gas samples were analyzed by mass spectroscopy. The molar composition of these gas samples is given in Table 15. Of more interest is the composition of gas that is generated; this composition is presented below the entry in that table for each run and is shaded. The uncertainties in all the entries in this table are approximately plus or minus one in the last digit. Air in-leakage during sampling is probably responsible for nitrogen being the major constituent of the off-gas followed by oxygen and carbon dioxide. The concentrations of nitrous oxide evolving from all solutions appear to increase with increasing temperature, but otherwise there are no other observable trends.

In the tables of molar composition and rates, the test number is used to identify the experimental condition. Test numbers in the gas composition and rate tables correspond to experiment numbers in Table 1.

Using the composition data, reaction times, and the mass of each sample, rates of gas generation were determined. These rates are given in Table 16 as a function of experiment number, solution type, and temperature.

Analyses of the composition of the gas phase of each reaction vessel after each reaction were performed according to analytical procedure PNNL-MA-599 ALO-284, Rev 1, by the Mass Spectroscopy Facility staff operated by PNNL and located in the 325 Building. The amount of a specific gas formed during heating is given by the mole percent of that gas present multiplied by the total moles of gas present in a system.

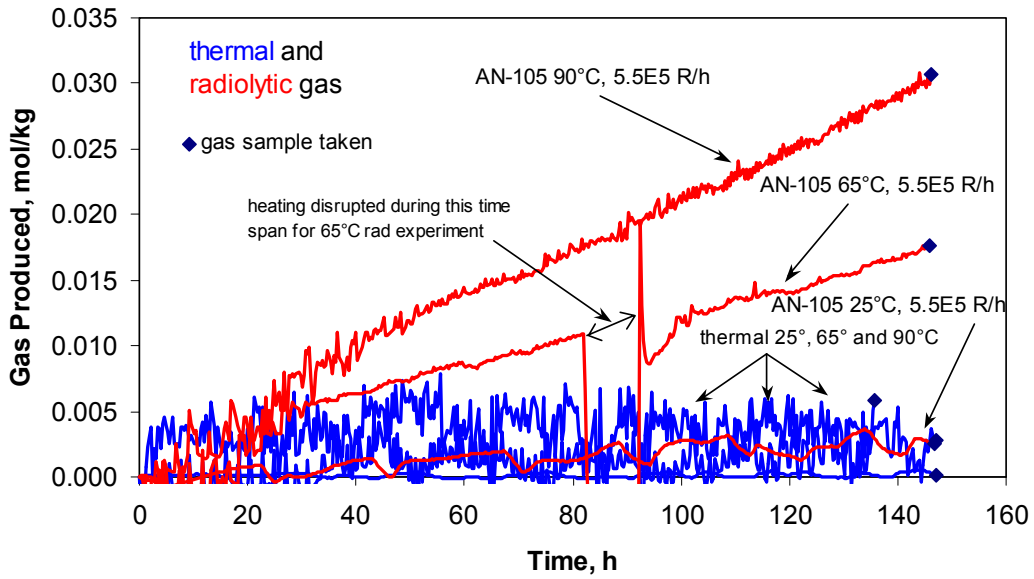


Figure 3-10 Gas Generated from Heating and Irradiating AN-105 Simulated Waste

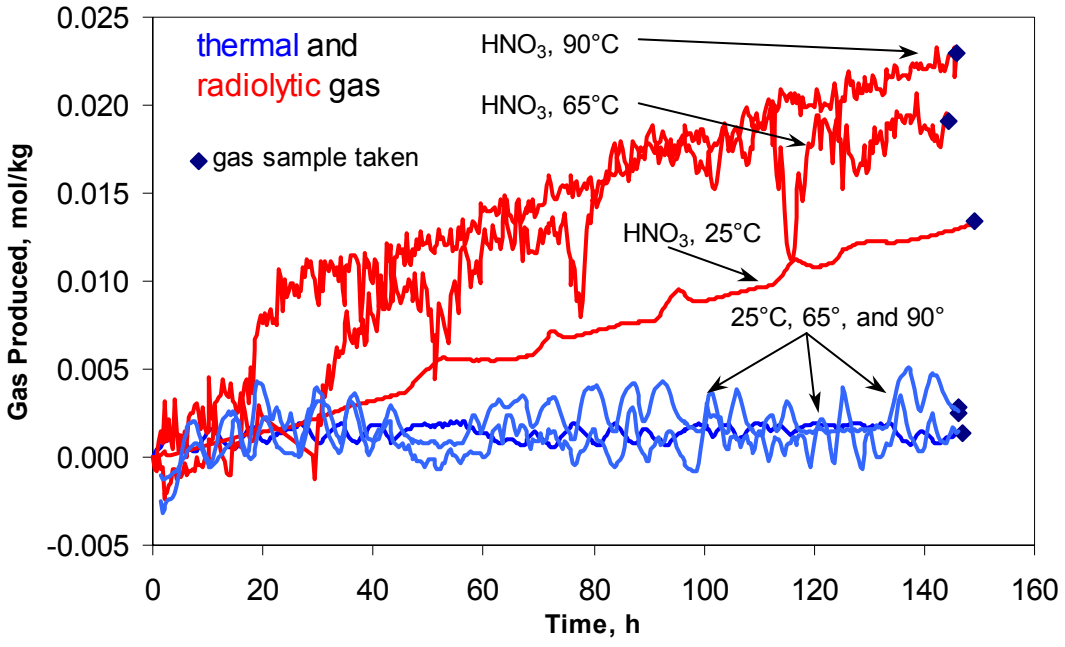


Figure 3-11 Gas Generated from Heating and Irradiating 0.5 M HNO_3

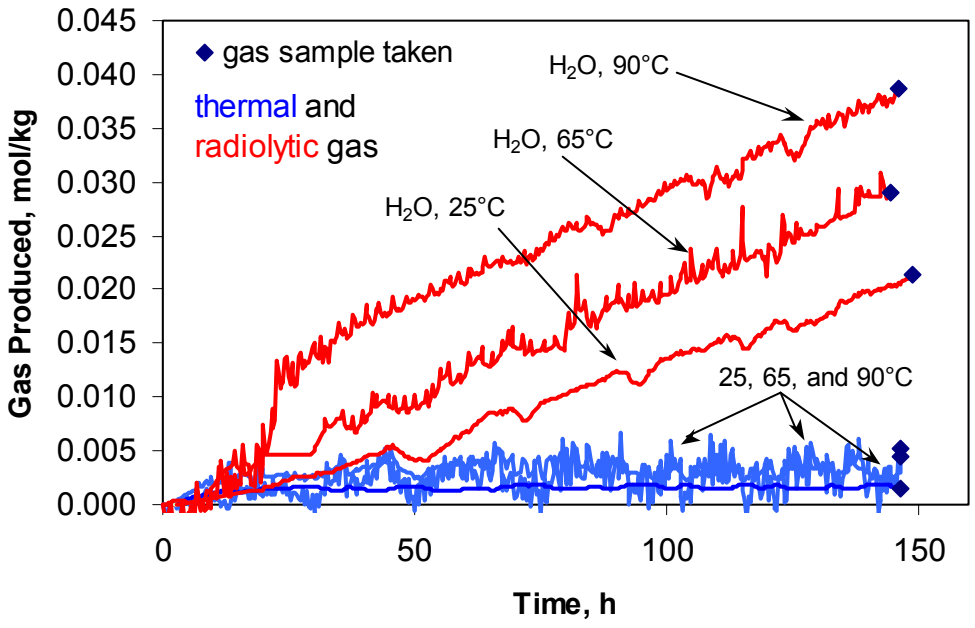


Figure 3-12 Gas Generated from Heating and Irradiating Water Within the Reaction Vessels

Table 15 Molar Composition (%) of Thermal Gas Sampled (including Ne) and Gas Formed (shaded), and Heating Times for AN-105 Simulated Waste, 0.5 M HNO_3 and Water (no external radiation source)

AN-105 simulated waste, no resin, thermal tests

Test #	Gas Sample ID	Temp:	Ne	Ar	H_2	CO_2	N_2	O_2	N_2O	NO_x	CH_4	$C_2H_{2,\ 4,\ or\ 6}$	other hydrocarbons	total hydrocarbons	Time, h
64	24G86-7	25	99	0.011	0.002		0.79	0.235	0.008					0	147
							76.3	22.7	0.8					0	
65	24G86-3	65	99.2	0.011	0.008		0.66	0.16	0.1					0	147
					1		71.1	17.2	10.8					0	
66	24G86-5	90	98.8	0.012	0.019	0.15	0.68	0.175	0.2		0.00	0.004		0.004	147
					2	12	55	14.2	16			0.3		0.3	

0.5M HNO_3, no resin, thermal tests

Test #	Gas Sample ID	Temp:	Ne	Ar	H_2	CO_2	N_2	O_2	N_2O	NO_x	CH_4	$C_2H_{2,\ 4,\ or\ 6}$	other hydrocarbons	total hydrocarbons	Time, h
54	24G77-8	25	97.1	0.021	0.001	0.012	1.23	0.428	0.01	0.005		0.002	0.002	0.004	147
					0.1	0.7	73.0	25.40	0.3	0.3		0.12	0.12	0.24	
55	24G77-9	65	96.8	0.017	0.002		0.99	0.068	0.348		0.00		0.001	0.001	146
							70.1	4.8	24.6		0.28		0.1	0.1	
56	24G77-10	90	95.2	0.018	0.002	2	1.1	0.017	0.81		0.03			0	146
						50.6	28	0.4	20		0.7			0	

H_2O, no resin, thermal tests

Test #	Gas Sample ID	Temp:	Ne	Ar	H_2	CO_2	N_2	O_2	N_2O	NO_x	CH_4	$C_2H_{2,\ 4,\ or\ 6}$	other hydrocarbons	total hydrocarbons	Time, h
61	24G86-1	25	98.8	0.016	0.002	0.03	0.84	0.304	0.01					0	146
					0.2	2	71	26	0.8					0	
62	24G86-2	65	98.9	0.015	0.003		0.82	0.286	0.018					0	147
					0.3		73	25	1.6					0	
63	24G86-4	90	98.6	0.02	0.003	0.036	1.08	0.261				0.002	0.001	0.003	146
					0.2	3	78	19				0.1	0.1	0.2	

Table 16 Gas Generation Rates from Thermal Treatment of AN-105 Simulated Waste, 0.5 M HNO_3, and Water (in the Absence of an External Radiation Source). Rates are expressed in moles gas generated per kg of total sample (resin and solution) per day or mol/kg/day.

AN-105 simulated waste, no resin, thermal tests

Test #	Temp:	H_2	CO_2	N_2	O_2	N_2O	NO_x	CH_4	$C_2H_{2, 4, \text{ or } 6}$	other hydrocarbons	total hydrocarbons	total gas	Time, h
64	25	3.9E-7		1.5E-4	4.5E-5	1.5E-6						2.0E-4	147
65	65	1.6E-6		1.3E-4	3.1E-5	2.0E-5						1.8E-4	147
66	90	4.8E-6	3.8E-5	1.7E-4	4.5E-5	5.1E-5		7.6E-7	1.02E-06		1.0E-6	3.1E-4	147

0.5M HNO_3, no resin, thermal tests

Test #	Temp:	H_2	CO_2	N_2	O_2	N_2O	NO_x	CH_4	$C_2H_{2, 4, \text{ or } 6}$	other hydrocarbons	total hydrocarbons	total gas	Time, h
54	25	2.4E-7	2.9E-6	2.9E-4	1.0E-4	1.2E-6	1.2E-6		4.8E-7	4.8E-7	9.5E-7	4.0E-4	147
55	65	4.9E-7		2.4E-4	1.7E-5	8.5E-5		9.8E-7		2.4E-7	2.4E-7	3.5E-4	146
56	90	4.9E-7	4.9E-4	2.7E-4	4.2E-6	2.0E-4		6.7E-6				9.7E-4	146

H_2O, no resin, thermal tests

Test #	Temp:	H_2	CO_2	N_2	O_2	N_2O	NO_x	CH_4	$C_2H_{2, 4, \text{ or } 6}$	other hydrocarbons	total hydrocarbons	total gas	Time, h
61	25	5.0E-7	6.3E-6	2.1E-4	7.6E-5	2.5E-6						3.0E-4	146
62	65	7.4E-7		2.0E-4	7.0E-5	4.4E-6						2.8E-4	147
63	90	7.3E-7	8.7E-6	2.6E-4	6.3E-5				4.85E-07	2.42E-07	7.3E-7	3.4E-4	146

3.4.2.2 Radiolytic Gas Generation from AN-105 Simulated Waste, 0.5 M HNO_3, and Water

This section contains the data from producing gases radiolytically by placing reaction vessels containing only AN-105 simulated waste, 0.5 M HNO_3, and water within the ^{60}Co gamma pit (3730 Facility) while heating the material in the reaction vessels to temperatures of 25, 65, and 90°C.

The total gas generated from irradiating AN-105 simulated waste within the reaction-vessel system is contained in Figure 3-10. Similar plots of total gas generated from irradiating 0.5 M HNO_3 and water are shown in Figure 3-11 and Figure 3-12. These figures show that the total gas generation is constant with increasing dose but increases with increasing temperature. The molar composition of the gas sampled at the end of each radiolytic gas-generation run is given in Table 17. Hydrogen and oxygen are the major constituents of the off-gas, probably arising from water radiolysis. The concentrations of hydrogen and nitrous oxide gases generated from irradiating the simulated LAW appears to decrease with increasing temperature. In contrast, the concentrations of hydrogen and nitrous oxide gases generated from irradiating 0.5 M HNO_3 appear to increase with increasing temperature. As expected, there are no observable trends in the concentrations of gases generated from irradiating water.

The 24-hour cycle observed on several of the gas generation plots is due to diurnal temperature effects within the gamma facility. Due to the long gas lines, and exposed parts of the manifold to the ambient laboratory environment, temperature effects will be seen when the temperature changes abruptly at day/night air conditioning shift change. This does not have a detrimental effect on the data since the temperature of the gas manifold and exposed tubing is accurately measured by the thermocouples associated with this equipment under static ambient laboratory temperature conditions.

Synergy between thermal and radiolytic processes was observed in these systems. Although the cause was not investigated within this series of experiments, Hanford waste systems containing organic show this effect (Pederson and Bryan 1996). The cause is believed to be due to the radiolytic formation of intermediates that are temperature sensitive to decomposition. Once the chemical intermediate is formed it follows normal chemical kinetic theory, and produces reaction products faster at higher temperatures. In actual Hanford waste containing organics, a common intermediate for gas formation was identified as hydroxylamine, whose fate was quite susceptible to effects of the chemical, radiochemical, and thermal environment. Hydroxylamine was formed thermally and radiolytically from nitrite, and decomposed forming principally nitrous oxide, ammonia, and nitrogen. The action of hydroxylamine with oxygen (formed radiolytically) was shown to eventually yield molecular hydrogen (Pederson and Bryan 1996).

The rates of gas generation obtained from each of these experiments are given in Table 18. These rates are given as a function of experiment number, solution type, and temperature. Experiment numbers in the gas composition and rate tables correspond to experiment numbers in Table 1. Table 23 contains a summary of the measured radiolytic G-values and thermal activation energies for gaseous products from these solutions.

The G-values measured from these studies for water radiolysis (G_{H2} = 0.196 molecules per 100 eV absorbed dose) is consistent with literature for pure water systems in a closed system (i.e. H_2 product not allowed to escape).

The fate of radical and molecular products in irradiated water depends a great deal on substances present in solution with which they may react. In the absence of such substances and in a closed system (which retains molecular hydrogen) the radicals will react with the hydrogen and hydrogen peroxide to reform water. The net result of continuous irradiation is to set up a steady state equilibrium in which the water contains an equilibrium concentration of hydrogen and hydrogen peroxide. The equilibrium concentrations depend on the yields of radical and molecular products. Low-LET radiation, where the radical yield is high and the molecular products produce a small equilibrium concentration of molecular products. Gamma-radiation, for example, produces very little change in pure de-aerated water irradiated in a closed system (Spinks and Woods (1964)).

Good agreement between theoretical and measured values for G_{H2} is obtained for such closed systems only when it is assumed that there is a small yield of molecular hydrogen (G_{H2}^{o}) produced within the spur which is little affected by contaminants or scavengers (Draganic and Draganic (1971)). The lower threshold for G_{H2} based on the "in-spur" molecular hydrogen yield is established as 0.175 (Schwarz 1969).

The G_{H2} value of 0.196 within the present study, measured for pure water in a closed system is consistent with literature values established for this system

Table 17 Molar Composition (%) of Radiolytic Gas Sampled (including Ne) and Gas Formed (shaded), and Heating Times for AN-105 Simulated Waste, 0.5 M HNO_3, and Water

AN-105 simulated waste, no resin, 5.5 × 10^5 R/h irradiation tests

Test #	Gas Sample ID	Temp:	Ne	Ar	H_2	CO_2	N_2	O_2	N_2O	NO_x	CH_4	$C_2H_{2,4,\text{ or }6}$	other hydrocarbons	total hydrocarbons	Time, h
9	24G81-8	25	98.4	0.015	0.237		1.05	0.274	0.05		0.002	0.004	0.005	0.009	15
					14.6		65	16.9	3.1		0.1	0.2	0.3	0.6	
2	24G62-8	25	95	0.012	2.54		0.9	0.273	0.178		0.01			0	147
					65.18		23.1	7.01	4.6		0.15			0	
5	24G71-11	65	88.5	0.01	3.33	0.002	0.7	6.4	0.155		0.01			0	146
					31.43	0.0	6.6	60.41	1.46		0.08			0	
4	24G66-11	90	83.7	0.009	2.87	0.008	0.64	12	0.119		0.01			0	146
					18.3	0.05	4.1	76.71	0.8		0.04			0	

0.5M HNO_3, no resin, 5.5 × 10^5 R/h irradiation tests

Test #	Gas Sample ID	Temp:	Ne	Ar	H_2	CO_2	N_2	O_2	N_2O	NO_x	CH_4	$C_2H_{2,4,\text{ or }6}$	other hydrocarbons	total hydrocarbons	Time, h
3	24G59-9	25	91	0.02	4.9	0.019	1.38	2.53						0	149
					55.5	0.22	15.63	28.66						0	
33	24G64-6	65	89.7	0.018	5.5	0.18	0.97	2.58	0.047					0	144
					59.3	1.94	10.46	27.81	0.51					0	
34	24G66-10	90	89.4	0.014	6.3	0.192	0.81	2.03	0.1		0.00	0.002	0.001	0.003	146
					66.8	2.0	8.6	21.51	1.1		0.0	0.02	0.01	0.03	

H_2O, no resin, 5.5 × 10^5 R/h irradiation tests

Test #	Gas Sample ID	Temp:	Ne	Ar	H_2	CO_2	N_2	O_2	N_2O	NO_x	CH_4	$C_2H_{2,4,\text{ or }6}$	other hydrocarbons	total hydrocarbons	Time, h
35	24G59-8	25	87.3	0.015	7.70	0.3	0.92	3.75						0	149
					60.6	3	7.2	29.52						0	
4	24G64-3	65	83.5	0.014	9.40	0.2	0.74	4.8						0	144
					62.1	1	4.9	31.71						0	
36	24G66-8	90	82.2	0.016	10.60	0.2	0.92	5.2						0	146
					62.5	1	5.4	30.678						0	

Table 18 Gas Generation Rates from Radiolytic Treatment of AN-105 Simulated Waste, 0.5 M HNO_3, and Water. Rates are expressed in moles gas generated per kg of total sample (resin and solution) per day or mol/kg/day.

AN-105 simulated waste, no resin, 5.5×10^5 R/h irradiation tests

Test #	Temp:	H_2	CO_2	N_2	O_2	N_2O	NO_x	CH_4	$C_2H_{2,\ 4,\ or\ 6}$	other hydrocarbons	total hydrocarbons	total gas	Time, h
9	25	2.2E-4		9.8E-4	2.6E-4	4.8E-5		1.9E-6	3.7E-6	4.7E-6	8.4E-6	1.5E-3	15
2	25	5.1E-4		1.8E-4	5.5E-5	3.6E-5		1.2E-6				7.9E-4	147
5	65	7.0E-4	4.2E-7	1.5E-4	1.3E-3	3.3E-5		1.7E-6				2.2E-3	146
4	90	6.7E-4	1.9E-6	1.5E-4	2.8E-3	2.8E-5		1.6E-6				3.7E-3	146

0.5M HNO_3, no resin, 5.5×10^5 R/h irradiation tests

Test #	Temp:	H_2	CO_2	N_2	O_2	N_2O	NO_x	CH_4	$C_2H_{2,\ 4,\ or\ 6}$	other hydrocarbons	total hydrocarbons	total gas	Time, h
3	25	1.3E-3	5.0E-6	3.6E-4	6.6E-4							2.3E-3	149
33	65	1.5E-3	4.8E-5	2.6E-4	6.9E-4	1.3E-5						2.5E-3	144
34	90	1.7E-3	5.1E-5	2.2E-4	5.4E-4	2.7E-5		5.3E-7	5.33E-07	2.66E-07	8.0E-7	2.5E-3	146

H_2O, no resin, 5.5×10^5 R/h irradiation tests

Test #	Temp:	H_2	CO_2	N_2	O_2	N_2O	NO_x	CH_4	$C_2H_{2,\ 4,\ or\ 6}$	other hydrocarbons	total hydrocarbons	total gas	Time, h
35	25	2.1E-3	9.2E-5	2.5E-4	1.0E-3							3.5E-3	149
4	65	2.8E-3	5.9E-5	2.2E-4	1.4E-3							4.5E-3	144
36	90	3.1E-3	6.7E-5	2.7E-4	1.5E-3							4.9E-3	146

3.4.3 Composition and Rates of Gas Generation from SL-639 Resin

Gas-generation tests were performed on SL-639 in contact with AN-105 simulated waste and with water. Two sets of measurements were made on SL-639 material in contact with each solution in the presence and absence of external radiation. These are referred to as radiolytic and thermal measurements, respectively. The measurements were run at three temperatures. The thermal and radiolytic measurements were made at 25°, 65°, and 90°C. These experiments are detailed in Table 1. Each reaction vessel was loaded with the resin and the test solution indicated in Table 1. Gas samples were taken from the vessels at the end of the experiment.

This section is divided into two parts. Section 3.4.3.1 presents the thermal results and Section 3.4.3.2 presents the radiolytic results of SL-639 in the presence of AN-105 simulated waste and with water. One radiolytic experiment was performed on SL-639 with no contact solution, and these results are included in Section 3.4.3.2.

3.4.3.1 Thermal Gas Generation from SL-639 Resin Samples

This section contains the thermal gas-generation data produced by heating SL-639 resin material in reaction vessels at 25, 65, and 90°C at zero radiation doses. Figure 3-13 contains a plot of the gas generated from heating SL-639 resin with AN-105 simulated waste. Very little gas was generated at 25°C and 65°C, and the rate decreased during the course of the test at 90°C. Figure 3-14 plots the gas generated from SL-639 resin in water and shows that little gas was evolved.

The total amount of gas produced versus heating time was measured for each reaction vessel. Gas samples were analyzed by mass spectroscopy to obtain separate rates for each gas present. The molar composition of these gas samples is given in Table 19. Of more interest is the composition of gas that is generated, and this composition is presented below the entry in that table for each run and is shaded. The uncertainties in all the entries in this table are approximately plus or minus one in the last digit. In the tables of composition and rates, the test number is used to identify the experimental condition. Test numbers in the gas composition and rate tables correspond to experiment numbers in Table 1. The major constituents of the gases are nitrogen and oxygen, probably associated with air in-leakage during sampling or displacement from the resin. Increasing concentrations of nitrous oxide and hydrocarbons become evident with increasing temperature, consistent with the results from heating only the simulated LAW and water.

Rates of gas generation were determined using the composition data, reaction times, and mass of each sample. These rates are given in Table 20 as a function of experiment number, resin type, solution type, and temperature.

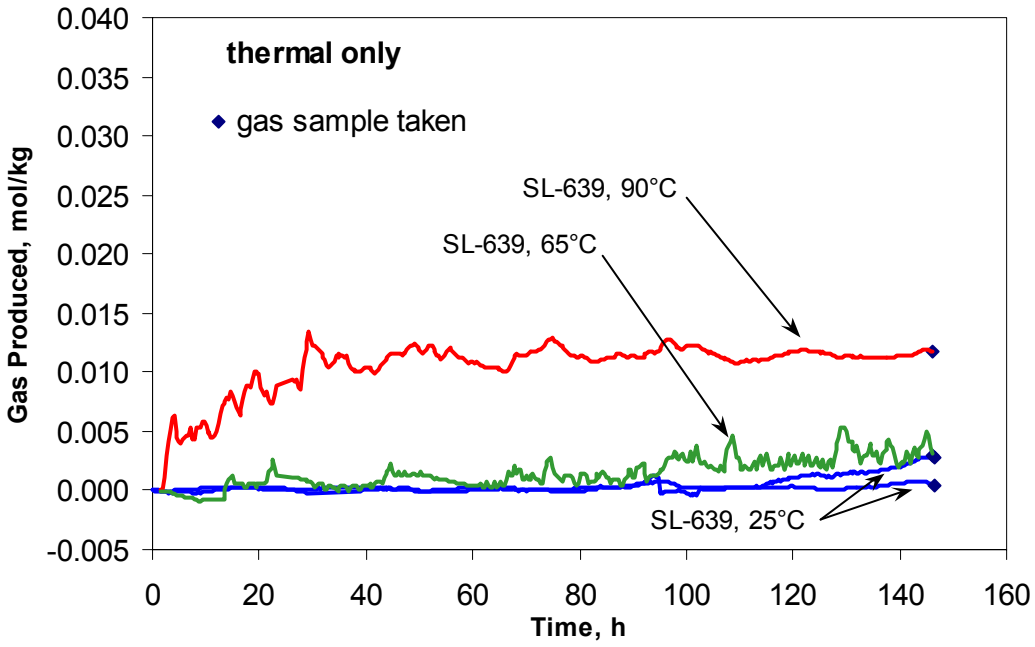


Figure 3-13 Gas Generated from Heating SL-639 Resin with AN-105 Simulated Waste

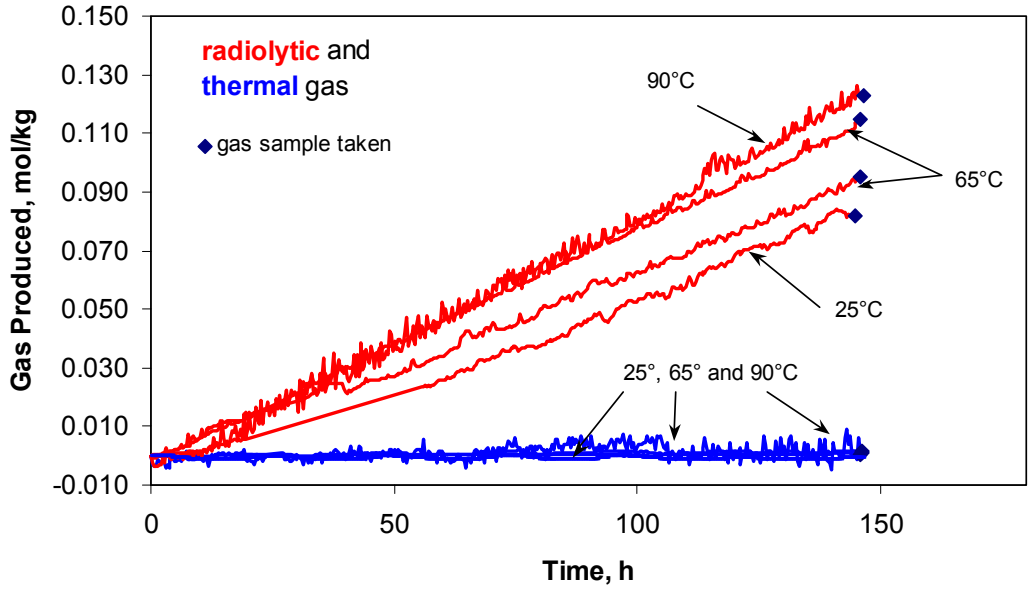


Figure 3-14 Gas Generated from Heating and Irradiating SL-639 Resin in Water. The blue trend lines detail the thermal gas; the red trend lines show the gases generated in the presence of 5.5×10^5 R/h gamma field.

Table 19 Molar Composition (%) of Thermal Gas Sampled (including Ne) and Gas Formed (shaded), and Heating Times for SL-639 Resin in Contact with AN-105 Simulated waste and in Contact with Water (no external radiation source)

SuperLig® 639 resin with AN-105 simulated waste, thermal tests

Test #	Gas Sample ID	Temp, °C	Ne	Ar	H_2	CO_2	N_2	O_2	N_2O	NO_x	CH_4	$C_2H_{2,\ 4,\ or\ 6}$	other hydrocarbons	total hydrocarbons	Time, h
6	24G43-1	25	99.46	0.008	0.001		0.423	0.109						0	147
							79	20.5						0	
6R	24G52-8	25	98.8	0.014	0.003	0.005	0.98	0.225						0	147
						0.4	80.8	18.5						0	
37	24G43-2	65	99.04	0.013	0.005		0.74	0.162	0.023		0.00	0.005	0.003	0.008	146
					1		79	17.3	2			0.5	0.3	0.9	
38	24G43-3	90	98.9	0.017	0.043		0.82	0.133	0.039		0.01	0.020	0.014	0.034	146
					4		76	12.4	4			1.9	1.30	3.2	

SuperLig® 639 resin with H_2O, thermal tests

Test #	Gas Sample ID	Temp, °C	Ne	Ar	H_2	CO_2	N_2	O_2	N_2O	NO_x	CH_4	$C_2H_{2,\ 4,\ or\ 6}$	other hydrocarbons	total hydrocarbons	Time, h
41	24G43-4	25	98.9	0.014	0.003		0.81	0.305	0.007			0.001		0.001	146
							71.9	27.1	0.6			0.1		0.1	
41R	24G52-7	25	98.1	0.018	0.005	0.008	1.47	0.358	0.007					0	146
					0.3	0.4	79.5	19.37	0.4					0	
12	24G43-5	65	56.4	0.414	0.004		34	9.2	0.033			0.002		0.002	146
					0.0		78.6	21.28	0.1			0.00		0.00	
42	24G43-6	90	98.5	0.021	0.076		1.15	0.181	0.101		0.00	0.005	0.004	0.009	146
					5		76	11.9	7		0.1	0.3	0.26	0.6	

Table 20 Gas Generation Rates from Thermal Treatment of SL-639 Resin in Contact with AN-105 Simulated waste and in Contact with Water (in the Absence of an External Radiation Source). Rates are expressed in moles gas generated per kg of total sample (resin and solution) per day or mol/kg/day.

		SuperLig® 639 resin with AN-105 simulated waste, thermal tests											
Test #	Temp, °C	H_2	CO_2	N_2	O_2	N_2O	NO_x	CH_4	$C_2H_{2,\ 4,\ or\ 6}$	other hydrocarbons	total hydrocarbons	total gas	Time, h
6	25	2.2E-7		9.4E-5	2.4E-5							1.2E-4	147
6R	25	6.7E-7	1.1E-6	2.2E-4	5.0E-5							2.7E-4	147
37	65	1.1E-6		1.7E-4	3.7E-5	5.2E-6		2.3E-7	1.1E-6	6.8E-7	1.8E-6	2.1E-4	146
38	90	9.5E-6		1.8E-4	2.9E-5	8.6E-6		1.1E-6	4.4E-6	3.1E-6	7.5E-6	2.4E-4	146

		SuperLig® 639 resin with H_2O, thermal tests											
Test #	Temp, °C	H_2	CO_2	N_2	O_2	N_2O	NO_x	CH_4	$C_2H_{2,\ 4,\ or\ 6}$	other hydrocarbons	total hydrocarbons	total gas	Time, h
41	25	8.1E-7		2.2E-4	8.2E-5	1.9E-6			2.7E-7		2.7E-7	3.0E-4	146
41R	25	1.3E-6	2.1E-6	3.9E-4	9.4E-5	1.8E-6						4.8E-4	146
12	65	1.1E-6		9.3E-3	2.5E-3	9.0E-6			5.5E-7		5.5E-7	1.2E-2	146
42	90	2.0E-5		3.1E-4	4.9E-5	2.7E-5		5.4E-7	1.3E-6	1.1E-6	2.4E-6	4.1E-4	146

3.4.3.2 Radiolytic Gas Generation from SL-639 Resin Samples

This section contains the gas-generation data obtained while exposing the samples to gamma radiation and heating the material in the reaction vessels to temperatures of 25, 65, and 90°C.

Figure 3-15 contains a plot of the gas generated from heating SL-639 resin with AN-105 simulated waste. The rate of gas generation is constant with increasing dose but increases with increasing temperature. Figure 3-14 shows that the rate of gas generation from SL-639 in water remains constant with increasing dose but increases with increasing temperature. The molar composition of the gas sampled at the end of each radiolytic gas generation run is given in Table 21.

The major constituent of the gas is generally hydrogen, probably associated with water radiolysis, followed by carbon dioxide and nitrous oxide, although nitrogen is a significant constituent from resin immersed in simulated LAW. The hydrogen concentration increases with increasing dose, but either remains nearly constant when the resin is immersed in simulated LAW, or decreases when the resin is immersed in water, with increasing temperature. The absence of oxygen expected from water radiolysis indicates that it is consumed perhaps in oxidizing organic compounds since the concentration of carbon dioxide increases with increasing dose. However, the presence of radiation seems to be critical for this reaction since oxygen was not consumed in the thermal tests. The concentration of hydrocarbons increases with increasing temperature and dose when the resin is immersed in either simulated LAW or water. Indeed, hydrocarbons are the major constituent of the gas in the absence of solution, indicating direct radiolytic degradation of the resin. Oxidation of the hydrocarbon products of radiolytic degradation is postulated as the reason for the lack of oxygen in the off-gas since the resin itself appears to be stable to air oxidation as shown in Section 3.4.3.1.

The rates of gas generation obtained from each of these experiments are given in Table 21 and Table 22. These rates are given as a function of experiment number, resin type, solution type, and temperature. Experiment numbers in the gas composition and rate tables correspond to experiment numbers in Table 1. The total gas-generation rates increase with increasing temperature but decrease with increasing dose. The generation rates of hydrocarbons increase with increasing dose and temperature for all conditions. The rate of hydrogen generation from resin immersed in simulated LAW increases with increasing temperature but remains nearly constant when immersed in water. However, hydrogen generation then increases with increasing dose for the resin immersed in water but is nearly constant in simulated LAW.

Hanford wastes containing organic complexants exhibit similar behavior with respect to production of hydrogen, and the nitrogenous gases. Additionally, the observation of oxygen being scavenged from Hanford waste solutions and from headspace over waste systems, under thermal and gamma radiolysis, has been detailed (Pederson and Bryan 1996).

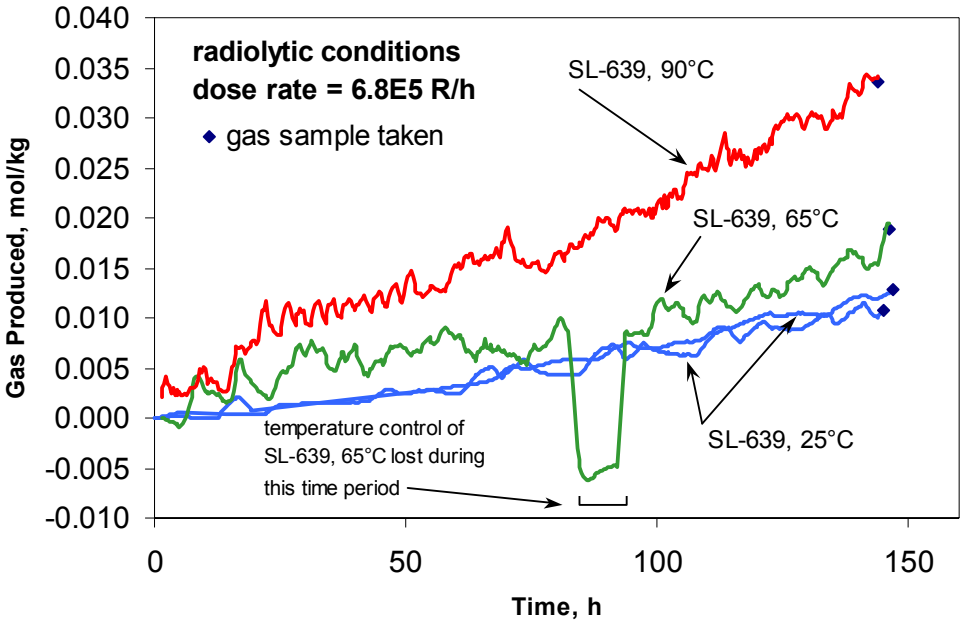


Figure 3-15 Gas Generated from Irradiating and Heating SL-639 Resin in Simulated AN-105 LAW

Table 21 Molar Composition (%) of Radiolytic Gas Sampled (including Ne) and Gas Formed (shaded), and Heating Times for SL-639 Resin in Contact with AN-105 Simulated Waste and in Contact with Water Exposed to Gamma Radiation

SuperLig® 639 resin with AN-105 simulated waste, 5.5 × 10^5 R/h irradiated tests

Test #	Gas Sample ID	Temp, °C	Ne	Ar	H_2	CO_2	N_2	O_2	N_2O	NO_x	CH_4	$C_2H_{2, 4, or 6}$	other hydrocarbons	total hydrocarbons	Time, h
10	24G62-9	25	95.8	0.011	0.65		1.01	0.049	0.51		0.023	0.013	0.014	0.027	147
					28.6		44.5	2.16	22.5		1.01	0.57	0.62	1.19	
11	24G68-3	25	96.1	0.011	0.7		0.89	0.091	0.329		0.02			0	145
					34.5		43.8	4.48	16.2		1.03			0	
39	24G71-8	65	85.9	0.065	4.39	0.064	2.63	0.086	2.65		0.23	0.960	1.58	2.540	146
					34.9	0.5	20.9	0.68	21.0		1.83	7.63	12.55	20.17	
40	24G66-9	90	87.3	0.078	3.96	1.5	2.5	0.046			0.27	1.260	2.07	3.330	144
					34.1	12.92	21.5	0.40			2.3	10.9	17.83	28.7	

SuperLig® 639 resin with H_2O, 5.5 × 10^5 R/h irradiated tests

Test #	Gas Sample ID	Temp, °C	Ne	Ar	H_2	CO_2	N_2	O_2	N_2O	NO_x	CH_4	$C_2H_{2, 4, or 6}$	other hydrocarbons	total hydrocarbons	Time, h
43	24G68-6	25	66.1	0.025	26.8	3.55	1.21	0.099			0.39	0.249	0.4	0.649	145
					81.777	10.83	3.7	0.302			1.190	0.760	1.221	1.980	
16	24G64-4	65	62.5	0.109	22.9	3.53	1.23	0.115			1.12	2.340	3.8	6.140	146
					62.543	9.64	3.36	0.314			3.059	6.391	10.378	16.769	
17	24G64-5	65	61.6	0.147	21.5	3.38	1.08	0.112			1.13	3.180	5.2	8.380	146
					57.269	9.00	2.88	0.298			3.010	8.471	13.851	22.322	
44	24G83-9	90	55.3	0.174	21.6		0.75	0.029	4.3		2.53	4.270	6.53	10.800	147
					48.53		1.7	0.07	9.7		5.68	9.59	14.671	24.265	

SuperLig® 639 resin with AN-105 simulated waste, 5.5 × 10^5 R/h irradiated tests

Test #	Gas Sample ID	Temp, °C	Ne	Ar	H_2	CO_2	N_2	O_2	N_2O	NO_x	CH_4	$C_2H_{2, 4, or 6}$	other hydrocarbons	total hydrocarbons	Time, h
7	24G55-5	25	99.07	0.01	0.001	0.012	0.71	0.193						0	0.147
					0.1	1	78	21						0	
8	24G57-8	25	99.28	0.008	0.003	0.003	0.54	0.15						0	1.47
							78	22						0	
9	24G81-9	25	99.1	0.01	0.019	0.05	0.76	0.122	0.11		0.00		0.005	0.005	14.7
					1.8	5	71	11	10.3		0.1		0.5	0.5	
10	24G62-9	25	95.8	0.011	0.65		1.01	0.049	0.51		0.02	0.013	0.014	0.027	147
					29		44.51	2.16	22.5		1.0	0.57	0.62	1.19	
11	24G68-3	25	96.1	0.011	0.7		0.89	0.091	0.329		0.02			0	147
					34		43.82	4.48	16.2		1.0			0	

Table 21 (Continued)

SuperLig® 639 resin with H_2O, 6.7 × 10^5 R/h irradiated tests

Test #	Gas Sample ID	Temp, °C	Ne	Ar	H_2	CO_2	N_2	O_2	N_2O	NO_x	CH_4	$C_2H_{2,4,\text{ or }6}$	other hydrocarbons	total hydrocarbons	Time, h
13	24G55-6	65	99.85	0.014	0.018	0.016	0.87	0.233						0	0.147
					2	1	77	20.5						0	
14	24G57-11	65	98.8	0.012	0.19	0.1	0.77	0.205			0.001		0.001	0.001	1.47
					15	5	63	16.8			0.1		0.1	0.1	
15	24G60-5	65	94.2	0.027	2.26	0.5	1.46	0.149			0.031	0.149	0.249	0.398	14.7
					46	11	29.9	3.05			0.63	3.05	5.09	8.14	
16	24G64-4	65	62.5	0.109	22.90	3.530	1.23	0.115			1.12	2.34	3.8	6.14	147
					62.5	10	3.36	0.314			3.06	6.39	10.38	16.77	
17	24G64-5	65	61.6	0.147	21.5	3.38	1.08	0.112			1.13	3.180	5.2	8.380	147
					57.3	9.00	2.9	0.30			3.01	8.47	13.85	22.32	

SuperLig® 639 resin with with no added solution, 6.7 × 10^5 R/h irradiated test

Test #	Gas Sample ID	Temp:	Ne	Ar	H_2	CO_2	N_2	O_2	N_2O	NO_x	CH_4	$C_2H_{2,4,\text{ or }6}$	other hydrocarbons	total hydrocarbons	Time, h
53	24G73-5	25	93.2	0.071	0.97		0.7	0.077	0.28		0.446	1.46	2.36	3.82	147
					14.58		10.5	1.2	4.2		6.704	21.94	35.47	57.42	

Table 22 Gas Generation Rates from SL-639 in Contact with AN-105 Simulated waste and Water exposed to gamma radiation. Rates are expressed in moles gas generated per kg of total sample (resin and solution) per day or mol/kg/day.

SuperLig® 639 resin with AN-105 simulated waste, 5.5 × 10^5 R/h irradiated tests

Test #	Temp, °C	H_2	CO_2	N_2	O_2	N_2O	NO_x	CH_4	$C_2H_{2,\ 4,\ or\ 6}$	other hydrocarbons	total hydrocarbons	total gas	Time, h
10	25	1.7E-4		2.6E-4	1.3E-5	1.3E-4		5.9E-6	3.3E-6	3.6E-6	6.9E-6	5.8E-4	147
11	25	1.7E-4		2.2E-4	2.3E-5	8.2E-5		5.2E-6				5.1E-4	145
39	65	1.1E-3	1.6E-5	6.4E-4	2.1E-5	6.5E-4		5.6E-5	2.3E-4	3.9E-4	6.2E-4	3.1E-3	146
40	90	1.0E-3	3.9E-4	6.5E-4	1.2E-5			7.0E-5	3.3E-4	5.3E-4	8.6E-4	3.0E-3	144

SuperLig® 639 resin with H_2O, 5.5 × 10^5 R/h irradiated tests

Test #	Temp, °C	H_2	CO_2	N_2	O_2	N_2O	NO_x	CH_4	$C_2H_{2,\ 4,\ or\ 6}$	other hydrocarbons	total hydrocarbons	total gas	Time, h
43	25	1.1E-2	1.5E-3	5.0E-4	4.1E-5			1.6E-4	1.0E-4	1.6E-4	2.7E-4	1.3E-2	145
16	65	9.9E-3	1.5E-3	5.3E-4	5.0E-5			4.8E-4	1.0E-3	1.6E-3	2.6E-3	1.5E-2	146
17	65	1.0E-2	1.6E-3	5.1E-4	5.3E-5			5.3E-4	1.5E-3	2.4E-3	3.9E-3	1.7E-2	146
44	90	1.1E-2		3.7E-4	1.4E-5	2.1E-3		1.3E-3	2.1E-3	3.2E-3	5.4E-3	2.0E-2	147

SuperLig® 639 resin with AN-105 simulated waste, 5.5 × 10^5 R/h irradiated tests

Test #	Temp, °C	H_2	CO_2	N_2	O_2	N_2O	NO_x	CH_4	$C_2H_{2,\ 4,\ or\ 6}$	other hydrocarbons	total hydrocarbons	total gas	Time, h
7	25	2.3E-4	2.7E-3	1.6E-1	4.4E-2							2.1E-1	0.147
8	25	6.7E-5	6.7E-5	1.2E-2	3.4E-3							1.6E-2	1.47
9	25	2.2E-5	5.9E-5	8.9E-4	1.4E-4	1.3E-4		1.2E-6		5.9E-6	5.9E-6	1.2E-3	14.7
10	25	1.7E-4		2.6E-4	1.3E-5	1.3E-4		5.9E-6	3.3E-6	3.6E-6	6.9E-6	5.8E-4	147
11	25	1.7E-4		2.2E-4	2.3E-5	8.2E-5		5.2E-6				5.1E-4	147

Table 22 (Continued)

SuperLig® 639 resin with H_2O, 6.7 × 10^5 R/h irradiated tests

Test #	Temp, °C	H_2	CO_2	N_2	O_2	N_2O	NO_x	CH_4	$C_2H_{2,\ 4,\ or\ 6}$	other hydrocarbons	total hydrocarbons	total gas	Time, h
13	65	4.9E-3	4.3E-3	2.4E-1	6.3E-2							3.1E-1	0.147
14	65	5.0E-3	1.6E-3	2.1E-2	5.6E-3			2.7E-5		2.7E-5	2.7E-5	3.3E-2	1.47
15	65	7.0E-3	1.6E-3	4.5E-3	4.6E-4			9.6E-5	4.6E-4	7.7E-4	1.2E-3	1.5E-2	14.7
16	65	9.9E-3	1.5E-3	5.3E-4	5.0E-5			4.8E-4	1.0E-3	1.6E-3	2.6E-3	1.5E-2	147
17	65	1.0E-2	1.6E-3	5.1E-4	5.3E-5			5.3E-4	1.5E-3	2.4E-3	3.9E-3	1.7E-2	147

SuperLig® 639 resin with with no added solution, 6.7 × 10^5 R/h irradiated test

Test #	Temp, °C	H_2	CO_2	N_2	O_2	N_2O	NO_x	CH_4	$C_2H_{2,\ 4,\ or\ 6}$	other hydrocarbons	total hydrocarbons	total gas	Time, h
53	25	3.2E-3		2.3E-3	2.6E-4	9.3E-4		1.5E-3	4.8E-3	7.8E-3	1.3E-2	2.1E-2	147

3.4.4 Composition and Rates of Gas Generation from SL-644 Resin

Gas-generation tests were performed on SL-644 in contact with AN-105 simulated waste and with 0.5 M HNO_3. Two sets of measurements were made on SL-644 material in contact with each solution in the presence and absence of external radiation. These are referred to as radiolytic and thermal measurements, respectively. For experiments with AN-105 simulated waste, the thermal and radiolytic measurements were made at 25°, 65°, and 90°C. For experiments using 0.5 M HNO_3, the thermal measurements were made at 25°, 45°, 65°, and 90°C; the radiolytic measurements were made at 25°, 65°, and 90°C. These experiments are detailed in Table 1. Each reaction vessel was loaded with the resin and the test solution indicated in Table 1. Gas samples were taken from the vessels at the end on the experiment.

This section is divided into two parts. Section 3.4.4.1 presents the thermal results, and Section 3.4.4.2 presents the radiolytic results of SL-644 immersed in AN-105 simulated waste and with 0.5 M HNO_3. One radiolytic experiment was performed on SL-644 with no contact solution, and these results are included in Section 3.4.4.2.

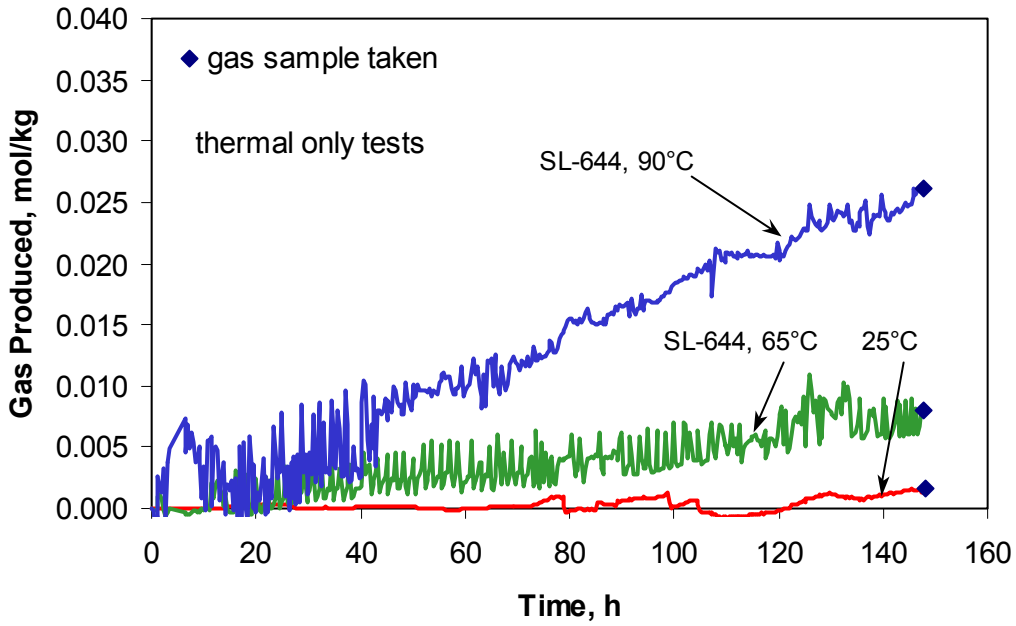
3.4.4.1 Thermal Gas Generation from SL-644 Resin Samples

This section contains the thermal gas-generation data produced by heating SL-644 resin material in reaction vessels in the absence of radiation. As shown in Figure 3-16, the rate of gas generation from SL-644 resin immersed in simulated LAW remained constant during the course of the test, although there was little gas generated at 25°C. Figure 3-17 contains the gas generated from SL-644 resin in contact with 0.5 M HNO_3. Again, there was little gas generated at 25°C, and the rates appear to decrease during the test. Gas generation ceased after approximately 30 h at 90°C, although the initial rate was higher than at 65°C.

The total amount of gas produced as a function of heating time was measured for each reaction vessel. To obtain separate rates for each gas present, gas samples were analyzed by mass spectroscopy. The molar composition of these gas samples is given in Table 23. Of more interest is the composition of gas that is generated, and this is presented below the entry in that table for each run and is shaded. The uncertainties in all the entries in this table are approximately plus or minus one in the last digit. Nitrogen and carbon dioxide are generally the major constituents in the gases generated from the resins immersed in simulated LAW and 0.5 M HNO_3. This is probably due to air in-leakage during sampling and displacement from the resin with oxygen being consumed in the oxidation of resin, giving rise to higher concentrations of carbon dioxide than expected from air alone. Steimke (2001) postulated that resin oxidation from reaction with oxygen is a major degradation mechanism for SL-644. The concentrations of nitrous oxide and hydrocarbons increase with increasing temperature when the resin is immersed in simulated LAW, perhaps indicating thermal breakdown of the resin. The concentrations of hydrocarbons and carbon dioxide also increase with increasing temperature for the resin immersed in 0.5 M HNO_3, again indicating thermal breakdown of the resin.

In the tables of percent composition and rates, the test number is used to identify the experimental condition. Test numbers in the gas composition and rate tables correspond to experiment numbers in Table 1.

Using the percent composition data, reaction times, and mass of each sample, rates of gas generation were determined. These rates are given in Table 24 as a function of experiment number, resin type, solution type, and temperature. The rates of generation of all gases increase with increasing temperature when the resin is immersed in either simulated LAW or 0.5 M HNO_3.



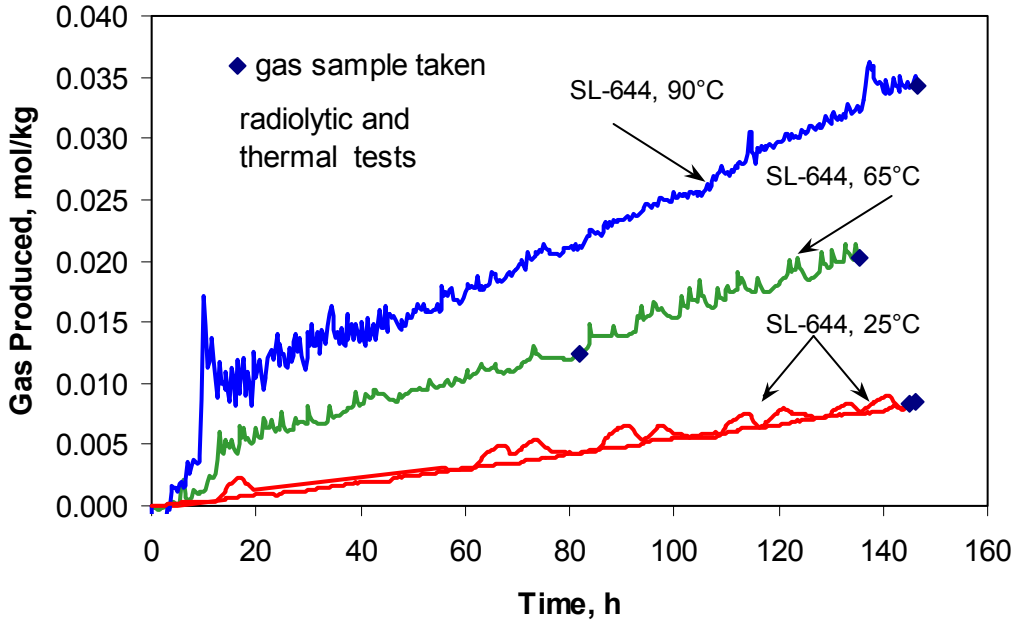


Figure 3-16 Gas Generated from Heating and Irradiating SL-644 Resin in AN-105 Simulated Waste. Upper plot thermal only, lower plot thermal in the presence of 6.8×10^5 R/h gamma field.

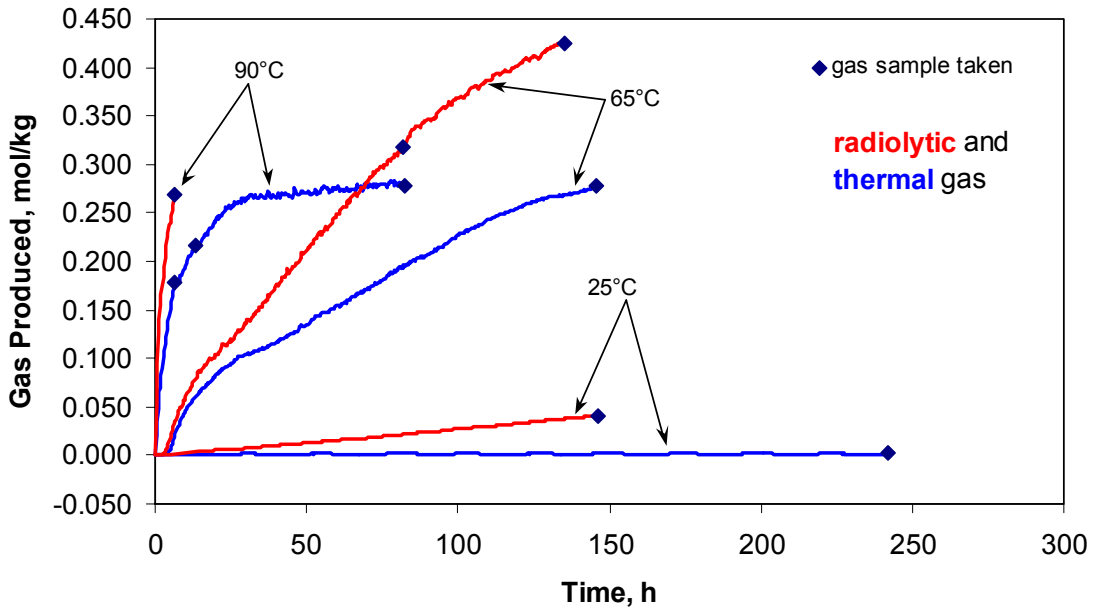


Figure 3-17 Gas Generated from Heating and Irradiating SL-644 Resin in 0.5 M HNO_3. The blue trend lines detail the thermal gas; the red trend lines show the gases generated in the presence of 5.5×10^5 R/h gamma field.

Table 23 Molar Composition (%) of Thermal Gas Sampled (including Ne) and Gas Formed (shaded), and Heating Times for SL-644 Resin in Contact with AN-105 Simulated waste and 0.5 M HNO_3 (no external radiation source)

SuperLig® 644 resin with AN-105 simulated waste, thermal tests

Test #	Gas Sample ID	Temp:	Ne	Ar	H_2	CO_2	N_2	O_2	N_2O	NO_x	CH_4	$C_2H_{2,4,\text{ or }6}$	other hydrocarbons	total hydrocarbons	Time, h
18	24G49-1	25	99.4	0.009	0.002		0.44	0.09	0.01					0	146
							81	16.5	2					0	
45	24G49-2	65	99	0.01	0.02		0.64	0.12	0.194		0.00	0.002	0.002	0.004	146
					2		65.2	12.2	19.8		0.31	0.2	0.2	0.4	
46	24G49-3	90	91.6	0.011	0.195		5.7	0.1	2.42		0.00	0.011	0.004	0.015	146
					2.3		67.6	1.19	28.7		0.0	0.13	0.05	0.18	

SuperLig® 644 resin with 0.5M HNO_3, thermal tests

Test #	Gas Sample ID	Temp:	Ne	Ar	H_2	CO_2	N_2	O_2	N_2O	NO_x	CH_4	$C_2H_{2,4,\text{ or }6}$	other hydrocarbons	total hydrocarbons	Time, h
26	24G49-4	25	98.3	0.017	0.01	0.55	0.96	0.17	0.04		0.002			0	242
					0.6	31.8	55.6	9.84	2.1		0.12			0	
58	24G77-11	45	88.5	0.02	0.02	4.90	2.61	0.104	2.73		0.005	0.003		0.003	146
					0.2	47.24	25.16	1.00	26.32		0.048	0.03		0.03	
57	24G78-3	45	94.7	0.026	0.01	0.3	1.76	0.39	0.1		0.002	0.002		0.002	14
						12.1	68	15.0	4		0.1	0.1		0.1	
49	24G49-5	65	44.2	0.009	0.01	33.60	9.8	0.019	9.6		0.061	0.006		0.006	146
					0.02	60.22	17.56	0.034	17.20		0.11	0.011		0.011	
59	24G78-4	65	77	0.022	0.02	10.1	5.2	0.066	5.6		0.01	0.007	0.002	0.009	14
					0.1	45.69	23.5	0.30	25.3		0.05	0.03	0.009	0.04	
50a[(a)]	24G46-6	90	41.7	0.007	0.01	38.0	10.5	0.021	6.1		0.134	0.043		0.043	7
					0.0	65.28	18.04	0.036	10.48		0.23	0.07		0.07	
50b[(a)]	24G48-6	90	69.2	0.004	0.00	22.0	5.1	0.012	3.63		0.084	0.03		0.03	6
					0.0	71.30	16.53	0.039	11.76		0.27	0.10		0.10	
50c[(a)]	24G49-6	90	72.9	0.007	0.00	20.3	5.2	0.017	1.5		0.07	0.009	0.005	0.014	69
					0.0	74.89	19.18	0.063	5.53		0.26	0.03	0.018	0.05	

(a) Test # 50 was sampled three separate times during the reaction sequence. The samples 50a, 50b, and 50c correspond to the three consecutive samples.

Table 24 Gas Generation Rates from Thermal Treatment of SL-644 Resin in Contact with AN-105 Simulated Waste and 0.5 M HNO_3 (in the Absence of an External Radiation Source). Rates are expressed in moles gas generated per kg of total sample (resin and solution) per day or mol/kg/day.

		SuperLig® 644 resin with AN-105 simulated waste, thermal tests											
Test #	Temp, °C	H_2	CO_2	N_2	O_2	N_2O	NO_x	CH_4	$C_2H_{2, 4, \text{ or } 6}$	other hydrocarbons	total hydrocarbons	total gas	Time, h
18	25	4.7E-7		1.0E-4	2.1E-5	3.1E-6						1.3E-4	146
45	65	5.2E-6		1.6E-4	3.1E-5	5.0E-5		7.7E-7	5.2E-7	5.2E-7	1.0E-6	2.5E-4	146
46	90	5.3E-5		1.5E-3	2.7E-5	6.6E-4		1.1E-6	3.0E-6	1.1E-6	4.1E-6	2.3E-3	146

		SuperLig® 644 resin with 0.5M HNO_3, thermal tests											
Test #	Temp, °C	H_2	CO_2	N_2	O_2	N_2O	NO_x	CH_4	$C_2H_{2, 4, \text{ or } 6}$	other hydrocarbons	total hydrocarbons	total gas	Time, h
26	25	1.8E-6	9.8E-5	1.7E-4	3.0E-5	6.4E-6		3.6E-7				3.1E-4	242
58	45	6.8E-6	1.6E-3	8.4E-4	3.4E-5	8.8E-4		1.6E-6	9.7E-7		9.7E-7	3.3E-3	146
57	45	1.9E-5	9.8E-4	5.5E-3	1.2E-3	3.1E-4		6.2E-6	6.2E-6		6.2E-6	8.0E-3	14
49	65	8.6E-6	2.4E-2	7.0E-3	1.4E-5	6.9E-3		4.4E-5	4.3E-6		4.3E-6	3.8E-2	146
59	65	7.4E-5	4.0E-2	2.0E-2	2.6E-4	2.2E-2		3.9E-5	2.7E-5	7.8E-6	3.5E-5	8.2E-2	14
50a[(a)]	90	2.3E-4	7.8E-1	2.2E-1	4.3E-4	1.2E-1		2.7E-3	8.8E-4		8.8E-4	1.1E+0	7
50b[(a)]	90	9.5E-6	2.1E-1	4.8E-2	1.1E-4	3.4E-2		8.0E-4	2.8E-4		2.8E-4	2.9E-1	6
50c[(a)]	90	3.4E-6	1.7E-2	4.4E-3	1.4E-5	1.3E-3		6.0E-5	7.7E-6	4.3E-6	1.2E-5	2.3E-2	69

(a) Test # 50 was sampled three separate times during the reaction sequence. The samples 50a, 50b, and 50c correspond to the three consecutive samples.

3.4.4.2 Radiolytic Gas Generation from SL-644 Resin Samples

This section contains the gas-generation results from resin samples exposed to gamma radiation and heating to temperatures of 25, 65, and 90°C.

Figure 3-16 and Figure 3-17 show that the rate of gas generation increases with increasing dose and temperature when the resin is immersed in simulated LAW or 0.5 M HNO_3, respectively. The molar composition of the gas sampled at the end of each radiolytic gas-generation run is given in Table 25. Hydrogen, carbon dioxide, nitrogen, and nitrous oxide all contribute to the off-gas. Concentrations of nitrous oxide and hydrocarbons increase with increasing temperature and dose when the resin is immersed in either simulated LAW or 0.5 M HNO_3. Concentrations of hydrogen and carbon dioxide also increase with increasing dose only, probably due to water radiolysis and resin oxidation by reaction with oxygen, respectively. The SL-644 also appears to undergo direct radiolytic degradation since methane and carbon dioxide are significant off-gas constituents when the only resin is irradiated. Hydrogen and nitrogen also appear to be products of direct radiolytic degradation.

The rates of gas generation obtained from each of these experiments are given in Table 26. The rates are given as a function of experiment number, resin type, solution type, and temperature. Experiment numbers in the gas composition and rate tables correspond to experiment numbers in Table 1. The generation rates of hydrogen, carbon dioxide, nitrous oxide, and hydrocarbons increase with increasing temperature. No trends in the gas-generation rates as a function of dose are observable, except that for hydrogen, which appears to increase with increasing dose.

Table 25 Molar Composition (%) of Radiolytic Gas Sampled (including Ne) and Gas Formed (shaded), and Heating Times for SL-644 Resin in Contact with AN-105 Simulated waste and 0.5 M HNO_3 (an external ^{60}Co gamma radiation source was used for these samples)

SuperLig® 644 resin with AN-105 simulated waste, 5.5 × 10^5 R/h irradiated tests

Test #	Gas Sample ID	Temp:	Ne	Ar	H_2	CO_2	N_2	O_2	N_2O	NO_x	CH_4	$C_2H_{2,\ 4,\ or\ 6}$	other hydrocarbons	total hydrocarbons	Time, h
21	24G62-10	25	93.9	0.014	2.46		1.47	0.054	0.96		0.036	0.005	0.001	0.006	146
					49.3		29.5	1.08	19.3		0.72	0.10	0.02	0.12	
22	24G68-4	25	94.2	0.012	2.49		1.16	0.128	0.8		0.04	0.006	0.004	0.01	145
					53.9		25.1	2.77	17.3		0.76	0.13	0.09	0.22	
24	24G73-3	25	93.7	0.007	2.68	0.002	0.7	0.09	0.5		0.02	0.002		0.002	147
					67	0.1	18	2.3	13		0.6	0.1		0.1	
25	24G73-4	25	94.4	0.008	2.93	0.0	0.81	0.13	0.54		0.021	0.003	0.002	0.005	147
					65.8	0.3	18	2.9	12		0.5	0.1	0.04	0.1	
47	24G71-9	65	88.7	0.013	3.22		2.59	0.047	3.18		0.07	0.027	0.01	0.037	146
					35		28.1	0.51	34.5		0.8	0.29	0.11	0.40	
48	24G83-10	90	90.6	0.016	2.71		3.69	0.056	2.62		0.06	0.043	0.018	0.061	147
					29		39.1	0.59	27.8		0.6	0.46	0.19	0.65	

SuperLig® 644 resin with 0.5M HNO_3, 5.5 × 10^5 R/h irradiated tests

Test #	Gas Sample ID	Temp:	Ne	Ar	H_2	CO_2	N_2	O_2	N_2O	NO_x	CH_4	$C_2H_{2,\ 4,\ or\ 6}$	other hydrocarbons	total hydrocarbons	Time, h
29	24G62-11	25	81.4	0.019	3.41	8.7	2.64	0.083	3.01		0.005			0	146
					19.106	48.74	14.8	0.465	16.86		0.028			0	
30	24G68-5	25	83.7	0.014	2.99	7.5	2.12	0.127	2.5		0.01	0.006	0.007	0.013	145
					19.60	49.2	13.9	0.83	16.39		0.03	0.04	0.05	0.09	
51	24G71-10	65	33.1	0.006	2.82	38.7	10.2	0.021	13.5		0.02	0.004		0.004	146
					4.25	58.31	15.37	0.032	20.34		0.03	0.006		0.006	
52	24G79-1	90	40.6	0.005	0.258	26.5	9.6	0.018	21.9		0.07	0.045	0.2	0.245	7
					0.4	44.54	16.14	0.030	36.81		0.12	0.08	0.336	0.412	

SuperLig® 644 resin with AN-105 simulated waste, 5.5 × 10^5 R/h irradiated tests

Test #	Gas Sample ID	Temp:	Ne	Ar	H_2	CO_2	N_2	O_2	N_2O	NO_x	CH_4	$C_2H_{2,\ 4,\ or\ 6}$	other hydrocarbons	total hydrocarbons	Time, h
19	24G57-9	25	99.25	0.008	0.018	0.013	0.59	0.122				0.002		0.002	1.47
					2.4	2	79	16				0.3		0.3	
20	24G81-10	25	98.6	0.013	0.15	0.01	0.92	0.101	0.162		0.003			0	14.7
					11.1	1	68	7	12.0		0.2			0	
21	24G62-10	25	93.9	0.014	2.46		1.47	0.054	0.96		0.036	0.005	0.001	0.006	146
					49.3		29	1	19.3		0.7	0.1	0.02	0.1	
22	24G68-4	25	94.2	0.012	2.49		1.16	0.128	0.8		0.035	0.006	0.004	0.01	145
					54		25.09	2.77	17.3		0.76	0.13	0.09	0.22	
23	24G75-1	25	61.7	0.015	13.2		11.6	0.181	13.1		0.16	0.010	0.01	0.02	1031
					34		30.318	0.473	34.24		0.418	0.026	0.026	0.052	

Table 25 (Continued)

SuperLig® 644 resin with 0.5M HNO_3, 5.5 × 10^5 R/h irradiated tests

Test #	Gas Sample ID	Temp:	Ne	Ar	H_2	CO_2	N_2	O_2	N_2O	NO_x	CH_4	$C_2H_{2,\ 4,\ or\ 6}$	other hydrocarbons	total hydrocarbons	Time, h
27	24G57-10	25	98.9	0.012	0.03	0.1	0.79	0.161	0.029					0	1.47
					3	11	70	14.2	2.6					0	
28	24G81-11	25	96.2	0.019	0.39	1.3	1.35	0.2	0.58		0.002			0	14.7
					10	34	35.3	5.24	15.2		0.05			0	
29	24G62-11	25	81.4	0.019	3.41	8.7	2.64	0.083	3.01		0.005			0	146
					19.1	49	14.8	0.465	16.86		0.028			0	
30	24G68-5	25	83.7	0.014	2.99	7.5	2.12	0.127	2.5		0.005	0.006	0.007	0.013	145
					19.6	49	13.9	0.83	16.39		0.03	0.04	0.05	0.09	

SuperLig® 644 resin with with no added solution, 5.5 × 10^5 R/h irradiated test

Test #	Gas Sample ID	Temp:	Ne	Ar	H_2	CO_2	N_2	O_2	N_2O	NO_x	CH_4	$C_2H_{2,\ 4,\ or\ 6}$	other hydrocarbons	total hydrocarbons	Time, h
5	24G59-11	25	97.2	0.022	0.41	0.7	1.6	0.097			0.026			0	149
					14.63	23	57	3.5			0.928			0	

Table 26 Gas Generation Rates from Radiolytic Treatment of SL-644 Resin in the Presence of an External ^{60}Co Radiation Source in Contact with AN-105 Simulated waste and 0.5 M HNO_3. Rates are expressed in moles gas generated per kg of total sample (resin and solution) per day or mol/kg/day.

SuperLig® 644 resin with AN-105 simulated waste, 5.5 × 10^5 R/h irradiated tests

Test #	Temp, °C	H_2	CO_2	N_2	O_2	N_2O	NO_x	CH_4	$C_2H_{2, 4, or 6}$	other hydrocarbons	total hydrocarbons	total gas	Time, h
21	25	6.5E-4		3.9E-4	1.4E-5	2.5E-4		9.5E-6	1.3E-6	2.6E-7	1.6E-6	1.3E-3	146
22	25	6.4E-4		3.0E-4	3.3E-5	2.1E-4		9.1E-6	1.6E-6	1.0E-6	2.6E-6	1.2E-3	145
24	25	5.9E-4	4.4E-7	1.5E-4	2.0E-5	1.1E-4		4.8E-6	4.4E-7		4.4E-7	8.8E-4	147
25	25	6.3E-4	3.0E-6	1.7E-4	2.8E-5	1.2E-4		4.5E-6	6.4E-7	4.3E-7	1.1E-6	9.5E-4	147
47	65	8.6E-4		6.9E-4	1.2E-5	8.5E-4		1.9E-5	7.2E-6	2.7E-6	9.8E-6	2.4E-3	146
48	90	1.1E-3		1.4E-3	2.2E-5	1.0E-3		2.3E-5	1.7E-5	7.0E-6	2.4E-5	3.6E-3	147

SuperLig® 644 resin with 0.5M HNO_3, 5.5 × 10^5 R/h irradiated tests

Test #	Temp, °C	H_2	CO_2	N_2	O_2	N_2O	NO_x	CH_4	$C_2H_{2, 4, or 6}$	other hydrocarbons	total hydrocarbons	total gas	Time, h
29	25	1.3E-3	3.3E-3	1.0E-3	3.2E-5	1.2E-3		1.9E-6				6.8E-3	146
30	25	1.3E-3	3.3E-3	9.2E-4	5.5E-5	1.1E-3		2.2E-6	2.6E-6	3.1E-6	5.7E-6	6.7E-3	145
51	65	2.7E-3	3.7E-2	9.7E-3	2.0E-5	1.3E-2		1.9E-5	3.8E-6		3.8E-6	6.2E-2	146
52	90	4.1E-3	4.2E-1	1.5E-1	2.9E-4	3.5E-1		1.2E-3	7.2E-4	3.2E-3	3.9E-3	9.4E-1	7

SuperLig® 644 resin with AN-105 simulated waste, 5.5 × 10^5 R/h irradiated tests

Test #	Temp, °C	H_2	CO_2	N_2	O_2	N_2O	NO_x	CH_4	$C_2H_{2, 4, or 6}$	other hydrocarbons	total hydrocarbons	total gas	Time, h
19	25	4.4E-4	3.1E-4	1.4E-2	3.0E-3				4.8E-5		4.8E-5	1.8E-2	1.47
20	25	1.9E-4	1.7E-5	1.2E-3	1.3E-4	2.1E-4		3.8E-6				1.7E-3	14.7
21	25	6.5E-4		3.9E-4	1.4E-5	2.5E-4		9.5E-6	1.3E-6	2.6E-7	1.6E-6	1.3E-3	147
22	25	6.4E-4		3.0E-4	3.3E-5	2.1E-4		9.1E-6	1.6E-6	1.0E-6	2.6E-6	1.2E-3	147
23	25	7.2E-4		6.3E-4	9.8E-6	7.1E-4		8.7E-6	5.4E-7	5.4E-7	1.1E-6	2.1E-3	1029.4

Table 26 (Continued)

SuperLig® 644 resin with 0.5M HNO_3, 5.5 × 10^5 R/h irradiated tests

Test #	Temp, °C	H_2	CO_2	N_2	O_2	N_2O	NO_x	CH_4	$C_2H_{2, 4, \text{ or } 6}$	other hydrocarbons	total hydrocarbons	total gas	Time, h
27	25	8.7E-4	3.5E-3	2.3E-2	4.7E-3	8.4E-4						3.3E-2	1.47
28	25	6.0E-4	2.0E-3	2.1E-3	3.1E-4	9.0E-4		3.1E-6				6.0E-3	14.7
29	25	1.3E-3	3.3E-3	1.0E-3	3.2E-5	1.2E-3		1.9E-6				6.8E-3	147
30	25	1.3E-3	3.3E-3	9.2E-4	5.5E-5	1.1E-3		2.2E-6	2.6E-6	3.1E-6	5.7E-6	6.7E-3	147

SuperLig® 644 resin with with no added solution, 5.5 × 10^5 R/h irradiated test

Test #	Temp, °C	H_2	CO_2	N_2	O_2	N_2O	NO_x	CH_4	$C_2H_{2, 4, \text{ or } 6}$	other hydrocarbons	total hydrocarbons	total gas	Time, h
5	25	2.0E-3	3.1E-3	7.6E-3	4.6E-4			1.2E-4				1.3E-2	149

3.4.5 Thermal and Radiolytic Rate Parameters for Gas Generation from SL-639 and SL-644 Resins in Contact with AN-105 Simulated Waste, 0.5 M HNO_3, and Water

Organic ion exchange resins in contact with Hanford simulated waste have been shown to produce gas from exposure to heat and radiation. The total rate of gas generation under radiolytic conditions is a sum of the thermal and radiolytic components according to the following equation

$$\text{Total Rate} = \text{Radiolytic Rate} + \text{Thermal Rate} \tag{6}$$

The thermal rate, k, varies with temperature according to the Arrhenius equation:

$$k = Ae^{\left(\frac{-E_a}{RT}\right)} \tag{7}$$

Here, R is the gas constant, 8.314 J/K-mol, T is the temperature in Kelvin, E_a is the activation energy, and A is the pre-exponential factor. The initial thermal rate is assumed to be zero-order, in which case the rate constant is equivalent to the observed rate. Values of E_a and A are then determined from the rates measured in the reaction vessels. The equation allows the thermal rates to be calculated at temperatures at which the rate is so slow that it is difficult to measure directly.

