AP42 Section:	11.7
Background Chapter:	4
Reference:	31
Title:	*Test Report for the Determination of Organic Compound Destruction Efficiency from SRK Kilns and Tokai Bakeout Ovens, Prepared for: Murata Erie North America, State College, PA*, Scott Environmental Technology, Plumsteadville, PA, August 1992.

STIRS PA30-02

Insuffic process data

AP-42 Section 4.7
Reference —
Report Sect. 4
Reference 31

COMMONWEALTH OF PENN

November 12, 1992

CERAMICS SECTION 4 REF. 31.

SUBJECT: Test Report
Murata Erie North America
Ferguson Township, Centre County
Files No. 14-399-009A and 14-399-011

TO: R. St.Louis, Chief
Source Testing Section
Division of Source Testing and Monitoring

THROUGH: Richard L. Maxwell, Jr.
Chief, Engineering Services
Air Quality
Northcentral Region

FROM: David Alan Bish
Air Pollution Control Engineer III
Northcentral Region

You will find attached a test report on the organic compound destruction efficiency for electrically heated afterburners on an SRK kiln and a Tokai bakeout oven. The test protocol was reviewed by Jaydeb Pal.

Both of these operations bakeout binder materials in an electronic capacitor production operation. I have enclosed a copy of my application review memo for 8 SRK kilns which describes the subject operations. The Tokai ovens operate on a different firing cycle and are physically different than the SRK kilns but perform basically the same function.

I was at the plant during part of the testing and have enclosed a copy of my observation memo.

Please have a member of your staff review the report and advise me regarding the acceptability of the test methods. You will note that additional testing was included in this report and was done to satisfy some EPA requirements. The Department's interest lies in the VOC destruction removal efficiency (DRE) of these units. The particulate, sulfur oxide and nitrogen oxide information is of no real import.

I briefly scanned this document and one obvious area of concern centers on the negative DRE measured on test runs 2 and 3 on the SRK kiln. The report doesn't really explain this problem other than to say that the VOC concentration in the exhaust gases remain relatively constant while the VOC concentrations to the afterburner decrease by magnitude of 100. The report states, "This would account for the erratic DRE data from the triplicate series". What are your thoughts on this matter? Are the PPM readings in the exhaust in a range where the accuracy of the measurement could be this far off?

If you need any additional data or want to discuss any aspect of this operation, please feel free to call me at 8-465-3642.

DAB/lm

Attachment

Note: No specific emission limitation. The application projected a DRE of 98%

SET 1526-01-0892-21B

TEST REPORT
FOR THE DETERMINATION OF
ORGANIC COMPOUND DESTRUCTION EFFICIENCY
FROM SRK KILNS (Plan Approval 14-399-09A)
AND TOKAI BAKEOUT OVENS (Plan Approval 14-399-011)

Prepared for:

MuRata Erie North America
1900 West College Avenue
State College, PA

August 1992

SCOTT ENVIRONMENTAL TECHNOLOGY
A Div. of National Air Network, Inc.
Plumsteadville, Pennsylvania

Commonwealth of Pennsylvania
Environmental Resources
December 31, 1992

Subject: Source Test Review

To: Data File
Murata Erie North America, Inc.
Ferguson Township, Centre County

From: Richard St. Louis, Chief
Source Testing Section
Division of Source Testing and Monitoring
Bureau of Air Quality Control

Through: Acting Chief, Division of Source Testing and Monitoring

MuRata Erie North America, Inc. operates eight SRK Kilns and three Tokai Bakeout Ovens at the above location used to heat treat ceramic capacitors.

Scott Environmental Technology conducted total VOC destruction efficiency tests for methanol, acetaldehyde, acetone, ethyl acetate, vinyl acetate, benzene, toluene and xylene at the inlet and exhaust of a Tokai bakeout oven and SRK kiln. Testing was conducted by EPA Method 18 using gas chromatography with a flame ionization detector. As part of a separate agreement with U.S. EPA, Murata Erie agreed to perform additional tests for sulfur dioxides (Method 6), nitrogen oxides (Method 7D), and particulate matter (Method 5) at the Tokai DEK afterburner exhaust location as well as some ambient outdoor air sampling. The tests were conducted in accordance with preapproved procedures and are acceptable to the Department with the following comment:

1. The NO_x sampling rate of 550 cc per minute is above the maximum sampling rate of 500 cc per minute as required by EPA Method 7D. This higher sampling rate could reduce the NO_x collection efficiency which could lower the amount of NO_x collected.

The following information was extracted from the test report:

Tokai Bakeout Oven DBK

Test Location	Inlet			Outlet		
Run No.	1	2	3	1	2	3
Test Date	7/22/92	7/22/92	7/22/92	7/22/92	7/22/92	7/22/92
CO (ppm)	780.0	743.0	552.0	65.9	195.0	27.0
Methanol (ppm)	50.69	ND	ND	ND	ND	ND
Acetaldehyde (ppm)	313.6	18.04	16.06	0.70	0.27	0.20
Acetone (ppm)	109.0	229.31	293.22	0.13	0.11	0.14
Ethyl Acetate (ppm)	17.67	22.22	6.31	ND	0.20	ND
Vinyl Acetate (ppm)	ND	ND	ND	ND	ND	ND
Benzene (ppm)	36.55	24.79	10.99	0.07	0.04	0.04
Toluene (ppm)	0.95	2.72	2.72	ND	ND	ND
Xylene (ppm)	1.36	2.48	0.50	ND	ND	ND
CO (lb./hr.)	5.8e-2	5.5e-2	4.0e-2	1.5e-2	4.1e-2	6.2e-3
Methanol (lb./hr.)	4.3e-3	ND	ND	ND	ND	ND
Acetaldehyde (lb./hr.)	3.7e-2	2.1e-3	1.8e-3	2.5e-4	8.9e-5	7.2e-5
Acetone (lb./hr.)	1.7e-2	3.5e-2	4.4e-2	6.1e-5	4.3e-5	6.7e-5
Ethyl Acetate (lb/hr.)	4.1e-3	5.1e-3	1.4e-3	ND	1.3e-5	ND
Vinyl Acetate (lb./hr.)	ND	ND	ND	ND	ND	ND
Benzene (lb./hr.)	7.6e-3	5.1e-3	2.2e-3	4.4e-5	2.3e-5	2.6e-5
Toluene (lb./hr.)	2.3e-3	6.6e-4	6.5e-4	ND	ND	ND
Xylene (lb./hr.)	3.8e-4	6.9e-4	1.4e-4	ND	ND	ND

ND - Not Detectable

Tokai Oven

Run No.	1	2	3
Test Date	7/23/92	7/23/92	7/23/92
Inlet (SCFM)	17.16	16.95	16.77
Exhaust (SCFM)	52.0	48.0	53.0
Common Header Exhaust (DSCFM)	1,511	1,506	1,468
Particulate Concentration (mg/scm)	0.0022	0.0011	0.0008
Particulate Emission Rate (lb./hr.)	0.03	0.01	0.01
NO_x Concentration (mg/scm)	21.498	18.241	15.449
NO_x Emission Rate (lb./hr.)	0.148	0.116	0.108
SO_2 Concentration (mg./scm)	41.83	6.01	1.67
SO_2 Emission Rate (lb./hr.)	0.17	0.02	0.01

