REPORT OF AIR POLLUTION SOURCE TESTING FOR CALIFORNIA AB2588 AT THE KERN RIVER COGENERATION COMPANY BAKERSFIELD, CALIFORNIA

Submitted to:

KERN COUNTY AIR POLLUTION CONTROL DISTRICT
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Submitted on:
March 28, 1990

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REPORT OF AIR POLLUTION SOURCE TESTING FOR CALIFORNIA AB2588 AT THE KERN RIVER COGENERATION COMPANY BAKERSFIELD, CALIFORNIA

INTRODUCTION

Kern River Cogeneration Company (KRCC) retained Engineering-Science (ES) to conduct air pollution source tests on a 75 MW cogeneration unit operated at Bakersfield, California. The purpose of the testing program was to determine emissions as stipulated by California Assembly Bill 2588.

AB2588 requires that KRCC conduct a monitoring program on one of the gas turbines while the unit is fired on fuel oil. Included in the source testing program were the determination of emission rates of formaldehyde, benzene, polynuclear aromatic hydrocarbons (PAH), dioxins (PCDD), furans (PCDF), hydrogen chloride, and trace elements, hexavalent chromium, beryllium, cadmium, nickel, arsenic, copper, lead, manganese, mercury, selenium, and zinc). Radionuclides were determined on a fuel sample collected by Engineering-Science during the testing program. The testing program was conducted in accordance with California Air Resources Board (CARB) and EPA test procedures.

The testing commenced January 25 and concluded in the early morning hours of January 26, 1990. Mr. Mervyn Soares, Environmental Engineer for KRCC coordinated the testing program. The ES testing team was comprised of Messrs. Dennis Bautista, Dennis Becvar (team leader), Jonathan Dailey, Humbert Deriada, Mike Edwards, Senen Karikitan, Tony King, Rollie Rosario and Dwight Wieman. Kern County Air Pollution Control District test observers were Messrs. Steven Arita, Greg Lafore and Ted Strauss.

SOURCE INFORMATION

KRCC operates a cogeneration facility comprised of four natural gas fired turbines with the capabilities of using fuel oil as a backup fuel. The units are comprised of General Electric, Frame 7, gas turbines rated at 75 MW (nominal) electrical power. The turbines are also equipped with heat recovery steam generators (HRSG) that produce steam for use in enhanced oil recovery. The

turbines are equipped with water injection for NO_x control. The testing program was conducted at the Heat Recovery Steam Generator (HRSG) on Unit #2. The primary fuel for the Omar Hill Unit #2 turbine is natural gas, however, it was operated on distillate oil for the AB 2588 testing.

SOURCE TEST PROCEDURES

Testing Methods

This section provides information on the sampling procedures and analytical methods used for each pollutant determination.

Location and Number of Traverse Points

The sampling ports were located one half diameter from the nearest downstream disturbance and two diameters from the nearest upstream disturbance. In accordance with CARB Method 1, a sample traverse of 24 traverse points, 12 points per port for two ports was conducted.

The absence of cyclonic flow was determined using an S type pitot tube connected to an inclined oil manometer. The pitot tube was rotated so the planes of the face openings were perpendicular to the stack cross-sectional plane. This is referred to as the 0^o reference position. A zero reading obtained in this position indicates no cyclonic flow. If the manometer did not read zero, the pitot tube was rotated until a zero reading was obtained. The angle of rotation was measured to the nearest degree. All traverse points were examined in this fashion. The average of all the rotation angles was less than 20^o. The source testing location was deemed acceptable.

Preliminary Velocity and Temperature Traverse

A preliminary velocity and temperature traverse was conducted in accordance with CARB Method 1 to calculate the diameter of the isokinetic source sampling nozzle and sampling rate required for the tests. An S type pitot tube and a K type thermocouple were positioned at each traverse point and the appropriate data recorded on a data sheet. The pitot tube was connected to an inclined oil manometer and the thermocouple was connected to an appropriate digital temperature readout device. All pitot tube and thermocouple sets were calibrated prior to use in the field.

Trace Elements

Trace elements that were analyzed concluded samples for trace elements Zn, Cu, Be, Cd, Mn Pb, Se, and Hg. Each sample was collected isokinetically using an EPA proposed combined trace elements sampling train. The train was configured similar to the sampling train used for determining particulates (Method 5) except the first and second impingers contained nitric acid (HNO_3) in a hydrogen peroxide (H_2O_2) solution. The third impinger was an empty modified Greenberg-Smith. The fourth impinger contained an acidified potassium permanganate ($KMnO_4$) solution. The fifth impinger contained approximately 400 grams of indicating silica gel. A glass fiber filter was located between the fourth and fifth impingers. Sampling train components were recovered in separate HNO_3 and $KMnO_4$ fractions. After the testing, the samples were analyzed by Inductively Coupled Argon Plasma Mass Spectrometry (ICAP-MS).

Hexavalent Chromium sampling was conducted in accordance with CARB Method 425. The sampling technique is the same as that for Carb Method 5 for particulates except the impinger solution was sodium bicarbonate. The samples were analyzed for hexavalent chromium by colorimetric technique.

A separate sampling train was operated for Arsenic in according with CARB Method 423 for Arsenic. The method 423 sampling train was run concurrently with the trace metals train.

Formaldehyde

Formaldehyde samples were collected in accordance with CARB Method 430. Three 4 hour test runs were conducted.

The sample train consisted of a Teflon lined probe connected to four impingers in series. The first and second impingers each contained 100ml each of @ 1% sodium bisulfite, the third impinger was empty, and the fourth contained about 400 grams of indicating silica gel.

After the testing the samples was sent to Thermo Analytical, Analytical Research Labs Inc. (TMA/ARLI) Monrovia, California.

Benzene Sampling

Benzene samples were collected in accordance with CARB Method 410A. Three integrated samples were collected over one hour periods. The analysis were performed using a gas chromatograph (GC) equipped with a photo-ionization detector (PID).

Dioxins, Dibenzofurans, and Polynuclear Aromatic Hydrocarbons

Dioxins (PCDD), Dibenzofurans (PCDF), and Polynuclear Aromatic Hydrocarbons (PAH) were collected in accordance with CARB Methods 428 and 429. The train design is based on a validated emission collection system with the addition of an adsorbent cartridge of XAD-2 resin to collect vaporous emissions for semi-volatile organics. The trains were operated for a period of 4 hours during each of three runs. The samples were collected using isokinetic sampling techniques described in CARB Method 5. The train recovery was modified from Method 5 procedures to include a sample wash with 1:1 methanol and methylene chloride.

The sampling probe liner was Teflon. Organics were collected by the adsorbent trap containing a precleaned XAD-2 Resin. This trap was made of glass and located in the sample line downstream of a heated filter holder and upstream of the first impinger. The module housing the trap was jacketed, and cold water was circulated to maintain an outlet temperature below 68^{O}F. The trap was wrapped with aluminum foil to eliminate possible effects from ultraviolet light. A glass Hempal-type condenser was located between the filter and the XAD-2 cartridge to ensure that cool stack gas was entering the adsorbent trap.

All solvents used for preparing the sampling train for testing and field sample recovery were stored in glass bottles and were spectrographic grade. The train components that came in contact with the sample were handled with clean, bare hands. All components were free of potential interfering materials, especially silicone grease.

The probe was rinsed with three portions of 1:1 methanol and methylene chloride and brushed during each rinse. The connecting tube between the filter and the adsorbent cartridge were also rinsed with 1:1 methanol and methylene chloride. All probe, filter, connecting tubing, and impinger washings were collected in precleaned glass containers. The sample train were separated into front and back halves. Field and sample blanks were collected during the testing program. Composite samples

of the front and back halves were sealed and shipped to Cal-Analytical Labs Enseco, Sacramento, California for analysis.

The samples submitted to the laboratory included a sample train blank which was collected on site. A sampling train was prepared as if it were to be used on the stack; however, the train was washed with the appropriate solvents and collected in the respective containers, and designated as the blank.

Hydrogen Chloride

Hydrogen Chloride sampling was conducted in accordance with CARB Method 421. It was similar to CARB 5 for particulate with two exceptions. First, the probe was lined with quartz glass to limit reactions between the gas and the probe. Second, to chemically collect the HCL, sodium carbonate and sodium bicarbonate solutions were used in the impingers. The impinger solution was analyzed for chloride ions using ion chromatography.

Radionuclides

Radionuclides were analyzed by TMA/NORCAL, Emery, CA, Nuclear Science Laboratory for alpha, beta and gamma emitters from a fuel sample collected by Engineering-Science.

QUALITY CONTROL

The following section describe the various quality assurance and quality control (QA/QC) procedures utilized by ES during this program.

Sample Custody

A specific Chain-of-Custody procedure was used for this project. The elements of this plan include:

- Train component identification
- Sample identification
- Sample labels
- Documentation
- Chain of custody forms

The sequence of activities concerned with sample custody together with identification and tracing procedures are described below:

1. Sample train preparation by laboratory included filter holders, impingers, and other sampling equipment identified by tags and codes.
2. Sample train issued to test team and master log filled out. Sample I.D. number stickers issued according to test identification code.
3. Train returned to recovery area when a valid sample was obtained. Sample train accompanied by all field data sheets.
4. Recovery team recovered samples using appropriate containers, affixed sample I.D. labels to sample containers, to master log, to field data sheet, and to train recovery sheet.
5. Samples transferred or shipped to appropriate laboratory with Chain-of-Custody form.
6. Samples examined at each transfer point for integrity (broken containers, loss in liquid, seal and identity).

Upon completing the required analysis, the analyzing laboratory returned the Chain-of Custody form along with results to ES. All samples were accounted for by the ES Laboratory Supervisor and Project Manager. Each laboratory identified the samples in its own laboratory notebooks by the ES I.D. number as well as any internal identification. Notebooks are retained by each laboratory according to usual laboratory practices.

RESULTS

The test results are presented in Tables 1-7. Supporting data are included in the appendices.

Table 1
Summary of Average Flow Data
Unit #2 Stack
January 25-26, 1990
Kern River Cogeneration Company
Bakersfield, California

Parameter	Average
Stack Diameter (inches)	167.5
Stack Area (ft^2)	153.02
Temperature (^oF)	298
Moisture (%)	7.3
Oxygen (%)	14.4
Carbon Dioxide (%)	4.65
Molecular Wt. (dry)	29.32
Molecular Wt. (wet)	28.51
Velocity (fps)	73.05
Volumetric flow	
DSCFM (F factor)	393,650

Table 2
Summary of Radionuclides
Fuel Sample
January 25-26, 1990
Kern River Cogeneration Company
Bakersfield, California

Parameter	Results Pico Curie/liter
Gross Alpha	0 ± 3
Gross Beta	87 ± 4
Gamma Scan:	
^{40}K Potassium	<131
^{137}Cs Cesium	<8
^{226}Ra Radium	<19
^{228}Th Thorium	<19
^{232}Th Thorium	<40

Table 3

Summary of Trace Elements Emissions
Unit #2 Stack
January 25-26, 1990
Kern River Cogeneration Company
Bakersfield, California

Parameter	Run #1 lb/hr	Run #2 lb/hr	Run #3 lb/hr	Average Emission Rate lb/hr	Average Emission Rate lb/MMBTU
Arsenic	1.5×10^{-3}	4.5×10^{-4}	1.6×10^{-3}	1.2×10^{-3}	1.5×10^{-6}
Beryllium	$<4.1 \times 10^{-5}$	7.8×10^{-4}	$<5.1 \times 10^{-5}$	$<2.9 \times 10^{-4}$	$<3.7 \times 10^{-7}$
Cadmium	$<1.6 \times 10^{-3}$	$<2.0 \times 10^{-3}$	$<2.0 \times 10^{-3}$	$<1.9 \times 10^{-3}$	$<2.4 \times 10^{-6}$
Chromium VI	3.4×10^{-5}	6.7×10^{-5}	1.0×10^{-4}	6.8×10^{-5}	8.6×10^{-8}
Chromium (Total)	3.4×10^{-3}	$<2.0 \times 10^{-3}$	$2.6 \times 10^{10-3}$	2.7×10^{-3}	$<3.4 \times 10^{-6}$
Copper	5.8×10^{-3}	8.5×10^{-3}	2.9×10^{-3}	5.7×10^{-3}	7.3×10^{-6}
Mercury	9.4×10^{-6}	2.9×10^{-5}	7.7×10^{-6}	1.5×10^{-6}	2.0×10^{-9}
Manganese	8.2×10^{-2}	4.2×10^{-2}	5.1×10^{-2}	5.8×10^{-2}	7.4×10^{-5}
Nickel	1.6×10^{-2}	8.2×10^{-1}	6.4×10^{-3}	2.8×10^{-1}	3.5×10^{-4}
Lead	4.0×10^{-3}	4.1×10^{-3}	2.3×10^{-3}	3.5×10^{-3}	4.4×10^{-3}
Selenium	$<4.1 \times 10^{-5}$	$<5.2 \times 10^{-5}$	$<5.1 \times 10^{-5}$	$<4.8 \times 10^{-4}$	6.1×10^{-8}
Zinc	7.7×10^{-2}	8.8×10^{-1}	3.2×10^{-2}	3.3×10^{-1}	4.2×10^{-4}