The radiolytic rate at a given temperature is determined experimentally by measuring the difference between rates measured in the presence and absence of external radiation. The G-value, a dose-independent rate, is related to the radiolytic rate by:

$$\text{G-value(molecules/100 eV)} = \frac{\text{Radiolytic rate (mol/kg/day)}}{\text{Dose rate (R/hr)}} \times (4.02 \times 10^7) \tag{8}$$

The constant 4.02×10^7 is a unit conversion factor. The activation energy for the initial rate of gas formation for each thermal gas reaction system was estimated from gas composition and generation data for each experiment.

The experimental thermal and radiolytic rates for hydrogen, nitrous oxide, nitrogen, oxygen, carbon dioxide (where observed), methane, and other hydrocarbons are presented in Appendix E. The thermal activation parameters, E_a, and radiolytic G-values derived from these data are listed in Table 27. In general, the rate of gas generation from SL-644 exhibits greater temperature dependence, and there is greater temperature dependence on rates when the resin is immersed in simulated LAW. The G-values suggest that the radiolytic gas-generation rates are greater for SL-639 and lower when the SL-639 resin is immersed in LAW. Hydrocarbon G-values are higher when the SL-644 resin is immersed in LAW, but there are otherwise no other generalizations.

Table 27 Gas-Generation Activation Parameters for SL-639 and SL-644 Resins in Contact with AN-105 Simulated Waste, 0.5 M HNO_3, and Water

		H_2			N_2O			O_2		
resin type	**contact solution**	**E_a**	**ln(A)**	**G-value**	**E_a**	**ln(A)**	**G-value**	**E_a**	**ln(A)**	**G-value**
639	AN-105	40(±56)	1(±21)	0.08 (65, 90°C); 0.01 (25°C)	19.9	-5.1	0.047 (65°C); 0.008 (25°C)	-2(±26)	-11(±10)	~0
639	H2O	32(±77)	-1(±29)	0.76	36(±7)	1(±3)	0.15	-8(±20)	-13(±8)	-0.002
644	AN-105	64(±142)	11(±52)	0.053	73(±147)	16(±54)	0.049 (90°C); 0.017 (65°C); 0.008 (25°C)	4(±42)	-9(±15)	~0
644	HNO3	60(±44)	11(±16)	0.24 (65, 90°C); 0.095 (25°C)	134(±37)	43(±14)	0.5 (65, 90°C); 0.08 (25°C)	21(±91)	-1(±34)	~0
	HNO3	11(±50)	-11(±18)	0.11	74(±199)	16(±72)	~0	-44(±43)	-27(±16)	0.043
	AN-105	34(±62)	-1(±22)	0.046	49(±32)	6(±12)	0.0025	-1(±69)	-11(±25)	0.2 (90°C); 0.1 (65°C); 0.0009 (25°C)
	H2O	6(±28)	-12(±10)	0.196	12.0	-8.0	~0	-2(±8)	-10(±3)	0.092

Table 27 (continued)

resin type	contact solution	N_2			CH_4			TH		
		E_a	ln(A)	G-value	E_a	ln(A)	G-value	E_a	ln(A)	G-value
639	AN-105	3(±29)	-8(±11)	0.034 (65, 90°C); 0.007 (25°C)	62.8	7.0	0.0046 (65, 90°C); 0.00041 (25°C)	56.0	6.8	0.054 (65, 90°C); 0.0005 (25°C)
639	H2O	1(±85)	-8(±32)	0.013	--	--	0.092 (90°C); 0.037 (65°C); 0.011 (25°C)	28(±142)	-4(±52)	0.29 (65, 90°C); 0.019 (25°C)
644	AN-105	34(±260)	4(±95)	0.034 (90°C); 0.020 (65°C); 0.0065 (25°C)	13.9	-9.1	0.0015 (90°C); 0.0007 (65°C); 0.00031 (25°C)	56.1	6.1	0.0015 (90°C); 0.00066 (65°C); 0.00015 (25°C)
644	HNO3	92(±40)	29(±15)	0.056	119(±39)	33(±14)	0.00013	116(±111)	31(±40)	0.0004
	HNO3	-1(±30)	-9(±11)	0.0008	74.6	12.8	~0	-29.9	-25.9	~0
	AN-105	1(±49)	-8(±18)	~0	--	--	~0	--	--	~0
	H2O	2(±37)	-7(±14)	0.0018	--	--	~0	--	--	~0

3.4.6 Analysis of Gases for Volatile Organic Compounds

Note that concentrations are reported on an acid form resin weight basis in the following discussion.

Appendix G presents the positively identified VOCs (PIVOCs). PIVOCs 1,1,2-trichloroethane, 1,2,2-trifluoroethane and 1,1,1-trichloroethane were positively identified at concentrations of ~1000 mg/kg in all samples including those without resin. These PIVOCs were most likely contaminants from the atmosphere of the refrigerator where the samples were temporarily stored. Benzene, toluene and some xylenes were positively identified up to concentrations of 600 mg/kg, 125 mg/kg and 25 mg/kg, respectively, in the gases generated from the SL-639 resin. There appears to be no trends with dose but their concentrations do increase with increasing temperature. Similarly, concentrations of benzene compounds, toluene, xylenes and 1,2-dichloropropane up to typically 100 mg/kg in the gases generated from the SL-644 increased with increasing temperature but there are again no trends with dose. Benzene, toluene and xylenes are all VOCs of regulatory concern and appear to be significant since their observed concentrations in the gases are above their LDR treatment standard concentrations of 10 mg/kg, 10 mg/kg and 30 mg/kg, respectively, as listed in Table 5.

The tentatively identified VOCs (TIVOCs) are presented in Appendix H. The concentrations of TIVOCs increase with increasing temperature for SL-644 and irradiation appears to accentuate the temperature effect while not having an effect at constant temperature. Major TIVOCs include silane methyl (up to 10^{-3} mg/kg), propanal (up to 0.5 mg/kg), propene (up to 5 mg/kg) and benzene compounds (up to 10 mg/kg). In addition, carbon disulfide (up to 0.04 mg/kg), acetone (up to 0.1 mg/kg) and methyl isobutyl ketone (up to 1 mg/kg) VOCs of regulatory concern were identified although the latter two were also identified in gases generated from the liquids alone. There is no LDR treatment standard for carbon disulfide but the concentrations of 160 mg/kg and 33 mg/kg for acetone and methyl isobutyl ketone, respectively, are above those observed in the gases.

For SL-639, the concentrations of TIVOCs typically increased with increasing dose while heating appears to accentuate the irradiation effect while having little effect at constant dose. Butanes (up to 100 mg/kg), pentanes (up to 1 mg/kg), propanals (up to 5 mg/kg) and propanol (up to 20 mg/kg) were the major TIVOCs. Acetone and methyl isobutyl ketone VOCs of regulatory concern were identified at concentrations up to 1 mg/g although both were also identified in the gases generated from the liquids alone. The concentrations of acetone and methyl isobutyl ketone in the liquids are below their LDR treatment standard concentrations of 160 mg/kg and 33 mg/kg, respectively.

4.0 Conclusions

The following conclusions from this work are categorized for clarity.

Physical Inspection of Reaction Vessels, Resins and Solutions

- Visual inspection of the irradiated and heated SL-644 and SL-639 resins showed no significant agglomeration.
- The SL-644 dissolved in the simulated LAW with the rate increasing with increasing dose and temperature. However, irradiation had no significant impact on the dissolution rate when the SL-644 was immersed in 0.5 M HNO_3, although it did increase with increasing temperature at constant dose. There appeared to be only a small effect of dose on the SL-639 resin dissolution rate and no discernible impact from temperature in either simulated LAW or water.
- Visual inspection of the reaction vessels did not indicate any corrosion.

Ion Exchange Capacity

- No significant deterioration in the SL-639 batch-equilibrium coefficient was observed up to the maximum tested dose of 10^8 R.
- An appreciable reduction in the batch-equilibrium coefficient of SL-644 was observed after doses of 10^6 R were attained, with the batch-equilibrium coefficient decreasing by ~ 70% by the time a total dose of 10^8 R was delivered.

Gas Generation

- Nitrogen, oxygen, and carbon dioxide were the major constituents in the gas evolved from only heating the resins and matrices. These gases were probably associated with air in-leakage during sampling and displacement from the resin. The absence of oxygen in the off-gas from heating SL-644 further confirms that it is consumed in oxidizing the resin.
- Nitrous oxide and hydrocarbons also became significant at high temperatures, perhaps indicating thermal breakdown of the resins.
- Water radiolysis probably accounted for hydrogen generally becoming the major constituent when the resins and matrices were irradiated. The absence of oxygen expected from water radiolysis was probably because it was consumed in oxidizing the SL-644 resin or SL-639 radiolytic degradation products since the concentration of carbon dioxide increased with increasing dose.
- The concentration of hydrocarbons also increased with increasing dose to both resins, further confirming that irradiation increased the resin dissolution rate.
- The rate of gas generation from SL-644 generally exhibited greater temperature dependence, and there was greater temperature dependence on rates when the resin was immersed in simulated LAW.
- The G-values suggest that the radiolytic gas-generation rates were greater for SL-639 than SL-644 and lower when the SL-639 resin was immersed in LAW.
- VOCs 1,1,2-trichloroethane, 1,2,2-trifluoroethane and 1,1,1-trichloroethane were positively identified in all gas samples including those without resin. These VOCs were most likely contaminants from the atmosphere of the refrigerator where the samples were temporarily stored.

- Concentrations of benzene, toluene and xylene VOCs positively identified in the gases generated from the SL-639 resin increased with increasing temperature but there was no trend with dose. In contrast, concentrations of butane, pentane, propanal and propanol VOCs tentatively identified generally increased with increasing dose but there was no trend with temperature.
- Similarly, concentrations of benzene compounds, toluene, xylenes and 1,2-dichloropropane positively identified in the gases generated from SL-644 increased with increasing temperature but there were again no trends with dose. Silane methyl, propanal, propene and benzene VOCs were tentatively identified.

Changes in Solution Composition

- There appeared to be no impact of dose on the SO_4^-, PO_4^-, Cl^-, or F^- concentrations in the simulated LAW in contact with SL-644 at 25°C.
- The oxalate concentration appeared to increase with increasing dose, perhaps because it was a product from radiolytic degradation of the resin or organic compounds in the simulated LAW.
- Hydroxide and NO_3^- anions were increasingly consumed with increasing dose while the NO_2^- anion was generated, especially at doses greater than 10^8 R.
- Both the organic and inorganic C concentrations increased with increasing dose. Irradiation appeared to increase the dissolution rate of the resin evident from the reduction in resin mass, the increase in organic C in solution and visual appearance of the solutions.
- The organic compounds were apparently oxidized to CO_2 that either evolved as gas or dissolved as carbonate, as evident from the increase in inorganic C concentration.
- Phenol and phthalate compounds were the semi-volatile organic compounds positively identified in the liquids. However, these compounds were most likely contaminants since phthalate compounds are used in a variety of plastics and tend to be ubiquitous while the phenol compounds were only detected at trace concentrations.

WTP Design and Operating Implications

- The SL-639 resin was calculated to become exposed to a dose of 2.77×10^4 R every cycle from processing envelope A LAW containing ^{99}Tc at a concentration of 64 μCi/L for 170 hours (the maximum duration assumed by Olson (2001a)) through a bed 1 m diameter and 1 m high. A dose of 3.42×10^4 R was calculated when processing envelope B LAW containing ^{99}Tc at a concentration of 375 μCi/L for 210 hours (the maximum duration assumed by Olson (2001a). The resin was assumed to receive no dose when the bed was in the second and lag positions. On the basis of the results from this report, the resin would only begin to show signs of deterioration in performance after 10,700 or 8,770 cycles processing envelope A or B LAW, respectively. Therefore, resin replacement would probably be required less frequently than the every 10 cycles currently designed. Note that the projection takes no account of chemical degradation.

- The SL-644 resin was calculated to become exposed to a dose of 2.05×10^6 R every cycle from processing envelope A LAW containing ^{137}Cs at a concentration of 180 mCi/L for 66 hours (the maximum duration assumed by Olson (2001b)) through a bed 1 m diameter and 1 m high. A dose of 5.56×10^6 R was calculated when processing envelope B LAW containing ^{137}Cs at a concentration of 2 Ci/L for 40 hours (the maximum duration assumed by Olson (2001b). The resin was assumed to receive no dose when the bed was in the lag and polishing positions. On this basis for the tested batch of resin, a resin bed in the WTP would require replacement every 75

and 28 cycles assuming it processes envelope A and B LAW, respectively, until complete loss of capacity. The current design basis assumes a bed is replaced every 10 cycles and so is broadly consistent with these test results. Note that the projection takes no account of chemical degradation.

- No semi-volatile organic compounds of regulatory concern were positively identified in the liquids in which the resin was immersed. Benzene compounds, toluene and xylenes of regulatory concern were the volatile organic compounds positively identified in the gases generated from either resin. Carbon disulfide, acetone and methyl isobutyl ketone were also tentatively identified although the latter two were also identified in the gases generated from the liquids alone.

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Appendix A

Verification of the Gas Generation System Reliability and Performance

Appendix A: Verification of the Gas Generation System Reliability and Performance

To assure that the moles of gas could be measured correctly when the reaction vessel temperature was changed, a known quantity of gas was measured at various reaction vessel temperatures. The reaction vessel temperature was changed from a starting temperature of 30ºC to 60ºC and finally to 90ºC, then decreased through 60ºC to 30ºC as the final temperature. This temperature range encompasses the experimental range that will be encountered during gas-generation tests. The pressure increased as the temperature increased, following the Ideal Gas Law. The moles of gas within the closed reaction system remained constant throughout the experiment.

The temperature of a reaction vessel attached to the gas manifold line in the same configuration used for gas-generation experiments is shown in Figure A.2. The temperature of the reaction vessel was initially regulated at 30ºC for 5 h. The reaction vessel temperature then was quickly increased to 60ºC and allowed to stay at this temperature for approximately 15 h. The temperature again was increased to 90ºC and allowed to stay at that temperature for approximately 10 h. The temperature then was lowered to 60ºC (for about 20 h), followed by a return to the original temperature of 30ºC. The pressure of the gas in the system increased as the temperature increased and decreased as the temperature decreased, as expected for a fixed-volume system; the pressure data are shown in Figure A.2. Comparing Figure A.1 with Figure A.2, we see that the pressure tracks the temperature very well.

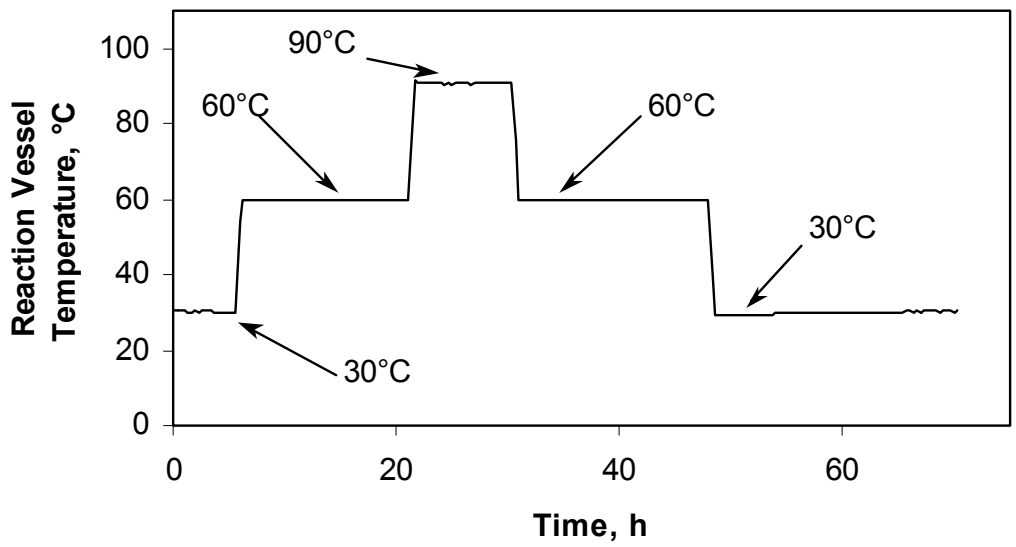


Figure A.1 Reaction Vessel Temperature During Initial Testing (temperature of the reaction vessel was changed from 30ºC to 90ºC and back to 30ºC during this experiment)

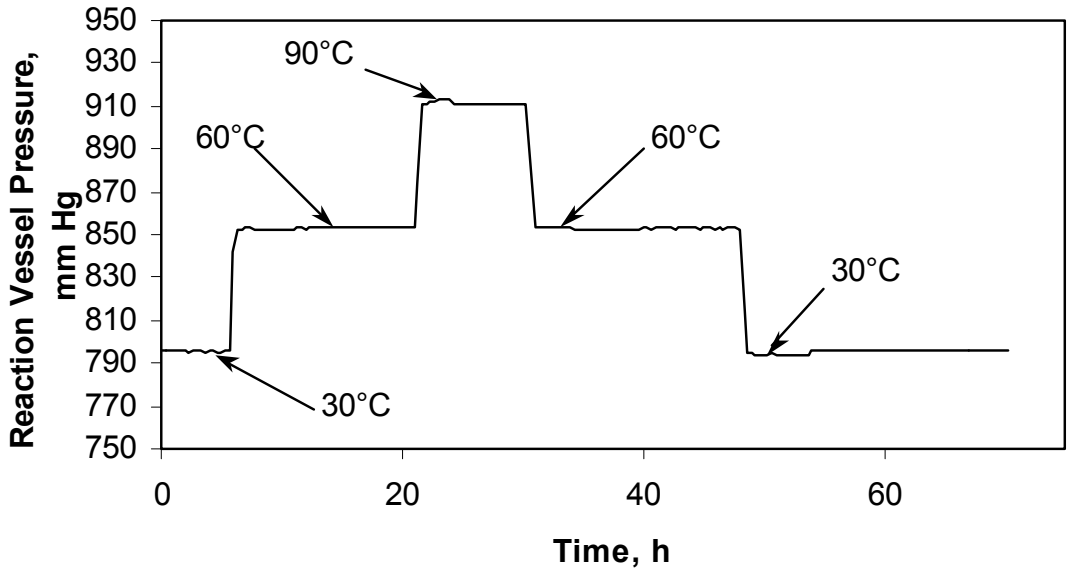


Figure A.2 Reaction Vessel Pressure During Initial Testing (temperature of the reaction vessel was changed from 30ºC to 90ºC and back to 30ºC during this experiment)

The moles of gas were calculated using pressure-volume-temperature relationships in which the volume and temperature were measured for each portion of the reaction system, and the total pressure of the system was known. For example, in System 1, the total moles present, 0.00155, ranged from a maximum of 0.00268 to a minimum of 0.00259 over the entire temperature range. The relative standard deviation (RSD) of total moles during this experiment was only 1.08%. For the system integrity check shown in Figure A.1 and Figure A.2, the total moles of gas within the reaction system as a function of time was calculated and is shown in Figure A.3. The calculated moles of gas were constant over the entire experimental duration, in which the temperature was changed from 30°C to 90°C and then back to 30°C.

This experiment was repeated for all of the reaction systems used in actual sludge testing. Each reaction vessel was attached to a separate gas manifold line and increased from 30ºC to 90ºC and back to 30ºC. The pressures, temperatures, and moles of gas were monitored for each reaction system. Table A-1 contains the results for reaction systems 1 through 10. In each case, the error in moles calculated was approximately 1% or less RSD, ranging from 0.11% to 1.08%. In all cases, the capability of each system to measure its quantity of gas was reproducible and excellent.

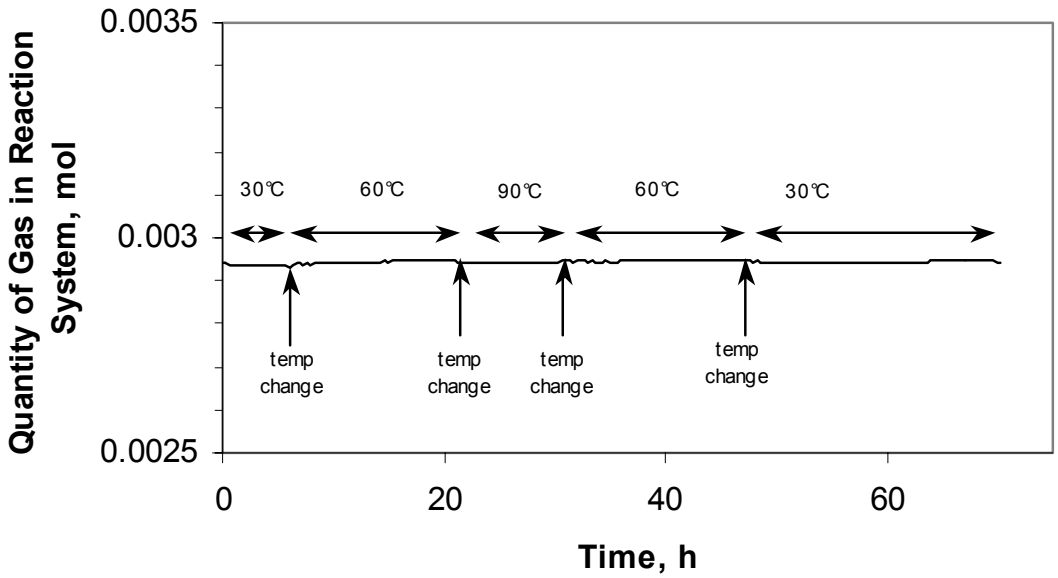


Figure A.3 Total Moles of Gas in Reaction System 1 During Initial Testing (temperature of the reaction vessel was changed from 30ºC to 90ºC and back to 30ºC during this experiment)

Table A.1 Measured Moles of Gas Contained in Gas Manifold System During Heating and Cooling System Check

System	1	2	3	4	5	6	7	8	9	10	11	12
Moles, average	2.65E-03	2.85E-03	2.84E-03	2.85E-03	2.86E-03	2.83E-03	2.94E-03	2.88E-03	2.98E-03	2.84E-03	2.83E-03	2.84E-03
Maximum moles	2.68E-03	2.86E-03	2.87E-03	2.87E-03	2.87E-03	2.85E-03	2.95E-03	2.89E-03	2.99E-03	2.85E-03	2.85E-03	2.85E-03
Minimum moles	2.59E-03	2.82E-03	2.81E-03	2.82E-03	2.84E-03	2.80E-03	2.93E-03	2.83E-03	2.97E-03	2.83E-03	2.80E-03	2.79E-03
Standard deviation	2.85E-05	1.22E-05	1.58E-05	1.11E-05	5.43E-06	1.23E-05	3.33E-06	1.26E-05	3.55E-06	6.43E-06	1.26E-05	6.24E-06
RSD	1.08%	0.43%	0.56%	0.39%	0.19%	0.44%	0.11%	0.44%	0.12%	0.23%	0.45%	0.22%

Appendix B

Photographs of Treated Resins and Solutions

Appendix B: Photographs of Treated Resins and Solutions

SL-644 Tests

SL-644 Immersed in Simulated LAW
Variation with Dose at 25°C

Simulated LAW turns from yellow to brown with increasing dose:

T18	T19	T20	T2	T21	T1	T24	T23
no dose	10^6R	10^7R	10^7R matrix only	10^8R	10^8R matrix only	10^8R 10:1 liq ratio	10^8R

No apparent change in resins:

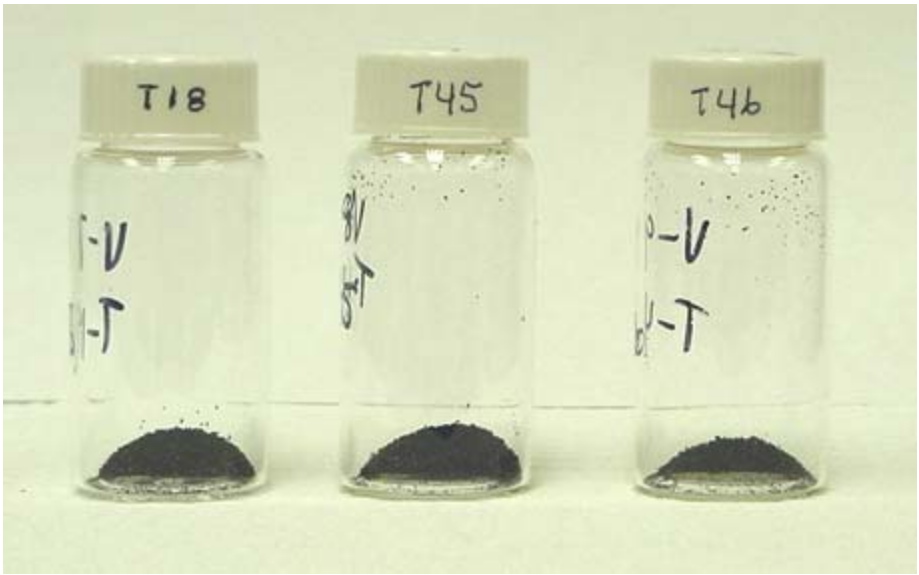
T18	T19	T20	T21	T24	T5	T23
no dose	10^6R	10^7R	10^7R	10^8R 10:1 liq ratio	10^8R	10^8R resin only

Variation with Temperature

Simulated LAW at zero dose turned a darker yellow when in contact with resin:

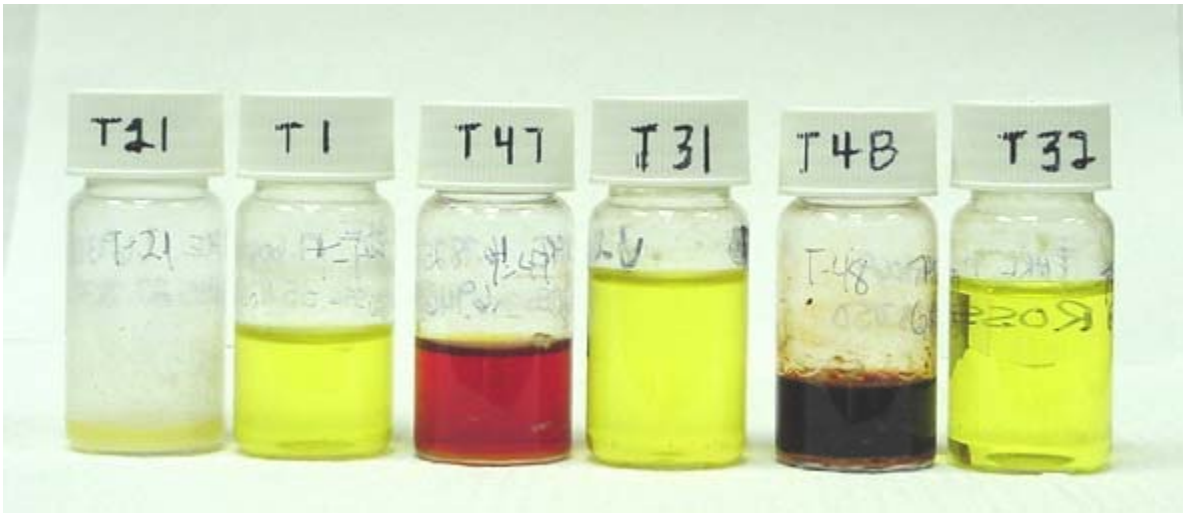
T18
25°C

No apparent change in resins at zero dose:



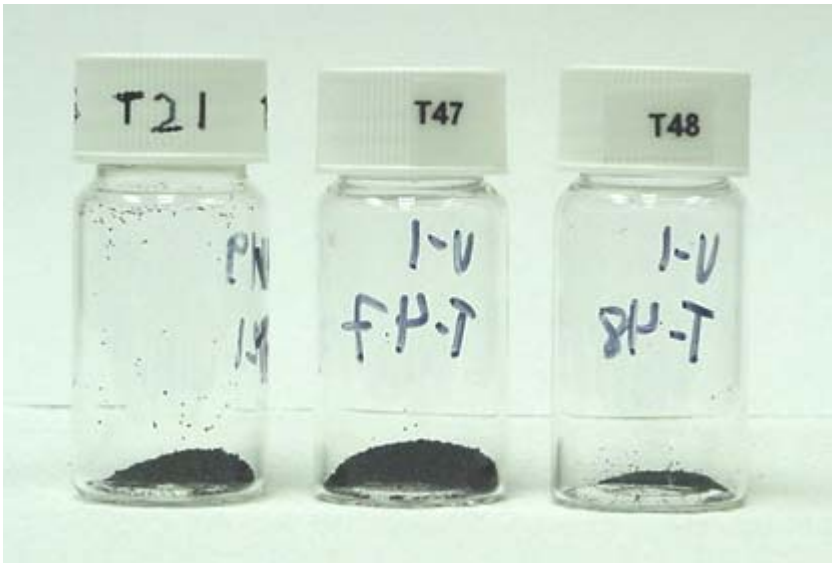
T18	T45	T46
25°C	65°C	90°C

Simulated LAW turned from yellow to red to brown with increasing temperature when in contact with resin at 10^8R dose; no change in simulated LAW alone:



T21	T1	T47	T31	T48	T32
25°C	25°C	65°C	65°C	90°C	90°C
	LAW only		LAW only		LAW only

No apparent change in resins at 10^8R dose:



T21	T47	T48
25°C	65°C	90°C

SL-644 Immersed in 0.5M HNO_3
Variation with Dose at 25°C

No apparent change in 0.5M HNO_3:

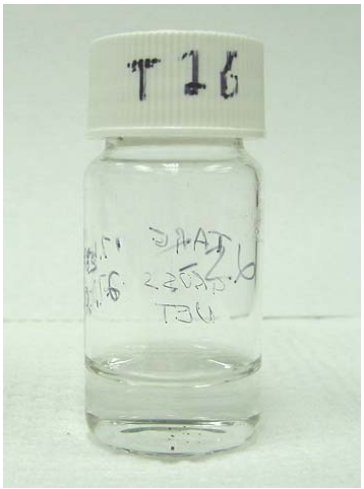
T26	T27	T28	T29	T3
No dose	10^6R	10^7R	10^8R	10^9R
				acid only

No apparent change in resin:

T26	T27	T28	T29	T5
No dose	10^6R	10^7R	10^8R	10^9R
				SL-644 only

Variation with Temperature

No apparent change to nitric acid at zero dose:



T26
25°C

No apparent change in resins at zero dose:

T26 25°C | T49 65°C | T50 90°C

Nitric acid turned increasingly yellow in contact with resin at 10^8R dose; no change in acid alone:

T29	T3	T51	T33	T52	T34
25°C	25°C	65°C	65°C	90°C	90°C
	acid only		acid only		acid only

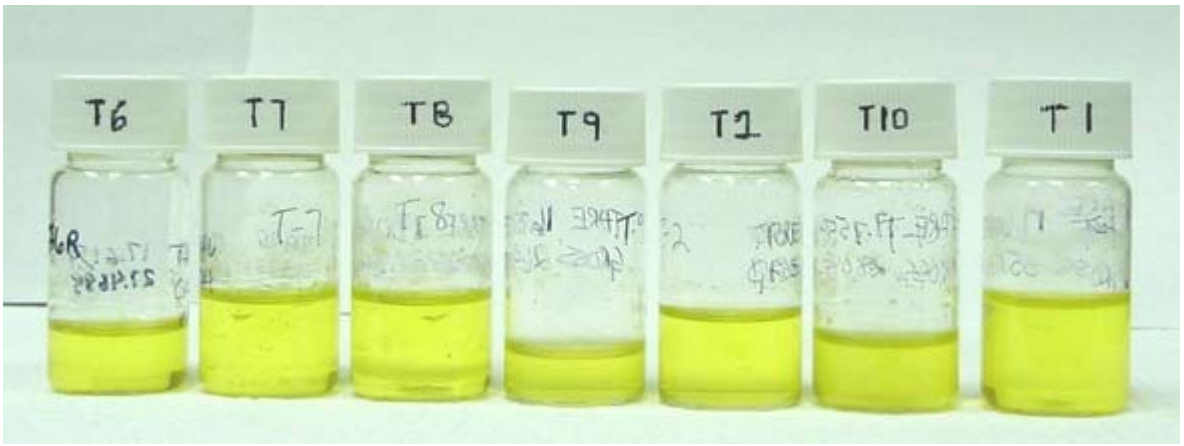
No apparent change in resins at 10^8R dose:

T29	T51	T52
25°C	65°C	90°C

SL-639 Tests

SL-639 Immersed in Simulated LAW
Variation with Dose at 25°C

Simulated LAW became increasingly opaque in contact with resin; no change in simulated LAW alone:



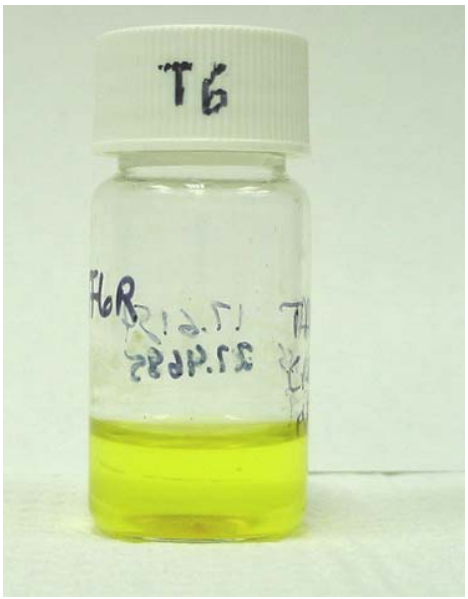
T6	T7	T8	T9	T2	T10	T1
No dose	10^5R	10^6R	10^7R	10^7R LAW only	10^8R	10^8R LAW only

No apparent change in resins:

T6	T7	T8	T9	T11	T53
No dose	10^5R	10^6R	10^7R	10^7R	10^8R SL-639 only

Variation with Temperature

No change in simulated LAW with zero dose:



T6
25°C

No change in resins at zero dose:

T6	T37	T38
25°C	65°C	90°C

No change in simulated LAW at 10^8R:

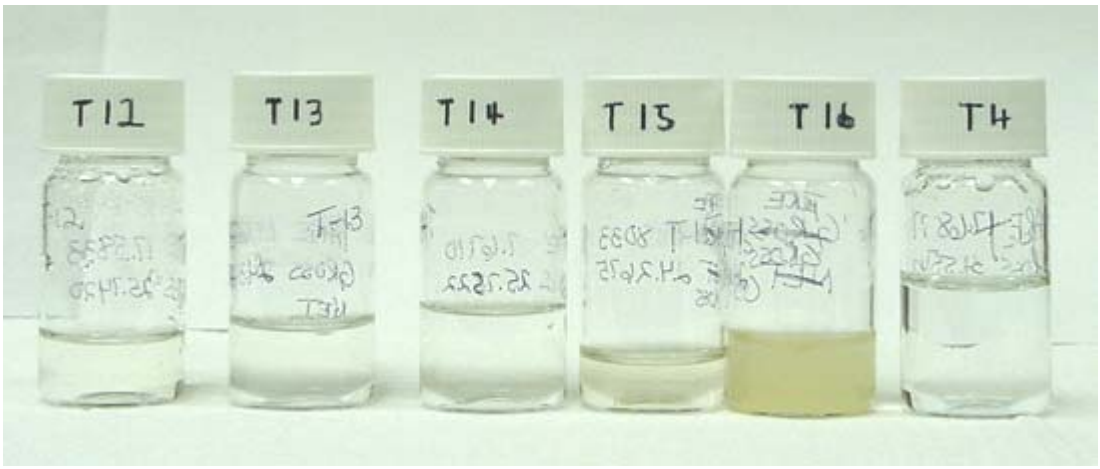
T11	T1	T39	T31	T40	T32
25°C	25°C	65°C	65°C	90°C	90°C
	Sim only		Sim only		Sim only

No change in resins at 10^8R:

T10	T39	T40
25°C	65°C	90°C

SL-639 Immersed in Water
Variation with Dose at 65°C

Water became increasingly brown when in contact with resin; no change in water alone:



T12	T13	T14	T15	T16	T4
No dose	10^5R	10^6R	10^7R	10^8R	10^8R Water only

No change in resins:

T12	T13	T14	T15	T16	T53
No dose	10^5R	10^6R	10^7R	10^8R	10^8R SL-639 only

Variation with Temperature

No change in water at zero dose:

T41	T12
25°C	65°C

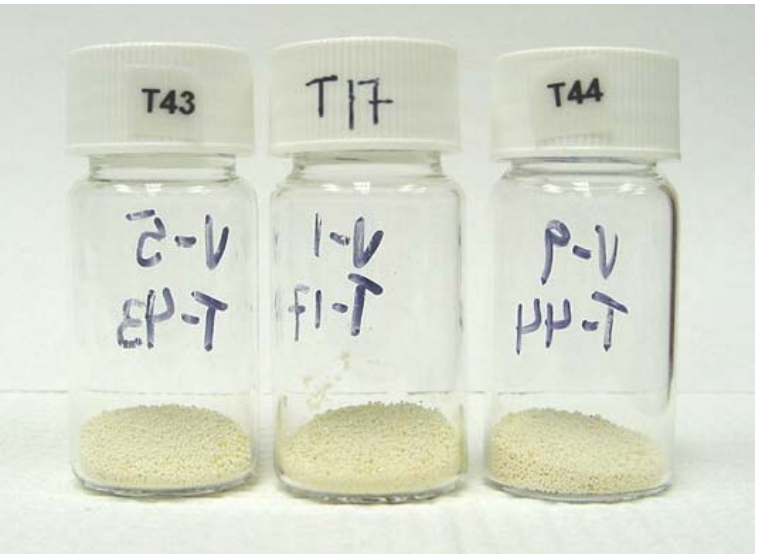
No change in resins at zero dose:

T41	T12	T42
25°C	65°C	90°C

Water became clearer with increasing temperature at 10^8R dose; no change in water alone:

T43	T35	T17	T4	T44	T36
25°C	25°C	65°C	65°C	90°C	90°C
	Water only		Water only		Water only

No change in resins at 10^8R dose:



T43	T17	T44
25°C	65°C	90°C

Appendix C

SL-639 Batch Contact Worksheets

	density test solution (g/mL)	1.2648								
		1.26106								
	ave:	1.26293								
Test #	Test conditions	wt solid (g)	wt dry solid (g)	volume solution (mL)	initial activity (CPM)	Initial specific activity (CPM/g)	Final activity (CPM)	Final specific activity (CPM/g)	Kd (mL/g)	Standard deviation on average Kd
6a	AN-105 simulant, 25C, 0R	0.1005	0.0995	10	397705	3212480	83385	966222	234	
6b	AN-105 simulant, 25C, 0R	0.0993	0.0983	10	397705	3212480	114654	952276	242	
ave:									238	6
12a	water, 25C, 0R	0.0998	0.0999	10	397705	3212480	92545	946268	240	
12b	water, 25C, 0R	0.1009	0.1010	10	397705	3212480	115677	932879	242	
ave:									241	2
37a	AN-105 simulant, 65C, 0R	0.1008	0.1010	10	397705	3212480	116435	944323	238	
37b	AN-105 simulant, 65C, 0R	0.1004	0.1005	10	397705	3212480	119349	965607	231	
ave:									235	5
38a	AN-105 simulant, 90C, 0R	0.1007	0.1009	10	397705	3212480	118390	960958	232	
38b	AN-105 simulant, 90C, 0R	0.1000	0.1002	10	397705	3212480	118059	975694	229	
ave:									231	2
41a	water, 65C, 0R	0.1028	0.1023	10	397705	3212480	113051	919114	244	
41b	water, 65C, 0R	0.0970	0.0965	10	397705	3212480	119293	968287	240	
ave:									242	3
42a	water, 90C, 0R	0.1001	0.0997	10	397705	3212480	116641	949845	239	
42b	water, 90C, 0R	0.0993	0.0989	10	397705	3212480	117082	958903	238	
ave:									238	1
7a	AN-105 simulant, 25C, 1E+05R	0.0991	0.0994	10	398052	3215283	109894	938463	244	
7b	AN-105 simulant, 25C, 1E+05R	0.1026	0.1029	10	398052	3215283	114907	917788	243	
ave:									244	1
8a	AN-105 simulant, 25C, 1E+06R	0.1031	0.1034	10	398052	3215283	112951	907966	246	
8b	AN-105 simulant, 25C, 1E+06R	0.1058	0.1061	10	398052	3215283	107932	900183	242	
ave:									244	2
13a	water, 25C, 1E+05R	0.0992	0.0995	10	398052	3215283	112820	927034	248	
13b	water, 25C, 1E+05R	0.1029	0.1032	10	398052	3215283	111746	897558	250	
ave:									249	1
14a	water, 25C, 1E+06R	0.0992	0.1023	10	398052	3215283	113071	911128	248	
14b	water, 25C, 1E+06R	0.1029	0.1024	10	398052	3215283	112639	906916	250	
ave:									249	1
10a	AN-105 simulant, 25C, 1E+08R	0.1012	0.1005	10	396535	3203029	134258	1135854	181	
10b	AN-105 simulant, 25C, 1E+08R	0.1036	0.1029	10	396535	3203029	104926	1110328	183	
ave:									182	1
11a	AN-105 simulant, 25C, 1E+08R	0.1041	0.1035	10	396535	3203029	132426	1114697	181	
11b	AN-105 simulant, 25C, 1E+08R	0.0999	0.0993	10	396535	3203029	132071	1133657	184	
ave:									182	2
									182	1
15a	water, 65C, 1E+07R	0.1023	0.1016	10	396535	3203029	106756	937278	238	
15b	water, 65C, 1E+07R	0.1037	0.1030	10	396535	3203029	93717	924231	239	
ave:									239	1
16a	water, 65C, 1E+08R	0.0991	0.0978	10	396535	3203029	129296	1031891	215	
16b	water, 65C, 1E+08R	0.1024	0.1011	10	396535	3203029	122284	1011447	214	
ave:									215	1
									216	3
17a	water, 65C, 1E+08R	0.1012	0.1007	10	396535	3203029	121966	995641	220	
17b	water, 65C, 1E+08R	0.0997	0.0992	10	396535	3203029	109353	1023904	215	
ave:									217	4
39a	AN-105 simulant, 65C, 1E+08R	0.1023	0.0995	10	396535	3203029	140135	1161982	177	

Test #	Test conditions	wt solid (g)	wt dry solid (g)	volume solution (mL)	initial activity (CPM)	Initial specific activity (CPM/g)	Final activity (CPM)	Final specific activity (CPM/g)	Kd (mL/g)	Standard deviation on average Kd
39b	AN-105 simulant, 65C, 1E+08R	0.1003	0.0975	10	396535	3203029	140247	1158109	181	
ave:									179	3
40a	AN-105 simulant, 90C, 1E+08R	0.1016	0.1005	10	396535	3203029	136854	1109927	188	
40b	AN-105 simulant, 90C, 1E+08R	0.1003	0.0992	10	396535	3203029	128280	1123292	187	
ave:									187	1
43a	water, 25C, 1E+08R	0.1020	0.1013	10	396535	3203029	122033	1019490	211	
43b	water, 25C, 1E+08R	0.1031	0.1024	10	396535	3203029	126425	1026177	207	
ave:									209	3
9a	AN-105 simulant, 25C, 1E+07R	0.0992	0.0975	10	399261	3225048	113769	969072	239	
9b	AN-105 simulant, 25C, 1E+07R	0.1024	0.1007	10	399261	3225048	126232	1005032	219	
ave:									229	14
44a	water, 25C, 1E+08R	0.0994	0.1000	10	399261	3225048	133226	1049850	207	
44b	water, 25C, 1E+08R	0.0995	0.1001	10	399261	3225048	131454	1045776	208	
ave:									208	1
53a	no solution, 25C, 1E+08R	0.0981	0.0985	10	399261	3225048	135937	1088367	199	
53b	no solution, 25C, 1E+08R	0.1001	0.1005	10	399261	3225048	132170	1056515	204	
ave:									202	3

	F-factor for initial conditioned resin				
F-factor	Test #	Total conditioned resin mass (initial) (g)	Total conditioned resin mass (final) (g)	Total dried resin mass (final) (g)	Effective Kd (mL/g)
0.980	6a				
0.999	6b				
0.990	ave:	1.8	1.78	1.76	232
1.003	12a				
1.000	12b				
1.001	ave:	1.8	1.78	1.78	238
1.004	37a				
0.999	37b				
1.001	ave:	1.8	1.75	1.75	228
1.004	38a				
1.000	38b				
1.002	ave:	1.8	1.73	1.73	221
0.982	41a				
1.008	41b				
0.995	ave:	1.8	1.77	1.76	237
0.989	42a				
1.003	42b				
0.996	ave:	1.8	1.76	1.75	232
0.9874	7a				
1.0178	7b				
1.003	ave:	1.8	1.77	1.78	241
1.0038	8a				
1.0020	8b				
1.003	ave:	1.8	1.77	1.78	241
1.0042	13a				
1.0010	13b				
1.003	ave:	1.8	1.39	1.40	193
1.0053	14a				
0.9867	14b				
1.003	ave:	1.8	1.77	1.78	246
0.9803	10a				
1.0059	10b				
0.993	ave:	1.8	1.71	1.70	172
0.9910	11a				
0.9971	11b				
0.994	ave:	1.8	1.74	1.73	175
					173
0.994	15a				
0.9922	15b				
0.993	ave:	1.8	1.76	1.75	232
0.9823	16a				
0.9923	16b				
0.987	ave:	1.8	1.70	1.69	201
					203
1.0020	17a				
0.9872	17b				
0.995	ave:	1.8	1.70	1.69	205
0.9709	39a				

F-factor	Test #	Total conditioned resin mass (initial) (g)	Total conditioned resin mass (final) (g)	total dried resin mass (final) (g)	Effective Kd (mL/g)
0.9740	39b				
0.972	ave:	1.8	1.70	1.66	165
0.9970	40a				
0.9807	40b				
0.989	ave:	1.8	1.70	1.68	174
1.0000	43a				
0.9867	43b				
0.993	ave:	1.8	1.72	1.71	198
0.9674	9a				
0.9990	9b				
0.983	ave:	1.8	1.78	1.75	223
1.0100	44a				
1.0030	44b				
1.007	ave:	1.8	1.69	1.70	196
1.0020	53a				
1.0060	53b				
1.004	ave:	1.8	1.71	1.71	192

Appendix D

SL-644 Batch Contact Worksheets

	density test solution (g/mL)	1.2648								
		1.26106								
	ave:	1.26293								
Test #	Test conditions	wt solid (g)	wt dry solid (g)	volume solution (mL)	initial activity (CPM)	Initial specific activity (CPM/g)	Final activity (CPM)	Final specific activity (CPM/g)	Kd (mL/g)	Standard deviation on average Kd
18b	AN-105 simulant, 25C, 0R	0.1070	0.1029	10	35984	28352	6429	5237	429	
ave:									429	
26a	0.5 M nitric acid, 25C, 0R	0.0982	0.0942	10	35984	28352	5129	4167	616	
26b	0.5 M nitric acid, 25C, 0R	0.1031	0.0989	10	35984	28352	4813	3903	633	
ave:									625	12
45a	AN-105 simulant, 65C, 0R	0.1045	0.0996	10	36572	28815	7144	5802	398	
45b	AN-105 simulant, 65C, 0R	0.1008	0.0961	10	36572	28815	7213	5838	410	
ave:									404	8
46a	AN-105 simulant, 90C, 0R	0.0995	0.0948	10	36572	28815	11112	9044	231	
46b	AN-105 simulant, 90C, 0R	0.0999	0.0952	10	36572	28815	13206	10694	178	
ave:									204	37
49a	0.5 M nitric acid, 65C, 0R	0.0963	0.0927	10	36572	28815	8573	6959	339	
49b	0.5 M nitric acid, 65C, 0R	0.0985	0.0949	10	36572	28815	8123	6614	354	
ave:									346	11
50a	0.5 M nitric acid, 90C, 0R	0.1025	0.0993	10	36572	28815	6596	5376	439	
50b	0.5 M nitric acid, 90C, 0R	0.0985	0.0954	10	36572	28815	6598	5356	459	
ave:									449	14
18a(rep)	AN-105 simulant, 25C, 0R	0.0993	0.0955	10	27687	21815	5946	4834	368	
18b(rep)	AN-105 simulant, 25C, 0R	0.1017	0.0978	10	27687	21815	7075	5745	286	
ave:									327	58
									361	72
19a	AN-105 simulant, 25C, 1E+06R	0.1043	0.1030	10	27687	21815	5927	4845	340	
19b	AN-105 simulant, 25C, 1E+06R	0.1006	0.0993	10	27687	21815	5852	4766	360	
ave.									350	14
27a	0.5 M nitric acid, 25C, 1E+06R	0.1043	0.1031	10	27687	21815	4886	3997	432	
27b	0.5 M nitric acid, 25C, 1E+06R	0.0995	0.0984	10	27687	21815	4394	3581	517	
ave.									475	60
5a	Nothing, 1E+08R	0.1043	0.0998	10	29406	23169	4734	3849	503	
5b	Nothing, 1E+08R	0.1046	0.1001	10	29406	23169	5082	4111	463	
ave.									483	28
21a	AN-105 simulant, 25C, 1E+08R	0.1043	0.0972	10	29406	23169	9749	8000	195	
21b	AN-105 simulant, 25C, 1E+08R	0.1032	0.0962	10	29406	23169	10120	8242	188	
ave.									192	5
22a	AN-105 simulant, 25C, 1E+08R	0.0995	0.0931	10	29406	23169	25910	21074	11	
22b	AN-105 simulant, 25C, 1E+08R	0.1005	0.0940	10	29406	23169	27202	22197	5	
ave.									8	4
29a	0.5 M nitric acid, 25C, 1E+08R	0.0989	0.0950	10	29406	23169	5942	4843	398	
29b	0.5 M nitric acid, 25C, 1E+08R	0.1004	0.0964	10	29406	23169	5784	4732	404	
ave.									401	4
30a	0.5 M nitric acid, 25C, 1E+08R	0.1011	0.0974	10	29406	23169	6089	4975	375	
30b	0.5 M nitric acid, 25C, 1E+08R	0.1060	0.1022	10	29406	23169	6085	4884	366	
ave.									371	6
									386	18
47a	AN-105 simulant, 65C, 1E+08R	0.1027	0.0971	10	29406	23169	7743	6288	277	
47b	AN-105 simulant, 65C, 1E+08R	0.0999	0.0944	10	29406	23169	8935	7266	232	
ave.									254	32

Test #	Test conditions	wt solid (g)	wt dry solid (g)	volume solution (mL)	initial activity (CPM)	Initial specific activity (CPM/g)	Final activity (CPM)	Final specific activity (CPM/g)	Kd (mL/g)	Standard deviation on average Kd
51a	0.5 M nitric acid, 65C, 1E+08R	0.0993	0.0956	10	29406	23169	6863	5549	332	
51b	0.5 M nitric acid, 65C, 1E+08R	0.0995	0.0957	10	29406	23169	7075	5794	313	
ave.									323	14
20a	AN-105 simulant, 25C, 1E+07R	0.1018	0.0984	10	37833	29809	10293	8040	275	
20b	AN-105 simulant, 25C, 1E+07R	0.0978	0.0946	10	37833	29809	10880	8825	251	
ave.									263	17
23a	AN-105 simulant, 25C, 7E+08R	0.1003	0.0969	10	37833	29809	23832	19292	56	
23b	AN-105 simulant, 25C, 7E+08R	0.0997	0.0963	10	37833	29809	20893	16855	80	
ave.									68	17
24a	AN-105 simulant, 25C, 1E+08R	0.0499	0.0470	5	37833	29809	17643	14296	116	
24b	AN-105 simulant, 25C, 1E+08R	0.0523	0.0492	5	37833	29809	17989	14545	107	
ave.	10:1 phase ratio								111	6
25a	AN-105 simulant, 25C, 1E+08R	0.0515	0.0483	5	37833	29809	17318	14121	115	
25b	AN-105 simulant, 25C, 1E+08R	0.0501	0.0469	5	37833	29809	19678	15954	92	
ave.	10:1 phase ratio								104	16
28a	0.5 M nitric acid, 25C, 1E+07R	0.1025	0.1004	10	36035	28392	7578	6011	371	
28b	0.5 M nitric acid, 25C, 1E+07R	0.1007	0.0986	10	36035	28392	9337	7516	282	
ave.									326	63
48a	AN-105 simulant, 90C, 1E+08R	0.1007	0.0971	10	37053	29041	10119	8203	262	
48b	AN-105 simulant, 90C, 1E+08R	0.0989	0.0954	10	37053	29041	11887	9440	218	
ave.									240	31
52a	0.5 M nitric acid, 90C, 1E+08R	0.1029	0.0998	10	37053	29041	8974	9614	203	
52b	0.5 M nitric acid, 90C, 1E+08R	0.1027	0.0996	10	37053	29041	9022	7261	301	
ave.									252	70
57a	0.5 M nitric acid, 45C, 0R	0.0996	0.0978	10	37053	29041	7121	5761	413	
57b	0.5 M nitric acid, 45C, 0R	0.0993	0.0975	10	37053	29041	7875	6171	380	
ave.									397	23
58a	0.5 M nitric acid, 45C, 0R	0.1012	0.0989	10	36035	28392	7183	5831	391	
58b	0.5 M nitric acid, 45C, 0R	0.0989	0.0967	10	36035	28392	9326	7550	286	
ave.									338	75
59a	0.5 M nitric acid, 65C, 0R	0.1009	0.0977	10	36035	28392	10075	8113	256	
59b	0.5 M nitric acid, 65C, 0R	0.1026	0.0993	10	36035	28392	7907	6421	344	
ave.									300	63
21aR	AN-105 simulant, 25C, 1E+08R	0.1008	0.0940	10	37833	29652	18998	15369	99	
21bR	AN-105 simulant, 25C, 1E+08R	0.1005	0.0937	10	37833	29652	17335	13963	120	
ave.									109	15
									151	48
22aR	AN-105 simulant, 25C, 1E+08R	0.0524	0.0490	5	37833	29652	31254	25299	18	
22bR	AN-105 simulant, 25C, 1E+08R	0.0502	0.0470	5	37833	29652	33259	26874	11	
ave.									14	5
									11	5
									81	81

			F-factor for initial conditioned resin			
F-factor		Test #	Total conditioned resin mass (initial) (g)	Total conditioned resin mass (final) (g)	Total dried resin mass (final) (g)	Effective Kd (mL/g)
0.962		18b				
0.962		ave:	0.9	0.85	0.82	390
0.962		26a				
0.957		26b				
0.960		ave:	0.9	0.85	0.81	565
0.939		45a				
0.967		45b				
0.953		ave:	0.9	0.81	0.77	346
0.960		46a				
0.945		46b				
0.953		ave:	0.9	0.50	0.48	109
0.965		49a				
0.961		49b				
0.963		ave:	0.9	0.79	0.76	292
0.972		50a				
0.965		50b				
0.969		ave:	0.9	0.76	0.74	368
0.962		18a(rep)				
0.962		18b(rep)				
0.962		ave:	0.9	0.85	0.82	297
						328
0.9909		19a				
0.9832		19b				
0.987		ave.	0.9	0.85	0.83	325
0.9904		27a				
0.9871		27b				
0.989		ave.	0.9	0.85	0.84	445
0.9615		5a				
0.9525		5b				
0.957		ave.	0.9	0.85	0.82	439
0.9329		21a				
0.9314		21b				
0.932		ave.	0.9	0.77	0.72	154
0.9446		22a				
0.9266		22b				
0.936		ave.	0.9	0.78	0.73	6
0.9540		29a				
0.9662		29b				
0.960		ave.	0.9	0.85	0.82	366
0.9571		30a				
0.9705		30b				
0.964		ave.	0.9	0.86	0.83	341
						353
0.9475		47a				
0.9426		47b				
0.945		ave.	0.9	0.77	0.73	206

F-factor		Test #	Total conditioned resin mass (initial) (g)	Total conditioned resin mass (final) (g)	total dried resin mass (final) (g)	Effective Kd (mL/g)
0.9608		51a				
0.9637		51b				
0.962		ave.	0.9	0.80	0.77	275
0.9709		20a				
0.9628		20b				
0.967		ave.	0.9	0.82	0.79	231
0.9664		23a				
0.9652		23b				
0.966		ave.	0.9	0.54	0.52	39
0.9416		24a				
0.9402		24b				
0.941		ave.	0.9	0.29	0.27	34
0.9327		25a				
0.9412		25b				
0.937		ave.	0.9	0.29	0.28	32
0.9805		28a				
0.9783		28b				
0.979		ave.	0.9	0.84	0.82	297
0.9518		48a				
0.9773		48b				
0.965		ave.	0.9	0.43	0.41	110
0.9713		52a				
0.9677		52b				
0.969		ave.	0.9	0.78	0.76	213
0.9815		57a				
0.9829		57b				
0.982		ave.	0.9	0.85	0.84	368
0.9751		58a				
0.9796		58b				
0.977		ave.	0.9	0.85	0.83	312
0.9692		59a				
0.9674		59b				
0.968		ave.	0.9	0.85	0.82	275
0.9329		21aR				
0.9314		21bR				
0.932		ave.	0.9	0.77	0.72	88
						121
0.9446		22aR				
0.9266		22bR				
0.936		ave.	0.9	0.78	0.73	12
						9
						65

Appendix E

Determination of Activation Energies and G-Values

Appendix E: Determination of Activation Energies and G-Values

E1. Figures Containing Thermal and Radiolytic Gas Generation from SL-639 Resin in contact with AN-105 Simulated Waste.

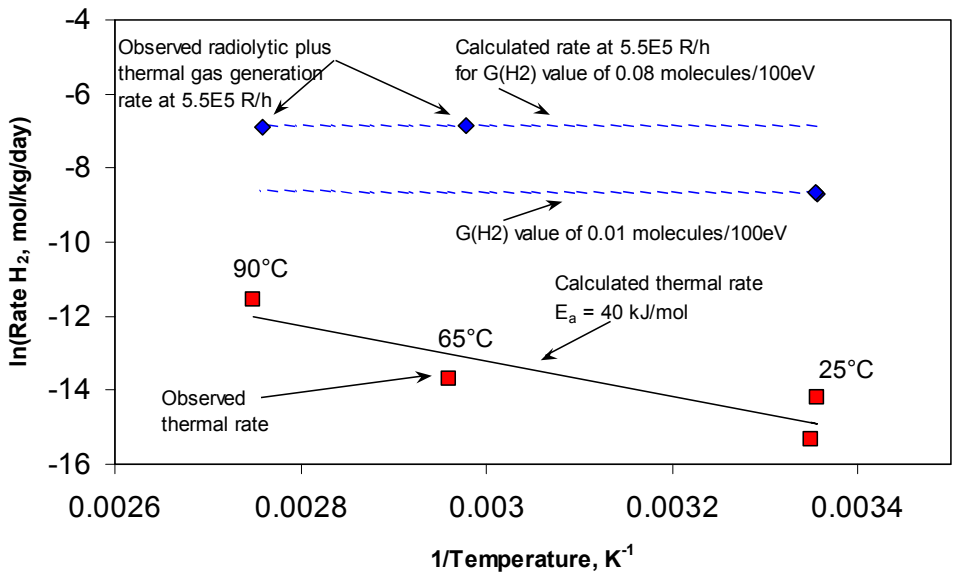


Figure E.1 Thermal and Radiolytic Hydrogen Gas Generation from SL-639 Resin in Contact with AN-105 Simulated Waste

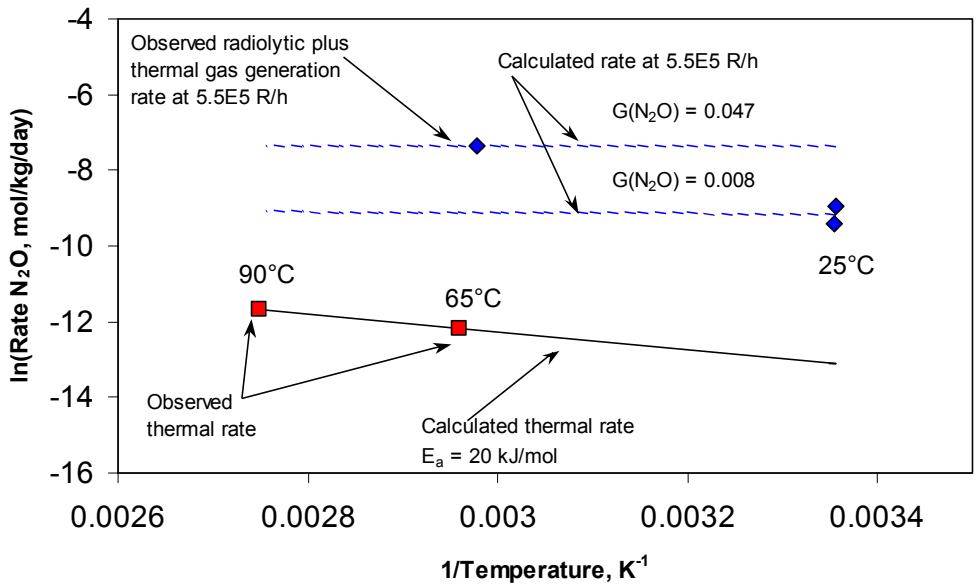


Figure E.2 Thermal and Radiolytic Nitrous Oxide Gas Generation from SL-639 Resin in Contact with AN-105 Simulated Waste

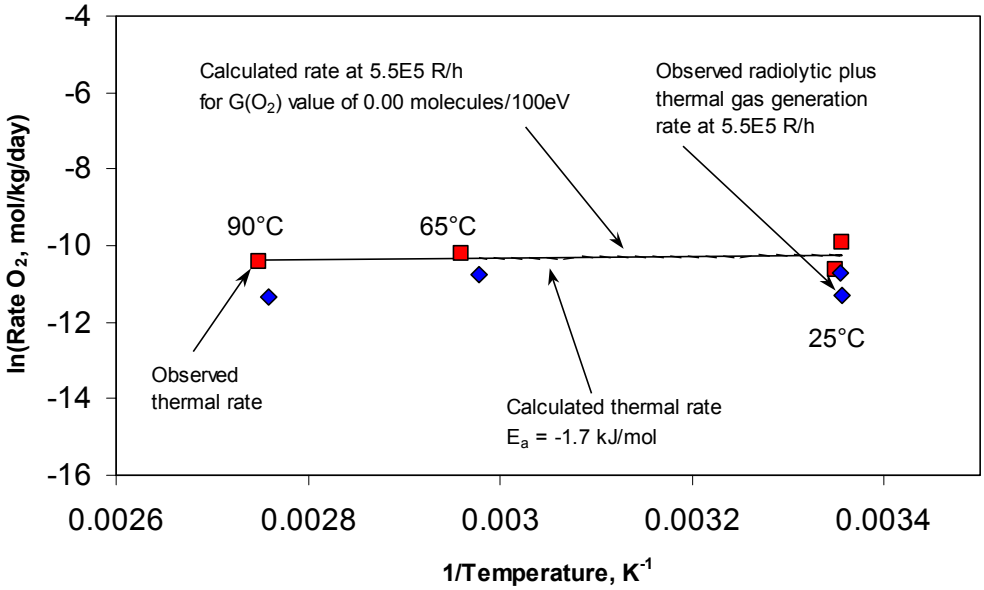


Figure E.3 Thermal and Radiolytic Oxygen Gas Generation from SL-639 Resin in Contact with AN-105 Simulated Waste

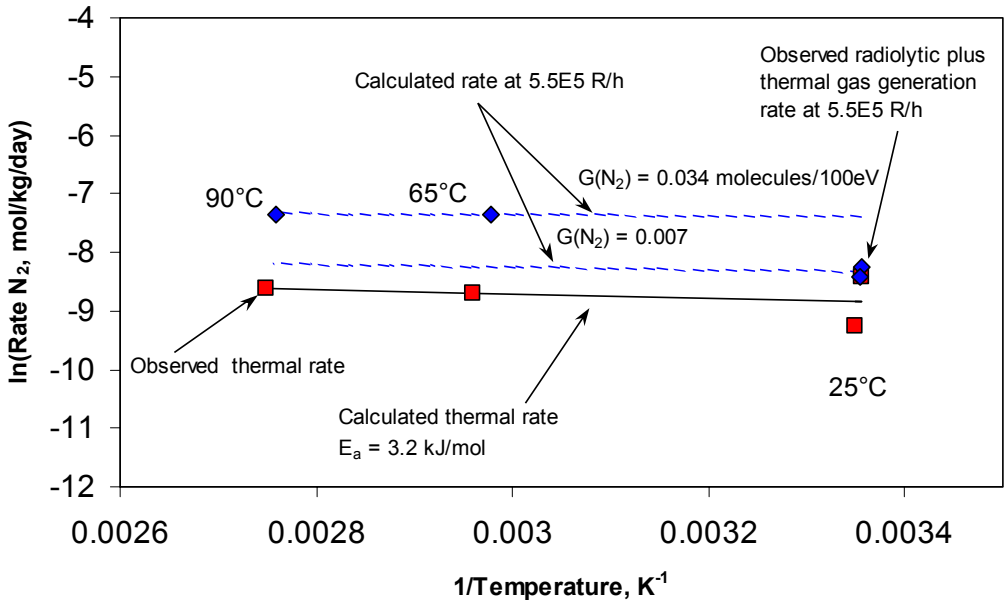


Figure E.4 Thermal and Radiolytic Nitrogen Gas Generation from SL-639 Resin in Contact with AN-105 Simulated Waste

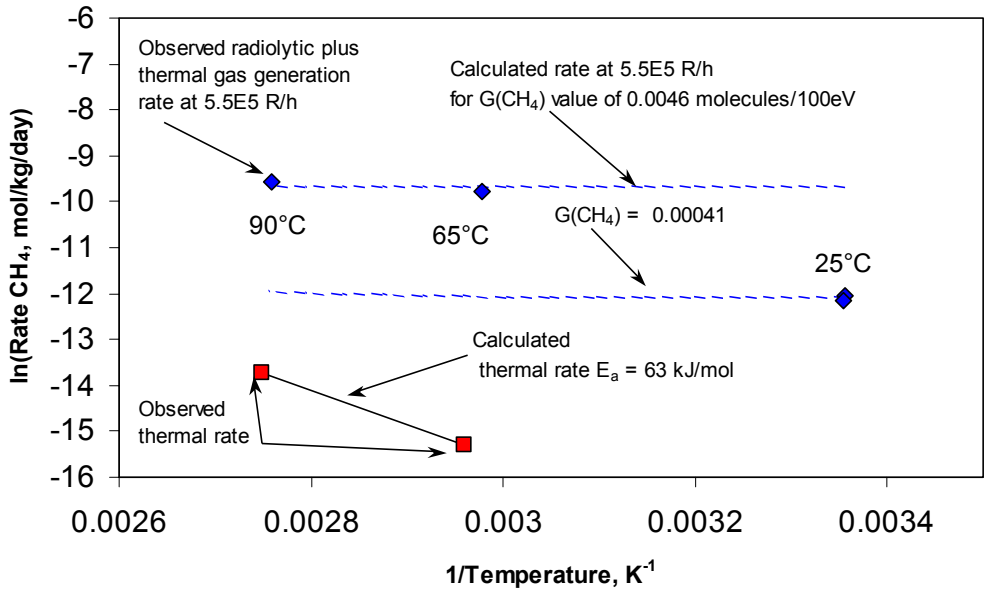


Figure E.5 Thermal and Radiolytic Methane Gas Generation from SL-639 Resin in Contact with AN-105 Simulated Waste

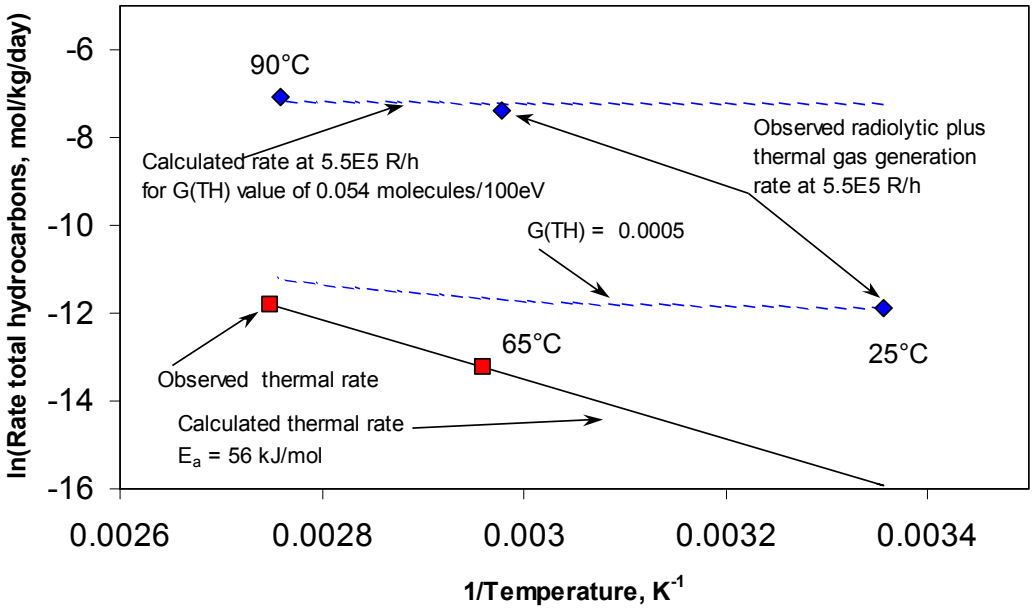


Figure E.6 Thermal and Radiolytic Total Hydrocarbon Gas Generation from SL-639 Resin in Contact with AN-105 Simulated Waste

E2. Figures Containing Thermal and Radiolytic Gas Generation from SL-639 Resin in contact with Water

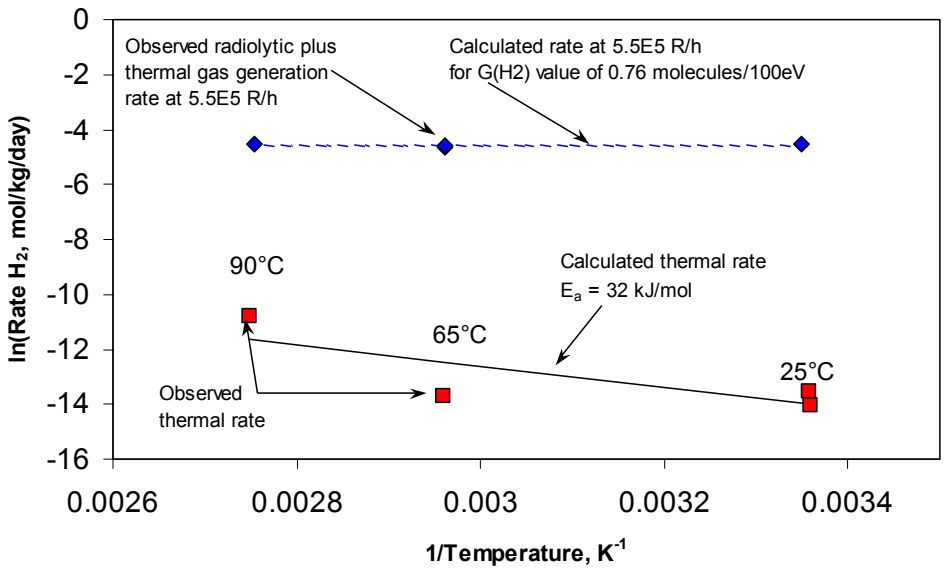


Figure E.7 Thermal and Radiolytic Hydrogen Gas Generation from SL-639 Resin in Contact with Water

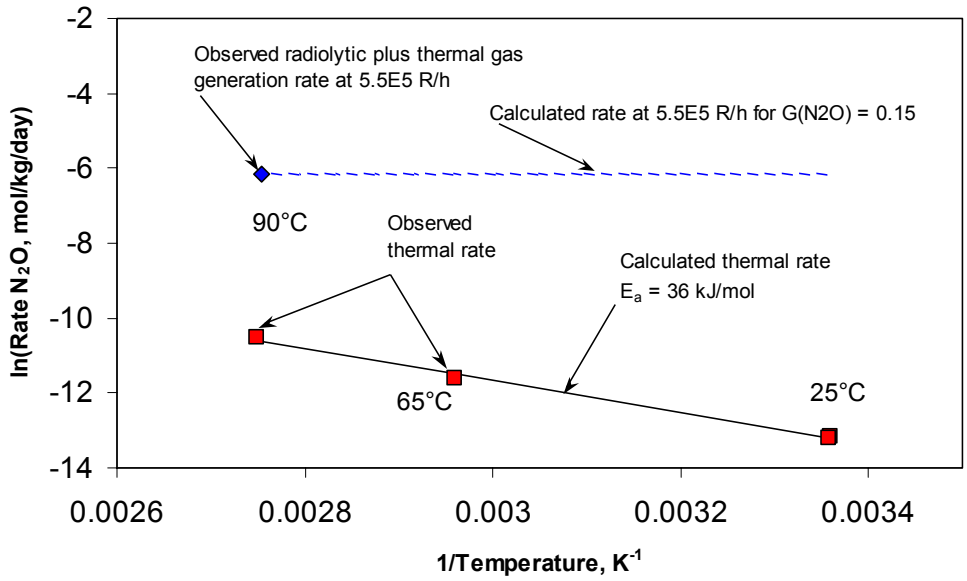


Figure E.8 Thermal and Radiolytic Nitrous Oxide Gas Generation from SL-639 Resin in Contact with Water