SRIC Kiln

Test Location	Inlet			Outlet		
Run No.	1	2	3	1	2	3
Test Date	7/22/92	7/23/92	7/23/92	7/22/92	7/23/92	7/23/92
Methanol (ppm)	9.80	ND	ND	ND	ND	ND
Acetaldehyde (ppm)	366.5	1.76	2.07	0.11	ND	0.09
Acetone (ppm)	352.0	2.52	0.34	0.04	0.06	0.11
Ethyl Acetate (ppm)	115.45	0.16	0.10	ND	ND	ND
Vinyl Acetate (ppm)	ND	ND	ND	ND	ND	ND
Benzene (ppm)	206.44	0.43	1.69	0.02	ND	ND
Toluene (ppm)	3.82	ND	ND	ND	ND	ND
Xylene (ppm)	2.98	ND	ND	ND	ND	ND
Methanol (lb./hr.)	2.1e-4	ND	ND	ND	ND	ND
Acetaldehyde (lb./hr.)	1.1e-2	5.2e-5	5.8e-5	5.3e-5	ND	5.0e-5
Acetone (lb./hr.)	1.4e-2	9.3e-5	1.3e-5	2.6e-5	4.3e-5	8.1e-5
Ethyl Acetate (lb/hr.)	6.8e-3	9.4e-6	5.6e-6	ND	ND	ND
Vinyl Acetate (lb./hr.)	ND	ND	ND	ND	ND	ND
Benzene (lb./hr.)	1.1e-2	2.2e-5	8.5e-5	1.7e-6	ND	ND
Toluene (lb./hr.)	2.3e-4	ND	ND	ND	ND	ND
Xylene (lb./hr.)	2.1e-4	ND	ND	ND	ND	ND
% Destruction Efficiency (Acetone)	99.81	55.91	-542			
% Destruction Efficiency (Benzene)	99.84	100.00	100.00			

cc: File No. 14-399-009
File No. 14-399-011
David Allen Bish, Northcentral Regional Office
EPA/RSL
Reading File

EBzwrek

MURATA ERIE NORTH AMERICA
1900 W. COLLEGE AVE.
STATE COLLEGE, PA 16801
TELEPHONE: 814-237-1431
TELEX: 26-1708
PANAFAX: 1-814-238-0490

CERTIFIED MAIL

November 2, 1992

David A. Bish
Air Quality Control Engineer
PaDER- North Central Region
200 Pine Street
Williamsport, PA 17701-6510

Re: Stack Test Report - SRK Kiln (14-399-009A) and Tokai Bakeout Oven (14-399-011)

Dear Mr. Bish:

Attached please find two (2) copies of a report prepared by Scott Environmental Technology of Plumsteadville, PA presenting the results of stack testing performed during the week of July 20, 1992 as required in the conditions for Plan Approval for 8 SRK Kilns (14-399-009A) and 3 Tokai Bakeout Ovens (14-399-011). As I believe you will see, the results of the stack test indicate excellent destruction efficiency (> 98%) of volatile organics by the DBK thermal afterburner for both the SRK Kiln tested as well as for the Tokai Bakeout Oven.

Based on the submission of this test report, Murata Erie has completed its obligations as specified in each of the Plan Approvals specified above.

Please contact me if you have any questions regarding this test report.

Sincerely,

Steven W. Foard

Steven W. Foard
Environmental/Safety Manager

cc: R. McKinney- Scott Environmental

SET 1526-01-0892-218

TEST REPORT
FOR THE DETERMINATION OF ORGANIC COMPOUND DESTRUCTION EFFICIENCY FROM SRK KILNS (Plan Approval 14-399-09A) AND TOKAI BAKEOUT OVENS (Plan Approval 14-399-011)

Prepared for:

MuRata Erie North America
1900 West College Avenue
State College, PA

August 1992

SCOTT ENVIRONMENTAL TECHNOLOGY
A Div. of National Air Network, Inc.
Plumsteadville, Pennsylvania

TABLE OF CONTENTS

This copy only contains pages 1-31. However, Appendix D is missing from the CD Rom file, so the report cannot be used for EF development.

SET 1526-01-0892-218

1.0 CERTIFICATION AND REVIEW

The following certifications are provided in order for the Pennsylvania Department of Environmental Resources to initiate the review of the MuRata Erie compliance test report.

"I certify under penalty of law that the information provided in this document is true, accurate and complete. I am aware that there are significant civil and criminal penalties, including fines or imprisonment or both, for submitting false or incomplete information."

.....

Robert M. McKinney

2.0 INTRODUCTION

Scott Environmental Technology (SCOTT) was contracted by MuRata Erie North America to conduct organic destruction efficiency tests on the electronically operated DBK afterburners associated with a Tokai Bakeout Oven and SRK Kiln, at the MuRata Erie North American facility in State College, Pennsylvania. The facility contains 3 identical Tokai Bakeout Ovens and 10 SRK Kilns. The tests were performed on a representative unit of each type. Triplicate tests were conducted at inlet and exhaust of one SRK Kiln and Tokai Bakeout Oven DBK afterburner.

A representative Tokai Bakeout Oven and SRK Kiln were selected for the test evaluation. (Tokai Oven 3, SRK Kiln Unit F).

As part of a separate agreement with the U.S. EPA, MuRata Erie agreed to perform additional tests for sulfur oxides, nitrogen oxides, and particulate matter at the Tokai DBK afterburner exhaust location, as well as some ambient outdoor air sampling.

The evaluation was performed on July 22, and 23, 1992. Mr. David Bish of the Pennsylvania Department of Environmental Resources observed stack testing activities on July 22, 1992. Tables 2-1 and 2-2 illustrate a complete breakdown of the test scope including pollutant parameter and test location.

The purpose of the evaluation was to demonstrate the performance of the DBK afterburners currently operating as control devices for VOC's generated from the SRK Kilns and Tokai bakeout ovens.

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Table 2-1

Emissions Test Scope Summary

Tokai Bakeout Oven DBK Afterburner Inlet

Volatile Organic Compounds (specified)
Oxygen, Carbon dioxide
Carbon monoxide

Tokai Bakeout Oven DBK Afterburner Exhaust

Volatile Organic Compounds (specified)
Oxygen, Carbon dioxide
Carbon monoxide
Moisture content
Sulfur dioxide
Nitrogen oxides
Particulate

Ambient Air (upwind and downwind)

Volatile Organic Compounds (specified)

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Table 2-2

Emissions Test Scope Summary

SRK Kiln DBK Afterburner Inlet

Volatile Organic Compounds (specified)
Oxygen, Carbon dioxide

SRK Kiln DBK Afterburner Exhaust

Volatile Organic Compounds (specified)
Oxygen, Carbon dioxide
Moisture content

SET 1526-01-0892-216

3.0 SUMMARY OF RESULTS

Emission test results are presented in tabular formats. Table 3-1 illustrates the destruction removal efficiency (DRE) test results for the Tokai Bakeout Oven. An average DRE of 99.78% and 99.27% was observed for acetone and benzene respectively. An average DRE of 99.07% total VOC was observed.