Table 4
Summary of Furans and Dioxins Emission
Unit #2 Stack
January 25-26, 1990
Kern River Cogeneration Company
Bakersfield, California

	Run #1		Run #2		Run #3		Average Emissions Rates	
	ug/ sample	lb/hr	ug/ sample	lb/hr	ug/ sample	lb/hr	lb/hr	lb/MMBTU
Furans								
TCDFs (total)	26	7.8×10^{-9}	45	1.5×10^{-8}	1600	5.5×10^{-7}	1.9×10^{-7}	2.4×10^{-10}
PeCDFs (total)	19	5.7×10^{-9}	120	4.0×10^{-8}	2200	7.6×10^{-7}	2.7×10^{-7}	3.4×10^{-10}
HxCDFs (total)	14	4.2×10^{-9}	94	3.2×10^{-8}	1100	3.8×10^{-7}	1.4×10^{-7}	1.8×10^{-10}
HpCDFs (total)	76	2.3×10^{-8}	110	3.7×10^{-8}	660	2.3×10^{-7}	1.0×10^{-7}	1.2×10^{-10}
OCDF	<18	$<5.4 \times 10^{-8}$	66	2.2×10^{-8}	196	6.7×10^{-8}	3.1×10^{-8}	4.0×10^{-11}
Dioxins								
TCDDs (total)	<15	$<4.5 \times 10^{-9}$	<19	$<6.4 \times 10^{-9}$	160	5.5×10^{-8}	$<2.2 \times 10^{-8}$	2.8×10^{-11}
PeCDDs (total)	<9.2	$<2.8 \times 10^{-9}$	<14	$<4.7 \times 10^{-9}$	340	1.2×10^{-7}	$<4.2 \times 10^{-8}$	5.4×10^{-11}
HxCDDs (total)	43	1.3×10^{-8}	43	1.4×10^{-8}	370	1.3×10^{-7}	5.2×10^{-8}	6.6×10^{-11}
HpCDDs (total)	110	3.3×10^{-8}	120	4.0×10^{-8}	370	1.3×10^{-7}	6.8×10^{-8}	8.6×10^{-11}
OCDD	<190	$<5.7 \times 10^{-8}$	400	1.3×10^{-7}	400	1.4×10^{-7}	1.1×10^{-7}	1.4×10^{-10}

Table 5
Summary of Polynuclear Aromatic Hydrocarbons (PAH) Emissions
Unit #2 Stack
January 25-26, 1990
Kern River Cogeneration Company
Bakersfield, California

Furans	Run #1		Run #2		Run #3		Average Emission Rates	
	ug/ sample	lb/hr	ug/ sample	lb/hr	ug/ sample	lb/hr	lb/hr	lb/MMBTU
Napththalene	4.9	1.4×10^{-3}	0.5	$<1.7 \times 10^{-4}$	4.6	1.6×10^{-3}	1.1×10^{-3}	1.3×10^{-6}
Acenaphthylene	<0.063	$<1.9 \times 10^{-5}$	<0.046	$<1.6 \times 10^{-5}$	0.37	1.3×10^{-4}	$<5.5 \times 10^{-5}$	7.0×10^{-8}
Acenaphthene	<0.045	$<1.3 \times 10^{-5}$	<0.35	$<1.2 \times 10^{-4}$	<0.063	$<2.0 \times 10^{-5}$	$<5.1 \times 10^{-5}$	6.5×10^{-8}
Fluorene	<0.51	$<1.5 \times 10^{-4}$	<0.37	$<1.2 \times 10^{-4}$	<0.58	$<2.0 \times 10^{-5}$	1.0×10^{-4}	1.2×10^{-7}
Phenanthrene	2.2	6.6×10^{-4}	1.2	$<4.1 \times 10^{-4}$	2.7	9.1×10^{-4}	6.6×10^{-4}	8.4×10^{-7}
Anthracene	<0.17	$<5.2 \times 10^{-5}$	<0.040	$<1.3 \times 10^{-5}$	0.82	2.8×10^{-4}	1.2×10^{-4}	1.5×10^{-7}
Fluoranthene	<0.51	1.5×10^{-4}	0.30	1.0×10^{-4}	0.44	1.5×10^{-4}	1.3×10^{-4}	1.7×10^{-7}
Benzo (a)anthracene	<0.18	5.5×10^{-5}	<0.090	$<3.0 \times 10^{-5}$	<0.015	$<5.1 \times 10^{-6}$	3.0×10^{-5}	$<3.8 \times 10^{-8}$
Chrysene	<0.19	5.8×10^{-5}	<0.094	$<3.2 \times 10^{-5}$	<0.062	$<2.1 \times 10^{-5}$	3.7×10^{-5}	$<4.7 \times 10^{-8}$
Pyrene	0.33	1.0×10^{-4}	0.37	1.2×10^{-4}	0.63	2.0×10^{-4}	1.4×10^{-4}	1.8×10^{-7}
Benzo (b)fluoranthene	0.71	2.1×10^{-4}	0.31	1.0×10^{-4}	<0.15	$<5.1 \times 10^{-5}$	1.2×10^{-4}	$<1.5 \times 10^{-7}$
Benzo (k)fluoranthene	<0.19	5.8×10^{-5}	<0.040	$<1.3 \times 10^{-5}$	<0.14	$<4.8 \times 10^{-5}$	4.0×10^{-5}	$<5.0 \times 10^{-8}$
Benzo (a)pyrene	0.55	1.6×10^{-4}	0.11	3.7×10^{-5}	<0.11	$<3.8 \times 10^{-5}$	7.8×10^{-5}	$<9.9 \times 10^{-8}$
Dibenzo (a, h) anthracene	<0.045	1.3×10^{-5}	<0.015	$<5.1 \times 10^{-6}$	<0.014	$<4.8 \times 10^{-6}$	7.6×10^{-6}	$<9.7 \times 10^{-9}$
Benzo (g,h,i) perylene	<0.034	1.1×10^{-8}	<0.020	$<6.7 \times 10^{-6}$	<0.0072	$<2.5 \times 10^{-6}$	3.1×10^{-6}	$<3.9 \times 10^{-9}$
Indeno (1,2,3-c,d) pyrene	<0.043	1.3×10^{-8}	<0.025	8.5×10^{-6}	<0.0056	$<2.0 \times 10^{-6}$	3.5×10^{-6}	$<4.5 \times 10^{-9}$

Table 6

Summary of Arsenic, Hydrogen Chloride and Formaldehyde Emissions
Unit #2 Stack
January 25-26, 1990
Kern River Cogeneration Company
Bakersfield, California

Parameter	Run #1 lb/hr	Run #2 lb/hr	Run #3 lb/hr	Average Emission Rates lb/hr	lb/MMBTU
Arsenic	4.5×10^{-4}	2.3×10^{-4}	8.4×10^{-5}	2.5×10^{-4}	3.2×10^{7}
Hydrogen Chloride	5.0×10^{-1}	4.2×10^{-1}	4.7×10^{-1}	4.6×10^{-1}	5.9×10^{-4}
Formaldehyde	5.7×10^{-2}	6.4×10^{-2}	4.7×10^{-2}	5.6×10^{-2}	7.1×10^{-5}

Table 7

Summary of Benzene, and Selected Volatile Emissions
Unit #2 Stack Outlet
January 25-26, 1990
Kern River Cogeneration Company
Bakersfield, California

Parameter	Run #1 ppm	Run #2 ppm	Run #3 ppm	Average Emissions Rate lb/hr	lb/MMBTU
Benzene	<0.11	<0.11	<0.11	<0.53	$<6.8 \times 10^{-4}$
Acrolein	<0.11	<0.11	<0.11	<0.38	$<4.8 \times 10^{-4}$
1-3 Butadiene	<0.11	<0.11	<0.11	<0.37	$<4.7 \times 10^{-4}$
Propylene	<0.10	<0.10	<0.10	<0.27	$<3.3 \times 10^{-4}$
Toluene	<0.066	<0.066	<0.066	<0.37	$<4.7 \times 10^{-4}$
Xylene	<0.056	<0.056	<0.056	<0.37	$<4.7 \times 10^{-4}$

Table 8
Summary of Trace Elements
Fuel Sample
January 25-26, 1990
Kern River Cogeneration Company
Bakersfield, California

Parameter	Results mg/l
Arsenic	<0.001
Beryllium	<0.010
Cadmium	0.110
Chloride	0.500
Chromium	0.290
Copper	0.540
Mercury	0.050
Manganese	0.050
Nickel	1.20
Lead	<1.0
Selenium	<0.002
Zinc	4.8

Appendix A
Field Data Sheets

#1

K= 2.44

ES ENGINEERING-SCIENCE COMPANIES

FIELD DATA

"D"

Plant KRCC
Date 1-26-90
Test Site KRCC COGEN #2
Run Number 1 TRACE ELEMENTS
Operator TK

Ambient Temp 60
Barometer 29.44
Stack Pressure -.01
Stack H2O % .08
Stack Dia 167.5

Meter ΔH@ 1.749
Meter Gamma 1.036
Meter Box [redacted] BLUE #3
Nozzle Diameter .25
Probe Length

Probe Mat'l TEFLON
Filter Number 0303132
Samp Box #
PRE LEAK 0.01 @ 5" HG
POST LEAK 1.3 @ 5" HG

	TRAVERSE POINT NUMBER	ELAPSED TIME (mins)	CLOCK TIME	GAS METER READING (Vm)	VELOCITY HEAD (delta p)	ORIFICE PRESSURE (delta H; "H2O) Desired	ORIFICE PRESSURE Actual	TEMPERATURES STACK (Ts)	METER INLET	METER OUT	IMPINGER	FILTER	PUMP VAC. "Hg
PORT D	1	0	0914	348.635	.65	1.58	1.6	304	54	44			3
	2	10	0924	356.9	.64	1.56	1.6	308	51	44			3
	3	20	0934	364.9	.65	1.58	1.6	308	53	46			3
	4	30	0944	371.3	.74	1.81	1.8	305	53	46			3
	5	40	0954	378.6	.65	1.58	1.6	308	60	50			3
	6	50	1004	385.8	.59	1.44	1.44	314	52	47			3
		60	1014	394.256				PORT	CHANGE				
PORT A	7	0	1017	394.256	.59	1.44	1.44	314	54	49			3
	8	10	1027	402.5	.59	1.44	1.44	312	55	50			3
	9	20	1037	406.8	.55	1.34	1.34	312	57	51			3
	10	30	1047	410.2	.59	1.44	1.44	313	48	49			3
	11	40	1057	415.5	.59	1.44	1.44	308	47	46			3
	12	50	1107	420.8	.59	1.44	1.44	311	45	45			3
		60	1112	426.383				PORT	CHANGE				
	AVERAGE /SUM	240		160.98	.7830		1.48	295	56				