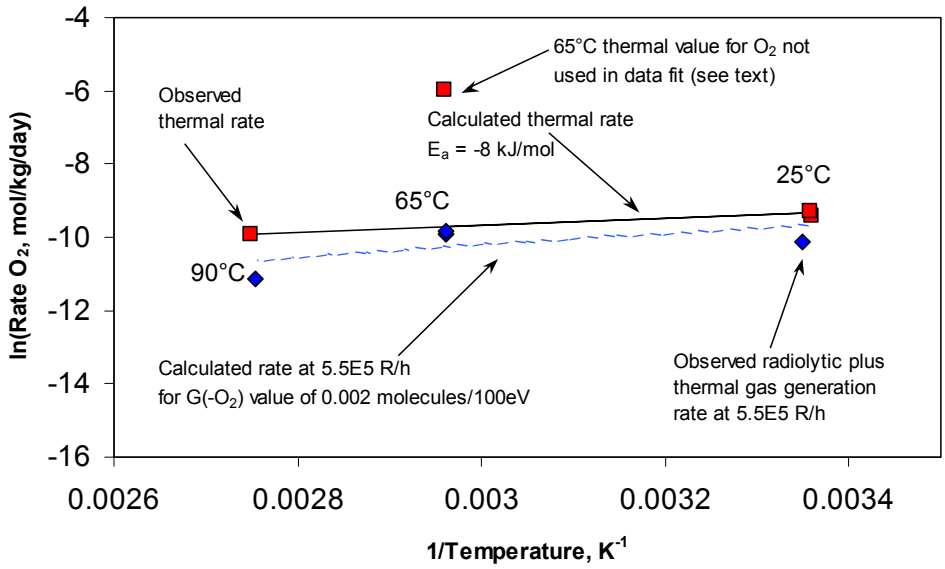


Figure E.9 Thermal and Radiolytic Oxygen Gas Generation from SL-639 Resin in Contact with Water

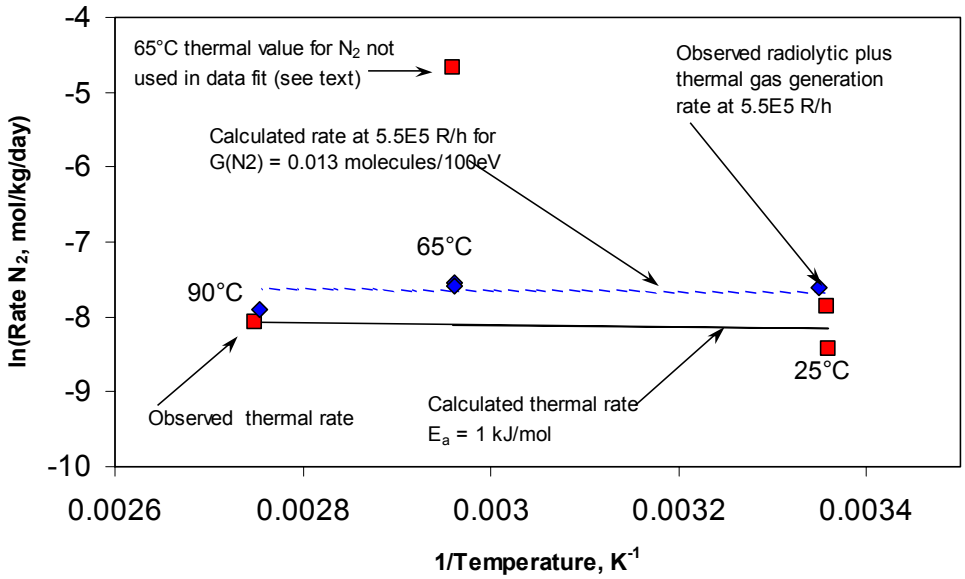


Figure E.10 Thermal and Radiolytic Nitrogen Gas Generation from SL-639 Resin in Contact with Water

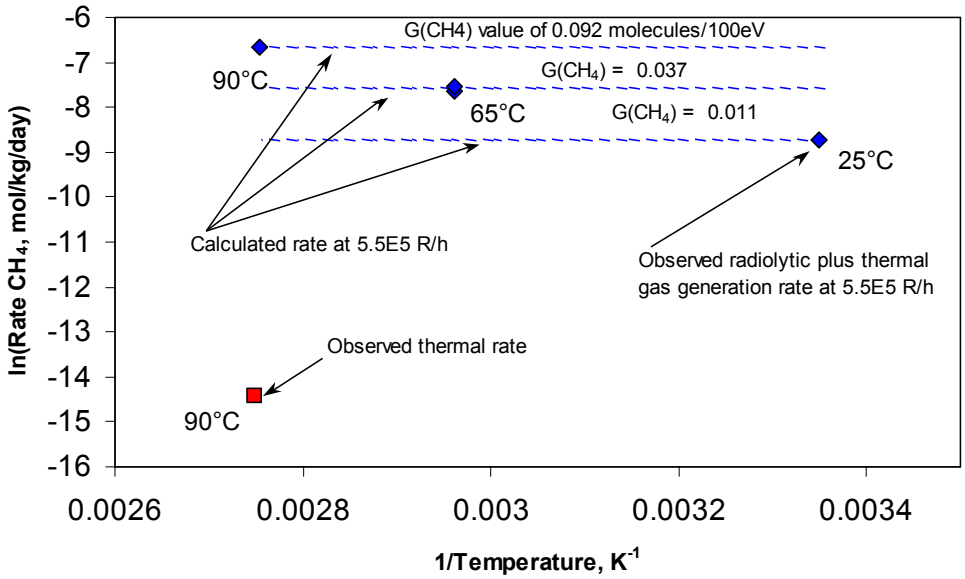


Figure E.11 Thermal and Radiolytic Methane Gas Generation from SL-639 Resin in Contact with Water

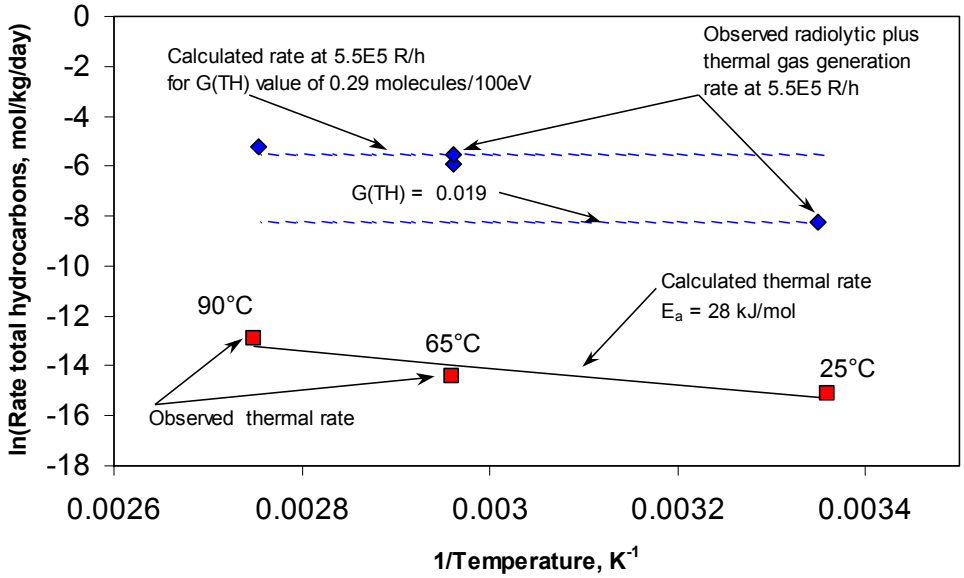


Figure E.12 Thermal and Radiolytic Total Hydrocarbons Gas Generation from SL-639 Resin in Contact with Water

E3. Figures Containing Thermal and Radiolytic Gas Generation from SL-644 Resin in contact with AN-105 Simulated Waste

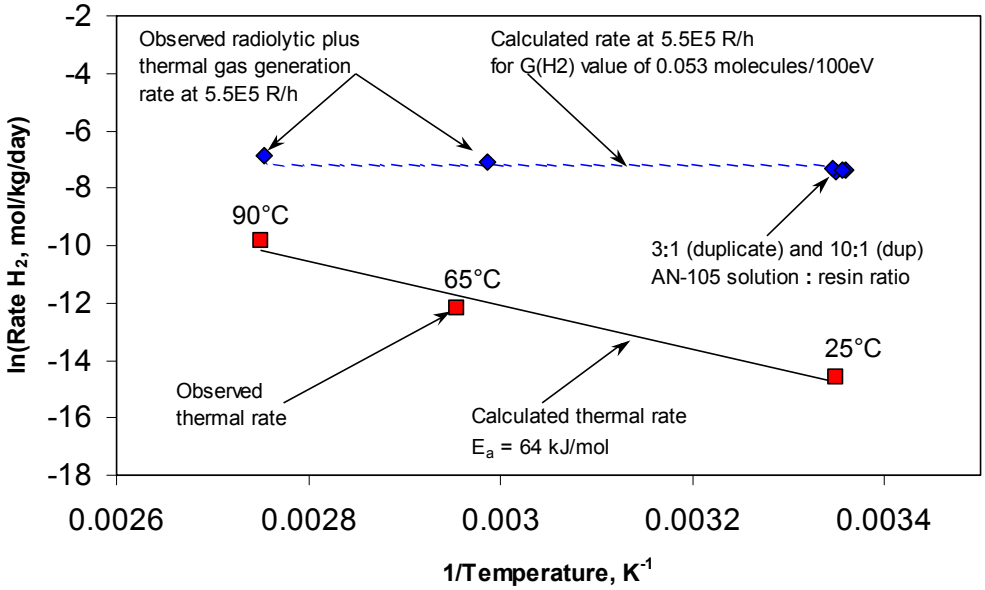


Figure E.13 Thermal and Radiolytic Hydrogen Gas Generation from SL-644 Resin in Contact with AN-105 Simulated Waste

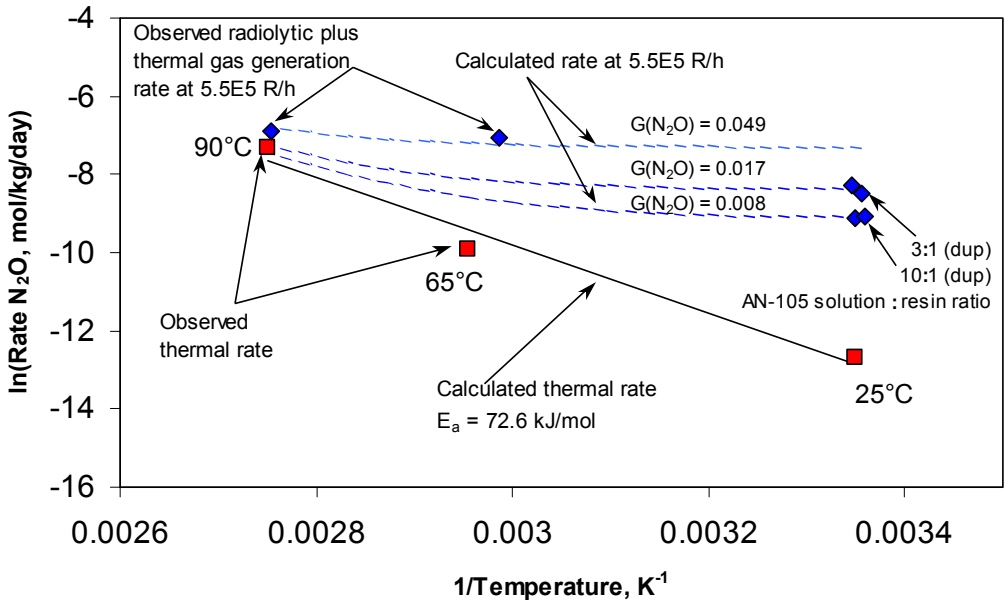


Figure E.14 Thermal and Radiolytic Nitrous Oxide Gas Generation from SL-644 Resin in Contact with AN-105 Simulated Waste

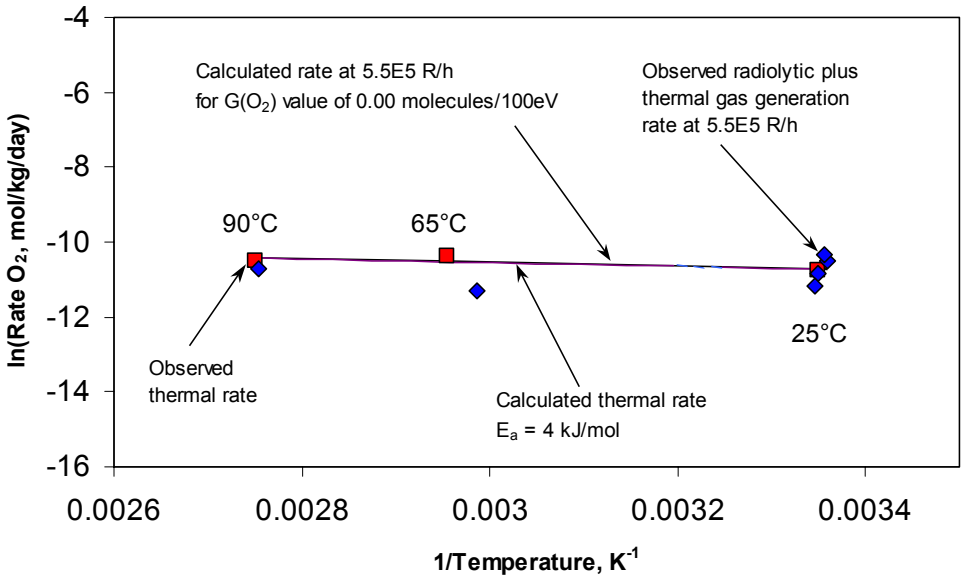


Figure E.15 Thermal and Radiolytic Oxygen Gas Generation from SL-644 Resin in Contact with AN-105 Simulated Waste

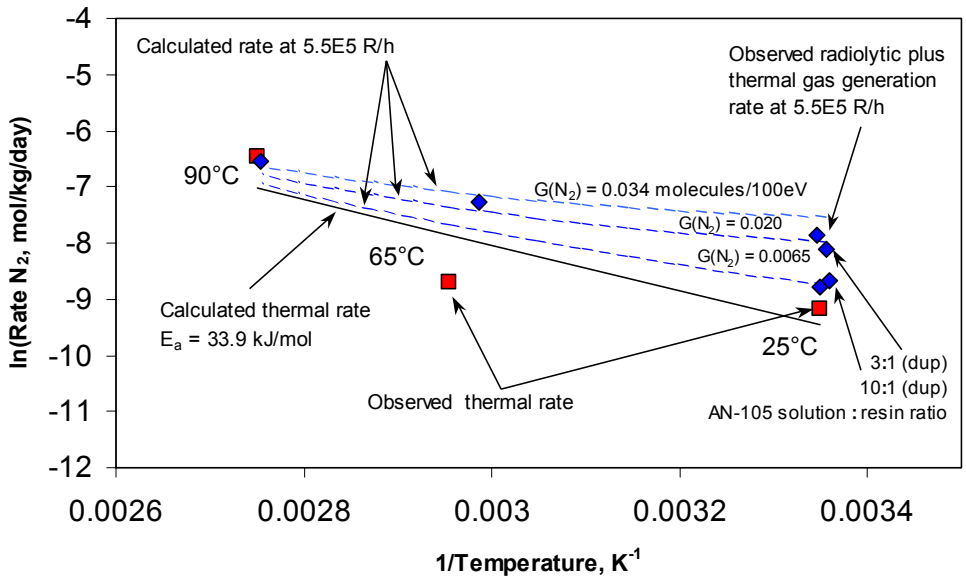


Figure E.16 Thermal and Radiolytic Nitrogen Gas Generation from SL-644 Resin in Contact with AN-105 Simulated Waste

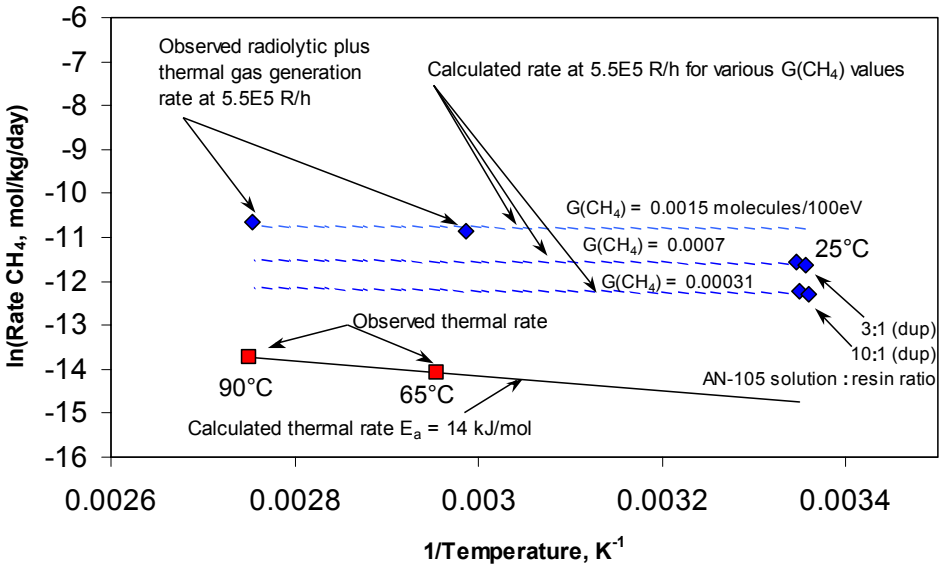


Figure E.17 Thermal and Radiolytic Methane Gas Generation from SL-644 Resin in Contact with AN-105 Simulated Waste

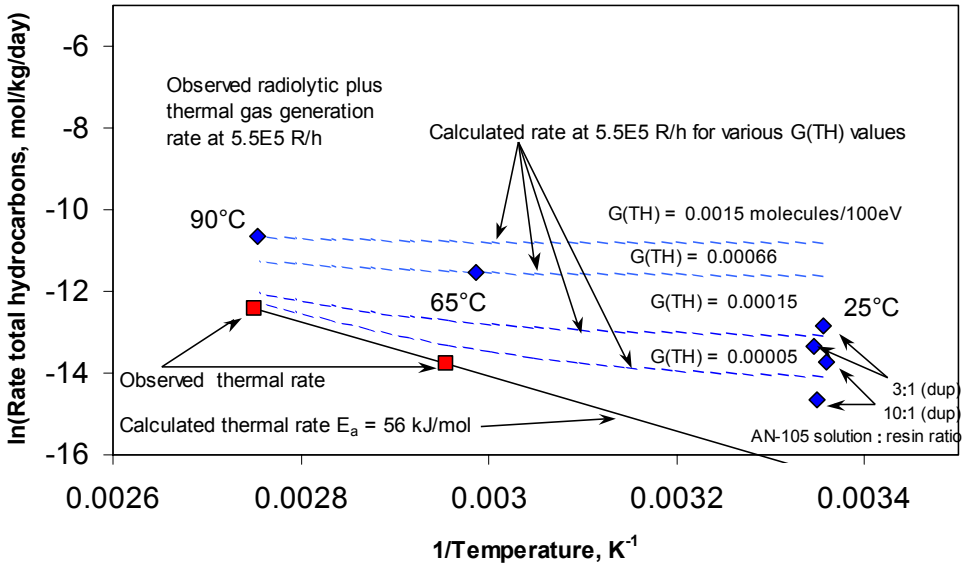


Figure E.18 Thermal and Radiolytic Total Hydrocarbon Gas Generation from SL-644 Resin in Contact with AN-105 Simulated Waste

E4. Figures Containing Thermal and Radiolytic Gas Generation from SL-644 Resin in contact with 0.5 M HNO_3

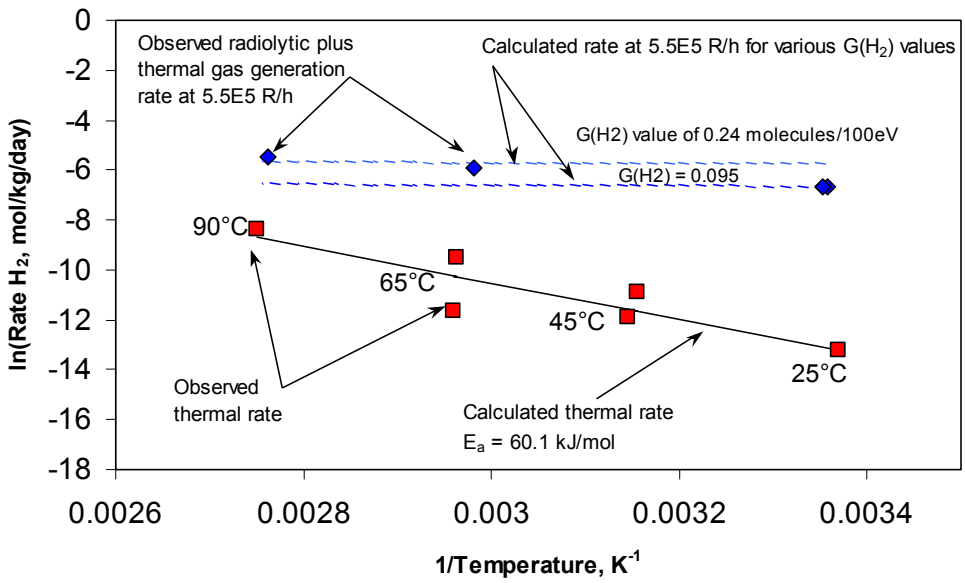


Figure E.19 Thermal and Radiolytic Hydrogen Gas Generation from SL-644 Resin in Contact with 0.5 M HNO_3

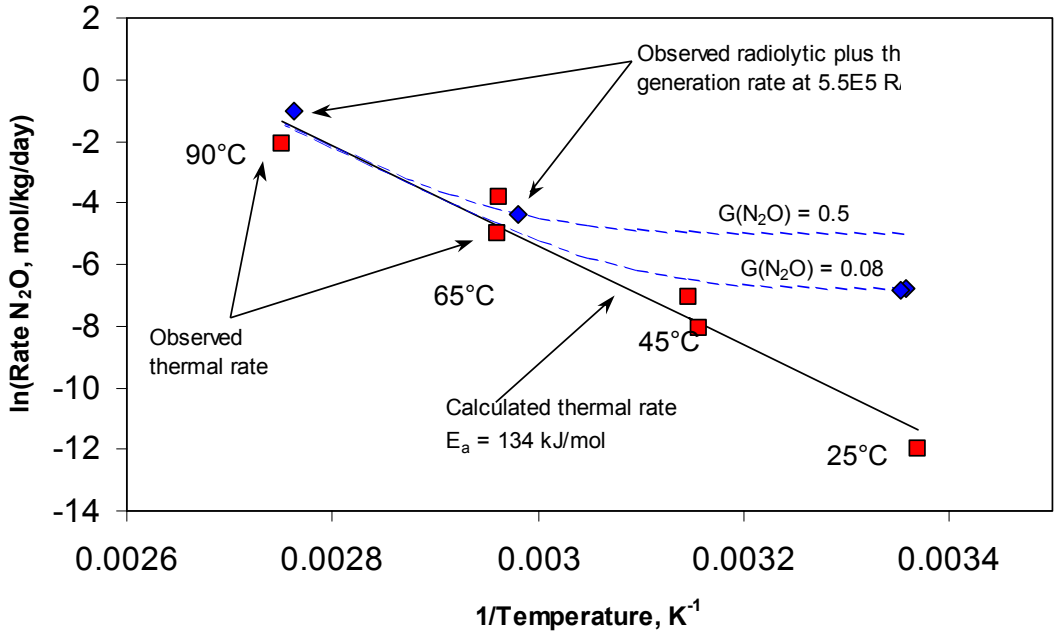


Figure E.20 Thermal and Radiolytic Nitrous Oxide Gas Generation from SL-644 Resin in Contact with 0.5 M HNO_3

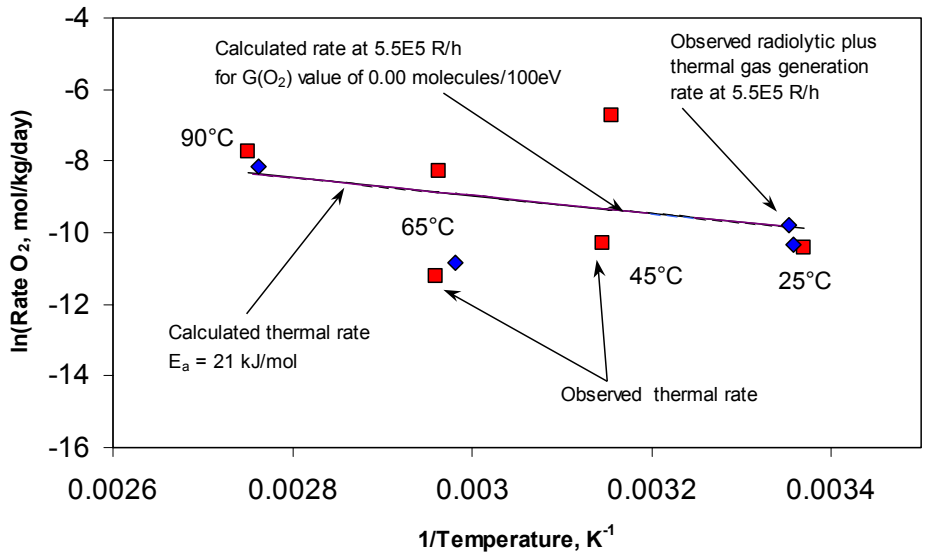


Figure E.21 Thermal and Radiolytic Oxygen Gas Generation from SL-644 Resin in Contact with 0.5 M HNO_3

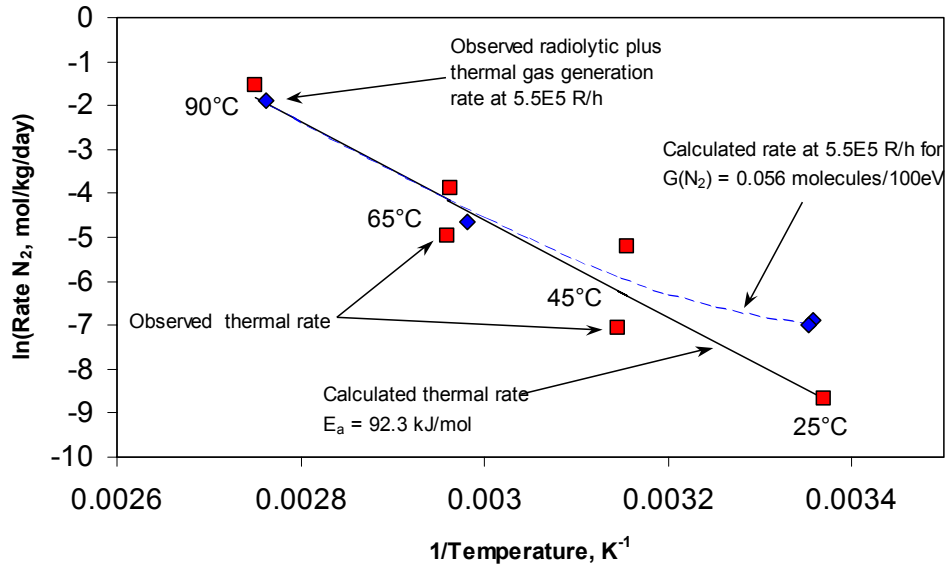


Figure E.22 Thermal and Radiolytic Nitrogen Gas Generation from SL-644 Resin in Contact with 0.5 M HNO_3

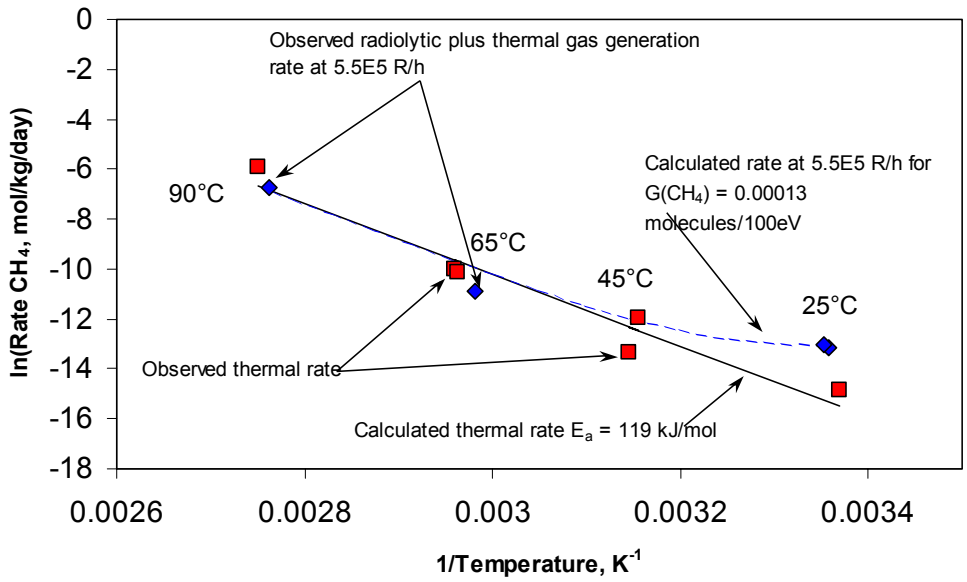


Figure E.23 Thermal and Radiolytic Methane Gas Generation from SL-644 Resin in Contact with 0.5 M HNO_3

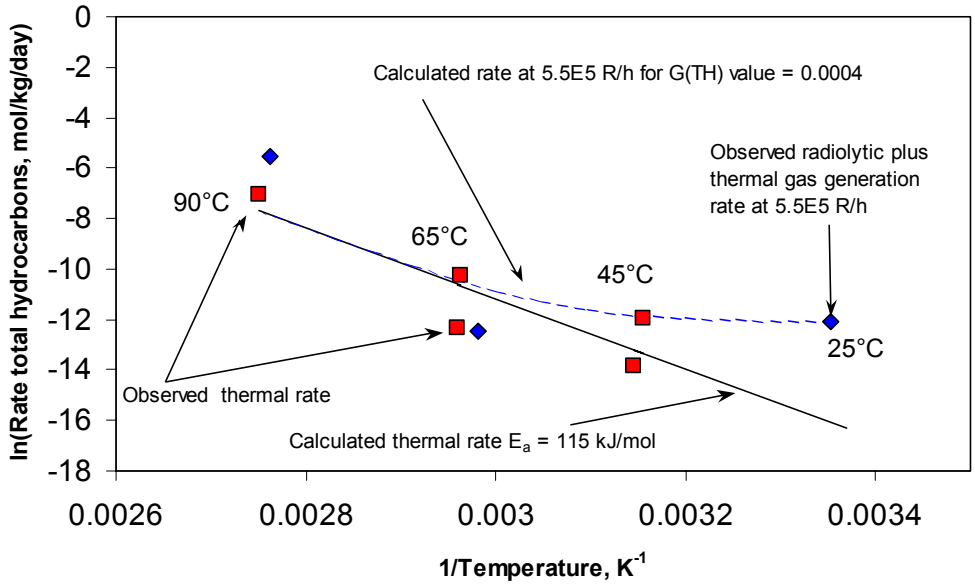


Figure E.24 Thermal and Radiolytic Total Hydrocarbon Gas Generation from SL-644 Resin in Contact with 0.5 M HNO_3

Appendix F

Results of Semi-volatile Organic Compound Analysis – Positively Identified Compounds

Positively Identified Semi-Volatile Organic Compounds

MS Integration Params: RTEINT.P
Quant Method : C:\MSDCHEM\1\METHODS\8270C.M
Title : CLP BNA Calibration
Response via : Continuing Cal Fil
DataAcq Meth : GSKM
Date Analyzed:4/25/02 and 4/26/02
Analyst: Alex Mitroshkov
Review by: Khris B. Olsen 7/11/02
DataAcq Meth : GSKM

Sample --> Resin--> **Internal Standards**	R.T.	Blank 1214 None ug/ml	BS 1214 None ug/ml	T15 SL-639 ug/ml	T16 SL-639 ug/ml	T17 SL-639 ug/ml	T26 SL-644 ug/ml	T29 SL-644 ug/ml	T29 Dup SL-644 ug/ml	T30 SL-644 ug/ml	T30 MS SL-644 ug/ml	T30 MSD SL-644 ug/ml	T12 SL-639 ug/ml
1) 1,4-Dichlorobenzene-d4	12.14	40	40	40	40	40	40	40	40	40	40	40	40
28) Naphthalene-d8	15.77	40	40	40	40	40	40	40	40	40	40	40	40
47) Acenaphthene-d10	20.95	40	40	40	40	40	40	40	40	40	40	40	40
76) Phenanthrene-d10	25.37	40	40	40	40	40	40	40	40	40	40	40	40
98) Chyrsene-d12	33.27	40	40	40	40	40	40	40	40	40	40	40	40
110) Perylene-d12	37.22	40	40	40	40	40	40	40	40	40	40	40	40
System Monitoring Compounds													
7) 2-Fluorophenol	8.69	0.18	0	66.14	65.71	69.08	0.09	66.94	14.48	0	58.79	1.72	45.05
10) Phenol-d5	11.27	2.07	6.39	61.89	60.75	63.61	0.51	61.14	22.9	1.34	58.71	3.7	41.23
29) Nitrobenzene-d5	13.73	0.11	4.45	49.42	44.62	48.38	0.05	42.53	12.86	0	33.25	1.54	17.82
52) 2-Fluorobiphenyl	19.04	7.88	31.18	52.87	46.26	48.81	2.61	39.37	28.7	8.81	34.52	18.98	34.06
80) 2,4,6-Tribromophenol	23.33	53.19	68.15	28.76	52.05	72.98	1.99	38.36	9.68	22.33	48.62	43.96	2.1
100) Terphenyl-d14	30.25	39.07	39.87	45.31	38.78	36.37	33.94	32.18	40.53	46.08	42.78	36.91	46.2

Sample --> Resin--> **Target Compounds**	R.T.	Blank 1214 None ug/ml	BS 1214 None ug/ml	T15 SL-639 ug/g	T16 SL-639 ug/g	T17 SL-639 ug/g	T26 SL-644 ug/g	T29 SL-644 ug/g	T29 Dup SL-644 ug/g	T30 SL-644 ug/g	T30 MS SL-644 ug/g	T30 MSD SL-644 ug/g	T12 SL-639 ug/g
2) Pyridine	5.27	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
3) N-Nitrosodimethylamine	5.3	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
4) 2-Picoline	7.1	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
5) N-nitrosomethylethylamine	7.47	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
6) Methyl methanesulfonate	8.3	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
8) N-nitrosodiethylamine	9.31	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
9) Ethyl methanesulfonate	10.17	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
11) Phenol*	11.29	0	3.95	0.11	0.09	0.12	N.D	0.09	N.D	N.D	49.84	2.02	N.D
12) Aniline	11.27	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
13) Pentachloroethane	11.35	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
14) bis(2-Chloroethyl)ether	11.52	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D

Positively Identified Semi-Volatile Organic Compounds

Sample --> Resin--> **Target Compounds**	R.T.	Blank 1214 None ug/ml	BS 1214 None ug/ml	T15 SL-639 ug/g	T16 SL-639 ug/g	T17 SL-639 ug/g	T26 SL-644 ug/g	T29 SL-644 ug/g	T29 Dup SL-644 ug/g	T30 SL-644 ug/g	T30 MS SL-644 ug/g	T30 MSD SL-644 ug/g	T12 SL-639 ug/g
15) 2-Chlorophenol*	11.56	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	57.35	1.14	N.D
16) 1,3-Dichlorobenzene	11.97	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	11.21	N.D	N.D
17) 1,4-Dichlorobenzene*	12.19	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	24.61	0.36	N.D
18) Benzyl alcohol	12.6	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
19) 1,2-Dichlorobenzene	12.59	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
20) 2-Methylphenol	12.95	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
21) bis(2-chloroisopropyl)ethe	13.02	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
22) 4 and 3-Methylphenol	13.43	N.D	N.D	N.D	N.D	0.06	N.D	N.D	N.D	N.D	N.D	N.D	N.D
23) n-Nitroso-di-n-propylamine*	13.4	N.D	34.03	3.43	8.41	3.47	N.D	8.01	N.D	N.D	33.09	16.5	N.D
24) Acetophenone*	13.34	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
25) o-Toluidine	13.42	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
26) Hexachloroethane	13.53	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
27) N-nitrosopirrolidine	13.32	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
30) Nitrobenzene	13.8	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
31) N-nitrosopiperidine	14.24	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
32) Isophorone	14.51	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
33) 2-Nitrophenol	14.7	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
34) 2,4-Dimethylphenol	14.92	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
35) bis(2-Chloroethoxy)methane	15.22	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
36) 2,4-Dichlorophenol	15.41	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
37) 1,2,4-Trichlorobenzene*	15.62	N.D	3.17	N.D	N.D	N.D	N.D	N.D	N.D	N.D	26.83	0.96	N.D
38) Naphthalene	15.82	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
39) 2,6-Dichlorophenol	16.05	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
40) 4-Chloroaniline	16.05	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
41) Hexachloropropene	16.09	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
42) Hexachlorobutadiene	16.23	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
43) N-nitroso-di-n-butylamine	17.12	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
44) 4-Chloro-3-methylphenol*	17.54	N.D	64.33	0.23	0.03	0.05	N.D	N.D	N.D	N.D	50.07	27.36	N.D
45) Isosafrole	17.7	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
46) 2-Methylnaphthalene	17.89	N.D	11.88	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
48) Hexachlorocyclopentadiene	18.36	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
49) 1,2,4,5-Tetrachlorobenzene	18.38	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
50) 2,4,6-Trichlorophenol	18.75	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
51) 2,4,5-Trichlorophenol	18.83	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
53) Safrole	19.24	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
54) 2-Chloronaphthalene	19.31	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
55) 2-Nitroaniline	19.67	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
56) 1,4-Naphtoquinone	19.88	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D

Positively Identified Semi-Volatile Organic Compounds

Sample --> Resin--> **Target Compounds**	R.T.	Blank 1214 None ug/ml	BS 1214 None ug/ml	T15 SL-639 ug/g	T16 SL-639 ug/g	T17 SL-639 ug/g	T26 SL-644 ug/g	T29 SL-644 ug/g	T29 Dup SL-644 ug/g	T30 SL-644 ug/g	T30 MS SL-644 ug/g	T30 MSD SL-644 ug/g	T12 SL-639 ug/g
57) Dimethylphthalate	20.35	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
58) 1,3-Dinitrobenzene	20.36	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
59) Acenaphthylene	20.53	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
60) 2,6-Dinitrotoluene	20.47	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
61) 3-Nitroaniline	20.93	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
62) Acenaphthene*	21.05	0.04	39.07	N.D	N.D	N.D	N.D	N.D	0.04	N.D	38.28	26.45	N.D
63) 2,4-Dinitrophenol	21.25	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
64) Pentachlorobenzene	21.45	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
65) 4-Nitrophenol*	21.58	N.D	16.65	N.D	N.D	N.D	N.D	N.D	N.D	N.D	5.08	7.79	N.D
66) Dibenzofuran	21.59	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
67) 2,4-Dinitrotoluene*	21.66	N.D	42.07	N.D	N.D	N.D	N.D	N.D	N.D	N.D	34.26	29.88	N.D
68) 1-Naphtylamine	21.83	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
69) 2,3,4,6-Tetrachlorophenol	21.98	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
70) 2-Naphtylamine	22.03	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
71) Diethylphthalate	22.49	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	0.14	N.D
72) Fluorene	22.6	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
73) 4-Chlorophenyl-phenylether	22.68	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
74) 5-Nitro-o-toluidine	22.73	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
75) 4-Nitroaniline	22.76	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
77) 4,6-Dinitro-2-methylphenol	22.85	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
78) Diphenylamine	23.07	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
79) Azobenzene	23.15	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
81) Diallate	24.21	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
82) 4-Bromophenyl-phenylether	24.13	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
83) 1,3,5-Trinitrobenzene	23.98	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
84) Hexachlorobenzene	24.21	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
85) Phenacetin	24.13	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
86) Pentachlorophenol*	24.85	N.D	39.7	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	47.25	N.D
87) 4-Aminobiphenyl	24.92	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	0.15	N.D	N.D
88) Pentachloronitrobenzene	24.88	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
89) Pronamide	25.21	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
90) Phenanthrene	25.45	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	0.11	N.D
91) Dinoseb	25.5	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
92) Anthracene	25.61	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
93) Carbazole	26.14	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
94) Di-n-butylphthalate	27.39	0.04	N.D	N.D	N.D	N.D	N.D	0.03	N.D	N.D	N.D	0.89	N.D
95) Isodrin	28.52	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
96) Fluoranthene	28.98	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D

Positively Identified Semi-Volatile Organic Compounds

Sample --> Resin--> **Target Compounds**	R.T.	Blank 1214 None ug/ml	BS 1214 None ug/ml	T15 SL-639 ug/g	T16 SL-639 ug/g	T17 SL-639 ug/g	T26 SL-644 ug/g	T29 SL-644 ug/g	T29 Dup SL-644 ug/g	T30 SL-644 ug/g	T30 MS SL-644 ug/g	T30 MSD SL-644 ug/g	T12 SL-639 ug/g
97) Benzidine	29.5	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
99) Pyrene*	29.63	N.D	56.36	N.D	N.D	N.D	N.D	N.D	N.D	N.D	50.9	49.35	3
101) Chlorobenzilate	30.88	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
102) p-Dimethylaminoazobenzene	30.68	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
103) 3,3-Dimethylbenzidine	31.68	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
104) Butylbenzylphthalate	31.83	N.D	N.D	N.D	N.D	0.06	N.D	N.D	N.D	N.D	N.D	N.D	N.D
105) 2-Acetoaminofluorene	32.45	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
106) Benzo[a]anthracene	33.22	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
107) 3,3'-Dichlorobenzidine	33.26	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
108) Chyrsene	33.35	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	0.2	N.D
109) bis(2-Ethylhexyl)phthalate	33.64	0.08	N.D	0.50	N.D	425	0.33	N.D	N.D	N.D	N.D	N.D	N.D
111) Di-n-octylphthalate	35.5	N.D	N.D	ND	0.17	0.72	0.08	N.D	N.D	N.D	1.64	N.D	N.D
112) Benzo[b]fluoranthene	36.22	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
113) 7,12-Dimethylbenz(a)anthra	36.24	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
114) Benzo[k]fluoranthene	36.32	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
115) Hexachlorophene	36.6	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
116) Benzo[a]pyrene	37.07	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
117) 3-Methylcholanthrene	38.09	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
118) Indeno[1,2,3-cd]pyrene	40.57	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
119) Dibenz[a,h]anthracene	40.72	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
120) Benzo[g,h,i]perylene	41.57	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D

* Matric Spike Compound

Positively Identified Semi-Volatile Organic Compounds

MS Integration Params: RTEINT.P
Quant Method : C:\MSDCHEM\1\METHODS\8270C.M
Title : CLP BNA Calibration
Response via : Continuing Cal Fil
DataAcq Meth : GSKM
Date Analyzed:5/08/02 and 5/09/02
Analyst: Alex Mitroshkov
Review by: Khris B. Olsen 7/10/2002

Sample --> Resin--> **Internal Standards**	R.T.	Blank 1214 None ug/ml	BS 1213 None ug/ml	T1 None ug/ml	T4 None ug/ml	T6R SL-639 ug/ml	T10 SL-639 ug/ml	T11 SL-639 ug/ml	T18 SL-644 ug/ml	T12 Rep SL-639 ug/ml	T21 SL-644 ug/ml	T21 Dup SL-644 ug/ml	T22 SL-644 ug/ml	T22 RR SL-644 ug/ml	T22 MS SL-644 ug/ml	T22 MSD SL-644 ug/ml	T41 SL-639 ug/ml
1) 1,4-Dichlorobenzene-d4	12.14	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
28) Naphthalene-d8	15.77	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
47) Acenaphthene-d10	20.95	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
76) Phenanthrene-d10	25.37	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
98) Chyrsene-d12	33.27	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
110) Perylene-d12	37.22	40	40	40	40	40	40	40	40	40	40	40	40	40	40	0	40
System Monitoring Compounds																	
7) 2-Fluorophenol	8.69	66.77	60.46	0.05	56.78	0.02	34.17	0.05	0	66.58	0	0	0	0	0.11	0	77.9
10) Phenol-d5	11.27	58.54	61.62	0.08	50.63	0	22.73	0.13	0.02	58.16	0	0	0	0	0.11	0	73.12
29) Nitrobenzene-d5	13.73	42.01	45.28	44.55	45.44	44.99	42.17	47.02	45.55	43.64	46.86	23.33	45.04	46.88	46.62	46.97	52.06
52) 2-Fluorobiphenyl	19.04	43.61	41.93	42.67	42.46	43.82	40.79	42.8	39.57	46.34	47.24	28.47	45.85	46.93	45.7	45.74	51.88
80) 2,4,6-Tribromophenol	23.33	55.46	63.92	0.3	52.62	0	38.89	0.15	0.03	22.73	1.84	1.23	0.08	2.8	0.64	0	16.65
100) Terphenyl-d14	30.25	44.96	45.82	44.41	41.29	40.23	37.98	38.87	36.5	44.01	38.42	33.2	47.72	40.31	42.25	37.7	43.04

Sample --> Resin--> **Target Compounds**	R.T.	Blank 1214 None ug/ml	BS 1213 None ug/ml	T1 None ug/ml	T4 None ug/ml	T6R SL-639 ug/g	T10 SL-639 ug/g	T11 SL-639 ug/g	T18 SL-644 ug/g	T12 Rep SL-639 ug/g	T21 SL-644 ug/g	T21 Dup SL-644 ug/g	T22 SL-644 ug/g	T22 RR SL-644 ug/g	T22 MS SL-644 ug/g	T22 MSD SL-644 ug/g	T41 SL-639 ug/g
2) Pyridine	5.27	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
3) N-Nitrosodimethylamine	5.30	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
4) 2-Picoline	7.10	N.D	N.D	0.07	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
5) N-nitrosomethylethylamine	7.47	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
6) Methyl methanesulfonate	8.30	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
8) N-nitrosodiethylamine	9.31	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
9) Ethyl methanesulfonate	10.17	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
11) Phenol*	11.29	0.09	42.16	0.04	0.09	N.D	0.31	0.08	N.D	0.22	N.D	N.D	N.D	N.D	0.06	0	0.25
12) Aniline	11.27	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
13) Pentachloroethane	11.35	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
14) bis(2-Chloroethyl)ether	11.52	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
15) 2-Chlorophenol*	11.56	N.D	64.67	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	0.22	N.D	N.D
16) 1,3-Dichlorobenzene	11.97	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
17) 1,4-Dichlorobenzene*	12.19	N.D	35.86	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	37.92	38.42	N.D
18) Benzyl alcohol	12.60	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
19) 1,2-Dichlorobenzene	12.59	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
20) 2-Methylphenol	12.95	N.D	N.D	N.D	N.D	N.D	0.06	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
21) bis(2-chloroisopropyl)ethe	13.02	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D

Positively Identified Semi-Volatile Organic Compounds

Sample --> Resin--> **Target Compounds**	R.T.	Blank 1214 None ug/ml	BS 1213 None ug/ml	T1 None ug/ml	T4 None ug/ml	T6R SL-639 ug/g	T10 SL-639 ug/g	T11 SL-639 ug/g	T18 SL-644 ug/g	T12 Rep SL-639 ug/g	T21 SL-644 ug/g	T21 Dup SL-644 ug/g	T22 SL-644 ug/g	T22 RR SL-644 ug/g	T22 MS SL-644 ug/g	T22 MSD SL-644 ug/g	T41 SL-639 ug/g
22) 4 and 3-Methylphenol	13.43	N.D	N.D	N.D	N.D	N.D	0.11	0.03	N.D	N.D	0.11	N.D	N.D	N.D	N.D	N.D	N.D
23) n-Nitroso-di-n-propylamine*	13.40	N.D	42.55	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	43.9	45.5	N.D
24) Acetophenone*	13.34	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
25) o-Toluidine	13.42	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
26) Hexachloroethane	13.53	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
27) N-nitrosopirrolidine	13.32	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
30) Nitrobenzene	13.80	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
31) N-nitrosopiperidine	14.24	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
32) Isophorone	14.51	N.D	N.D	0.75	N.D	N.D	N.D	2.19	4.44	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
33) 2-Nitrophenol	14.70	N.D	N.D	0.09	N.D	0.25	N.D	0.1	N.D	N.D	N.D	N.D	1.56	0.56	239	232	N.D
34) 2,4-Dimethylphenol	14.92	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
35) bis(2-Chloroethoxy)methane	15.22	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
36) 2,4-Dichlorophenol	15.41	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
37) 1,2,4-Trichlorobenzene*	15.62	N.D	40.25	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	42.09	41.42	N.D
38) Naphthalene	15.82	N.D	N.D	0	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
39) 2,6-Dichlorophenol	16.05	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
40) 4-Chloroaniline	16.05	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
41) Hexachloropropene	16.09	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
42) Hexachlorobutadiene	16.23	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
43) N-nitroso-di-n-butylamine	17.12	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
44) 4-Chloro-3-methylphenol*	17.54	N.D	59.31	N.D	N.D	N.D	0.61	0.25	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
45) Isosafrole	17.70	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
46) 2-Methylnaphthalene	17.89	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
48) Hexachlorocyclopentadiene	18.36	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
49) 1,2,4,5-Tetrachlorobenzene	18.38	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
50) 2,4,6-Trichlorophenol	18.75	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
51) 2,4,5-Trichlorophenol	18.83	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
53) Safrole	19.24	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
54) 2-Chloronaphthalene	19.31	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
55) 2-Nitroaniline	19.67	N.D	0.05	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	12.2	12.8	N.D
56) 1,4-Naphtoquinone	19.88	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
57) Dimethylphthalate	20.35	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
58) 1,3-Dinitrobenzene	20.36	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
59) Acenaphthylene	20.53	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	12.9	17.9	N.D
60) 2,6-Dinitrotoluene	20.47	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
61) 3-Nitroaniline	20.93	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
62) Acenaphthene*	21.05	N.D	45.41	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	37.46	8.1	N.D
63) 2,4-Dinitrophenol	21.25	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	396	508	N.D
64) Pentachlorobenzene	21.45	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
65) 4-Nitrophenol*	21.58	N.D	13.83	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	11.01	12.37	N.D
66) Dibenzofuran	21.59	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
67) 2,4-Dinitrotoluene*	21.66	N.D	41.17	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	46.6	48.46	N.D
68) 1-Naphtylamine	21.83	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
69) 2,3,4,6-Tetrachlorophenol	21.98	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D

Positively Identified Semi-Volatile Organic Compounds

Sample --> Resin--> **Target Compounds**	R.T.	Blank 1214 None ug/ml	BS 1213 None ug/ml	T1 None ug/ml	T4 None ug/ml	T6R SL-639 ug/g	T10 SL-639 ug/g	T11 SL-639 ug/g	T18 SL-644 ug/g	T12 Rep SL-639 ug/g	T21 SL-644 ug/g	T21 Dup SL-644 ug/g	T22 SL-644 ug/g	T22 RR SL-644 ug/g	T22 MS SL-644 ug/g	T22 MSD SL-644 ug/g	T41 SL-639 ug/g
70) 2-Naphtylamine	22.03	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
71) Diethylphthalate	22.49	N.D	N.D	N.D	0.07	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
72) Fluorene	22.60	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
73) 4-Chlorophenyl-phenylether	22.68	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
74) 5-Nitro-o-toluidine	22.73	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
75) 4-Nitroaniline	22.76	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
77) 4,6-Dinitro-2-methylphenol	22.85	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
78) Diphenylamine	23.07	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
79) Azobenzene	23.15	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
81) Diallate	24.21	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
82) 4-Bromophenyl-phenylether	24.13	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
83) 1,3,5-Trinitrobenzene	23.98	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
84) Hexachlorobenzene	24.21	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
85) Phenacetin	24.13	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
86) Pentachlorophenol*	24.85	N.D	63.46	0.05	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	21.93	24.87	N.D
87) 4-Aminobiphenyl	24.92	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
88) Pentachloronitrobenzene	24.88	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
89) Pronamide	25.21	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
90) Phenanthrene	25.45	N.D	N.D	N.D	N.D	N.D	0.03	N.D	N.D	N.D	N.D	N.D	N.D	N.D	0.1	0.1	N.D
91) Dinoseb	25.50	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
92) Anthracene	25.61	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
93) Carbazole	26.14	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
94) Di-n-butylphthalate	27.39	0.02	0.02	0.06	0.06	0.17	0.25	N.D	0.4	0.06	N.D	N.D	N.D	N.D	N.D	N.D	0.06
95) Isodrin	28.52	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
96) Fluoranthene	28.98	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
97) Benzidine	29.50	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
99) Pyrene*	29.63	N.D	61.4	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	36.35	0.05	N.D
101) Chlorobenzilate	30.88	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
102) p-Dimethylaminoazobenzene	30.68	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
103) 3,3-Dimethylbenzidine	31.68	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
104) Butylbenzylphthalate	31.83	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	0.03
105) 2-Acetoaminofluorene	32.45	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
106) Benzo[a]anthracene	33.22	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	0.17
107) 3,3'-Dichlorobenzidine	33.26	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
108) Chyrsene	33.35	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
109) bis(2-Ethylhexyl)phthalate	33.64	23.94	0.34	0.28	N.D	0.44	0.75	1.14	0.12	N.D	0.9	1.8	0.7	0.7	1.0	1.6	0.92
111) Di-n-octylphthalate	35.50	N.D	N.D	0.15	0.07	0.06	0.22	N.D	0.97	N.D	N.D	N.D	N.D	N.D	N.D	N.D	0.11
112) Benzo[b]fluoranthene	36.22	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
113) 7,12-Dimethylbenz(a)anthra	36.24	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
114) Benzo[k]fluoranthene	36.32	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
115) Hexachlorophene	36.6	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
116) Benzo[a]pyrene	37.07	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
117) 3-Methylcholanthrene	38.09	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
118) Indeno[1,2,3-cd]pyrene	40.57	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D

Positively Identified Semi-Volatile Organic Compounds

Sample --> Resin--> **Target Compounds**	R.T.	Blank 1214 None ug/ml	BS 1213 None ug/ml	T1 None ug/ml	T4 None ug/ml	T6R SL-639 ug/g	T10 SL-639 ug/g	T11 SL-639 ug/g	T18 SL-644 ug/g	T12 Rep SL-639 ug/g	T21 SL-644 ug/g	T21 Dup SL-644 ug/g	T22 SL-644 ug/g	T22 RR SL-644 ug/g	T22 MS SL-644 ug/g	T22 MSD SL-644 ug/g	T41 SL-639 ug/g
119) Dibenz[a,h]anthracene	40.72	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
120) Benzo[g,h,i]perylene	41.57	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D

* Matric Spike Compound

N.D = Not Detected

Positively Identified Semi-Volatile Organic Compounds

MS Integration Params: RTEINT.P
Quant Method : C:\MSDCHEM\1\METHODS\8270C.M
Title : CLP BNA Calibration
Response via : Continuing Cal Fil
DataAcq Meth : GSKM
Date Analyzed:6/11/02 and 6/13/02
Analyst: Alex Mitroshkov
Review by: Khris Olsen 6/19/02

Sample -->		BLK	BS	T-2	T-9	T-9 Dup	T-20	T-23	T-28	T-2 MS	T-2 MSD	T-30 RR	T-28 Dup	T-29 RR	T-26 RR
Resin-->		None	None	None	SL-639	SL-639	SL-644	SL-644	SL-644	None	None	SL-644	SL-644	SL-644	SL-644
Internal Standards	R.T.	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml
1) 1,4-Dichlorobenzene-d4	12.14	40	40	40	40	40	40	40	40	40	40	40	40	40	40
28) Naphthalene-d8	15.77	40	40	40	40	40	40	40	40	40	40	40	40	40	40
47) Acenaphthene-d10	20.95	40	40	40	40	40	40	40	40	40	40	40	40	40	40
76) Phenanthrene-d10	25.37	40	40	40	40	40	40	40	40	40	40	40	40	40	40
98) Chyrsene-d12	33.27	40	40	40	40	40	40	40	40	40	40	40	40	40	40
110) Perylene-d12	37.22	40	40	40	40	40	40	40	40	40	40	40	40	40	40
System Monitoring Compounds															
7) 2-Fluorophenol	8.69	39.2	40.6	51.1	53.8	0.0	0.0	46.3	76.2	18.1	26.7	70.7	70.4	29.9	62.9
10) Phenol-d5	11.27	49.7	39.7	53.3	45.0	0.0	0.0	43.2	65.3	42.8	51.8	63.3	61.9	52.6	55.9
29) Nitrobenzene-d5	13.73	39.2	27.3	38.2	37.5	45.5	49.8	45.4	45.0	38.8	42.8	40.4	41.1	39.6	46.2
52) 2-Fluorobiphenyl	19.04	40.8	23.5	36.7	35.6	40.1	51.6	48.5	38.1	36.6	40.0	32.9	34.8	31.6	37.4
80) 2,4,6-Tribromophenol	23.33	26.3	32.8	61.9	44.7	0.0	0.0	48.2	74.7	4.5	24.1	71.9	65.8	5.2	62.0
100) Terphenyl-d14	30.25	99.9	47.4	54.6	52.7	49.7	39.2	66.8	57.1	68.5	68.1	68.1	62.4	50.4	58.6

Sample -->		BLK	BS	T-2	T-9	T-9 Dup	T-20	T-23	T-28	T-2 MS	T-2 MSD	T-30 RR	T-28 Dup	T-29 RR	T-26 RR
Resin-->		None	None	None	SL-639	SL-639	SL-644	SL-644	SL-644	None	None	SL-644	SL-644	SL-644	SL-644
Target Compounds	R.T.	ug/ml	ug/ml	ug/ml	ug/g	ug/g	ug/g	ug/g	ug/g	ug/ml	ug/ml	ug/g	ug/g	ug/g	ug/g
2) Pyridine	5.27	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
3) N-Nitrosodimethylamine	5.3	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
4) 2-Picoline	7.1	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
5) N-nitrosomethylethylamine	7.47	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
6) Methyl methanesulfonate	8.3	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
8) N-nitrosodiethylamine	9.31	N.D	N.D	1.76	2.31	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
9) Ethyl methanesulfonate	10.17	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
11) Phenol*	11.29	0.02	39.25	N.D	N.D	N.D	N.D	0.02	N.D	28.32	30.24	N.D	N.D	N.D	N.D
12) Aniline	11.27	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D

Positively Identified Semi-Volatile Organic Compounds

Sample -->		BLK	BS	T-2	T-9	T-9 Dup	T-20	T-23	T-28	T-2 MS	T-2 MSD	T-30 RR	T-28 Dup	T-29 RR	T-26 RR
Resin-->		None	None	None	SL-639	SL-639	SL-644	SL-644	SL-644	None	None	SL-644	SL-644	SL-644	SL-644
Target Compounds	R.T.	ug/ml	ug/ml	ug/ml	ug/g	ug/g	ug/g	ug/g	ug/g	ug/ml	ug/ml	ug/g	ug/g	ug/g	ug/g
13) Pentachloroethane	11.35	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
14) bis(2-Chloroethyl)ether	11.52	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
15) 2-Chlorophenol*	11.56	N.D	42.04	N.D	N.D	N.D	N.D	N.D	N.D	36.18	41.74	N.D	N.D	N.D	N.D
16) 1,3-Dichlorobenzene	11.97	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
17) 1,4-Dichlorobenzene*	12.19	N.D	17.61	N.D	N.D	N.D	N.D	N.D	N.D	27.52	31.46	N.D	N.D	N.D	N.D
18) Benzyl alcohol	12.6	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
19) 1,2-Dichlorobenzene	12.59	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
20) 2-Methylphenol	12.95	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
21) bis(2-chloroisopropyl)ethe	13.02	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
22) 4 and 3-Methylphenol	13.43	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
23) n-Nitroso-di-n-propylamine*	13.4	N.D	21.18	N.D	N.D	N.D	N.D	N.D	N.D	34.0	40.07	N.D	N.D	N.D	N.D
24) Acetophenone*	13.34	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
25) o-Toluidine	13.42	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
26) Hexachloroethane	13.53	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
27) N-nitrosopirrolidine	13.32	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
30) Nitrobenzene	13.8	N.D	0.02	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
31) N-nitrosopiperidine	14.24	N.D	0.06	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
32) Isophorone	14.51	N.D	0	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
33) 2-Nitrophenol	14.7	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
34) 2,4-Dimethylphenol	14.92	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
35) bis(2-Chloroethoxy)methane	15.22	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
36) 2,4-Dichlorophenol	15.41	N.D	0.08	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
37) 1,2,4-Trichlorobenzene*	15.62	N.D	20.14	N.D	N.D	N.D	N.D	N.D	N.D	30.0	34.48	N.D	N.D	N.D	N.D
38) Naphthalene	15.82	N.D	0.01	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
39) 2,6-Dichlorophenol	16.05	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
40) 4-Chloroaniline	16.05	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
41) Hexachloropropene	16.09	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
42) Hexachlorobutadiene	16.23	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
43) N-nitroso-di-n-butylamine	17.12	N.D	0.02	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
44) 4-Chloro-3-methylphenol*	17.54	N.D	44.32	N.D	N.D	N.D	N.D	N.D	N.D	40.71	42.75	N.D	N.D	N.D	N.D
45) Isosafrole	17.7	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
46) 2-Methylnaphthalene	17.89	N.D	7.98	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
48) Hexachlorocyclopentadiene	18.36	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
49) 1,2,4,5-Tetrachlorobenzene	18.38	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
50) 2,4,6-Trichlorophenol	18.75	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
51) 2,4,5-Trichlorophenol	18.83	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
53) Safrole	19.24	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D

Positively Identified Semi-Volatile Organic Compounds

Sample -->		BLK	BS	T-2	T-9	T-9 Dup	T-20	T-23	T-28	T-2 MS	T-2 MSD	T-30 RR	T-28 Dup	T-29 RR	T-26 RR
Resin-->		None	None	None	SL-639	SL-639	SL-644	SL-644	SL-644	None	None	SL-644	SL-644	SL-644	SL-644
Target Compounds	R.T.	ug/ml	ug/ml	ug/ml	ug/g	ug/g	ug/g	ug/g	ug/g	ug/ml	ug/ml	ug/g	ug/g	ug/g	ug/g
54) 2-Chloronaphthalene	19.31	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
55) 2-Nitroaniline	19.67	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
56) 1,4-Naphtoquinone	19.88	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
57) Dimethylphthalate	20.35	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
58) 1,3-Dinitrobenzene	20.36	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
59) Acenaphthylene	20.53	N.D	0.18	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
60) 2,6-Dinitrotoluene	20.47	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
61) 3-Nitroaniline	20.93	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
62) Acenaphthene*	21.05	N.D	26.66	N.D	N.D	N.D	N.D	N.D	N.D	37.83	43.32	N.D	N.D	N.D	N.D
63) 2,4-Dinitrophenol	21.25	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
64) Pentachlorobenzene	21.45	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
65) 4-Nitrophenol*	21.58	N.D	6.35	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
66) Dibenzofuran	21.59	N.D	0.93	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
67) 2,4-Dinitrotoluene*	21.66	N.D	20.44	N.D	N.D	N.D	N.D	N.D	N.D	25.23	32.39	N.D	N.D	N.D	N.D
68) 1-Naphtylamine	21.83	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
69) 2,3,4,6-Tetrachlorophenol	21.98	N.D	0.13	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
70) 2-Naphtylamine	22.03	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
71) Diethylphthalate	22.49	N.D	0.36	N.D	N.D	N.D	3.33	3.64	2.44	N.D	N.D	1.39	3.08	2.47	1.83
72) Fluorene	22.6	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
73) 4-Chlorophenyl-phenylether	22.68	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
74) 5-Nitro-o-toluidine	22.73	N.D	0.01	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
75) 4-Nitroaniline	22.76	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
77) 4,6-Dinitro-2-methylphenol	22.85	N.D	0.12	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
78) Diphenylamine	23.07	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
79) Azobenzene	23.15	N.D	0.01	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
81) Diallate	24.21	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
82) 4-Bromophenyl-phenylether	24.13	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
83) 1,3,5-Trinitrobenzene	23.98	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
84) Hexachlorobenzene	24.21	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
85) Phenacetin	24.13	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
86) Pentachlorophenol*	24.85	N.D	23.9	N.D	N.D	N.D	N.D	N.D	N.D	0.33	0.2	N.D	N.D	N.D	N.D
87) 4-Aminobiphenyl	24.92	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
88) Pentachloronitrobenzene	24.88	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
89) Pronamide	25.21	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
90) Phenanthrene	25.45	N.D	0.02	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
91) Dinoseb	25.5	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
92) Anthracene	25.61	N.D	0.02	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D

Positively Identified Semi-Volatile Organic Compounds

Sample -->		BLK	BS	T-2	T-9	T-9 Dup	T-20	T-23	T-28	T-2 MS	T-2 MSD	T-30 RR	T-28 Dup	T-29 RR	T-26 RR
Resin-->		None	None	None	SL-639	SL-639	SL-644	SL-644	SL-644	None	None	SL-644	SL-644	SL-644	SL-644
Target Compounds	R.T.	ug/ml	ug/ml	ug/ml	ug/g	ug/g	ug/g	ug/g	ug/g	ug/ml	ug/ml	ug/g	ug/g	ug/g	ug/g
93) Carbazole	26.14	N.D	0.01	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
94) Di-n-butylphthalate	27.39	0.81	0.45	2.79	3.50	2.03	2.08	2.00	2.03	0.68	0.7	1.64	2.11	2.58	1.89
95) Isodrin	28.52	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
96) Fluoranthene	28.98	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
97) Benzidine	29.5	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
99) Pyrene*	29.63	N.D	45.09	N.D	N.D	N.D	N.D	N.D	N.D	56.0	62.53	N.D	N.D	N.D	N.D
101) Chlorobenzilate	30.88	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
102) p-Dimethylaminoazobenzene	30.68	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
103) 3,3-Dimethylbenzidine	31.68	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
104) Butylbenzylphthalate	31.83	N.D	0.08	0.15	N.D	N.D	0.03	0.04	N.D	N.D	N.D	N.D	N.D	15.9	N.D
105) 2-Acetoaminofluorene	32.45	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
106) Benzo[a]anthracene	33.22	N.D	0.06	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
107) 3,3'-Dichlorobenzidine	33.26	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
108) Chyrsene	33.35	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
109) bis(2-Ethylhexyl)phthalate	33.64	N.D	0.29	N.D	N.D	N.D	N.D	N.D	0.9	1.06	0.46	1.94	2.00	1.72	1.72
111) Di-n-octylphthalate	35.5	N.D	0.03	N.D	N.D	0.33	N.D	N.D	2.42	0.68	N.D	0.92	0.64	0.72	0.97
112) Benzo[b]fluoranthene	36.22	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
113) 7,12-Dimethylbenz(a)anthra	36.24	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
114) Benzo[k]fluoranthene	36.32	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
115) Hexachlorophene	36.6	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
116) Benzo[a]pyrene	37.07	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
117) 3-Methylcholanthrene	38.09	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
118) Indeno[1,2,3-cd]pyrene	40.57	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
119) Dibenz[a,h]anthracene	40.72	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
120) Benzo[g,h,i]perylene	41.57	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D

* Matric Spike Compound

Positively Identified Semi-Volatile Organic Compounds

MS Integration Params: RTEINT.P
Quant Method : C:\MSDCHEM\1\METHODS\8270C.M
Title : CLP BNA Calibration
Response via : Continuing Cal Fil
DataAcq Meth : GSKM
Date Analyzed:7/26/02 and 6/27/02
Analyst: Alex Mitroshkov
Review by:

Sample -->	R.T.	Blank Prep	BS	1	2	24	25	25 Dup	24 MS	24 MSD	9	9D	10	11
Resin-->		None	None	None	None	SL-644	SL-644	SL-644	SL-644	SL-644	SL-639	SL-639	SL-639	SL-639
Internal Standards	------	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml
1) 1,4-Dichlorobenzene-d4	12.11	40	40	40	40	40	40	40	40	40	40	40	40	40
28) Naphthalene-d8	15.74	40	40	40	40	40	40	40	40	40	40	40	40	40
47) Acenaphthene-d10	20.92	40	40	40	40	40	40	40	40	40	40	40	40	40
76) Phenanthrene-d10	25.33	40	40	40	40	40	40	40	40	40	40	40	40	40
98) Chyrsene-d12	33.19	40	40	40	40	40	40	40	40	40	40	40	40	40
110) Perylene-d12	37.16	40	40	40	40	40	40	40	40	40	40	40	40	40
System Monitoring Compounds														
7) 2-Fluorophenol	0	23.27	42.85	0	0	0	0	0	0	0	0	17.47	18.12	19.23
10) Phenol-d5	0	20.49	39.79	0	0	0	0	0	0	0	0	0	0	0
29) Nitrobenzene-d5	13.68	12.98	27.08	42.32	44.57	35.39	38.45	43.56	41.97	33.65	43.83	37.52	32.76	43.39
52) 2-Fluorobiphenyl	18.98	16.29	25.59	42.37	46.05	36.44	41	45.46	36.3	30.69	43.88	37.67	33.17	42.05
80) 2,4,6-Tribromophenol	23.26	24.26	45.77	25.29	23.51	25.99	29.08	38.01	31.57	15.59	26.22	38.04	21.74	34.64
100) Terphenyl-d14	30.19	10.75	18.56	43.75	36.29	18.45	18.92	20.8	21.17	18.16	32.52	26.66	22.68	30.36

Sample -->	R.T.	Blank Prep	BS	1	2	24	25	25 Dup	24 MS	24 MSD	9	9D	10	11
Resin-->		None	None	None	None	SL-644	SL-644	SL-644	SL-644	SL-644	SL-639	SL-639	SL-639	SL-639
Target Compounds	------	ug/ml	ug/ml	ug/g	ug/g	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml
2) Pyridine	5.27	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
3) N-Nitrosodimethylamine	5.3	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
4) 2-Picoline	7.1	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
5) N-nitrosomethylethylamine	7.47	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
6) Methyl methanesulfonate	8.3	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
8) N-nitrosodiethylamine	9.31	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
9) Ethyl methanesulfonate	10.17	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
11) Phenol	11.29	N.D	24.8	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
12) Aniline	11.27	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
13) Pentachloroethane	11.35	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
14) bis(2-Chloroethyl)ether	11.52	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
15) 2-Chlorophenol	11.56	N.D	41.59	N.D	N.D	N.D	N.D	N.D	5.73	N.D	N.D	N.D	N.D	N.D
16) 1,3-Dichlorobenzene	11.97	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D

Positively Identified Semi-Volatile Organic Compounds

Sample -->	R.T.	Blank Prep	BS	1	2	24	25	25 Dup	24 MS	24 MSD	9	9D	10	11
Resin-->		None	None	None	None	SL-644	SL-644	SL-644	SL-644	SL-644	SL-639	SL-639	SL-639	SL-639
Target Compounds	------	ug/ml	ug/ml	ug/g	ug/g	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml
17) 1,4-Dichlorobenzene	12.19	N.D	16.7	N.D	N.D	N.D	N.D	N.D	26.76	21.85	N.D	N.D	N.D	N.D
18) Benzyl alcohol	12.6	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
19) 1,2-Dichlorobenzene	12.59	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
20) 2-Methylphenol	12.95	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
21) bis(2-chloroisopropyl)ethe	13.02	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
22) 4 and 3-Methylphenol	13.43	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
23) n-Nitroso-di-n-propylamine	13.4	N.D	22.27	N.D	7.4	N.D	N.D	N.D	42.06	31.21	N.D	N.D	N.D	N.D
24) Acetophenone	13.34	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
25) o-Toluidine	13.42	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
26) Hexachloroethane	13.53	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
27) N-nitrosopirrolidine	13.32	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
30) Nitrobenzene	13.8	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
31) N-nitrosopiperidine	14.24	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
32) Isophorone	14.51	N.D	N.D	N.D	0.69	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
33) 2-Nitrophenol	14.7	N.D	N.D	N.D	N.D	N.D	N.D	N.D	36.52	33.09	N.D	N.D	N.D	N.D
34) 2,4-Dimethylphenol	14.92	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
35) bis(2-Chloroethoxy)methane	15.22	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
36) 2,4-Dichlorophenol	15.41	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
37) 1,2,4-Trichlorobenzene	15.62	N.D	18.31	N.D	N.D	N.D	N.D	N.D	30.06	25.67	N.D	N.D	N.D	N.D
38) Naphthalene	15.82	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
39) 2,6-Dichlorophenol	16.05	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
40) 4-Chloroaniline	16.05	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
41) Hexachloropropene	16.09	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
42) Hexachlorobutadiene	16.23	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
43) N-nitroso-di-n-butylamine	17.12	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
44) 4-Chloro-3-methylphenol	17.54	N.D	33.47	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
45) Isosafrole	17.7	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
46) 2-Methylnaphthalene	17.89	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
48) Hexachlorocyclopentadiene	18.36	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
49) 1,2,4,5-Tetrachlorobenzene	18.38	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
50) 2,4,6-Trichlorophenol	18.75	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
51) 2,4,5-Trichlorophenol	18.83	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
53) Safrole	19.24	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
54) 2-Chloronaphthalene	19.31	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
55) 2-Nitroaniline	19.67	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
56) 1,4-Naphtoquinone	19.88	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
57) Dimethylphthalate	20.35	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
58) 1,3-Dinitrobenzene	20.36	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
59) Acenaphthylene	20.53	N.D	N.D	N.D	N.D	N.D	N.D	N.D	1.25	0.76	N.D	N.D	N.D	N.D

Positively Identified Semi-Volatile Organic Compounds

Sample -->	R.T.	Blank Prep	BS	1	2	24	25	25 Dup	24 MS	24 MSD	9	9D	10	11
Resin-->		None	None	None	None	SL-644	SL-644	SL-644	SL-644	SL-644	SL-639	SL-639	SL-639	SL-639
Target Compounds	------	ug/ml	ug/ml	ug/g	ug/g	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml
60) 2,6-Dinitrotoluene	20.47	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
61) 3-Nitroaniline	20.93	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
62) Acenaphthene	21.05	N.D	24.22	N.D	N.D	N.D	N.D	N.D	35.95	27.34	N.D	N.D	N.D	N.D
63) 2,4-Dinitrophenol	21.25	N.D	N.D	N.D	N.D	N.D	N.D	N.D	11.68	12.97	N.D	N.D	N.D	N.D
64) Pentachlorobenzene	21.45	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
65) 4-Nitrophenol	21.58	N.D	N.D	N.D	N.D	N.D	N.D	N.D	19.22	13.47	N.D	N.D	N.D	N.D
66) Dibenzofuran	21.59	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
67) 2,4-Dinitrotoluene	21.66	N.D	20.15	N.D	N.D	N.D	N.D	N.D	43.08	32.98	N.D	N.D	N.D	N.D
68) 1-Naphtylamine	21.83	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
69) 2,3,4,6-Tetrachlorophenol	21.98	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
70) 2-Naphtylamine	22.03	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
71) Diethylphthalate	22.49	0.7	N.D	1.31	1.41	0.86	N.D	0.9	N.D	1.1	1.33	1.04	0.87	0.65
72) Fluorene	22.6	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
73) 4-Chlorophenyl-phenylether	22.68	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
74) 5-Nitro-o-toluidine	22.73	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
75) 4-Nitroaniline	22.76	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
77) 4,6-Dinitro-2-methylphenol	22.85	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
78) Diphenylamine	23.07	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
79) Azobenzene	23.15	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
81) Diallate	24.21	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
82) 4-Bromophenyl-phenylether	24.13	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
83) 1,3,5-Trinitrobenzene	23.98	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
84) Hexachlorobenzene	24.21	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
85) Phenacetin	24.13	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
86) Pentachlorophenol	24.85	N.D	37.89	N.D	N.D	N.D	N.D	N.D	38.7	30.07	N.D	N.D	N.D	N.D
87) 4-Aminobiphenyl	24.92	N.D	N.D	N.D	N.D	N.D	N.D	N.D	1.67	1.32	N.D	N.D	N.D	N.D
88) Pentachloronitrobenzene	24.88	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
89) Pronamide	25.21	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
90) Phenanthrene	25.45	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
91) Dinoseb	25.5	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
92) Anthracene	25.61	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
93) Carbazole	26.14	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
94) Di-n-butylphthalate	27.39	N.D	0.72	0.51	0.44	0.26	N.D	N.D	N.D	0.4	0.46	0.37	0.38	0.32
95) Isodrin	28.52	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
96) Fluoranthene	28.98	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
97) Benzidine	29.5	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
99) Pyrene	29.63	N.D	23.44	N.D	N.D	N.D	N.D	N.D	27.17	10.73	N.D	N.D	N.D	N.D
101) Chlorobenzilate	30.88	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
102) p-Dimethylaminoazobenzene	30.68	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D