Table 3-2 illustrates the DRE test results for the SRK Kiln. The test results indicate that VOC loading to the afterburner significantly decreased for test runs 2 and 3. Therefore DRE values were greatly affected. Test run 1 exhibited a DRE of 99.81%, 99.84%, and 99.04%, for acetone, benzene, and total VOC respectively. The actual concentrations of VOC's in the exhaust gases remained relatively constant throughout the triplicate evaluation. However, the concentration of VOC's emitted from the kiln to the afterburner decreased by a magnitude of 100. This would account for the erratic DRE data from the triplicate series. (i.e. low and negative DRE values).

A record of DBK afterburner temperature and kiln/oven temperature was maintained throughout the evaluation by Scott personnel. This record is included in Appendix D of this report.

Tables 3-3 thru 3-6 illustrate the test results for carbon monoxide (CO) and specific volatile organic compounds (VOC's) for the Tokai Bakeout Oven and SRK kiln.

Table 3-7 presents the test results for the additional test parameters requested by the U.S. EPA. (NO_x, SO_2, and Particulate) for the Tokai Bakeout Oven DBK afterburners exhaust.

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The results for the ambient air samples conducted were less than the detectable limits for each component. Table 3-8 presents a summary of the detectable ranges for these tests as well as the actual sample volumes.

All test results for which no pollutant concentrations were detected are denoted by ND.

A GC-MS scan was conducted on each of the bag samples collected. This scan was conducted as a semi-quantitative search for other possible source gas constituents. Appendix F of this report contains the GC-MS scan results.

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Table 3-1

Tokai Oven DRE Test Results

Date		7-22-92	7-22-92	7-22-92	AVERAGE
Run ID		RUN 1	RUN 2	RUN 3	
Start Time		1113	1415	1620	
Finish Time		1213	1515	1720	
Bakeout Oven Temperature (°C)		270.9	305.0	328.4	301.4
INLET	SCFM	17.16	16.95	16.77	16.96
EXHAUST	SCFM	52	48	53	51.00
LABORATORY RESULTS					
INLET	ppm Acetone	109.00	229.31	293.22	210.51
EXHAUST	ppm Acetone	.13	.11	.14	.13
INLET	ppm Benzene	36.55	24.79	10.99	24.11
EXHAUST	ppm Benzene	.07	.04	.04	.05
INLET	Total VOC as Propane (ppm)	773.3	816.55	291.37	627
EXHAUST	Total VOC as Propane (ppm)	2.12	2.60	.98	1.90
MASS EMISSION RATE (Pounds per Hour)					
INLET	Acetone	1.7e-2	3.5e-2	4.4e-2	3.2e-2
EXHAUST	Acetone	6.1e-5	4.8e-5	6.7e-5	5.8e-5
INLET	Benzene	7.6e-3	5.1e-3	2.2e-3	5.0e-3
EXHAUST	Benzene	4.4e-5	2.3e-5	2.6e-5	3.1e-5
INLET	Total VOC as Propane	9.1e-2	9.4e-2	3.3e-2	7.3e-2
EXHAUST	Total VOC as Propane	7.5e-4	8.5e-4	3.5e-4	6.5e-4
% DESTRUCTION EFFICIENCY					
Acetone		99.64	99.86	99.85	99.78
Benzene		99.42	99.54	98.85	99.27
Total VOC as Propane		99.17	99.10	98.94	99.07

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Table 3-2

SRK Kiln DRE Test Results

Date		7-22-92	7-23-92	7-23-92	AVERAGE
Run ID		RUN 1	RUN 2	RUN 3	
Start Time		800	100	710	
Finish Time		1000	200	910	
Kiln Temperature (°C)		260.2	300.2	388.8	316.4
INLET	SCFM	4.29	4.32	4.13	4.25
EXHAUST	SCFM	71	80	82	77.67
LABORATORY RESULTS					
INLET	ppm Acetone	352.00	2.52	.34	118.29
EXHAUST	ppm Acetone	.04	.06	.11	.07
INLET	ppm Benzene	206.44	.43	1.69	69.52
EXHAUST	ppm Benzene	.02	ND	ND	.02
INLET	Total VOC as Propane (ppm)	3301.2	12.01	10.72	1108
EXHAUST	Total VOC as Propane (ppm)	1.92	2.37	2.51	2.27
MASS EMISSION RATE (Pounds per Hour)					
INLET	Acetone	1.4e-2	9.8e-5	1.3e-5	4.6e-3
EXHAUST	Acetone	2.6e-5	4.3e-5	8.1e-5	5.0e-5
INLET	Benzene	1.1e-2	2.2e-5	8.5e-5	3.6e-3
EXHAUST	Benzene	1.7e-5	ND	ND	1.9e-5
INLET	Total VOC as Propane	9.7e-2	3.5e-4	3.0e-4	3.2e-2
EXHAUST	Total VOC as Propane	9.3e-4	1.3e-3	1.4e-3	1.2e-3
% DESTRUCTION EFFICIENCY					
Acetone		99.81	55.91	-542	
Benzene		99.84	100.00	100.00	
Total VOC as Propane		99.04	-265	-365	

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Table 3-3

Tokai Oven VOC Laboratory Results

Date		7-22-92	7-22-92	7-22-92	AVERAGE
Run ID		RUN 1	RUN 2	RUN 3	
Start Time		1113	1415	1620	
Finish Time		1213	1515	1720	
INLET	SCFM	17.16	16.95	16.77	16.96
EXHAUST	SCFM	52	48	53	51.00
Tokai Bakeout Oven Temperature (°C)		270.9	305.0	328.4	301.4
LABORATORY RESULTS					
INLET	ppm CO	780	743	552	692
EXHAUST	ppm CO	65.9	195.0	27.0	95.97
INLET	ppm Methanol	50.69	ND	ND	50.69
EXHAUST	ppm Methanol	ND	ND	ND	ND
INLET	ppm Acetaldehyde	313.6	18.04	16.06	116
EXHAUST	ppm Acetaldehyde	.70	.27	.20	.39
INLET	ppm Acetone	109	229.31	293.22	210.51
EXHAUST	ppm Acetone	.13	.11	.14	.13
INLET	ppm Ethyl Acetate	17.67	22.22	6.31	15.40
EXHAUST	ppm Ethyl Acetate	ND	.02	ND	.02
INLET	ppm Vinyl Acetate	ND	ND	ND	ND
EXHAUST	ppm Vinyl Acetate	ND	ND	ND	ND
INLET	ppm Benzene	36.55	24.79	10.99	24.11
EXHAUST	ppm Benzene	.07	.04	.04	.05
INLET	ppm Toluene	.95	2.72	2.72	2.13
EXHAUST	ppm Toluene	ND	ND	ND	ND
INLET	ppm Xylene	1.36	2.48	.50	1.45
EXHAUST	ppm Xylene	ND	ND	ND	ND