Ihu = wl

Trace Elements #1

ES ENGINEERING-SCIENCE COMPANIES

Plant KRCC
Date 1-26-90
POST LEAK RATE .015@ 5"Hg

Run Number 1 TRACE ELEM
Operator DK

TRAVERSE POINT NUMBER	ELAPSED TIME (mins)	CLOCK TIME	GAS METER READING (Vm)	VELOCITY HEAD (delta p)	ORIFICE PRESSURE (delta H, "H2O)		TEMPERATURES					PUMP VAC. "Hg
					Desired	Actual	STACK (Ts)	METER INLET	METER OUT	IMPINGER	FILTER	
13	0	1144	426.383	.54	1.32	1.3	297	47	47			2.5
14	10	1151	432.7	.63	1.54	1.5	297	48	45			3
15	20	1201	439.1	.81	1.98	2.0	297	57	49			3
16	30	1211	446.7	.64	1.56	1.6	299	56	50			3
17	40	1221	454.1	.65	1.59	1.6	300	56	51			3
18	50	1231	461.9	.54	1.32	1.3	314	59	53			3
	60	1241	468.825			PORT	CHANGE					
19	0	1245	468.825	.53	1.29	1.3	312	58	56			3
20	10	1255	476.3	.57	1.39	1.3	308	64	57			3
21	20	1305	482.9	.63	1.54	1.5	309	63	58			3
22	30	1315	489.5	.59	1.44	1.4	307	56	55			3
23	40	1325	495.8	.59	1.44	1.4	307	56	55			3
24	50	1335	502.8	.61	1.45	1.5	317	60	57			3
	60	1345	509.615			END	RUN	#1				
AVERAGE /SUM	240		160.980	.7830		1.48	295					

PORT B

PORT C

K=2.27

TRACE ELEMENTS #2

ES ENGINEERING-SCIENCE COMPANIES

FIELD DATA

PAGE 1 OF 2

Plant KRCC
Date 1-25-90
Test Site KRCC Coal #2
Run Number 2 TRACE ELEMENTS
Operator TR

Ambient Temp 75
Barometer 29.44
Stack Pressure .67
Stack H2O % .08
Stack Dia 167.5

Meter #SN 1.629
Meter Gamma 0.994
Meter Box # IRH #2
Nozzle Diameter
Probe Length

Probe Mat'l
Filter Number
Sump Box #
PRE LEAK 0.001 @ 5" HG
POST LEAK

TRAVERSE POINT NUMBER	ELAPSED TIME (mins)	CLOCK TIME	GAS METER READING (Vm)	VELOCITY HEAD (delta p)	ORIFICE PRESSURE (delta H; "H2O)		TEMPERATURES					PUMP VAC. "Hg
					Desired	Actual	STACK (Ts)	METER INLET	METER OUT	IMPINGER	FILTER	
1	0	1455	416.790	.67	1.52	1.5	298	7	5			1
2	10	1505	424.1	.71	1.61	1.6	292	8	1			1
3	20	1515	431.1	.74	1.68	1.7	292	8	2			1
4	30	1525	438.7	.67	1.52	1.5	290	8	4			1
5	40	1535	445.9	.66	1.50	1.5	290	8	3			1
6	50	1545	453.3	.69	1.57	1.6	294	8	7			1
	60	1555				PORT	CHANGE					
7	0	1600	460.956	.61	1.38	1.4	291	8	6			1
8	10	1610	467.5	.61	1.38	1.4	291	9	0			1
9	20	1620	474.6	.59	1.34	1.3	293	9	2			1
10	30	1630	482.4	.59	1.34	1.3	293	9	2			1
11	40	1640	488.0	.68	1.54	1.5	291	9	2			1
12	50	1650	495.3	.63	1.43	1.4	292	9	0			1
	60	1700	501.592			PORT	CHANGE					
AVERAGE /SUM	240		170.023	.8250		1.5	295	83				

Ihw = 2797

TRACE ELEM. #2

ES ENGINEERING-SCIENCE COMPANIES

Plant KRCC
Date 1-25-90
POST LEAK RATE 0.002

Run Number 2 TRACE ELEM.
Operator TR

TRAVERSE POINT NUMBER	ELAPSED TIME (mins)	CLOCK TIME	GAS METER READING (Vm)	VELOCITY HEAD (delta p)	ORIFICE PRESSURE (delta H, "H2O)		TEMPERATURES					PUMP VAC. "Hg
					Desired	Actual	STACK (Ts)	METER INLET	METER OUT	IMPINGER	FILTER	
13	0	1706	501.592	.74	1.68	1.7	290	8	0			1
14	10	1716	508.3	.65	1.48	1.5	291	7	8			1
15	20	1726	514.7	.65	1.48	1.5	290	7	7			1
16	30	1736	521.0	.72	1.63	1.6	290	7	7			1
17	40	1746	528.7	.63	1.43	1.4	287	7	6			1
18	50	1756	525.6	.68	1.54	1.5	293	8	6			1
	60	1806	543.002			PORT	CHANGE					
19	0	1811	543.002	0.70	1.71	1.71	297	8	6			1
20	10	1821	550.1	0.78	1.77	1.77	299	8	6			1
21	20	1831	557.3	0.75	1.70	1.70	299	8	7			
22	30	1841	562.8	0.72	1.63	1.63	300	8	6			
23	40	1851	573.1	0.74	1.67	1.7	300	8	6			
24	50	1901	579.8	0.75	1.70	1.70	255	8	6			
	60	1911	586.813			END	RUN #2					
AVERAGE /SUM	240		170.02	.9250		1.6	295	83				

TRACE ELEMENTS #3

K=2.27

ES ENGINEERING-SCIENCE COMPANIES

FIELD DATA

PAGE 1 OF 2

Plant KRCC
Date 1-25-90
Test Site COGEN #2
Run Number TRACE ELEM. #3
Operator TR

Ambient Temp 70
Barometer 29.44
Stack Pressure .61
Stack H2O % .08
Stack Dia 107.5

Meter ΔH 1.629
Meter Gamma 0.994
Meter Box # (3) #2
Nozzle Diameter .25
Probe Length

Probe Mat'l
Filter Number
Samp Box #
PRE LEAK 0.005 @ 5" HG
POST LEAK

TRAVERSE POINT NUMBER	ELAPSED TIME (mins)	CLOCK TIME	GAS METER READING (Vm)	VELOCITY HEAD (delta p)	ORIFICE PRESSURE (delta H; "H2O)		TEMPERATURES					PUMP VAC. "Hg
					Desired	Actual	STACK (Ts)	METER INLET	METER OUT	IMPINGER	FILTER	
1	0	2000	587.628	.68	1.54	1.5	292	8	2			1
2	10	2010	594.6	.73	1.66	1.7	293	8	2			1
3	20	2020	602.1	.79	1.79	1.8	290	8	2			1
4	30	2030	609.0	.72	1.63	1.6	293	8	2			1
5	40	2040	617.0	.71	1.61	1.6	293	8	2			1
6	50	2050	625.1	.81	1.83	1.8	294	8	2			1
	60	2100	631.665			PORT	CHANGE					
7	0	2106	631.665	.71	1.61	1.6	295	7	8			.5
8	10	2116	638.4	.68	1.54	1.5	298	8	0			.5
9	20	2126	645.3	.72	1.63	1.6	297	8	2			.5
10	30	2136	651.9	.71	1.61	1.6	295	7	8			1
11	40	2146	658.9	.74	1.68	1.7	294	7	6			1
12	50	2156	666.5	.71	1.61	1.6	297	7	5			1
	60	2206	673.549			PORT	CHANGE					
AVERAGE /SUM	240		172.234	.8459		1.6	295	80				

MW = 31.6 Vol. %

ES ENGINEERING-SCIENCE COMPANIES

K = 2.27

TRACE ELEMENTS #3

Plant KRCC
Date 1-25-90
POST LEAK RATE 0.005@5" HG

Run Number 3 TRACE ELEM.
Operator TR

TRAVERSE POINT NUMBER	ELAPSED TIME (mins)	CLOCK TIME	GAS METER READING (Vm)	VELOCITY HEAD (delta p)	ORIFICE PRESSURE (delta H, "H2O)		TEMPERATURES					PUMP VAC. "Hg
					Desired	Actual	STACK (Ts)	METER INLET	METER OUT	IMPINGER	FILTER	
13	0	2213	673.549	.75	1.70	1.7	298	7	2			1
14	10	2223	680.3	.73	1.66	1.7	296	7	6			1
15	20	2233	687.1	.71	1.61	1.6	297	8	1			1
16	30	2243	694.4	.78	1.77	1.8	296	8	1			1
17	40	2253	701.8	.78	1.77	1.8	296	8	1			1
18	50	2303	709.3	.59	1.34	1.3	297	7	8			1
	60	2313	715.861		PORT CHANGE							
19	0	2318	715.861	.71	1.61	1.6	297	7	8			1
20	10	2328	722.2	.65	1.48	1.5	295	7	8			1
21	20	2338	730.1	.65	1.48	1.5	296	8	2			1
22	30	2348	737.6	.69	1.57	1.6	293	8	5			1
23	40	2358	745.4	.73	1.66	1.7	295	8	6			1
24	50	2408	753.5	.71	1.61	1.6	294	8	4			1
	60	2418	759.912			END	RUN	#3				
AVERAGE /SUM	240		172.28	.8459		1.6	295	80				

ENGINEERING-SCIENCE, INC.

DATE 1-25-90 TRAIN RECOVERY SHEET TRAIN # 1

FACILITY ICREE TH 2 RUN# _____ METHOD _____

TECHNICIAN RR TYPE _____

IMP. SOLUTION HNO3 KMnO4

	SOLUTION	VOL. (ml)	DESCRIPTION
NOZZLE-PROBE RINSE			✓
UMBILICAL RINSE			✓

		FINAL (g)	INITIAL(g)	NET(g)
IMPINGER # 1	HNO3/H2O	265	100	165
IMPINGER # 2	HNO3/H2O	150	100	50
IMPINGER # 3	MT			
IMPINGER # 4	KMnO4/H2SO4	105	100	5
DESCRIPTION				
IMPINGER RINSE				

		FINAL (g)	INITIAL(g)	
SILICA GEL (DESCRIPTION)	4/5 orange	849.3	814.7	34.6
FILTER# (DESCRIPTION)		TOTAL MOISTURE		254.6 (g)

FIELD BLANKS _____

DISPOSITION/COMMENTS _____

ENGINEERING-SCIENCE, INC.

DATE 1-25-90 TRAIN RECOVERY SHEET TRACE # V

FACILITY RACE T# V RUN# _____ METHOD _____

TECHNICIAN RR TYPE _____

IMP. SOLUTION HNO_3. KMnO4

	SOLUTION	VOL. (ml)	DESCRIPTION
NOZZLE-PROBE RINSE			/
UMBILICAL RINSE			/

		FINAL (g)	INITIAL(g)	NET(g)
IMPINGER # 1	HNO_3/HNV	NV	100	NV
IMPINGER # 2	HNO_3/HNV	170	100	70
IMPINGER # 3	MT	10	0	10
IMPINGER # 4	$KMnO_4$/HNV	105	100	5
DESCRIPTION				
IMPINGER RINSE				

		FINAL (g)	INITIAL(g)	
SILICA GEL (DESCRIPTION)	2/3 USED	824.6	791.9	32.7
FILTER# (DESCRIPTION)		TOTAL MOISTURE		279.7 (g)

FIELD BLANKS _____

_____

_____

DISPOSITION/COMMENTS

_____

_____

_____

ENGINEERING-SCIENCE, INC.