Positively Identified Semi-Volatile Organic Compounds

Sample -->	R.T.	Blank Prep	BS	1	2	24	25	25 Dup	24 MS	24 MSD	9	9D	10	11
Resin-->		None	None	None	None	SL-644	SL-644	SL-644	SL-644	SL-644	SL-639	SL-639	SL-639	SL-639
Target Compounds	------	ug/ml	ug/ml	ug/g	ug/g	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml	ug/ml
103) 3,3-Dimethylbenzidine	31.68	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
104) Butylbenzylphthalate	31.83	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
105) 2-Acetoaminofluorene	32.45	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
106) Benzo[a]anthracene	33.22	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
107) 3,3'-Dichlorobenzidine	33.26	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
108) Chyrsene	33.35	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
109) bis(2-Ethylhexyl)phthalate	33.64	0.53	0.49	0.66	0.63	N.D	N.D	N.D	N.D	N.D	0.57	N.D	N.D	0.18
111) Di-n-octylphthalate	35.5	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
112) Benzo[b]fluoranthene	36.22	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
113) 7,12-Dimethylbenz(a)anthra	36.24	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
114) Benzo[k]fluoranthene	36.32	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
115) Hexachlorophene	36.6	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
116) Benzo[a]pyrene	37.07	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
117) 3-Methylcholanthrene	38.09	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
118) Indeno[1,2,3-cd]pyrene	40.57	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
119) Dibenz[a,h]anthracene	40.72	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D
120) Benzo[g,h,i]perylene	41.57	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D	N.D

* Matric Spike Compound

Appendix G

Results of Volatile Organic Compound Analysis - Positively Identified Compounds

Positively Identified Volatile Organic Compounds from SL-639

datafile	011003.b\01100304.d\		011029.b\01101704.d\		011003.b\01100305.d\	
ALO #	01-02347		02-00278		01-02348	
sample id	24G43-1 CLY E		24G52-8 CLY F		24G43-2 CLY D	
pressure & temp before GC/MS (final)	296.3		311.6		315.2	
pressure & temp before GC/MS	296.3		311.6		315.2	
pressure & temp before MS	350.6407336		368.6366089		373.3436893	
pressure & temp before sample	759	20.8	758	22.7	760	20.8
pressure & temp after sample	420	21.2	382	22.6	391	21.2
mass-->	1.8		1.8		1.8	
medium-->	AN105 sim		AN105 sim		AN105 sim	
dose-->						
temperature-->	25		25		65	
Concentration (ng/g resin)						
Dichlorotetrafluoroethane	3.44	J		U		U
Chloromethane	1.8			U		U
Trichlorofluoromethane		U		U		U
Vinyl Chloride		U		U		U
Bromomethane		U		U		U
Chloroethane		U		U		U
1,1-Dichloroethene		U		U		U
Methylene Chloride		U		U		U
cis-1,2-Dichloroethene		U		U		U
1,1-Dichloroethane		U		U		U
Chloroform		U		U		U
1,1,2-Trichloro-1,2,2-trifluoroethane	1687		270		900	
1,2-Dichloroethane		U		U		U
1,1,1-Trichloroethane	152		34		120	
Carbon Tetrachloride		U		U		U
Benzene		U		U	1.64	J
Trichloroethene		U		U		U
1,2-Dichloropropane		U		U		U
cis-1,3-Dichloropropene		U		U		U
trans-1,3-Dichloropropene		U		U		U
1,1,2-Trichloroethane		U		U		U
Toluene		U		U		U
1,2-Dibromoethane		U		U		U
Tetrachloroethene		U		U		U
Chlorobenzene		U		U		U
Ethylbenzene		U		U		U
Xylene (total o&p)		U		U		U
Xylene (m)		U		U		U
Styrene		U		U		U
1,1,2,2-Tetrachloroethane		U		U		U
1,2-Dichlorobenzene		U		U		U
1,3-Dichlorobenzene		U		U		U
1,4-Dichlorobenzene		U		U		U
1,2,4-Trimethylenebenzene		U		U		U
1,3,5-Trimethylenebenzene		U		U		U
1,2,4-Trichlorobenzene		U		U		U
hexachloro-1,3-butadiene		U		U		U

Positively Identified Volatile Organic Compounds from SL-639

datafile	011003.b\01100306.d\		011029.b\01101706.d\		011029.b\01101705.d\	
ALO #	01-02349		02-00353		02-00355	
sample id	24G43-3 CLY C		24G55-5 CLY C		24G57-8 CLY L	
pressure & temp before GC/MS (final)	313.8		318.8		307.8	
pressure & temp before GC/MS	313.8		318.8		307.8	
pressure & temp before MS	371.4615087		377.3802708		364.3589942	
pressure & temp before sample	748	21.4	779	25.2	760	
pressure & temp after sample	380	21.8	448	25.6	380	
mass-->	1.8		1.8		1.8	
medium-->	AN105 sim		AN105 sim		AN105 sim	
dose-->			1.00E+05		1.00E+06	
temperature-->	90		25		25	
Concentration (ng/g resin)						
Dichlorotetrafluoroethane		U		U		U
Chloromethane		U		U		U
Trichlorofluoromethane		U		U		U
Vinyl Chloride		U		U		U
Bromomethane		U		U		U
Chloroethane		U		U		U
1,1-Dichloroethene		U		U		U
Methylene Chloride		U		U		U
cis-1,2-Dichloroethene		U		U		U
1,1-Dichloroethane	15			U		U
Chloroform		U		U		U
1,1,2-Trichloro-1,2,2-trifluoroethane	1687		163		275	
1,2-Dichloroethane		U		U		U
1,1,1-Trichloroethane	232		19		8	
Carbon Tetrachloride		U		U		U
Benzene	3.98			U		U
Trichloroethene		U		U		U
1,2-Dichloropropane		U		U		U
cis-1,3-Dichloropropene		U		U		U
trans-1,3-Dichloropropene		U		U		U
1,1,2-Trichloroethane		U		U		U
Toluene	1.77	J		U		U
1,2-Dibromoethane		U		U		U
Tetrachloroethene		U		U		U
Chlorobenzene		U		U		U
Ethylbenzene		U		U		U
Xylene (total o&p)		U		U		U
Xylene (m)		U		U		U
Styrene		U		U		U
1,1,2,2-Tetrachloroethane		U		U		U
1,2-Dichlorobenzene		U		U		U
1,3-Dichlorobenzene		U		U		U
1,4-Dichlorobenzene		U		U		U
1,2,4-Trimethylenebenzene		U		U		U
1,3,5-Trimethylenebenzene		U		U		U
1,2,4-Trichlorobenzene		U		U		U
hexachloro-1,3-butadiene		U		U		U

Positively Identified Volatile Organic Compounds from SL-639

datafile	020130.b\02013004.d\		011114.b\01111207.d\		011127.b\01112704.d\	
ALO #	02-01282		02-00672		02-00838	
sample id	24G81-9 CLY J (51.8CC)		24G62-9 CLY C (51.7CC)		24G68-3 CLY G (51.8CC)	
pressure & temp before GC/MS (final)	308		341.4		331.8	
pressure & temp before GC/MS	308		341.4		331.8	
pressure & temp before MS	371.3501931		404.1330754		392.6513514	
pressure & temp before sample	760	20	838	23.2	828	21.8
pressure & temp after sample	383	19.8	426	22.9	432	21.9
mass-->	1.8		1.8		1.8	
medium-->	AN105 sim		AN105 sim		AN105 sim	
dose-->	1.00E+07		1.00E+08		1.00E+08	
temperature-->	25		25		25	
Concentration (ng/g resin)						
Dichlorotetrafluoroethane		U		U		U
Chloromethane		U		U		U
Trichlorofluoromethane		U		U		U
Vinyl Chloride		U		U		U
Bromomethane		U		U		U
Chloroethane		U		U		U
1,1-Dichloroethene		U		U		U
Methylene Chloride		U		U		U
cis-1,2-Dichloroethene		U		U		U
1,1-Dichloroethane		U		U	6.5	
Chloroform		U		U		U
1,1,2-Trichloro-1,2,2-trifluoroethane		U		U	956	
1,2-Dichloroethane		U		U		U
1,1,1-Trichloroethane	6		7		296	
Carbon Tetrachloride		U		U		U
Benzene	1.7	J	8.20		3.5	
Trichloroethene		U		U		U
1,2-Dichloropropane		U		U		U
cis-1,3-Dichloropropene		U		U		U
trans-1,3-Dichloropropene		U		U		U
1,1,2-Trichloroethane		U		U		U
Toluene		U		U		U
1,2-Dibromoethane		U		U		U
Tetrachloroethene		U		U		U
Chlorobenzene		U		U		U
Ethylbenzene		U		U		U
Xylene (total o&p)		U		U		U
Xylene (m)		U		U		U
Styrene		U		U		U
1,1,2,2-Tetrachloroethane		U		U		U
1,2-Dichlorobenzene		U		U		U
1,3-Dichlorobenzene		U		U		U
1,4-Dichlorobenzene		U		U		U
1,2,4-Trimethylenebenzene		U		U		U
1,3,5-Trimethylenebenzene		U		U		U
1,2,4-Trichlorobenzene		U		U		U
hexachloro-1,3-butadiene		U		U		U

Positively Identified Volatile Organic Compounds from SL-639

datafile	011127.b\01120607.d\		011121.b\01112107.d\		011017a.b\01101710.d	
ALO #	02-00882		02-00835		02-00184	
sample id	24G71-8 CLY M (11.4CC)43.		24G66-9 CLY H (11.4CC) 42		24G52-7 CLY B	
pressure & temp before GC/MS (final)	43.7		42	19.9	300.2	
pressure & temp before GC/MS	347.4		350.3		300.2	
pressure & temp before MS	411.1123552		414.668472		355.2559846	
pressure & temp before sample	848	26.7	851	20	760	22.7
pressure & temp after sample	418	26	429	19.9	380	22.6
mass-->	1.8		1.8		1.8	
medium-->	AN105 sim		AN105 sim		water	
dose-->	1.00E+08		1.00E+08			
temperature-->	65		90		25	
Concentration (ng/g resin)						
Dichlorotetrafluoroethane		U		U		U
Chloromethane		U		U		U
Trichlorofluoromethane		U		U		U
Vinyl Chloride		U		U		U
Bromomethane		U		U		U
Chloroethane		U		U		U
1,1-Dichloroethene		U		U		U
Methylene Chloride		U	232			U
cis-1,2-Dichloroethene		U		U		U
1,1-Dichloroethane		U		U		U
Chloroform		U		U		U
1,1,2-Trichloro-1,2,2-trifluoroethane	186			U	1799	
1,2-Dichloroethane		U		U		U
1,1,1-Trichloroethane		U		U	24	
Carbon Tetrachloride		U		U		U
Benzene	422		562		3.51	
Trichloroethene		U		U		U
1,2-Dichloropropane		U		U		U
cis-1,3-Dichloropropene		U		U		U
trans-1,3-Dichloropropene		U		U		U
1,1,2-Trichloroethane		U		U		U
Toluene		U	124			U
1,2-Dibromoethane		U		U		U
Tetrachloroethene		U		U		U
Chlorobenzene		U		U		U
Ethylbenzene		U		U		U
Xylene (total o&p)		U		U		U
Xylene (m)		U		U		U
Styrene		U		U		U
1,1,2,2-Tetrachloroethane		U		U		U
1,2-Dichlorobenzene		U		U		U
1,3-Dichlorobenzene		U		U		U
1,4-Dichlorobenzene		U		U		U
1,2,4-Trimethylenebenzene		U		U		U
1,3,5-Trimethylenebenzene		U		U		U
1,2,4-Trichlorobenzene		U		U		U
hexachloro-1,3-butadiene		U		U		U

Positively Identified Volatile Organic Compounds from SL-639

datafile	011003.b\01100307.d\		011003.b\01100308.d\		011029.b\01101707.d\	
ALO #	01-02351		01-02352		02-00354	
sample id	24G43-5 CLY I		24G43-6 CLY F		24G55-6 CLY D	
pressure & temp before GC/MS (final)	504.6		311.8		315.9	
pressure & temp before GC/MS	504.6		311.8		315.9	
pressure & temp before MS	597.5011628		368.8732177		374.1728155	
pressure & temp before sample	761	20.9	744	21.2	775	25.2
pressure & temp after sample	418	21.8	420	21.9	410	25.6
mass-->	1.8		1.8		1.8	
medium-->	water		water		water	
dose-->					1.00E+05	
temperature-->	65		90		65	
Concentration (ng/g resin)						
Dichlorotetrafluoroethane		U		U		U
Chloromethane		U		U		U
Trichlorofluoromethane		U		U		U
Vinyl Chloride		U		U		U
Bromomethane		U		U		U
Chloroethane		U		U		U
1,1-Dichloroethene		U		U		U
Methylene Chloride		U		U		U
cis-1,2-Dichloroethene		U		U		U
1,1-Dichloroethane		U		U		U
Chloroform		U		U		U
1,1,2-Trichloro-1,2,2-trifluoroethane	118		219		90	
1,2-Dichloroethane		U		U		U
1,1,1-Trichloroethane	18		204		128	
Carbon Tetrachloride		U		U		U
Benzene		U	5.62			U
Trichloroethene		U		U		U
1,2-Dichloropropane		U		U		U
cis-1,3-Dichloropropene		U		U		U
trans-1,3-Dichloropropene		U		U		U
1,1,2-Trichloroethane		U		U		U
Toluene		U		U		U
1,2-Dibromoethane		U		U		U
Tetrachloroethene		U		U		U
Chlorobenzene		U		U		U
Ethylbenzene		U		U		U
Xylene (total o&p)		U		U		U
Xylene (m)		U		U		U
Styrene		U		U		U
1,1,2,2-Tetrachloroethane		U		U		U
1,2-Dichlorobenzene		U		U		U
1,3-Dichlorobenzene		U		U		U
1,4-Dichlorobenzene		U		U		U
1,2,4-Trimethylenebenzene		U		U		U
1,3,5-Trimethylenebenzene		U		U		U
1,2,4-Trichlorobenzene		U		U		U
hexachloro-1,3-butadiene		U		U		U

Positively Identified Volatile Organic Compounds from SL-639

datafile	011029.b\01101710.d\		011102.b\01110207.d\	
ALO #	02-00358		02-00370	
sample id	24G57-11 CLY G		24G60-5 CLY H 11.4 CC 170.3Torr 23.8C	
pressure & temp before GC/MS (final)	307.7		170.3	
pressure & temp before GC/MS	307.7		334.9	
pressure & temp before MS	364.1314672		396.4386847	
pressure & temp before sample	764	23.4	760	20.6
pressure & temp after sample	384	22.8	411	20.6
mass-->	1.8		1.8	
medium-->	water		water	
dose-->	1.00E+06		1.00E+07	
temperature-->	65		65	
Concentration (ng/g resin)				
Dichlorotetrafluoroethane		U		U
Chloromethane		U		U
Trichlorofluoromethane		U		U
Vinyl Chloride		U		U
Bromomethane		U		U
Chloroethane		U		U
1,1-Dichloroethene		U		U
Methylene Chloride		U	33	
cis-1,2-Dichloroethene		U		U
1,1-Dichloroethane		U		U
Chloroform		U		U
1,1,2-Trichloro-1,2,2-trifluoroethane		U	214	
1,2-Dichloroethane		U		U
1,1,1-Trichloroethane		U		U
Carbon Tetrachloride		U		U
Benzene	1.69	J	28.12	
Trichloroethene		U		U
1,2-Dichloropropane		U		U
cis-1,3-Dichloropropene		U		U
trans-1,3-Dichloropropene		U		U
1,1,2-Trichloroethane		U		U
Toluene	1.85	J	30.4	
1,2-Dibromoethane		U		U
Tetrachloroethene		U		U
Chlorobenzene		U		U
Ethylbenzene		U		U
Xylene (total o&p)		U		U
Xylene (m)		U		U
Styrene		U		U
1,1,2,2-Tetrachloroethane		U		U
1,2-Dichlorobenzene		U		U
1,3-Dichlorobenzene		U		U
1,4-Dichlorobenzene		U		U
1,2,4-Trimethylenebenzene		U		U
1,3,5-Trimethylenebenzene		U		U
1,2,4-Trichlorobenzene		U		U
hexachloro-1,3-butadiene		U		U

Positively Identified Volatile Organic Compounds from SL-639

datafile	011116.b\01111606.d\		011116.b\01111607.d\	
ALO #	02-00748		02-00749	
sample id	24G64-4 CLY H (11.4CC) 57.1 TORR 19.9C		24G64-5 CLY H (11.4CC)	
pressure & temp before GC/MS (final)	57.1	19.9	521.2	
pressure & temp before GC/MS	479.4		521.2	
pressure & temp before MS	567.3208494		617.1573643	
pressure & temp before sample	1174	20.1	1263	19.9
pressure & temp after sample	588	20.1	636	19.9
mass-->	1.8		1.8	
medium-->	water		water	
dose-->	1.00E+08		1.00E+08	
temperature-->	65		65	
Concentration (ng/g resin)				
Dichlorotetrafluoroethane		U		U
Chloromethane		U		U
Trichlorofluoromethane		U		U
Vinyl Chloride		U		U
Bromomethane		U		U
Chloroethane	3096		99	
1,1-Dichloroethene		U		U
Methylene Chloride		U		U
cis-1,2-Dichloroethene		U		U
1,1-Dichloroethane		U		U
Chloroform		U		U
1,1,2-Trichloro-1,2,2-trifluoroethane	843		8	
1,2-Dichloroethane		U		U
1,1,1-Trichloroethane	252		2	J
Carbon Tetrachloride		U		U
Benzene	117		3.3	
Trichloroethene		U		U
1,2-Dichloropropane		U		U
cis-1,3-Dichloropropene		U		U
trans-1,3-Dichloropropene		U		U
1,1,2-Trichloroethane		U		U
Toluene		U		U
1,2-Dibromoethane		U		U
Tetrachloroethene		U		U
Chlorobenzene		U		U
Ethylbenzene		U		U
Xylene (total o&p)		U		U
Xylene (m)		U		U
Styrene		U		U
1,1,2,2-Tetrachloroethane		U		U
1,2-Dichlorobenzene		U		U
1,3-Dichlorobenzene		U		U
1,4-Dichlorobenzene		U		U
1,2,4-Trimethylenebenzene		U		U
1,3,5-Trimethylenebenzene		U		U
1,2,4-Trichlorobenzene		U		U
hexachloro-1,3-butadiene		U		U

Positively Identified Volatile Organic Compounds from SL-639

datafile	020131.b\02020104.d\		011127.b\01112707.d\	
ALO #	02-01380		02-00841	
sample id	24G83-9 281.5 TORR @ 21.5C H 11.4CC		24G68-6 CLY H (11.4CC) 24(	
pressure & temp before GC/MS (final)	281.5		240.1	
pressure & temp before GC/MS	548.8		470	
pressure & temp before MS	649.8387597		556.1969112	
pressure & temp before sample	1347	20.1	1153	22.3
pressure & temp after sample	676	20.2	598	22.3
mass-->	1.8		1.8	
medium-->	water		water	
dose-->	1.00E+08		1.00E+08	
temperature-->	90		25	
Concentration (ng/g resin)				
Dichlorotetrafluoroethane		U		U
Chloromethane		U		U
Trichlorofluoromethane		U		U
Vinyl Chloride		U		U
Bromomethane		U		U
Chloroethane	36765		329	
1,1-Dichloroethene		U		U
Methylene Chloride		U	48	
cis-1,2-Dichloroethene		U		U
1,1-Dichloroethane		U		U
Chloroform		U		U
1,1,2-Trichloro-1,2,2-trifluoroethane		U	236	
1,2-Dichloroethane		U		U
1,1,1-Trichloroethane		U	136	
Carbon Tetrachloride		U		U
Benzene	351		6.6	
Trichloroethene		U		U
1,2-Dichloropropane		U		U
cis-1,3-Dichloropropene		U		U
trans-1,3-Dichloropropene		U		U
1,1,2-Trichloroethane	64			U
Toluene	91.2			U
1,2-Dibromoethane		U		U
Tetrachloroethene		U		U
Chlorobenzene		U		U
Ethylbenzene		U		U
Xylene (total o&p)	27			U
Xylene (m)		U		U
Styrene		U		U
1,1,2,2-Tetrachloroethane		U		U
1,2-Dichlorobenzene		U		U
1,3-Dichlorobenzene		U		U
1,4-Dichlorobenzene		U		U
1,2,4-Trimethylenebenzene		U		U
1,3,5-Trimethylenebenzene		U		U
1,2,4-Trichlorobenzene		U		U
hexachloro-1,3-butadiene		U		U

Positively Identified Volatile Organic Compounds from SL-639

datafile	011213.b\01120606.d\	
ALO #	02-00893	
sample id	24G73-5 CLY M (11.4CC) 46.0TORR 19C	
pressure & temp before GC/MS (final)	46	
pressure & temp before GC/MS	471.1	
pressure & temp before MS	557.4986486	
pressure & temp before sample	1056	21.4
pressure & temp after sample	576	21.6
mass-->	1.8	
medium-->	none	
dose-->	1.00E+08	
temperature-->	25	
Concentration (ng/g resin)		
Dichlorotetrafluoroethane		U
Chloromethane		U
Trichlorofluoromethane		U
Vinyl Chloride		U
Bromomethane		U
Chloroethane		U
1,1-Dichloroethene		U
Methylene Chloride	160	
cis-1,2-Dichloroethene		U
1,1-Dichloroethane		U
Chloroform		U
1,1,2-Trichloro-1,2,2-trifluoroethane	545	
1,2-Dichloroethane		U
1,1,1-Trichloroethane		U
Carbon Tetrachloride		U
Benzene	129	
Trichloroethene		U
1,2-Dichloropropane		U
cis-1,3-Dichloropropene		U
trans-1,3-Dichloropropene		U
1,1,2-Trichloroethane		U
Toluene		U
1,2-Dibromoethane		U
Tetrachloroethene		U
Chlorobenzene		U
Ethylbenzene		U
Xylene (total o&p)		U
Xylene (m)		U
Styrene		U
1,1,2,2-Tetrachloroethane		U
1,2-Dichlorobenzene		U
1,3-Dichlorobenzene		U
1,4-Dichlorobenzene		U
1,2,4-Trimethylenebenzene		U
1,3,5-Trimethylenebenzene		U
1,2,4-Trichlorobenzene		U
hexachloro-1,3-butadiene		U

Positively Identified Volatile Organic Compounds from SL-644

datafile	011017a.b\01101707.d		011219.b\01121907.d\		011219.b\01121908.d\	
ALO #	02-00052		02-00948		02-00949	
sample id	24G49-4 CLY I		24G77-11 CLY L (51.7CC)		24G78-3 CLY A (51.6CC)	
pressure & temp before GC/MS (final)	316.3		347.6		324.9	
pressure & temp before GC/MS	316.3		347.6		324.9	
pressure & temp before MS	374.5		411.5		384.7	
pressure & temp before sample	777	22.9	844	22.7	791	22.3
pressure & temp after sample	400	23.4	422	22.7	422	22.1
mass-->	0.9		0.9		0.9	
medium-->	HNO3		HNO3		HNO3	
dose-->						
temperature-->	25		45		45	
Concentration (ng/g resin)						
Dichlorotetrafluoroethane	18.46			U		U
Chloromethane		U		U		U
Trichlorofluoromethane		U		U		U
Vinyl Chloride		U		U		U
Bromomethane		U		U		U
Chloroethane		U		U		U
1,1-Dichloroethene		U		U	38.41	
Methylene Chloride		U		U		U
cis-1,2-Dichloroethene		U		U		U
1,1-Dichloroethane		U		U	3.920	J
Chloroform		U		U		U
1,1,2-Trichloro-1,2,2-trifluoroethane	584.7			U	2361	
1,2-Dichloroethane		U		U		U
1,1,1-Trichloroethane	256.1			U	552.3	
Carbon Tetrachloride		U		U		U
Benzene		U	2.952	J		U
Trichloroethene		U		U		U
1,2-Dichloropropane		U		U		U
cis-1,3-Dichloropropene		U		U		U
trans-1,3-Dichloropropene	35.96			U		U
1,1,2-Trichloroethane		U		U		U
Toluene		U		U		U
1,2-Dibromoethane		U		U		U
Tetrachloroethene		U		U		U
Chlorobenzene		U		U		U
Ethylbenzene		U		U		U
Xylene (total o&p)		U		U		U
Xylene (m)		U		U		U
Styrene		U		U		U
1,1,2,2-Tetrachloroethane		U		U		U
1,2-Dichlorobenzene		U		U		U
1,3-Dichlorobenzene		U		U		U
1,4-Dichlorobenzene		U		U		U
1,2,4-Trimethylenebenzene		U		U		U
1,3,5-Trimethylenebenzene		U		U		U
1,2,4-Trichlorobenzene		U		U		U
hexachloro-1,3-butadiene		U		U		U

Positively Identified Volatile Organic Compounds from SL-644

datafile	011017a.b\01101708.d		011219.b\01121909.d\		011003.b\01100310.d\	
ALO #	02-00053		02-00950		02-0003 835.8T 21.7C 431T 19C	
sample id	24G49-5 CLY J		24G78-4 CLY B (51.8CC)		24G46-6 CLY H x 432/835.8	
pressure & temp before GC/MS (final)	760.4		409.6		432	
pressure & temp before GC/MS	760.4		409.6		835.8	
pressure & temp before MS	899.9		484.7		989.1	
pressure & temp before sample	1844	23	1000	22.4	2025	23.4
pressure & temp after sample	938	23.5	509	22.3	1023	23.5
mass-->	0.9		0.9		0.9	
medium-->	HNO3		HNO3		HNO3	
dose-->						
temperature-->	65		65		90	
Concentration (ng/g resin)						
Dichlorotetrafluoroethane		U		U		U
Chloromethane		U		U		U
Trichlorofluoromethane		U		U		U
Vinyl Chloride		U		U		U
Bromomethane		U		U		U
Chloroethane		U		U		U
1,1-Dichloroethene		U	11.64		58.2	
Methylene Chloride	8.660			U		U
cis-1,2-Dichloroethene		U		U		U
1,1-Dichloroethane		U		U		U
Chloroform	11.46		10.03		93.1	
1,1,2-Trichloro-1,2,2-trifluoroethane	269.9		506.0		1102	
1,2-Dichloroethane		U		U		U
1,1,1-Trichloroethane	45.62		232.1		1281	
Carbon Tetrachloride		U		U		U
Benzene	18.74		4.686		229.6	
Trichloroethene		U		U		U
1,2-Dichloropropane	46.78			U		U
cis-1,3-Dichloropropene		U		U		U
trans-1,3-Dichloropropene		U		U		U
1,1,2-Trichloroethane		U		U		U
Toluene		U		U	29.2878	
1,2-Dibromoethane		U		U		U
Tetrachloroethene		U		U		U
Chlorobenzene		U		U	58.7772	
Ethylbenzene		U		U		U
Xylene (total o&p)		U		U		U
Xylene (m)		U		U		U
Styrene		U		U		U
1,1,2,2-Tetrachloroethane		U		U		U
1,2-Dichlorobenzene		U		U		U
1,3-Dichlorobenzene		U		U		U
1,4-Dichlorobenzene		U		U		U
1,2,4-Trimethylenebenzene		U		U		U
1,3,5-Trimethylenebenzene		U		U		U
1,2,4-Trichlorobenzene		U		U		U
hexachloro-1,3-butadiene		U		U		U

Positively Identified Volatile Organic Compounds from SL-644

datafile	011017a.b\01101709.d		011017a.b\01101711.d		020131.b\02013105.d\	
ALO #	02-00054		02-00046		02-01280	
sample id	24G49-6 CLY L		24G48-6 CLY A		24G79-1 388.1 TORR @ 22C B 51.8C(	
pressure & temp before GC/MS (final)	438.4		441.5		388.1	
pressure & temp before GC/MS	438.4		441.5		747	
pressure & temp before MS	519.0		522.8		884.0	
pressure & temp before sample	1027	23.1	1058	21.5		
pressure & temp after sample	530	23.5	552	21.5		
mass-->	0.9		0.9		0.9	
medium-->	HNO3		HNO3		HNO3	
dose-->						
temperature-->	90		90		90	
Concentration (ng/g resin)						
Dichlorotetrafluoroethane		U		U		U
Chloromethane		U		U	8.484	
Trichlorofluoromethane		U		U		U
Vinyl Chloride		U		U		U
Bromomethane		U		U		U
Chloroethane		U		U		U
1,1-Dichloroethene		U		U		U
Methylene Chloride	6.622			U	18.34	
cis-1,2-Dichloroethene		U		U		U
1,1-Dichloroethane		U		U		U
Chloroform	17.91		13.61		32.95	
1,1,2-Trichloro-1,2,2-trifluoroethane	202.4		247.4		4273	
1,2-Dichloroethane		U		U		U
1,1,1-Trichloroethane	272.1		288.1		248.1	
Carbon Tetrachloride		U		U		U
Benzene	30.93		27.18		46.39	
Trichloroethene		U		U		U
1,2-Dichloropropane	39.32		27.80		284.8	
cis-1,3-Dichloropropene		U		U		U
trans-1,3-Dichloropropene		U		U		U
1,1,2-Trichloroethane		U		U		U
Toluene		U		U	6.631	
1,2-Dibromoethane		U		U		U
Tetrachloroethene		U		U		U
Chlorobenzene		U		U		U
Ethylbenzene		U		U		U
Xylene (total o&p)		U		U		U
Xylene (m)		U		U		U
Styrene		U		U		U
1,1,2,2-Tetrachloroethane		U		U		U
1,2-Dichlorobenzene		U		U		U
1,3-Dichlorobenzene		U		U		U
1,4-Dichlorobenzene		U		U		U
1,2,4-Trimethylenebenzene		U		U		U
1,3,5-Trimethylenebenzene		U		U		U
1,2,4-Trichlorobenzene		U		U		U
hexachloro-1,3-butadiene		U		U		U

Positively Identified Volatile Organic Compounds from SL-644

datafile	011029.b\01101709.d\		020130.b\02013007.d\		011114.b\01111205.d\	
ALO #	02-00357		02-01284		02-00674	
sample id	24G57-10 CLY H		24G81-11 CLY C (51.7CC)		24G62-11 CLY F (51.9CC)	
pressure & temp before GC/MS (final)	309.3		324.3		386.2	
pressure & temp before GC/MS	309.3		324.3		386.2	
pressure & temp before MS	366.0		383.9		456.9	
pressure & temp before sample	765	23.5	783	19.8	939	22.9
pressure & temp after sample	391	23.5	397	19.6	472	22.5
mass-->	0.91		0.9		0.9	
medium-->	HNO3		HNO3		HNO3	
dose-->	1.00E+06		1.00E+07		1.00E+08	
temperature-->	25		25		25	
Concentration (ng/g resin)						
Dichlorotetrafluoroethane		U		U		U
Chloromethane		U		U		U
Trichlorofluoromethane		U		U		U
Vinyl Chloride		U		U		U
Bromomethane		U		U		U
Chloroethane		U		U		U
1,1-Dichloroethene		U		U		U
Methylene Chloride		U		U		U
cis-1,2-Dichloroethene		U		U		U
1,1-Dichloroethane		U		U		U
Chloroform		U		U		U
1,1,2-Trichloro-1,2,2-trifluoroethane		U		U		U
1,2-Dichloroethane		U		U		U
1,1,1-Trichloroethane	9.605			U		U
Carbon Tetrachloride		U		U		U
Benzene		U		U		U
Trichloroethene		U		U		U
1,2-Dichloropropane		U		U		U
cis-1,3-Dichloropropene		U		U		U
trans-1,3-Dichloropropene		U		U		U
1,1,2-Trichloroethane		U		U		U
Toluene		U		U		U
1,2-Dibromoethane		U		U		U
Tetrachloroethene		U		U		U
Chlorobenzene		U		U		U
Ethylbenzene		U		U		U
Xylene (total o&p)		U		U		U
Xylene (m)		U		U		U
Styrene		U		U		U
1,1,2,2-Tetrachloroethane		U		U		U
1,2-Dichlorobenzene		U		U		U
1,3-Dichlorobenzene		U		U		U
1,4-Dichlorobenzene		U		U		U
1,2,4-Trimethylenebenzene		U		U		U
1,3,5-Trimethylenebenzene		U		U		U
1,2,4-Trichlorobenzene		U		U		U
hexachloro-1,3-butadiene		U		U		U

Positively Identified Volatile Organic Compounds from SL-644

datafile	011127.b\01112706.d\		011127.b\01120605.d\		020131.b\02013104.d\	
ALO #	02-00840		02-00884		02-01280	
sample id	24G68-5 CLY I (51.6CC)		24G71-10 CLY E (51.8CC)		24G79-1 72.5 TORR @ 22C H 11.4CC	
pressure & temp before GC/MS (final)	472.7		1005.2		72.5	
pressure & temp before GC/MS	472.7		1005.2		747	
pressure & temp before MS	559.7		1189.6		884.0	
pressure & temp before sample	1157	22.5	2466	25.8	1884	22.4
pressure & temp after sample	586	22.4	1246	25.2	914	22.1
mass-->	0.9		0.9		0.9	
medium-->	HNO3		HNO3		HNO3	
dose-->	1.00E+08		1.00E+08		5.00E+06	
temperature-->	25		65		90	
Concentration (ng/g resin)						
Dichlorotetrafluoroethane		U		U		U
Chloromethane		U	118.2			U
Trichlorofluoromethane		U		U		U
Vinyl Chloride		U		U		U
Bromomethane		U	27.61			U
Chloroethane	4.644			U		U
1,1-Dichloroethene		U		U		U
Methylene Chloride		U		U	392.2	
cis-1,2-Dichloroethene		U		U		U
1,1-Dichloroethane		U		U		U
Chloroform		U	5.946	J		U
1,1,2-Trichloro-1,2,2-trifluoroethane	269.9			U	6297	
1,2-Dichloroethane		U		U		U
1,1,1-Trichloroethane	37.62			U		U
Carbon Tetrachloride		U		U		U
Benzene		U	4.124	J		U
Trichloroethene		U		U		U
1,2-Dichloropropane		U		U		U
cis-1,3-Dichloropropene		U		U		U
trans-1,3-Dichloropropene		U		U		U
1,1,2-Trichloroethane		U		U		U
Toluene		U		U		U
1,2-Dibromoethane		U		U		U
Tetrachloroethene		U		U		U
Chlorobenzene		U		U		U
Ethylbenzene		U		U		U
Xylene (total o&p)		U		U		U
Xylene (m)		U		U		U
Styrene		U		U		U
1,1,2,2-Tetrachloroethane		U		U		U
1,2-Dichlorobenzene		U		U		U
1,3-Dichlorobenzene		U		U		U
1,4-Dichlorobenzene		U		U		U
1,2,4-Trimethylenebenzene		U		U		U
1,3,5-Trimethylenebenzene		U		U		U
1,2,4-Trichlorobenzene		U		U		U
hexachloro-1,3-butadiene		U		U		U

Positively Identified Volatile Organic Compounds from SL-644

datafile	011017a.b\01101704.d		011017a.b\01101705.d		011017a.b\01101706.d	
ALO #	02-00049		02-00050		02-00051	
sample id	24G49-1 CLY C		24G49-2 CLY D		24G49-3 CLY E	
pressure & temp before GC/MS (final)	303.8		338.6		353.8	
pressure & temp before GC/MS	303.8		338.6		353.8	
pressure & temp before MS	359.6		401.1		418.7	
pressure & temp before sample	758	22.5	811	22.5	863	23.2
pressure & temp after sample	425	22.8	418	22.8	446	23.4
mass-->	0.9		0.9		0.9	
medium-->	AN105 sim		AN105 sim		AN105 sim	
dose-->						
temperature-->	25		65		90	
Concentration (ng/g resin)						
Dichlorotetrafluoroethane		U		U		U
Chloromethane		U		U		U
Trichlorofluoromethane		U		U		U
Vinyl Chloride		U		U		U
Bromomethane		U		U		U
Chloroethane		U		U		U
1,1-Dichloroethene		U		U		U
Methylene Chloride		U	11.21			U
cis-1,2-Dichloroethene		U		U		U
1,1-Dichloroethane		U		U	21.38	
Chloroform		U		U		U
1,1,2-Trichloro-1,2,2-trifluoroethane	1462		3598		2024	
1,2-Dichloroethane		U		U		U
1,1,1-Trichloroethane	288.1		272.1		728.4	
Carbon Tetrachloride		U		U		U
Benzene	10.78		2.671	J	74.98	
Trichloroethene		U		U		U
1,2-Dichloropropane		U		U		U
cis-1,3-Dichloropropene		U		U		U
trans-1,3-Dichloropropene		U		U		U
1,1,2-Trichloroethane		U		U		U
Toluene	13.82			U	44.76	
1,2-Dibromoethane		U		U		U
Tetrachloroethene		U		U		U
Chlorobenzene	6.756	J		U		U
Ethylbenzene	5.225	J		U	15.93	
Xylene (total o&p)	10.83			U	82.84	
Xylene (m)	6.372	J		U	12.11	
Styrene		U		U		U
1,1,2,2-Tetrachloroethane		U		U		U
1,2-Dichlorobenzene		U		U		U
1,3-Dichlorobenzene		U		U		U
1,4-Dichlorobenzene		U		U		U
1,2,4-Trimethylenebenzene		U		U		U
1,3,5-Trimethylenebenzene	4.832	J		U	122.6	
1,2,4-Trichlorobenzene		U		U		U
hexachloro-1,3-butadiene		U		U		U

Positively Identified Volatile Organic Compounds from SL-644

datafile	011029.b\01101708.d\		020130.b\02013006.d\		011114.b\01111204.d\	
ALO #	02-00356		02-01283		02-00673	
sample id	24G57-9 CLY J		24G81-10 CLY D (51.5CC) 183.1 T		24G62-10 CLY E (51.8CC)	
pressure & temp before GC/MS (final)	311		183.1		336	
pressure & temp before GC/MS	311		313.8		336	
pressure & temp before MS	368.0		384.1		397.6	
pressure & temp before sample	762	23.4	758	20.2	817	23.1
pressure & temp after sample	395	23	385	20.1	414	22.6
mass-->	0.9		0.9		0.9	
medium-->	AN105 sim		AN105 sim		AN105 sim	
dose-->	1.00E+06		1.00E+07		1.00E+08	
temperature-->	25		25		25	
Concentration (ng/g resin)						
Dichlorotetrafluoroethane		U		U		U
Chloromethane		U	57.57		23.33	
Trichlorofluoromethane		U		U		U
Vinyl Chloride		U		U		U
Bromomethane		U		U		U
Chloroethane		U		U		U
1,1-Dichloroethene		U		U		U
Methylene Chloride		U		U		U
cis-1,2-Dichloroethene		U		U		U
1,1-Dichloroethane		U		U		U
Chloroform		U		U		U
1,1,2-Trichloro-1,2,2-trifluoroethane	13.49			U		U
1,2-Dichloroethane		U		U		U
1,1,1-Trichloroethane	44.82			U		U
Carbon Tetrachloride		U		U		U
Benzene		U		U		U
Trichloroethene		U		U		U
1,2-Dichloropropane		U		U		U
cis-1,3-Dichloropropene		U		U		U
trans-1,3-Dichloropropene		U		U		U
1,1,2-Trichloroethane		U		U		U
Toluene		U		U		U
1,2-Dibromoethane		U		U		U
Tetrachloroethene		U		U		U
Chlorobenzene		U		U		U
Ethylbenzene		U		U		U
Xylene (total o&p)		U		U		U
Xylene (m)		U		U		U
Styrene		U		U		U
1,1,2,2-Tetrachloroethane		U		U		U
1,2-Dichlorobenzene		U		U		U
1,3-Dichlorobenzene		U		U		U
1,4-Dichlorobenzene		U		U		U
1,2,4-Trimethylenebenzene		U		U		U
1,3,5-Trimethylenebenzene		U		U		U
1,2,4-Trichlorobenzene		U		U		U
hexachloro-1,3-butadiene		U		U		U

Positively Identified Volatile Organic Compounds from SL-644

datafile	011127.b\01112705.d\		011213.b\01120604.d\		011213.b\01120605.d\	
ALO #	02-00839		02-00891		02-00892	
sample id	24G68-4 CLY H (51.8CC)		24G73-3 CLY D (51.5CC)		24G73-4 CLY H (51.3CC)	
pressure & temp before GC/MS (final)	328.2		321.6		319.3	
pressure & temp before GC/MS	328.2		321.6		319.3	
pressure & temp before MS	388.4		380.9		377.9	
pressure & temp before sample	810	22	792	20.8	794	21.3
pressure & temp after sample	413	22	410	21.2	396	21.5
mass-->	0.9		0.9		0.9	
medium-->	AN105 sim		AN105 sim		AN105 sim	
dose-->	1.00E+08		1.00E+08		1.00E+08	
temperature-->	25		25		25	
Concentration (ng/g resin)						
Dichlorotetrafluoroethane	12.30			U	10.25	
Chloromethane		U	13.94			U
Trichlorofluoromethane		U		U		U
Vinyl Chloride		U		U		U
Bromomethane		U		U		U
Chloroethane		U		U		U
1,1-Dichloroethene		U		U		U
Methylene Chloride		U		U		U
cis-1,2-Dichloroethene		U		U		U
1,1-Dichloroethane		U	9.504			U
Chloroform		U		U		U
1,1,2-Trichloro-1,2,2-trifluoroethane	618.4		2024		562.2	
1,2-Dichloroethane		U		U		U
1,1,1-Trichloroethane	272.1		624.3		224.1	
Carbon Tetrachloride		U		U		U
Benzene	1.734	J		U		U
Trichloroethene		U		U		U
1,2-Dichloropropane		U		U		U
cis-1,3-Dichloropropene		U		U		U
trans-1,3-Dichloropropene		U		U		U
1,1,2-Trichloroethane		U		U		U
Toluene		U		U		U
1,2-Dibromoethane		U		U		U
Tetrachloroethene		U		U		U
Chlorobenzene		U		U		U
Ethylbenzene		U		U		U
Xylene (total o&p)		U		U		U
Xylene (m)		U		U		U
Styrene		U		U		U
1,1,2,2-Tetrachloroethane		U		U		U
1,2-Dichlorobenzene		U		U		U
1,3-Dichlorobenzene		U		U		U
1,4-Dichlorobenzene		U		U		U
1,2,4-Trimethylenebenzene		U		U		U
1,3,5-Trimethylenebenzene		U		U		U
1,2,4-Trichlorobenzene		U		U		U
hexachloro-1,3-butadiene		U		U		U

Positively Identified Volatile Organic Compounds from SL-644

datafile	020131.b\02013106.d\		011127.b\01120606.d\	
ALO #	02-01263		02-00883	
sample id	24G75-1 G 51.8CC		24G71-9 CLY C (51.7CC)	
pressure & temp before GC/MS (final)	474.8		346.4	
pressure & temp before GC/MS	474.8		346.4	
pressure & temp before MS	561.9		410.1	
pressure & temp before sample	1236	24.2	852	26.4
pressure & temp after sample	613	23.8	429	25.6
mass-->	0.9		0.9	
medium-->	AN105 sim		AN105 sim	
dose-->	7.00E+08		1.00E+08	
temperature-->	25		65	
Concentration (ng/g resin)				
Dichlorotetrafluoroethane		U		U
Chloromethane	66.66			U
Trichlorofluoromethane		U		U
Vinyl Chloride		U		U
Bromomethane		U		U
Chloroethane	30.96			U
1,1-Dichloroethene		U		U
Methylene Chloride		U		U
cis-1,2-Dichloroethene		U		U
1,1-Dichloroethane		U		U
Chloroform		U		U
1,1,2-Trichloro-1,2,2-trifluoroethane	4160			U
1,2-Dichloroethane		U		U
1,1,1-Trichloroethane	352.2		12.81	
Carbon Tetrachloride		U		U
Benzene	3.421	J	6.560	
Trichloroethene		U		U
1,2-Dichloropropane		U		U
cis-1,3-Dichloropropene		U		U
trans-1,3-Dichloropropene		U		U
1,1,2-Trichloroethane		U		U
Toluene		U	5.305	J
1,2-Dibromoethane		U		U
Tetrachloroethene		U		U
Chlorobenzene		U		U
Ethylbenzene		U		U
Xylene (total o&p)		U		U
Xylene (m)		U		U
Styrene		U		U
1,1,2,2-Tetrachloroethane		U		U
1,2-Dichlorobenzene		U		U
1,3-Dichlorobenzene		U		U
1,4-Dichlorobenzene		U		U
1,2,4-Trimethylenebenzene		U		U
1,3,5-Trimethylenebenzene		U		U
1,2,4-Trichlorobenzene		U		U
hexachloro-1,3-butadiene		U		U

Positively Identified Volatile Organic Compounds from SL-644

datafile	020131.b\02020105.d\		011102.b\01110206.d\	
ALO #	02-01381		02-00369	
sample id	24G83-10 181.8 TORR @ 19C H 11.4CC		24G59-11 CLY J	
pressure & temp before GC/MS (final)	181.1		341.5	
pressure & temp before GC/MS	354.1		341.5	
pressure & temp before MS	419.0		404.1	
pressure & temp before sample	831	20.2	774	20.6
pressure & temp after sample	433	20.4	424	20.6
mass-->	0.9		0.9	
medium-->	AN105 sim		none	
dose-->	1.00E+08		1.00E+07	
temperature-->	90		25	
Concentration (ng/g resin)				
Dichlorotetrafluoroethane		U		U
Chloromethane		U		U
Trichlorofluoromethane		U		U
Vinyl Chloride		U		U
Bromomethane		U		U
Chloroethane	1664			U
1,1-Dichloroethene		U		U
Methylene Chloride		U		U
cis-1,2-Dichloroethene		U		U
1,1-Dichloroethane		U		U
Chloroform		U		U
1,1,2-Trichloro-1,2,2-trifluoroethane		U		U
1,2-Dichloroethane		U		U
1,1,1-Trichloroethane		U		U
Carbon Tetrachloride		U		U
Benzene	20.62			U
Trichloroethene		U		U
1,2-Dichloropropane		U		U
cis-1,3-Dichloropropene		U		U
trans-1,3-Dichloropropene		U		U
1,1,2-Trichloroethane		U		U
Toluene		U		U
1,2-Dibromoethane		U		U
Tetrachloroethene		U		U
Chlorobenzene		U		U
Ethylbenzene		U		U
Xylene (total o&p)		U		U
Xylene (m)		U		U
Styrene		U		U
1,1,2,2-Tetrachloroethane		U		U
1,2-Dichlorobenzene		U		U
1,3-Dichlorobenzene		U		U
1,4-Dichlorobenzene		U		U
1,2,4-Trimethylenebenzene		U		U
1,3,5-Trimethylenebenzene		U		U
1,2,4-Trichlorobenzene		U		U
hexachloro-1,3-butadiene		U		U

Positively Identified Volatile Organic Compounds - Quality Control

datafile	011003.b\01100303.d\		011003.b\01100311.d\		011017a.b\01101703.d	
ALO #	VOCBLK		CYLINDER BATCH BLANK		VOCBLK	
sample id	0		CLY G 51.8CC		0	
pressure & temp before GC/MS (final)	760		760		760	
pressure & temp before GC/MS	760		760		760	
pressure & temp before MS	760		760		760	
pressure & temp before sample	760		760		760	
pressure & temp after sample	760		760		760	
medium-->						
dose-->						
Mass detected (ng)						
Dichlorotetrafluoroethane		U		U		U
Chloromethane		U		U		U
Trichlorofluoromethane		U		U		U
Vinyl Chloride		U		U		U
Bromomethane		U		U		U
Chloroethane		U		U		U
1,1-Dichloroethene		U		U		U
Methylene Chloride		U	2.0	J		U
cis-1,2-Dichloroethene		U		U		U
1,1-Dichloroethane		U		U		U
Chloroform		U		U		U
1,1,2-Trichloro-1,2,2-trifluoroethane		U		U		U
1,2-Dichloroethane		U		U		U
1,1,1-Trichloroethane		U	0.8	J		U
Carbon Tetrachloride		U		U		U
Benzene		U	2.5	J		U
Trichloroethene		U		U		U
1,2-Dichloropropane		U		U		U
cis-1,3-Dichloropropene		U		U		U
trans-1,3-Dichloropropene		U		U		U
1,1,2-Trichloroethane		U		U		U
Toluene		U		U		U
1,2-Dibromoethane		U		U		U
Tetrachloroethene		U		U		U
Chlorobenzene		U	0.67	J		U
Ethylbenzene		U		U		U
Xylene (total o&p)		U		U		U
Xylene (m)		U		U		U
Styrene		U		U		U
1,1,2,2-Tetrachloroethane		U		U		U
1,2-Dichlorobenzene		U		U		U
1,3-Dichlorobenzene		U		U		U
1,4-Dichlorobenzene		U		U		U
1,2,4-Trimethylenebenzene		U		U		U
1,3,5-Trimethylenebenzene		U		U		U
1,2,4-Trichlorobenzene		U		U		U
hexachloro-1,3-butadiene		U		U		U

Positively Identified Volatile Organic Compounds - Quality Control

datafile	011029.b\01101703.d\		011102.b\01110203.d\		011102.b\01110204.d\	
ALO #	VOCBLK		VOCBLK		02-00367	
sample id	0		0		24G59-8 CLY G	
pressure & temp before GC/MS (final)	760		760		351.6	
pressure & temp before GC/MS	760		760		351.6	
pressure & temp before MS	760		760		416.1	
pressure & temp before sample	760		760		891	20.9
pressure & temp after sample					440	20.9
medium-->					water	
dose-->						
Mass detected (ng)						
Dichlorotetrafluoroethane		U		U		U
Chloromethane		U		U		U
Trichlorofluoromethane		U		U		U
Vinyl Chloride		U		U		U
Bromomethane		U		U		U
Chloroethane		U		U		U
1,1-Dichloroethene		U		U		U
Methylene Chloride		U		U		U
cis-1,2-Dichloroethene		U		U		U
1,1-Dichloroethane		U		U		U
Chloroform		U		U		U
1,1,2-Trichloro-1,2,2-trifluoroethane		U		U	405	
1,2-Dichloroethane		U		U		U
1,1,1-Trichloroethane		U		U	23.1	
Carbon Tetrachloride		U		U		U
Benzene		U		U		U
Trichloroethene		U		U		U
1,2-Dichloropropane		U		U		U
cis-1,3-Dichloropropene		U		U		U
trans-1,3-Dichloropropene		U		U		U
1,1,2-Trichloroethane		U		U		U
Toluene		U		U		U
1,2-Dibromoethane		U		U		U
Tetrachloroethene		U		U		U
Chlorobenzene		U		U		U
Ethylbenzene		U		U		U
Xylene (total o&p)		U		U		U
Xylene (m)		U		U		U
Styrene		U		U		U
1,1,2,2-Tetrachloroethane		U		U		U
1,2-Dichlorobenzene		U		U		U
1,3-Dichlorobenzene		U		U		U
1,4-Dichlorobenzene		U		U		U
1,2,4-Trimethylenebenzene		U		U		U
1,3,5-Trimethylenebenzene		U		U		U
1,2,4-Trichlorobenzene		U		U		U
hexachloro-1,3-butadiene		U		U		U

Positively Identified Volatile Organic Compounds - Quality Control

datafile	011102.b\01110205.d\		011114.b\01111203.d\		011114.b\01111206.d\	
ALO #	02-00368		VOCBLK		02-00671	
sample id	24G59-9 CLY I		0		24G62-8 CLY B (51.8CC)	
pressure & temp before GC/MS (final)	337.7		760		318.5	
pressure & temp before GC/MS	337.7		760		318.5	
pressure & temp before MS	399.9		760		376.9	
pressure & temp before sample	837	21.1	760		796	23.3
pressure & temp after sample	418	21			390	22.9
medium-->	HNO3				AN105 sim	
dose-->						
Mass detected (ng)						
Dichlorotetrafluoroethane		U		U		U
Chloromethane		U		U	9.5	
Trichlorofluoromethane		U		U		U
Vinyl Chloride		U		U		U
Bromomethane		U		U		U
Chloroethane		U		U		U
1,1-Dichloroethene		U		U		U
Methylene Chloride		U		U		U
cis-1,2-Dichloroethene		U		U		U
1,1-Dichloroethane		U		U		U
Chloroform		U		U		U
1,1,2-Trichloro-1,2,2-trifluoroethane		U		U	455	
1,2-Dichloroethane		U		U		U
1,1,1-Trichloroethane	20.2			U	25.2	
Carbon Tetrachloride		U		U		U
Benzene		U		U		U
Trichloroethene		U		U		U
1,2-Dichloropropane		U		U		U
cis-1,3-Dichloropropene		U		U		U
trans-1,3-Dichloropropene		U		U		U
1,1,2-Trichloroethane		U		U		U
Toluene		U		U		U
1,2-Dibromoethane		U		U		U
Tetrachloroethene		U		U		U
Chlorobenzene		U		U		U
Ethylbenzene		U		U		U
Xylene (total o&p)		U		U		U
Xylene (m)		U		U		U
Styrene		U		U		U
1,1,2,2-Tetrachloroethane		U		U		U
1,2-Dichlorobenzene		U		U		U
1,3-Dichlorobenzene		U		U		U
1,4-Dichlorobenzene		U		U		U
1,2,4-Trimethylenebenzene		U		U		U
1,3,5-Trimethylenebenzene		U		U		U
1,2,4-Trichlorobenzene		U		U		U
hexachloro-1,3-butadiene		U		U		U

Positively Identified Volatile Organic Compounds - Quality Control

datafile	011114.b\01111208.d\		011114.b\01111209.d\		011116.b\01111603.d\	
ALO #	BLANK		VBLK		VOCBLK	
sample id	CLY H 51.8CC		BLANK		0	
pressure & temp before GC/MS (final)	760		760		760	
pressure & temp before GC/MS	760		760		760	
pressure & temp before MS	760		760		760	
pressure & temp before sample	760		760		760	
pressure & temp after sample						
medium-->						
dose-->						
Mass detected (ng)						
Dichlorotetrafluoroethane		U		U		U
Chloromethane		U		U		U
Trichlorofluoromethane		U		U		U
Vinyl Chloride		U		U		U
Bromomethane		U		U		U
Chloroethane		U		U		U
1,1-Dichloroethene		U		U		U
Methylene Chloride		U		U		U
cis-1,2-Dichloroethene		U		U		U
1,1-Dichloroethane		U		U		U
Chloroform		U		U		U
1,1,2-Trichloro-1,2,2-trifluoroethane		U		U		U
1,2-Dichloroethane		U		U		U
1,1,1-Trichloroethane		U		U		U
Carbon Tetrachloride		U		U		U
Benzene		U		U		U
Trichloroethene		U		U		U
1,2-Dichloropropane		U		U		U
cis-1,3-Dichloropropene		U		U		U
trans-1,3-Dichloropropene		U		U		U
1,1,2-Trichloroethane		U		U		U
Toluene		U		U		U
1,2-Dibromoethane		U		U		U
Tetrachloroethene		U		U		U
Chlorobenzene		U		U		U
Ethylbenzene		U		U		U
Xylene (total o&p)		U		U		U
Xylene (m)		U		U		U
Styrene		U		U		U
1,1,2,2-Tetrachloroethane		U		U		U
1,2-Dichlorobenzene		U		U		U
1,3-Dichlorobenzene		U		U		U
1,4-Dichlorobenzene		U		U		U
1,2,4-Trimethylenebenzene		U		U		U
1,3,5-Trimethylenebenzene		U		U		U
1,2,4-Trichlorobenzene		U		U		U
hexachloro-1,3-butadiene		U		U		U

Positively Identified Volatile Organic Compounds - Quality Control

datafile	011116.b\01111604.d\		011116.b\01111605.d\		011121.b\01112103.d\	
ALO #	02-00747		02-00750		VOCBLK	
sample id	24G64-3 CLY D (51.5CC)		24G64-6 CLY L (51.7CC)		0	
pressure & temp before GC/MS (final)	366.4		339.7		760	
pressure & temp before GC/MS	366.4		339.7		760	
pressure & temp before MS	434.0		402.1		760	
pressure & temp before sample	907	20	836	20	760	
pressure & temp after sample	458	19.9	438	20		
medium-->	water		HNO3			
dose-->						
Mass detected (ng)						
Dichlorotetrafluoroethane		U		U		U
Chloromethane		U		U		U
Trichlorofluoromethane		U		U		U
Vinyl Chloride		U		U		U
Bromomethane		U		U		U
Chloroethane		U		U		U
1,1-Dichloroethene		U		U		U
Methylene Chloride		U		U		U
cis-1,2-Dichloroethene		U		U		U
1,1-Dichloroethane	12.3			U		U
Chloroform		U		U		U
1,1,2-Trichloro-1,2,2-trifluoroethane	2125		263			U
1,2-Dichloroethane		U		U		U
1,1,1-Trichloroethane	648.3		216.1			U
Carbon Tetrachloride		U		U		U
Benzene		U		U		U
Trichloroethene		U		U		U
1,2-Dichloropropane		U		U		U
cis-1,3-Dichloropropene		U		U		U
trans-1,3-Dichloropropene		U		U		U
1,1,2-Trichloroethane		U		U		U
Toluene		U		U		U
1,2-Dibromoethane		U		U		U
Tetrachloroethene		U		U		U
Chlorobenzene		U		U		U
Ethylbenzene		U		U		U
Xylene (total o&p)		U		U		U
Xylene (m)		U		U		U
Styrene		U		U		U
1,1,2,2-Tetrachloroethane		U		U		U
1,2-Dichlorobenzene		U		U		U
1,3-Dichlorobenzene		U		U		U
1,4-Dichlorobenzene		U		U		U
1,2,4-Trimethylenebenzene		U		U		U
1,3,5-Trimethylenebenzene		U		U		U
1,2,4-Trichlorobenzene		U		U		U
hexachloro-1,3-butadiene		U		U		U

Positively Identified Volatile Organic Compounds - Quality Control

datafile	011121.b\01112104.d\		011121.b\01112105.d\		011121.b\01112106.d\	
ALO #	02-00834		02-00836		02-00837	
sample id	24G66-8 CLY B (51.8CC)		24G66-10 CLY E (51.8CC)		24G66-11 CLY F (51.9CC)	
pressure & temp before GC/MS (final)	369.9		337.9		359.4	
pressure & temp before GC/MS	369.9		337.9		359.4	
pressure & temp before MS	437.7		399.9		425.2	
pressure & temp before sample	916	20.2	836	20.3	899	20
pressure & temp after sample	454	20.1	412	20.2	439	19.8
medium-->	water		HNO3		AN105 sim	
dose-->						
Mass detected (ng)						
Dichlorotetrafluoroethane		U		U		U
Chloromethane		U		U		U
Trichlorofluoromethane		U		U		U
Vinyl Chloride		U		U		U
Bromomethane		U		U		U
Chloroethane		U		U		U
1,1-Dichloroethene		U		U		U
Methylene Chloride		U		U		U
cis-1,2-Dichloroethene		U		U		U
1,1-Dichloroethane		U		U		U
Chloroform		U		U		U
1,1,2-Trichloro-1,2,2-trifluoroethane	344		5.5	J		U
1,2-Dichloroethane		U		U		U
1,1,1-Trichloroethane	20.2		3.4	J		U
Carbon Tetrachloride		U		U		U
Benzene		U		U		U
Trichloroethene		U		U		U
1,2-Dichloropropane		U		U		U
cis-1,3-Dichloropropene		U		U		U
trans-1,3-Dichloropropene		U		U		U
1,1,2-Trichloroethane		U		U		U
Toluene		U		U		U
1,2-Dibromoethane		U		U		U
Tetrachloroethene		U		U		U
Chlorobenzene		U		U		U
Ethylbenzene		U		U		U
Xylene (total o&p)		U		U		U
Xylene (m)		U		U		U
Styrene		U		U		U
1,1,2,2-Tetrachloroethane		U		U		U
1,2-Dichlorobenzene		U		U		U
1,3-Dichlorobenzene		U		U		U
1,4-Dichlorobenzene		U		U		U
1,2,4-Trimethylenebenzene		U		U		U
1,3,5-Trimethylenebenzene		U		U		U
1,2,4-Trichlorobenzene		U		U		U
hexachloro-1,3-butadiene		U		U		U

Positively Identified Volatile Organic Compounds - Quality Control

datafile	011121.b\01112108.d\		011127.b\01112703.d\		011127.b\01112708.d\	
ALO #	BLANK		VOCBLK		BLANK	
sample id	CLY L (51.7CC) 750 TORR 2		0		CLY L (51.7CC) 750 TORR 28C	
pressure & temp before GC/MS (final)	760		760		760	
pressure & temp before GC/MS	760		760		760	
pressure & temp before MS	760		760		760	
pressure & temp before sample	760		760		760	
pressure & temp after sample						
medium-->						
dose-->						
Mass detected (ng)						
Dichlorotetrafluoroethane		U		U		U
Chloromethane		U		U		U
Trichlorofluoromethane		U		U		U
Vinyl Chloride		U		U		U
Bromomethane		U		U		U
Chloroethane		U		U		U
1,1-Dichloroethene		U		U		U
Methylene Chloride		U		U		U
cis-1,2-Dichloroethene		U		U		U
1,1-Dichloroethane		U		U		U
Chloroform		U		U		U
1,1,2-Trichloro-1,2,2-trifluoroethane		U		U		U
1,2-Dichloroethane		U		U		U
1,1,1-Trichloroethane		U		U		U
Carbon Tetrachloride		U		U		U
Benzene		U		U		U
Trichloroethene		U		U		U
1,2-Dichloropropane		U		U		U
cis-1,3-Dichloropropene		U		U		U
trans-1,3-Dichloropropene		U		U		U
1,1,2-Trichloroethane		U		U		U
Toluene		U		U		U
1,2-Dibromoethane		U		U		U
Tetrachloroethene		U		U		U
Chlorobenzene		U		U		U
Ethylbenzene		U		U		U
Xylene (total o&p)		U		U		U
Xylene (m)		U		U		U
Styrene		U		U		U
1,1,2,2-Tetrachloroethane		U		U		U
1,2-Dichlorobenzene		U		U		U
1,3-Dichlorobenzene		U		U		U
1,4-Dichlorobenzene		U		U		U
1,2,4-Trimethylenebenzene		U		U		U
1,3,5-Trimethylenebenzene		U		U		U
1,2,4-Trichlorobenzene		U		U		U
hexachloro-1,3-butadiene		U		U		U

Positively Identified Volatile Organic Compounds - Quality Control

datafile	011127.b\01120603.d\		011127.b\01120604.d\		011127.b\01120608.d\	
ALO #	VOCBLK		02-00885		BLANK	
sample id	0		24G71-11 CLY F (51.9CC)		CLY L (51.7CC) 750 TORR 28C	
pressure & temp before GC/MS (final)	312.6		336.6		760	
pressure & temp before GC/MS	312.6		336.6		760	
pressure & temp before MS	370.0		398.2		760	
pressure & temp before sample			849	25.3	760	
pressure & temp after sample			407	24.8		
medium-->			AN105 sim			
dose-->						
Mass detected (ng)						
Dichlorotetrafluoroethane		U		U		U
Chloromethane		U		U		U
Trichlorofluoromethane		U		U		U
Vinyl Chloride		U		U		U
Bromomethane		U		U		U
Chloroethane		U		U		U
1,1-Dichloroethene		U		U		U
Methylene Chloride		U		U		U
cis-1,2-Dichloroethene		U		U		U
1,1-Dichloroethane		U		U		U
Chloroform		U		U		U
1,1,2-Trichloro-1,2,2-trifluoroethane		U		U		U
1,2-Dichloroethane		U		U		U
1,1,1-Trichloroethane		U		U		U
Carbon Tetrachloride		U		U		U
Benzene		U		U		U
Trichloroethene		U		U		U
1,2-Dichloropropane		U		U		U
cis-1,3-Dichloropropene		U		U		U
trans-1,3-Dichloropropene		U		U		U
1,1,2-Trichloroethane		U		U		U
Toluene		U		U		U
1,2-Dibromoethane		U		U		U
Tetrachloroethene		U		U		U
Chlorobenzene		U		U		U
Ethylbenzene		U		U		U
Xylene (total o&p)		U		U		U
Xylene (m)		U		U		U
Styrene		U		U		U
1,1,2,2-Tetrachloroethane		U		U		U
1,2-Dichlorobenzene		U		U		U
1,3-Dichlorobenzene		U		U		U
1,4-Dichlorobenzene		U		U		U
1,2,4-Trimethylenebenzene		U		U		U
1,3,5-Trimethylenebenzene		U		U		U
1,2,4-Trichlorobenzene		U		U		U
hexachloro-1,3-butadiene		U		U		U

Positively Identified Volatile Organic Compounds - Quality Control

datafile	011213.b\01120603.d\		011213.b\01120608.d\		011219.b\01121903.d\	
ALO #	VOCBLK		BLANK		VOCBLK	
sample id	0		CLY L (51.7CC) 750 TORR 28C		0	
pressure & temp before GC/MS (final)	760		760		760	
pressure & temp before GC/MS	760		760		760	
pressure & temp before MS	760		760		760	
pressure & temp before sample	760		760		760	
pressure & temp after sample						
medium-->						
dose-->						
Mass detected (ng)						
Dichlorotetrafluoroethane		U		U		U
Chloromethane		U		U		U
Trichlorofluoromethane		U		U		U
Vinyl Chloride		U		U		U
Bromomethane		U		U		U
Chloroethane		U		U		U
1,1-Dichloroethene		U		U		U
Methylene Chloride		U		U		U
cis-1,2-Dichloroethene		U		U		U
1,1-Dichloroethane		U		U		U
Chloroform		U		U		U
1,1,2-Trichloro-1,2,2-trifluoroethane		U		U		U
1,2-Dichloroethane		U		U		U
1,1,1-Trichloroethane		U		U		U
Carbon Tetrachloride		U		U		U
Benzene		U		U		U
Trichloroethene		U		U		U
1,2-Dichloropropane		U		U		U
cis-1,3-Dichloropropene		U		U		U
trans-1,3-Dichloropropene		U		U		U
1,1,2-Trichloroethane		U		U		U
Toluene		U		U		U
1,2-Dibromoethane		U		U		U
Tetrachloroethene		U		U		U
Chlorobenzene		U		U		U
Ethylbenzene		U		U		U
Xylene (total o&p)		U		U		U
Xylene (m)		U		U		U
Styrene		U		U		U
1,1,2,2-Tetrachloroethane		U		U		U
1,2-Dichlorobenzene		U		U		U
1,3-Dichlorobenzene		U		U		U
1,4-Dichlorobenzene		U		U		U
1,2,4-Trimethylenebenzene		U		U		U
1,3,5-Trimethylenebenzene		U		U		U
1,2,4-Trichlorobenzene		U		U		U
hexachloro-1,3-butadiene		U		U		U

Positively Identified Volatile Organic Compounds - Quality Control

datafile	011219.b\01121904.d\		011219.b\01121905.d\	
ALO #	02-00945		02-00946	
sample id	24G77-8 CLY C (51.7CC)		24G77-9 CLY E(51.8CC)	
pressure & temp before GC/MS (final)	310.9		305.9	
pressure & temp before GC/MS	310.9		305.9	
pressure & temp before MS	368.0		362.0	
pressure & temp before sample	765	22.7	772	23
pressure & temp after sample	386	22.5	383	22.9
medium-->	HNO3		HNO3	
dose-->				
Mass detected (ng)				
Dichlorotetrafluoroethane	5.91	J		U
Chloromethane		U		U
Trichlorofluoromethane		U		U
Vinyl Chloride		U		U
Bromomethane		U		U
Chloroethane		U		U
1,1-Dichloroethene		U		U
Methylene Chloride		U		U
cis-1,2-Dichloroethene		U		U
1,1-Dichloroethane		U		U
Chloroform		U		U
1,1,2-Trichloro-1,2,2-trifluoroethane	364		10	
1,2-Dichloroethane		U		U
1,1,1-Trichloroethane	26.7			U
Carbon Tetrachloride		U		U
Benzene		U		U
Trichloroethene		U		U
1,2-Dichloropropane		U		U
cis-1,3-Dichloropropene		U		U
trans-1,3-Dichloropropene		U		U
1,1,2-Trichloroethane		U		U
Toluene		U		U
1,2-Dibromoethane		U		U
Tetrachloroethene		U		U
Chlorobenzene		U		U
Ethylbenzene		U		U
Xylene (total o&p)		U		U
Xylene (m)		U		U
Styrene		U		U
1,1,2,2-Tetrachloroethane		U		U
1,2-Dichlorobenzene		U		U
1,3-Dichlorobenzene		U		U
1,4-Dichlorobenzene		U		U
1,2,4-Trimethylenebenzene		U		U
1,3,5-Trimethylenebenzene		U		U
1,2,4-Trichlorobenzene		U		U
hexachloro-1,3-butadiene		U		U

Positively Identified Volatile Organic Compounds - Quality Control

datafile	011219.b\01121906.d\		011219.b\01121910.d\	
ALO #	02-00947		BLANK	
sample id	24G77-10 CLY F (51.9CC) 183.1 TORR 20		CLY L (51.7CC) 750 TORR 28C	
pressure & temp before GC/MS (final)	183.1		760	
pressure & temp before GC/MS	312		760	
pressure & temp before MS	369.1		760	
pressure & temp before sample	776	22.9	760	
pressure & temp after sample	383	22.9		
medium-->	HNO3			
dose-->				
Mass detected (ng)				
Dichlorotetrafluoroethane		U		U
Chloromethane		U		U
Trichlorofluoromethane		U		U
Vinyl Chloride		U		U
Bromomethane		U		U
Chloroethane		U		U
1,1-Dichloroethene		U		U
Methylene Chloride		U		U
cis-1,2-Dichloroethene		U		U
1,1-Dichloroethane		U		U
Chloroform		U		U
1,1,2-Trichloro-1,2,2-trifluoroethane		U		U
1,2-Dichloroethane		U		U
1,1,1-Trichloroethane		U		U
Carbon Tetrachloride		U		U
Benzene	59.0			U
Trichloroethene		U		U
1,2-Dichloropropane		U		U
cis-1,3-Dichloropropene		U		U
trans-1,3-Dichloropropene		U		U
1,1,2-Trichloroethane		U		U
Toluene		U		U
1,2-Dibromoethane		U		U
Tetrachloroethene		U		U
Chlorobenzene		U		U
Ethylbenzene		U		U
Xylene (total o&p)		U		U
Xylene (m)		U		U
Styrene		U		U
1,1,2,2-Tetrachloroethane		U		U
1,2-Dichlorobenzene		U		U
1,3-Dichlorobenzene		U		U
1,4-Dichlorobenzene		U		U
1,2,4-Trimethylenebenzene		U		U
1,3,5-Trimethylenebenzene		U		U
1,2,4-Trichlorobenzene		U		U
hexachloro-1,3-butadiene		U		U

Positively Identified Volatile Organic Compounds - Quality Control

datafile	020130.b\02013003.d\		020130.b\02013005.d\		020130.b\02013008.d\	
ALO #	VOCBLK		02-01281		BLANK	
sample id	0		24G81-8 CLY L(51.7CC)		CLY L (51.7CC) 750 TORR 28C	
pressure & temp before GC/MS (final)	760		307.2		760	
pressure & temp before GC/MS	760		307.2		760	
pressure & temp before MS	760		363.6		760	
pressure & temp before sample	760		774	20.1	760	
pressure & temp after sample			384	19.8		
medium-->			AN105 sim			
dose-->						
Mass detected (ng)						
Dichlorotetrafluoroethane		U		U		U
Chloromethane		U		U		U
Trichlorofluoromethane		U		U		U
Vinyl Chloride		U		U		U
Bromomethane		U		U		U
Chloroethane		U		U		U
1,1-Dichloroethene		U		U		U
Methylene Chloride		U		U		U
cis-1,2-Dichloroethene		U		U		U
1,1-Dichloroethane		U		U		U
Chloroform		U		U		U
1,1,2-Trichloro-1,2,2-trifluoroethane		U	293			U
1,2-Dichloroethane		U		U		U
1,1,1-Trichloroethane		U	18.7			U
Carbon Tetrachloride		U		U		U
Benzene		U		U		U
Trichloroethene		U		U		U
1,2-Dichloropropane		U		U		U
cis-1,3-Dichloropropene		U		U		U
trans-1,3-Dichloropropene		U		U		U
1,1,2-Trichloroethane		U		U		U
Toluene		U		U		U
1,2-Dibromoethane		U		U		U
Tetrachloroethene		U		U		U
Chlorobenzene		U		U		U
Ethylbenzene		U		U		U
Xylene (total o&p)		U		U		U
Xylene (m)		U		U		U
Styrene		U		U		U
1,1,2,2-Tetrachloroethane		U		U		U
1,2-Dichlorobenzene		U		U		U
1,3-Dichlorobenzene		U		U		U
1,4-Dichlorobenzene		U		U		U
1,2,4-Trimethylenebenzene		U		U		U
1,3,5-Trimethylenebenzene		U		U		U
1,2,4-Trichlorobenzene		U		U		U
hexachloro-1,3-butadiene		U		U		U