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Table 3-4

Tokai Oven VOC Emission Results

Date		7-22-92	7-22-92	7-22-92	AVERAGE
Run ID		RUN 1	RUN 2	RUN 3	
Start Time		1113	1415	1620	
Finish Time		1213	1515	1720	
INLET	SCFM	17.16	16.95	16.77	16.96
EXHAUST	SCFM	52	48	53	51.00
Tokai Bakeout Oven Temperature (°C)		270.9	305.0	328.4	301.4
MASS EMISSION RATE (Pounds per Hour)					
INLET	CO	5.8e-2	5.5e-2	4.0e-2	5.1e-2
EXHAUST	CO	1.5e-2	4.1e-2	6.2e-3	2.1e-2
INLET	Methanol	4.3e-3	ND	ND	4.3e-3
EXHAUST	Methanol	ND	ND	ND	ND
INLET	Acetaldehyde	3.7e-2	2.1e-3	1.8e-3	1.4e-2
EXHAUST	Acetaldehyde	2.5e-4	8.9e-5	7.2e-5	1.4e-4
INLET	Acetone	1.7e-2	3.5e-2	4.4e-2	3.2e-2
EXHAUST	Acetone	6.1e-5	4.8e-5	6.7e-5	5.8e-5
INLET	Ethyl Acetate	4.1e-3	5.1e-3	1.4e-3	3.6e-3
EXHAUST	Ethyl Acetate	ND	1.3e-5	ND	1.3e-5
INLET	Vinyl Acetate	ND	ND	ND	ND
EXHAUST	Vinyl Acetate	ND	ND	ND	ND
INLET	Benzene	7.6e-3	5.1e-3	2.2e-3	5.0e-3
EXHAUST	Benzene	4.4e-5	2.3e-5	2.6e-5	3.1e-5
INLET	Toluene	2.3e-4	6.6e-4	6.5e-4	5.1e-4
EXHAUST	Toluene	ND	ND	ND	ND
INLET	Xylene	3.8e-4	6.9e-4	1.4e-4	4.0e-4
EXHAUST	Xylene	ND	ND	ND	ND

SET 1526-01-0892-218

Table 3-5

SRK Kiln VOC Laboratory Results

Date		7-22-92	7-23-92	7-23-92	AVERAGE
Run ID		RUN 1	RUN 2	RUN 3	
Start Time		800	100	710	
Finish Time		1000	200	910	
Kiln Temperature (°C)		260.2	300.2	388.8	316.4
INLET	SCFM	4.29	4.32	4.13	4.25
EXHAUST	SCFM	71	80	82	77.67
LABORATORY RESULTS					
INLET	ppm Methanol	9.80	ND	ND	9.80
EXHAUST	ppm Methanol	ND	ND	ND	ND
INLET	ppm Acetaldehyde	366.5	1.76	2.07	123
EXHAUST	ppm Acetaldehyde	.11	ND	.09	.10
INLET	ppm Acetone	352	2.52	.34	118.29
EXHAUST	ppm Acetone	.04	.06	.11	.07
INLET	ppm Ethyl Acetate	115.45	.16	.10	38.57
EXHAUST	ppm Ethyl Acetate	ND	ND	ND	ND
INLET	ppm Vinyl Acetate	ND	ND	ND	ND
EXHAUST	ppm Vinyl Acetate	ND	ND	ND	ND
INLET	ppm Benzene	206.44	.43	1.69	69.52
EXHAUST	ppm Benzene	.02	ND	ND	.02
INLET	ppm Toluene	3.82	ND	ND	3.82
EXHAUST	ppm Toluene	ND	ND	ND	ND
INLET	ppm Xylene	2.96	ND	ND	2.98
EXHAUST	ppm Xylene	ND	ND	ND	ND

SET 1526-01-0892-216

Table 3-6

SRK Kiln VOC Emission Results

Date		7-22-92	7-23-92	7-23-92	AVERAGE
Run ID		RUN 1	RUN 2	RUN 3	
Start Time		800	100	710	
Finish Time		1000	200	910	
Kiln Temperature (°C)		260.2	300.2	348.8	316.4
INLET	SCFM	4.29	4.32	4.13	4.25
EXHAUST	SCFM	71	80	82	77.67
MASS EMISSION RATE (Pounds per Hour)					
INLET	Methanol	2.1e-4	ND	ND	2.1e-4
EXHAUST	Methanol	ND	ND	ND	ND
INLET	Acetaldehyde	1.1e-2	5.2e-5	5.8e-5	3.6e-3
EXHAUST	Acetaldehyde	5.3e-5	ND	5.0e-5	3.5e-5
INLET	Acetone	1.4e-2	9.8e-5	1.3e-5	4.6e-3
EXHAUST	Acetone	2.6e-5	4.3e-5	8.1e-5	5.0e-5
INLET	Ethyl Acetate	6.8e-3	9.4e-6	5.6e-6	2.3e-3
EXHAUST	Ethyl Acetate	ND	ND	ND	ND
INLET	Vinyl Acetate	ND	ND	ND	ND
EXHAUST	Vinyl Acetate	ND	ND	ND	ND
INLET	Benzene	1.1e-2	2.2e-5	8.5e-5	3.6e-3
EXHAUST	Benzene	1.7e-5	ND	ND	1.9e-5
INLET	Toluene	2.3e-4	ND	ND	2.3e-4
EXHAUST	Toluene	ND	ND	ND	ND
INLET	Xylene	2.1e-4	ND	ND	2.1e-4
EXHAUST	Xylene	ND	ND	ND	ND

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Table 3-7

Tokai Oven NO_x, SO_2, Particulate Results

Date	7-23-92	7-23-92	7-23-92	AVERAGE
Run ID	RUN 1	RUN 2	RUN 3	
Start Time	1113	1415	1620	
Finish Time	1213	1515	1720	
INLET SCFM	17.16	16.95	16.77	16.96
EXHAUST SCFM	52	48	53	51
Common Header Exhaust (DSCFM)	1,511	1,506	1,468	1,495
CONCENTRATION IN EXHAUST				
PARTICULATE (grains/dscf)	.0022	.0011	.0008	.0014
NOx (mg/scm)	21.498	18.241	15.449	18.396
SO2 (mg/scm)	41.83	6.01	1.67	16.50
MASS EMISSION RATE (Pounds per Hour)				
PARTICULATE	.03	.01	.01	.02
NOx	.148	.116	.108	.124
SO2	.17	.02	.01	.07

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Table 3-8

Ambient Air Test Results

Compund	Sample Volume (l)	Concentration (ppm)
Toluene	480	<0.1
Acetone	480	<0.1
Benzene	480	<0.1
Ethyl Acetate	480	<0.1
Vinyl Acetate	480	<0.1
Xylene	480	<0.1
Acetaldehyde	480	<0.05
Methanol	480	<1.0

Standard Conditions - 70°F/29.92 inches Hg.

The concentrations reported are less than the analytical detection limit either by GC/MS or GC/FID.