TRAIN RECOVERY SHEET

DATE 1-26-90

RUN# 3 METHOD

FACILITY KELL

TYPE TRACE ELEMENTS

TECHNICIAN RO/RD

IMP. SOLUTION H_2O / HNO_3

	SOLUTION	VOL. (ml)	DESCRIPTION
NOZZLE-PROBE RINSE			
UMBILICAL RINSE			

	FINAL (g)	INITIAL (g)	NET (g)
IMPINGER # 1	HNO_3 / H_2O ✓	~~205~~ 200	100 ~~105~~
IMPINGER # 2	HNO_3 / H_2O ✓	130	100 30
IMPINGER # 3	MT	10	0 10
IMPINGER # 4	$KMnO_4$	100	100
DESCRIPTION			
IMPINGER RINSE			

	FINAL (g)	INITIAL (g)	
SILICA GEL (DESCRIPTION)	858.3	821.7	36.6
FILTER# (DESCRIPTION)		TOTAL MOISTURE	~~181.6~~ 281.6 (g)

FIELD BLANKS

DISPOSITION/COMMENTS

box #5 @ Bk = 2.43

Bk = 2.43

Bk = 0.79

ES ENGINEERING-SCIENCE COMPANIES

FIELD DATA

DIOXIN #1

PAGE 1 OF ✓

Plant ICRCC
Date 11/26/96
Test Site Kiln Vent #2
Run Number 1 dioxin
Operator KMB/GK

Ambient Temp 65 (start)
Barometer
Stack Pressure
Stack H2O % 8
Stack Dia 167.5"

Meter #HB 1.74
Meter Gamma 1.01
Meter Box # HB #3
Nozzle Diameter .25 .28
Probe Length

Probe Mat'l QUARTZ
Filter Number
Samp Box #
PRE LEAK 0.002 @ 12 "Hg
POST LEAK 0.005 @ 20 "Hg

TRAVERSE POINT NUMBER	ELAPSED TIME (mins)	CLOCK TIME	GAS METER READING (Vm)	VELOCITY HEAD (delta p) .65	ORIFICE PRESSURE (delta H; "H2O) Desired 1.52	Actual 1.6	TEMPERATURES STACK (Ts)	METER INLET	METER OUT	IMPINGER	FILTER	PUMP VAC. "Hg
1	0	0912	402.534	.68	3	3	280	60	51	44	230	15
2	10	0922	405.7	.67	1.63	1.6	280	60	51	44	234	14
3	20	0932	415.8	.67	1.63	1.6	281	60	51	44	235	14
4	30	0942	422.4	.65	1.65	1.7	281	60	51	45	232	15
5	40	0952	429.5	.65	1.58	1.6	285	64	54	45	230	15
6	50	1002	436.8	.65	1.58	1.6						
	60	1012	442.985		post change							
7	60	1017	442.985	.66	1.60	1.6	300	64	56	45	250	14
8	70	1027	449.9	.63	1.53	1.5	310	65	57	45	250	14
9	80	1037	456.9	.63	1.55	1.50	311	66	58	45	245	14
10	90	1047	463.7	.63	1.53	1.5	311	66	55	45	240	15
11	100	1057	470.7	.63	1.5	1.5	311	64	58	45	240	15
12	110	1107	477.5	.63	1.5	1.5	310	63	58	45	235	15
	120	1117	484.778									
AVERAGE /SUM	240											

Box B K = 2.43

DIOXIN #1

ES ENGINEERING-SCIENCE COMPANIES

Plant KRCC
Date 11/26/90
POST LEAK RATE 0.005 @ 20"Hg

Page 2 of ✓
Run Number 1 Dioxin
Operator MH/SK

TRAVERSE POINT NUMBER	ELAPSED TIME (mins)	CLOCK TIME	GAS METER READING (Vm)	VELOCITY HEAD (delta p)	ORIFICE PRESSURE (delta H, "H2O)		TEMPERATURES					PUMP VAC. "Hg
					Desired	Actual	STACK (Ts)	METER INLET	METER OUT	IMPINGER	FILTER	
13	120	1142	484.778	1.8	4.37	~~4.37~~ 2.0	300	63	59	50	230	19
14	130	1152	492.0	1.7	4.13	~~4.13~~ 2.0	300	58	55		250	19
15	140	1202	499.5	1.6	3.89	2.0	299	60	55		248	19
16	150	1212	507.1	1.7	4.13	2.0	305	63	56		252	19
17	160	1222	514.8	1.7	4.13	2.0	312	63	57		249	19
18	170	1232	522.4	1.7	4.13	2.0	312	65	58		242	19
	180	1242	530.163			port	change					
19	180	1249	530.163	~~1.8~~	~~4.37~~	~~1.9~~	311	63	59		252	19
20	190	1259	537.6	1.8	4.37	1.9	310	67	60		240	19
21	200	1309	545.2	1.8	4.37	1.9	310	69	62		240	19
22	210	1319	552.9	1.7	4.13	1.9	311	69	63		252	19
23	220	1329	560.6	1.7	4.13	1.9	308	69	64		252	19
24	230	1339	568.5	1.1	2.67	1.9	315	76	69		230	19
	240	1349	575.941			end	sum		#1			
									AH = 349.0			
AVERAGE /SUM	240		173.407	1.05		1.75	303	61				

Box B

ES ENGINEERING-SCIENCE COMPANIES

Nozzle #2 $K = 2.43 (.164)^4 / (.23)$ = $K = .776$ $K = 0.79$

FIELD DATA

Plant KPCC
Date 11/26/90
Test Site Stack #2
Run Number 2 Again
Operator Dan/Ric

Ambient Temp 70
Barometer
Stack Pressure
Stack H2O % 8
Stack Dia 167.5"

Meter "Hg 1.74
Meter Gamma 1.01
Meter Box # #3
Nozzle Diameter .164
Probe Length

Probe Mat'l
Filter Number
Samp Box #
PRE LEAK 0.001
POST LEAK

TRAVERSE POINT NUMBER	ELAPSED TIME (mins)	CLOCK TIME	GAS METER READING (Vm)	VELOCITY HEAD (delta p)	ORIFICE PRESSURE (delta H, "H2O)		TEMPERATURES					PUMP VAC. "Hg
					Desired	Actual	STACK (Ts)	METER INLET	METER OUT	IMPINGER	FILTER	
1	0	1502	576.425	1.7	1.34	1.3	305	76	69	49	250	9
2	10	1512	582.4	1.7	1.34	1.3	303	76	69	49	250	9
3	20	1522	588.4	1.7	1.34	1.3	307	76	69	49	250	9
4	30	1532	595.0	1.7	1.34	1.3	308	80	72	49	249	10
5	40	1542	600.9	1.7	1.34	1.3	309	81	73	50	247	9
6	50	1552	608.1	1.7	1.34	1.3	309	83	75	50	250	10
	60	1602	614.515		port	change		79	76	50		
7	60	1609	614.615	1.7	1.34	1.3	309	79	76	50	241	9
8	70	1619	621.3	1.7	1.34	1.4	304	83	77	50	238	10
9	80	1629	627.9	1.7	1.34	1.3	302	84	77	50	2.40	11
10	90	1639	634.5	1.7	1.34	1.3	301	83	78	50	2.34	11
11	100	1649	641.8	1.7	1.34	1.3	301	82	77	50	264	11
12	110	1659	647.8	1.7	1.34	1.3	300	81	77	52	238	11
	120	1709	654.172			port change						
AVERAGE /SUM	240		158.887	1.3038		1.3	301	72				

$\Delta H = 2.15$

Box B

DIOXIN #2

K.O; 7.9

ES ENGINEERING-SCIENCE COMPANIES

Plant KRCC
Date 11/26/89
POST LEAK RATE 0.007

Page 2 of 2
Run Number 2 dioxin
Operator WH/SC

TRAVERSE POINT NUMBER	ELAPSED TIME (mins)	CLOCK TIME	GAS METER READING (Vm)	VELOCITY HEAD (delta p)	ORIFICE PRESSURE (delta H, "H2O)		TEMPERATURES					PUMP VAC. "Hg
					Desired	Actual	STACK (Ts)	METER INLET	METER OUT	IMPINGER	FILTER	
13	120	1715	654.172	1.7	1.34	1.3	300	77	75	49	266	11
14	130	1725	660.7	1.7	1.34	1.3	300	79	75	49	249	11
15	140	1735	667.0	1.7	1.34	1.3	299	79	75	49	243	11
16	150	1745	673.4	1.7	1.34	1.3	300	79	75	50	255	11
17	160	1755	679.0	1.7	1.34	1.3	300	79	74	50	254	11
18	170	1805	686.5	1.7	1.34	1.3	299	79	74	48	236	11
	180	1815	693.068		port change							
1	180	1824	693.068	1.7	1.34	1.3	301	76	72	48	252	11
2	190	1834	699.9	1.7	1.34	1.3	306	75	71	47	233	11
3	200	1844	705.1	1.7	1.34	1.3	301	74	70	47	222	11
4	210	1854	711.6	1.7	1.34	1.3	301	73	69	47	232	11
5	220	1904	719.3	1.7	1.34	1.3	306	73	70	47	237	11
6	230	1914	726.9	1.7	1.34	1.3	304	73	70	46	224	11
	240	1924	735.311		END	TEST						
AVERAGE /SUM	240		158.887	1.3038		1.3	301	72				

Box B dioxin #3 K = 0.79

ES ENGINEERING-SCIENCE COMPANIES

FIELD DATA

PAGE 1 OF 2

Plant KRCC
Date 1/26/90
Test Site stack #2
Run Number 3 dioxin
Operator BJB

Ambient Temp 65
Barometer
Stack Pressure
Stack H2O % 8
Stack Dia 167.5"

Meter ΔH@ 1.774
Meter Gamma 1.01
Meter Box # old #3
Nozzle Diameter 0.189
Probe Length

Probe Mat'l
Filter Number
Samp Box #
PRE LEAK 0.002 @ 15 "Hg
POST LEAK

TRAVERSE POINT NUMBER	ELAPSED TIME (mins)	CLOCK TIME	GAS METER READING (Vm)	VELOCITY HEAD (delta p)	ORIFICE PRESSURE (delta H, "H2O)		TEMPERATURES					PUMP VAC. "Hg
					Desired	Actual	STACK (Ts)	METER INLET	METER OUT	IMPINGER	FILTER	
1	0	2002	735.472	1.6	1.26	1.3	300	77	75	49	240	13
2	10	2012	743.2	1.6	1.26	1.3	297	77	75	49	243	12
3	20	2022	750.2	1.6	1.26	1.3	295	77	75	49	250	9
4	30	2032	756.2	1.8	1.42	1.4	295	77	75	49	250	10
5	40	2042	762.7	1.8	1.42	1.4	295	77	75	49	250	10
6	50	2052	769.3	1.8	1.42	1.4	295	77	75	49	250	10
	60	2102	775.984			port	change					
7	60	2110	775.984	1.8	1.42	1.4	295	78	76	50	250	11
8	70	2120	782.6	1.8	1.42	1.4	295	78	76	50	250	11
9	80	2130	789.7	1.7	1.34	1.3	297	78	76	50	250	11
10	90	2140	796.5	1.7	1.34	1.3	297	78	76	50	250	11
11	100	2150	803.5	1.7	1.34	1.3	295	78	76	50	249	11
12	110	2200	810.8	1.7	1.34	1.3	296	78	76	50	250	11
	120	2210	816.780									
AVERAGE /SUM	240		156.167	1.3052		1.3	296	76				

ΔH = 166.7

BOX B
DIOXIN #3

K = 0.79

ENGINEERING-SCIENCE COMPANIES

Plant KRCC
Date 1-26-90
POST LEAK RATE 0.004 @ 12 "Hg

Run Number 3
Operator SK

TRAVERSE POINT NUMBER	ELAPSED TIME (mins)	CLOCK TIME	GAS METER READING (Vm)	VELOCITY HEAD (delta p)	ORIFICE PRESSURE (delta H, "H2O)		TEMPERATURES					PUMP VAC. "Hg
					Desired	Actual	STACK (Ts)	METER INLET	METER OUT	IMPINGER	FILTER	
13	120	2215	816.780	1.7	1.34	1.3	296	78	76	50	250	11
14	130	2225	823.9	1.6	1.26	1.3	295	78	76	50	249	11
15	140	2235	829.8	1.7	1.34	1.3	296	78	76	50	249	10
16	150	2245	836.8	1.7	1.34	1.3	296	78	76	50	249	10
17	160	2255	843.0	1.7	1.34	1.3	295	78	76	50	250	10
18	170	2305	849.5	1.7	1.34	1.3	295	78	76	50	250	10
	180	2310	853.744			Port change						
19	180	2318	853.744	1.7	1.34	1.3	295	78	76	50	250	10
20	190	2328	860	1.7	1.34	1.3	296	78	76	50	250	10
21	200	2338	861.9	1.7	1.34	1.3	296	78	76	50	250	10
22	210	2348	872.5	1.7	1.34	1.3	296	78	77	50	251	10
23	220	2358	878.9	1.7	1.34	1.3	296	78	76	50	250	10
24	230	2408	885.2	1.7	1.34	1.3	296	78	76	50	250	10
	240	2418	891.639			end run # 3						
AVERAGE /SUM	240		156.17	1.3052		1.3	296					

ENGINEERING-SCIENCE, INC.

TRAIN RECOVERY SHEET

DATE 1-25-90

RUN# DIOXIN-1 METHOD

FACILITY KRCC T&V

TYPE

TECHNICIAN RR

IMP. SOLUTION

	SOLUTION	VOL. (ml)	DESCRIPTION
NOZZLE-PROBE RINSE			/
UMBILICAL RINSE			/

		FINAL (g)	INITIAL(g)	NET(g)
IMPINGER # 1	HW	310	100	210
IMPINGER # 2	HW	130	100	30
IMPINGER # 3	MT.	0	0	0
IMPINGER #				
DESCRIPTION				
IMPINGER RINSE				

		FINAL (g)	INITIAL(g)	
SILICA GEL (DESCRIPTION)	1/3 SILICA	835.4	786.4	49.0
FILTER# (DESCRIPTION)		TOTAL MOISTURE		289.0 (g)

FIELD BLANKS

DISPOSITION/COMMENTS

ENGINEERING-SCIENCE, INC.