Positively Identified Volatile Organic Compounds - Quality Control

datafile	020131.b\02013103.d\		020131.b\02013107.d\		020131.b\02020103.d\	
ALO #	VOCBLK		VOCBLK		VOCBLK	
sample id	0		0		0	
pressure & temp before GC/MS (final)	760		760		760	
pressure & temp before GC/MS	760		760		760	
pressure & temp before MS	760		760		760	
pressure & temp before sample	760					
pressure & temp after sample						
medium-->						
dose-->						
Mass detected (ng)						
Dichlorotetrafluoroethane		U		U		U
Chloromethane		U		U		U
Trichlorofluoromethane		U		U		U
Vinyl Chloride		U		U		U
Bromomethane		U		U		U
Chloroethane		U		U		U
1,1-Dichloroethene		U		U		U
Methylene Chloride		U		U		U
cis-1,2-Dichloroethene		U		U		U
1,1-Dichloroethane		U		U		U
Chloroform		U		U		U
1,1,2-Trichloro-1,2,2-trifluoroethane		U		U		U
1,2-Dichloroethane		U		U		U
1,1,1-Trichloroethane		U		U		U
Carbon Tetrachloride		U		U		U
Benzene		U		U		U
Trichloroethene		U		U		U
1,2-Dichloropropane		U		U		U
cis-1,3-Dichloropropene		U		U		U
trans-1,3-Dichloropropene		U		U		U
1,1,2-Trichloroethane		U		U		U
Toluene		U		U		U
1,2-Dibromoethane		U		U		U
Tetrachloroethene		U		U		U
Chlorobenzene		U		U		U
Ethylbenzene		U		U		U
Xylene (total o&p)		U		U		U
Xylene (m)		U		U		U
Styrene		U		U		U
1,1,2,2-Tetrachloroethane		U		U		U
1,2-Dichlorobenzene		U		U		U
1,3-Dichlorobenzene		U		U		U
1,4-Dichlorobenzene		U		U		U
1,2,4-Trimethylenebenzene		U		U		U
1,3,5-Trimethylenebenzene		U		U		U
1,2,4-Trichlorobenzene		U		U		U
hexachloro-1,3-butadiene		U		U		U

Positively Identified Volatile Organic Compounds - Quality Control

datafile	020131.b\02020107.d\		020211.b\02021103.d\		020211.b\02021104.d\	
ALO #	VOCBLK		VOCBLK		02-01410	
sample id					24G86-1 306.3 Torr 22.4C CLY A 51.6CC	
pressure & temp before GC/MS (final)	760		760		306.3	
pressure & temp before GC/MS	760		760		306.3	
pressure & temp before MS	760		760		362.7	
pressure & temp before sample					774	20.7
pressure & temp after sample					428	20.9
medium-->					water	
dose-->						
Mass detected (ng)						
Dichlorotetrafluoroethane		U		U		U
Chloromethane		U		U	2.6	J
Trichlorofluoromethane		U		U		U
Vinyl Chloride		U		U		U
Bromomethane		U		U		U
Chloroethane		U		U		U
1,1-Dichloroethene		U		U		U
Methylene Chloride		U		U	9.2	
cis-1,2-Dichloroethene		U		U		U
1,1-Dichloroethane		U		U		U
Chloroform		U		U		U
1,1,2-Trichloro-1,2,2-trifluoroethane		U		U	6881	
1,2-Dichloroethane		U		U		U
1,1,1-Trichloroethane		U		U	360.2	
Carbon Tetrachloride		U		U		U
Benzene		U		U		U
Trichloroethene		U		U		U
1,2-Dichloropropane		U		U		U
cis-1,3-Dichloropropene		U		U		U
trans-1,3-Dichloropropene		U		U		U
1,1,2-Trichloroethane		U		U		U
Toluene		U		U		U
1,2-Dibromoethane		U		U		U
Tetrachloroethene		U		U		U
Chlorobenzene		U		U		U
Ethylbenzene		U		U		U
Xylene (total o&p)		U		U		U
Xylene (m)		U		U		U
Styrene		U		U		U
1,1,2,2-Tetrachloroethane		U		U		U
1,2-Dichlorobenzene		U		U		U
1,3-Dichlorobenzene		U		U		U
1,4-Dichlorobenzene		U		U		U
1,2,4-Trimethylenebenzene		U		U		U
1,3,5-Trimethylenebenzene		U		U		U
1,2,4-Trichlorobenzene		U		U		U
hexachloro-1,3-butadiene		U		U		U

Positively Identified Volatile Organic Compounds - Quality Control

datafile	020211.b\02021105.d\		020211.b\02021106.d\	
ALO #	02-01411		02-01412	
sample id	24G86-2 321.7 Torr 22.5C CLY B 51.8CC		24G86-3 313.8 Torr 22.5C CLY D 51.5CC	
pressure & temp before GC/MS (final)	321.7		313.8	
pressure & temp before GC/MS	321.7		313.8	
pressure & temp before MS	380.7		366.9	
pressure & temp before sample	760	21.2	784	21.8
pressure & temp after sample	386	21.5	407	21.8
medium-->	water		AN105 sim	
dose-->				
Mass detected (ng)				
Dichlorotetrafluoroethane		U		U
Chloromethane		U		U
Trichlorofluoromethane		U		U
Vinyl Chloride		U		U
Bromomethane		U		U
Chloroethane		U		U
1,1-Dichloroethene		U		U
Methylene Chloride		U		U
cis-1,2-Dichloroethene		U		U
1,1-Dichloroethane		U	9.6	
Chloroform		U		U
1,1,2-Trichloro-1,2,2-trifluoroethane	1417		2125	
1,2-Dichloroethane		U		U
1,1,1-Trichloroethane	266.5		626.7	
Carbon Tetrachloride		U		U
Benzene		U		U
Trichloroethene		U		U
1,2-Dichloropropane		U		U
cis-1,3-Dichloropropene		U		U
trans-1,3-Dichloropropene		U		U
1,1,2-Trichloroethane		U		U
Toluene		U		U
1,2-Dibromoethane		U		U
Tetrachloroethene		U		U
Chlorobenzene		U		U
Ethylbenzene		U		U
Xylene (total o&p)		U		U
Xylene (m)		U		U
Styrene		U		U
1,1,2,2-Tetrachloroethane		U		U
1,2-Dichlorobenzene		U		U
1,3-Dichlorobenzene		U		U
1,4-Dichlorobenzene		U		U
1,2,4-Trimethylenebenzene		U		U
1,3,5-Trimethylenebenzene		U		U
1,2,4-Trichlorobenzene		U		U
hexachloro-1,3-butadiene		U		U

Positively Identified Volatile Organic Compounds - Quality Control

datafile	020211.b\02021107.d\		020211.b\02021108.d\	
ALO #	02-01413		02-01414	
sample id	24G86-4 309.8 Torr 22.5C CLY E 51.8CC		24G86-5 405.0 Torr 22.6C CLY F 51.9CC	
pressure & temp before GC/MS (final)	309.8		405	
pressure & temp before GC/MS	309.8		405	
pressure & temp before MS	366.6		479.1	
pressure & temp before sample	773	21.6	998	21.7
pressure & temp after sample	385	21.9	492	22.4
medium-->	water		AN105 sim	
dose-->				
Mass detected (ng)				
Dichlorotetrafluoroethane	10.2			U
Chloromethane		U		U
Trichlorofluoromethane		U		U
Vinyl Chloride		U		U
Bromomethane		U		U
Chloroethane		U		U
1,1-Dichloroethene		U		U
Methylene Chloride	6.4			U
cis-1,2-Dichloroethene		U		U
1,1-Dichloroethane		U		U
Chloroform		U		U
1,1,2-Trichloro-1,2,2-trifluoroethane	739		334	
1,2-Dichloroethane		U		U
1,1,1-Trichloroethane	295.3		46.1	
Carbon Tetrachloride		U		U
Benzene	2.4	J	2.6	J
Trichloroethene		U		U
1,2-Dichloropropane		U		U
cis-1,3-Dichloropropene		U		U
trans-1,3-Dichloropropene		U		U
1,1,2-Trichloroethane		U		U
Toluene		U	8.0	
1,2-Dibromoethane		U		U
Tetrachloroethene		U		U
Chlorobenzene		U		U
Ethylbenzene		U		U
Xylene (total o&p)		U		U
Xylene (m)		U		U
Styrene		U		U
1,1,2,2-Tetrachloroethane		U		U
1,2-Dichlorobenzene		U		U
1,3-Dichlorobenzene		U		U
1,4-Dichlorobenzene		U		U
1,2,4-Trimethylenebenzene		U		U
1,3,5-Trimethylenebenzene		U		U
1,2,4-Trichlorobenzene		U		U
hexachloro-1,3-butadiene		U		U

Positively Identified Volatile Organic Compounds - Quality Control

datafile	020211.b\02021109.d\		020211.b\02021110.d\	
ALO #	02-01415		VOCBLK	
sample id	24G86-7 312.6 Torr 22.5C CLY L 51.7CC		0	
pressure & temp before GC/MS (final)	312.6		760	
pressure & temp before GC/MS	312.6		760	
pressure & temp before MS	370.0		760	
pressure & temp before sample	768	20.9	760	
pressure & temp after sample	376	21.5		
medium-->	AN105 sim			
dose-->				
Mass detected (ng)				
Dichlorotetrafluoroethane		U		U
Chloromethane		U		U
Trichlorofluoromethane		U		U
Vinyl Chloride		U		U
Bromomethane		U		U
Chloroethane		U		U
1,1-Dichloroethene		U		U
Methylene Chloride		U		U
cis-1,2-Dichloroethene		U		U
1,1-Dichloroethane		U		U
Chloroform		U		U
1,1,2-Trichloro-1,2,2-trifluoroethane	6983		54	
1,2-Dichloroethane		U		U
1,1,1-Trichloroethane	37.5			U
Carbon Tetrachloride		U		U
Benzene		U		U
Trichloroethene		U		U
1,2-Dichloropropane		U		U
cis-1,3-Dichloropropene		U		U
trans-1,3-Dichloropropene		U		U
1,1,2-Trichloroethane		U		U
Toluene		U		U
1,2-Dibromoethane		U		U
Tetrachloroethene		U		U
Chlorobenzene		U		U
Ethylbenzene		U		U
Xylene (total o&p)		U		U
Xylene (m)		U		U
Styrene		U		U
1,1,2,2-Tetrachloroethane		U		U
1,2-Dichlorobenzene		U		U
1,3-Dichlorobenzene		U		U
1,4-Dichlorobenzene		U		U
1,2,4-Trimethylenebenzene		U		U
1,3,5-Trimethylenebenzene		U		U
1,2,4-Trichlorobenzene		U		U
hexachloro-1,3-butadiene		U		U

Appendix H

Results of Volatile Organic Compound Analysis - Tentatively Identified Compounds

Tentatively Identified Volatile Organic Compounds from SL-644

			File -->	01101707	01121907	01121908	01121909	01101708
			Sample -->	02-00052	02-00948	02-00949	02-00950	02-00053
			Cylinder ID -->	24G49-4 CLYI	24G77-11 CLYL	24G78-3 CLYA	24G78-4 CLYB	24G49-5 CLYJ
			Resin Mass (g)	0.9007	0.9026	0.904	0.908	0.9025
			Medium-->	HNO3	HNO3	HNO3	HNO3	HNO3
			Temperature (C)-->	25	45	45	65	65
			Dose (R)-->					
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW					
Isobutane	75-28-5	3.28	58.12					
1-Propene, 2-methyl-	115-11-7	3.44	56.1					
Silane, methyl	992-94-9	3.62	46.1	148.0		302.2	1092.6	
Propane, 2,2-dimethyl-	463-82-1	3.71	72.1					
2-Butene	590-18-1	3.81	56.1					
Butane, 2-methyl-	78-78-4	4.5	72.1					
Pentane	109-66-0	4.85	72.1					
1,2-Butadiene	590-19-2	5.06	54.1					
2-Pentene	627-20-3	5.27	70.1					
Ethanol	64-17-5	5.38	46.1				12.6	
Cyclopropane, 1,1-dimethyl-	1630-94-0	5.43	70.1					
Ether	60-29-7	5.5	74.1					
Propanal	123-38-6	5.67	50.1		70.7		265.3	94.7
Butane, 2,2-dimethyl	75-83-2	5.77	86.2					
Acetone	67-64-1	5.87	58.1		45.2			
Carbon Disulfide	75-15-0	5.92	76.1					
Isopropyl Alcohol	67-63-0	6.24	60.1					
Acetonitrile	75-05-8	6.36	41.1					616.5
Propene	115-07-1	6.41	42.1		53.6		162.3	
Unknown		6.45						
Pentane, 2-methyl-	107-83-5	6.61	86.2					
Propane, 2-chloro-2-methyl-	507-20-0	6.66	92.6					
2-Propanol, 2-methyl-	75-65-0	6.83	74.1					
1-Propene, 2-metoxy-	116-11-0	6.85	72.1					
Propane, 2-ethoxy	625-54-7	6.97	88.1					
Cyanogen, bromide	506-68-3	7	105.9					
Pentane, 3-methyl-	96-14-0	7.07	86.2					
Methyl nitrate	598-58-3	7.1	77					
Propane, 2-methoxy-2methyl-	1634-04-4	7.21	88.1					
2-Pentyne	627-21-4	7.4	68.1					55.5
1,2_Butadiene, 3-methyl-	598-25-4	7.46	68.1					
Propanal, 2-methyl-	78-84-2	7.56	72.1					
2-Butenal	4170-30-3	7.88	70.1	14.3	18.7	21.0	44.9	20.7

Tentatively Identified Volatile Organic Compounds from SL-644

			File -->	01101707	01121907	01121908	01121909	01101708
			Sample -->	02-00052	02-00948	02-00949	02-00950	02-00053
			Cylinder ID -->	24G49-4 CLYI	24G77-11 CLYL	24G78-3 CLYA	24G78-4 CLYB	24G49-5 CLYJ
			Resin Mass (g)	0.9007	0.9026	0.904	0.908	0.9025
			Medium-->	HNO3	HNO3	HNO3	HNO3	HNO3
			Temperature (C)-->	25	45	45	65	65
			Dose (R)-->					
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW					
1-Pentene, 4,4-dimethyl-	762-62-9	8.11	98.2					
Butane, 2,2,3-trimethyl-	464-06-2	8.36	100.2					
1-Propanol	71-23-8	8.39	60.1	25.1				
Pentane, 2,2-dimethyl-	590-35-2	8.41	100.2					
Hexane	110-54-3	8.54	86.2					
Propanal, 2,2-dimethyl	630-19-3	8.55	86.1					
Butanal	123-72-8	8.67	72.1					
Propane, 1-chloro-2-methyl-	513-36-0	8.71	92.6					
Silanol, trimethyl-	66-40-6	8.79	90	94.6	92.6			
Methane, nitro-	75-52-5	8.83	61			19.2	58.4	113.5
Pentane, 2,4-dimethyl-	108-08-7	8.8	100.2					
Butane, 2,2,3-trimethyl-	464-06-2	8.91	100.2					
Propanenitrile	107-12-0	9.07	55.1		14.5		80.6	169.4
2-Butanone	78-93-3	9.14	72.1				21.2	22.9
3-Hexyne	928-49-4	9.25	82.1					
Furan, tetrahydro-	109-99-9	9.28	72.1					
Pentane, 3,3-dimethyl-	562-49-2	9.44	100.2					
Oxirane, ethyl	106-88-7	9.46	72.1					
Nitric acid, ethyl ester	625-58-1	9.88	91.1					
1,3-Dioxolane, 2-methyl-	497-26-7	10.15	88.1					
3-Hexanol	623-37-0	10.45	102.2					
Butane, 2,2,3,3-tetramethyl-	594-82-1	10.57	114.2					
Acetic acid	64-19-7	10.8	60.1					
2-Butanone, 3-methyl-	563-80-4	10.87	86.1					
Heptane	142-82-5	10.92	100.2					44.2
2-Propen-1-ol, 2-methyl-	513-42-8	11.13	72.1					
1-Butanol	71-36-3	11.42	72.1		51.2			
1-Pentene, 2,4,4-trimethyl-	107-39-1	11.44	112.2					
Butane, tetramethyl-	na	11.6	114.2				25.2	
Pentanal	110-62-3	11.78	86.1					
2-Pentanone	107-87-9	11.93	86.1	16.8			20.3	23.1
Hexane, 2,2-dimethyl-	590-73-8	11.97	114.2					
3-Pentanone	96-22-0	12.15	86.1					

Tentatively Identified Volatile Organic Compounds from SL-644

			File -->	01101707	01121907	01121908	01121909	01101708
			Sample -->	02-00052	02-00948	02-00949	02-00950	02-00053
			Cylinder ID -->	24G49-4 CLYI	24G77-11 CLYL	24G78-3 CLYA	24G78-4 CLYB	24G49-5 CLYJ
			Resin Mass (g)	0.9007	0.9026	0.904	0.908	0.9025
			Medium-->	HNO3	HNO3	HNO3	HNO3	HNO3
			Temperature (C)-->	25	45	45	65	65
			Dose (R)-->					
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW					
2-Butanone, 3,3-dimethyl-	75-97-8	12.37	100.2					
2,4-Hexadiene, 3-methyl-	28823-42-9	12.46	96					
Pentane, 2,2,4,4-tetramethyl-	1070-87-7	13.05	128.3					
Hexane, 2,2,5-trimethyl-	3522-94-9	13.24	128.3					
Methyl Isobutyl Ketone	108-10-1	13.29	100.2		619.2			
2-Butenal, 2-methyl-	497-03-0	13.55	84.1					
2-Pentanone, 3-methyl	565-61-7	13.59	100.2					
Propane, 2-methyl-2-nitro	594-70-7	13.89	103.1					
2-Pentanone, 4,4-dimethyl-	590-50-1	14.4	114.2					
Hexane, 2,2,5,5-tetramethyl-	1071-81-4	14.58	142.3					
3-Hexanone	589-38-8	14.64	100.2					
2,3,5-Trimethylfuran	10504-04-8	14.73	110					
Hexanal	66-25-1	14.74	100.2					
2-Hexanone	591-78-6	14.86	100.2					
2-Pentenoic acid, 2-methyl-	3142-72-1	15.09	114.1					
1,3-Dioxolane, 2,4-dimethyl-	766-20-1	15.2	116.2					
Pentane, 2,2,3,3-tetramethyl-	7154-79-2	15.43	128.3					
Isoxazole, 3,5-dimethyl-	300-87-8	15.67	97.1					
5,5-Dimethyl-1,3-hexadiene	1515-79-3	15.9	110					
Cyclohexane, 1,1,3,5-tetramethyl-	50876-31-8	16.4	140.3					33.0
3-Heptanone	06-35-4	17.18	114					
Heptanal	111-71-7	17.36	114.2					
1,3-Dioxane, 2-ethyl-5-methyl	627-54-7	17.58	130					
Benzene, nitroso-	586-96-9	17.79	107.1					120.5
Ethanamine, N-ethyl-N-nitroso-	55-18-5	18.52	102.1					
1H-Benzotriazole	95-14-7	18.7	119.1					
Tetramethyloctane	na	18.75	154					
Benzene, isocyanato-	103-71-9	19.13	119.1					
Benzaldehyde	100-52-7	19.37	106.1				21.0	269.0
Octanal	124-13-0	19.94	128.2					
Benzonitrile	100-47-0	20.38	103.1					303.1
Butane,1,1,3,4-tetrachloro-1,2,2,3,4,4-hexafluoro-	423-38-1	21.35	303.8	92.1		209.2	111.2	

Tentatively Identified Volatile Organic Compounds from SL-644

			File -->	01101707	01121907	01121908	01121909	01101708
			Sample -->	02-00052	02-00948	02-00949	02-00950	02-00053
			Cylinder ID -->	24G49-4 CLYI	24G77-11 CLYL	24G78-3 CLYA	24G78-4 CLYB	24G49-5 CLYJ
			Resin Mass (g)	0.9007	0.9026	0.904	0.908	0.9025
			Medium-->	HNO3	HNO3	HNO3	HNO3	HNO3
			Temperature (C)-->	25	45	45	65	65
			Dose (R)-->					
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW					
Acetophenone	98-86-2	21.93	120.2					241.6
Nonanal	124-19-6	22.1	142.2					
Benzenemethanol,.alpha.,.alpha.-dimethyl-	617-94-7	22.35	136.2		126.5		24.9	
Benzenoacetonitrile,.alpha.-oxo-	613-90-1	22.6	131.1					174.4
Benzene, nitro	98-95-3	22.75	123.1					31.8
Dodecane	112-40-3	23	170.3		426.6			
Butane,tetrachloro-,hexafluoro-	423-38-1	26.49	303.8	61.5			82.0	

Tentatively Identified Volatile Organic Compounds from SL-644

			File -->	01100310	01101709	01101711	01101709	02013007
			Sample -->	02-00003	02-00054	02-00046	02-00357	02-01284
			Cylinder ID -->	24G46-6 CLYH	24G49-6 CLYL	24G48-6 CLYA	24G57-10 CLYH	24G81-11 CLYC
			Resin Mass (g)	0.9045	0.9045	0.9045	0.9055	0.8974
			Medium-->	HNO3	HNO3	HNO3	HNO3	HNO3
			Temperature (C)-->	90	90	90	25	25
			Dose (R)-->				1.E+06	1.E+07
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW					
Isobutane	75-28-5	3.28	58.12					
1-Propene, 2-methyl-	115-11-7	3.44	56.1					
Silane, methyl	992-94-9	3.62	46.1		781.4	278.7	51.6	47.0
Propane, 2,2-dimethyl-	463-82-1	3.71	72.1					
2-Butene	590-18-1	3.81	56.1					
Butane, 2-methyl-	78-78-4	4.5	72.1					
Pentane	109-66-0	4.85	72.1					
1,2-Butadiene	590-19-2	5.06	54.1					
2-Pentene	627-20-3	5.27	70.1					
Ethanol	64-17-5	5.38	46.1					
Cyclopropane, 1,1-dimethyl-	1630-94-0	5.43	70.1					
Ether	60-29-7	5.5	74.1					
Propanal	123-38-6	5.67	50.1		437.4	77.4	9.7	12.9
Butane, 2,2-dimethyl	75-83-2	5.77	86.2					
Acetone	67-64-1	5.87	58.1		906.7	765.4	11.3	19.3
Carbon Disulfide	75-15-0	5.92	76.1					
Isopropyl Alcohol	67-63-0	6.24	60.1				12.4	
Acetonitrile	75-05-8	6.36	41.1					
Propene	115-07-1	6.41	42.1	4692.1				
Unknown		6.45			2753.3			
Pentane, 2-methyl-	107-83-5	6.61	86.2					
Propane, 2-chloro-2-methyl-	507-20-0	6.66	92.6					
2-Propanol, 2-methyl-	75-65-0	6.83	74.1					
1-Propene, 2-metoxy-	116-11-0	6.85	72.1					
Propane, 2-ethoxy	625-54-7	6.97	88.1					
Cyanogen, bromide	506-68-3	7	105.9					
Pentane, 3-methyl-	96-14-0	7.07	86.2					
Methyl nitrate	598-58-3	7.1	77					
Propane, 2-methoxy-2methyl-	1634-04-4	7.21	88.1					
2-Pentyne	627-21-4	7.4	68.1		170.6	57.4		
1,2_Butadiene, 3-methyl-	598-25-4	7.46	68.1					
Propanal, 2-methyl-	78-84-2	7.56	72.1					
2-Butenal	4170-30-3	7.88	70.1		542.6	71.0	35.1	

Tentatively Identified Volatile Organic Compounds from SL-644

			File -->	01100310	01101709	01101711	01101709	02013007
			Sample -->	02-00003	02-00054	02-00046	02-00357	02-01284
			Cylinder ID -->	24G46-6 CLYH	24G49-6 CLYL	24G48-6 CLYA	24G57-10 CLYH	24G81-11 CLYC
			Resin Mass (g)	0.9045	0.9045	0.9045	0.9055	0.8974
			Medium-->	HNO3	HNO3	HNO3	HNO3	HNO3
			Temperature (C)-->	90	90	90	25	25
			Dose (R)-->				1.E+06	1.E+07
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW					
1-Pentene, 4,4-dimethyl-	762-62-9	8.11	98.2					
Butane, 2,2,3-trimethyl-	464-06-2	8.36	100.2					
1-Propanol	71-23-8	8.39	60.1					
Pentane, 2,2-dimethyl-	590-35-2	8.41	100.2					
Hexane	110-54-3	8.54	86.2					
Propanal, 2,2-dimethyl	630-19-3	8.55	86.1					
Butanal	123-72-8	8.67	72.1		22.8			
Propane, 1-chloro-2-methyl-	513-36-0	8.71	92.6					
Silanol, trimethyl-	66-40-6	8.79	90				45.5	52.9
Methane, nitro-	75-52-5	8.83	61	1015.8	463.0	183.0		
Pentane, 2,4-dimethyl-	108-08-7	8.8	100.2					
Butane, 2,2,3-trimethyl-	464-06-2	8.91	100.2					
Propanenitrile	107-12-0	9.07	55.1	1666.5	1000.1	447.1		
2-Butanone	78-93-3	9.14	72.1		214.1			
3-Hexyne	928-49-4	9.25	82.1					
Furan, tetrahydro-	109-99-9	9.28	72.1	2238.9				
Pentane, 3,3-dimethyl-	562-49-2	9.44	100.2					
Oxirane, ethyl	106-88-7	9.46	72.1					
Nitric acid, ethyl ester	625-58-1	9.88	91.1					
1,3-Dioxolane, 2-methyl-	497-26-7	10.15	88.1					
3-Hexanol	623-37-0	10.45	102.2					
Butane, 2,2,3,3-tetramethyl-	594-82-1	10.57	114.2					
Acetic acid	64-19-7	10.8	60.1			0.4		
2-Butanone, 3-methyl-	563-80-4	10.87	86.1					
Heptane	142-82-5	10.92	100.2					
2-Propen-1-ol, 2-methyl-	513-42-8	11.13	72.1					
1-Butanol	71-36-3	11.42	72.1					46.8
1-Pentene, 2,4,4-trimethyl-	107-39-1	11.44	112.2		31.0	40.7		
Butane, tetramethyl-	na	11.6	114.2					
Pentanal	110-62-3	11.78	86.1					
2-Pentanone	107-87-9	11.93	86.1		140.8	28.8		
Hexane, 2,2-dimethyl-	590-73-8	11.97	114.2					
3-Pentanone	96-22-0	12.15	86.1					

Tentatively Identified Volatile Organic Compounds from SL-644

			File -->	01100310	01101709	01101711	01101709	02013007
			Sample -->	02-00003	02-00054	02-00046	02-00357	02-01284
			Cylinder ID -->	24G46-6 CLYH	24G49-6 CLYL	24G48-6 CLYA	24G57-10 CLYH	24G81-11 CLYC
			Resin Mass (g)	0.9045	0.9045	0.9045	0.9055	0.8974
			Medium-->	HNO3	HNO3	HNO3	HNO3	HNO3
			Temperature (C)-->	90	90	90	25	25
			Dose (R)-->				1.E+06	1.E+07
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW					
2-Butanone, 3,3-dimethyl-	75-97-8	12.37	100.2					
2,4-Hexadiene, 3-methyl-	28823-42-9	12.46	96					
Pentane, 2,2,4,4-tetramethyl-	1070-87-7	13.05	128.3					
Hexane, 2,2,5-trimethyl-	3522-94-9	13.24	128.3					
Methyl Isobutyl Ketone	108-10-1	13.29	100.2	1033.2	222.4	204.4		598.2
2-Butenal, 2-methyl-	497-03-0	13.55	84.1					
2-Pentanone, 3-methyl	565-61-7	13.59	100.2					
Propane, 2-methyl-2-nitro	594-70-7	13.89	103.1					
2-Pentanone, 4,4-dimethyl-	590-50-1	14.4	114.2					
Hexane, 2,2,5,5-tetramethyl-	1071-81-4	14.58	142.3					
3-Hexanone	589-38-8	14.64	100.2					
2,3,5-Trimethylfuran	10504-04-8	14.73	110					
Hexanal	66-25-1	14.74	100.2					
2-Hexanone	591-78-6	14.86	100.2					
2-Pentenoic acid, 2-methyl-	3142-72-1	15.09	114.1					
1,3-Dioxolane, 2,4-dimethyl-	766-20-1	15.2	116.2					
Pentane, 2,2,3,3-tetramethyl-	7154-79-2	15.43	128.3					
Isoxazole, 3,5-dimethyl-	300-87-8	15.67	97.1					
5,5-Dimethyl-1,3-hexadiene	1515-79-3	15.9	110					
Cyclohexane, 1,1,3,5-tetramethyl-	50876-31-8	16.4	140.3					
3-Heptanone	06-35-4	17.18	114					
Heptanal	111-71-7	17.36	114.2					
1,3-Dioxane, 2-ethyl-5-methyl	627-54-7	17.58	130					
Benzene, nitroso-	586-96-9	17.79	107.1		105.7	90.0		
Ethanamine, N-ethyl-N-nitroso-	55-18-5	18.52	102.1		36.4	58.5		
1H-Benzotriazole	95-14-7	18.7	119.1					
Tetramethyloctane	na	18.75	154					
Benzene, isocyanato-	103-71-9	19.13	119.1			58.4		
Benzaldehyde	100-52-7	19.37	106.1	2873.4	366.0	300.8		
Octanal	124-13-0	19.94	128.2					
Benzonitrile	100-47-0	20.38	103.1	4019.0	429.9	435.6		
Butane,1,1,3,4-tetrachloro-1,2,2,3,4,4-hexafluoro-	423-38-1	21.35	303.8					

Tentatively Identified Volatile Organic Compounds from SL-644

			File -->	01100310	01101709	01101711	01101709	02013007
			Sample -->	02-00003	02-00054	02-00046	02-00357	02-01284
			Cylinder ID -->	24G46-6 CLYH	24G49-6 CLYL	24G48-6 CLYA	24G57-10 CLYH	24G81-11 CLYC
			Resin Mass (g)	0.9045	0.9045	0.9045	0.9055	0.8974
			Medium-->	HNO3	HNO3	HNO3	HNO3	HNO3
			Temperature (C)-->	90	90	90	25	25
			Dose (R)-->				1.E+06	1.E+07
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW					
Acetophenone	98-86-2	21.93	120.2	3782.6	278.7	229.0		
Nonanal	124-19-6	22.1	142.2					
Benzenemethanol,.alpha.,.alpha.-dimethyl-	617-94-7	22.35	136.2		30.2			
Benzenoacetonitrile,.alpha.-oxo-	613-90-1	22.6	131.1	2985.4	277.3	275.3		
Benzene, nitro	98-95-3	22.75	123.1		159.7	265.9		
Dodecane	112-40-3	23	170.3		113.9	113.7		155.1
Butane,tetrachloro-,hexafluoro-	423-38-1	26.49	303.8		154.5	115.3		

Tentatively Identified Volatile Organic Compounds from SL-644

			File -->	01111205	01112706	01120605	02013105	01101704
			Sample -->	02-00674	02-00840	02-00884	02-01280	02-00049
			Cylinder ID -->	24G62-11 CLYF	24G68-5 CLYI	24G71-10 CLYE	24G79-1	24G49-1 CLYC
			Resin Mass (g)	0.9009	0.9043	0.9018	0.9001	0.9028
			Medium-->	HNO3	HNO3	HNO3	HNO3	AN105 sim
			Temperature (C)-->	25	25	65	90	25
			Dose (R)-->	1.E+08	1.E+08	1.E+08	5.E+06	
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW					
Isobutane	75-28-5	3.28	58.12		1743.6		9832.9	
1-Propene, 2-methyl-	115-11-7	3.44	56.1					
Silane, methyl	992-94-9	3.62	46.1			195.0		
Propane, 2,2-dimethyl-	463-82-1	3.71	72.1					
2-Butene	590-18-1	3.81	56.1					
Butane, 2-methyl-	78-78-4	4.5	72.1					
Pentane	109-66-0	4.85	72.1					
1,2-Butadiene	590-19-2	5.06	54.1					
2-Pentene	627-20-3	5.27	70.1					
Ethanol	64-17-5	5.38	46.1					30.8
Cyclopropane, 1,1-dimethyl-	1630-94-0	5.43	70.1					
Ether	60-29-7	5.5	74.1					35.5
Propanal	123-38-6	5.67	50.1			27.8		
Butane, 2,2-dimethyl	75-83-2	5.77	86.2					
Acetone	67-64-1	5.87	58.1			136.0		
Carbon Disulfide	75-15-0	5.92	76.1					
Isopropyl Alcohol	67-63-0	6.24	60.1					174.6
Acetonitrile	75-05-8	6.36	41.1				48471.7	
Propene	115-07-1	6.41	42.1		19.2	669.4		
Unknown		6.45						
Pentane, 2-methyl-	107-83-5	6.61	86.2					
Propane, 2-chloro-2-methyl-	507-20-0	6.66	92.6					
2-Propanol, 2-methyl-	75-65-0	6.83	74.1		223.4			118.6
1-Propene, 2-metoxy-	116-11-0	6.85	72.1					
Propane, 2-ethoxy	625-54-7	6.97	88.1					72.8
Cyanogen, bromide	506-68-3	7	105.9				6110.9	
Pentane, 3-methyl-	96-14-0	7.07	86.2					
Methyl nitrate	598-58-3	7.1	77					
Propane, 2-methoxy-2methyl-	1634-04-4	7.21	88.1					
2-Pentyne	627-21-4	7.4	68.1				1013.5	
1,2_Butadiene, 3-methyl-	598-25-4	7.46	68.1					
Propanal, 2-methyl-	78-84-2	7.56	72.1					
2-Butenal	4170-30-3	7.88	70.1			38.3	3385.7	

Tentatively Identified Volatile Organic Compounds from SL-644

			File -->	01111205	01112706	01120605	02013105	01101704
			Sample -->	02-00674	02-00840	02-00884	02-01280	02-00049
			Cylinder ID -->	24G62-11 CLYF	24G68-5 CLYI	24G71-10 CLYE	24G79-1	24G49-1 CLYC
			Resin Mass (g)	0.9009	0.9043	0.9018	0.9001	0.9028
			Medium-->	HNO3	HNO3	HNO3	HNO3	AN105 sim
			Temperature (C)-->	25	25	65	90	25
			Dose (R)-->	1.E+08	1.E+08	1.E+08	5.E+06	
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW					
1-Pentene, 4,4-dimethyl-	762-62-9	8.11	98.2					
Butane, 2,2,3-trimethyl-	464-06-2	8.36	100.2					
1-Propanol	71-23-8	8.39	60.1					416.5
Pentane, 2,2-dimethyl-	590-35-2	8.41	100.2					
Hexane	110-54-3	8.54	86.2					
Propanal, 2,2-dimethyl	630-19-3	8.55	86.1					
Butanal	123-72-8	8.67	72.1					
Propane, 1-chloro-2-methyl-	513-36-0	8.71	92.6					
Silanol, trimethyl-	66-40-6	8.79	90					
Methane, nitro-	75-52-5	8.83	61	81.3	95.2	200.4	6723.1	
Pentane, 2,4-dimethyl-	108-08-7	8.8	100.2					
Butane, 2,2,3-trimethyl-	464-06-2	8.91	100.2					
Propanenitrile	107-12-0	9.07	55.1			63.4	18179.7	
2-Butanone	78-93-3	9.14	72.1					684.6
3-Hexyne	928-49-4	9.25	82.1					
Furan, tetrahydro-	109-99-9	9.28	72.1					135.1
Pentane, 3,3-dimethyl-	562-49-2	9.44	100.2					
Oxirane, ethyl	106-88-7	9.46	72.1					
Nitric acid, ethyl ester	625-58-1	9.88	91.1					
1,3-Dioxolane, 2-methyl-	497-26-7	10.15	88.1					
3-Hexanol	623-37-0	10.45	102.2					
Butane, 2,2,3,3-tetramethyl-	594-82-1	10.57	114.2		26.9			
Acetic acid	64-19-7	10.8	60.1					
2-Butanone, 3-methyl-	563-80-4	10.87	86.1					
Heptane	142-82-5	10.92	100.2				1610.8	
2-Propen-1-ol, 2-methyl-	513-42-8	11.13	72.1					
1-Butanol	71-36-3	11.42	72.1	87.7				
1-Pentene, 2,4,4-trimethyl-	107-39-1	11.44	112.2					
Butane, tetramethyl-	na	11.6	114.2		81.5			
Pentanal	110-62-3	11.78	86.1					
2-Pentanone	107-87-9	11.93	86.1				1499.0	1212.5
Hexane, 2,2-dimethyl-	590-73-8	11.97	114.2					
3-Pentanone	96-22-0	12.15	86.1				1353.9	143.2

Tentatively Identified Volatile Organic Compounds from SL-644

			File -->	01111205	01112706	01120605	02013105	01101704
			Sample -->	02-00674	02-00840	02-00884	02-01280	02-00049
			Cylinder ID -->	24G62-11 CLYF	24G68-5 CLYI	24G71-10 CLYE	24G79-1	24G49-1 CLYC
			Resin Mass (g)	0.9009	0.9043	0.9018	0.9001	0.9028
			Medium-->	HNO3	HNO3	HNO3	HNO3	AN105 sim
			Temperature (C)-->	25	25	65	90	25
			Dose (R)-->	1.E+08	1.E+08	1.E+08	5.E+06	
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW					
2-Butanone, 3,3-dimethyl-	75-97-8	12.37	100.2					
2,4-Hexadiene, 3-methyl-	28823-42-9	12.46	96					
Pentane, 2,2,4,4-tetramethyl-	1070-87-7	13.05	128.3					
Hexane, 2,2,5-trimethyl-	3522-94-9	13.24	128.3					
Methyl Isobutyl Ketone	108-10-1	13.29	100.2	1234.0				102.1
2-Butenal, 2-methyl-	497-03-0	13.55	84.1					
2-Pentanone, 3-methyl	565-61-7	13.59	100.2					
Propane, 2-methyl-2-nitro	594-70-7	13.89	103.1					
2-Pentanone, 4,4-dimethyl-	590-50-1	14.4	114.2					
Hexane, 2,2,5,5-tetramethyl-	1071-81-4	14.58	142.3					
3-Hexanone	589-38-8	14.64	100.2					140.8
2,3,5-Trimethylfuran	10504-04-8	14.73	110					
Hexanal	66-25-1	14.74	100.2					
2-Hexanone	591-78-6	14.86	100.2					72.1
2-Pentenoic acid, 2-methyl-	3142-72-1	15.09	114.1					
1,3-Dioxolane, 2,4-dimethyl-	766-20-1	15.2	116.2					551.3
Pentane, 2,2,3,3-tetramethyl-	7154-79-2	15.43	128.3					
Isoxazole, 3,5-dimethyl-	300-87-8	15.67	97.1					
5,5-Dimethyl-1,3-hexadiene	1515-79-3	15.9	110					
Cyclohexane, 1,1,3,5-tetramethyl-	50876-31-8	16.4	140.3					
3-Heptanone	06-35-4	17.18	114					
Heptanal	111-71-7	17.36	114.2					
1,3-Dioxane, 2-ethyl-5-methyl	627-54-7	17.58	130					171.8
Benzene, nitroso-	586-96-9	17.79	107.1				8119.9	
Ethanamine, N-ethyl-N-nitroso-	55-18-5	18.52	102.1				1247.1	
1H-Benzotriazole	95-14-7	18.7	119.1				14.0	
Tetramethyloctane	na	18.75	154					
Benzene, isocyanato-	103-71-9	19.13	119.1					
Benzaldehyde	100-52-7	19.37	106.1			59.2	14151.6	49.0
Octanal	124-13-0	19.94	128.2					
Benzonitrile	100-47-0	20.38	103.1			42.2	18673.1	
Butane,1,1,3,4-tetrachloro-1,2,2,3,4,4-hexafluoro-	423-38-1	21.35	303.8					237.0

Tentatively Identified Volatile Organic Compounds from SL-644

			File -->	01111205	01112706	01120605	02013105	01101704
			Sample -->	02-00674	02-00840	02-00884	02-01280	02-00049
			Cylinder ID -->	24G62-11 CLYF	24G68-5 CLYI	24G71-10 CLYE	24G79-1	24G49-1 CLYC
			Resin Mass (g)	0.9009	0.9043	0.9018	0.9001	0.9028
			Medium-->	HNO3	HNO3	HNO3	HNO3	AN105 sim
			Temperature (C)-->	25	25	65	90	25
			Dose (R)-->	1.E+08	1.E+08	1.E+08	5.E+06	
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW					
Acetophenone	98-86-2	21.93	120.2			26.7	8353.7	
Nonanal	124-19-6	22.1	142.2					
Benzenemethanol,.alpha.,.alpha.-dimethyl-	617-94-7	22.35	136.2			29.2		
Benzenoacetonitrile,.alpha.-oxo-	613-90-1	22.6	131.1				8697.0	
Benzene, nitro	98-95-3	22.75	123.1				7526.9	
Dodecane	112-40-3	23	170.3	715.3				
Butane,tetrachloro-,hexafluoro-	423-38-1	26.49	303.8		82.9		3092.4	

Tentatively Identified Volatile Organic Compounds from SL-644

			File -->	01101705	01101706	01101708	02013006	01111204
			Sample -->	02-00050	02-00051	02-00356	02-01283	02-00673
			Cylinder ID -->	24G49-2 CLYD	24G49-3 CLYE	24G57-9 CLYJ	24G81-10 CLYD	24G62-10 CLYE
			Resin Mass (g)	0.901	0.9057	0.8998	0.8978	0.9031
			Medium-->	AN105 sim	AN105 sim	AN105 sim	AN105 sim	AN105 sim
			Temperature (C)-->	65	90	25	25	25
			Dose (R)-->			1.E+06	1.E+07	1.E+08
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW					
Isobutane	75-28-5	3.28	58.12					
1-Propene, 2-methyl-	115-11-7	3.44	56.1		82.8			
Silane, methyl	992-94-9	3.62	46.1		16.8	39.6	249.6	21.2
Propane, 2,2-dimethyl-	463-82-1	3.71	72.1					
2-Butene	590-18-1	3.81	56.1		45.4			
Butane, 2-methyl-	78-78-4	4.5	72.1					
Pentane	109-66-0	4.85	72.1					
1,2-Butadiene	590-19-2	5.06	54.1		132.4			
2-Pentene	627-20-3	5.27	70.1		87.0			
Ethanol	64-17-5	5.38	46.1	9.0		9.3	92.4	25.2
Cyclopropane, 1,1-dimethyl-	1630-94-0	5.43	70.1		109.7			
Ether	60-29-7	5.5	74.1					
Propanal	123-38-6	5.67	50.1			17.7		
Butane, 2,2-dimethyl	75-83-2	5.77	86.2					
Acetone	67-64-1	5.87	58.1			127.3	1539.9	121.2
Carbon Disulfide	75-15-0	5.92	76.1					
Isopropyl Alcohol	67-63-0	6.24	60.1	59.7	123.6	57.8	350.3	
Acetonitrile	75-05-8	6.36	41.1					
Propene	115-07-1	6.41	42.1				809.9	
Unknown		6.45				12.6		273.0
Pentane, 2-methyl-	107-83-5	6.61	86.2					
Propane, 2-chloro-2-methyl-	507-20-0	6.66	92.6					
2-Propanol, 2-methyl-	75-65-0	6.83	74.1		75.1	27.2		
1-Propene, 2-metoxy-	116-11-0	6.85	72.1					
Propane, 2-ethoxy	625-54-7	6.97	88.1		86.0			
Cyanogen, bromide	506-68-3	7	105.9					
Pentane, 3-methyl-	96-14-0	7.07	86.2					
Methyl nitrate	598-58-3	7.1	77					
Propane, 2-methoxy-2methyl-	1634-04-4	7.21	88.1					
2-Pentyne	627-21-4	7.4	68.1					
1,2_Butadiene, 3-methyl-	598-25-4	7.46	68.1		39.5			
Propanal, 2-methyl-	78-84-2	7.56	72.1					
2-Butenal	4170-30-3	7.88	70.1				192.2	18.7

Tentatively Identified Volatile Organic Compounds from SL-644

			File -->	01101705	01101706	01101708	02013006	01111204
			Sample -->	02-00050	02-00051	02-00356	02-01283	02-00673
			Cylinder ID -->	24G49-2 CLYD	24G49-3 CLYE	24G57-9 CLYJ	24G81-10 CLYD	24G62-10 CLYE
			Resin Mass (g)	0.901	0.9057	0.8998	0.8978	0.9031
			Medium-->	AN105 sim	AN105 sim	AN105 sim	AN105 sim	AN105 sim
			Temperature (C)-->	65	90	25	25	25
			Dose (R)-->			1.E+06	1.E+07	1.E+08
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW					
1-Pentene, 4,4-dimethyl-	762-62-9	8.11	98.2					
Butane, 2,2,3-trimethyl-	464-06-2	8.36	100.2					
1-Propanol	71-23-8	8.39	60.1	14.4	810.5			
Pentane, 2,2-dimethyl-	590-35-2	8.41	100.2					
Hexane	110-54-3	8.54	86.2					
Propanal, 2,2-dimethyl	630-19-3	8.55	86.1					
Butanal	123-72-8	8.67	72.1			14.5	240.9	
Propane, 1-chloro-2-methyl-	513-36-0	8.71	92.6					
Silanol, trimethyl-	66-40-6	8.79	90					
Methane, nitro-	75-52-5	8.83	61					
Pentane, 2,4-dimethyl-	108-08-7	8.8	100.2					
Butane, 2,2,3-trimethyl-	464-06-2	8.91	100.2					
Propanenitrile	107-12-0	9.07	55.1				297.7	71.2
2-Butanone	78-93-3	9.14	72.1	114.9	1014.2	127.6		59.5
3-Hexyne	928-49-4	9.25	82.1		33.8			
Furan, tetrahydro-	109-99-9	9.28	72.1		71.0			
Pentane, 3,3-dimethyl-	562-49-2	9.44	100.2					
Oxirane, ethyl	106-88-7	9.46	72.1					
Nitric acid, ethyl ester	625-58-1	9.88	91.1					17.2
1,3-Dioxolane, 2-methyl-	497-26-7	10.15	88.1					
3-Hexanol	623-37-0	10.45	102.2					
Butane, 2,2,3,3-tetramethyl-	594-82-1	10.57	114.2					
Acetic acid	64-19-7	10.8	60.1					
2-Butanone, 3-methyl-	563-80-4	10.87	86.1					
Heptane	142-82-5	10.92	100.2		128.3			
2-Propen-1-ol, 2-methyl-	513-42-8	11.13	72.1					
1-Butanol	71-36-3	11.42	72.1	13.5		25.0		
1-Pentene, 2,4,4-trimethyl-	107-39-1	11.44	112.2					
Butane, tetramethyl-	na	11.6	114.2					
Pentanal	110-62-3	11.78	86.1	28.7				
2-Pentanone	107-87-9	11.93	86.1	202.2	899.3	142.1	273.8	26.1
Hexane, 2,2-dimethyl-	590-73-8	11.97	114.2					
3-Pentanone	96-22-0	12.15	86.1		346.4			

Tentatively Identified Volatile Organic Compounds from SL-644

			File -->	01101705	01101706	01101708	02013006	01111204
			Sample -->	02-00050	02-00051	02-00356	02-01283	02-00673
			Cylinder ID -->	24G49-2 CLYD	24G49-3 CLYE	24G57-9 CLYJ	24G81-10 CLYD	24G62-10 CLYE
			Resin Mass (g)	0.901	0.9057	0.8998	0.8978	0.9031
			Medium-->	AN105 sim	AN105 sim	AN105 sim	AN105 sim	AN105 sim
			Temperature (C)-->	65	90	25	25	25
			Dose (R)-->			1.E+06	1.E+07	1.E+08
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW					
2-Butanone, 3,3-dimethyl-	75-97-8	12.37	100.2					
2,4-Hexadiene, 3-methyl-	28823-42-9	12.46	96		22.6			
Pentane, 2,2,4,4-tetramethyl-	1070-87-7	13.05	128.3					
Hexane, 2,2,5-trimethyl-	3522-94-9	13.24	128.3					
Methyl Isobutyl Ketone	108-10-1	13.29	100.2		160.4			
2-Butenal, 2-methyl-	497-03-0	13.55	84.1			38.6		
2-Pentanone, 3-methyl	565-61-7	13.59	100.2					
Propane, 2-methyl-2-nitro	594-70-7	13.89	103.1					
2-Pentanone, 4,4-dimethyl-	590-50-1	14.4	114.2					
Hexane, 2,2,5,5-tetramethyl-	1071-81-4	14.58	142.3					
3-Hexanone	589-38-8	14.64	100.2		61.5			
2,3,5-Trimethylfuran	10504-04-8	14.73	110		234.4			
Hexanal	66-25-1	14.74	100.2					
2-Hexanone	591-78-6	14.86	100.2					
2-Pentenoic acid, 2-methyl-	3142-72-1	15.09	114.1					
1,3-Dioxolane, 2,4-dimethyl-	766-20-1	15.2	116.2	53.9	104.8	20.6		
Pentane, 2,2,3,3-tetramethyl-	7154-79-2	15.43	128.3					
Isoxazole, 3,5-dimethyl-	300-87-8	15.67	97.1					
5,5-Dimethyl-1,3-hexadiene	1515-79-3	15.9	110		38.0			
Cyclohexane, 1,1,3,5-tetramethyl-	50876-31-8	16.4	140.3					
3-Heptanone	06-35-4	17.18	114	25.5				
Heptanal	111-71-7	17.36	114.2	26.6				
1,3-Dioxane, 2-ethyl-5-methyl	627-54-7	17.58	130		37.6			
Benzene, nitroso-	586-96-9	17.79	107.1					
Ethanamine, N-ethyl-N-nitroso-	55-18-5	18.52	102.1					
1H-Benzotriazole	95-14-7	18.7	119.1					
Tetramethyloctane	na	18.75	154					
Benzene, isocyanato-	103-71-9	19.13	119.1					
Benzaldehyde	100-52-7	19.37	106.1	32.3	32.1			
Octanal	124-13-0	19.94	128.2					
Benzonitrile	100-47-0	20.38	103.1					
Butane,1,1,3,4-tetrachloro-1,2,2,3,4,4-hexafluoro-	423-38-1	21.35	303.8	126.2				

Tentatively Identified Volatile Organic Compounds from SL-644

			File -->	01101705	01101706	01101708	02013006	01111204
			Sample -->	02-00050	02-00051	02-00356	02-01283	02-00673
			Cylinder ID -->	24G49-2 CLYD	24G49-3 CLYE	24G57-9 CLYJ	24G81-10 CLYD	24G62-10 CLYE
			Resin Mass (g)	0.901	0.9057	0.8998	0.8978	0.9031
			Medium-->	AN105 sim	AN105 sim	AN105 sim	AN105 sim	AN105 sim
			Temperature (C)-->	65	90	25	25	25
			Dose (R)-->			1.E+06	1.E+07	1.E+08
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW					
Acetophenone	98-86-2	21.93	120.2					
Nonanal	124-19-6	22.1	142.2	30.3				
Benzenemethanol,.alpha.,.alpha.-dimethyl-	617-94-7	22.35	136.2					
Benzenoacetonitrile,.alpha.-oxo-	613-90-1	22.6	131.1					
Benzene, nitro	98-95-3	22.75	123.1					
Dodecane	112-40-3	23	170.3					
Butane,tetrachloro-,hexafluoro-	423-38-1	26.49	303.8					

Tentatively Identified Volatile Organic Compounds from SL-644

			File -->	01112705	01120604	01120605	02013106	01120606
			Sample -->	02-00839	02-00891	02-00892	02-01263	02-00883
			Cylinder ID -->	24G68-4 CLYH	24G73-3 CLYD	24G73-4 CLYH	24G75-1 G	24G71-9 CLYC
			Resin Mass (g)	0.902	0.3282	0.3282	0.9088	0.9009
			Medium-->	AN105 sim	AN105 sim	AN105 sim	AN105 sim	AN105 sim
			Temperature (C)-->	25	25	25	25	65
			Dose (R)-->	1.E+08	1.E+08	1.E+08	7.E+08	1.E+08
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW					
Isobutane	75-28-5	3.28	58.12	1769.8		523.1		
1-Propene, 2-methyl-	115-11-7	3.44	56.1					302.1
Silane, methyl	992-94-9	3.62	46.1				217.7	
Propane, 2,2-dimethyl-	463-82-1	3.71	72.1					
2-Butene	590-18-1	3.81	56.1					
Butane, 2-methyl-	78-78-4	4.5	72.1					85.5
Pentane	109-66-0	4.85	72.1					
1,2-Butadiene	590-19-2	5.06	54.1					
2-Pentene	627-20-3	5.27	70.1					
Ethanol	64-17-5	5.38	46.1	21.4	40.6	59.9	208.4	
Cyclopropane, 1,1-dimethyl-	1630-94-0	5.43	70.1					
Ether	60-29-7	5.5	74.1					
Propanal	123-38-6	5.67	50.1					
Butane, 2,2-dimethyl	75-83-2	5.77	86.2					
Acetone	67-64-1	5.87	58.1					1107.2
Carbon Disulfide	75-15-0	5.92	76.1			38.5		
Isopropyl Alcohol	67-63-0	6.24	60.1			30.4		
Acetonitrile	75-05-8	6.36	41.1				5338.4	
Propene	115-07-1	6.41	42.1	207.1	182.9	195.4		53.7
Unknown		6.45						
Pentane, 2-methyl-	107-83-5	6.61	86.2					
Propane, 2-chloro-2-methyl-	507-20-0	6.66	92.6					
2-Propanol, 2-methyl-	75-65-0	6.83	74.1	287.9	112.2	72.8	93.5	155.6
1-Propene, 2-metoxy-	116-11-0	6.85	72.1					
Propane, 2-ethoxy	625-54-7	6.97	88.1					
Cyanogen, bromide	506-68-3	7	105.9					
Pentane, 3-methyl-	96-14-0	7.07	86.2					70.7
Methyl nitrate	598-58-3	7.1	77		164.0			
Propane, 2-methoxy-2methyl-	1634-04-4	7.21	88.1					
2-Pentyne	627-21-4	7.4	68.1					
1,2_Butadiene, 3-methyl-	598-25-4	7.46	68.1					
Propanal, 2-methyl-	78-84-2	7.56	72.1	23.7				
2-Butenal	4170-30-3	7.88	70.1	27.2	56.2	396.3	34.9	

Tentatively Identified Volatile Organic Compounds from SL-644

			File -->	01112705	01120604	01120605	02013106	01120606
			Sample -->	02-00839	02-00891	02-00892	02-01263	02-00883
			Cylinder ID -->	24G68-4 CLYH	24G73-3 CLYD	24G73-4 CLYH	24G75-1 G	24G71-9 CLYC
			Resin Mass (g)	0.902	0.3282	0.3282	0.9088	0.9009
			Medium-->	AN105 sim	AN105 sim	AN105 sim	AN105 sim	AN105 sim
			Temperature (C)-->	25	25	25	25	65
			Dose (R)-->	1.E+08	1.E+08	1.E+08	7.E+08	1.E+08
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW					
1-Pentene, 4,4-dimethyl-	762-62-9	8.11	98.2					
Butane, 2,2,3-trimethyl-	464-06-2	8.36	100.2					
1-Propanol	71-23-8	8.39	60.1					42.6
Pentane, 2,2-dimethyl-	590-35-2	8.41	100.2					
Hexane	110-54-3	8.54	86.2					
Propanal, 2,2-dimethyl	630-19-3	8.55	86.1					
Butanal	123-72-8	8.67	72.1					
Propane, 1-chloro-2-methyl-	513-36-0	8.71	92.6					
Silanol, trimethyl-	66-40-6	8.79	90			115.4		
Methane, nitro-	75-52-5	8.83	61					
Pentane, 2,4-dimethyl-	108-08-7	8.8	100.2					
Butane, 2,2,3-trimethyl-	464-06-2	8.91	100.2					
Propanenitrile	107-12-0	9.07	55.1	60.1	48.8	54.2	698.2	
2-Butanone	78-93-3	9.14	72.1	91.5	47.5		280.3	605.6
3-Hexyne	928-49-4	9.25	82.1					
Furan, tetrahydro-	109-99-9	9.28	72.1					
Pentane, 3,3-dimethyl-	562-49-2	9.44	100.2					70.5
Oxirane, ethyl	106-88-7	9.46	72.1					
Nitric acid, ethyl ester	625-58-1	9.88	91.1					
1,3-Dioxolane, 2-methyl-	497-26-7	10.15	88.1					
3-Hexanol	623-37-0	10.45	102.2					
Butane, 2,2,3,3-tetramethyl-	594-82-1	10.57	114.2	98.0				414.5
Acetic acid	64-19-7	10.8	60.1					
2-Butanone, 3-methyl-	563-80-4	10.87	86.1					195.0
Heptane	142-82-5	10.92	100.2					
2-Propen-1-ol, 2-methyl-	513-42-8	11.13	72.1					
1-Butanol	71-36-3	11.42	72.1					
1-Pentene, 2,4,4-trimethyl-	107-39-1	11.44	112.2					
Butane, tetramethyl-	na	11.6	114.2	320.3		236.6		637.2
Pentanal	110-62-3	11.78	86.1					
2-Pentanone	107-87-9	11.93	86.1				89.0	464.9
Hexane, 2,2-dimethyl-	590-73-8	11.97	114.2					
3-Pentanone	96-22-0	12.15	86.1					105.9

Tentatively Identified Volatile Organic Compounds from SL-644

			File -->	01112705	01120604	01120605	02013106	01120606
			Sample -->	02-00839	02-00891	02-00892	02-01263	02-00883
			Cylinder ID -->	24G68-4 CLYH	24G73-3 CLYD	24G73-4 CLYH	24G75-1 G	24G71-9 CLYC
			Resin Mass (g)	0.902	0.3282	0.3282	0.9088	0.9009
			Medium-->	AN105 sim	AN105 sim	AN105 sim	AN105 sim	AN105 sim
			Temperature (C)-->	25	25	25	25	65
			Dose (R)-->	1.E+08	1.E+08	1.E+08	7.E+08	1.E+08
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW					
2-Butanone, 3,3-dimethyl-	75-97-8	12.37	100.2					138.3
2,4-Hexadiene, 3-methyl-	28823-42-9	12.46	96					
Pentane, 2,2,4,4-tetramethyl-	1070-87-7	13.05	128.3					91.8
Hexane, 2,2,5-trimethyl-	3522-94-9	13.24	128.3					
Methyl Isobutyl Ketone	108-10-1	13.29	100.2					121.7
2-Butenal, 2-methyl-	497-03-0	13.55	84.1					
2-Pentanone, 3-methyl	565-61-7	13.59	100.2					84.8
Propane, 2-methyl-2-nitro	594-70-7	13.89	103.1					
2-Pentanone, 4,4-dimethyl-	590-50-1	14.4	114.2					83.8
Hexane, 2,2,5,5-tetramethyl-	1071-81-4	14.58	142.3					
3-Hexanone	589-38-8	14.64	100.2					
2,3,5-Trimethylfuran	10504-04-8	14.73	110					
Hexanal	66-25-1	14.74	100.2					
2-Hexanone	591-78-6	14.86	100.2					
2-Pentenoic acid, 2-methyl-	3142-72-1	15.09	114.1					
1,3-Dioxolane, 2,4-dimethyl-	766-20-1	15.2	116.2					
Pentane, 2,2,3,3-tetramethyl-	7154-79-2	15.43	128.3					135.5
Isoxazole, 3,5-dimethyl-	300-87-8	15.67	97.1					84.8
5,5-Dimethyl-1,3-hexadiene	1515-79-3	15.9	110					
Cyclohexane, 1,1,3,5-tetramethyl-	50876-31-8	16.4	140.3					
3-Heptanone	06-35-4	17.18	114					
Heptanal	111-71-7	17.36	114.2					
1,3-Dioxane, 2-ethyl-5-methyl	627-54-7	17.58	130					
Benzene, nitroso-	586-96-9	17.79	107.1					
Ethanamine, N-ethyl-N-nitroso-	55-18-5	18.52	102.1				42.9	
1H-Benzotriazole	95-14-7	18.7	119.1					
Tetramethyloctane	na	18.75	154					180.6
Benzene, isocyanato-	103-71-9	19.13	119.1					
Benzaldehyde	100-52-7	19.37	106.1				236.8	
Octanal	124-13-0	19.94	128.2					
Benzonitrile	100-47-0	20.38	103.1				120.8	
Butane,1,1,3,4-tetrachloro-1,2,2,3,4,4-hexafluoro-	423-38-1	21.35	303.8	132.6	403.7	315.3	179.4	

Tentatively Identified Volatile Organic Compounds from SL-644

			File -->	01112705	01120604	01120605	02013106	01120606
			Sample -->	02-00839	02-00891	02-00892	02-01263	02-00883
			Cylinder ID -->	24G68-4 CLYH	24G73-3 CLYD	24G73-4 CLYH	24G75-1 G	24G71-9 CLYC
			Resin Mass (g)	0.902	0.3282	0.3282	0.9088	0.9009
			Medium-->	AN105 sim	AN105 sim	AN105 sim	AN105 sim	AN105 sim
			Temperature (C)-->	25	25	25	25	65
			Dose (R)-->	1.E+08	1.E+08	1.E+08	7.E+08	1.E+08
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW					
Acetophenone	98-86-2	21.93	120.2				73.4	
Nonanal	124-19-6	22.1	142.2					
Benzenemethanol,.alpha.,.alpha.-dimethyl-	617-94-7	22.35	136.2					
Benzenoacetonitrile,.alpha.-oxo-	613-90-1	22.6	131.1					
Benzene, nitro	98-95-3	22.75	123.1					
Dodecane	112-40-3	23	170.3					
Butane,tetrachloro-,hexafluoro-	423-38-1	26.49	303.8	57.0		153.8		

Tentatively Identified Volatile Organic Compounds from SL-644

			File -->	02020105	01110206
			Sample -->	02-01381	02-00369
			Cylinder ID -->	24G83-10	24G59-11 CLYJ
			Resin Mass (g)	0.674	0.9122
			Medium-->	AN105 sim	none
			Temperature (C)-->	90	25
			Dose (R)-->	1.E+08	1.E+08
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW		
Isobutane	75-28-5	3.28	58.12	25261.5	
1-Propene, 2-methyl-	115-11-7	3.44	56.1		
Silane, methyl	992-94-9	3.62	46.1		33.9
Propane, 2,2-dimethyl-	463-82-1	3.71	72.1		
2-Butene	590-18-1	3.81	56.1		
Butane, 2-methyl-	78-78-4	4.5	72.1	2469.4	
Pentane	109-66-0	4.85	72.1	938.9	
1,2-Butadiene	590-19-2	5.06	54.1		
2-Pentene	627-20-3	5.27	70.1		
Ethanol	64-17-5	5.38	46.1	259.7	
Cyclopropane, 1,1-dimethyl-	1630-94-0	5.43	70.1		
Ether	60-29-7	5.5	74.1		
Propanal	123-38-6	5.67	50.1		
Butane, 2,2-dimethyl	75-83-2	5.77	86.2		
Acetone	67-64-1	5.87	58.1	8023.1	27.9
Carbon Disulfide	75-15-0	5.92	76.1		22.0
Isopropyl Alcohol	67-63-0	6.24	60.1		
Acetonitrile	75-05-8	6.36	41.1		
Propene	115-07-1	6.41	42.1		
Unknown		6.45			
Pentane, 2-methyl-	107-83-5	6.61	86.2	723.8	
Propane, 2-chloro-2-methyl-	507-20-0	6.66	92.6		
2-Propanol, 2-methyl-	75-65-0	6.83	74.1		
1-Propene, 2-metoxy-	116-11-0	6.85	72.1		
Propane, 2-ethoxy	625-54-7	6.97	88.1		
Cyanogen, bromide	506-68-3	7	105.9		
Pentane, 3-methyl-	96-14-0	7.07	86.2	1306.8	
Methyl nitrate	598-58-3	7.1	77		
Propane, 2-methoxy-2methyl-	1634-04-4	7.21	88.1		
2-Pentyne	627-21-4	7.4	68.1		
1,2_Butadiene, 3-methyl-	598-25-4	7.46	68.1		
Propanal, 2-methyl-	78-84-2	7.56	72.1		
2-Butenal	4170-30-3	7.88	70.1		

Tentatively Identified Volatile Organic Compounds from SL-644

			File -->	02020105	01110206
			Sample -->	02-01381	02-00369
			Cylinder ID -->	24G83-10	24G59-11 CLYJ
			Resin Mass (g)	0.674	0.9122
			Medium-->	AN105 sim	none
			Temperature (C)-->	90	25
			Dose (R)-->	1.E+08	1.E+08
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW		
1-Pentene, 4,4-dimethyl-	762-62-9	8.11	98.2		
Butane, 2,2,3-trimethyl-	464-06-2	8.36	100.2		
1-Propanol	71-23-8	8.39	60.1	793.1	
Pentane, 2,2-dimethyl-	590-35-2	8.41	100.2		
Hexane	110-54-3	8.54	86.2		
Propanal, 2,2-dimethyl	630-19-3	8.55	86.1		
Butanal	123-72-8	8.67	72.1		
Propane, 1-chloro-2-methyl-	513-36-0	8.71	92.6		
Silanol, trimethyl-	66-40-6	8.79	90		86.5
Methane, nitro-	75-52-5	8.83	61		
Pentane, 2,4-dimethyl-	108-08-7	8.8	100.2		
Butane, 2,2,3-trimethyl-	464-06-2	8.91	100.2		
Propanenitrile	107-12-0	9.07	55.1		
2-Butanone	78-93-3	9.14	72.1	3071.1	
3-Hexyne	928-49-4	9.25	82.1		
Furan, tetrahydro-	109-99-9	9.28	72.1		
Pentane, 3,3-dimethyl-	562-49-2	9.44	100.2		
Oxirane, ethyl	106-88-7	9.46	72.1		
Nitric acid, ethyl ester	625-58-1	9.88	91.1		
1,3-Dioxolane, 2-methyl-	497-26-7	10.15	88.1		
3-Hexanol	623-37-0	10.45	102.2		
Butane, 2,2,3,3-tetramethyl-	594-82-1	10.57	114.2	752.5	
Acetic acid	64-19-7	10.8	60.1		
2-Butanone, 3-methyl-	563-80-4	10.87	86.1		
Heptane	142-82-5	10.92	100.2		
2-Propen-1-ol, 2-methyl-	513-42-8	11.13	72.1		
1-Butanol	71-36-3	11.42	72.1		117.9
1-Pentene, 2,4,4-trimethyl-	107-39-1	11.44	112.2		
Butane, tetramethyl-	na	11.6	114.2	1266.7	
Pentanal	110-62-3	11.78	86.1		
2-Pentanone	107-87-9	11.93	86.1	1293.3	
Hexane, 2,2-dimethyl-	590-73-8	11.97	114.2		
3-Pentanone	96-22-0	12.15	86.1	389.2	

Tentatively Identified Volatile Organic Compounds from SL-644

			File -->	02020105	01110206
			Sample -->	02-01381	02-00369
			Cylinder ID -->	24G83-10	24G59-11 CLYJ
			Resin Mass (g)	0.674	0.9122
			Medium-->	AN105 sim	none
			Temperature (C)-->	90	25
			Dose (R)-->	1.E+08	1.E+08
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW		
2-Butanone, 3,3-dimethyl-	75-97-8	12.37	100.2		
2,4-Hexadiene, 3-methyl-	28823-42-9	12.46	96		
Pentane, 2,2,4,4-tetramethyl-	1070-87-7	13.05	128.3		
Hexane, 2,2,5-trimethyl-	3522-94-9	13.24	128.3		
Methyl Isobutyl Ketone	108-10-1	13.29	100.2		1518.0
2-Butenal, 2-methyl-	497-03-0	13.55	84.1		
2-Pentanone, 3-methyl	565-61-7	13.59	100.2		
Propane, 2-methyl-2-nitro	594-70-7	13.89	103.1		
2-Pentanone, 4,4-dimethyl-	590-50-1	14.4	114.2		
Hexane, 2,2,5,5-tetramethyl-	1071-81-4	14.58	142.3		
3-Hexanone	589-38-8	14.64	100.2		
2,3,5-Trimethylfuran	10504-04-8	14.73	110		
Hexanal	66-25-1	14.74	100.2		
2-Hexanone	591-78-6	14.86	100.2		
2-Pentenoic acid, 2-methyl-	3142-72-1	15.09	114.1		
1,3-Dioxolane, 2,4-dimethyl-	766-20-1	15.2	116.2		
Pentane, 2,2,3,3-tetramethyl-	7154-79-2	15.43	128.3		
Isoxazole, 3,5-dimethyl-	300-87-8	15.67	97.1		
5,5-Dimethyl-1,3-hexadiene	1515-79-3	15.9	110		
Cyclohexane, 1,1,3,5-tetramethyl-	50876-31-8	16.4	140.3		
3-Heptanone	06-35-4	17.18	114		
Heptanal	111-71-7	17.36	114.2		
1,3-Dioxane, 2-ethyl-5-methyl	627-54-7	17.58	130		
Benzene, nitroso-	586-96-9	17.79	107.1		
Ethanamine, N-ethyl-N-nitroso-	55-18-5	18.52	102.1		
1H-Benzotriazole	95-14-7	18.7	119.1		
Tetramethyloctane	na	18.75	154		
Benzene, isocyanato-	103-71-9	19.13	119.1		
Benzaldehyde	100-52-7	19.37	106.1		
Octanal	124-13-0	19.94	128.2		
Benzonitrile	100-47-0	20.38	103.1		
Butane,1,1,3,4-tetrachloro-1,2,2,3,4,4-hexafluoro-	423-38-1	21.35	303.8		

Tentatively Identified Volatile Organic Compounds from SL-644

			File -->	02020105	01110206
			Sample -->	02-01381	02-00369
			Cylinder ID -->	24G83-10	24G59-11 CLYJ
			Resin Mass (g)	0.674	0.9122
			Medium-->	AN105 sim	none
			Temperature (C)-->	90	25
			Dose (R)-->	1.E+08	1.E+08
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW		
Acetophenone	98-86-2	21.93	120.2		
Nonanal	124-19-6	22.1	142.2		
Benzenemethanol,.alpha.,.alpha.-dimethyl-	617-94-7	22.35	136.2		
Benzenoacetonitrile,.alpha.-oxo-	613-90-1	22.6	131.1		
Benzene, nitro	98-95-3	22.75	123.1		
Dodecane	112-40-3	23	170.3		661.6
Butane,tetrachloro-,hexafluoro-	423-38-1	26.49	303.8		

Tentatively Identified Volatile Organic Compounds from SL-639

			File -->	01101710	01100307	01101707	01100308	01112707
			Sample -->	02-00184	01-02351	02-00354	01-02352	02-00841
			Cylinder ID -->	24G52-7 CLYB	24G43-5 CLY I	24G55-6 CLYD	24G43-6 CLYF	24G68-6 CLYH
			Resin Mass (g)	1.8026	1.804	1.8007	1.7583	1.8014
			Medium-->	water	water	water	water	water
			Temperature (C)-->	25	65	65	90	25
			Dose (R)-->					1.E+08
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW					
Isobutane	75-28-5	3.28	58.12			9	8	2179
1-Propene, 2-methyl-	115-11-7	3.44	56.1		13	14	44	
Silane, methyl	992-94-9	3.62	46.1	31		13		
Propane, 2,2-dimethyl-	463-82-1	3.71	72.1					
2-Butene	590-18-1	3.81	56.1					
Butane, 2-methyl-	78-78-4	4.5	72.1					182
Pentane	109-66-0	4.85	72.1					
1,2-Butadiene	590-19-2	5.06	54.1					
2-Pentene	627-20-3	5.27	70.1					
Ethanol	64-17-5	5.38	46.1					
Cyclopropane, 1,1-dimethyl-	1630-94-0	5.43	70.1					
Ether	60-29-7	5.5	74.1					
Propanal	123-38-6	5.67	50.1					
Butane, 2,2-dimethyl	75-83-2	5.77	86.2					
Acetone	67-64-1	5.87	58.1					
Carbon Disulfide	75-15-0	5.92	76.1					
Isopropyl Alcohol	67-63-0	6.24	60.1	17				9
Acetonitrile	75-05-8	6.36	41.1					
Propene	115-07-1	6.41	42.1					
Unknown		6.45		41				
Pentane, 2-methyl-	107-83-5	6.61	86.2					74
Propane, 2-chloro-2-methyl-	507-20-0	6.66	92.6					
2-Propanol, 2-methyl-	75-65-0	6.83	74.1	54	100	54	73	32
1-Propene, 2-metoxy-	116-11-0	6.85	72.1					
Propane, 2-ethoxy	625-54-7	6.97	88.1					
Cyanogen, bromide	506-68-3	7	105.9					
Pentane, 3-methyl-	96-14-0	7.07	86.2					
Methyl nitrate	598-58-3	7.1	77					
Propane, 2-methoxy-2methyl-	1634-04-4	7.21	88.1					
2-Pentyne	627-21-4	7.4	68.1					
1,2_Butadiene, 3-methyl-	598-25-4	7.46	68.1					
Propanal, 2-methyl-	78-84-2	7.56	72.1					
2-Butenal	4170-30-3	7.88	70.1			8		

Tentatively Identified Volatile Organic Compounds from SL-639

			File -->	01101710	01100307	01101707	01100308	01112707
			Sample -->	02-00184	01-02351	02-00354	01-02352	02-00841
			Cylinder ID -->	24G52-7 CLYB	24G43-5 CLY I	24G55-6 CLYD	24G43-6 CLYF	24G68-6 CLYH
			Resin Mass (g)	1.8026	1.804	1.8007	1.7583	1.8014
			Medium-->	water	water	water	water	water
			Temperature (C)-->	25	65	65	90	25
			Dose (R)-->					1.E+08
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW					
1-Pentene, 4,4-dimethyl-	762-62-9	8.11	98.2					
Butane, 2,2,3-trimethyl-	464-06-2	8.36	100.2					
1-Propanol	71-23-8	8.39	60.1					
Pentane, 2,2-dimethyl-	590-35-2	8.41	100.2					186
Hexane	110-54-3	8.54	86.2					
Propanal, 2,2-dimethyl	630-19-3	8.55	86.1					
Butanal	123-72-8	8.67	72.1	19				
Propane, 1-chloro-2-methyl-	513-36-0	8.71	92.6					
Silanol, trimethyl-	66-40-6	8.79	90			23		
Methane, nitro-	75-52-5	8.83	61					
Pentane, 2,4-dimethyl-	108-08-7	8.8	100.2					65
Butane, 2,2,3-trimethyl-	464-06-2	8.91	100.2					797
Propanenitrile	107-12-0	9.07	55.1	17				
2-Butanone	78-93-3	9.14	72.1					
3-Hexyne	928-49-4	9.25	82.1					
Furan, tetrahydro-	109-99-9	9.28	72.1	260	63	109	65	
Pentane, 3,3-dimethyl-	562-49-2	9.44	100.2					
Oxirane, ethyl	106-88-7	9.46	72.1					
Nitric acid, ethyl ester	625-58-1	9.88	91.1					
1,3-Dioxolane, 2-methyl-	497-26-7	10.15	88.1					
3-Hexanol	623-37-0	10.45	102.2					
Butane, 2,2,3,3-tetramethyl-	594-82-1	10.57	114.2					899
Acetic acid	64-19-7	10.8	60.1					
2-Butanone, 3-methyl-	563-80-4	10.87	86.1					
Heptane	142-82-5	10.92	100.2		15		69	
2-Propen-1-ol, 2-methyl-	513-42-8	11.13	72.1					
1-Butanol	71-36-3	11.42	72.1					
1-Pentene, 2,4,4-trimethyl-	107-39-1	11.44	112.2					
Butane, tetramethyl-	na	11.6	114.2					3957
Pentanal	110-62-3	11.78	86.1	8	13			
2-Pentanone	107-87-9	11.93	86.1					
Hexane, 2,2-dimethyl-	590-73-8	11.97	114.2					110
3-Pentanone	96-22-0	12.15	86.1					