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Table 3-9

Tokai Bakeout Oven
Volatile Organic Compound
GC/MS Library Search Results

Run No. 1 - Inlet	Concentration (ppm)
Compound	
Methyl acetate	210
Acetic acid	500
Trioxacane	50
Methyl trioxacane	90
Butyl acetate	340

Run No. 2 - Inlet	Concentration (ppm)
Compound	
Acetic acid	530
Butylacetate	20

Run No. 3 - Inlet	Concentration (ppm)
Compound	
Butyl acetate	20

Concentrations expressed are approximately Values. Outlet sampling indicate that the concentration of detected compounds was below the analytical detection limit (1 ppm).

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4.0 SOURCE OPERATION

4.1 TOKAI BAKEOUT OVENS

The Tokai bakeout ovens consist of the oven, a flow monitored nitrogen/air source into each oven, an exit vent leading from each oven, an air in-bleed, a forced draft fan immediately before the afterburner, the DBK thermal afterburner, and a duct leading to a common header and exhaust stack. There is a fan in the second chamber of the afterburner which allows ambient air into the chamber. A diagram of the oven is contained in Figure 4-1.

During the test evaluation, the Tokai oven was loaded with a maximum quantity of ceramic chips, sealed, and the oven started through a heating and cooling cycle which typically lasts for approximately 26 hours. The ovens operate at temperatures ranging from 20 to 400°C. Appendix D contains a representative temperature profile of the oven operation. The exhaust gas from the ovens vent to the afterburners, except during the final oven cooling phase when an auxiliary fan is used to bring additional cooling air into the oven, and this gas exhausts through an additional by-pass stack. The DBK afterburner operates at a temperature of approximately 1000°C.

4.2 SRK KILN

The SRK Kilns consist of the kiln, a measured flow of nitrogen gas/air into each kiln, an exit vent leading to the DBK afterburner, an air in-bleed, a forced draft fan immediately

before the afterburner, the DBK afterburner, and a duct leading to a common header and exhaust stack. There is a fan in the second chamber of the afterburner which allows ambient air into the chamber. A diagram of the SRK Kiln is contained in Figure 4-2.

The SRK Kiln typically has a 50 hour cycle with temperatures ranging from 20 to approximately 1300°C. Appendix D contains a representative temperature profile of the oven operation. The DBK afterburner for the SRK Kiln operates at temperatures ranging from 900-1000°C. Stack testing was conducted with the kiln operating at the maximum process rate (kiln loaded with the maximum number of parts).

4.3 PROCESS DATA

Throughout the evaluation, the SRK Kilns' and Tokai Ovens' DBK afterburners were maintained at approximately 1000°C (1832°F). These temperatures were manually recorded at approximately ten minute intervals by Scott personnel. Additionally, the oven/kiln flow data for each system was recorded at the same time interval to determine volumetric flow rate entering each DBK afterburner. Averages were calculated to determine total DBK inlet flow. This data is included within Appendix D of this report.

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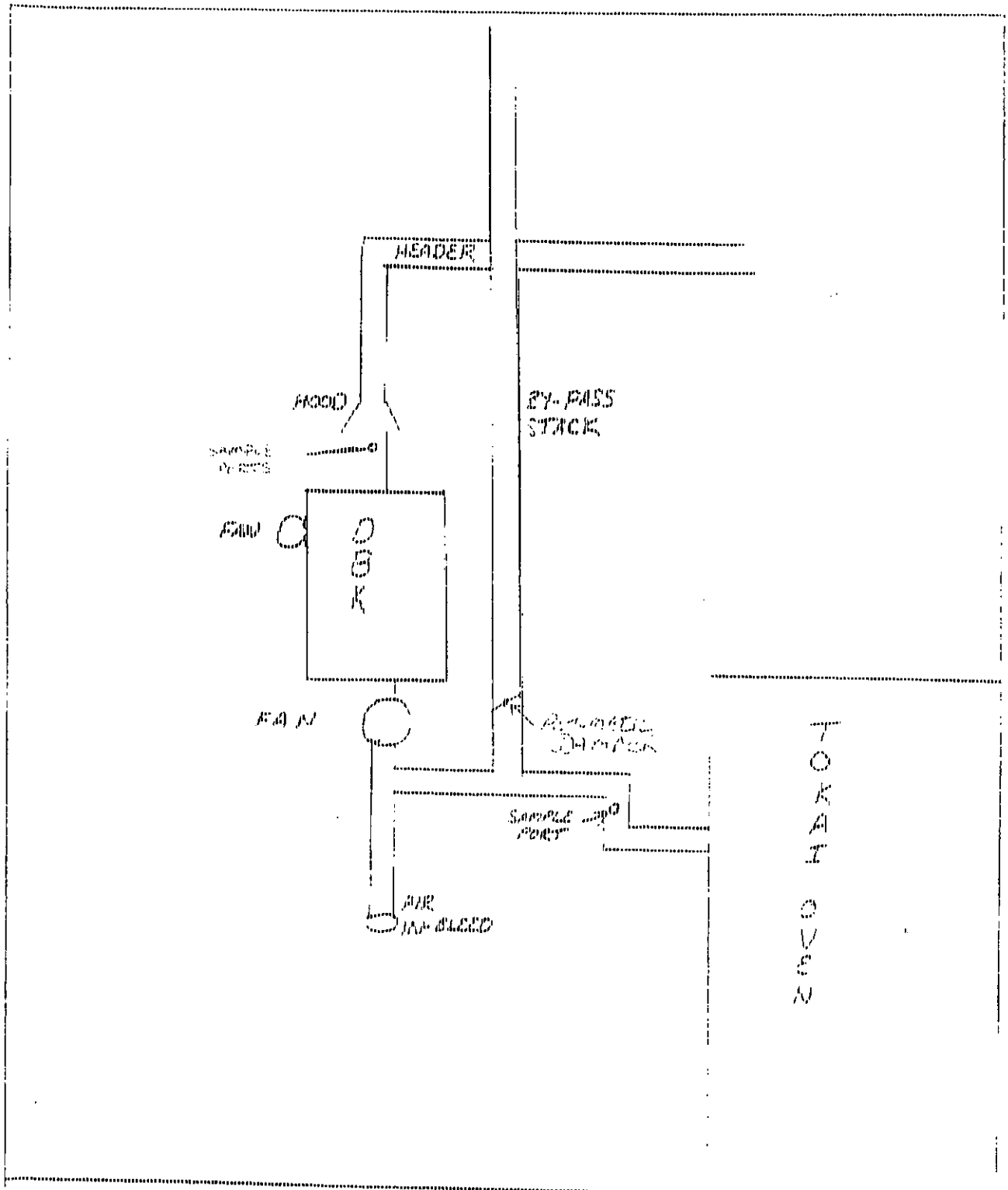

FIGURE 4-1. TOKAI BAKEOUT OVEN SCHEMATIC

SET 1526-01-0893-21B

This equipment is made up of ① Circular kiln body ② Rotating table lifter ③ DBK ④ Control panel ⑤ Rotating table ⑥ Carrier