TRAIN RECOVERY SHEET

DATE 1-26-90 RUN# 2 METHOD

FACILITY KRCC T#V TYPE Dioxin

TECHNICIAN RS/RR IMP. SOLUTION

	SOLUTION	VOL. (ml)	DESCRIPTION
NOZZLE-PROBE RINSE			
UMBILICAL RINSE			

		FINAL (g)	INITIAL (g)	NET (g)
IMPINGER # 1	HW	390	100	290
IMPINGER # 2	HW	40	100	-60
IMPINGER # 3	MT	20	0	20
IMPINGER #				
DESCRIPTION				
IMPINGER RINSE				

	FINAL (g)	INITIAL (g)	
SILICA GEL (DESCRIPTION)	1/3 used	837.6	792.2	45.4
FILTER# (DESCRIPTION)		TOTAL MOISTURE	

295.4 (g)

FIELD BLANKS

DISPOSITION/COMMENTS

ENGINEERING-SCIENCE, INC.

TRAIN RECOVERY SHEET

DATE 1-26-90 RUN# 3 METHOD _____

FACILITY KRCC T & V TYPE DIOXIN

TECHNICIAN RO/RB IMP. SOLUTION _____

	SOLUTION	VOL. (ml)	DESCRIPTION
NOZZLE-PROBE RINSE			
UMBILICAL RINSE			

		FINAL (g)	INITIAL(g)	NET(g)
IMPINGER # 1	H_2O	315	100	215
IMPINGER # 2	H_2O	5	100	-95
IMPINGER # 3	MT	0	0	0
IMPINGER # _____				
DESCRIPTION				
IMPINGER RINSE				

		FINAL (g)	INITIAL(g)	
SILICA GEL (DESCRIPTION)	1/3 used	868.8	821.9	46.9
FILTER# (DESCRIPTION)		TOTAL MOISTURE		

166.9 (g)

FIELD BLANKS _____

_____

_____

DISPOSITION/COMMENTS

_____

_____

_____

K = 2.29

HCL #1

Unit C

ES ENGINEERING-SCIENCE COMPANIES

FIELD DATA

PAGE 1 OF 2

Plant KCCC
Date 1-26-90
Test Site KCCC COGEN #2
Run Number 1 HCL
Operator TK

Ambient Temp 60
Barometer 29.84
Stack Pressure .107
Stack H2O % .05
Stack Dia 167.5

Meter "H@ 1.629
Meter Gamma 0.994
Meter Box # ICEI #2
Nozzle Diameter .2
Probe Length

Probe Mat'l TEFLON
Filter Number
Samp Box #
PRE LEAK 0.002
POST LEAK

TRAVERSE POINT NUMBER	ELAPSED TIME (mins)	CLOCK TIME	GAS METER READING (Vm)	VELOCITY HEAD (delta p)	ORIFICE PRESSURE (delta H; "H2O) Desired	ORIFICE PRESSURE (delta H; "H2O) Actual	TEMPERATURES STACK (Ts)	TEMPERATURES METER INLET	TEMPERATURES METER OUT	TEMPERATURES IMPINGER	TEMPERATURES FILTER	PUMP VAC. "Hg
1	0	0920	231.482	1.7	3.86	3.9	308					1
2	10	0930	238.8	.71	1.61	1.6	283	50				5
3	20	0940	244.7	1.7	3.86	3.9	283	50				6
4	30	0950	253.2	1.7	3.86	3.9	281	50				6
5	40	1000	263.5	1.7	3.86	3.9	314	50				6
6	50	1010	273.9	1.7	3.86	3.9	312	50				6
	60	1020	282.340			PORT	CHANGE					6
7	0	1027	282.340	2.0	4.54	4.5	312	50				6
8	10	1037	291.5	2.0	4.54	4.5	312	50				6
9	20	1047	300.2	2.0	4.54	4.5	313	50				6
10	30	1057	308.7	2.0	4.54	4.5	308	50				6
11	40	1107	317.5	2.0	4.54	4.5	311	50				6
12	50	1117	328.7	2.0	4.54	4.5	312	50				6
	60	1127	334.988			PORT	CHANGE					
AVERAGE /SUM	240		184.6	1.080		2.9	296	60				

PORT A

PORT B

184.674 1.04

2.8

HCl #1
Cu #1

ENGINEERING-SCIENCE COMPANIES

Plant KRCC
Date 1-28-90
POST LEAK RATE 0.00025 "HG

Run Number 1 HCl
Operator TK

TRAVERSE POINT NUMBER	ELAPSED TIME (mins)	CLOCK TIME	GAS METER READING (Vm)	VELOCITY HEAD (delta p)	ORIFICE PRESSURE (delta H, "H2O)		TEMPERATURES					PUMP VAC. "Hg
					Desired	Actual	STACK (Ts)	METER INLET	METER OUT	IMPINGER	FILTER	
13	0	1144	334.986	.71	1.61	1.6	295	60				2
14	10	1154	342.5	.71	1.61	1.6	294	62				2
15	20	1204	349.1	.75	1.70	1.7	294	70				2
16	30	1214	356.6	.75	1.70	1.7	298	71				2
17	40	1224	362.4	.65	1.48	1.5	300	73				2
18	50	1234	369.6	.72	1.63	1.6	288	70				2
	60	1244	375.869			PORT	CHANGE					
19	0	1248	375.869	.73	1.66	1.7	285	75				2
20	10	1258	382.2	.74	1.68	1.7	287	79				2
21	20	1308	389.3	.78	1.77	1.8	288	80				2
22	30	1318	396.5	.72	1.63	1.6	287	75				2
23	40	1328	403.2	.70	1.59	1.6	287	76				2
24	50	1338	410.2	.52	1.18	1.2	294	77				2
	60	1348	416.156			END	RUN	#1				
AVERAGE	240		184.67	1.0801		2.9	296	Cole				

PORT C
PORT D

K=2.44

HCC #2

ES ENGINEERING-SCIENCE COMPANIES

FIELD DATA

Plant KRCC
Date 1-25-90
Test Site Comb #2
Run Number 2 HCl
Operator

Ambient Temp 75
Barometer 29.44
Stack Pressure -.67
Stack H2O % .08
Stack Dia 167.5

Meter ΔH@ 1.749
Meter Gamma 1.030
Meter Box # BOX #3
Nozzle Diameter .5
Probe Length

Probe Mat'l
Filter Number
Samp Box #
PRE LEAK .0012 5"HG
POST LEAK

TRAVERSE POINT NUMBER	ELAPSED TIME (mins)	CLOCK TIME	GAS METER READING (Vm)	VELOCITY HEAD (delta p)	ORIFICE PRESSURE (delta H; "H2O) Desired	ORIFICE PRESSURE (delta H; "H2O) Actual	TEMPERATURES STACK (Ts)	TEMPERATURES METER INLET	TEMPERATURES METER OUT	TEMPERATURES IMPINGER	TEMPERATURES FILTER	PUMP VAC. "Hg
												5
1	0	1500	511.127	.78	1.90	1.9	306	64	65			4.5
2	10	1510	517.7	.71	1.73	1.7	302	65	63			4.5
3	20	1520	525.2	.68	1.56	1.6	304	70	66			4.5
4	30	1530	532.2	.68	1.66	1.7	308	72	68			5
5	40	1540	539.3	.72	1.76	1.8	309	75	71			5
6	50	1550	546.2	.73	1.78	1.8	309	79	72			
						PORT	CHANGE					
	60	1600	553.320									6
7	0	1605	553.320	.78	1.90	1.9	306	77	73			6
8	10	1615	560.3	.72	1.76	1.8	302	82	76			7
9	20	1625	570.4	.77	1.88	1.9	300	83	78			4.5
10	30	1635	579.5	.71	1.73	1.7	300	83	78			5
11	40	1645	587.1	.76	1.85	1.9	301	74	73			3.5
12	50	1655	593.1	.75	1.86	1.9	302	73	72			
						BOX		CHANGE				
	60	1705	599.149									
AVERAGE /SUM	240		76.57	.8643		1.8	300	70				

HCl #2
CW

ES ENGINEERING-SCIENCE COMPANIES

Plant KRCC
Date 1-25-90
POST LEAK RATE 0.000

Run Number 2 HCl
Operator TK

TRAVERSE POINT NUMBER	ELAPSED TIME (mins)	CLOCK TIME	GAS METER READING (Vm)	VELOCITY HEAD (delta p)	ORIFICE PRESSURE (delta H, "H2O)		TEMPERATURES					PUMP VAC. "Hg
					Desired	Actual	STACK (Ts)	METER INLET	METER OUT	IMPINGER	FILTER	
13	0	1709	599.149	.78	1.90	1.9	299	68	68			5
14	10	1719	606.4	.74	1.81	1.8	299	69	66			5
15	20	1729	613.9	.78	1.90	1.9	300	69	65			5
16	30	1739	621.1	.78	1.90	1.9	300	69	65			5
17	40	1749	629.8	.74	1.81	1.8	296	71	65			6
18	50	1759	637.2	.69	1.68	1.7	295	72	65			4.5
	60	1809	644.461			PORT	CHANGE					
19	0	1811	644.461	0.80	1.81	1.81	297	72	65			4.5
20	10	1821	652.1	0.77	1.88	1.88	298	70	64			5
21	20	1831	659.0	0.78	1.90	1.90	297	70	64			5
22	30	1841	665.5	0.78	1.70	1.90	299	70	64			5
23	40	1851	672.2	0.77	1.11	1.11	255	70	64			5
24	50	1901	680.6	0.74	1.81	1.81	255	70	64			5
	60	1911	687.701			END RUN #2						
AVERAGE /SUM	240		176.574	.8643		1.8	300	70				

ES ENGINEERING-SCIENCE COMPANIES

K=2.44

HCC #3

CW #7

FIELD DATA

Plant KRCC
Date 1-25-90
Test Site Cond #2
Run Number HCC #3
Operator JL

Ambient Temp 70
Barometer 29.44
Stack Pressure -.07
Stack H2O % .03
Stack Dia 167.5

Meter #1 1.749
Meter Gamma 1.030
Meter Box # BWE #3
Nozzle Diameter .25
Probe Length

Probe Mat'l
Filter Number
Samp Box #
PRE LEAK 0.001 @ 5" HG
POST LEAK

TRAVERSE POINT NUMBER	ELAPSED TIME (mins)	CLOCK TIME	GAS METER READING (Vm)	VELOCITY HEAD (delta p)	ORIFICE PRESSURE (delta H; "H2O)		TEMPERATURES					PUMP VAC. "Hg
					Desired	Actual	STACK (Ts)	METER INLET	METER OUT	IMPINGER	FILTER	
1	0	2002	689.512	.75	1.83	1.8	294	62	61			5
2	10	2012	696.6	.85	2.07	2.1	291	65	63			5
3	20	2022	704.1	.71	1.73	1.7	292	66	61			5
4	30	2032	711.7	.71	1.73	1.7	293	66	61			5
5	40	2042	719.2	.80	1.95	2.0	294	66	61			5
6	50	2052	727.5	.75	1.83	1.8	294	66	60			5
	60	2102	735.321			PORT	CHANGE					
7	0	2107	735.321	.75	1.83	1.8	295	62	60			4.5
8	10	2117	742.0	.71	1.73	1.7	298	64	59			5
9	20	2127	749.6	.81	1.98	2.0	297	65	59			5
10	30	2137	756.4	.74	1.81	1.8	297	65	59			5
11	40	2147	763.6	.78	1.90	1.9	294	64	59			5
12	50	2157	771.2	.75	1.83	1.8	297	66	59			5
	60	2207	779.358			PORT	CHANGE					
AVERAGE /SUM	240		172.68	.8072		1.83	295	60				

HCl #3
Cr #3

ES ENGINEERING-SCIENCE COMPANIES

Plant KRCC
Date 1-25-90
POST LEAK RATE 0.001 @ 5" HG

Run Number HCl 3
Operator TL

TRAVERSE POINT NUMBER	ELAPSED TIME (mins)	CLOCK TIME	GAS METER READING (Vm)	VELOCITY HEAD (delta p)	ORIFICE PRESSURE (delta H, "H2O)		TEMPERATURES					PUMP VAC. "Hg
					Desired	Actual	STACK (Ts)	METER INLET	METER OUT	IMPINGER	FILTER	
13	0	2214	778.358	.75	1.83	1.8	297	60	57			5
14	10	2224	784.2	.69	1.68	1.7	296	62	57			5
15	20	2234	791.2	.80	1.95	2.0	297	64	58			5
16	30	2244	798.7	.78	1.90	1.9	296	64	58			5
17	40	2254	805.8	.78	1.90	1.9	296	64	58			5
18	50	2304	813.9	.74	1.81	1.8	297	63	57			
	60	2314	820.891		PORT CHANGE							
19	0	2320	820.891	.74	1.81	1.8	297	63	57			5
20	10	2330	826.8	.72	1.76	1.8	295	63	57			5
21	20	2340	834.5	.69	1.68	1.7	296	66	58			5
22	30	2350	840.7	.75	1.83	1.8	293	67	60			5
23	40	2400	847.9	.75	1.83	1.8	295	68	60			5
24	50	2410	854.8	.76	1.85	1.9	294	66	60			5
	60	2420	862.189		END RUN #3							
AVERAGE /SUM	240		172.60 107	.8672		1.8	295	60				

ENGINEERING-SCIENCE, INC.