Tentatively Identified Volatile Organic Compounds from SL-639

			File -->	01101710	01100307	01101707	01100308	01112707
			Sample -->	02-00184	01-02351	02-00354	01-02352	02-00841
			Cylinder ID -->	24G52-7 CLYB	24G43-5 CLY I	24G55-6 CLYD	24G43-6 CLYF	24G68-6 CLYH
			Resin Mass (g)	1.8026	1.804	1.8007	1.7583	1.8014
			Medium-->	water	water	water	water	water
			Temperature (C)-->	25	65	65	90	25
			Dose (R)-->					1.E+08
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW					
2-Butanone, 3,3-dimethyl-	75-97-8	12.37	100.2					
2,4-Hexadiene, 3-methyl-	28823-42-9	12.46	96					
Pentane, 2,2,4,4-tetramethyl-	1070-87-7	13.05	128.3					88
Hexane, 2,2,5-trimethyl-	3522-94-9	13.24	128.3					
Methyl Isobutyl Ketone	108-10-1	13.29	100.2			110	157	21
2-Butenal, 2-methyl-	497-03-0	13.55	84.1					
2-Pentanone, 3-methyl	565-61-7	13.59	100.2					
Propane, 2-methyl-2-nitro	594-70-7	13.89	103.1					
2-Pentanone, 4,4-dimethyl-	590-50-1	14.4	114.2					
Hexane, 2,2,5,5-tetramethyl-	1071-81-4	14.58	142.3					
3-Hexanone	589-38-8	14.64	100.2					
2,3,5-Trimethylfuran	10504-04-8	14.73	110					
Hexanal	66-25-1	14.74	100.2		20			
2-Hexanone	591-78-6	14.86	100.2					
2-Pentenoic acid, 2-methyl-	3142-72-1	15.09	114.1					
1,3-Dioxolane, 2,4-dimethyl-	766-20-1	15.2	116.2					
Pentane, 2,2,3,3-tetramethyl-	7154-79-2	15.43	128.3					81
Isoxazole, 3,5-dimethyl-	300-87-8	15.67	97.1					
5,5-Dimethyl-1,3-hexadiene	1515-79-3	15.9	110					
Cyclohexane, 1,1,3,5-tetramethyl-	50876-31-8	16.4	140.3					
3-Heptanone	06-35-4	17.18	114	15				
Heptanal	111-71-7	17.36	114.2	14	30			
1,3-Dioxane, 2-ethyl-5-methyl	627-54-7	17.58	130					
Benzene, nitroso-	586-96-9	17.79	107.1					
Ethanamine, N-ethyl-N-nitroso-	55-18-5	18.52	102.1					
1H-Benzotriazole	95-14-7	18.7	119.1					
Tetramethyloctane	na	18.75	154					
Benzene, isocyanato-	103-71-9	19.13	119.1					
Benzaldehyde	100-52-7	19.37	106.1	52				
Octanal	124-13-0	19.94	128.2	12	36			
Benzonitrile	100-47-0	20.38	103.1	33				

Tentatively Identified Volatile Organic Compounds from SL-639

			File -->	01101710	01100307	01101707	01100308	01112707
			Sample -->	02-00184	01-02351	02-00354	01-02352	02-00841
			Cylinder ID -->	24G52-7 CLYB	24G43-5 CLY I	24G55-6 CLYD	24G43-6 CLYF	24G68-6 CLYH
			Resin Mass (g)	1.8026	1.804	1.8007	1.7583	1.8014
			Medium-->	water	water	water	water	water
			Temperature (C)-->	25	65	65	90	25
			Dose (R)-->					1.E+08
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW					
Butane,1,1,3,4-tetrachloro-1,2,2,3,4,4-hexafluoro-	423-38-1	21.35	303.8	33		45	28	
Acetophenone	98-86-2	21.93	120.2	31				
Nonanal	124-19-6	22.1	142.2	16	44			
Benzenemethanol,.alpha.,.alpha.-dimethyl-	617-94-7	22.35	136.2		25			
Benzenoacetonitrile,.alpha.-oxo-	613-90-1	22.6	131.1					
Benzene, nitro	98-95-3	22.75	123.1					
Dodecane	112-40-3	23	170.3			0	88	
Butane,tetrachloro-,hexafluoro-	423-38-1	26.49	303.8			94		

Tentatively Identified Volatile Organic Compounds from SL-639

			File -->	01101710	01110207	01111606	01111607	02020104
			Sample -->	02-00358	02-00370	02-00748	02-00749	02-01380
			Cylinder ID -->	24G57-11 CLYG	24G60-5 CLYH	24G64-4 CLYH	24G64-5 CLYH	24G83-9
			Resin Mass (g)	1.8033	1.8	1.8044	1.8024	1.69
			Medium-->	water	water	water	water	water
			Temperature (C)-->	65	65	65	65	90
			Dose (R)-->	1.E+06	1.E+07	1.E+08	1.E+08	1.E+08
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW					
Isobutane	75-28-5	3.28	58.12	99	5368	160356	4358	20607
1-Propene, 2-methyl-	115-11-7	3.44	56.1	55				
Silane, methyl	992-94-9	3.62	46.1	26				
Propane, 2,2-dimethyl-	463-82-1	3.71	72.1					
2-Butene	590-18-1	3.81	56.1					
Butane, 2-methyl-	78-78-4	4.5	72.1					5114
Pentane	109-66-0	4.85	72.1					
1,2-Butadiene	590-19-2	5.06	54.1					
2-Pentene	627-20-3	5.27	70.1					
Ethanol	64-17-5	5.38	46.1					
Cyclopropane, 1,1-dimethyl-	1630-94-0	5.43	70.1					
Ether	60-29-7	5.5	74.1					
Propanal	123-38-6	5.67	50.1					
Butane, 2,2-dimethyl	75-83-2	5.77	86.2			34695	665	6107
Acetone	67-64-1	5.87	58.1	32	537			
Carbon Disulfide	75-15-0	5.92	76.1					
Isopropyl Alcohol	67-63-0	6.24	60.1					
Acetonitrile	75-05-8	6.36	41.1					
Propene	115-07-1	6.41	42.1					
Unknown		6.45						
Pentane, 2-methyl-	107-83-5	6.61	86.2			6709	144	1834
Propane, 2-chloro-2-methyl-	507-20-0	6.66	92.6					
2-Propanol, 2-methyl-	75-65-0	6.83	74.1	45	514			2208
1-Propene, 2-metoxy-	116-11-0	6.85	72.1					
Propane, 2-ethoxy	625-54-7	6.97	88.1					
Cyanogen, bromide	506-68-3	7	105.9					
Pentane, 3-methyl-	96-14-0	7.07	86.2					3080
Methyl nitrate	598-58-3	7.1	77					
Propane, 2-methoxy-2methyl-	1634-04-4	7.21	88.1					
2-Pentyne	627-21-4	7.4	68.1					
1,2_Butadiene, 3-methyl-	598-25-4	7.46	68.1					
Propanal, 2-methyl-	78-84-2	7.56	72.1					
2-Butenal	4170-30-3	7.88	70.1					

Tentatively Identified Volatile Organic Compounds from SL-639

			File -->	01101710	01110207	01111606	01111607	02020104
			Sample -->	02-00358	02-00370	02-00748	02-00749	02-01380
			Cylinder ID -->	24G57-11 CLYG	24G60-5 CLYH	24G64-4 CLYH	24G64-5 CLYH	24G83-9
			Resin Mass (g)	1.8033	1.8	1.8044	1.8024	1.69
			Medium-->	water	water	water	water	water
			Temperature (C)-->	65	65	65	65	90
			Dose (R)-->	1.E+06	1.E+07	1.E+08	1.E+08	1.E+08
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW					
1-Pentene, 4,4-dimethyl-	762-62-9	8.11	98.2					32
Butane, 2,2,3-trimethyl-	464-06-2	8.36	100.2			5863	117	
1-Propanol	71-23-8	8.39	60.1					
Pentane, 2,2-dimethyl-	590-35-2	8.41	100.2					8742
Hexane	110-54-3	8.54	86.2					50
Propanal, 2,2-dimethyl	630-19-3	8.55	86.1					
Butanal	123-72-8	8.67	72.1	13				
Propane, 1-chloro-2-methyl-	513-36-0	8.71	92.6					124
Silanol, trimethyl-	66-40-6	8.79	90	51				
Methane, nitro-	75-52-5	8.83	61					
Pentane, 2,4-dimethyl-	108-08-7	8.8	100.2			26272	467	179
Butane, 2,2,3-trimethyl-	464-06-2	8.91	100.2					2772
Propanenitrile	107-12-0	9.07	55.1					
2-Butanone	78-93-3	9.14	72.1					
3-Hexyne	928-49-4	9.25	82.1					
Furan, tetrahydro-	109-99-9	9.28	72.1					
Pentane, 3,3-dimethyl-	562-49-2	9.44	100.2					
Oxirane, ethyl	106-88-7	9.46	72.1					
Nitric acid, ethyl ester	625-58-1	9.88	91.1					
1,3-Dioxolane, 2-methyl-	497-26-7	10.15	88.1					
3-Hexanol	623-37-0	10.45	102.2					
Butane, 2,2,3,3-tetramethyl-	594-82-1	10.57	114.2			28682	552	20414
Acetic acid	64-19-7	10.8	60.1					
2-Butanone, 3-methyl-	563-80-4	10.87	86.1					
Heptane	142-82-5	10.92	100.2					
2-Propen-1-ol, 2-methyl-	513-42-8	11.13	72.1					
1-Butanol	71-36-3	11.42	72.1	131				
1-Pentene, 2,4,4-trimethyl-	107-39-1	11.44	112.2			61934	1245	1990
Butane, tetramethyl-	na	11.6	114.2			28682	552	35076
Pentanal	110-62-3	11.78	86.1					
2-Pentanone	107-87-9	11.93	86.1					
Hexane, 2,2-dimethyl-	590-73-8	11.97	114.2					2714
3-Pentanone	96-22-0	12.15	86.1					

Tentatively Identified Volatile Organic Compounds from SL-639

			File -->	01101710	01110207	01111606	01111607	02020104
			Sample -->	02-00358	02-00370	02-00748	02-00749	02-01380
			Cylinder ID -->	24G57-11 CLYG	24G60-5 CLYH	24G64-4 CLYH	24G64-5 CLYH	24G83-9
			Resin Mass (g)	1.8033	1.8	1.8044	1.8024	1.69
			Medium-->	water	water	water	water	water
			Temperature (C)-->	65	65	65	65	90
			Dose (R)-->	1.E+06	1.E+07	1.E+08	1.E+08	1.E+08
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW					
2-Butanone, 3,3-dimethyl-	75-97-8	12.37	100.2					
2,4-Hexadiene, 3-methyl-	28823-42-9	12.46	96					
Pentane, 2,2,4,4-tetramethyl-	1070-87-7	13.05	128.3					1784
Hexane, 2,2,5-trimethyl-	3522-94-9	13.24	128.3					3094
Methyl Isobutyl Ketone	108-10-1	13.29	100.2	992				
2-Butenal, 2-methyl-	497-03-0	13.55	84.1					
2-Pentanone, 3-methyl	565-61-7	13.59	100.2					
Propane, 2-methyl-2-nitro	594-70-7	13.89	103.1					
2-Pentanone, 4,4-dimethyl-	590-50-1	14.4	114.2					
Hexane, 2,2,5,5-tetramethyl-	1071-81-4	14.58	142.3					2655
3-Hexanone	589-38-8	14.64	100.2					
2,3,5-Trimethylfuran	10504-04-8	14.73	110					
Hexanal	66-25-1	14.74	100.2					
2-Hexanone	591-78-6	14.86	100.2					
2-Pentenoic acid, 2-methyl-	3142-72-1	15.09	114.1					
1,3-Dioxolane, 2,4-dimethyl-	766-20-1	15.2	116.2					
Pentane, 2,2,3,3-tetramethyl-	7154-79-2	15.43	128.3					
Isoxazole, 3,5-dimethyl-	300-87-8	15.67	97.1					
5,5-Dimethyl-1,3-hexadiene	1515-79-3	15.9	110					
Cyclohexane, 1,1,3,5-tetramethyl-	50876-31-8	16.4	140.3					
3-Heptanone	06-35-4	17.18	114					
Heptanal	111-71-7	17.36	114.2					
1,3-Dioxane, 2-ethyl-5-methyl	627-54-7	17.58	130					
Benzene, nitroso-	586-96-9	17.79	107.1					
Ethanamine, N-ethyl-N-nitroso-	55-18-5	18.52	102.1					
1H-Benzotriazole	95-14-7	18.7	119.1					
Tetramethyloctane	na	18.75	154					
Benzene, isocyanato-	103-71-9	19.13	119.1					
Benzaldehyde	100-52-7	19.37	106.1					
Octanal	124-13-0	19.94	128.2					
Benzonitrile	100-47-0	20.38	103.1					

Tentatively Identified Volatile Organic Compounds from SL-639

			File -->	01101710	01110207	01111606	01111607	02020104
			Sample -->	02-00358	02-00370	02-00748	02-00749	02-01380
			Cylinder ID -->	24G57-11 CLYG	24G60-5 CLYH	24G64-4 CLYH	24G64-5 CLYH	24G83-9
			Resin Mass (g)	1.8033	1.8	1.8044	1.8024	1.69
			Medium-->	water	water	water	water	water
			Temperature (C)-->	65	65	65	65	90
			Dose (R)-->	1.E+06	1.E+07	1.E+08	1.E+08	1.E+08
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW					
Butane,1,1,3,4-tetrachloro-1,2,2,3,4,4-hexafluoro-	423-38-1	21.35	303.8					
Acetophenone	98-86-2	21.93	120.2					
Nonanal	124-19-6	22.1	142.2					
Benzenemethanol,.alpha.,.alpha.-dimethyl-	617-94-7	22.35	136.2					
Benzenoacetonitrile,.alpha.-oxo-	613-90-1	22.6	131.1					
Benzene, nitro	98-95-3	22.75	123.1					
Dodecane	112-40-3	23	170.3	3				
Butane,tetrachloro-,hexafluoro-	423-38-1	26.49	303.8					

Tentatively Identified Volatile Organic Compounds from SL-639

			File -->	01100304	01101704	01101706	01100305	01100306
			Sample -->	01-02347	02-00278	02-00353	01-02348	01-02349
			Cylinder ID -->	24G43-1 CLY E	24G52-8 CLYF	24G55-5 CLYC	24G43-2 CLY D	24G43-3 CLY C
			Resin Mass (g)	1.8009	1.8	1.8004	1.8025	1.8022
			Medium-->	AN105 sim	AN105 sim	AN105 sim	AN105 sim	AN105 sim
			Temperature (C)-->	25	25	25	65	90
			Dose (R)-->					
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW					
Isobutane	75-28-5	3.28	58.12					2
1-Propene, 2-methyl-	115-11-7	3.44	56.1			20	4	7
Silane, methyl	992-94-9	3.62	46.1			13		
Propane, 2,2-dimethyl-	463-82-1	3.71	72.1					
2-Butene	590-18-1	3.81	56.1					
Butane, 2-methyl-	78-78-4	4.5	72.1					
Pentane	109-66-0	4.85	72.1					
1,2-Butadiene	590-19-2	5.06	54.1					
2-Pentene	627-20-3	5.27	70.1					
Ethanol	64-17-5	5.38	46.1					
Cyclopropane, 1,1-dimethyl-	1630-94-0	5.43	70.1					
Ether	60-29-7	5.5	74.1					
Propanal	123-38-6	5.67	50.1					
Butane, 2,2-dimethyl	75-83-2	5.77	86.2					
Acetone	67-64-1	5.87	58.1					
Carbon Disulfide	75-15-0	5.92	76.1					
Isopropyl Alcohol	67-63-0	6.24	60.1			24	2	3
Acetonitrile	75-05-8	6.36	41.1					
Propene	115-07-1	6.41	42.1					
Unknown		6.45						
Pentane, 2-methyl-	107-83-5	6.61	86.2					
Propane, 2-chloro-2-methyl-	507-20-0	6.66	92.6					
2-Propanol, 2-methyl-	75-65-0	6.83	74.1	43	37	342	25	37
1-Propene, 2-metoxy-	116-11-0	6.85	72.1					
Propane, 2-ethoxy	625-54-7	6.97	88.1					
Cyanogen, bromide	506-68-3	7	105.9					
Pentane, 3-methyl-	96-14-0	7.07	86.2					
Methyl nitrate	598-58-3	7.1	77					
Propane, 2-methoxy-2methyl-	1634-04-4	7.21	88.1					
2-Pentyne	627-21-4	7.4	68.1					
1,2_Butadiene, 3-methyl-	598-25-4	7.46	68.1					
Propanal, 2-methyl-	78-84-2	7.56	72.1					
2-Butenal	4170-30-3	7.88	70.1					

Tentatively Identified Volatile Organic Compounds from SL-639

			File -->	01100304	01101704	01101706	01100305	01100306
			Sample -->	01-02347	02-00278	02-00353	01-02348	01-02349
			Cylinder ID -->	24G43-1 CLY E	24G52-8 CLYF	24G55-5 CLYC	24G43-2 CLY D	24G43-3 CLY C
			Resin Mass (g)	1.8009	1.8	1.8004	1.8025	1.8022
			Medium-->	AN105 sim	AN105 sim	AN105 sim	AN105 sim	AN105 sim
			Temperature (C)-->	25	25	25	65	90
			Dose (R)-->					
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW					
1-Pentene, 4,4-dimethyl-	762-62-9	8.11	98.2					
Butane, 2,2,3-trimethyl-	464-06-2	8.36	100.2					
1-Propanol	71-23-8	8.39	60.1					
Pentane, 2,2-dimethyl-	590-35-2	8.41	100.2					
Hexane	110-54-3	8.54	86.2					
Propanal, 2,2-dimethyl	630-19-3	8.55	86.1					
Butanal	123-72-8	8.67	72.1			11		
Propane, 1-chloro-2-methyl-	513-36-0	8.71	92.6					
Silanol, trimethyl-	66-40-6	8.79	90	10		23		
Methane, nitro-	75-52-5	8.83	61					
Pentane, 2,4-dimethyl-	108-08-7	8.8	100.2					
Butane, 2,2,3-trimethyl-	464-06-2	8.91	100.2					
Propanenitrile	107-12-0	9.07	55.1					
2-Butanone	78-93-3	9.14	72.1					
3-Hexyne	928-49-4	9.25	82.1					
Furan, tetrahydro-	109-99-9	9.28	72.1	63	63	379	63	63
Pentane, 3,3-dimethyl-	562-49-2	9.44	100.2					
Oxirane, ethyl	106-88-7	9.46	72.1				63	63
Nitric acid, ethyl ester	625-58-1	9.88	91.1					
1,3-Dioxolane, 2-methyl-	497-26-7	10.15	88.1					
3-Hexanol	623-37-0	10.45	102.2					
Butane, 2,2,3,3-tetramethyl-	594-82-1	10.57	114.2					
Acetic acid	64-19-7	10.8	60.1					
2-Butanone, 3-methyl-	563-80-4	10.87	86.1					
Heptane	142-82-5	10.92	100.2					
2-Propen-1-ol, 2-methyl-	513-42-8	11.13	72.1					
1-Butanol	71-36-3	11.42	72.1				7	
1-Pentene, 2,4,4-trimethyl-	107-39-1	11.44	112.2					
Butane, tetramethyl-	na	11.6	114.2					
Pentanal	110-62-3	11.78	86.1	8				
2-Pentanone	107-87-9	11.93	86.1					
Hexane, 2,2-dimethyl-	590-73-8	11.97	114.2					
3-Pentanone	96-22-0	12.15	86.1					

Tentatively Identified Volatile Organic Compounds from SL-639

			File -->	01100304	01101704	01101706	01100305	01100306
			Sample -->	01-02347	02-00278	02-00353	01-02348	01-02349
			Cylinder ID -->	24G43-1 CLY E	24G52-8 CLYF	24G55-5 CLYC	24G43-2 CLY D	24G43-3 CLY C
			Resin Mass (g)	1.8009	1.8	1.8004	1.8025	1.8022
			Medium-->	AN105 sim	AN105 sim	AN105 sim	AN105 sim	AN105 sim
			Temperature (C)-->	25	25	25	65	90
			Dose (R)-->					
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW					
2-Butanone, 3,3-dimethyl-	75-97-8	12.37	100.2				29	53
2,4-Hexadiene, 3-methyl-	28823-42-9	12.46	96					
Pentane, 2,2,4,4-tetramethyl-	1070-87-7	13.05	128.3					
Hexane, 2,2,5-trimethyl-	3522-94-9	13.24	128.3					
Methyl Isobutyl Ketone	108-10-1	13.29	100.2		28			
2-Butenal, 2-methyl-	497-03-0	13.55	84.1					
2-Pentanone, 3-methyl	565-61-7	13.59	100.2					
Propane, 2-methyl-2-nitro	594-70-7	13.89	103.1					
2-Pentanone, 4,4-dimethyl-	590-50-1	14.4	114.2					
Hexane, 2,2,5,5-tetramethyl-	1071-81-4	14.58	142.3					
3-Hexanone	589-38-8	14.64	100.2					
2,3,5-Trimethylfuran	10504-04-8	14.73	110					
Hexanal	66-25-1	14.74	100.2	9			8	
2-Hexanone	591-78-6	14.86	100.2					
2-Pentenoic acid, 2-methyl-	3142-72-1	15.09	114.1					
1,3-Dioxolane, 2,4-dimethyl-	766-20-1	15.2	116.2					
Pentane, 2,2,3,3-tetramethyl-	7154-79-2	15.43	128.3					
Isoxazole, 3,5-dimethyl-	300-87-8	15.67	97.1					
5,5-Dimethyl-1,3-hexadiene	1515-79-3	15.9	110					
Cyclohexane, 1,1,3,5-tetramethyl-	50876-31-8	16.4	140.3					
3-Heptanone	06-35-4	17.18	114					13
Heptanal	111-71-7	17.36	114.2	11			12	
1,3-Dioxane, 2-ethyl-5-methyl	627-54-7	17.58	130					
Benzene, nitroso-	586-96-9	17.79	107.1					
Ethanamine, N-ethyl-N-nitroso-	55-18-5	18.52	102.1					
1H-Benzotriazole	95-14-7	18.7	119.1					
Tetramethyloctane	na	18.75	154					
Benzene, isocyanato-	103-71-9	19.13	119.1					
Benzaldehyde	100-52-7	19.37	106.1	11				
Octanal	124-13-0	19.94	128.2					
Benzonitrile	100-47-0	20.38	103.1					

Tentatively Identified Volatile Organic Compounds from SL-639

			File -->	01100304	01101704	01101706	01100305	01100306
			Sample -->	01-02347	02-00278	02-00353	01-02348	01-02349
			Cylinder ID -->	24G43-1 CLY E	24G52-8 CLYF	24G55-5 CLYC	24G43-2 CLY D	24G43-3 CLY C
			Resin Mass (g)	1.8009	1.8	1.8004	1.8025	1.8022
			Medium-->	AN105 sim	AN105 sim	AN105 sim	AN105 sim	AN105 sim
			Temperature (C)-->	25	25	25	65	90
			Dose (R)-->					
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW					
Butane,1,1,3,4-tetrachloro-1,2,2,3,4,4-hexafluoro-	423-38-1	21.35	303.8	28		46	59	
Acetophenone	98-86-2	21.93	120.2					
Nonanal	124-19-6	22.1	142.2					
Benzenemethanol,.alpha.,.alpha.-dimethyl-	617-94-7	22.35	136.2					
Benzenoacetonitrile,.alpha.-oxo-	613-90-1	22.6	131.1					
Benzene, nitro	98-95-3	22.75	123.1					
Dodecane	112-40-3	23	170.3					
Butane,tetrachloro-,hexafluoro-	423-38-1	26.49	303.8	28		46	59	

Tentatively Identified Volatile Organic Compounds from SL-639

			File -->	01101705	01111207	02013004	01112704	01120607
			Sample -->	02-00355	02-00672	02-01282	02-00838	02-00882
			Cylinder ID -->	24G57-8 CLYL	24G62-9 CLYC	24G81-9 CLYJ	24G68-3 CLYG	24G71-8 CLYM
			Resin Mass (g)	1.802	1.802	1.8032	1.802	1.8011
			Medium-->	AN105 sim	AN105 sim	AN105 sim	AN105 sim	AN105 sim
			Temperature (C)-->	25	25	25	25	65
			Dose (R)-->	1.E+06	1.E+08	1.E+07	1.E+08	1.E+08
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW					
Isobutane	75-28-5	3.28	58.12		710	61	259	62748
1-Propene, 2-methyl-	115-11-7	3.44	56.1	19	459	62	186	
Silane, methyl	992-94-9	3.62	46.1	9		14		
Propane, 2,2-dimethyl-	463-82-1	3.71	72.1		735		334	
2-Butene	590-18-1	3.81	56.1					
Butane, 2-methyl-	78-78-4	4.5	72.1		63			1805
Pentane	109-66-0	4.85	72.1					
1,2-Butadiene	590-19-2	5.06	54.1					
2-Pentene	627-20-3	5.27	70.1					
Ethanol	64-17-5	5.38	46.1					
Cyclopropane, 1,1-dimethyl-	1630-94-0	5.43	70.1					
Ether	60-29-7	5.5	74.1					
Propanal	123-38-6	5.67	50.1					
Butane, 2,2-dimethyl	75-83-2	5.77	86.2					4324
Acetone	67-64-1	5.87	58.1		854	262	776	
Carbon Disulfide	75-15-0	5.92	76.1					
Isopropyl Alcohol	67-63-0	6.24	60.1	11	28		12	
Acetonitrile	75-05-8	6.36	41.1					
Propene	115-07-1	6.41	42.1					
Unknown		6.45			51		25	
Pentane, 2-methyl-	107-83-5	6.61	86.2					561
Propane, 2-chloro-2-methyl-	507-20-0	6.66	92.6					
2-Propanol, 2-methyl-	75-65-0	6.83	74.1	311	4629	628	2695	28410
1-Propene, 2-metoxy-	116-11-0	6.85	72.1		45		31	
Propane, 2-ethoxy	625-54-7	6.97	88.1					
Cyanogen, bromide	506-68-3	7	105.9					
Pentane, 3-methyl-	96-14-0	7.07	86.2					
Methyl nitrate	598-58-3	7.1	77					
Propane, 2-methoxy-2methyl-	1634-04-4	7.21	88.1					
2-Pentyne	627-21-4	7.4	68.1					
1,2_Butadiene, 3-methyl-	598-25-4	7.46	68.1					
Propanal, 2-methyl-	78-84-2	7.56	72.1		914		461	
2-Butenal	4170-30-3	7.88	70.1		22			

Tentatively Identified Volatile Organic Compounds from SL-639

			File -->	01101705	01111207	02013004	01112704	01120607
			Sample -->	02-00355	02-00672	02-01282	02-00838	02-00882
			Cylinder ID -->	24G57-8 CLYL	24G62-9 CLYC	24G81-9 CLYJ	24G68-3 CLYG	24G71-8 CLYM
			Resin Mass (g)	1.802	1.802	1.8032	1.802	1.8011
			Medium-->	AN105 sim	AN105 sim	AN105 sim	AN105 sim	AN105 sim
			Temperature (C)-->	25	25	25	25	65
			Dose (R)-->	1.E+06	1.E+08	1.E+07	1.E+08	1.E+08
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW					
1-Pentene, 4,4-dimethyl-	762-62-9	8.11	98.2					
Butane, 2,2,3-trimethyl-	464-06-2	8.36	100.2					
1-Propanol	71-23-8	8.39	60.1					
Pentane, 2,2-dimethyl-	590-35-2	8.41	100.2				11	552
Hexane	110-54-3	8.54	86.2					
Propanal, 2,2-dimethyl	630-19-3	8.55	86.1					1883
Butanal	123-72-8	8.67	72.1	9		12		
Propane, 1-chloro-2-methyl-	513-36-0	8.71	92.6					
Silanol, trimethyl-	66-40-6	8.79	90					
Methane, nitro-	75-52-5	8.83	61					
Pentane, 2,4-dimethyl-	108-08-7	8.8	100.2					
Butane, 2,2,3-trimethyl-	464-06-2	8.91	100.2					3328
Propanenitrile	107-12-0	9.07	55.1					
2-Butanone	78-93-3	9.14	72.1		260		114	
3-Hexyne	928-49-4	9.25	82.1					
Furan, tetrahydro-	109-99-9	9.28	72.1	140	45			
Pentane, 3,3-dimethyl-	562-49-2	9.44	100.2					
Oxirane, ethyl	106-88-7	9.46	72.1					
Nitric acid, ethyl ester	625-58-1	9.88	91.1					
1,3-Dioxolane, 2-methyl-	497-26-7	10.15	88.1					
3-Hexanol	623-37-0	10.45	102.2				109	
Butane, 2,2,3,3-tetramethyl-	594-82-1	10.57	114.2		93	51		8356
Acetic acid	64-19-7	10.8	60.1					
2-Butanone, 3-methyl-	563-80-4	10.87	86.1				27	
Heptane	142-82-5	10.92	100.2					
2-Propen-1-ol, 2-methyl-	513-42-8	11.13	72.1		69		72	
1-Butanol	71-36-3	11.42	72.1					
1-Pentene, 2,4,4-trimethyl-	107-39-1	11.44	112.2					
Butane, tetramethyl-	na	11.6	114.2		93	121	288	17575
Pentanal	110-62-3	11.78	86.1					
2-Pentanone	107-87-9	11.93	86.1				8	
Hexane, 2,2-dimethyl-	590-73-8	11.97	114.2					
3-Pentanone	96-22-0	12.15	86.1					

Tentatively Identified Volatile Organic Compounds from SL-639

			File -->	01101705	01111207	02013004	01112704	01120607
			Sample -->	02-00355	02-00672	02-01282	02-00838	02-00882
			Cylinder ID -->	24G57-8 CLYL	24G62-9 CLYC	24G81-9 CLYJ	24G68-3 CLYG	24G71-8 CLYM
			Resin Mass (g)	1.802	1.802	1.8032	1.802	1.8011
			Medium-->	AN105 sim	AN105 sim	AN105 sim	AN105 sim	AN105 sim
			Temperature (C)-->	25	25	25	25	65
			Dose (R)-->	1.E+06	1.E+08	1.E+07	1.E+08	1.E+08
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW					
2-Butanone, 3,3-dimethyl-	75-97-8	12.37	100.2		61		62	
2,4-Hexadiene, 3-methyl-	28823-42-9	12.46	96					
Pentane, 2,2,4,4-tetramethyl-	1070-87-7	13.05	128.3				46	1067
Hexane, 2,2,5-trimethyl-	3522-94-9	13.24	128.3					
Methyl Isobutyl Ketone	108-10-1	13.29	100.2	23				
2-Butenal, 2-methyl-	497-03-0	13.55	84.1					
2-Pentanone, 3-methyl	565-61-7	13.59	100.2					
Propane, 2-methyl-2-nitro	594-70-7	13.89	103.1	19	75	102	11	
2-Pentanone, 4,4-dimethyl-	590-50-1	14.4	114.2		79		54	
Hexane, 2,2,5,5-tetramethyl-	1071-81-4	14.58	142.3					
3-Hexanone	589-38-8	14.64	100.2					
2,3,5-Trimethylfuran	10504-04-8	14.73	110					
Hexanal	66-25-1	14.74	100.2					
2-Hexanone	591-78-6	14.86	100.2					
2-Pentenoic acid, 2-methyl-	3142-72-1	15.09	114.1					
1,3-Dioxolane, 2,4-dimethyl-	766-20-1	15.2	116.2					
Pentane, 2,2,3,3-tetramethyl-	7154-79-2	15.43	128.3		60		36	561
Isoxazole, 3,5-dimethyl-	300-87-8	15.67	97.1					
5,5-Dimethyl-1,3-hexadiene	1515-79-3	15.9	110					
Cyclohexane, 1,1,3,5-tetramethyl-	50876-31-8	16.4	140.3					
3-Heptanone	06-35-4	17.18	114					
Heptanal	111-71-7	17.36	114.2					
1,3-Dioxane, 2-ethyl-5-methyl	627-54-7	17.58	130					
Benzene, nitroso-	586-96-9	17.79	107.1					
Ethanamine, N-ethyl-N-nitroso-	55-18-5	18.52	102.1					
1H-Benzotriazole	95-14-7	18.7	119.1					
Tetramethyloctane	na	18.75	154					
Benzene, isocyanato-	103-71-9	19.13	119.1					
Benzaldehyde	100-52-7	19.37	106.1					
Octanal	124-13-0	19.94	128.2					
Benzonitrile	100-47-0	20.38	103.1					

Tentatively Identified Volatile Organic Compounds from SL-639

			File -->	01101705	01111207	02013004	01112704	01120607
			Sample -->	02-00355	02-00672	02-01282	02-00838	02-00882
			Cylinder ID -->	24G57-8 CLYL	24G62-9 CLYC	24G81-9 CLYJ	24G68-3 CLYG	24G71-8 CLYM
			Resin Mass (g)	1.802	1.802	1.8032	1.802	1.8011
			Medium-->	AN105 sim	AN105 sim	AN105 sim	AN105 sim	AN105 sim
			Temperature (C)-->	25	25	25	25	65
			Dose (R)-->	1.E+06	1.E+08	1.E+07	1.E+08	1.E+08
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW					
Butane,1,1,3,4-tetrachloro-1,2,2,3,4,4-hexafluoro-	423-38-1	21.35	303.8	29			54	
Acetophenone	98-86-2	21.93	120.2					
Nonanal	124-19-6	22.1	142.2					
Benzenemethanol,.alpha.,.alpha.-dimethyl-	617-94-7	22.35	136.2				0	
Benzenoacetonitrile,.alpha.-oxo-	613-90-1	22.6	131.1					
Benzene, nitro	98-95-3	22.75	123.1					
Dodecane	112-40-3	23	170.3					
Butane,tetrachloro-,hexafluoro-	423-38-1	26.49	303.8					

Tentatively Identified Volatile Organic Compounds from SL-639

			File -->	01112107	01120606
			Sample -->	02-00835	02-00893
			Cylinder ID -->	24G66-9 CLYH	24G73-5 CLYM
			Resin Mass (g)	1.8017	1.8066
			Medium-->	AN105 sim	none
			Temperature (C)-->	90	25
			Dose (R)-->	1.E+08	1.E+08
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW		
Isobutane	75-28-5	3.28	58.12	63864	69720
1-Propene, 2-methyl-	115-11-7	3.44	56.1		
Silane, methyl	992-94-9	3.62	46.1		
Propane, 2,2-dimethyl-	463-82-1	3.71	72.1		
2-Butene	590-18-1	3.81	56.1		
Butane, 2-methyl-	78-78-4	4.5	72.1	5132	
Pentane	109-66-0	4.85	72.1		
1,2-Butadiene	590-19-2	5.06	54.1		
2-Pentene	627-20-3	5.27	70.1		
Ethanol	64-17-5	5.38	46.1		
Cyclopropane, 1,1-dimethyl-	1630-94-0	5.43	70.1		
Ether	60-29-7	5.5	74.1		
Propanal	123-38-6	5.67	50.1		
Butane, 2,2-dimethyl	75-83-2	5.77	86.2	5820	
Acetone	67-64-1	5.87	58.1		5856
Carbon Disulfide	75-15-0	5.92	76.1		
Isopropyl Alcohol	67-63-0	6.24	60.1		772
Acetonitrile	75-05-8	6.36	41.1		
Propene	115-07-1	6.41	42.1		
Unknown		6.45			
Pentane, 2-methyl-	107-83-5	6.61	86.2	1310	
Propane, 2-chloro-2-methyl-	507-20-0	6.66	92.6		26
2-Propanol, 2-methyl-	75-65-0	6.83	74.1	15333	13498
1-Propene, 2-metoxy-	116-11-0	6.85	72.1		
Propane, 2-ethoxy	625-54-7	6.97	88.1		
Cyanogen, bromide	506-68-3	7	105.9		
Pentane, 3-methyl-	96-14-0	7.07	86.2		
Methyl nitrate	598-58-3	7.1	77		
Propane, 2-methoxy-2methyl-	1634-04-4	7.21	88.1		4208
2-Pentyne	627-21-4	7.4	68.1		
1,2_Butadiene, 3-methyl-	598-25-4	7.46	68.1		
Propanal, 2-methyl-	78-84-2	7.56	72.1		
2-Butenal	4170-30-3	7.88	70.1		

Tentatively Identified Volatile Organic Compounds from SL-639

			File -->	01112107	01120606
			Sample -->	02-00835	02-00893
			Cylinder ID -->	24G66-9 CLYH	24G73-5 CLYM
			Resin Mass (g)	1.8017	1.8066
			Medium-->	AN105 sim	none
			Temperature (C)-->	90	25
			Dose (R)-->	1.E+08	1.E+08
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW		
1-Pentene, 4,4-dimethyl-	762-62-9	8.11	98.2		
Butane, 2,2,3-trimethyl-	464-06-2	8.36	100.2		
1-Propanol	71-23-8	8.39	60.1		
Pentane, 2,2-dimethyl-	590-35-2	8.41	100.2	1517	320
Hexane	110-54-3	8.54	86.2		
Propanal, 2,2-dimethyl	630-19-3	8.55	86.1	4212	
Butanal	123-72-8	8.67	72.1		
Propane, 1-chloro-2-methyl-	513-36-0	8.71	92.6		
Silanol, trimethyl-	66-40-6	8.79	90		
Methane, nitro-	75-52-5	8.83	61		
Pentane, 2,4-dimethyl-	108-08-7	8.8	100.2	6774	
Butane, 2,2,3-trimethyl-	464-06-2	8.91	100.2		3607
Propanenitrile	107-12-0	9.07	55.1		
2-Butanone	78-93-3	9.14	72.1		
3-Hexyne	928-49-4	9.25	82.1		
Furan, tetrahydro-	109-99-9	9.28	72.1		
Pentane, 3,3-dimethyl-	562-49-2	9.44	100.2		
Oxirane, ethyl	106-88-7	9.46	72.1		
Nitric acid, ethyl ester	625-58-1	9.88	91.1		
1,3-Dioxolane, 2-methyl-	497-26-7	10.15	88.1		1216
3-Hexanol	623-37-0	10.45	102.2		
Butane, 2,2,3,3-tetramethyl-	594-82-1	10.57	114.2	23191	1740
Acetic acid	64-19-7	10.8	60.1		
2-Butanone, 3-methyl-	563-80-4	10.87	86.1		
Heptane	142-82-5	10.92	100.2		
2-Propen-1-ol, 2-methyl-	513-42-8	11.13	72.1		
1-Butanol	71-36-3	11.42	72.1		
1-Pentene, 2,4,4-trimethyl-	107-39-1	11.44	112.2	1310	
Butane, tetramethyl-	na	11.6	114.2	38286	4056
Pentanal	110-62-3	11.78	86.1		
2-Pentanone	107-87-9	11.93	86.1		
Hexane, 2,2-dimethyl-	590-73-8	11.97	114.2		
3-Pentanone	96-22-0	12.15	86.1		

Tentatively Identified Volatile Organic Compounds from SL-639

			File -->	01112107	01120606
			Sample -->	02-00835	02-00893
			Cylinder ID -->	24G66-9 CLYH	24G73-5 CLYM
			Resin Mass (g)	1.8017	1.8066
			Medium-->	AN105 sim	none
			Temperature (C)-->	90	25
			Dose (R)-->	1.E+08	1.E+08
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW		
2-Butanone, 3,3-dimethyl-	75-97-8	12.37	100.2		
2,4-Hexadiene, 3-methyl-	28823-42-9	12.46	96		
Pentane, 2,2,4,4-tetramethyl-	1070-87-7	13.05	128.3	2031	
Hexane, 2,2,5-trimethyl-	3522-94-9	13.24	128.3	1026	
Methyl Isobutyl Ketone	108-10-1	13.29	100.2		
2-Butenal, 2-methyl-	497-03-0	13.55	84.1		
2-Pentanone, 3-methyl	565-61-7	13.59	100.2		
Propane, 2-methyl-2-nitro	594-70-7	13.89	103.1		
2-Pentanone, 4,4-dimethyl-	590-50-1	14.4	114.2		
Hexane, 2,2,5,5-tetramethyl-	1071-81-4	14.58	142.3		
3-Hexanone	589-38-8	14.64	100.2		
2,3,5-Trimethylfuran	10504-04-8	14.73	110		
Hexanal	66-25-1	14.74	100.2		
2-Hexanone	591-78-6	14.86	100.2		
2-Pentenoic acid, 2-methyl-	3142-72-1	15.09	114.1		
1,3-Dioxolane, 2,4-dimethyl-	766-20-1	15.2	116.2		
Pentane, 2,2,3,3-tetramethyl-	7154-79-2	15.43	128.3		
Isoxazole, 3,5-dimethyl-	300-87-8	15.67	97.1		
5,5-Dimethyl-1,3-hexadiene	1515-79-3	15.9	110		
Cyclohexane, 1,1,3,5-tetramethyl-	50876-31-8	16.4	140.3		
3-Heptanone	06-35-4	17.18	114		
Heptanal	111-71-7	17.36	114.2		
1,3-Dioxane, 2-ethyl-5-methyl	627-54-7	17.58	130		
Benzene, nitroso-	586-96-9	17.79	107.1		
Ethanamine, N-ethyl-N-nitroso-	55-18-5	18.52	102.1		
1H-Benzotriazole	95-14-7	18.7	119.1		
Tetramethyloctane	na	18.75	154		
Benzene, isocyanato-	103-71-9	19.13	119.1		
Benzaldehyde	100-52-7	19.37	106.1		
Octanal	124-13-0	19.94	128.2		
Benzonitrile	100-47-0	20.38	103.1		

Tentatively Identified Volatile Organic Compounds from SL-639

			File -->	01112107	01120606
			Sample -->	02-00835	02-00893
			Cylinder ID -->	24G66-9 CLYH	24G73-5 CLYM
			Resin Mass (g)	1.8017	1.8066
			Medium-->	AN105 sim	none
			Temperature (C)-->	90	25
			Dose (R)-->	1.E+08	1.E+08
Tentatively Identified Compounds (ng/g resin)	CAS#	RT	MW		
Butane,1,1,3,4-tetrachloro-1,2,2,3,4,4-hexafluoro-	423-38-1	21.35	303.8		
Acetophenone	98-86-2	21.93	120.2		
Nonanal	124-19-6	22.1	142.2		
Benzenemethanol,.alpha.,.alpha.-dimethyl-	617-94-7	22.35	136.2		
Benzenoacetonitrile,.alpha.-oxo-	613-90-1	22.6	131.1		
Benzene, nitro	98-95-3	22.75	123.1		
Dodecane	112-40-3	23	170.3		
Butane,tetrachloro-,hexafluoro-	423-38-1	26.49	303.8		

Tentatively Identified Volatile Organic Compounds - Quality Control

			File -->	01100311	01111208	01112708	02021104	02021105
			Sample -->	Cylinder	blank	Blank	02-01410	02-01411
			Cylinder ID -->	batch blank	CLY H	CLY L	24G86-1	24G86-2
			Resin Mass (g)				No Resin	No Resin
			Medium-->				water	water
			Temperature (C)-->				25	65
			Dose (R)-->					
Tentatively Identified Compounds (ng)	CAS#	RT	MW					
Isobutane	75-28-5	3.28	58.12			337.3		
1-Propene, 2-methyl-	115-11-7	3.44	56.1					
Silane, methyl	992-94-9	3.62	46.1				11.0	10.5
Propane, 2,2-dimethyl-	463-82-1	3.71	72.1					
2-Butene	590-18-1	3.81	56.1					
Butane, 2-methyl-	78-78-4	4.5	72.1					
Pentane	109-66-0	4.85	72.1					
1,2-Butadiene	590-19-2	5.06	54.1					
2-Pentene	627-20-3	5.27	70.1					
Ethanol	64-17-5	5.38	46.1					
Cyclopropane, 1,1-dimethyl-	1630-94-0	5.43	70.1					
Ether	60-29-7	5.5	74.1					
Propanal	123-38-6	5.67	50.1					
Butane, 2,2-dimethyl	75-83-2	5.77	86.2					
Acetone	67-64-1	5.87	58.1					
Carbon Disulfide	75-15-0	5.92	76.1					
Isopropyl Alcohol	67-63-0	6.24	60.1		26.0		23.9	
Acetonitrile	75-05-8	6.36	41.1	6.6				
Propene	115-07-1	6.41	42.1					
Unknown		6.45						
Pentane, 2-methyl-	107-83-5	6.61	86.2					
Propane, 2-chloro-2-methyl-	507-20-0	6.66	92.6					
2-Propanol, 2-methyl-	75-65-0	6.83	74.1	24.5	514.2			
1-Propene, 2-metoxy-	116-11-0	6.85	72.1					
Propane, 2-ethoxy	625-54-7	6.97	88.1					
Cyanogen, bromide	506-68-3	7	105.9					
Pentane, 3-methyl-	96-14-0	7.07	86.2					
Methyl nitrate	598-58-3	7.1	77					
Propane, 2-methoxy-2methyl-	1634-04-4	7.21	88.1					
2-Pentyne	627-21-4	7.4	68.1					
1,2_Butadiene, 3-methyl-	598-25-4	7.46	68.1					
Propanal, 2-methyl-	78-84-2	7.56	72.1		45.3			
2-Butenal	4170-30-3	7.88	70.1					

Tentatively Identified Volatile Organic Compounds - Quality Control

			File -->	01100311	01111208	01112708	02021104	02021105
			Sample -->	Cylinder	blank	Blank	02-01410	02-01411
			Cylinder ID -->	batch blank	CLY H	CLY L	24G86-1	24G86-2
			Resin Mass (g)				No Resin	No Resin
			Medium-->				water	water
			Temperature (C)-->				25	65
			Dose (R)-->					
Tentatively Identified Compounds (ng)	CAS#	RT	MW					
1-Pentene, 4,4-dimethyl-	762-62-9	8.11	98.2					
Butane, 2,2,3-trimethyl-	464-06-2	8.36	100.2					
1-Propanol	71-23-8	8.39	60.1					
Pentane, 2,2-dimethyl-	590-35-2	8.41	100.2					
Hexane	110-54-3	8.54	86.2					
Propanal, 2,2-dimethyl	630-19-3	8.55	86.1					
Butanal	123-72-8	8.67	72.1				0.2	
Propane, 1-chloro-2-methyl-	513-36-0	8.71	92.6					
Silanol, trimethyl-	66-40-6	8.79	90					16.9
Methane, nitro-	75-52-5	8.83	61					
Pentane, 2,4-dimethyl-	108-08-7	8.8	100.2					
Butane, 2,2,3-trimethyl-	464-06-2	8.91	100.2					
Propanenitrile	107-12-0	9.07	55.1					
2-Butanone	78-93-3	9.14	72.1					
3-Hexyne	928-49-4	9.25	82.1					
Furan, tetrahydro-	109-99-9	9.28	72.1					
Pentane, 3,3-dimethyl-	562-49-2	9.44	100.2					
Oxirane, ethyl	106-88-7	9.46	72.1					
Nitric acid, ethyl ester	625-58-1	9.88	91.1					
1,3-Dioxolane, 2-methyl-	497-26-7	10.15	88.1					
3-Hexanol	623-37-0	10.45	102.2					
Butane, 2,2,3,3-tetramethyl-	594-82-1	10.57	114.2			22.7		
Acetic acid	64-19-7	10.8	60.1					
2-Butanone, 3-methyl-	563-80-4	10.87	86.1					
Heptane	142-82-5	10.92	100.2					
2-Propen-1-ol, 2-methyl-	513-42-8	11.13	72.1					
1-Butanol	71-36-3	11.42	72.1					
1-Pentene, 2,4,4-trimethyl-	107-39-1	11.44	112.2					
Butane, tetramethyl-	na	11.6	114.2			211.2		
Pentanal	110-62-3	11.78	86.1					
2-Pentanone	107-87-9	11.93	86.1					
Hexane, 2,2-dimethyl-	590-73-8	11.97	114.2					
3-Pentanone	96-22-0	12.15	86.1					

Tentatively Identified Volatile Organic Compounds - Quality Control

			File -->	01100311	01111208	01112708	02021104	02021105
			Sample -->	Cylinder	blank	Blank	02-01410	02-01411
			Cylinder ID -->	batch blank	CLY H	CLY L	24G86-1	24G86-2
			Resin Mass (g)				No Resin	No Resin
			Medium-->				water	water
			Temperature (C)-->				25	65
			Dose (R)-->					
Tentatively Identified Compounds (ng)	CAS#	RT	MW					
2-Butanone, 3,3-dimethyl-	75-97-8	12.37	100.2					
2,4-Hexadiene, 3-methyl-	28823-42-9	12.46	96					
Pentane, 2,2,4,4-tetramethyl-	1070-87-7	13.05	128.3					
Hexane, 2,2,5-trimethyl-	3522-94-9	13.24	128.3					
Methyl Isobutyl Ketone	108-10-1	13.29	100.2					
2-Butenal, 2-methyl-	497-03-0	13.55	84.1					
2-Pentanone, 3-methyl	565-61-7	13.59	100.2					
Propane, 2-methyl-2-nitro	594-70-7	13.89	103.1					
2-Pentanone, 4,4-dimethyl-	590-50-1	14.4	114.2					
Hexane, 2,2,5,5-tetramethyl-	1071-81-4	14.58	142.3					
3-Hexanone	589-38-8	14.64	100.2					
2,3,5-Trimethylfuran	10504-04-8	14.73	110					
Hexanal	66-25-1	14.74	100.2					
2-Hexanone	591-78-6	14.86	100.2					
2-Pentenoic acid, 2-methyl-	3142-72-1	15.09	114.1					
1,3-Dioxolane, 2,4-dimethyl-	766-20-1	15.2	116.2					
Pentane, 2,2,3,3-tetramethyl-	7154-79-2	15.43	128.3					
Isoxazole, 3,5-dimethyl-	300-87-8	15.67	97.1					
5,5-Dimethyl-1,3-hexadiene	1515-79-3	15.9	110					
Cyclohexane, 1,1,3,5-tetramethyl-	50876-31-8	16.4	140.3					
3-Heptanone	06-35-4	17.18	114					
Heptanal	111-71-7	17.36	114.2					
1,3-Dioxane, 2-ethyl-5-methyl	627-54-7	17.58	130					
Benzene, nitroso-	586-96-9	17.79	107.1					
Ethanamine, N-ethyl-N-nitroso-	55-18-5	18.52	102.1					
1H-Benzotriazole	95-14-7	18.7	119.1					
Tetramethyloctane	na	18.75	154					
Benzene, isocyanato-	103-71-9	19.13	119.1					
Benzaldehyde	100-52-7	19.37	106.1	52.1				
Octanal	124-13-0	19.94	128.2					
Benzonitrile	100-47-0	20.38	103.1	19.1				

Tentatively Identified Volatile Organic Compounds - Quality Control

			File -->	01100311	01111208	01112708	02021104	02021105
			Sample -->	Cylinder	blank	Blank	02-01410	02-01411
			Cylinder ID -->	batch blank	CLY H	CLY L	24G86-1	24G86-2
			Resin Mass (g)				No Resin	No Resin
			Medium-->				water	water
			Temperature (C)-->				25	65
			Dose (R)-->					
Tentatively Identified Compounds (ng)	CAS#	RT	MW					
Butane,1,1,3,4-tetrachloro-1,2,2,3,4,4-hexafluoro-	423-38-1	21.35	303.8				86.5	137.4
Acetophenone	98-86-2	21.93	120.2	0.3				
Nonanal	124-19-6	22.1	142.2					
Benzenemethanol,.alpha.,.alpha.-dimethyl-	617-94-7	22.35	136.2					
Benzenoacetonitrile,.alpha.-oxo-	613-90-1	22.6	131.1					
Benzene, nitro	98-95-3	22.75	123.1					
Dodecane	112-40-3	23	170.3					
Butane,tetrachloro-,hexafluoro-	423-38-1	26.49	303.8					

Tentatively Identified Volatile Organic Compounds - Quality Control

			File -->	02021107	01110204	01111604	01112104	01121904
			Sample -->	02-01413	02-00367	02-00747	02-00834	02-00945
			Cylinder ID -->	24G86-4	24G59-8 CLYG	24G64-3 CLYD	24G66-8 CLYB	24G77-8 CLYC
			Resin Mass (g)	No Resin	No Resin	No Resin	No Resin	No Resin
			Medium-->	water	water	water	water	HNO3
			Temperature (C)-->	90	25	65	90	25
			Dose (R)-->		1.00E+08	1.00E+08	1.00E+08	
Tentatively Identified Compounds (ng)	CAS#	RT	MW					
Isobutane	75-28-5	3.28	58.12	423.5			71.4	8.8
1-Propene, 2-methyl-	115-11-7	3.44	56.1					
Silane, methyl	992-94-9	3.62	46.1	33.2	11.5	8.8	11.9	
Propane, 2,2-dimethyl-	463-82-1	3.71	72.1					
2-Butene	590-18-1	3.81	56.1					
Butane, 2-methyl-	78-78-4	4.5	72.1					
Pentane	109-66-0	4.85	72.1					
1,2-Butadiene	590-19-2	5.06	54.1					
2-Pentene	627-20-3	5.27	70.1					
Ethanol	64-17-5	5.38	46.1					
Cyclopropane, 1,1-dimethyl-	1630-94-0	5.43	70.1					
Ether	60-29-7	5.5	74.1					
Propanal	123-38-6	5.67	50.1					
Butane, 2,2-dimethyl	75-83-2	5.77	86.2					
Acetone	67-64-1	5.87	58.1					
Carbon Disulfide	75-15-0	5.92	76.1	16.0				
Isopropyl Alcohol	67-63-0	6.24	60.1	28.1				
Acetonitrile	75-05-8	6.36	41.1					
Propene	115-07-1	6.41	42.1					
Unknown		6.45						
Pentane, 2-methyl-	107-83-5	6.61	86.2					
Propane, 2-chloro-2-methyl-	507-20-0	6.66	92.6					
2-Propanol, 2-methyl-	75-65-0	6.83	74.1			17.8		170.1
1-Propene, 2-metoxy-	116-11-0	6.85	72.1					
Propane, 2-ethoxy	625-54-7	6.97	88.1					
Cyanogen, bromide	506-68-3	7	105.9					
Pentane, 3-methyl-	96-14-0	7.07	86.2					
Methyl nitrate	598-58-3	7.1	77					
Propane, 2-methoxy-2methyl-	1634-04-4	7.21	88.1					
2-Pentyne	627-21-4	7.4	68.1					
1,2_Butadiene, 3-methyl-	598-25-4	7.46	68.1					
Propanal, 2-methyl-	78-84-2	7.56	72.1					
2-Butenal	4170-30-3	7.88	70.1					

Tentatively Identified Volatile Organic Compounds - Quality Control

			File -->	02021107	01110204	01111604	01112104	01121904
			Sample -->	02-01413	02-00367	02-00747	02-00834	02-00945
			Cylinder ID -->	24G86-4	24G59-8 CLYG	24G64-3 CLYD	24G66-8 CLYB	24G77-8 CLYC
			Resin Mass (g)	No Resin	No Resin	No Resin	No Resin	No Resin
			Medium-->	water	water	water	water	HNO3
			Temperature (C)-->	90	25	65	90	25
			Dose (R)-->		1.00E+08	1.00E+08	1.00E+08	
Tentatively Identified Compounds (ng)	CAS#	RT	MW					
1-Pentene, 4,4-dimethyl-	762-62-9	8.11	98.2					
Butane, 2,2,3-trimethyl-	464-06-2	8.36	100.2					
1-Propanol	71-23-8	8.39	60.1					
Pentane, 2,2-dimethyl-	590-35-2	8.41	100.2					
Hexane	110-54-3	8.54	86.2					
Propanal, 2,2-dimethyl	630-19-3	8.55	86.1					
Butanal	123-72-8	8.67	72.1					
Propane, 1-chloro-2-methyl-	513-36-0	8.71	92.6					
Silanol, trimethyl-	66-40-6	8.79	90	22.2	150.7	17.1	122.7	28.6
Methane, nitro-	75-52-5	8.83	61					
Pentane, 2,4-dimethyl-	108-08-7	8.8	100.2					
Butane, 2,2,3-trimethyl-	464-06-2	8.91	100.2					
Propanenitrile	107-12-0	9.07	55.1					
2-Butanone	78-93-3	9.14	72.1					
3-Hexyne	928-49-4	9.25	82.1					
Furan, tetrahydro-	109-99-9	9.28	72.1					
Pentane, 3,3-dimethyl-	562-49-2	9.44	100.2					
Oxirane, ethyl	106-88-7	9.46	72.1					
Nitric acid, ethyl ester	625-58-1	9.88	91.1					
1,3-Dioxolane, 2-methyl-	497-26-7	10.15	88.1					
3-Hexanol	623-37-0	10.45	102.2					
Butane, 2,2,3,3-tetramethyl-	594-82-1	10.57	114.2					47.0
Acetic acid	64-19-7	10.8	60.1					
2-Butanone, 3-methyl-	563-80-4	10.87	86.1					
Heptane	142-82-5	10.92	100.2					
2-Propen-1-ol, 2-methyl-	513-42-8	11.13	72.1					
1-Butanol	71-36-3	11.42	72.1					
1-Pentene, 2,4,4-trimethyl-	107-39-1	11.44	112.2					
Butane, tetramethyl-	na	11.6	114.2	38.9				149.2
Pentanal	110-62-3	11.78	86.1					
2-Pentanone	107-87-9	11.93	86.1					
Hexane, 2,2-dimethyl-	590-73-8	11.97	114.2					
3-Pentanone	96-22-0	12.15	86.1					

Tentatively Identified Volatile Organic Compounds - Quality Control

			File -->	02021107	01110204	01111604	01112104	01121904
			Sample -->	02-01413	02-00367	02-00747	02-00834	02-00945
			Cylinder ID -->	24G86-4	24G59-8 CLYG	24G64-3 CLYD	24G66-8 CLYB	24G77-8 CLYC
			Resin Mass (g)	No Resin	No Resin	No Resin	No Resin	No Resin
			Medium-->	water	water	water	water	HNO3
			Temperature (C)-->	90	25	65	90	25
			Dose (R)-->		1.00E+08	1.00E+08	1.00E+08	
Tentatively Identified Compounds (ng)	CAS#	RT	MW					
2-Butanone, 3,3-dimethyl-	75-97-8	12.37	100.2					
2,4-Hexadiene, 3-methyl-	28823-42-9	12.46	96					
Pentane, 2,2,4,4-tetramethyl-	1070-87-7	13.05	128.3					
Hexane, 2,2,5-trimethyl-	3522-94-9	13.24	128.3					
Methyl Isobutyl Ketone	108-10-1	13.29	100.2		40.4		33.7	41.1
2-Butenal, 2-methyl-	497-03-0	13.55	84.1					
2-Pentanone, 3-methyl	565-61-7	13.59	100.2					
Propane, 2-methyl-2-nitro	594-70-7	13.89	103.1					
2-Pentanone, 4,4-dimethyl-	590-50-1	14.4	114.2					
Hexane, 2,2,5,5-tetramethyl-	1071-81-4	14.58	142.3					
3-Hexanone	589-38-8	14.64	100.2					
2,3,5-Trimethylfuran	10504-04-8	14.73	110					
Hexanal	66-25-1	14.74	100.2					
2-Hexanone	591-78-6	14.86	100.2					
2-Pentenoic acid, 2-methyl-	3142-72-1	15.09	114.1					
1,3-Dioxolane, 2,4-dimethyl-	766-20-1	15.2	116.2					
Pentane, 2,2,3,3-tetramethyl-	7154-79-2	15.43	128.3					
Isoxazole, 3,5-dimethyl-	300-87-8	15.67	97.1					
5,5-Dimethyl-1,3-hexadiene	1515-79-3	15.9	110					
Cyclohexane, 1,1,3,5-tetramethyl-	50876-31-8	16.4	140.3					
3-Heptanone	06-35-4	17.18	114					
Heptanal	111-71-7	17.36	114.2					
1,3-Dioxane, 2-ethyl-5-methyl	627-54-7	17.58	130					
Benzene, nitroso-	586-96-9	17.79	107.1					
Ethanamine, N-ethyl-N-nitroso-	55-18-5	18.52	102.1					
1H-Benzotriazole	95-14-7	18.7	119.1					
Tetramethyloctane	na	18.75	154					
Benzene, isocyanato-	103-71-9	19.13	119.1					
Benzaldehyde	100-52-7	19.37	106.1					
Octanal	124-13-0	19.94	128.2					
Benzonitrile	100-47-0	20.38	103.1					

Tentatively Identified Volatile Organic Compounds - Quality Control

			File -->	02021107	01110204	01111604	01112104	01121904
			Sample -->	02-01413	02-00367	02-00747	02-00834	02-00945
			Cylinder ID -->	24G86-4	24G59-8 CLYG	24G64-3 CLYD	24G66-8 CLYB	24G77-8 CLYC
			Resin Mass (g)	No Resin	No Resin	No Resin	No Resin	No Resin
			Medium-->	water	water	water	water	HNO3
			Temperature (C)-->	90	25	65	90	25
			Dose (R)-->		1.00E+08	1.00E+08	1.00E+08	
Tentatively Identified Compounds (ng)	CAS#	RT	MW					
Butane,1,1,3,4-tetrachloro-1,2,2,3,4,4-hexafluoro-	423-38-1	21.35	303.8	103.4		83.7		55.4
Acetophenone	98-86-2	21.93	120.2					
Nonanal	124-19-6	22.1	142.2					
Benzenemethanol,.alpha.,.alpha.-dimethyl-	617-94-7	22.35	136.2					33.6
Benzenoacetonitrile,.alpha.-oxo-	613-90-1	22.6	131.1					
Benzene, nitro	98-95-3	22.75	123.1					
Dodecane	112-40-3	23	170.3					
Butane,tetrachloro-,hexafluoro-	423-38-1	26.49	303.8					

Tentatively Identified Volatile Organic Compounds - Quality Control

			File -->	01121905	01121906	01110205	01111605	01112105
			Sample -->	02-00946	02-00947	02-00368	02-00750	02-00836
			Cylinder ID -->	24G77-9 CLYE	24G77-10 CLYF	24G59-9 CLYI	24G64-6 CLYL	24G66-10 CLYE
			Resin Mass (g)	No Resin	No Resin	No Resin	No Resin	No Resin
			Medium-->	HNO3	HNO3	HNO3	HNO3	HNO3
			Temperature (C)-->	65	90	25	65	90
			Dose (R)-->			1.00E+08	1.00E+08	1.00E+08
Tentatively Identified Compounds (ng)	CAS#	RT	MW					
Isobutane	75-28-5	3.28	58.12	58.1				
1-Propene, 2-methyl-	115-11-7	3.44	56.1	135.6				
Silane, methyl	992-94-9	3.62	46.1					11.2
Propane, 2,2-dimethyl-	463-82-1	3.71	72.1					
2-Butene	590-18-1	3.81	56.1					
Butane, 2-methyl-	78-78-4	4.5	72.1					
Pentane	109-66-0	4.85	72.1					
1,2-Butadiene	590-19-2	5.06	54.1					
2-Pentene	627-20-3	5.27	70.1					
Ethanol	64-17-5	5.38	46.1					
Cyclopropane, 1,1-dimethyl-	1630-94-0	5.43	70.1					
Ether	60-29-7	5.5	74.1					
Propanal	123-38-6	5.67	50.1					
Butane, 2,2-dimethyl	75-83-2	5.77	86.2					
Acetone	67-64-1	5.87	58.1	32.1	95.0			
Carbon Disulfide	75-15-0	5.92	76.1		107.6			
Isopropyl Alcohol	67-63-0	6.24	60.1					
Acetonitrile	75-05-8	6.36	41.1					
Propene	115-07-1	6.41	42.1					
Unknown		6.45						
Pentane, 2-methyl-	107-83-5	6.61	86.2					
Propane, 2-chloro-2-methyl-	507-20-0	6.66	92.6					
2-Propanol, 2-methyl-	75-65-0	6.83	74.1	55.6	133.2		18.9	
1-Propene, 2-metoxy-	116-11-0	6.85	72.1					
Propane, 2-ethoxy	625-54-7	6.97	88.1					
Cyanogen, bromide	506-68-3	7	105.9					
Pentane, 3-methyl-	96-14-0	7.07	86.2					
Methyl nitrate	598-58-3	7.1	77					
Propane, 2-methoxy-2methyl-	1634-04-4	7.21	88.1					
2-Pentyne	627-21-4	7.4	68.1					
1,2_Butadiene, 3-methyl-	598-25-4	7.46	68.1					
Propanal, 2-methyl-	78-84-2	7.56	72.1					
2-Butenal	4170-30-3	7.88	70.1					

Tentatively Identified Volatile Organic Compounds - Quality Control

			File -->	01121905	01121906	01110205	01111605	01112105
			Sample -->	02-00946	02-00947	02-00368	02-00750	02-00836
			Cylinder ID -->	24G77-9 CLYE	24G77-10 CLYF	24G59-9 CLYI	24G64-6 CLYL	24G66-10 CLYE
			Resin Mass (g)	No Resin	No Resin	No Resin	No Resin	No Resin
			Medium-->	HNO3	HNO3	HNO3	HNO3	HNO3
			Temperature (C)-->	65	90	25	65	90
			Dose (R)-->			1.00E+08	1.00E+08	1.00E+08
Tentatively Identified Compounds (ng)	CAS#	RT	MW					
1-Pentene, 4,4-dimethyl-	762-62-9	8.11	98.2					
Butane, 2,2,3-trimethyl-	464-06-2	8.36	100.2					
1-Propanol	71-23-8	8.39	60.1					
Pentane, 2,2-dimethyl-	590-35-2	8.41	100.2					
Hexane	110-54-3	8.54	86.2					
Propanal, 2,2-dimethyl	630-19-3	8.55	86.1					
Butanal	123-72-8	8.67	72.1					
Propane, 1-chloro-2-methyl-	513-36-0	8.71	92.6					
Silanol, trimethyl-	66-40-6	8.79	90			106.2		15.8
Methane, nitro-	75-52-5	8.83	61		158.3			
Pentane, 2,4-dimethyl-	108-08-7	8.8	100.2	32.1				
Butane, 2,2,3-trimethyl-	464-06-2	8.91	100.2					
Propanenitrile	107-12-0	9.07	55.1					
2-Butanone	78-93-3	9.14	72.1					
3-Hexyne	928-49-4	9.25	82.1					
Furan, tetrahydro-	109-99-9	9.28	72.1					
Pentane, 3,3-dimethyl-	562-49-2	9.44	100.2					
Oxirane, ethyl	106-88-7	9.46	72.1					
Nitric acid, ethyl ester	625-58-1	9.88	91.1					
1,3-Dioxolane, 2-methyl-	497-26-7	10.15	88.1					
3-Hexanol	623-37-0	10.45	102.2					
Butane, 2,2,3,3-tetramethyl-	594-82-1	10.57	114.2	97.0				
Acetic acid	64-19-7	10.8	60.1					
2-Butanone, 3-methyl-	563-80-4	10.87	86.1					
Heptane	142-82-5	10.92	100.2					
2-Propen-1-ol, 2-methyl-	513-42-8	11.13	72.1					
1-Butanol	71-36-3	11.42	72.1			12.7		
1-Pentene, 2,4,4-trimethyl-	107-39-1	11.44	112.2					
Butane, tetramethyl-	na	11.6	114.2	239.0				
Pentanal	110-62-3	11.78	86.1					
2-Pentanone	107-87-9	11.93	86.1					
Hexane, 2,2-dimethyl-	590-73-8	11.97	114.2					
3-Pentanone	96-22-0	12.15	86.1					

Tentatively Identified Volatile Organic Compounds - Quality Control

			File -->	01121905	01121906	01110205	01111605	01112105
			Sample -->	02-00946	02-00947	02-00368	02-00750	02-00836
			Cylinder ID -->	24G77-9 CLYE	24G77-10 CLYF	24G59-9 CLYI	24G64-6 CLYL	24G66-10 CLYE
			Resin Mass (g)	No Resin	No Resin	No Resin	No Resin	No Resin
			Medium-->	HNO3	HNO3	HNO3	HNO3	HNO3
			Temperature (C)-->	65	90	25	65	90
			Dose (R)-->			1.00E+08	1.00E+08	1.00E+08
Tentatively Identified Compounds (ng)	CAS#	RT	MW					
2-Butanone, 3,3-dimethyl-	75-97-8	12.37	100.2					
2,4-Hexadiene, 3-methyl-	28823-42-9	12.46	96					
Pentane, 2,2,4,4-tetramethyl-	1070-87-7	13.05	128.3					
Hexane, 2,2,5-trimethyl-	3522-94-9	13.24	128.3					
Methyl Isobutyl Ketone	108-10-1	13.29	100.2					
2-Butenal, 2-methyl-	497-03-0	13.55	84.1					
2-Pentanone, 3-methyl	565-61-7	13.59	100.2					
Propane, 2-methyl-2-nitro	594-70-7	13.89	103.1					
2-Pentanone, 4,4-dimethyl-	590-50-1	14.4	114.2					
Hexane, 2,2,5,5-tetramethyl-	1071-81-4	14.58	142.3					
3-Hexanone	589-38-8	14.64	100.2					
2,3,5-Trimethylfuran	10504-04-8	14.73	110					
Hexanal	66-25-1	14.74	100.2					
2-Hexanone	591-78-6	14.86	100.2					
2-Pentenoic acid, 2-methyl-	3142-72-1	15.09	114.1					
1,3-Dioxolane, 2,4-dimethyl-	766-20-1	15.2	116.2					
Pentane, 2,2,3,3-tetramethyl-	7154-79-2	15.43	128.3					
Isoxazole, 3,5-dimethyl-	300-87-8	15.67	97.1					
5,5-Dimethyl-1,3-hexadiene	1515-79-3	15.9	110					
Cyclohexane, 1,1,3,5-tetramethyl-	50876-31-8	16.4	140.3					
3-Heptanone	06-35-4	17.18	114					
Heptanal	111-71-7	17.36	114.2					
1,3-Dioxane, 2-ethyl-5-methyl	627-54-7	17.58	130					
Benzene, nitroso-	586-96-9	17.79	107.1					
Ethanamine, N-ethyl-N-nitroso-	55-18-5	18.52	102.1					
1H-Benzotriazole	95-14-7	18.7	119.1					
Tetramethyloctane	na	18.75	154	57.2				
Benzene, isocyanato-	103-71-9	19.13	119.1					
Benzaldehyde	100-52-7	19.37	106.1		346.1			
Octanal	124-13-0	19.94	128.2					
Benzonitrile	100-47-0	20.38	103.1		284.2			

Tentatively Identified Volatile Organic Compounds - Quality Control

			File -->	01121905	01121906	01110205	01111605	01112105
			Sample -->	02-00946	02-00947	02-00368	02-00750	02-00836
			Cylinder ID -->	24G77-9 CLYE	24G77-10 CLYF	24G59-9 CLYI	24G64-6 CLYL	24G66-10 CLYE
			Resin Mass (g)	No Resin	No Resin	No Resin	No Resin	No Resin
			Medium-->	HNO3	HNO3	HNO3	HNO3	HNO3
			Temperature (C)-->	65	90	25	65	90
			Dose (R)-->			1.00E+08	1.00E+08	1.00E+08
Tentatively Identified Compounds (ng)	CAS#	RT	MW					
Butane,1,1,3,4-tetrachloro-1,2,2,3,4,4-hexafluoro-	423-38-1	21.35	303.8					
Acetophenone	98-86-2	21.93	120.2					
Nonanal	124-19-6	22.1	142.2					
Benzenemethanol,.alpha.,.alpha.-dimethyl-	617-94-7	22.35	136.2	40.5	286.1			
Benzenoacetonitrile,.alpha.-oxo-	613-90-1	22.6	131.1					
Benzene, nitro	98-95-3	22.75	123.1					
Dodecane	112-40-3	23	170.3				64.1	
Butane,tetrachloro-,hexafluoro-	423-38-1	26.49	303.8					

Tentatively Identified Volatile Organic Compounds - Quality Control

			File -->	02021109	02021106	02021108	02013005	01111206
			Sample -->	02-01415	02-01412	02-01414	02-01281	02-00671
			Cylinder ID -->	24G86-7	24G86-3	24G86-5	24G81-8 CLYL	24G62-8 CLYB
			Resin Mass (g)	No Resin	No Resin	No Resin	No Resin	No Resin
			Medium-->	AN105 sim	AN105 sim	AN105 sim	AN105 sim	AN105 sim
			Temperature (C)-->	25	65	90	25	25
			Dose (R)-->				1.00E+07	1.00E+08
Tentatively Identified Compounds (ng)	CAS#	RT	MW					
Isobutane	75-28-5	3.28	58.12	82.4		862.8	251.0	
1-Propene, 2-methyl-	115-11-7	3.44	56.1					
Silane, methyl	992-94-9	3.62	46.1	14.7	17.4			
Propane, 2,2-dimethyl-	463-82-1	3.71	72.1					
2-Butene	590-18-1	3.81	56.1					
Butane, 2-methyl-	78-78-4	4.5	72.1			26.0		
Pentane	109-66-0	4.85	72.1					
1,2-Butadiene	590-19-2	5.06	54.1					
2-Pentene	627-20-3	5.27	70.1					
Ethanol	64-17-5	5.38	46.1					
Cyclopropane, 1,1-dimethyl-	1630-94-0	5.43	70.1					
Ether	60-29-7	5.5	74.1					
Propanal	123-38-6	5.67	50.1					
Butane, 2,2-dimethyl	75-83-2	5.77	86.2					
Acetone	67-64-1	5.87	58.1					
Carbon Disulfide	75-15-0	5.92	76.1					
Isopropyl Alcohol	67-63-0	6.24	60.1	184.2	419.5	557.4	47.3	924.9
Acetonitrile	75-05-8	6.36	41.1					
Propene	115-07-1	6.41	42.1					
Unknown		6.45						
Pentane, 2-methyl-	107-83-5	6.61	86.2					
Propane, 2-chloro-2-methyl-	507-20-0	6.66	92.6					
2-Propanol, 2-methyl-	75-65-0	6.83	74.1			40.4	24.6	
1-Propene, 2-metoxy-	116-11-0	6.85	72.1					
Propane, 2-ethoxy	625-54-7	6.97	88.1					
Cyanogen, bromide	506-68-3	7	105.9					
Pentane, 3-methyl-	96-14-0	7.07	86.2					
Methyl nitrate	598-58-3	7.1	77					87.9
Propane, 2-methoxy-2methyl-	1634-04-4	7.21	88.1					
2-Pentyne	627-21-4	7.4	68.1					
1,2_Butadiene, 3-methyl-	598-25-4	7.46	68.1					
Propanal, 2-methyl-	78-84-2	7.56	72.1					
2-Butenal	4170-30-3	7.88	70.1				0.2	