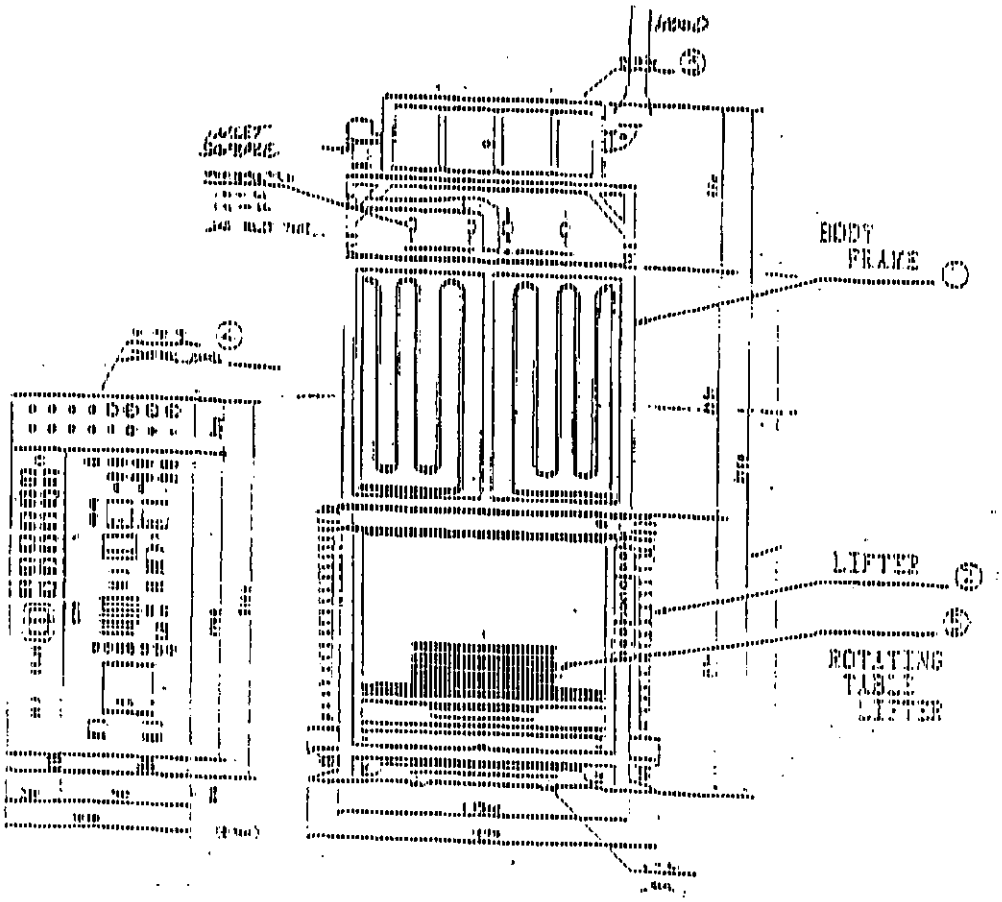

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FIGURE 4-2. SRK KILN SCHEMATIC

SET 1526-01-0892-218

5.0 SAMPLING AND ANALYTICAL PROCEDURES

5.1 TOKAI BAKEOUT OVEN LOCATIONS

DBK Inlet samples were extracted from a single point centrally located within the rectangular duct leading from the Tokai Bakeout Oven chamber. Due to the configuration of the duct exiting the oven, and because the unit operates at a flow rate of approximately 400 liters per minute, a velocity traverse at the inlet to the DBK afterburner was not possible. There is no location at the exit of the oven (inlet to the DBK) which meets the upstream/downstream dimensions recommended for conducting flow measurements, and the flow from the oven has been calculated to be below the detection limits of the standard EPA velocity measurement methods. Since MuRate Erie measures the nitrogen/air flow into the Tokai Bakeout Ovens with rotameters, SCOTT recorded the air flow into the oven using the installed flow meters, and used this flow to calculate the emissions rate from the oven into the DBK afterburner.

Tokai Bakeout Oven DBK exhaust samples were extracted from a single point centrally located within the 6" ID circular exhaust duct. The exhaust duct was equipped with two small openings located at a 90° orientation. The port openings are located at 42 inches and 6 inches of the nearest downstream and upstream flow disturbances respectively. A sixteen point velocity traverse was conducted to determine volumetric flow rate at the exhaust location. Figure 5-1 illustrates the location of the test points.

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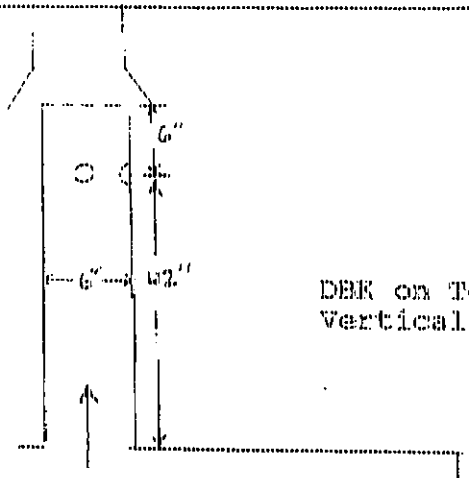

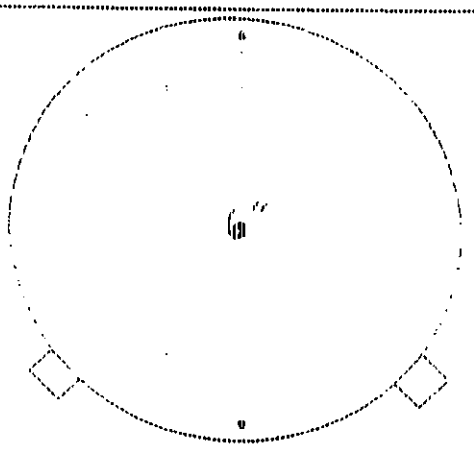

Traverse Point Number	Point Location % of Diameter	Inches from Wall
1	1.2	.5
2	10.9	.63
3	19.4	1.164
4	35.3	1.938
5	67.7	4.062
6	80.6	4.836
7	89.1	5.37
8	98.8	5.5

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Table 5-1
Location of Test Points

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5.2 SRK KILN LOCATIONS

DBK inlet samples were extracted from a single point centrally located within the 2 inch ID circular duct leading from the SRK kiln chamber. A velocity traverse to the DBK afterburner was not possible due to the low flow rates from the SRK kiln. Since MuRate Erie measures the nitrogen/air flow into the SRK kilns with mass flow meters, Scott recorded the air flow into the oven using the existing flow meters, and used this flow to calculate emissions rate from the kiln into the DBK afterburner.

SRK kiln DBK exhaust samples were extracted from a single point centrally located within the 6" ID circular exhaust duct. The exhaust duct was equipped with two small openings located at a 90° orientation. The port openings are located at 16 inches and 6 inches of the nearest downstream and upstream flow disturbances respectively.

A sixteen point velocity traverse was conducted to determine volumetric flow rate at the exhaust location. Figure 5-2 illustrates the location of the test points.