TRAIN RECOVERY SHEET

Cr #1

DATE 1-25-90

FACILITY KRCC T# V

TECHNICIAN RP

RUN# _____ METHOD _____

TYPE _____

IMP. SOLUTION $NaHCO_3$

	SOLUTION	VOL. (ml)	DESCRIPTION
NOZZLE-PROBE RINSE			✓
UMBILICAL RINSE			✓

		FINAL (g)	INITIAL(g)	NET(g)
IMPINGER # 1	$NaHCO_3$	375	100	275
IMPINGER # 2	$NaHCO_3$	100	100	0
IMPINGER # 3	MT	0	0	0
IMPINGER # _____				
DESCRIPTION				
IMPINGER RINSE				

		FINAL (g)	INITIAL(g)	
SILICA GEL (DESCRIPTION)	4/5 mesh	827.0	788.9	38.1
FILTER# (DESCRIPTION)			TOTAL MOISTURE	

313.1 (g)

FIELD BLANKS _____

_____

_____

DISPOSITION/COMMENTS

_____

_____

_____

ENGINEERING-SCIENCE, INC.

TRAIN RECOVERY SHEET

DATE 1-25-90

FACILITY KPCC #TV

TECHNICIAN RM

RUN# _____ METHOD _____

TYPE _____

IMP. SOLUTION $NaHCO_3$

	SOLUTION	VOL. (ml)	DESCRIPTION
NOZZLE-PROBE RINSE			✓
UMBILICAL RINSE			✓

		FINAL (g)	INITIAL (g)	NET (g)
IMPINGER # 1	$NaHCO_3$	345	100	245
IMPINGER # ✓	$NaHCO_3$	110	100	10
IMPINGER # 3	MT	0	0	0
IMPINGER # _____				
DESCRIPTION				
IMPINGER RINSE				

		FINAL (g)	INITIAL (g)	
SILICA GEL (DESCRIPTION)	1/3 new	856.7	814.0	42.7
FILTER# (DESCRIPTION)				
		TOTAL MOISTURE		297.7 (g)

FIELD BLANKS _____

DISPOSITION/COMMENTS _____

ENGINEERING-SCIENCE, INC.

TRAIN RECOVERY SHEET

Cr #3

DATE 1-Nov-90

RUN# _____ METHOD _____

FACILITY KRCC & TV

TYPE _____

TECHNICIAN RR

IMP. SOLUTION _____

	SOLUTION	VOL. (ml)	DESCRIPTION
NOZZLE-PROBE RINSE			✓
UMBILICAL RINSE			✓

		FINAL (g)	INITIAL(g)	NET(g)
IMPINGER # 1	$NaHCO_3$	360	100	260
IMPINGER # 2	$NaHCO_3$	100	100	0
IMPINGER # 3	MT.	0	0	0
IMPINGER # _____				
DESCRIPTION				
IMPINGER RINSE				

		FINAL (g)	INITIAL(g)	
SILICA GEL (DESCRIPTION)	2/3 used	877.1	782.8	34.3
FILTER# (DESCRIPTION)				

TOTAL MOISTURE 299.3 (g)

FIELD BLANKS _____

DISPOSITION/COMMENTS _____

Formaldehyde #1

ES ENGINEERING-SCIENCE COMPANIES

Plant KKCC
Date 1-15-93
POST LEAK RATE

Page 1 of 1
Run Number 1
Operator TK

TRAVERSE POINT NUMBER	ELAPSED TIME (mins)	CLOCK TIME	GAS METER READING (Vm)	VELOCITY HEAD (delta p)	ORIFICE PRESSURE (delta H, "H2O)		TEMPERATURES					PUMP VAC. "Hg
					Desired	Actual	STACK (Ts)	METER INLET	METER OUT	IMPINGER	FILTER	
	~~0915~~											
1	0	0915	8849.71									
	62	~~1027~~ 1027	9038									
	85	1050	9124									
	105	1110	9280									
	~~150~~ 150	1155	9339									
	163	1208	9378									
	218	1303	9043									
	240	1325	9621.57									
AVERAGE /SUM	240		771.850									

$\Delta H = 1.74$

Formal Dehyde #2

ENGINEERING-SCIENCE COMPANIES

FIELD DATA

PAGE 1 OF 1

Plant KRCC
Date 1-25-90
Test Site KRCC Cogen #2
Run Number 2
Operator TK

Ambient Temp 75
Barometer 29.44
Stack Pressure .17
Stack H2O % .05
Stack Dia 167.5

Meter #
Meter Gamma
Meter Box #
Nozzle Diameter
Probe Length

Probe Mat'l
Filter Number
Samp Box #
PRE LEAK
POST LEAK

TRAVERSE POINT NUMBER	ELAPSED TIME (mins)	CLOCK TIME	GAS METER READING (Vm) LITERS	VELOCITY HEAD (delta p)	ORIFICE PRESSURE (delta H; "H2O) Desired	ORIFICE PRESSURE (delta H; "H2O) Actual	TEMPERATURES STACK (Ts)	TEMPERATURES METER INLET	TEMPERATURES METER OUT	TEMPERATURES IMPINGER	TEMPERATURES FILTER	PUMP VAC. "Hg
	0	1502	9621.67				304	54				<1
	23	1525	9690									
	54	1556	0786									
		1605		POWER OUT								
		1615		POWER BACK ON				UNIT				
	64	1620	0727									
	109	1701	0948									
	145	1737	0093									
	191	1814	0157									
	227	1849	0317				300	53				<1
	251	1913	0316.50	END		TES						
					24.54							
AVERAGE /SUM	251		694.890				301	54				

ES ENGINEERING-SCIENCE COMPANIES

FORM ALTERNATE #3

Plant ICI CC
Date 1-28-93
POST LEAK RATE

Run Number
Operator JK

TRAVERSE POINT NUMBER	ELAPSED TIME (mins)	CLOCK TIME	GAS METER READING (Vm) LITERS	VELOCITY HEAD (delta p)	ORIFICE PRESSURE (delta H, "H2O)		TEMPERATURES					PUMP VAC. "Hg
					Desired	Actual	STACK (Ts)	METER INLET	METER OUT	IMPINGER	FILTER	
	0	1917	0317.03				300	57				
	8.2	2039	0533									
	113	2110	1626									
	179	2208	1770									
	239	2316	1946									
	240	2317	1946.98									
AVERAGE /SUM	240		629.950				300	57 ✓				

cox [illegible] A   K = 2.79 (mv.33)   Arsenic #1

ES ENGINEERING-SCIENCE COMPANIES

FIELD DATA

Plant KRCC
Date 11/26/90
Test Site [illegible] #2
Run Number 1 A5
Operator [illegible]

Ambient Temp 65
Barometer
Stack Pressure
Stack H2O % 8
Stack Dia 169.5"

Meter ΔH@ 2.00
Meter Gamma 0.97
Meter Box # [illegible] #1
Nozzle Diameter .259
Probe Length

Probe Mat'l
Filter Number
Samp Box #
PRE LEAK 0.00 @ 15"Hg
POST LEAK 0.00 @ 16"Hg

TRAVERSE POINT NUMBER	ELAPSED TIME (mins)	CLOCK TIME	GAS METER READING (Vm)	VELOCITY HEAD (delta p)	ORIFICE PRESSURE (delta H; "H2O) Desired	ORIFICE PRESSURE (delta H; "H2O) Actual	TEMPERATURES STACK (Ts)	TEMPERATURES METER INLET	TEMPERATURES METER OUT	TEMPERATURES IMPINGER	TEMPERATURES FILTER	PUMP VAC. "Hg
1	0	0915 / 0916	376.375 / 402.594	31.1 / 2.5	3.96	4.0	[illegible]	44		44	NA	8
2	10	0925						50		"		
3	20	0935	397.3	1.5	3.5	3.5	280	56		"		11
4	30	0945	406.9	1.6	3.73	3.7	280	56		"		12
5	40	0955	417.1	1.6	3.73	3.7	280	50		45		12
6	50	1005	427.4	1.6	3.73	3.7	258	56		45		12
	60	1015	437.584	port change								
7	60	1020	437.584	1.7	3.96	4.0	300	60		45		12
8	70	1030	447.7	1.7	3.96	4.0	310	60		45		13
9	80	1040	458.5	1.6	3.73	3.7	311	60		45		12
10	90	1050	468.2	1.6	3.73	3.7	311	60		45		12
11	100	1100	479.1	1.6	3.73	3.7	311	60		45		12
12	110	1110	489.1	1.6	3.73	3.7	310	60		48		12
	120	1120	499.297									
AVERAGE /SUM	240		255.21	1.3031		4.1	295	61				

Box A

Ic = 2.33 ?

ES ENGINEERING-SCIENCE COMPANIES

Quisenic #1

Plant KRCC
Date 1/20/90
POST LEAK RATE 0.007 @ 16 "Hg

Run Number 1 A5
Operator [illegible]

TRAVERSE POINT NUMBER	ELAPSED TIME (mins)	CLOCK TIME	GAS METER READING (Vm)	VELOCITY HEAD (delta p)	ORIFICE PRESSURE (delta H, "H2O)		TEMPERATURES					PUMP VAC. "Hg
					Desired	Actual	STACK (Ts)	METER INLET	METER OUT	IMPINGER	FILTER	
13	120	~~1127~~ ~~1130~~	499.297	~~2.1~~	~~4.43~~ ~~4.69~~	~~4.4~~ ~~4.9~~	300	60		50	~~1~~ 1A	15
14	130	~~1137~~ ~~1140~~	510.1	1.9	4.43	4.4	300	60		50		15
15	140	~~1147~~ ~~1147~~	521.2	1.9	4.43	4.4	300	60		50		15
16	150	1157	532.0	2.2	5.13	4.4	295	60		50		15
17	160	1207	542.1	2.2	5.13	4.4	305	60		50		15
18	170	1217	554.1	2.2	5.13	4.4	310	60		50		15
	180	1227	565.198		post leak							
19	180	1237	565.198	2.2	5.13	4.4	310	60		50		15
20	190	~~1247~~ ~~1245~~	575.9	2.2	5.13	4.3	311	64		50		14
21	200	~~1257~~ ~~1255~~	587.0	2.3	5.36	4.3	310	68		50		14
22	210	~~1307~~ ~~1307~~	598.0	2.0	4.66	4.3	310	70		50		15
23	220	~~1317~~ ~~1317~~	609.2	2.0	4.66	4.3	311	70		50		14
24	230	~~1327~~ ~~1325~~	620.4	2.0	4.66	4.3	~~308~~	70		50		~~15~~
	240	~~1337~~ ~~1337~~	631.603		end run		#1					
AVERAGE /SUM	240		255.21	1.3031		4.1	295	61				

Box A

K = 2.33

ES ENGINEERING-SCIENCE COMPANIES

FIELD DATA Chromic #2

Plant KICC
Date 1/24/90
Test Site Unit #2
Run Number 2 A5
Operator MP/SK

Ambient Temp 70
Barometer
Stack Pressure
Stack H2O %
Stack Dia 164.5"