Tentatively Identified Volatile Organic Compounds - Quality Control

			File -->	02021109	02021106	02021108	02013005	01111206
			Sample -->	02-01415	02-01412	02-01414	02-01281	02-00671
			Cylinder ID -->	24G86-7	24G86-3	24G86-5	24G81-8 CLYL	24G62-8 CLYB
			Resin Mass (g)	No Resin	No Resin	No Resin	No Resin	No Resin
			Medium-->	AN105 sim	AN105 sim	AN105 sim	AN105 sim	AN105 sim
			Temperature (C)-->	25	65	90	25	25
			Dose (R)-->				1.00E+07	1.00E+08
Tentatively Identified Compounds (ng)	CAS#	RT	MW					
1-Pentene, 4,4-dimethyl-	762-62-9	8.11	98.2					
Butane, 2,2,3-trimethyl-	464-06-2	8.36	100.2					
1-Propanol	71-23-8	8.39	60.1					
Pentane, 2,2-dimethyl-	590-35-2	8.41	100.2					
Hexane	110-54-3	8.54	86.2					
Propanal, 2,2-dimethyl	630-19-3	8.55	86.1					
Butanal	123-72-8	8.67	72.1					
Propane, 1-chloro-2-methyl-	513-36-0	8.71	92.6					
Silanol, trimethyl-	66-40-6	8.79	90	27.8			15.4	
Methane, nitro-	75-52-5	8.83	61			19.2		
Pentane, 2,4-dimethyl-	108-08-7	8.8	100.2					
Butane, 2,2,3-trimethyl-	464-06-2	8.91	100.2					
Propanenitrile	107-12-0	9.07	55.1					
2-Butanone	78-93-3	9.14	72.1		0.2			
3-Hexyne	928-49-4	9.25	82.1					
Furan, tetrahydro-	109-99-9	9.28	72.1					
Pentane, 3,3-dimethyl-	562-49-2	9.44	100.2					
Oxirane, ethyl	106-88-7	9.46	72.1					
Nitric acid, ethyl ester	625-58-1	9.88	91.1					
1,3-Dioxolane, 2-methyl-	497-26-7	10.15	88.1					
3-Hexanol	623-37-0	10.45	102.2					
Butane, 2,2,3,3-tetramethyl-	594-82-1	10.57	114.2					
Acetic acid	64-19-7	10.8	60.1					
2-Butanone, 3-methyl-	563-80-4	10.87	86.1					
Heptane	142-82-5	10.92	100.2					
2-Propen-1-ol, 2-methyl-	513-42-8	11.13	72.1					
1-Butanol	71-36-3	11.42	72.1		23.5			
1-Pentene, 2,4,4-trimethyl-	107-39-1	11.44	112.2					
Butane, tetramethyl-	na	11.6	114.2			40.4		
Pentanal	110-62-3	11.78	86.1					
2-Pentanone	107-87-9	11.93	86.1					
Hexane, 2,2-dimethyl-	590-73-8	11.97	114.2					
3-Pentanone	96-22-0	12.15	86.1					

Tentatively Identified Volatile Organic Compounds - Quality Control

			File -->	02021109	02021106	02021108	02013005	01111206
			Sample -->	02-01415	02-01412	02-01414	02-01281	02-00671
			Cylinder ID -->	24G86-7	24G86-3	24G86-5	24G81-8 CLYL	24G62-8 CLYB
			Resin Mass (g)	No Resin	No Resin	No Resin	No Resin	No Resin
			Medium-->	AN105 sim	AN105 sim	AN105 sim	AN105 sim	AN105 sim
			Temperature (C)-->	25	65	90	25	25
			Dose (R)-->				1.00E+07	1.00E+08
Tentatively Identified Compounds (ng)	CAS#	RT	MW					
2-Butanone, 3,3-dimethyl-	75-97-8	12.37	100.2		22.0	18.8		
2,4-Hexadiene, 3-methyl-	28823-42-9	12.46	96					
Pentane, 2,2,4,4-tetramethyl-	1070-87-7	13.05	128.3					
Hexane, 2,2,5-trimethyl-	3522-94-9	13.24	128.3					
Methyl Isobutyl Ketone	108-10-1	13.29	100.2				29.8	57.2
2-Butenal, 2-methyl-	497-03-0	13.55	84.1					
2-Pentanone, 3-methyl	565-61-7	13.59	100.2					
Propane, 2-methyl-2-nitro	594-70-7	13.89	103.1					
2-Pentanone, 4,4-dimethyl-	590-50-1	14.4	114.2					
Hexane, 2,2,5,5-tetramethyl-	1071-81-4	14.58	142.3					
3-Hexanone	589-38-8	14.64	100.2					
2,3,5-Trimethylfuran	10504-04-8	14.73	110					
Hexanal	66-25-1	14.74	100.2					
2-Hexanone	591-78-6	14.86	100.2					
2-Pentenoic acid, 2-methyl-	3142-72-1	15.09	114.1					
1,3-Dioxolane, 2,4-dimethyl-	766-20-1	15.2	116.2					
Pentane, 2,2,3,3-tetramethyl-	7154-79-2	15.43	128.3					
Isoxazole, 3,5-dimethyl-	300-87-8	15.67	97.1					
5,5-Dimethyl-1,3-hexadiene	1515-79-3	15.9	110					
Cyclohexane, 1,1,3,5-tetramethyl-	50876-31-8	16.4	140.3					
3-Heptanone	06-35-4	17.18	114					
Heptanal	111-71-7	17.36	114.2					
1,3-Dioxane, 2-ethyl-5-methyl	627-54-7	17.58	130					
Benzene, nitroso-	586-96-9	17.79	107.1					
Ethanamine, N-ethyl-N-nitroso-	55-18-5	18.52	102.1					
1H-Benzotriazole	95-14-7	18.7	119.1					
Tetramethyloctane	na	18.75	154					
Benzene, isocyanato-	103-71-9	19.13	119.1					
Benzaldehyde	100-52-7	19.37	106.1					
Octanal	124-13-0	19.94	128.2					
Benzonitrile	100-47-0	20.38	103.1					

Tentatively Identified Volatile Organic Compounds - Quality Control

			File -->	02021109	02021106	02021108	02013005	01111206
			Sample -->	02-01415	02-01412	02-01414	02-01281	02-00671
			Cylinder ID -->	24G86-7	24G86-3	24G86-5	24G81-8 CLYL	24G62-8 CLYB
			Resin Mass (g)	No Resin	No Resin	No Resin	No Resin	No Resin
			Medium-->	AN105 sim	AN105 sim	AN105 sim	AN105 sim	AN105 sim
			Temperature (C)-->	25	65	90	25	25
			Dose (R)-->				1.00E+07	1.00E+08
Tentatively Identified Compounds (ng)	CAS#	RT	MW					
Butane,1,1,3,4-tetrachloro-1,2,2,3,4,4-hexafluoro-	423-38-1	21.35	303.8	80.0	84.9			
Acetophenone	98-86-2	21.93	120.2					
Nonanal	124-19-6	22.1	142.2					
Benzenemethanol,.alpha.,.alpha.-dimethyl-	617-94-7	22.35	136.2					
Benzenoacetonitrile,.alpha.-oxo-	613-90-1	22.6	131.1					
Benzene, nitro	98-95-3	22.75	123.1					
Dodecane	112-40-3	23	170.3					
Butane,tetrachloro-,hexafluoro-	423-38-1	26.49	303.8			51.3		

Tentatively Identified Volatile Organic Compounds - Quality Control

			File -->	01120604	01112106
			Sample -->	02-00885	02-00837
			Cylinder ID -->	24G71-11 CLYF	24G66-11 CLYF
			Resin Mass (g)	No Resin	No Resin
			Medium-->	AN105 sim	AN105 sim
			Temperature (C)-->	65	90
			Dose (R)-->	1.00E+08	1.00E+08
Tentatively Identified Compounds (ng)	CAS#	RT	MW		
Isobutane	75-28-5	3.28	58.12		
1-Propene, 2-methyl-	115-11-7	3.44	56.1		
Silane, methyl	992-94-9	3.62	46.1		
Propane, 2,2-dimethyl-	463-82-1	3.71	72.1		
2-Butene	590-18-1	3.81	56.1		
Butane, 2-methyl-	78-78-4	4.5	72.1		
Pentane	109-66-0	4.85	72.1		
1,2-Butadiene	590-19-2	5.06	54.1		
2-Pentene	627-20-3	5.27	70.1		
Ethanol	64-17-5	5.38	46.1		
Cyclopropane, 1,1-dimethyl-	1630-94-0	5.43	70.1		
Ether	60-29-7	5.5	74.1		
Propanal	123-38-6	5.67	50.1		
Butane, 2,2-dimethyl	75-83-2	5.77	86.2		
Acetone	67-64-1	5.87	58.1	12.5	14.1
Carbon Disulfide	75-15-0	5.92	76.1	20.6	12.3
Isopropyl Alcohol	67-63-0	6.24	60.1		12.2
Acetonitrile	75-05-8	6.36	41.1		
Propene	115-07-1	6.41	42.1		
Unknown		6.45			
Pentane, 2-methyl-	107-83-5	6.61	86.2		
Propane, 2-chloro-2-methyl-	507-20-0	6.66	92.6		
2-Propanol, 2-methyl-	75-65-0	6.83	74.1		
1-Propene, 2-metoxy-	116-11-0	6.85	72.1		
Propane, 2-ethoxy	625-54-7	6.97	88.1		
Cyanogen, bromide	506-68-3	7	105.9		
Pentane, 3-methyl-	96-14-0	7.07	86.2		
Methyl nitrate	598-58-3	7.1	77		
Propane, 2-methoxy-2methyl-	1634-04-4	7.21	88.1		
2-Pentyne	627-21-4	7.4	68.1		
1,2_Butadiene, 3-methyl-	598-25-4	7.46	68.1		
Propanal, 2-methyl-	78-84-2	7.56	72.1		
2-Butenal	4170-30-3	7.88	70.1		

Tentatively Identified Volatile Organic Compounds - Quality Control

			File -->	01120604	01112106
			Sample -->	02-00885	02-00837
			Cylinder ID -->	24G71-11 CLYF	24G66-11 CLYF
			Resin Mass (g)	No Resin	No Resin
			Medium-->	AN105 sim	AN105 sim
			Temperature (C)-->	65	90
			Dose (R)-->	1.00E+08	1.00E+08
Tentatively Identified Compounds (ng)	CAS#	RT	MW		
1-Pentene, 4,4-dimethyl-	762-62-9	8.11	98.2		
Butane, 2,2,3-trimethyl-	464-06-2	8.36	100.2		
1-Propanol	71-23-8	8.39	60.1		
Pentane, 2,2-dimethyl-	590-35-2	8.41	100.2		
Hexane	110-54-3	8.54	86.2		
Propanal, 2,2-dimethyl	630-19-3	8.55	86.1		
Butanal	123-72-8	8.67	72.1		
Propane, 1-chloro-2-methyl-	513-36-0	8.71	92.6		
Silanol, trimethyl-	66-40-6	8.79	90	57.6	60.3
Methane, nitro-	75-52-5	8.83	61		
Pentane, 2,4-dimethyl-	108-08-7	8.8	100.2		
Butane, 2,2,3-trimethyl-	464-06-2	8.91	100.2		
Propanenitrile	107-12-0	9.07	55.1		
2-Butanone	78-93-3	9.14	72.1		
3-Hexyne	928-49-4	9.25	82.1		
Furan, tetrahydro-	109-99-9	9.28	72.1		
Pentane, 3,3-dimethyl-	562-49-2	9.44	100.2		
Oxirane, ethyl	106-88-7	9.46	72.1		
Nitric acid, ethyl ester	625-58-1	9.88	91.1		
1,3-Dioxolane, 2-methyl-	497-26-7	10.15	88.1		
3-Hexanol	623-37-0	10.45	102.2		
Butane, 2,2,3,3-tetramethyl-	594-82-1	10.57	114.2		
Acetic acid	64-19-7	10.8	60.1		
2-Butanone, 3-methyl-	563-80-4	10.87	86.1		
Heptane	142-82-5	10.92	100.2		
2-Propen-1-ol, 2-methyl-	513-42-8	11.13	72.1		
1-Butanol	71-36-3	11.42	72.1	55.7	63.9
1-Pentene, 2,4,4-trimethyl-	107-39-1	11.44	112.2		
Butane, tetramethyl-	na	11.6	114.2		
Pentanal	110-62-3	11.78	86.1		
2-Pentanone	107-87-9	11.93	86.1		
Hexane, 2,2-dimethyl-	590-73-8	11.97	114.2		
3-Pentanone	96-22-0	12.15	86.1		

Tentatively Identified Volatile Organic Compounds - Quality Control

			File -->	01120604	01112106
			Sample -->	02-00885	02-00837
			Cylinder ID -->	24G71-11 CLYF	24G66-11 CLYF
			Resin Mass (g)	No Resin	No Resin
			Medium-->	AN105 sim	AN105 sim
			Temperature (C)-->	65	90
			Dose (R)-->	1.00E+08	1.00E+08
Tentatively Identified Compounds (ng)	CAS#	RT	MW		
2-Butanone, 3,3-dimethyl-	75-97-8	12.37	100.2		
2,4-Hexadiene, 3-methyl-	28823-42-9	12.46	96		
Pentane, 2,2,4,4-tetramethyl-	1070-87-7	13.05	128.3		
Hexane, 2,2,5-trimethyl-	3522-94-9	13.24	128.3		
Methyl Isobutyl Ketone	108-10-1	13.29	100.2	660.1	871.1
2-Butenal, 2-methyl-	497-03-0	13.55	84.1		
2-Pentanone, 3-methyl	565-61-7	13.59	100.2		
Propane, 2-methyl-2-nitro	594-70-7	13.89	103.1		
2-Pentanone, 4,4-dimethyl-	590-50-1	14.4	114.2		
Hexane, 2,2,5,5-tetramethyl-	1071-81-4	14.58	142.3		
3-Hexanone	589-38-8	14.64	100.2		
2,3,5-Trimethylfuran	10504-04-8	14.73	110		
Hexanal	66-25-1	14.74	100.2		
2-Hexanone	591-78-6	14.86	100.2		
2-Pentenoic acid, 2-methyl-	3142-72-1	15.09	114.1		
1,3-Dioxolane, 2,4-dimethyl-	766-20-1	15.2	116.2		
Pentane, 2,2,3,3-tetramethyl-	7154-79-2	15.43	128.3		
Isoxazole, 3,5-dimethyl-	300-87-8	15.67	97.1		
5,5-Dimethyl-1,3-hexadiene	1515-79-3	15.9	110		
Cyclohexane, 1,1,3,5-tetramethyl-	50876-31-8	16.4	140.3		
3-Heptanone	06-35-4	17.18	114		
Heptanal	111-71-7	17.36	114.2		
1,3-Dioxane, 2-ethyl-5-methyl	627-54-7	17.58	130		
Benzene, nitroso-	586-96-9	17.79	107.1		
Ethanamine, N-ethyl-N-nitroso-	55-18-5	18.52	102.1		
1H-Benzotriazole	95-14-7	18.7	119.1		
Tetramethyloctane	na	18.75	154		
Benzene, isocyanato-	103-71-9	19.13	119.1		
Benzaldehyde	100-52-7	19.37	106.1		
Octanal	124-13-0	19.94	128.2		
Benzonitrile	100-47-0	20.38	103.1		

Tentatively Identified Volatile Organic Compounds - Quality Control

			File -->	01120604	01112106
			Sample -->	02-00885	02-00837
			Cylinder ID -->	24G71-11 CLYF	24G66-11 CLYF
			Resin Mass (g)	No Resin	No Resin
			Medium-->	AN105 sim	AN105 sim
			Temperature (C)-->	65	90
			Dose (R)-->	1.00E+08	1.00E+08
Tentatively Identified Compounds (ng)	CAS#	RT	MW		
Butane,1,1,3,4-tetrachloro-1,2,2,3,4,4-hexafluoro-	423-38-1	21.35	303.8		
Acetophenone	98-86-2	21.93	120.2		
Nonanal	124-19-6	22.1	142.2		
Benzenemethanol,.alpha.,.alpha.-dimethyl-	617-94-7	22.35	136.2	57.7	
Benzenoacetonitrile,.alpha.-oxo-	613-90-1	22.6	131.1		
Benzene, nitro	98-95-3	22.75	123.1		
Dodecane	112-40-3	23	170.3	344.9	321.9
Butane,tetrachloro-,hexafluoro-	423-38-1	26.49	303.8		

Appendix I

Chemical Analysis Reports

Battelle PNNL/RPG/Inorganic Analysis --- IC Report

PO Box 999, Richland, Washington 99352

Client:	D. Blanchard	Charge Code/Project:	W58005 / 42365
ASR Number:	6312	Sample Receipt Date:	12/19/01
Sample Prep Date:	N/A	Sample Analysis Date:	02/06-08/02
Analyst:	MJ Steele		

Preparation Procedure: Analytical dilution only.
Analysis Procedure: PNL-ALO-212, "Determination of Inorganic Anions by Ion Chromatography"
M&TE: IC system (WD25214); Balance (360-06-01-031)
Records: CMC 98620 RIDS "IC File" for all IC analysis records and chromatograms.

Table 1: Sample Results

RPL Number	Sample ID	F (a) µg/ml	Cl µg/ml	NO_2 µg/ml	Br µg/ml	NO_3 µg/ml	PO_4 µg/ml	SO_4 µg/ml	C_2O_4 µg/ml
	EQL	0.13	0.13	0.25	0.13	0.25	0.25	0.25	0.25
	Diluent Blank	< 0.13	< 0.13	< 0.25	< 0.13	< 0.25	< 0.25	< 0.25	< 0.25
	MRQ	(b)	(b)	(b)	(b)	(b)	(b)	(b)	(b)
	EQL	60	60	500	60	1,000	130	130	130
02-00968	T-1	330	4,750	61,900	< 60	81,400	430	560	320
02-00969	T-21	800	5,610	81,700	< 60	89,200	460	990	640
02-00970	T-24	450	4,560	61,500	< 60	74,300	410	660	590
02-00971	T-25	410	4,630	62,300	< 60	74,300	400	710	580
02-00971 Dup	T-25 Dup	410	4,610	61,700	< 60	73,800	400	730	570
	RPD	0%	1%	1%	(c)	1%	0%	3%	0%
02-00972	T-22	750	4,830	68,100	< 60	77,000	400	650	1,300
QC Samples									
02-00971 MS	Matrix Spike %Rec	133%	92%	96%	93%	91%	90%	89%	94%
BS/LCS -1	Lab Control Sample %Rec	91%	95%	94%	96%	88%	90%	89%	94%
BS/LCS -1	Lab Control Sample %Rec	90%	94%	94%	96%	89%	90%	89%	94%
BS/LCS -1	Lab Control Sample %Rec	90%	94%	93%	97%	89%	91%	89%	95%

EQL = estimated quantitation level
MRQ = minimum reportable quantity
RPD = relative percent difference (between laboratory duplicates)

(a) The fluoride results should be considered the upper bound concentration for the fluoride, since the fluoride peak shape and retention time suggests the presence of co-eluting anion(s).
(b) No MRQ defined by client
(c) Not applicable; sample and/or duplicate concentration <EQL.

The samples associated with Analytical Service Request (ASR) 6312 were prepared for ion chromatography anion analysis by diluting an additional 500-fold to 4,000-fold in order to ensure that the anions of interest were measured within the calibration range and that column overloading was minimized. The stated estimated quantitation levels (EQL) are based on the lowest calibration standard adjusted for the analytical dilutions used to obtain the sample results reported in Table 1. No minimum reportable quantities (MRQ) were stated in the ASR, nor were the anions of interest.

Q.C. Comments:

Duplicates: The relative percent difference (RPD) for the duplicate prepared from sample 02-0971 (T-25)) meets the acceptance criteria of <20% per the laboratory's QA plan.

Laboratory Control Sample/Blank Spike - (HCV 010912 @3x [LCS 020402]): A Blank Spike was prepared as the Laboratory Control Sample (LCS) and demonstrated recoveries within the 80% to 120% acceptance criteria as stated in the laboratory's QA plan.

Matrix Spike (HCV 010912 @2x): A matrix spike was prepared using sample 02-0971 (T-25) and the high-range HCV standard solution. Except for fluoride, the anion recoveries are within the 75% to 125% acceptance criteria as stated in the laboratory's QA plan. The reason for the high fluoride recovery is unknown. The standard solution used to prepare the matrix spike is the same as used to prepare the blank spike, which demonstrated a fluoride recovery of about 90%.

Process/Dilution Blank: The diluent used for diluting the samples was analyzed for chloride and nitrate. No anions were detected in the diluent blank above the laboratory's QA plan acceptance criteria of <EQL.

General Comments:

- The reported "Final Results" have been corrected for all dilution performed on the sample during processing or analysis.
- The low calibration standards are defined as the estimated quantitation limit (EQL) for the reported results and assume non-complex aqueous matrices. Actual detection limits or quantitation limits for specific sample matrices may be determined, if requested.
- Routine precision and bias are typically ±15% or better for non-complex aqueous samples that are free of interference and have similar concentrations as the measured anions.

Report Prepared by: MW Ulm Date 4/5/02

Review/Approval: Marilyn J. Steele Date 4/5/02

Excel Archive Information: ASR 6312 Klinger 6314 6359 Fiskum.xls

S. Hm

Battelle - Pacific Northwest National Laboratory
Radiochemical Science and Technology – IC Report
PO Box 999, Richland, Washington 99352

REVISION 1: Correction to nitrite and nitrate results

Project / Charge Code: 42365 / W58005
ASR Number: 6465
Client: DL Blanchard
Total Samples: 5

	First in Series	Last in Series
RPL Numbers	02-02728	02-02732
Client IDs	T-2	T-23

Analysis Procedure	PNL-ALO-212, "Determination of Inorganic Anions by Ion Chromatography"
Prep Procedure	None
Analyst	MJ Steele
Analysis Date	07/01/2001, 07/02/2002
Calibration Date	04/17/2002
Cal/Ver Stds Prep Date	04/11/2002
Excel Data File	ASR 6465 Blanchard.xls
M&TE Numbers	IC system (WD25214)
	Balance (360-06-01-031)
All Analysis Records	Chemical Measurement Center 98620 RIDS IC System File

MW Ulm 7-19-02
Prepared By **Date**

Marilyn J Steele 7-19-02
Reviewed By **Date**

Sample Results

RPL Number	Sample ID	F (a) µg/ml	Cl µg/ml	NO_2 µg/ml	Br µg/ml	NO_3 µg/ml	PO_4 µg/ml	SO_4 µg/ml	C_2O_4 µg/ml
	EQL (b)	0.13	0.13	0.25	0.13	0.25	0.25	0.25	0.25
Dil. Blank	Lab Dilution Blank	< 0.13	< 0.13	< 0.25	< 0.13	< 0.25	< 0.25	< 0.25	< 0.25
	MRQ	150	300	3,000	n/a	3,000	2,500	2,300	1,500
	EQL (b)	130	130	2,500	500	2,500	250	250	250
02-02728	T-2	780	4,800	57,900	< 500	80,500	700	800	500
02-02728 Dup	T-2 Dup	790	4,800	60,100	< 500	83,700	700	1,300	500
	RPD	1	0	4	(c)	4	0	48	0
02-02729	T-18	1,100	5,000	58,100	< 500	82,500	700	1,300	800
02-02730	T-19	990	4,800	62,000	< 500	87,900	700	800	800
02-02731	T-20	1,000	5,000	62,400	< 500	85,700	700	1,000	900
	EQL (b)	130	130	1,000	130	250	250	250	250
02-02732	T-23	970	4,800	92,800	< 130	27,400	700	1,000	1,800
02-02732 MS 20000x	T-23 MS %Recovery	108	99	96	98	93	102	101	104
02-02732 MS 2000x	T-23 MS %Recovery	55	92	83	97	94	102	103	107
LCS 070102 #1	LCS/BS %Recovery	104	98	103	104	97	105	103	107
LCS 070102 #2	LCS/BS %Recovery	105	95	102	100	100	112	110	114

MRQ: minimum reportable quantity EQL: estimated quantitation limit RPD: relative percent difference
Shaded results exceed QC acceptance criteria

(a) Fluoride results should be considered an upper bound. Coeluting anions (e.g., formate) make accurate quantitation impossible.
(b) EQL based on lowest calibration standard times dilution factors used to obtain sample results
(c) RPD not calculated unless both sample and duplicate results >EQL

Sample Analysis/Results Discussion

The AN-105 Simulant samples required additional laboratory dilutions from 1,000x to 4,000x in order to ensure that the anions were measured within the calibration range and that the IC column was not overloaded during the analysis. The minimum reportable quantities (MRQ) and the estimated quantitation levels (EQL) are provided; the MRQs are based on Table A.2 provided with ASR 6465 and the EQLs are based on the lowest calibration standard adjusted for the dilutions used for reporting the results.

Quality Control Discussion

Duplicate: No sample duplicate was provided by the client. A laboratory duplicate was prepared using sample 'T-2' The laboratory duplicate relative percent difference (RPD) is well within the acceptance criterion of <20% (as defined by the laboratory's QA plan) for all anions measured above the EQL, except sulfate, which had an RPD of 48%. The poor sulfate precision is most likely due to solubility and the low sulfate concentration (i.e., near the EQL).

Laboratory Control Sample/Blank Spike - (BS 070102 [HCV020411 @3x)]): The high range calibration verification standard diluted by a factor of three was used as the LCS/BS on both analysis days. The LCS/BS demonstrated recoveries within the 80% to 120% acceptance criteria for all anions measured.

Matrix Spike (CCV020411 @2x): Two matrix spikes (MS) were prepared using the mid-range calibration check standard and the 'T-23' sample; one at a sample dilution of 2,000x and the other at a sample dilution of 20,000x. The MS recoveries were within the 75% to 125% recovery acceptance criteria for the anions of measured, except for fluoride on the 2,000x MS. Significant interferences were noted in the fluoride region, most likely due to low molecular organic anions (e.g., formate). At the 20,000x dilution, the MS concentration is significantly higher than the sample concentration and, thus, the interfering anions have less impact on recovery.

Process/Dilution Blank: A dilution blank (i.e., diluted eluant) was analyzed for all reported analytes and no anions were measured above the EQL.

IC System QC samples: No anions of interest were measured in the calibration blanks (ICB/CCB). The six calibration verification standards analyzed with the samples met the 90% to 110% recovery criteria for all anions measured, except one chloride (88%) and one nitrate (89.5%) result. The single chloride and nitrate result are not considered significant.

Summary of Deviation: None

General Comments

- The reported "Final Results" have been corrected for all dilution performed on the sample during processing or analysis.
- The low calibration standards are defined as the estimated quantitation limit (EQL) for the reported results and assume non-complex aqueous matrices. Actual detection limits or quantitation limits for specific sample matrices may be determined, if requested. For routine analyses, no results are reported below the EQL.
- Routine precision and bias are typically ±15% or better for non-complex aqueous samples that are free of interference.

Battelle - Pacific Northwest National Laboratory
Radiochemical Science and Technology
TOC/TIC Report – Hot Persulfate Oxidation Method
PO Box 999, Richland, Washington 99352

Project Number:	42365
Charge Code:	W58005
ASR Number:	6312 and 6465
Client:	D. Blanchard
Total Samples:	9

	First in Series	Last in Series
RPL Numbers	ASR 6312 – 02-0968	ASR 6312 – 02-0971 (a)
	ASR 6465 – 02-2728	ASR 6465 – 02-2732
Client IDs	ASR 6312 – 'T1'	ASR 6312 – 'T-25'
	ASR 6465 – 'T2'	ASR 6465 – 'T-23'

(a) ASR 6312 included 02-0972 (T-22); however, insufficient sample quantity was provided to perform both IC and Carbon. Sample was used for IC analysis.

Analysis Procedure	PNL-ALO-381, "Direct Determination of TC, TOC, and TIC in Radioactive Sludges and Liquids by Hot Persulfate Method"
Prep Procedure	None
Analyst	M. Steele
Analysis Date	07/11/2002 and 07/12/2002
Cal/Verify Standards	TOC CMS-53219, TIC CMS-161359
LCS/MS Standards	TOC CMS161713, TIC CMS-161732
Excel Data File	ASR 6312 6465 HP.xls
M&TE Numbers	Carbon System (WA92040)
	Balance (360-06-01-023)
All Analysis Records	Project File

MW Thu — 7-23-02
Prepared By — **Date**

D. Baldwin — 7-22-02
Reviewed By — **Date**

Carbon Results

RPL Number	Sample ID	Run Date	TIC MDL µgC/mL	TIC Results µgC/mL	TOC MDL µgC/mL	TOC Results µgC/mL		TC Results µgC/mL
	MRQ			150		1,500		
ASR 6312								
02-00968	T-1	07/11/02	70	2,200	200	400		2,600
02-00968 Dup	T-1 Dup	07/11/02	70	2,200	200	400		2,600
	RPD			0%		n/a		0%
02-00969	T-21	07/12/02	70	4,700	200	1,300		6,000
02-00970	T-24	07/12/02	70	2,800	200	800		3,600
02-00971	T-25	07/12/02	70	2,900	200	700		3,600
ASR 6465								
02-02728	T-2	07/11/02	70	1,300	200	600		1,900
02-02729	T-18	07/11/02	70	1,800	200	2,200		4,000
02-02730	T-19	07/12/02	70	1,900	200	1,900		3,800
02-02730 Dup	T-19 Dup	07/12/02	70	2,000	200	1,800		3,800
	RPD			6%		6%		0%
02-02731	T-20	07/12/02	70	2,200	200	2,100		4,300
02-02732	T-23	07/12/02	70	9,800	200	9,900		19,700
02-00971 MS	Matrix Spike %Rec	07/12/02		98%		96%		97%
Blank Spike/LCS	LCS %Rec	07/11/02		98%		97%		
Blank Spike/LCS	LCS %Rec	07/12/02		101%		101%		

TIC: total inorganic carbon TOC: total organic carbon TC: total carbon (sum of TIC and TOC)
MDL: method detection limit RPD: relative percent difference MRQ: minimum reportable quantity
'n/a': not applicable; RPD only calculated when both sample and duplicate >5xMDL

Sample Analysis/Results Discussion

The TOC/TIC analyses of the samples submitted under Analytical Service Requests (ASR) 6312 and 6465 are to be performed by both the hot persulfate and furnace methods. This report presents the results from the hot persulfate wet oxidation method. The hot persulfate method uses acid decomposition for TIC and acidic potassium persulfate oxidation at 92-95°C for TOC, all on the same sample, with TC being the sum of the TIC and TOC.

The table above shows the results, rounded to two to three significant figures. The raw data bench sheets and calculation work sheets showing all calculations are attached. All sample results are corrected for average percent recovery of system calibration standards and are also corrected for contribution from the blank, as per procedure PNL-ALO-381.

Quality Control Discussion

The TIC analysis uses calcium carbonate and the TOC analysis uses α-D-Glucose as the calibration, laboratory control, and matrix spike standards. (The JT Baker, Aldrich, Sigma, and Mallinckrodt Chemical Measurement System numbers are provided on the raw data benchsheets for traceability).

The QC for the method involves calibration blanks, sample duplicates (laboratory), laboratory control sample, and matrix spike. The ASRs indicates that the analyses are to be performed per the QA Plan "Conducting Analytical Work in Support of Regulatory Programs"; the performance of the QC samples is compared to this Plan.

The coulometer analysis system calibration is checked by analyzing calibration check standards at the beginning, middle, and end of each day's run. The average recovery from the calibration check standards is applied as a correction factor to the 'raw data' results obtained for the samples. The average recoveries for the TIC were 96% and 96% for the two analysis days, and for TOC were 98% and 97%.

Duplicate: Precision of the carbon measurements is demonstrated by the Relative Percent Difference (RPD) between sample and duplicate (or replicate). No duplicate sample was provided by the client; therefore, two laboratory duplicates were prepared: 'T-1' and 'T-19'. The TIC and TOC RPD results are well within the QP Plan acceptance criteria of <20% RPD. Note that the RPD is only calculated if both the sample and duplicate result exceed 5xMDL.

Laboratory Control Sample/Blank Spike: A LCS/BS was analyzed with the batch of samples on each day of analysis. At 98% and 100% TIC and 97% and 101 % TOC, the LCS/BS recoveries are well within acceptance criteria of 80% to 120%.

Matrix Spike: The accuracy of the carbon measurements can be estimated by the recovery results from the matrix spike. A matrix spike was prepared from sample 'T-25', an inorganic standard, and an organic standard (see cover page for standard identification). The TIC and TOC matrix spike recoveries are well within the acceptance criteria of 75% to 125% recovery. At 97%, the TC recovery (TIC + TOC standard) indicates that all the carbon added as a matrix spike was recovered.

Summary of Deviation from Procedure

None

General Comments

1) The reported "Final Results" have been corrected for all dilution performed on the sample during processing or analysis.
2) Routine precision and bias are typically ±15% or better for non-complex samples that are free of interferences.
3) The estimated quantitation limit (EQL) is defined as 5 times the MDL. Results < 5xMDL have higher uncertainties, and RPDs (or RSDs, if applicable) are not calculated.
4) For both the TC and TOC, the analysis MDL is based on three times the standard deviation of a set of historical 'system blank' data. The sample MDL (in μgC/ml or μgC/g) are calculated by using the analysis MDL adjusted for the sample volume or mass.

PNNL Radiochemical Processing Group: TOC/TIC/TC Calculations **Review** Report - Hot Persulfate Method PNL-ALO-381

Client:	Blanchard	Analyzer M&TE:	WC01713 -- 701	
Project :		Balance M&TE:	360-06-01-023	
Work Pkg:	CMC	TOC STD: alpha-D-glucose Aldrich CMS#53219	40.00% Carbon	<<[G]
Analyzed:	July 12, 2002	JT Baker CMS#161359	11.99% Carbon	<<[C]
ASR:	6312, 6465			

		Raw TIC (ug C)	Raw TOC (ug C)
Blanks:	Calibration blank (start of batch)	7.8	69.4
	Calibration blank (start of batch)	7.9	66.9
	Calibration blank (end of batch)	15.8	58.7

TIC	TOC	
10.5	65.0	<<< Blank Average (ug C)
4.6	5.6	<<< Blank Std Dev (ug C)
2.16	*5.8*	*<<< Pooled Std Dev (ug C)*
6.5	*17.3*	*<<< Method Det. Limit (ug C)*

Is Blank Std Dev < Method Det Limit?	
TIC	Yes
TOC	Yes

		Total Inorganic Carbon (TIC)					Total Organic Carbon (TOC)				
		[A] Raw TIC (ug)	[B] Blk (ug)	[D] Std wt (g)	TIC % Rec		[E] Raw TOC (ug)	[F] Blk (ug)	[H] Std wt (g)	TOC % Rec	
Standards:	Calibration Standard (start of batch)	415	11	0.0036	93.7		5602	65	0.0138	100.3	
	Calibration Standard (start of batch)	272	11	0.0023	94.8		3342	65	0.0084	97.5	
	Calibration Standard (end of batch)	507	11	0.0042	98.6		2165	65	0.0057	92.1	
		[L] Average TIC % Rec >>>>			95.7	<<[L]	[P] Average TOC % Rec >>>>			96.6	<<[P]
QC	Blank Spike/LCS 1	336	11	0.0028	101.3		5556	65	0.0141	100.7	
TOC	Sigma CMS#161713										
TIC	Calcium Carbonate Mallinkrodt CMS# 161732										

Formulas:

Standard TIC % Recovery = $((A-B)/((C/100)*D))*10^{-6}*100$

Standard TOC % Recovery = $((E-F)/((G/100)*H))*10^{-6}*100$

Sample TIC (ug C/ml or ug C/g) = $(I-J)/(K*L/100)$

Sample TOC (ug C/ml or ug C/g)= $(M-N)/(O*P/100)$

Matrix Spike Recoveries:

TIC % Recovery = $(((Q-R)/(L/100))-S*T)*100/U$

TOC % Recovery = $(((Q-R)/(P/100))-S*T)*100/U$

TC % Recovery = $((((Q^{TIC}-R^{TIC})/(L/100))-V^{TIC})+(((Q^{TOC}-R^{TOC})/(P/100))-V^{TOC}))*100/U^{TIC+TOC}$

Comments:

Due to the precision carried in the spreadsheet, some results may appear to be slightly off due to rounding.

The Pooled SD is the averaged SD for a recent list of 12 sample batches. MDL is based upon the Pooled SD. MDL = 3 x pooled SD.

If either the Sample or Duplicate are < 5x mdl, then the RPD is not calculated and displayed as "n/a".

TIC and TOC are measured; TC is the sum of the TIC and TOC results.

PNNL Radiochemical Processing Group: TOC/TIC/TC Calculations **Review** Report - Hot Persulfate Method PNL-ALO-381

Client:	Blanchard	Analyzer M&TE:	WC01713 -- 701	
Project :		Balance M&TE:	360-06-01-023	
Work Pkg:	CMC	TOC STD: alpha-D-glucose Aldrich CMS#53219	40.00% Carbon	<<[G]
Analyzed:	July 11, 2002	JT Baker CMS#161359	11.99% Carbon	<<[C]
ASR:	6312, 6465			

Sample Results		Note: Sample weights are on "as received" basis; i.e., wet weight											
		[I] Raw	[J]	[K] Sam	TIC	TIC	[M] Raw	[N]	[O] Sam	TOC	TOC	TC	TC
ACL Number	Client Sample ID (Liquids)	TIC (ug C)	Blk (ug C)	Vol (ml)	(ug C/ml)	RPD (%)	TOC (ug C)	Blk (ug C)	Vol (ml)	(ug C/ml)	RPD (%)	(ug C/ml)	RPD (%)
02-00968	T-1	222	11	0.10	2,205		75	36	0.10	402		2,607	
02-00968 DUP	T-1	217	11	0.10	2,152	2	72	36	0.10	364	n/a	2,516	4
02-02728	T-2	135	11	0.10	1,297		98	36	0.10	636		1,933	
02-02729	T-18	187	11	0.10	1,839		255	36	0.10	2,244		4,084	
	(Note: For any TOC or TIC result displayed as "# (<mdl)" the final reported "less than" concentration is calculated by dividing the Method Detection Limit by [K]												

Reviewer/date: 7-22-02

PNNL Radiochemical Processing Group: TOC/TIC/TC Calculations **Review** Report - Hot Persulfate Method PNL-ALO-381

Client:	Blanchard	Analyzer M&TE:	WC01713 -- 701	
Project :		Balance M&TE:	360-06-01-023	
Work Pkg:	CMC	TOC STD: alpha-D-glucose Aldrich CMS#53219	40.00% Carbon	<<[G]
Analyzed:	July 11, 2002	JT Baker CMS#161359	11.99% Carbon	<<[C]
ASR:	6312, 6465			

		Raw TIC (ug C)	Raw TOC (ug C)
Blanks:	Calibration blank (start of batch)	8.9	36.5
	Calibration blank (start of batch)	8.3	35.2
	Calibration blank (end of batch)	14.8	36.9

TIC	TOC	
10.7	36.2	<<< Blank Average (ug C)
3.6	0.9	<<< Blank Std Dev (ug C)
2.16	*5.8*	*<<< Pooled Std Dev (ug C)*
6.5	*17.3*	*<<< Method Det. Limit (ug C)*

Is Blank Std Dev < Method Det Limit?	
TIC	Yes
TOC	Yes

		Total Inorganic Carbon (TIC)					Total Organic Carbon (TOC)				
		[A] Raw TIC (ug)	[B] Blk (ug)	[D] Std wt (g)	TIC % Rec		[E] Raw TOC (ug)	[F] Blk (ug)	[H] Std wt (g)	TOC % Rec	
Standards:	Calibration Standard (start of batch)	501	11	0.0044	92.9		5104	36	0.0133	95.3	
	Calibration Standard (start of batch)	417	11	0.0035	96.8		4417	36	0.0114	96.1	
	Calibration Standard (end of batch)	4115	11	0.0350	97.8		631	36	0.0015	101.2	
		[L] Average TIC % Rec >>>>			95.9	<<[L]	[P] Average TOC % Rec >>>>			97.5	<<[P]
QC	Blank Spike/LCS 1	1498	11	0.0132	98.0		831	36	0.0021	97.0	
TOC	Sigma CMS#161713										
TIC	Calcium Carbonate Mallinkrodt CMS# 161732										

Formulas:

Standard TIC % Recovery = $((A-B)/((C/100)*D))*10^{-6}*100$

Standard TOC % Recovery = $((E-F)/((G/100)*H))*10^{-6}*100$

Sample TIC (ug C/ml or ug C/g) = $(I-J)/(K*L/100)$

Sample TOC (ug C/ml or ug C/g)= $(M-N)/(O*P/100)$

Matrix Spike Recoveries:

TIC % Recovery = $(((Q-R)/(L/100))-S*T)*100/U$

TOC % Recovery = $(((Q-R)/(P/100))-S*T)*100/U$

TC % Recovery = $((((Q^{TIC}-R^{TIC})/(L/100))-V^{TIC})+(((Q^{TOC}-R^{TOC})/(P/100))-V^{TOC}))*100/U^{TIC+TOC}$

Comments:

Due to the precision carried in the spreadsheet, some results may appear to be slightly off due to rounding.

The Pooled SD is the averaged SD for a recent list of 12 sample batches. MDL is based upon the Pooled SD. MDL = 3 x pooled SD.

If either the Sample or Duplicate are < 5x mdl, then the RPD is not calculated and displayed as "n/a".

TIC and TOC are measured; TC is the sum of the TIC and TOC results.

PNNL Radiochemical Processing Group: TOC/TIC/TC Calculations **Review** Report - Hot Persulfate Method PNL-ALO-381

Client:	Blanchard	Analyzer M&TE:	WC01713 -- 701	
Project :		Balance M&TE:	360-06-01-023	
Work Pkg:	CMC	TOC STD: alpha-D-glucose Aldrich CMS#53219	40.00% Carbon	<<[G]
Analyzed:	July 12, 2002	JT Baker CMS#161359	11.99% Carbon	<<[C]
ASR:	6312, 6465			

Sample Results		Note: Sample weights are on "as received" basis; i.e., wet weight											
		[I] Raw	[J]	[K] Sam	TIC	TIC	[M] Raw	[N]	[O] Sam	TOC	TOC	TC	TC
ACL Number	Client Sample ID (Liquids)	TIC (ug C)	Blk (ug C)	Vol (ml)	(ug C/ml)	RPD (%)	TOC (ug C)	Blk (ug C)	Vol (ml)	(ug C/ml)	RPD (%)	(ug C/ml)	RPD (%)
02-02730	T-19	192	11	0.10	1,896		251	65	0.10	1,925		3,821	
02-02730 DUP	T-19	198	11	0.10	1,959	3	240	65	0.10	1,811	6	3,770	1
02-02731	T-20	222	11	0.10	2,210		264	65	0.10	2,059		4,269	
02-00969	T-21	458	11	0.10	4,676		194	65	0.10	1,335		6,010	
02-02732	T-23	950	11	0.10	9,816		1017	65	0.10	9,850		19,666	
02-00970	T-24	275	11	0.10	2,764		139	65	0.10	766		3,529	
02-00971	T-25	284	11	0.10	2,858		134	65	0.10	714		3,571	
02-00971 MS	T-25	836	11	0.10	see below		1136	65	0.10	see below		see below	
	(Note: For any TOC or TIC result displayed as "# (<mdl)" the final reported "less than" concentration is calculated by dividing the Method Detection Limit by [K]												

Matrix Spike Results										
		[Q] Raw MS	[R] MS Blk	[S] Sam	[T] MS Sam	[V] Sample	Spike	[U] Spike	MS	
ACL Number	Client Sample ID	(ug C)	(ug C)	(ug C/ml)	Vol (ml)	(ug C)	wt (g)	(ug C)	% Recovery	
02-00971 MS	TIC Recovery	836	11	2858	0.10	286	0.0049	588	98.2	TIC
	TOC Recovery	1136	65	714	0.10	71	0.0027	1080	96.0	TOC
	Total Carbon Recovery (TIC + TOC)							1668	96.8	TC

Reviewer/date: 7-22-02

HOT PERSULFATE WORKSHEET

Client D. Blanchard ASR 6465/6412 Analyst [illegible] Date 7-11-02

Procedure: PNL-ALO-381 Analyzer M&TE: Balance M&TE: 360-06-01-023

Standards:

STD 1-2 TIC - CaCO3 # 161359 STD 1-2 TOC - D-Glucose # 53219 1g wt - 1.0002g

LCS/MS - CaCO3 # 161732 LCS/MS - D-Glucose # 161713 100µl - 0.0987g

		Standard WT (g)		Sample		TIC			TOC		
Lab ID	Client ID	TIC	TOC	Vol.	Wt.(g)	std value	inst. Reading	% recovery	std value	inst. Reading	% recovery
Blank 1							8.89			36.5	
Blank 2							8.31			35.2	
STD 1		0.0044	0.0133			528	501	93.3	5320	5104	95.3
STD 2		0.0035	0.0114			420	417	97.2	4560	4417	96.1
02-00968	T-1			100µl			222			75.4	
↓	T-1 DUP			100µl			217			71.7	
02-2728	T-2			100µl			135			98.2	
02-2729	T-18			100µl			187			255	
LCS/BS		~~.0025~~									
		~~.0066~~									
LCS/BS		~~0.0121~~	0.00210			1583	1498		840	831	
		0.0132									
Blank 3							14.76			36.91	
Std 3		.03499	.00147			4195	4115		560	631	

Carbon Bench sheet.xls

HOT PERSULFATE WORKSHEET

Client D Blanchard ASR 6465/6512 Analyst DRS Date 7-12-02

Procedure: PNL-ALO-381 Analyzer M&TE: Balance M&TE: 360-06-01-023

Standards: STD $CaCO_3$ # 161359 D-Glucose # 53214 1gr Wt - 1.00032g.

LCS/BSIMS $CaCO_3$ # 161732 D-Glucose # 161713 100ml ppm # 06870 = 0.09982g.

		Standard WT (g)		Sample		TIC			TOC		
Lab ID	Client ID	TIC	TOC	Vol.	Wt.(g)	std value	inst. Reading	% recovery	std value	inst. Reading	% recovery
Blank 1							7.81	DRS 7-12-02 ~~94.2~~		69.4	
Blank 2							7.93			66.9	
STD 1		0.0036	0.0138			432	415	94.2	5520	5602	100.3
STD 2		0.0023	0.0084			276	272	95.7	3360	3342	97.4
BS/LCS		0.0029	0.0141			336	336	97.6	5640	5550	97.3
02-2730	T-19			100ml			192	~~198~~	~~[illegible]~~	251	
02-2730 DUP	T-19DUP			↓			198			240	
02-2731	T-20						222			~~455~~ 364	
02-00969	T-21						458			194	
02-02732	T-23						950			1017	
02-00970	T-24						275			139	
02-00971	T-25			↓			284			134	
MS	T-25-MS	0.0049	0.0027	100ml		588	836		1080	1136	
Blank 3							15.8			58.7	
STD 3		0.0042	0.0057			504	507		2280	2165	92.4

* T-23 was a dark reddish/brown color. DRS 7-12-02

Battelle - Pacific Northwest National Laboratory
Radiochemical Science and Technology
TOC/TIC Report – Furnace Oxidation Method
PO Box 999, Richland, Washington 99352

Project Number:	42365
Charge Code:	W58005
ASR Number:	6312 and 6465
Client:	D. Blanchard
Total Samples:	9

	First in Series	Last in Series
RPL Numbers	ASR 6312 – 02-0968	ASR 6312 – 02-0971 (a)
	ASR 6465 – 02-2728	ASR 6465 – 02-2732
Client IDs	ASR 6312 – 'T1'	ASR 6312 – 'T-25'
	ASR 6465 – 'T2'	ASR 6465 – 'T-23'

(a) ASR 6312 included 02-0972 (T-22); however, insufficient sample quantity was provided to perform both IC and Carbon. Sample was used for IC analysis.

Analysis Procedure	PNL-ALO-380, "Determination of Carbon in Solids Using the Coulometrics Carbon Dioxide Coulometer"
Prep Procedure	None
Analyst	M. Steele
Analysis Date	07/15/2002 and 07/16/2002
Cal/Verify Standards	TOC: CMS-53219, TC: CMS-161359
MS/LCS Standards	TOC: CMS-161713, TC: CMS-161732
Excel Data File	ASR 6312 6465 F.xls
M&TE Numbers	Carbon System (WD13071)
	Balance (360-06-01-023)
All Analysis Records	Project File

MLO Thee — 7-23-02
Prepared By — **Date**

D. Baldwin — 7-22-02
Reviewed By — **Date**

Carbon Results

RPL Number	Sample ID	TIC Results µgC/mL		TOC MDL µgC/mL	TOC Results µgC/mL	TC MDL µgC/mL	TC Results µgC/mL
	MRQ	150			1,500		
ASR 6312							
02-00968	T-1	2,600		400	< 400	600	2,600
02-00969	T-21	8,100		400	800	600	8,900
02-00970	T-24	3,400		400	< 400	600	3,400
02-00971	T-25	3,800		400	< 400	600	3,800
ASR 6465							
02-02728	T-2	2,300		400	< 400	600	2,300
02-02729	T-18	3,800		400	1,100	600	4,900
02-02729 Dup	T-18 Dup			400	1,100		
	RPD				0%		
02-02730	T-19	3,700		400	1,100	600	4,800
02-02731	T-20	4,000		400	500	600	4,500
02-02732	T-23	14,200		700	8,100	600	22,200
02-02732 Dup	T-23 Dup					600	22,900
	RPD						3%
02-02730 MS1 @10 min	Matrix Spike %Rec				18%		98%
02-02730 MS2 @10 min	Matrix Spike %Rec				49%		
02-02730 MS2 @40 min	Matrix Spike %Rec				97%		
Blank Spike/LCS	LCS %Rec				102%		100%

TOC: total organic carbon
MDL: method detection limit
TC: total carbon
RPD: relative percent difference
TIC: total inorganic carbon (by difference)
MRQ: minimum reportable quantity

Sample Analysis/Results Discussion

The TOC/TIC analyses of the samples submitted under ASR 6431 were to be performed by both the hot persulfate and furnace methods. This report presents the results from the furnace oxidation method and the results are compared to the results obtained from the hot persulfate method. Determination of total organic carbon (TOC) is performed by combusting an aliquot of the sample (solids or liquid) in oxygen at 700 °C for 10 minutes. The total carbon is determined on another aliquot of the sample by combusting at 1000 °C for 10 minutes. The total inorganic carbon is obtained by difference.

The table above shows the results, rounded to two or three significant figures. The raw data bench sheets and calculation work sheets showing all calculations are attached. All sample results are corrected for average percent recovery of system calibration standards and are also corrected for contribution from the blank, as per procedure PNL-ALO-380.

Quality Control Discussion

The calibration and QC standards for TC and TOC analysis are solid carbon pure chemicals from JT Baker, Aldrich, Sigma, and Mallinckrodt. The identification of the standards and their Chemical Management System (CMS) numbers are included on the raw data benchsheets for traceability.

The QC for the method involves calibration blanks, sample duplicates (laboratory), laboratory control sample, and matrix spike. The ASRs indicates that the analyses are to be performed per the QA Plan "Conducting Analytical Work in Support of Regulatory Programs"; the performance of the QC samples is compared to this Plan.

The coulometer analysis system calibration is checked by analyzing calibration check standards at the beginning, middle, and end of each day's run. The samples were analyzed for TOC as a batch and for TC as a batch. The average recovery from the calibration check standards is applied as a correction factor to the 'raw data' results obtained for the samples. The average recovery for the TOC was 98% and for TC was 99%.

Analysis Run 07/15/2002: TC QC

Blank Spike/Laboratory Control Sample: A TC LCS/BS (inorganic standard) was analyzed with the samples. At 100% TC, the LCS/BS recovery is well within acceptance criteria of 80% to 120%.

Duplicate: The TC measurement precision is demonstrated by the RPD between duplicate analyses. No duplicate sample was provided by the client; therefore, a laboratory duplicate were prepared from sample 'T-23'. The TC RPD for the laboratory duplicate meets the QA Plan's acceptance criteria of <20%.

Matrix Spike: The accuracy of the carbon measurements can be estimated by the recovery results from the matrix spike. A matrix spike was prepared from sample 'T-19'by adding a know quantity of an inorganic standard. The TC matrix spike recovery of 98% is well within the acceptance criteria of 75% to 125% recovery

Analysis Run 07/17/2002: TOC QC

Blank Spike/Laboratory Control Sample: A TOC LCS/BS (organic standard) was analyzed with samples. At 102% recovery, the LCS/BS recovery is well within acceptance criteria of 80% to 120%.

Duplicates: A laboratory duplicate was prepared from sample 'T-18'; the TOC RPD meets the QA Plan's acceptance criteria of <20%.

Matrix Spike: Two matrix spikes (MS1 and MS2) were prepared from sample 'T-19' by adding a know quantity of an organic standard. At the analysis parameter (time and temperature) defined by the procedure, both matrix spikes has recoveries (i.e., 18% and 49%) far below the acceptance criteria. MS2 was allowed to combust for 40 minutes versus the standard 10 minutes and the recovery improved to 97%. Since the MS standard is an easily combusted sugar, the low recoveries appear to be matrix related (i.e., matrix inhibits combustion of organic carbon at the time/temperature parameters used for analysis).

Summary of Deviations from Procedure

None. (However, MS2 was allowed to combust for an extended time to evaluate recovery.)

Comparision: Furnace Oxidation and Hot Persulfate Oxidation Results

RPL Number	Sample ID	HP TIC Results µgC/mL	Furn TIC (a) Results µgC/mL	HP TOC Results µgC/mL	Furn TOC Results µgC/mL	HP TC (b) Results µgC/mL	Furn TC Results µgC/mL
ASR 6312							
02-00968	T-1	2,200	2,600	400	< 400	2,600	2,600
02-00969	T-21	4,700	8,100	1,300	800	6,000	8,900
02-00970	T-24	2,800	3,400	800	< 400	3,600	3,400
02-00971	T-25	2,900	3,800	700	< 400	3,600	3,800
ASR 6465							
02-02728	T-2	1,300	2,300	600	< 400	1,900	2,300
02-02729	T-18	1,800	3,800	2,200	1,100	4,000	4,900
02-02730	T-19	1,900	3,700	1,900	1,100	3,800	4,800
02-02731	T-20	2,200	4,000	2,100	500	4,300	4,500
02-02732	T-23	9,800	14,200	9,900	8,100	19,700	22,200

HP = Hot Persulfate Method Furn = Furnace Combustion Method

a) TIC Furn is determined by difference (Furn TC – Furn TOC)
b) TC HP is determined by sum (HP TIC + HP TOC)

There are only moderate differences in between the TIC, TOC, and TC results between the two methods. At the 700 °C temperature used for analysis of TOC by the furnace method, some metal carbonates, such as iron, magnesium, and nickel, may fully oxidize and bias the TOC results high. Some organic compounds are difficult to oxidize by the hot persulfate method, leading to a potential low bias in the TOC results; this effect can also be seen in the furnace method (but is generally not as severe). Typically the furnace method produces the highest, and most accurate, TC results and the hot persulfate method the most accurate TIC results; thus the best estimate for TOC is 'Furn TC minus HP TIC'.

General Comments

1) The reported "Final Results" have been corrected for all dilution performed on the sample during processing or analysis.
2) Routine precision and bias are typically ±15% or better for non-complex samples that are free of interferences.
3) The estimated quantitation limit (EQL) is defined as 5 times the MDL. Results <5xMDL have higher uncertainties, and RPDs (or RSDs, if applicable) are not calculated.
4) For both the TC and TOC, the analysis MDL is based on the standard deviation calculated from the number (n) of system blanks analyzed with the batch of samples. The standard deviation is multiplied by the Student's t values for n-1 degrees of freedom to establish the daily MDL. The sample MDL (in µgC/ml or µgC/g) are calculated by using the analysis MDL adjusted for the sample volume or mass.

PNNL Radiochemical Processing Group: TC Calculations **Review** Report - Furnace Method PNL-ALO-380

Client:	Blanchard	Temp.	Analyzer M&TE: WD13071 -- 701 Balance M&TE: 360-06-01-023
Project :		1000 Degree C	
Work Pkg:	CMC	Run time	TIC Cal Std: JT Baker CMS#161359 11.99% Carbon <<[G]
Analyzed:	July 15, 2002	10 Minutes	LCS/BS/MS TIC Std: Mallinckrodt CMS#161732 11.99% Carbon <<[C]
ASR:	6312, 6465		

		TC (ug C)	
Blanks:	Calibration blank (start of batch)	5	
	Calibration blank (start of batch)	6	
	Calibration blank (middle of batch)	26	
	Calibration blank (end of batch)	36	

18.3	<<< Blank Average (ug C)
15.2	<<< Blank Std Dev (ug C)
4	<<< *# of Blanks analyzed*
57	<<< *Method Det. Limit (ug C)* [M]

99.1 <<< [L] Average TC % Rec

		TC			
		[A] Raw TC (ug)	[B] Blk (ug)	[D] Std Vol (ml)	TC % Rec
Standards:	Calibration Standard (start of batch)	2743	18	0.02323	97.8
	Calibration Standard (start of batch)	2958	18	0.02494	98.3
		2913		0.02427	100.1
		1360	18	0.01117	100.2
	Calibration Standard (end of batch)	3775	18	0.03156	99.3
QC	Blank Spike/LCS	1006	18	0.00832	99.9

Formulas:

Standard TC % Recovery = $((A-B)/((C/100)*D))*E^{-6}*100$

QC % Recovery = $(((A-B)/((G/100)*D))*E^{-6}*100)/(L/100)$

Sample TC (ug C/ml or ug C/g) = $(I-J)/(K*L/100)$

MS TC % Recovery = $((((Q-R)/(L/100))-S*T)*100)/U$

Comments:

Due to the precision carried in the spreadsheet, some results may appear to be slightly off due to rounding.

The Method Detection Limit for the batch run is the Std Deviation from the number (n) of blanks times the Student's *t* value for the number of degrees of freedom (n-1).

For any TC result displayed as "# (<mdl)" the final reported "less than" concentration is calculated by dividing the Method Detection Limit [M] by [K].

If either the Sample or Duplicate are < 5x mdl, then the RPD is not calculated and displayed as "n/a".

Sample Results		[I] Raw	[J]	[K] Sam	TC	
RPL Number	Sample ID	TC (ug C)	Blk (ug C)	Vol. (ml)	(ug C/ml)	RPD (%)
02-00968	T-1	277	18	0.100	2,610	
02-02728	T-2	249	18	0.100	2,327	
02-02729	T-18	504	18	0.100	4,899	
02-02730	T-19	495	18	0.100	4,809	
02-02730 MS	T-19	1541	18	0.100	see below	
02-02731	T-20	465	18	0.100	4,506	
02-00969	T-21	903	18	0.100	8,924	
02-02732	T-23	2228	18	0.100	22,289	
02-02732 DUP	T-23	2292	18	0.100	22,935	3
02-00970	T-24	356	18	0.100	3,407	
02-00971	T-25	396	18	0.100	3,810	

Matrix Spike Results		[Q] Raw MS	[R] MS Blk	[S] Sam	[T] MS San	[V] Sampl	Spike	[U] Spike	MS
RPL Number	Client Sample ID	(ug C)	(ug C)	(ug C/ml)	Vol. (ml)	(ug C)	Wt (g)	(ug C)	% Recovery
02-02730 MS	Total Organic Carbon Recovery	1541	18	4809	0.10	481	0.0090	1079	97.8

Reviewer/date: D L Bellavia 7-22-02

PNNL Radiochemical Processing Group: TOC Calculations **Review** Report - Furnace Method PNL-ALO-380

Client:	Blanchard	Temp.	Analyzer M&TE: WD13071 -- 701 Balance M&TE: 360-06-01-023
Project :		700 Degree C	
Work Pkg:	CMC	Run time	Cal Std: alpha-D-glucose Aldrich CMS#53219 40.00% Carbon <<[G]
Analyzed:	July 17, 2002	10 Minutes	BS MS Std: alpha-D-glucose Sigma CMS#161713 40.00% Carbon <<[C]
ASR:	6312, 6465		

		TOC (ug C)	
Blanks:	Calibration blank (start of batch)	7.8	
	Calibration blank (start of batch)	10.6	
	Calibration blank (end of batch)	36.6	

18.3	<<< Blank Average (ug C)
15.9	<<< Blank Std Dev (ug C)
3	<<< *# of Blanks analyzed*
71	<<< *Method Det. Limit (ug C)* [M]

97.6 <<< [L] Average TOC % Rec

		TOC			
		[A] Raw TOC (ug)	[B] Blk (ug)	[D] Std Vol (ml)	TOC % Rec
Standards:	Calibration Standard (start of batch)	1998	18	0.0052	95.9
	Calibration Standard (start of batch)	1330	18	0.0033	98.5
	Calibration Standard (end of batch)	2699	18	0.0068	98.6
QC	Blank Spike/LCS	1225	18	0.0030	102.3

Formulas:

Standard TOC % Recovery = $((A-B)/((C/100)*D))*E^{-6}*100$

QC % Recovery = $(((A-B)/((G/100)*D))*E^{-6}*100)/(L/100)$

Sample TOC (ug C/ml or ug C/g) = $(I-J)/(K*L/100)$

MS TOC % Recovery = $((((Q-R)/(L/100))-S*T)*100)/U$

Comments:

Due to the precision carried in the spreadsheet, some results may appear to be slightly off due to rounding.

The Method Detection Limit for the batch run is the Std Deviation from the number (n) of blanks times the Student's *t* value for the number of degrees of freedom (n-1).

For any TC result displayed as "# (<mdl)" the final reported "less than" concentration is calculated by dividing the Method Detection Limit [M] by [K].

If either the Sample or Duplicate are < 5x mdl, then the RPD is not calculated and displayed as "n/a".

PNNL Radiochemical Processing Group: TOC Calculations **Review** Report - Furnace Method PNL-ALO-380

Client:	Blanchard	Temp.	Analyzer M&TE: WD13071 -- 701	Balance M&TE: 360-06-01-023	
Project :		700 Degree C			
Work Pkg:	CMC	Run time	Cal Std: alpha-D-glucose Aldrich CMS#53219	40.00% Carbon	<<[G]
Analyzed:	July 17, 2002	10 Minutes	BS MS Std: alpha-D-glucose Sigma CMS#161713	40.00% Carbon	<<[C]
ASR:	6312, 6465				

Sample Results		[I] Raw	[J]	[K] Sam	TOC	
RPL Number	Sample ID	TOC (ug C)	Blk (ug C)	Vol. (ml)	(ug C/ml)	RPD (%)
02-00968	T-1	37	18	0.200	94 (<mdl)	
02-02728	T-2	29	18	0.200	54 (<mdl)	
02-02729	T-18	229	18	0.200	1,079	
02-02729 DUP	T-18	231	18	0.200	1,089	1
02-02730	T-19	235	18	0.200	1,110	
02-02730 MS1	T-19 MS1	356	18	0.200	see below	
02-02730 MS2	T-19 MS2	757	18	0.200	see below	
02-02730 MS2	T-19 MS2 (after 40 min)	1265	18	0.200	see below	
02-02731	T-20	118	18	0.200	510	
02-00969	T-21	170	18	0.200	777	
02-02732	T-23	805	18	0.100	8,056	
02-00970	T-24	43	18	0.200	124 (<mdl)	
02-00971	T-25	45	18	0.200	137 (<mdl)	

Matrix Spike Results		[Q] Raw MS	[R] MS Blk	[S] Sam	[T] MS San	[V] Sampl	Spike	[U] Spike	MS
RPL Number	Client Sample ID	(ug C)	(ug C)	(ug C/ml)	Vol. (ml)	(ug C)	Wt (g)	(ug C)	% Recovery
02-02730 MS1	Total Organic Carbon Recovery	356	18	1110	0.20	222	0.0017	688	18.0
02-02730 MS2	Total Organic Carbon Recovery	757	18	1110	0.20	222	0.0027	1084	49.3
02-02730 MS2	Total Organic Carbon Recovery	1265	18	1110	0.20	222	0.0027	1084	97.3

Reviewer/date: 7-23-02

FINAL REPORT

The attached report is sent for **final distribution** to the client.

Status these tests as sent to client -

ACL Numbers: 02-0968 - 0971

ASR Number: 6312

Tests: OH

File in Project File -

Project Number: 42365 or ED Work Order: _____

or __ ACL Waste File, or P.E. File: _____

Distribution -

Send To	BY FAX	REPORT	DATA	SUPPORT	Include Titration Curves! MSIN, Address, Fax Number (as req'd)
G. Klinger		X	X		

__ Special distribution instructions are attached.

Project Manager -

Signature: L R Greenwood Date: 1-18-02

Return copy of this coversheet to: _____

For LSO Use Only

Sent to client by: Karla Smith Date: 1/22/02

Battelle

. . . Putting Technology To Work

Client: George Klinger Date: 01/17/02

Subject: Hydroxide Analyses for: AN-105

ASR: 6312

Direct sample aliquots of **AN-105 tank waste simulant** were analyzed in duplicate for the hydroxide content following procedure PNL-ALO-228 and using a Brinkman 636 Auto-Titrator. A 0.1186 N NaOH (ChemRec_57) solution was used as a standard and sample spike and the titrant was a 0.2040 M HCl prepared solution for the all the samples. The attached Report Summary indicates good RPD on the OH molarity (1st inflection point) on the sample and replicate results. An MRQ value was not specified, however the sample hydroxide molarities were all above 1M and the RPD's were 3% or less. The hydroxide recovery on the standard was 98% and the matrix spike recovery on 02-968 was 91% and and the matrix spike recovery on 02-971 was 100%. No hydroxide was detected in the reagent blank. The second and third inflection points frequently associated with carbonate and bicarbonate, showed excellent RPD for all the samples.

Following is the report summary, the sample results calculated from the raw data, and the record file for the standardized acid and base used. Also included in this report are copies of the titration curves.

Prepared by: _____ Date: 1-17-02

Reviewed by: _____ Date: 1-17-02

Battelle Pacific Northwest Laboratory
Radiochemical Processing Group-325 Building
Chemical Measurements Center

ASR 6312

WP# W58005

Hydroxide and Alkalinity Determination
Procedure: **PNL-ALO-228** Equip # **WB76843**

Report Summary for ASR # -- 6312

RPG #	Client ID		OH conc ug/mL	Concentration, moles / Liter: First Point	RPD	Second Point	RPD	Third Point	RPD
02-0968	T-1		2.9E+04	1.70		1.18		0.28	
02-0968	T-1	Rep	2.8E+04	1.64	3%	1.21	3%	0.28	2%
02-0969	T-21		1.8E+04	1.08		1.13		0.24	
02-0969	T-21	Rep	1.8E+04	1.06	2%	1.11	2%	0.24	0%
02-970	T-24		2.5E+04	1.45		1.05		0.17	
02-970	T-24	Rep	2.5E+04	1.47	2%	1.03	2%	0.17	1%
02-971	T-25		2.4E+04	1.42		1.02		0.19	
02-971	T-25	Rep	2.4E+04	1.44	1%	1.02	0%		11%

OH conc (ug/mL) = M (g/L) * 17,000

Reag. Blk.1		**0**
Standard 1		**98%**
MS 02-969	**Matrix spike**	**91%**
MS 02-971	**Matrix spike**	**100%**

Note: Results are presented for the first, second, and third inflection points on the titration curves, as applicable. The first inflection point is generally associated with the hydroxide concentration. The second and third points generally represent the carbonate and bicarbonate concentrations.

Analyst: [signature] 1-18-02

Reviewer: [signature] 1-18-02

Battelle Pacific Northwest Laboratory
Radiochemical Processing Group-325 Building

ASR # **6312**
Client: George Klinger
WP# W58005

File: R:\radchem\hydroxide\asr 6312
Analysis Date: **01/10/02**
Report Date: **01/17/02**

Procedures: **RPG-CMC-228:** Determination of Hydroxyl (OH-) and Alkalinity of Aqueous Solutions, Leachates and Supernates and Operation of Brinkman 636 Auto-Titrator

Analyst: 1/17/02

Equip # **WB76843** Lab Loc. 525

	Titrant	Molarity	Rec#
Strong	HCl	**0.2040**	72
Weak	HCl		

Std. & Spike	Molarity
NaOH	**0.1186**

RPG #	Sample ID		Dilution Factor	Sample Vol. (mL)	Sample Wt. (g)	Density g/mL	Titrator Routine #	Diluted Initial pH reading	OH 1st Equivalence Point Titrant Vol. (mL)	OH 1st Equivalence Point pH	Found millimoles base	Molarity base	millimole RPD
02-0968	T-1		na	0.200	0.2433	1.217	30	12.849	1.665	10.868	0.340	1.70	
02-0968	T-1	Replicate	na	0.200	0.2448	1.224	31	12.695	1.611	11.084	0.329	1.64	3.30%
02-0969	T-21		na	0.200	0.2461	1.231	32	12.598	1.054	10.991	0.215	1.08	
02-0969	T-21	Replicate	na	0.200	0.2475	1.238	33	12.517	1.038	10.941	0.212	1.06	1.53%
02-970	T-24		na	0.200	0.2491	1.246	35	12.616	1.423	10.959	0.290	1.45	
02-970	T-24	Replicate	na	0.200	0.2500	1.250	36	12.560	1.445	10.895	0.295	1.47	1.53%
02-971	T-25		na	0.200	0.2457	1.229	37	12.515	1.393	10.848	0.284	1.42	
02-971	T-25	Replicate	na	0.200	0.2455	1.228	38	12.599	1.411	10.870	0.288	1.44	1.28%
Reag. Blk.1				5.00			17					**OH % Recovery**	
Standard 1	0.1186 N NaOH			2.500		0.000	20	12.579	1.42	10.770	0.2897	**97.7%**	
MS 02-969	+ 1mL 0.1N NaOH			0.100	0.1206	1.206	34	12.450	1.05	10.842	0.2142	**90.6%**	MS
MS 02-971	+ 1mL 0.1N NaOH			0.100	0.1241	1.241	39	12.498	1.197	10.746	0.2442	**100.1%**	MS

Buffer	JT Baker Lot #	CMS#	Expire Date
10	J38505	161304	Sep-02
4	V0510	161306	Jan-03
7	J34512	161305	Aug-02

Initial	pH 7.0 reading =	7.009
Continuing	pH 7.0 reading =	7.015

Performance checks using Balance # 360--01-06-037

Pipet #	Vol.	Wt.	Pipet #	Vol.	Wt.
F04171	2.50	2.5018	120737	0.200	0.2009
F04171	2.50	2.4997	120737	0.200	0.1997
F04171	2.50	2.4981	120737	0.200	0.2017
			120737	0.100	0.1011
			120737	0.100	0.9981
			120737	0.100	0.1005

Battelle Pacific Northwest Laboratory
Radiochemical Processing Group-325 Building

ASR # 6312

File: R:\radchem\hydroxide\asr

WP# W58005

Procedures: RPG-CMC-228: Determination of Hydroxyl (OH-) and Alkalinity of Aqueous Solutions, Leachates and Supernates and Operation of Brinkman 636 Auto-Titrator
Equip # WB76843

Analyst: [signature] 1/17/02

Titrant	Molarity
HCl	0.2040

RPG #		Sample Vol. (mL)	2nd Equivalence Point Titrant Vol. (mL)	pH	Found millimoles base	Molarity base	millimole RPD	3rd Equivalence Point Titrant Vol. (mL)	pH	Found millimoles base	Molarity base	millimole RPD
02-0968	0	0.200	2.822	7.871	0.236	1.180		3.098	5.141	0.056	0.28	
02-0968	Replicat	0.200	2.800	7.928	0.243	1.213	2.73%	3.070	5.317	0.055	0.28	2.2%
02-0969	0	0.200	2.163	7.856	0.226	1.131		2.397	5.332	0.048	0.24	
02-0969	Replicat	0.200	2.128	8.079	0.222	1.112	1.73%	2.362	5.505	0.048	0.24	0.0%
02-970	0	0.200	2.453	7.564	0.210	1.051		2.618	5.421	0.034	0.17	
02-970	Replicat	0.200	2.457	7.802	0.206	1.032	1.76%	2.624	5.544	0.034	0.17	1.2%
02-971	0	0.200	2.394	7.864	0.204	1.021		2.579	5.527	0.038	0.19	
02-971	Replicat	0.200	2.410	7.779	0.204	1.019	0.20%					
						2-nd Recovered						
Standard 1		2.500	1.572	7.526	0.03101	10.5%	sample	1.603	4.308			
MS 02-969		0.100	1.608	7.566	#REF!		sample	1.748	5.462			
MS 02-971		0.100	1.75	7.716	0.11281		2.978	1.904	5.277			

Matrix spike recovery is calculated as follows:
Spike = 2.00 mL 0.1018 N NaOH was added to the 0.100-mL of sample for each matrix spike.
SpikeTitrant vol. (sample @ .1mL + spike) - SampleTitrant vol. (average sample only equated to .1mL) * 0.2034 N (HCl titrant) = meq. OH
meq OH / 2.00 mL added = meq OH/mL found / 0.1018 N OH added * 100 = % recovered.

Prep record on 0.2041 M HCl is on following page.

Chem Rec_57

Prep date: 5/8/00

Preparation of Standardized 0.2 M HCl

WP# K88426 for: RPL-CMC- OH analysis

Prepare 1- liter supply of 1M HCL and 0.2M HCl
Calculation: 1000 mL * 1.0 N HCl / 12M HCl = 83.33 mL of 12 N HCl diluted to 1liter with H20.
0.2 M HCl is a 1 : 5 dilution of 1M HCl
Used 83.5 mL reagent grade conc HCl (Barcode # 58914) and diluted to 1000 mL using nanopure (Type II ASTM grade) water. The 0.2M HCl was prepared by diluting 200 mL of 1M HCl to 1Liter

The 0.2 M HCl will be titrated against standardized 0.1186 M NaOH solution (Chem Rec_55).