5.3 TOKAI OVEN PARTICULATE LOCATION

Due to the location of the Tokai oven DBK exhaust duct, the particulate tests were conducted on the roof at the common exhaust stack for all three Tokai ovens. Particulate emissions were anticipated to be very minimal and this location would represent emissions from all three of the Tokai ovens in operation.

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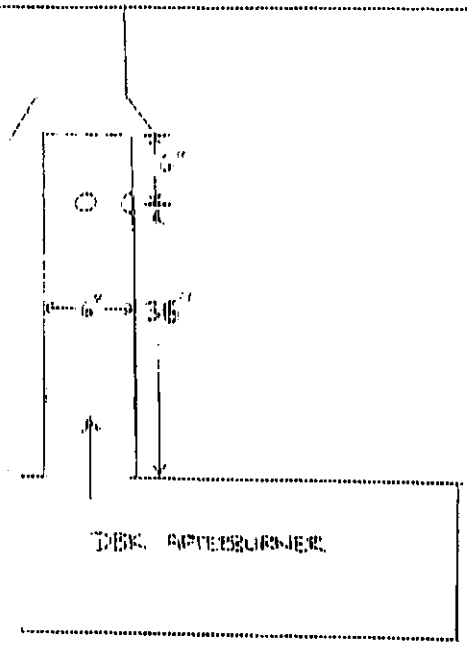
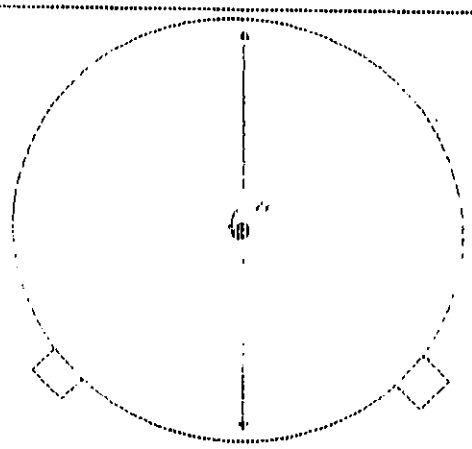
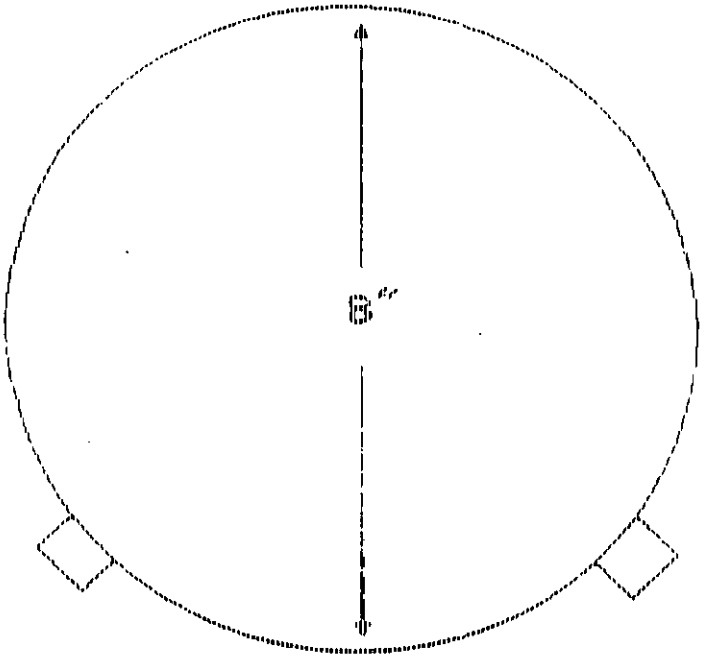




Traverse Point Number	Point Location % of Diameter	Point Location Inches from Wall
1	3.2	.5
2	10.5	.63
3	19.4	1.164
4	32.3	1.938
5	67.7	4.062
6	80.6	4.836
7	89.5	5.37
8	96.8	5.5

Table 5-2 - SRK KILN EXHAUST TEST LOCATION

SET 1526-01-0892-218



Traverse Point Number	Point Location % of Diameter	Point Location inches from Wall	
1	2.1	.168	combined point
2	6.7	.536	combined point
3	11.8	.944	
4	17.7	1.416	
5	25	2	
6	35.6	2.848	
7	64.4	5.152	
8	75	6	
9	82.3	6.584	
10	88.2	7.056	
11	92.3	7.464	combined point
12	97.9	7.832	combined point

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Table 5-3 TOKAI BAKEOUT OVEN