Meter #Hg 2.00
Meter Gamma 0.97
Meter Box # 2-M1
Nozzle Diameter 2.39
Probe Length

Probe Mat'l
Filter Number
Samp Box #
PRE LEAK 0.001
POST LEAK

TRAVERSE POINT NUMBER	ELAPSED TIME (mins)	CLOCK TIME	GAS METER READING (Vm)	VELOCITY HEAD (delta p)	ORIFICE PRESSURE (delta H; "H2O) Desired	ORIFICE PRESSURE (delta H; "H2O) Actual	TEMPERATURES STACK (Ts)	TEMPERATURES METER INLET	TEMPERATURES METER OUT	TEMPERATURES IMPINGER	TEMPERATURES FILTER	PUMP VAC. "Hg
1	0	1500	640.147	1.8	4.19	4.2	305	70		49	N/A	11
2	10	1510	652.4	1.9	4.43	4.4	303	70		49		12
3	20	1520	662.8	1.9	4.43	4.4	303	70		49		12
4	30	1530	674.1	2.0	4.66	4.7	308	70		49		12
5	40	1540	685.6	2.0	4.66	4.7	309	72		50		12
6	50	1550	697.2	2.0	4.66	4.7	309	72		50		11
	60	1600	709.181	2.0	Port change							11
7	60	1607	709.181	2.2	5.13	5.1	309	72		50		11
8	70	1617	724.6	2.2	5.13	5.1	309	72		50		11
9	80	1623	736.6	2.3	5.13	5.1	303	72		50		11
10	90	1637	748.6	2.0	4.66	4.7	302		72	50		11
11	100	1647	761.3	2.2	5.13	5.1	301		72	50		11
12	110	1657	772.4	2.2	5.13	5.1	301		72	50		11
	120	1707	784.540					Port change				
AVERAGE /SUM	240		284.37	1.4311		4.8	303	71				

Page 1
Received: 01/30/90

TMA Inc. REPORT

Work Order # A0-01[illegible]84

02/06/90 14:48:48

REPORT TO
Engineering Science
75 N. Fair Oaks Ave.
P.O. Box 7107
Pasadena, CA 91109
ATTEN H. Doriada

PREPARED BY
Thermo Analytical, Inc.
160 Taylor Street
Monrovia, CA 91016
ATTEN Ms. Carole Harris
PHONE 818-357-3247

Robert Marcek
CERTIFIED BY

CONTACT REM

CLIENT ENGINEER SCI SAMPLES 3
COMPANY Engineering Science
FACILITY

This report is for the sole and exclusive use of the client to whom it is addressed and represents only those samples herein described. Samples not destroyed in testing are retained a maximum of 30 days unless otherwise requested.

WORK ID WA 005 KRCC
TAKEN By ES Staff
TRANS By ES Staff
TYPE Gas
P.O. # WA 005
INVOICE under separate cover

SAMPLE IDENTIFICATION

01 900159
02 900160
03 900161

TEST CODES and NAMES used on this report

VOA A Volatile Organics by GC/MS

Received: 01/30/90

TMA Inc. REPORT

Work Order # A0-0[illegible]34

Results by Sample

SAMPLE ID 900159

FRACTION 01A TEST CODE VOA A NAME Volatile Organics by GC/MS

Date & Time Collected 01/25/90 Category

VOLATILE ORGANIC RESULTS

COMPOUND	RESULT	DET LIMIT	COMPOUND	RESULT	DET LIMIT
Chloromethane	ND	0.25	1,1,2,2-Tetrachloroethane	ND	0.25
Bromomethane	ND	0.25	1,2-Dichloropropane	ND	0.25
Vinyl chloride	ND	0.25	trans-1,3-Dichloropropene	ND	0.25
Chloroethane	ND	0.25	Trichloroethene	ND	0.25
Methylene chloride	ND	0.25	Dibromochloromethane	ND	0.25
Acetone	ND	0.25	1,1,2-Trichloroethane	ND	0.25
Acrolein	ND	0.25	Benzene	ND	0.25
Acrylonitrile	ND	0.25	cis-1,3-Dichloropropene	ND	0.25
Carbon disulfide	ND	0.25	2-Chloroethyl Vinyl Ether	ND	0.25
1,1-Dichloroethene	ND	0.25	Bromoform	ND	0.25
1,1-Dichloroethane	ND	0.25	2-Hexanone	ND	0.25
1,2-Dichloroethene	ND	0.25	4-Methyl-2-Pentanone	ND	0.25
Chloroform	ND	0.25	Tetrachloroethene	ND	0.25
1,2-Dichloroethane	ND	0.25	Toluene	ND	0.25
Methylethyl ketone	ND	0.25	Chlorobenzene	ND	0.25
1,1,1-Trichloroethane	ND	0.25	Ethyl benzene	ND	0.25
Carbon tetrachloride	ND	0.25	Styrene	ND	0.25
Vinyl acetate	ND	0.25	Xylenes (Total)	ND	0.25
Bromodichloromethane	ND	0.25			

NOTE: All results reported in mg/M3 unless otherwise specified
ND = Not detected at the specified limits
NA = Not Analyzed

SURROGATE COMPOUNDS	% RECOVERY
d8-Toluene	NA
Bromofluorobenzene	NA
1,2-Dichloroethane-d4	NA

ANALYST TZ

DATE INJECTED 01/30/90

TMA Inc. REPORT
Results by Sample

Work Order # A0-0[illegible]34
Continued From Above

SAMPLE ID 900159

FRACTION 01A TEST CODE VOA A NAME Volatile Organics by GC/MS
Date & Time Collected 01/25/90 Category

TENTATIVELY IDENTIFIED VOLATILE COMPOUNDS

COMPOUND	APPR. CONC. mg/M3
1,3 Butadiene	ND
Propylene	ND

TMA Inc. REPORT

Work Order # A0-0◯34

Received: 01/30/90

Results by Sample

SAMPLE ID 900160

FRACTION 02A TEST CODE VOA A NAME Volatile Organics by GC/MS

Date & Time Collected 01/25/90 Category

VOLATILE ORGANIC RESULTS

COMPOUND	RESULT	DET LIMIT	COMPOUND	RESULT	DET LIMIT
Chloromethane	ND	0.25	1,1,2,2-Tetrachloroethane	ND	0.25
Bromomethane	ND	0.25	1,2-Dichloropropane	ND	0.25
Vinyl chloride	ND	0.25	trans-1,3-Dichloropropene	ND	0.25
Chloroethane	ND	0.25	Trichloroethene	ND	0.25
Methylene chloride	ND	0.25	Dibromochloromethane	ND	0.25
Acetone	ND	0.25	1,1,2-Trichloroethane	ND	0.25
Acrolein	ND	0.25	Benzene	ND	0.25
Acrylonitrile	ND	0.25	cis-1,3-Dichloropropene	ND	0.25
Carbon disulfide	ND	0.25	2-Chloroethyl Vinyl Ether	ND	0.25
1,1-Dichloroethene	ND	0.25	Bromoform	ND	0.25
1,1-Dichloroethane	ND	0.25	2-Hexanone	ND	0.25
1,2-Dichloroethene	ND	0.25	4-Methyl-2-Pentanone	ND	0.25
Chloroform	ND	0.25	Tetrachloroethene	ND	0.25
1,2-Dichloroethane	ND	0.25	Toluene	ND	0.25
Methylethyl ketone	ND	0.25	Chlorobenzene	ND	0.25
1,1,1-Trichloroethane	ND	0.25	Ethyl benzene	ND	0.25
Carbon tetrachloride	ND	0.25	Styrene	ND	0.25
Vinyl acetate	ND	0.25	Xylenes (Total)	ND	0.25
Bromodichloromethane	ND	0.25			

NOTE: All results reported in mg/M3 unless otherwise specified
ND = Not detected at the specified limits
NA = Not Analyzed

SURROGATE COMPOUNDS	% RECOVERY
d8-Toluene	NA
Bromofluorobenzene	NA
1,2-Dichloroethane-d4	NA

ANALYST TZ

DATE INJECTED 01/30/90

TMA Inc. REPORT
Results by Sample

Work Order # A0-0[illegible]34
Continued From Above

SAMPLE ID 900160

FRACTION 02A TEST CODE VOA A NAME Volatile Organics by GC/MS
Date & Time Collected 01/25/90 Category

TENTATIVELY IDENTIFIED VOLATILE COMPOUNDS

COMPOUND	APPR. CONC. mg/M3
1,3 Butadiene	ND
Propylene	ND

Received: 01/30/90

TMA Inc. REPORT

Work Order # A0-01034

Results by Sample

SAMPLE ID 900161

FRACTION 03A TEST CODE VOA A NAME Volatile Organics by GC/MS

Date & Time Collected 01/25/90 Category

VOLATILE ORGANIC RESULTS

COMPOUND	RESULT	DET LIMIT	COMPOUND	RESULT	DET LIMIT
Chloromethane	ND	0.25	1,1,2,2-Tetrachloroethane	ND	0.25
Bromomethane	ND	0.25	1,2-Dichloropropane	ND	0.25
Vinyl chloride	ND	0.25	trans-1,3-Dichloropropene	ND	0.25
Chloroethane	ND	0.25	Trichloroethene	ND	0.25
Methylene chloride	ND	0.25	Dibromochloromethane	ND	0.25
Acetone	ND	0.25	1,1,2-Trichloroethane	ND	0.25
Acrolein	ND	0.25	Benzene	ND	0.25
Acrylonitrile	ND	0.25	cis-1,3-Dichloropropene	ND	0.25
Carbon disulfide	ND	0.25	2-Chloroethyl Vinyl Ether	ND	0.25
1,1-Dichloroethene	ND	0.25	Bromoform	ND	0.25
1,1-Dichloroethane	ND	0.25	2-Hexanone	ND	0.25
1,2-Dichloroethene	ND	0.25	4-Methyl-2-Pentanone	ND	0.25
Chloroform	ND	0.25	Tetrachloroethene	ND	0.25
1,2-Dichloroethane	ND	0.25	Toluene	ND	0.25
Methylethyl ketone	ND	0.25	Chlorobenzene	ND	0.25
1,1,1-Trichloroethane	ND	0.25	Ethyl benzene	ND	0.25
Carbon tetrachloride	ND	0.25	Styrene	ND	0.25
Vinyl acetate	ND	0.25	Xylenes (Total)	ND	0.25
Bromodichloromethane	ND	0.25			

NOTE: All results reported in mg/M3 unless otherwise specified
ND = Not detected at the specified limits
NA = Not Analyzed

SURROGATE COMPOUNDS	% RECOVERY
d8-Toluene	NA
Bromofluorobenzene	NA
1,2-Dichloroethane-d4	NA

ANALYST TZ
DATE INJECTED 01/30/90

TMA Inc. REPORT
Results by Sample

Work Order # A0-0134
Continued From Above

SAMPLE ID 900161

FRACTION 03A TEST CODE VOA A NAME Volatile Organics by GC/MS
Date & Time Collected 01/25/90 Category

TENTATIVELY IDENTIFIED VOLATILE COMPOUNDS

COMPOUND	APPR. CONC. mg/M3
1,3 Butadiene	ND
Propylene	ND

TMA Inc. REPORT
02/06/90 14:48:48

Work Order # A0-0034

Engineering Science

SUMMARY OF RESULTS

Compound/Sample#	900159	900160	900161	Detecttion Limit
Benzene	ND	ND	ND	0.11
Acrolein	ND	ND	ND	0.11
1-3 Butadiene	ND	ND	ND	0.11
Propylene	ND	ND	ND	0.10
Toluene	ND	ND	ND	0.066
Xylene	ND	ND	ND	0.056

Results given in ppm

Appendix C
Detailed Results

Engineering-Science, Pasadena, California

Plant: KRCC
Source: UNIT 2 STACK OUTLET
Date: 1/25/90
Run: DIOXINS 2
Standard Temp = 60 deg F Standard Press = 29.92 in Hg

FLOW DATA

STACK DIAMETER (inches)	167.50
STACK CROSS-SECTIONAL AREA (sq feet)	153.02
BAROMETRIC PRESSURE (inches Hg)	29.44
OXYGEN CONTENT (%)	14.4
CARBON DIOXIDE CONTENT (%)	4.7
MOISTURE CONTENT (%)	8.2
STACK TEMPERATURE (deg F)	301
STACK STATIC PRESSURE (inches water)	0.08
DRY STACK GAS MOLECULAR WEIGHT	29.33
VELOCITY PRESSURE (sq rt inches water)	1.30
PITOT TUBE CORRECTION FACTOR	0.84
VELOCITY (ft per sec)	89.04
EXHAUST GAS FLOW RATE (ACFM)	817,465
EXHAUST GAS FLOW RATE (DSCFM)	504,928