20 mL aliquots of 0.2 M HCl were were neutralized to the phenopthalien endpoint using the recently standardized 0.1186 M NaOH. The volume of NaOH is accurate to +/- 0.02mL and the pipitting error is estimated to be < 1% @ 1s. Thus total error is < 3 % for the measurements

NaOH Molarity veification --- from Chem Rec -55

Verification Test #	(target = .41g) Wt. of KAP	Vol. Of ~ **0.1M NaOH** to neutralize	NaOH Molarity =a * 1000 / b * 204.23	Molarity Error +/- @ 1 s
1	0.42767	17.68	0.1184	
2	0.43489	17.90	0.1190	
3	0.57140	23.65	0.1183	
		Ave=	**0.1186**	0.00035
			certified value	

Titration Id.	aliquot of sample	Vol. of **0.1186M NaOH** to neutralize	**Molarity of Acid** in Sample	Molarity Error +/- @ 1 s
1	20.00	34.55	0.2048	
2	20.00	34.40	0.2035	
3	20.00	34.45	0.2038	
		Ave Molarity =	**0.2040**	0.00071

~1M HCl then equates to 1.02M HCl
0.02040 X 1000/200 = 1.02

Expires 5-8-2002

rg 1/17/02
Analyst/Date

Battelle

. . . Putting Technology To Work

Client: Dave Blanchard Date: 6/11/02

Subject: Hydroxide Analyses for: AN-105

ASR: 6465

Direct sample aliquots of **AN-105 tank waste simulant** were analyzed in duplicate for the hydroxide content following procedure PNL-ALO-228 and using a Brinkman 636 Auto-Titrator. A 0.1186 N NaOH (ChemRec_57) solution was used as a standard and sample spike and the titrant was a 0.2040 M HCl prepared solution for the all the samples. The attached Report Summary indicates good RPD on the OH molarity (1st inflection point) on the sample and replicate results. The MRQ value required was 7.5 E+04 ug/mL and in all cases concentrations well below this value were detected and the RPD's were 8% or less. The hydroxide recovery on the two standards were 93% and 89% respectively the matrix spike recovery on 02-2730 was 100%. No hydroxide was detected in the reagent blank. The second and third inflection points showed excellent RPD for all the samples where detected.

Following is the report summary, the sample results calculated from the raw data, and the record file for the standardized acid and base used. Also included in this report are copies of the titration curves.

Prepared by: [signature] Date: 6/11/02

Reviewed by: [signature] Date: 6/11/02

Battelle Pacific Northwest Laboratory
Radiochemical Processing Group-325 Building
Chemical Measurements Center

ASR 6465

WP# W58005

Hydroxide and Alkalinity Determination
Procedure: **PNL-ALO-228** Equip # **WB76843**

Report Summary for ASR # -- 6465

RPG #	Client ID		OH conc ug/mL	Concentration, moles / Liter: First Point	RPD	Second Point	RPD	Third Point	RPD
02-2728	T-2		2.9E+04	1.73		0.92			
02-2728	T-2	Rep	2.9E+04	1.72	1%	0.93	1%		
02-2729	T-18		2.1E+04	1.22		0.95		0.14	
02-2729	T-18	Rep	2.1E+04	1.21	1%	0.95	0%		
02-2730	T-19		2.1E+04	1.24		0.95			
02-2730	T-19	Rep	2.1E+04	1.21	2%	0.94	1%	0.13	
02-2731	T-20		2.0E+04	1.19		0.99		0.14	
02-2731	T-20	Rep	2.0E+04	1.16	2%	1.00	1%	0.17	22%
02-2732	T-23		1.4E+04	0.84		1.01		0.79	
02-2732	T-23	Rep	1.6E+04	0.91	8%	0.96	5%	0.80	1%

OH conc (ug/mL) = M (g/L) * 17,000

Reag. Blk.1	**0**
Standard 1	**92%**
Standard 2	**89%**
MS 02-2730 Matrix spike	**100%**

Note: Results are presented for the first, second, and third inflection points on the titration curves, as applicable. The first inflection point is generally associated with the hydroxide concentration. The second and third points generally represent the carbonate and bicarbonate concentrations.

Analyst: [signature] 6/11/02

Reviewer: [signature] 6/11/02

Battelle Pacific Northwest Laboratory
Radiochemical Processing Group-325 Building

ASR # 6465
Client: Dave Blanchard
WP# W58005

File: R:\radchem\hydroxide\asr 6465
Analysis Date: 6/10/02
Report Date: 6/11/02

Procedures: **RPG-CMC-228:** Determination of Hydroxyl (OH-) and Alkalinity of Aqueous Solutions, Leachates and Supernates and Operation of Brinkman 636 Auto-Titrator

Analyst: [signature] 6/11/02

Equip # **WB76843** Lab Loc. 525

	Titrant	Molarity	Rec#		Std. & Spike	Molarity
Strong	HCl	**0.2040**	72		NaOH	**0.1186**
Weak	HCl					

RPG #	Sample ID		Dilution Factor	Sample Vol. (mL)	Sample Wt. (g)	Density g/mL	Titrator Routine #	Diluted Initial pH reading	OH 1st Equivalence Point Titrant Vol. (mL)	pH	Found millimoles base	Molarity base	millimole RPD
02-2728	T-2		na	0.200	0.2465	1.233	7	12.523	1.697	10.766	0.346	1.73	
02-2728	T-2	Replicate	na	0.200	0.2497	1.249	8	12.621	1.686	10.804	0.344	1.72	0.65%
02-2729	T-18		na	0.200	0.2449	1.225	9	12.505	1.198	10.828	0.244	1.22	
02-2729	T-18	Replicate	na	0.200	0.2431	1.216	10	12.516	1.189	10.827	0.243	1.21	0.75%
02-2730	T-19		na	0.200	0.2463	1.232	11	12.478	1.212	10.823	0.247	1.24	
02-2730	T-19	Replicate	na	0.200	0.2431	1.216	12	12.521	1.186	10.820	0.242	1.21	2.17%
02-2731	T-20		na	0.200	0.2453	1.227	14	12.293	1.163	10.787	0.237	1.19	
02-2731	T-20	Replicate	na	0.200	0.2419	1.210	15	12.554	1.140	10.946	0.233	1.16	2.00%
02-2732	T-23		na	0.200	0.2422	1.211	16	12.420	0.825	11.059	0.168	0.84	
02-2732	T-23	Replicate	na	0.200	0.2355	1.178	17	12.376	0.896	10.850	0.183	0.91	8.25%
Reag. Blk.1				5.00			5	4.9933				**OH % Recovery**	
Standard 1	0.1186 N NaOH			5.000	5.0149	1.003	1	12.514	2.688	10.765	0.5484	**92.5%**	
Standard 2	0.1186 N NaOH			5.000	5.0211		6	12.488	2.574	10.785	0.5251	**88.5%**	
MS 02-2730	+ 2mL 0.1N NaOH			0.100	0.1239	1.239	13	12.608	1.767	10.607	0.3605	**100.4%**	MS

Buffer	JT Baker Lot #	CMS#	Expire Date
10	J38505	161304	Sep-02
4	V0510	161306	Jan-03
7	J34512	161305	Aug-02

Initial	pH 7.0 reading =	7.024
Continuing	pH 7.0 reading =	7.008

Performance checks using Balance # 360--01-06-037

Pipet #	Vol.	Wt.	Pipet #	Vol.	Wt.
F04171	2.50	2.4967	120737	0.200	0.1989
F04171	2.50	2.5081	120737	0.200	0.2017
F04171	2.50	2.5019	120737	0.200	0.2000

Review: LR Greenwood 6/11/02

Battelle Pacific Northwest Laboratory
Radiochemical Processing Group-325 Building

ASR # 6465

File: R:\radchem\hydroxide\asr

WP# W58005

Procedures: RPG-CMC-228: Determination of Hydroxyl (OH-) and Alkalinity of Aqueous Solutions, Leachates and Supernates and Operation of Brinkman 636 Auto-Titrator
Equip # WB76843

Analyst: [signature] 6/11/02

Titrant	Molarity
HCl	0.2040

RPG #	0	Sample Vol. (mL	2nd Equivalence Point Titrant ol. (mL)	pH	Found millimoles base	olarity base	illimole RPD	3rd Equivalence Point Titrant ol. (mL)	pH	Found millimoles base	Molarity base	millimole RPD
02-2728	0	0.200	2.599	7.531	0.184	0.920						
02-2728	Replica	0.200	2.600	7.419	0.186	0.932	1.32%					
02-2729	0	0.200	2.127	7.749	0.190	0.948		2.260	5.437	0.027	0.14	
02-2729	Replica	0.200	2.121	7.665	0.190	0.951	0.32%					
02-2730	0	0.200	2.141	7.708	0.190	0.948						
02-2730	Replica	0.200	2.110	7.880	0.188	0.942	0.54%	2.233	5.623	0.025	0.13	
02-2731	0	0.200	2.130	7.707	0.197	0.986		2.266	5.575	0.028	0.14	
02-2731	Replica	0.200	2.117	7.944	0.199	0.997	1.03%	2.287	5.315	0.035	0.17	22.2%
02-2732	0	0.200	1.817	7.984	0.202	1.012		2.594	4.885	0.159	0.79	
02-2732	Replica	0.200	1.842	7.810	0.193	0.965	4.75%	2.627	4.845	0.160	0.80	1.0%
						2-nd Recovered						
Standard 1		5.000	3.144	7.561	0.09302	15.7%	sample	3.277	3.965			
		5.000	3.013	7.539	0.08956	15.1%		3.132	3.906			
MS 02-2730		0.100	2.199	7.529			sample	2.378	4.859			

Matrix spike recovery is calculated as follows:
Spike = 2.00 mL 0.1018 N NaOH was added to the 0.100-mL of sample for each matrix spike.
SpikeTitrant vol. (sample @ .1mL + spike) - SampleTitrant vol. (average sample only equated to .1mL) * 0.2034 N (HCl titrant) = meq. OH
meq OH / 2.00 mL added = meq OH/mL found / 0.1018 N OH added * 100 = % recovered.

Prep record on 0.2041 M HCl is on following page.

Chem Rec_57

Prep date: 5/8/00

Preparation of Standardized 0.2 M HCl

WP# K88426 for: RPL-CMC- OH analysis

Prepare 1- liter supply of 1M HCL and 0.2M HCl
Calculation: 1000 mL * 1.0 N HCl / 12M HCl = 83.33 mL of 12 N HCl diluted to 1liter with H20.
0.2 M HCl is a 1 : 5 dilution of 1M HCl
Used 83.5 mL reagent grade conc HCl (Barcode # 58914) and diluted to 1000 mL using nanopure (Type II ASTM grade) water. The 0.2M HCl was prepared by diluting 200 mL of 1M HCl to 1Liter

The 0.2 M HCl will be titrated against standardized 0.1186 M NaOH solution (Chem Rec_55).

20 mL aliquots of 0.2 M HCl were were neutralized to the phenopthalien endpoint using the recently standardized 0.1186 M NaOH. The volume of NaOH is accurate to +/- 0.02mL and the pipitting error is estimated to be < 1% @ 1s. Thus total error is < 3 % for the measurements

NaOH Molarity veification --- from Chem Rec -55

Verification Test #	(target = .41g) Wt. of KAP	Vol. Of ~ **0.1M NaOH** to neutralize	NaOH Molarity =a * 1000 / b * 204.23	Molarity Error +/- @ 1 s
1	0.42767	17.68	0.1184	
2	0.43489	17.90	0.1190	
3	0.57140	23.65	0.1183	
		Ave=	**0.1186**	0.00035
			certified value	

Titration Id.	aliquot of sample	Vol. of **0.1186M NaOH** to neutralize	**Molarity of Acid** in Sample	Molarity Error +/- @ 1 s
1	20.00	34.55	0.2048	
2	20.00	34.40	0.2035	
3	20.00	34.45	0.2038	
		Ave Molarity =	**0.2040**	0.00071

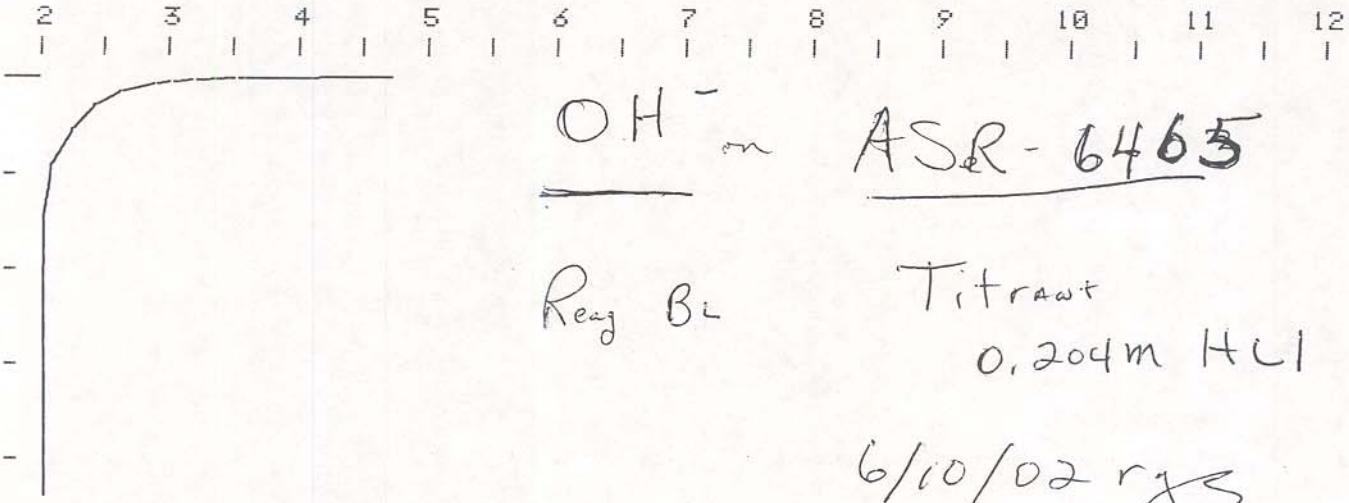
~1M HCl then equates to 1.02M HCl
0.02040 X 1000/200 = 1.02

Expires 5-8-2003

6/11/02

Analyst/Date

0.25ML/DIV V(START)/ML 0.000 PH



OH^- on ASR-6465

Reag BL

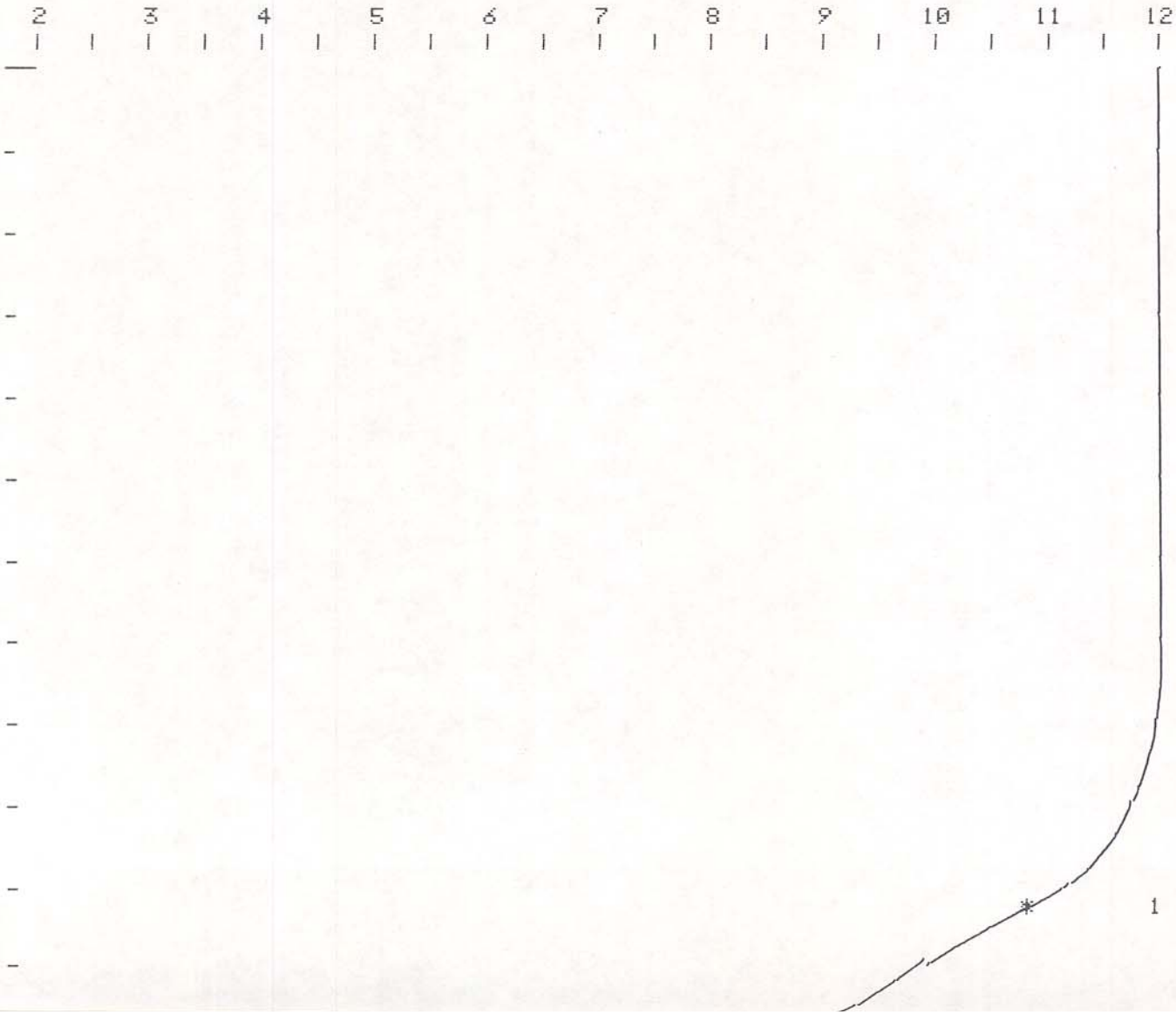
Titrant
0.204m HCl

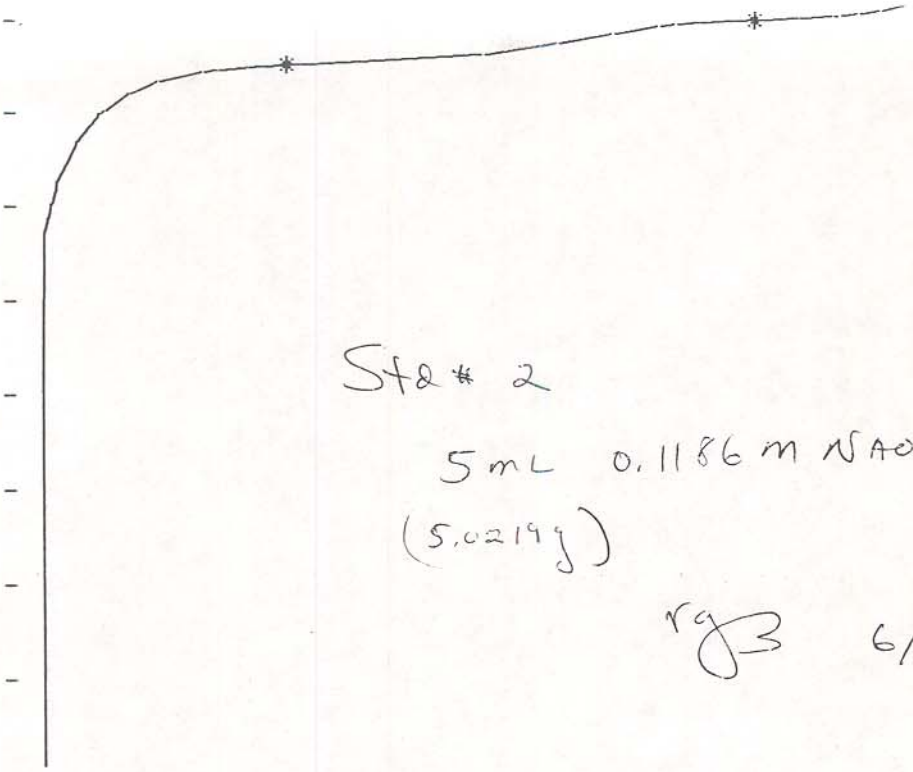
6/10/02 rgs

ROUTINE # 101
5 PH(INIT) 4.933 V(TE)/ML 1.327

DATE 11.06.02 NAME

0.25ML/DIV V(START)/ML 0.000 PH





Std # 2

5 mL 0.1186 M NaOH

(5.0219 g)

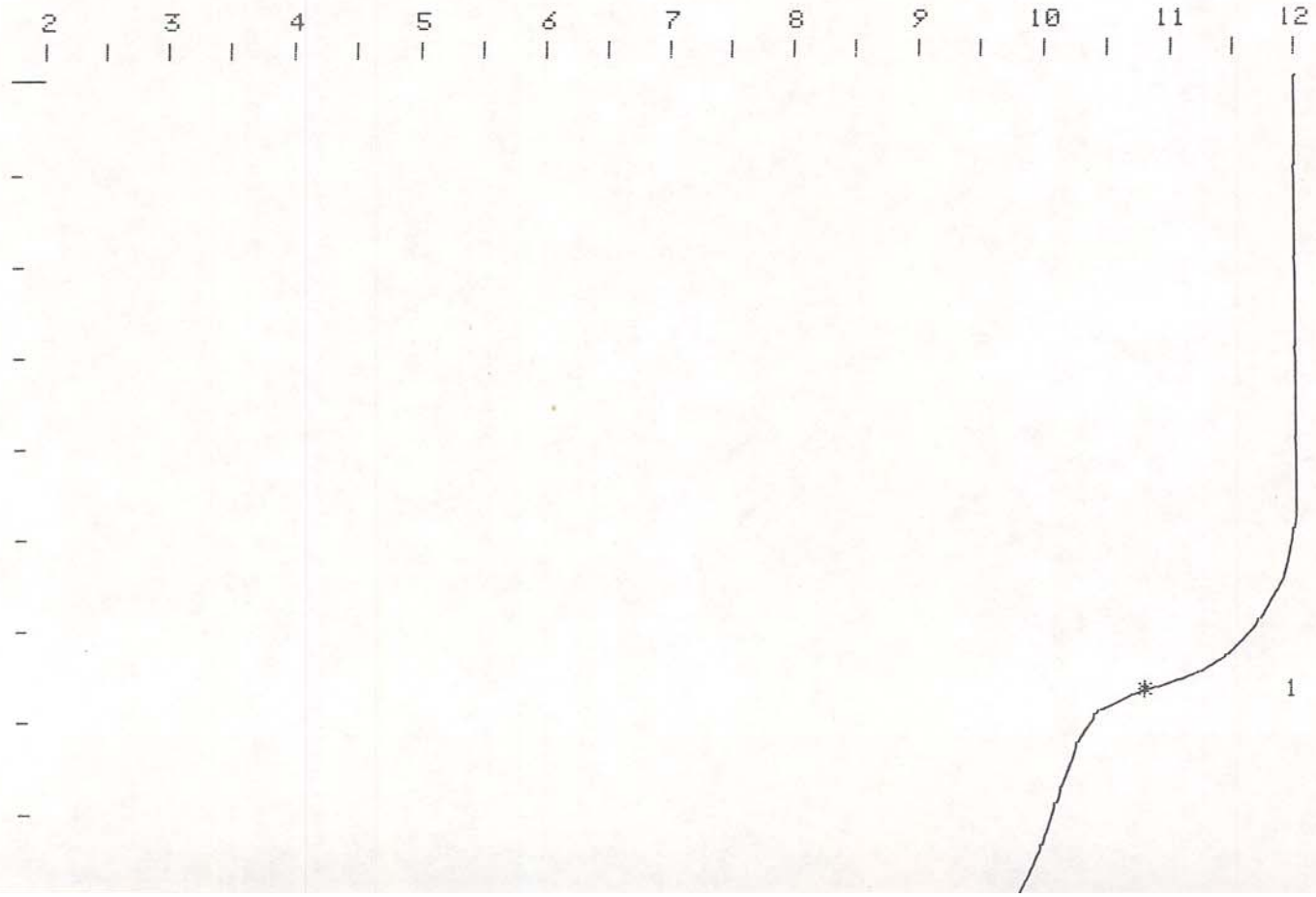
rgB 6/10/02

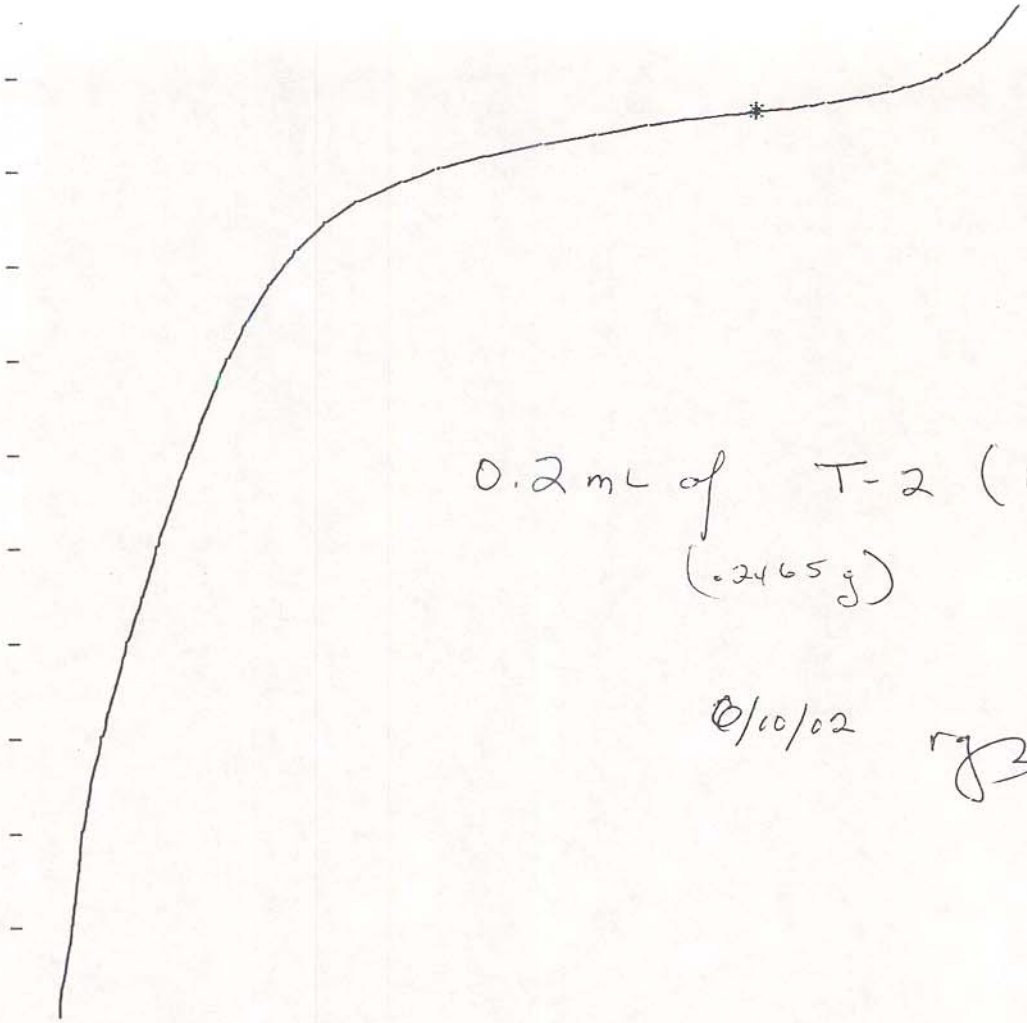
ROUTINE # 101

#	6	PH(INIT)	12.488	V(TE)/ML	5.000
1	V/ML	2.574	PH(M)	10.785	
2	V/ML	3.013	PH(M)	7.539	
3	V/ML	3.132	PH(M)	3.906	

DATE 11.06.02 NAME

0.25ML/DIV V(START)/ML 0.000 PH





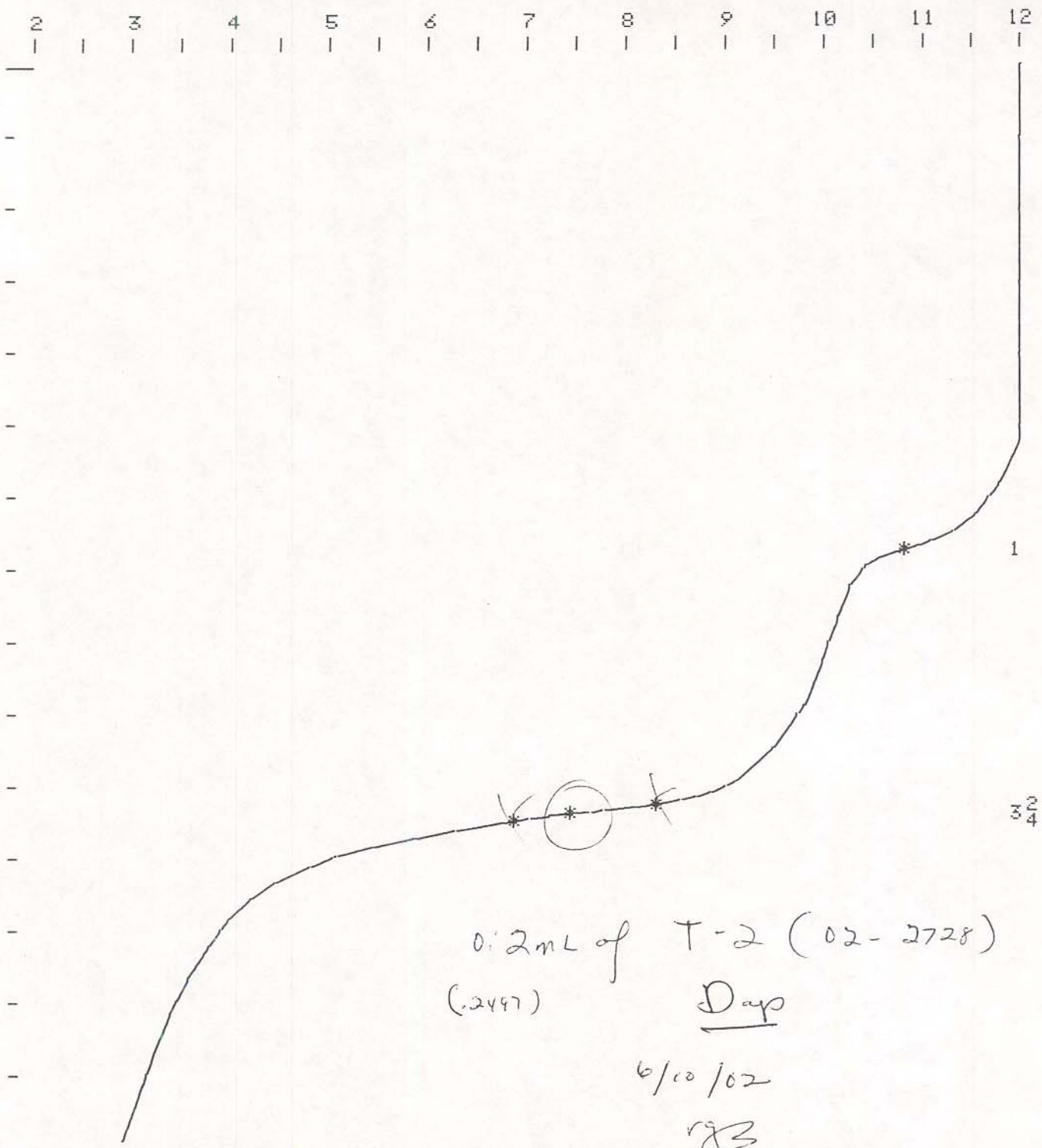
0.2 mL of T-2 (02-2728)
(.2465 g)

6/10/02 rgB

ROUTINE # 101
7 PH(INIT) 12.523 V(TE)/ML 5.000
1 V/ML 1.697 PH(M) 10.766
2 V/ML 2.599 PH(M) 7.531

DATE 11.06.02 NAME

0.25ML/DIV V(START)/ML 0.000 PH



0.2mL of T-2 (02-2728)
(.2447)
Days
6/10/02
rgB

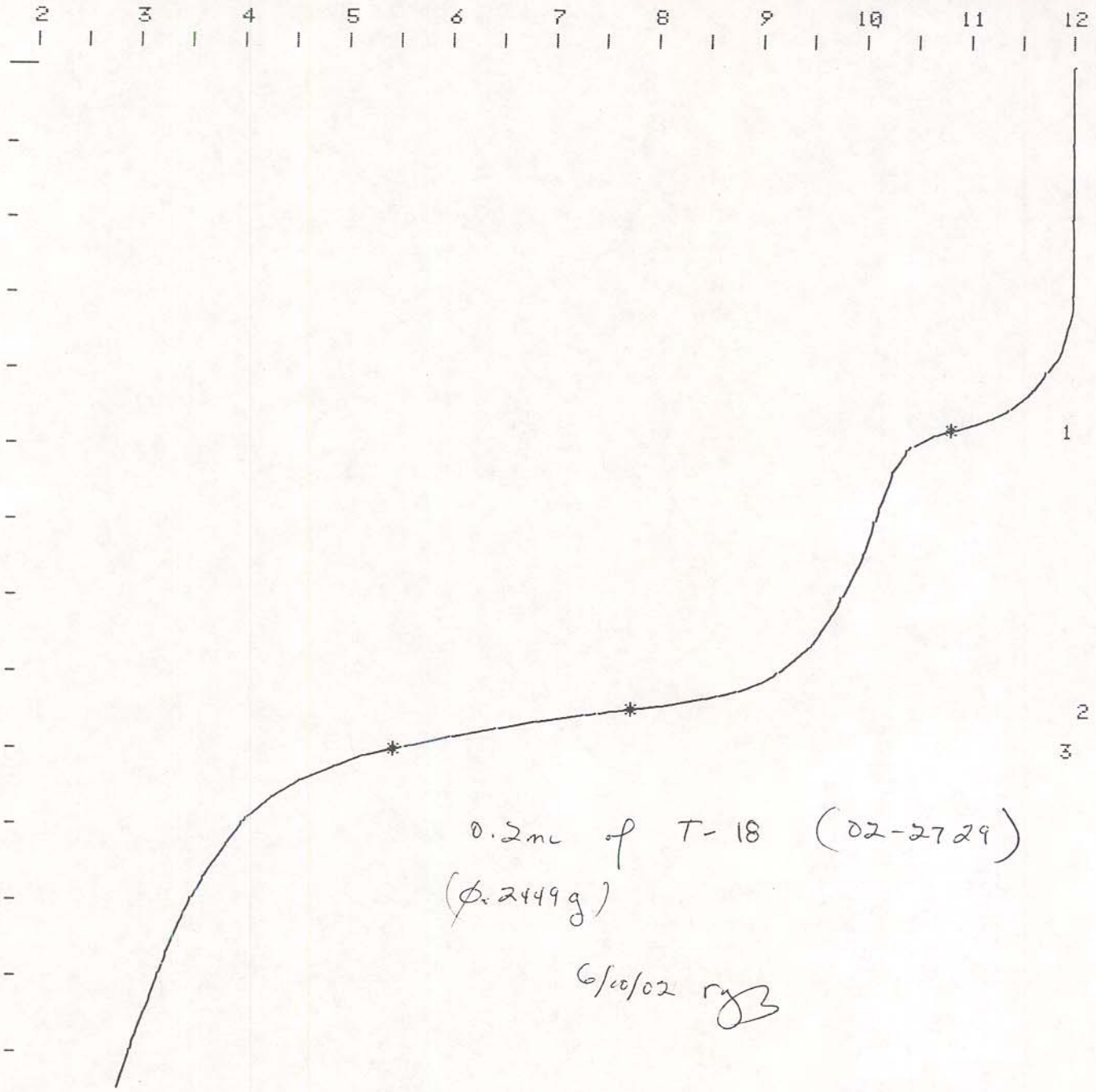
BRINKMANN CAT # 2025015-1

ROUTINE # 101
8 PH(INIT) 12.621 V(TE)/ML 3.888
1 V/ML 1.686 PH(M) 10.804
2 V/ML 2.569 PH(M) 8.277
3 V/ML 2.600 PH(M) 7.419
4 V/ML 2.626 PH(M) 6.845

These 2 pts are not inflection pts
rgB 6/10/02

DATE 11.06.02 NAME

0.25ML/DIV V(START)/ML 0.000 PH



0.2mL of T-18 (02-2729)
(0.2449 g)

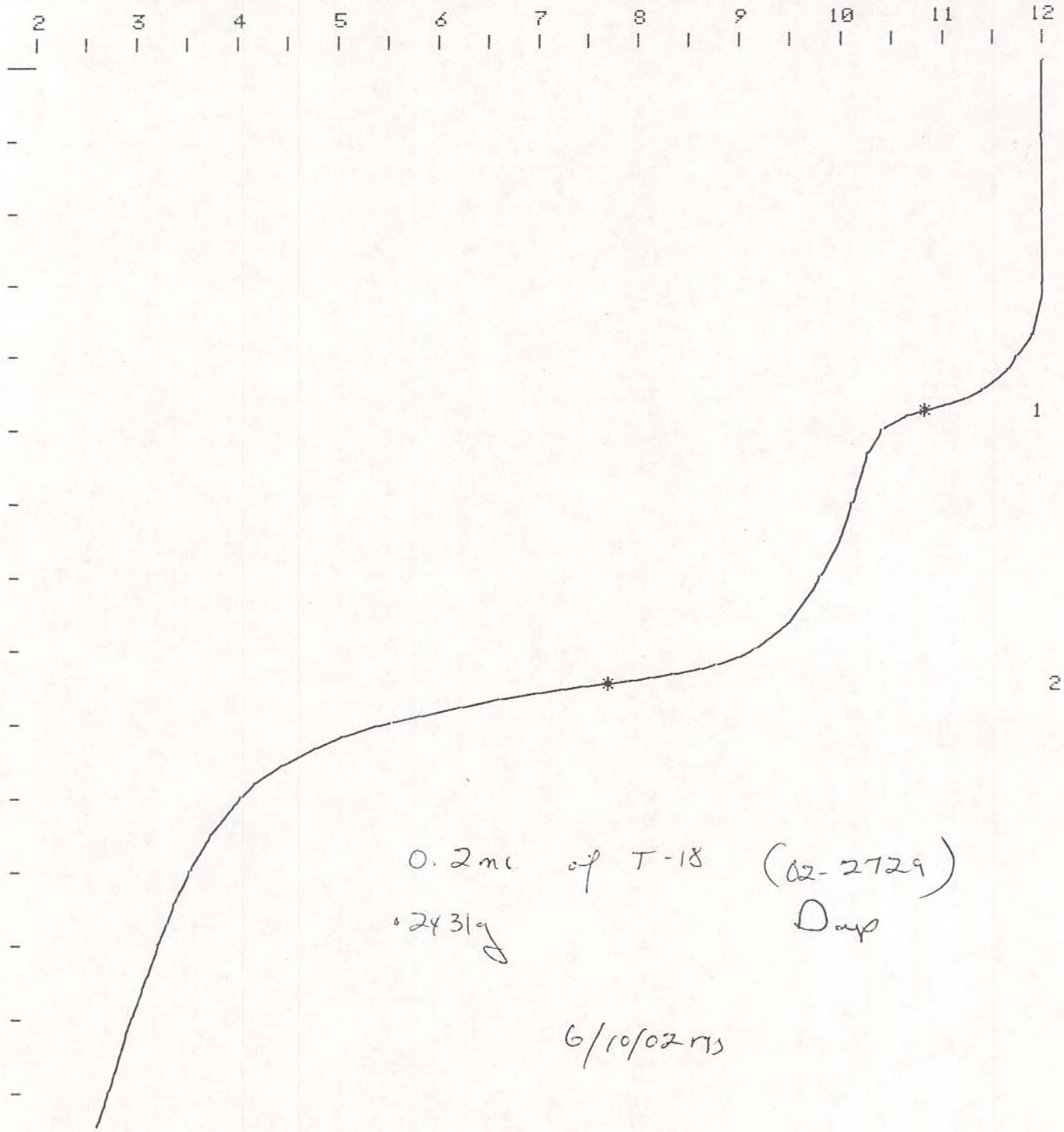
6/10/02 rgB

BRINKMANN CAT # 2025015-1

ROUTINE # 101
9 PH(INIT) 12.505 V(TE)/ML 3.544
1 V/ML 1.198 PH(M) 10.828
2 V/ML 2.127 PH(M) 7.749
3 V/ML 2.260 PH(M) 5.437

DATE 11.06.02 NAME

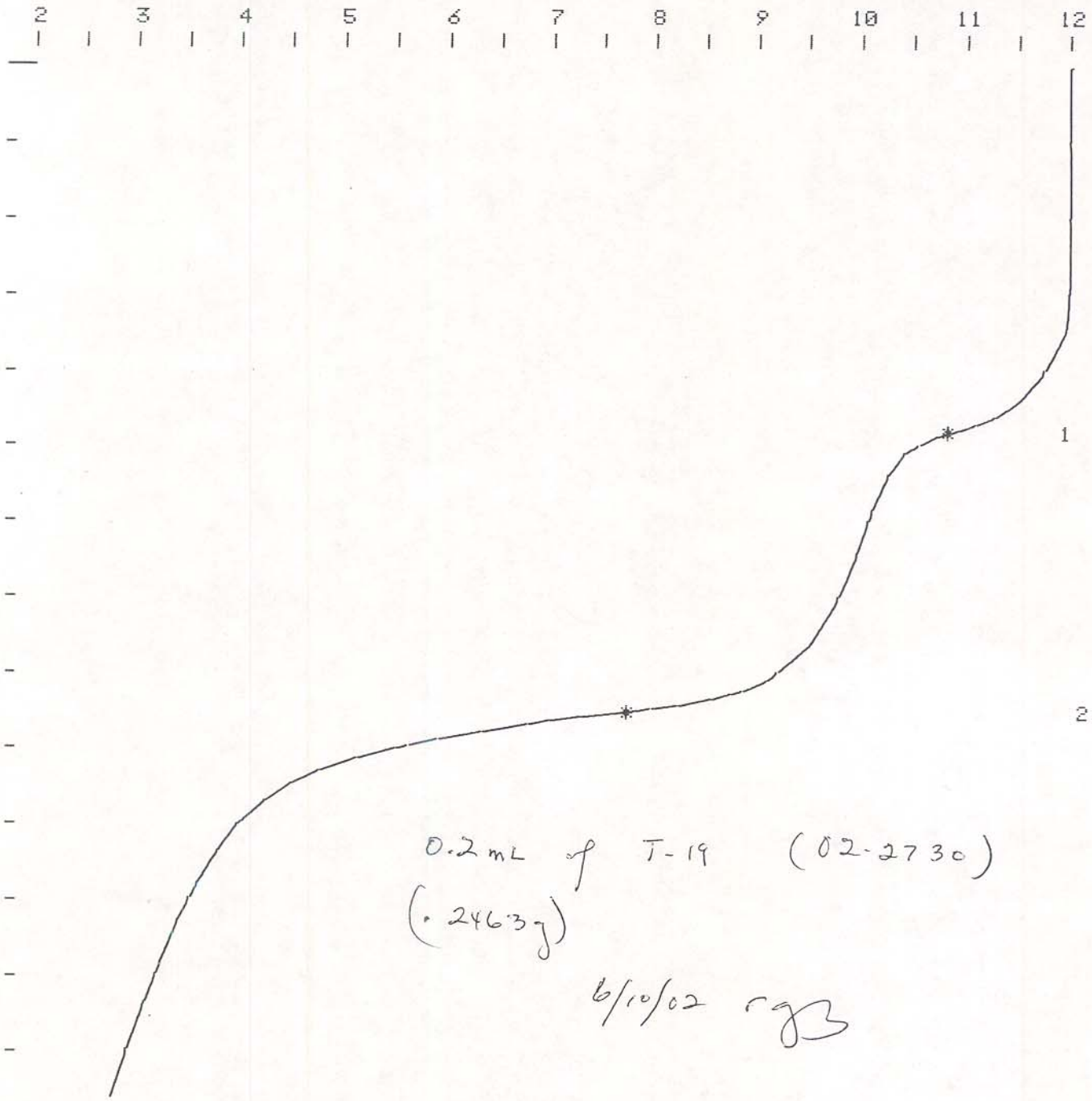
0.25ML/DIV V(START)/ML 0.000 PH



ROUTINE # 101
10 PH(INIT) 12.516 V(TE)/ML 3.787
1 V/ML 1.189 PH(M) 10.827
2 V/ML 2.121 PH(M) 7.665

DATE 11.06.02 NAME

0.25ML/DIV V(START)/ML 0.000 PH

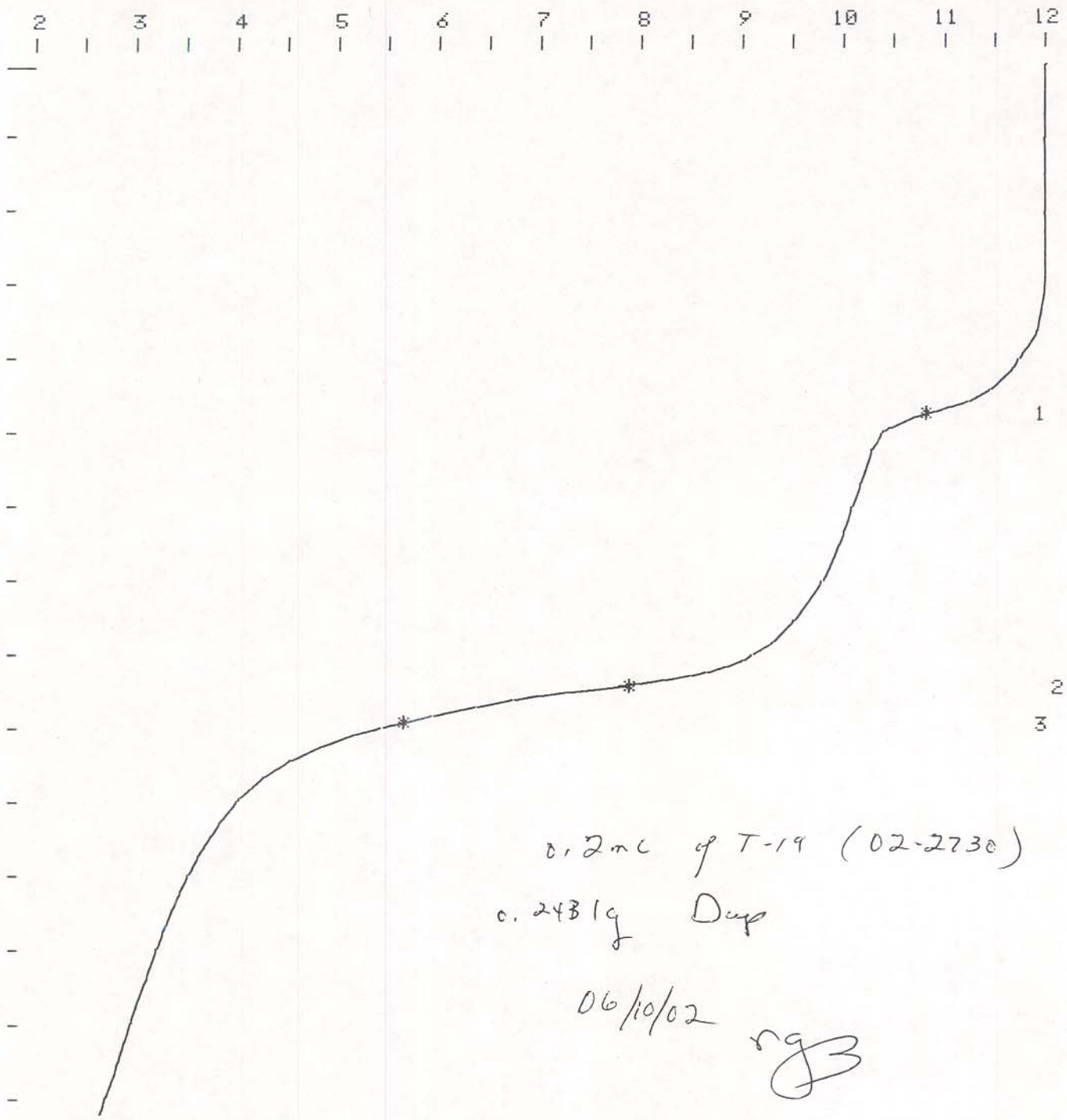


0.2 mL of T-19 (02-2730)
(.2463 g)
6/10/02 rgB

ROUTINE # 101
11 PH(INIT) 12.478 V(TE)/ML 3.571
1 V/ML 1.212 PH(M) 10.823
2 V/ML 2.141 PH(M) 7.708

DATE 11.06.02 NAME

0.25ML/DIV V(START)/ML 0.000 PH



0.2mL of T-19 (02-2730)

0.2431g Dup

06/10/02

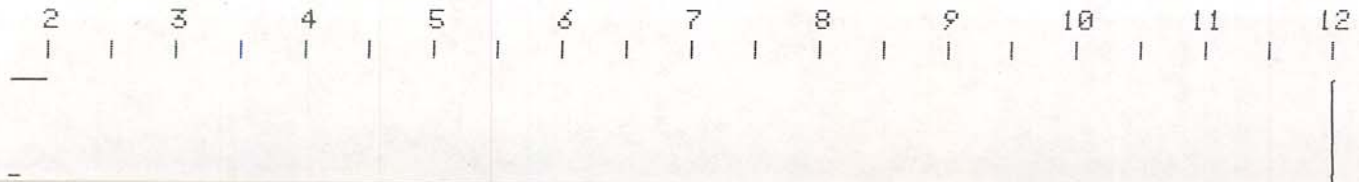
rgB

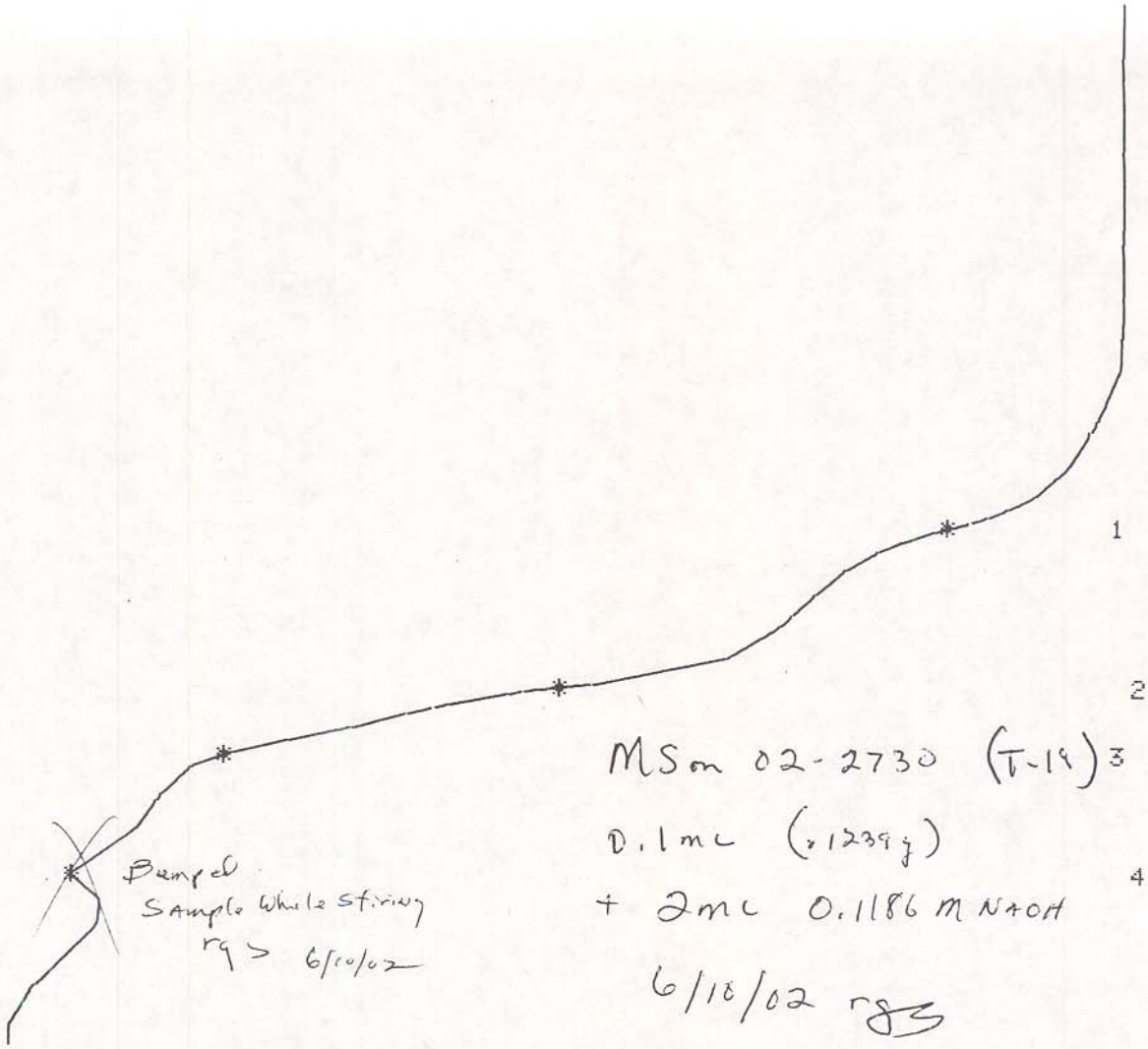
ROUTINE # 101

#	12	PH(INIT)	12.521	V(TE)/ML	3.719
1	V/ML	1.186	PH(M)	10.820	
2	V/ML	2.110	PH(M)	7.880	
3	V/ML	2.233	PH(M)	5.623	

DATE 11.06.02 NAME

0.25ML/DIV V(START)/ML 0.000 PH



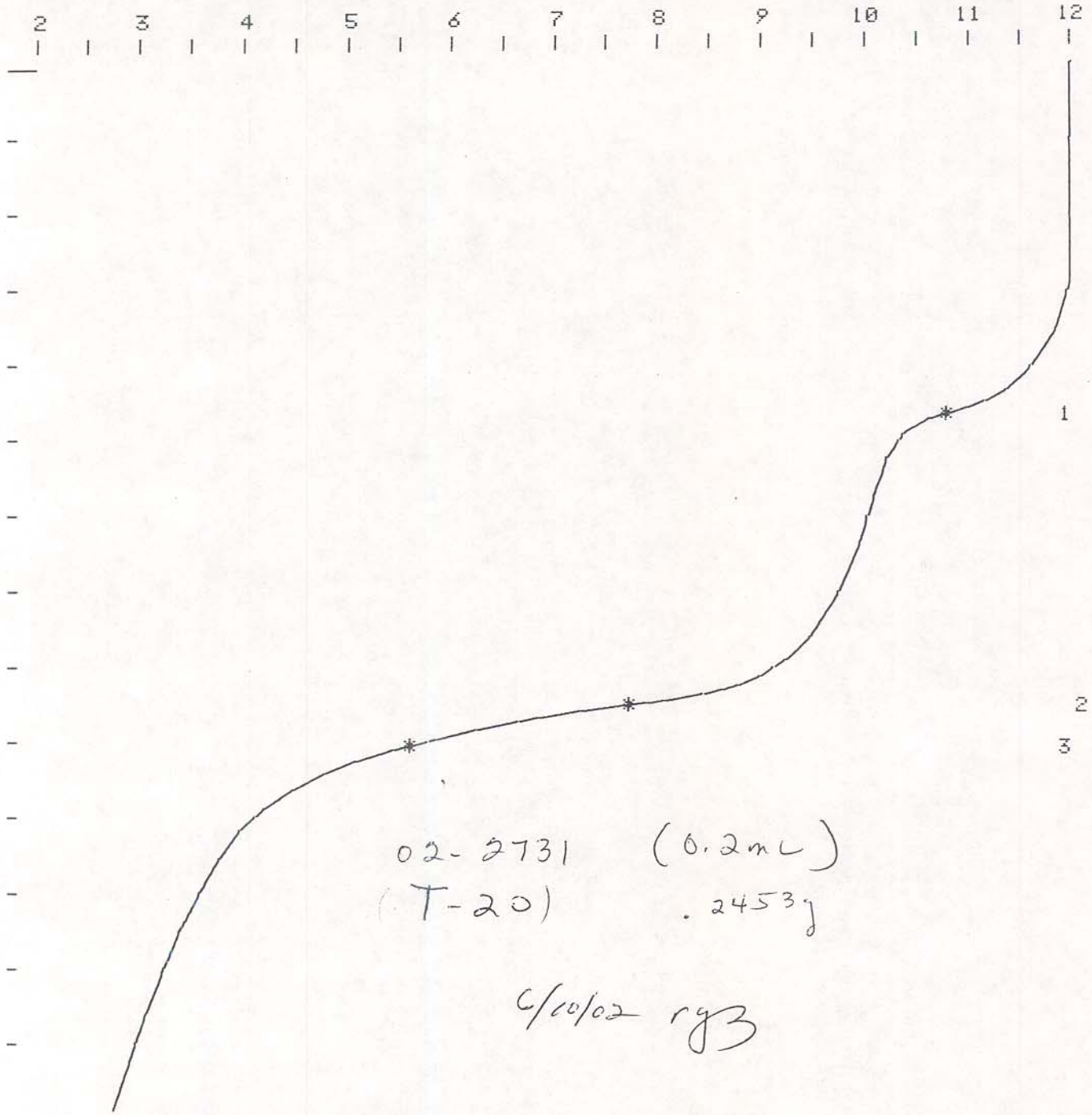


ROUTINE # 101

#	13	PH(INIT)	12.608	V(TE)/ML	3.204
1	V/ML	1.767	PH(M)	10.607	
2	V/ML	2.199	PH(M)	7.529	
3	V/ML	2.378	PH(M)	4.859	
4	V/ML	~~2.701~~	~~PH(M)~~	~~3.684~~	reject (rgs) 6/10/02

DATE 11.06.02 NAME

0.25ML/DIV V(START)/ML 0.000 PH



02-2731 (0.2mL)
(T-20) .2453g

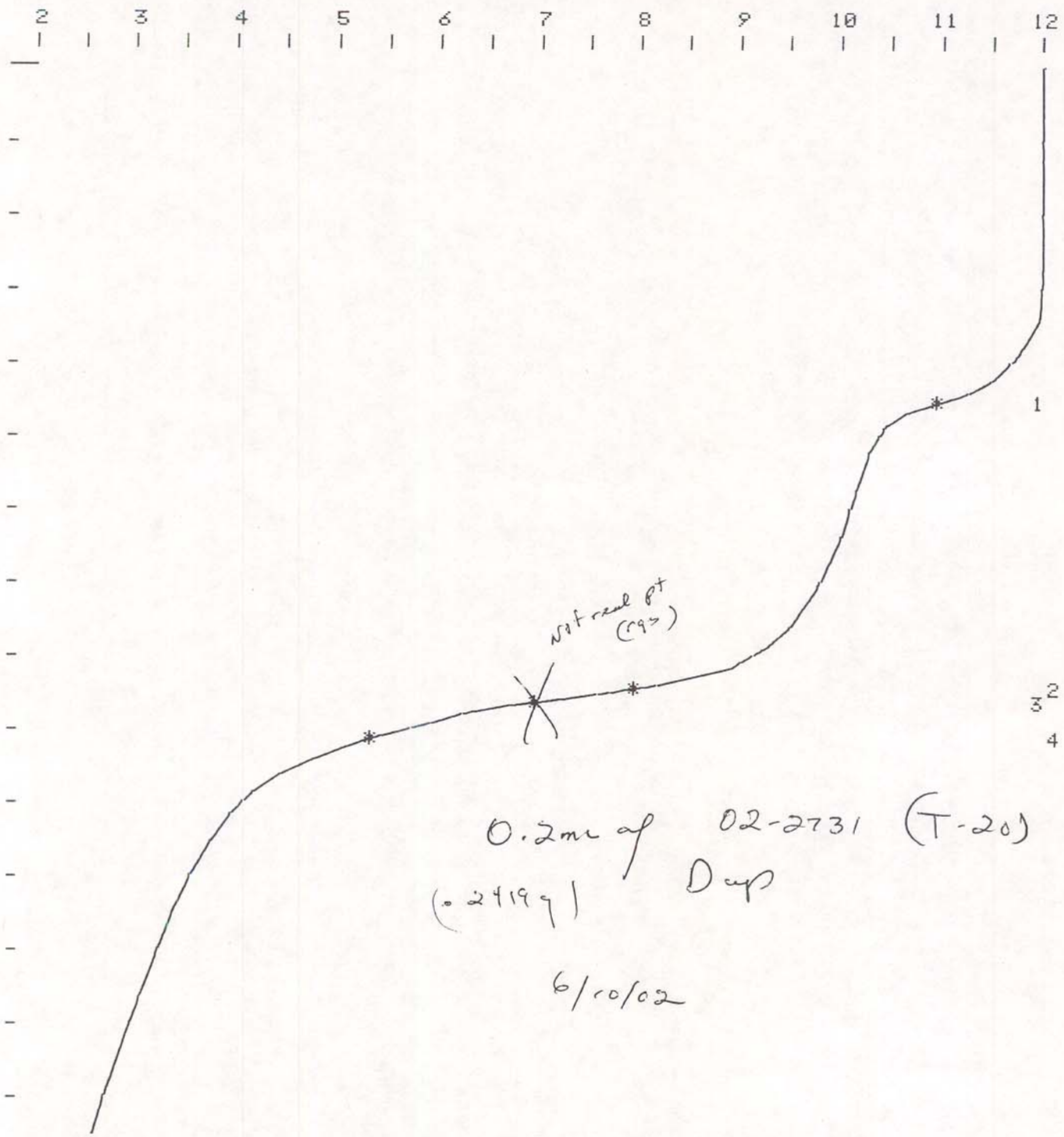
6/10/02 rgB

ROUTINE # 101
14 PH(INIT) 12.293 V(TE)/ML 3.638
1 V/ML 1.163 PH(M) 10.787
2 V/ML 2.130 PH(M) 7.707
3 V/ML 2.266 PH(M) 5.575

DATE 11.06.02 NAME

BRINKMANN CAT # 2025015-1

0.25ML/DIV V(START)/ML 0.000 PH



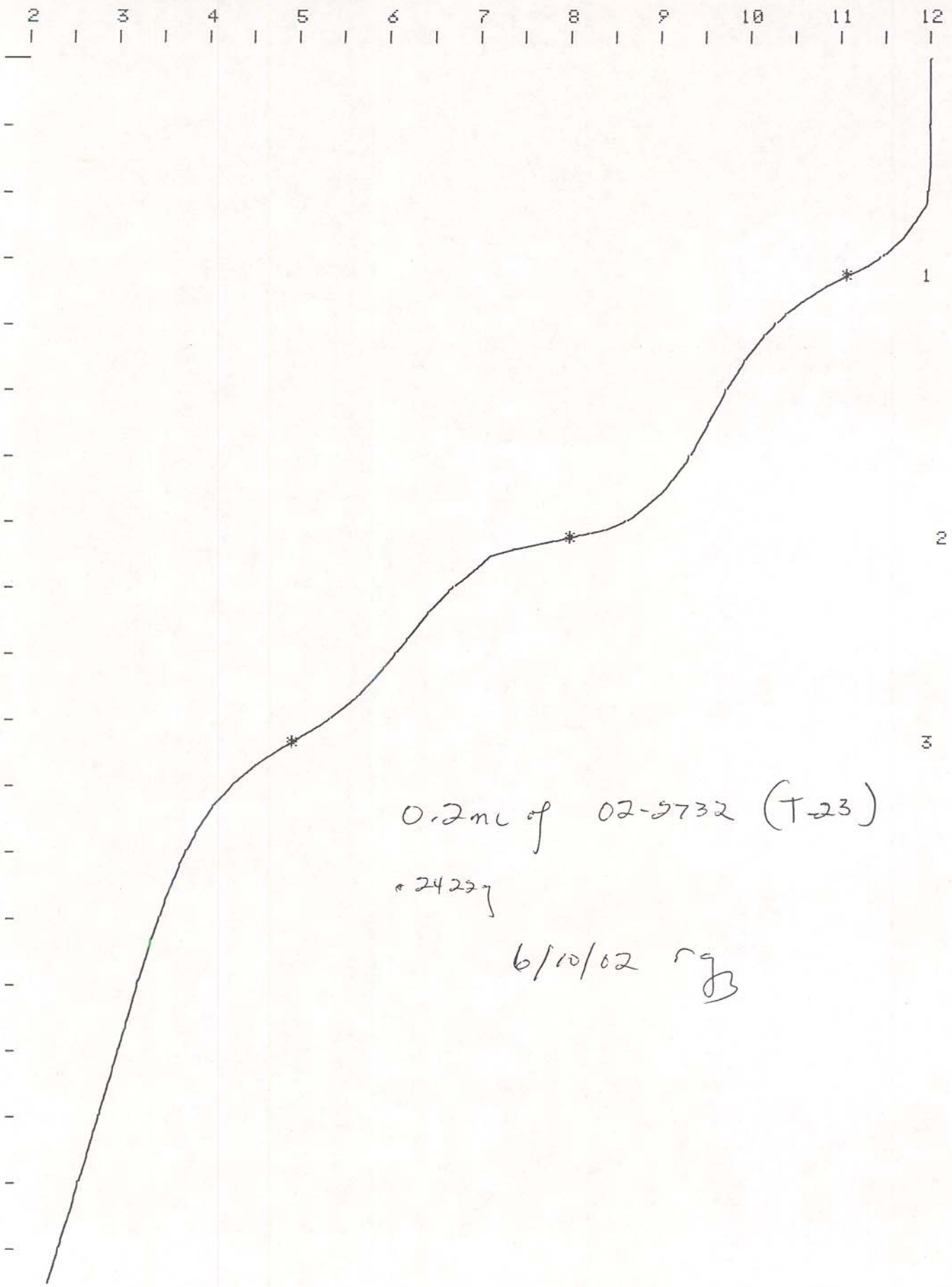
ROUTINE # 101
15 PH(INIT) 12.554 V(TE)/ML 3.795

1	V/ML	1.140	PH(M)	10.946
2	V/ML	2.117	PH(M)	7.944
3	V/ML	~~2.164~~	PH(M)	~~6.927~~ reject this one rgs 6/10/02
4	V/ML	2.287	PH(M)	5.315

DATE 11.06.02 NAME

BRINKMANN CAT # 2025015-1

0.25ML/DIV V(START)/ML 0.000 PH



0.2mL of 02-2732 (T-23)

.2427g

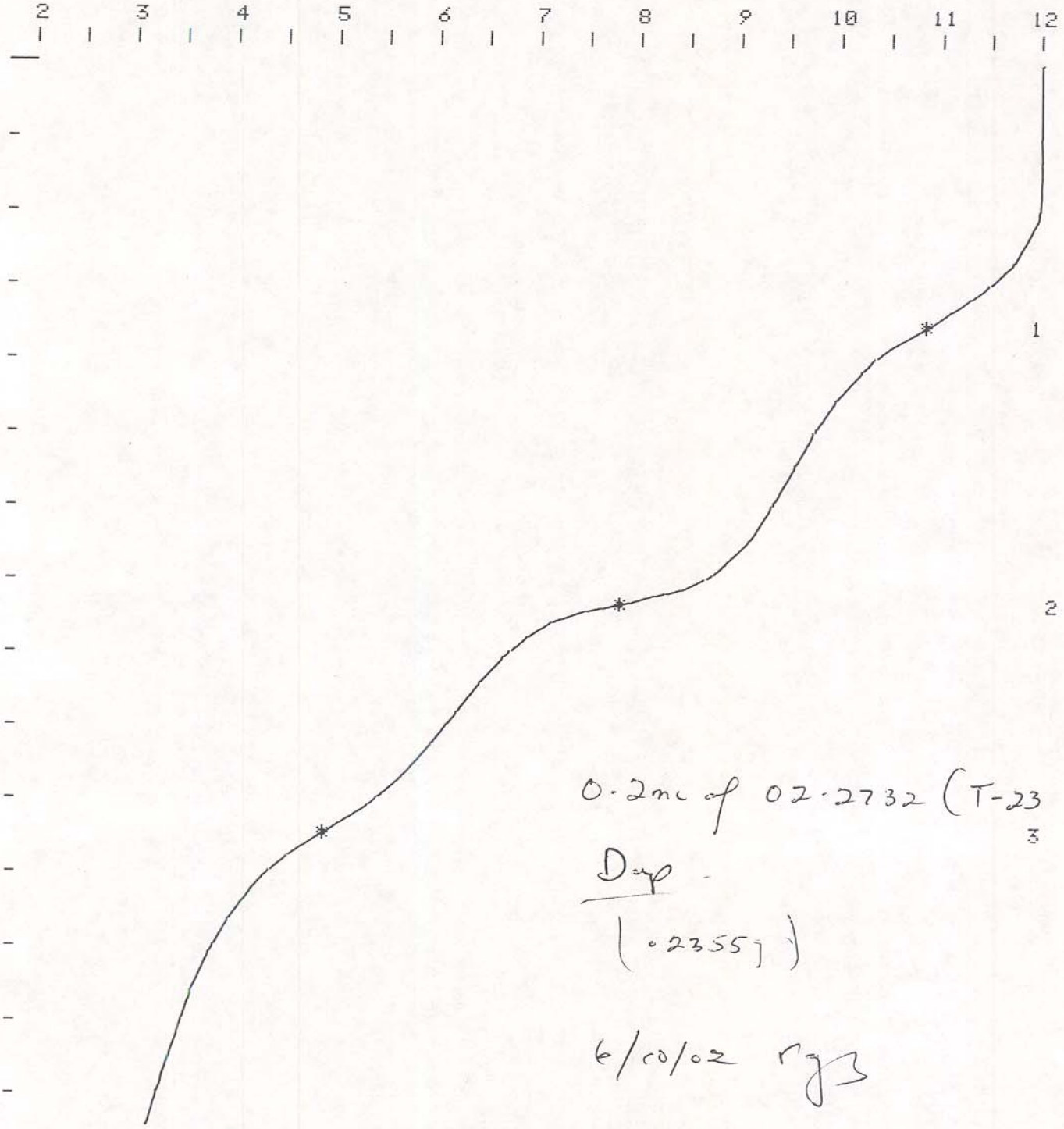
6/10/02 rg

BRINKMANN CAT # 2025015-1

ROUTINE # 101
16 PH(INIT) 12.420 V(TE)/ML 4.807
1 V/ML 0.825 PH(M) 11.059
2 V/ML 1.817 PH(M) 7.984
3 V/ML 2.594 PH(M) 4.885

DATE 11.06.02 NAME

0.25ML/DIV V(START)/ML 0.000 PH



0.2mc of 02.2732 (T-23

Dap

(.2355g)

6/10/02 rgB

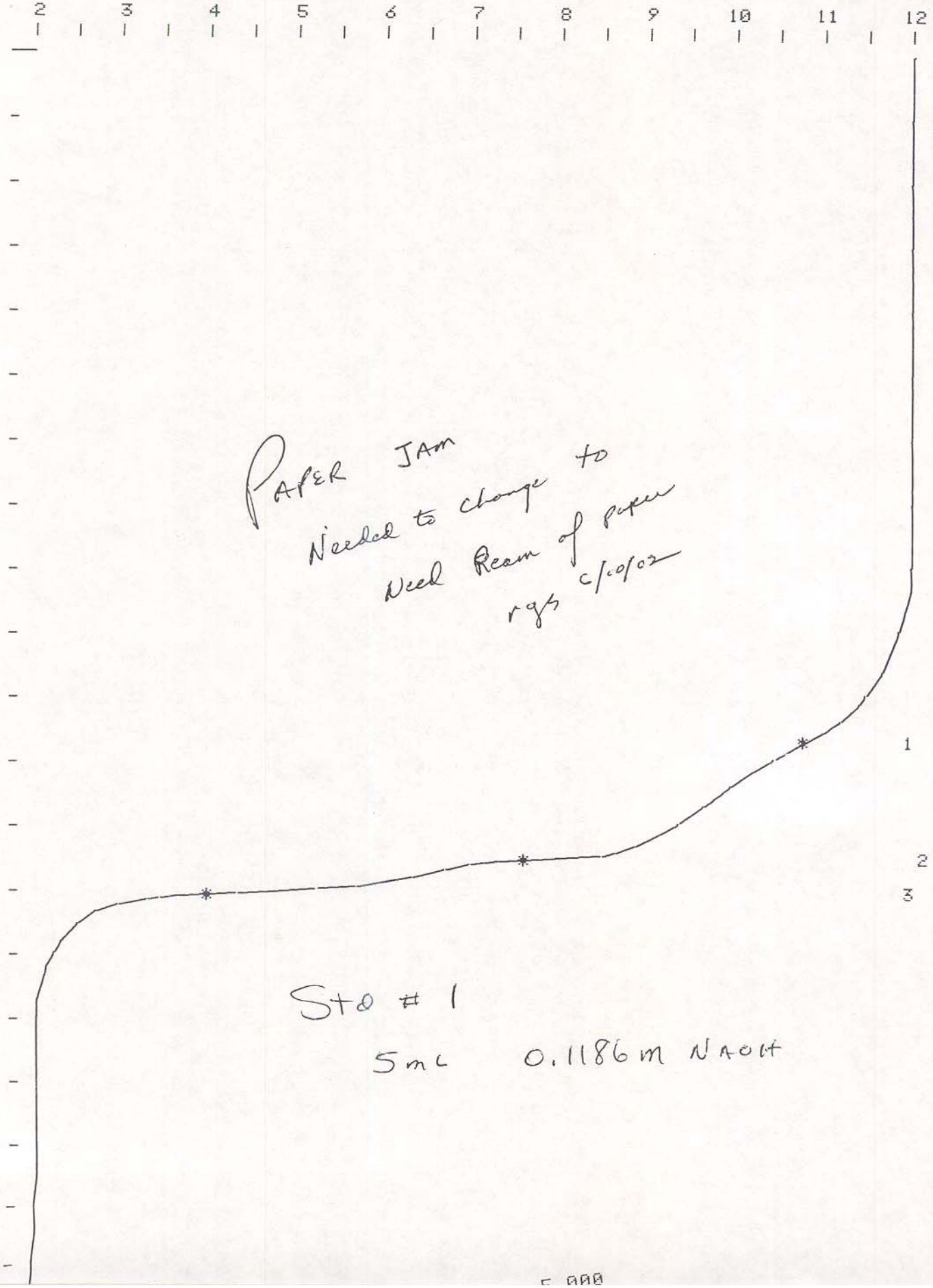
ROUTINE # 101

#	17	PH(INIT)	12.376	V(TE)/ML	3.785
1	V/ML	0.896	PH(M)	10.850	
2	V/ML	1.842	PH(M)	7.810	
3	V/ML	2.627	PH(M)	4.845	

DATE 11.06.02 NAME

CALIBR.ELECTRODES 1
PH(S) 10.000 4.000
TEMP/C 25.0 SLOPE 0.969 U(AS)/MV - 12.5

0.25ML/DIV V(START)/ML 0.000 PH



Paper Jam
Needed to change to
Need Ream of paper
rgs 6/10/02

Std # 1
5mL 0.1186m NaOH

BRINKMANN CAT # 2025015-1

ROUTINE # 101 PH(INIT) 12.514 V(TE)/ML 10.765
1 PH(M) 10.581
1 V/ML 2.688 PH(M) 7.985
2 V/ML 3.144 PH(M) 3.985
3 V/ML 3.277

DATE 11.06.02 NAME

0.25ML/DIV V(START)/ML 0.000 PH

Std #1 evaluation

7/30/02 rgs

Data is Ledgible even though the paper jammed @ the end of paper ream.

.204 M HCl = ~~.0641~~ .641 meq

~~.2041~~ 7/30/02 rgs

3.14 mL

Std is OK rgs

I reran QC Again on New ream of paper.

= 5mL × .1186 M NaOH = .593 meq

rgs 7/30/02

ROUTINE # 101
2 PH(INIT) 2.925 V(TE)/ML 1.045

FAILED

DATE 11.06.02 NAME

Second try on just a blank - paper jam at end of paper stock. I'll replace paper and start with .

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