SET 1526-01-0892-218

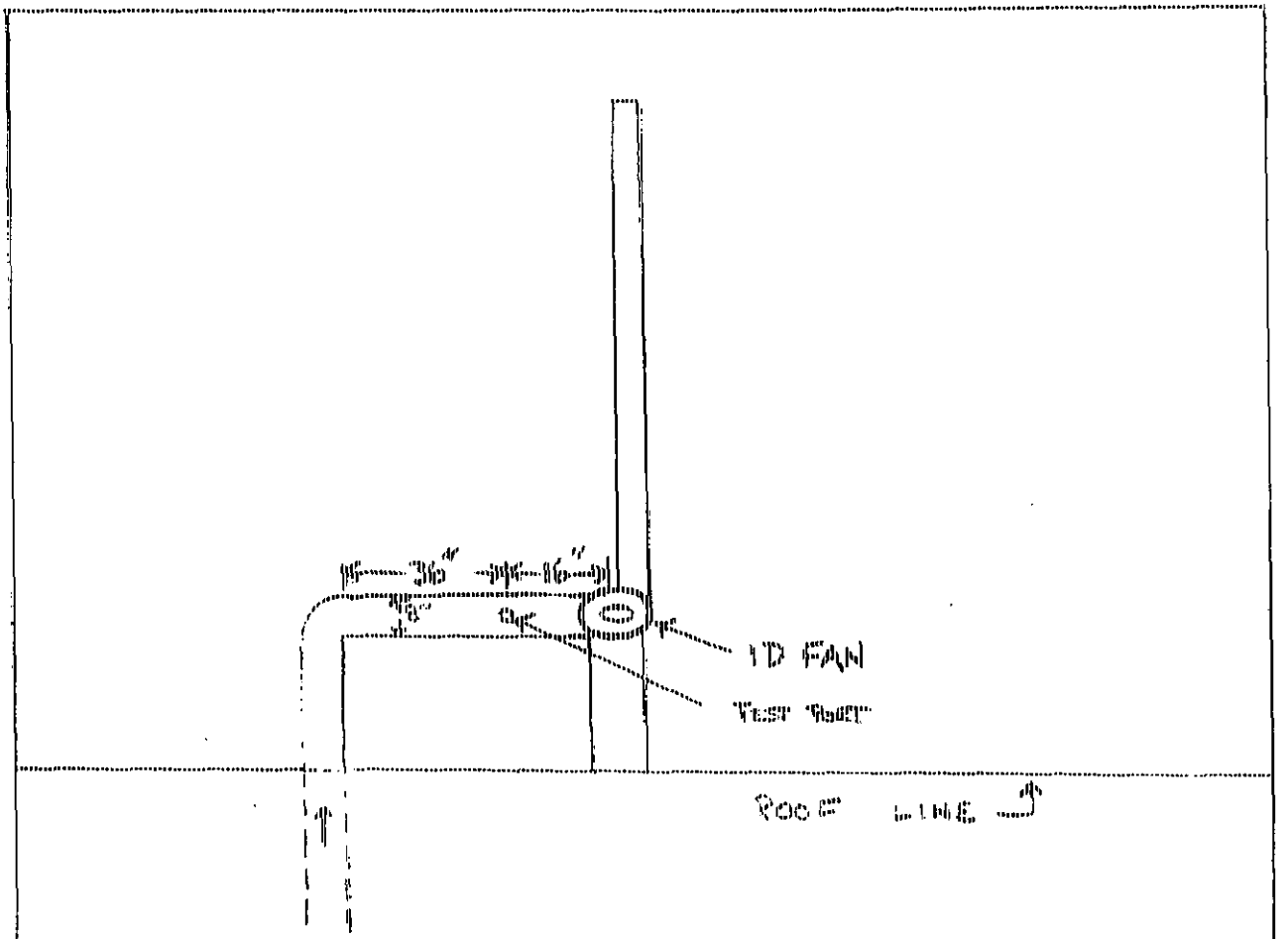

Table 5-4
TOKAI BAKEOUT OVENS PARTICULATE LOCATION

The particulate sample was extracted from a single 2.5" opening in the horizontal duct leading to the common ID fan. A twelve point traverse was conducted for the particulate test. Figure 5-3 and 5-4 illustrate the location of the test port opening and sampling points for the total particulate tests conducted.

5.4 DESTRUCTION EFFICIENCY

Due to the similarity between the Tokai Bakeout Oven and SRK Kiln, the sampling procedures for the acetone, benzene, and total VOC destruction efficiencies for both units was identical.

The sampling for the acetone, benzene, and total VOC destruction efficiencies, of the DBK afterburners, was performed using EPA Methods 1,2,3,4 (where applicable) and 18. During this test, samples of the gas stream were withdrawn from the inlet and exhaust ducts of the SRK Kiln and Tokai Bakeout Oven using Teflon sampling line, and drawn directly into a Tedlar gas sample bag, using the EPA Method 18 integrated bag sampling technique. Using this technique a rigid walled cylinder containing a Tedlar bag was evacuated. The Tedlar bag was open to the stack gas and as it expanded, the sample gas was drawn into the bag. The gas samples were drawn at a constant rate from the inlet and outlet ducts simultaneously from each location and three sets of samples were obtained. Due to the batch nature of the oven and kiln processes, sampling was conducted during three different time/temperature sections of each process. The test periods are noted on Table 5-1. Plant data anticipated that the maximum

emissions from the process occur as the units approach 300°C; therefore, the first test period was performed when the oven was reaching its maximum emissions. The second and third test periods took place when potential emissions were still near their maximum. The data shows that the maximum emissions occur during a short time period, so this project scope offered times of maximum emissions as well as periods of high temperature but low organic concentrations.

As stated previously, the oven/kiln exhaust (DBK inlet) rates were determined from the indicated gas flow into the oven. The DBK emission rate was determined by measuring the air flow out of the afterburner using EPA Method 1, 2, and 3. A standard type pitot tube was used to determine flow using a two diameter traverse with 8 traverse points per diameter. The points were determined in accordance with EPA Method 1. The sample bags were analyzed for the concentrations of acetone, benzene, and total VOC, using Gas chromatography with a flame ionization detector. The GC-FID operating conditions are listed on Table 5-2.

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Table 5-1
(Sampling Periods)

Tokai Bakeout Ovens

Test Run	Date	Interval	Temperature Range C°	Sample Time Hours	Process Time Hours	Temperature (°C)
1	7/22/92	11:13 -12:13	255-267	1	8-9	270.9
2	7/22/92	14:15 -15:15	290-302	1	11-12	305.0
3	7/22/92	16:20 -17:20	320-332	1	13-14	328.4

SRK Kiln

1	7/23/92	8:00 -10:00	258-262	2	9-11	260.2
2	7/23/92	13:00 -14:00	290-310	1	20	300.2
3	7/23/92	19:10 -21:10	370-400	2	32-34	380.8

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Table 5-2

Chromatographic Conditions

Varian 3400 - Volatile Organic Analysis

Column:	1% SP-1000
Carrier Gas:	N_2 @ 40 cc/minute
Start Temperature:	35°C for 5 minutes
Temperature Program:	250°C @ 40°C/minute
Detector:	FID

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5.5 CARBON DIOXIDE, OXYGEN, AND NITROGEN

A Tedlar bag sample, separate from the sample used for the organic determination, was collected from the inlet and outlet of the Tokai Bakeout Oven and SRK Kiln DBK's and analyzed by ORSAT analyzer for oxygen and carbon dioxide. The ORSAT operates by selectively absorbing the carbon dioxide or oxygen in potassium hydroxide or alkaline pyrogallic solution, and measuring the change in the gas volume. Nitrogen was then determined by difference.

5.6 CARBON MONOXIDE

Additional analyses for carbon monoxide concentrations were performed for the Tokai Bakeout Oven. The tedlar gas bags collected for oxygen and carbon dioxide determinations were analyzed using a non-dispersive infrared (NDIR) analyzer (a Beckman 865 or Siemens Ultramat 21, or equivalent). The NDIR was calibrated using nitrogen as a zero gas and two additional span gases, and the instrument output was recorded by stripchart. The three inlet and outlet air sample sets were analyzed.

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5.7 NITROGEN OXIDES (NO_x)

The outlet of the Tokai DBK was sampled utilizing EPA Method 7D. This test was conducted by drawing a gas sample from the outlet using a heated Teflon line. The gas was drawn through a series of standard impingers containing 150 milliliters of alkaline potassium permanganate solution. Each sample was collected for one hour at a rate of 0.4 liters per minute. Following collection, the samples were recovered as per the method. The samples were sent to a contract laboratory for Ion Chromatography (IC) analysis, and calculated and reported as NO_2. Three tests were conducted in conjunction with the organic sampling.

5.8 SULFUR DIOXIDE (SO_2)

Using the same Teflon sample line as noted above, an EPA Method 6 sampling train was operated to collect and determine the concentration of SO_2 in the outlet from the Tokai DBK. A series of four midget impingers were employed in this method, the first containing 15 ml of isopropyl alcohol, two containing 3% hydrogen peroxide, and the fourth containing Silica Gel desiccant. Gas was drawn through this impinger train at a rate of 1 liter per minute for 60 minutes. This is a deviation from the EPA Method 6 procedure of 20 minutes per test run but deemed advisable due the low concentration of SO_2 expected in the original gas stream, and the amount of dilution of the gas stream which is a normal part of the afterburner operation. The samples were recovered as stated in the method, and analyzed at SCOTT's laboratory by Barium chloride - thorin indicator titration. Sampling for SO_2 was performed in conjunction with the NO_x tests.