SAMPLING DATA

DRY GAS VOLUME SAMPLED (DCF)	158.887
DRY GAS VOLUME SAMPLED (DSCF)	154.841
DRY GAS METER TEMPERATURE (deg F)	72
DRY GAS METER GAMMA	1.01
AVERAGE ORIFICE PRESSURE (inches water)	1.30
TOTAL RUN TIME (min)	240
NOZZLE DIAMETER (inches)	0.188
ISOKINETIC (%)	102.0

LABORATORY DATA

MOISTURE RECOVERED (mls)	295.40

Engineering-Science, Pasadena, California

Plant: KRCC
Source: UNIT 2 STACK OUTLET
Date: 1/25/90
Run: DIOXINS 1
Standard Temp = 60 deg F Standard Press = 29.92 in Hg

FLOW DATA

STACK DIAMETER (inches)	167.50
STACK CROSS-SECTIONAL AREA (sq feet)	153.02
BAROMETRIC PRESSURE (inches Hg)	29.44
OXYGEN CONTENT (%)	14.4
CARBON DIOXIDE CONTENT (%)	4.7
MOISTURE CONTENT (%)	7.2
STACK TEMPERATURE (deg F)	303
STACK STATIC PRESSURE (inches water)	0.08
DRY STACK GAS MOLECULAR WEIGHT	29.33
VELOCITY PRESSURE (sq rt inches water)	1.05
PITOT TUBE CORRECTION FACTOR	0.84
VELOCITY (ft per sec)	71.88
EXHAUST GAS FLOW RATE (ACFM)	659,904
EXHAUST GAS FLOW RATE (DSCFM)	410,658

SAMPLING DATA

DRY GAS VOLUME SAMPLED (DCF)	173.407
DRY GAS VOLUME SAMPLED (DSCF)	172.752
DRY GAS METER TEMPERATURE (deg F)	61
DRY GAS METER GAMMA	1.01
AVERAGE ORIFICE PRESSURE (inches water)	1.75
TOTAL RUN TIME (min)	240
NOZZLE DIAMETER (inches)	0.225
ISOKINETIC (%)	97.1

LABORATORY DATA

MOISTURE RECOVERED (mls)	289.00

Engineering-Science, Pasadena, California

Plant: KRCC
Source: UNIT 2 STACK OUTLET
Date: 1/26/90
Run: TRACE 3
Standard Temp = 60 deg F Standard Press = 29.92 in Hg

FLOW DATA

STACK DIAMETER (inches)	167.50
STACK CROSS-SECTIONAL AREA (sq feet)	153.02
BAROMETRIC PRESSURE (inches Hg)	29.44
OXYGEN CONTENT (%)	14.4
CARBON DIOXIDE CONTENT (%)	4.7
MOISTURE CONTENT (%)	7.4
STACK TEMPERATURE (deg F)	295
STACK STATIC PRESSURE (inches water)	0.05
DRY STACK GAS MOLECULAR WEIGHT	29.33
VELOCITY PRESSURE (sq rt inches water)	0.85
PITOT TUBE CORRECTION FACTOR	0.84
VELOCITY (ft per sec)	57.91
EXHAUST GAS FLOW RATE (ACFM)	531,654
EXHAUST GAS FLOW RATE (DSCFM)	333,529

SAMPLING DATA

DRY GAS VOLUME SAMPLED (DCF)	172.284
DRY GAS VOLUME SAMPLED (DSCF)	162.911
DRY GAS METER TEMPERATURE (deg F)	80
DRY GAS METER GAMMA	0.99
AVERAGE ORIFICE PRESSURE (inches water)	1.60
TOTAL RUN TIME (min)	240
NOZZLE DIAMETER (inches)	0.245
ISOKINETIC (%)	95.1

LABORATORY DATA

MOISTURE RECOVERED (mls)	281.60

Engineering-Science, Pasadena, California

Plant: KRCC
Source: UNIT 2 STACK OUTLET
Date: 1/25/90
Run: TRACE 2
Standard Temp = 60 deg F Standard Press = 29.92 in Hg

FLOW DATA

STACK DIAMETER (inches)	167.50
STACK CROSS-SECTIONAL AREA (sq feet)	153.02
BAROMETRIC PRESSURE (inches Hg)	29.44
OXYGEN CONTENT (%)	14.4
CARBON DIOXIDE CONTENT (%)	4.7
MOISTURE CONTENT (%)	7.5
STACK TEMPERATURE (deg F)	295
STACK STATIC PRESSURE (inches water)	0.05
DRY STACK GAS MOLECULAR WEIGHT	29.33
VELOCITY PRESSURE (sq rt inches water)	0.82
PITOT TUBE CORRECTION FACTOR	0.84
VELOCITY (ft per sec)	55.87
EXHAUST GAS FLOW RATE (ACFM)	512,977
EXHAUST GAS FLOW RATE (DSCFM)	321,517

SAMPLING DATA

DRY GAS VOLUME SAMPLED (DCF)	170.023
DRY GAS VOLUME SAMPLED (DSCF)	159.845
DRY GAS METER TEMPERATURE (deg F)	83
DRY GAS METER GAMMA	0.99
AVERAGE ORIFICE PRESSURE (inches water)	1.50
TOTAL RUN TIME (min)	240
NOZZLE DIAMETER (inches)	0.245
ISOKINETIC (%)	96.8

LABORATORY DATA

MOISTURE RECOVERED (mls)	279.70

Engineering-Science, Pasadena, California

Plant: KRCC
Source: UNIT 2 STACK OUTLET
Date: 1/25/90
Run: TRACE 1
Standard Temp = 60 deg F Standard Press = 29.92 in Hg

FLOW DATA

STACK DIAMETER (inches)	167.50
STACK CROSS-SECTIONAL AREA (sq feet)	153.02
BAROMETRIC PRESSURE (inches Hg)	29.44
OXYGEN CONTENT (%)	14.4
CARBON DIOXIDE CONTENT (%)	4.7
MOISTURE CONTENT (%)	6.7
STACK TEMPERATURE (deg F)	295
STACK STATIC PRESSURE (inches water)	0.05
DRY STACK GAS MOLECULAR WEIGHT	29.33
VELOCITY PRESSURE (sq rt inches water)	0.78
PITOT TUBE CORRECTION FACTOR	0.84
VELOCITY (ft per sec)	53.06
EXHAUST GAS FLOW RATE (ACFM)	487,114
EXHAUST GAS FLOW RATE (DSCFM)	308,169

SAMPLING DATA

DRY GAS VOLUME SAMPLED (DCF)	160.980
DRY GAS VOLUME SAMPLED (DSCF)	165.983
DRY GAS METER TEMPERATURE (deg F)	56
DRY GAS METER GAMMA	1.04
AVERAGE ORIFICE PRESSURE (inches water)	1.48
TOTAL RUN TIME (min)	240
NOZZLE DIAMETER (inches)	0.245
ISOKINETIC (%)	104.9

LABORATORY DATA

MOISTURE RECOVERED (mls)	254.60

Engineering-Science, Pasadena, California

Plant: KRCC
Source: UNIT 2 STACK OUTLET
Date: 1/26/90
Run: DIOXINS 3
Standard Temp = 60 deg F Standard Press = 29.92 in Hg

FLOW DATA

STACK DIAMETER (inches)	167.50
STACK CROSS-SECTIONAL AREA (sq feet)	153.02
BAROMETRIC PRESSURE (inches Hg)	29.44
OXYGEN CONTENT (%)	14.4
CARBON DIOXIDE CONTENT (%)	4.7
MOISTURE CONTENT (%)	4.9
STACK TEMPERATURE (deg F)	296
STACK STATIC PRESSURE (inches water)	0.08
DRY STACK GAS MOLECULAR WEIGHT	29.33
VELOCITY PRESSURE (sq rt inches water)	1.30
PITOT TUBE CORRECTION FACTOR	0.84
VELOCITY (ft per sec)	88.17
EXHAUST GAS FLOW RATE (ACFM)	809,512
EXHAUST GAS FLOW RATE (DSCFM)	521,248

SAMPLING DATA

DRY GAS VOLUME SAMPLED (DCF)	156.467
DRY GAS VOLUME SAMPLED (DSCF)	151.345
DRY GAS METER TEMPERATURE (deg F)	76
DRY GAS METER GAMMA	1.01
AVERAGE ORIFICE PRESSURE (inches water)	1.30
TOTAL RUN TIME (min)	240
NOZZLE DIAMETER (inches)	0.188
ISOKINETIC (%)	96.5

LABORATORY DATA

MOISTURE RECOVERED (mls)	166.90

Engineering-Science, Pasadena, California

Plant: KRCC
Source: UNIT 2 STACK OUTLET
Date: 1/25/90
Run: CR 3
Standard Temp = 60 deg F Standard Press = 29.92 in Hg

FLOW DATA

STACK DIAMETER (inches)	167.50
STACK CROSS-SECTIONAL AREA (sq feet)	153.02
BAROMETRIC PRESSURE (inches Hg)	29.44
OXYGEN CONTENT (%)	14.4
CARBON DIOXIDE CONTENT (%)	4.7
MOISTURE CONTENT (%)	7.3
STACK TEMPERATURE (deg F)	295
STACK STATIC PRESSURE (inches water)	0.08
DRY STACK GAS MOLECULAR WEIGHT	29.33
VELOCITY PRESSURE (sq rt inches water)	0.87
PITOT TUBE CORRECTION FACTOR	0.84
VELOCITY (ft per sec)	59.25
EXHAUST GAS FLOW RATE (ACFM)	543,989
EXHAUST GAS FLOW RATE (DSCFM)	341,819

SAMPLING DATA

DRY GAS VOLUME SAMPLED (DCF)	172.677
DRY GAS VOLUME SAMPLED (DSCF)	176.815
DRY GAS METER TEMPERATURE (deg F)	60
DRY GAS METER GAMMA	1.04
AVERAGE ORIFICE PRESSURE (inches water)	1.80
TOTAL RUN TIME (min)	250
NOZZLE DIAMETER (inches)	0.250
ISOKINETIC (%)	92.9

LABORATORY DATA

MOISTURE RECOVERED (mls)	299.30

Engineering-Science, Pasadena, California

Plant: KRCC
Source: UNIT 2 STACK OUTLET
Date: 1/25/90
Run: CR 2
Standard Temp = 60 deg F Standard Press = 29.92 in Hg

FLOW DATA

STACK DIAMETER (inches)	167.50
STACK CROSS-SECTIONAL AREA (sq feet)	153.02
BAROMETRIC PRESSURE (inches Hg)	29.44
OXYGEN CONTENT (%)	14.4
CARBON DIOXIDE CONTENT (%)	4.7
MOISTURE CONTENT (%)	7.2
STACK TEMPERATURE (deg F)	300
STACK STATIC PRESSURE (inches water)	0.08
DRY STACK GAS MOLECULAR WEIGHT	29.33
VELOCITY PRESSURE (sq rt inches water)	0.86
PITOT TUBE CORRECTION FACTOR	0.84
VELOCITY (ft per sec)	58.76
EXHAUST GAS FLOW RATE (ACFM)	539,451
EXHAUST GAS FLOW RATE (DSCFM)	336,949

SAMPLING DATA

DRY GAS VOLUME SAMPLED (DCF)	176.574
DRY GAS VOLUME SAMPLED (DSCF)	177.394
DRY GAS METER TEMPERATURE (deg F)	70
DRY GAS METER GAMMA	1.04
AVERAGE ORIFICE PRESSURE (inches water)	1.80
TOTAL RUN TIME (min)	240
NOZZLE DIAMETER (inches)	0.250
ISOKINETIC (%)	98.5

LABORATORY DATA

MOISTURE RECOVERED (mls)	297.70

Engineering-Science, Pasadena, California

Plant: KRCC
Source: UNIT 2 STACK OUTLET
Date: 1/25/90
Run: CR 1
Standard Temp = 60 deg F Standard Press = 29.92 in Hg

FLOW DATA

STACK DIAMETER (inches)	167.50
STACK CROSS-SECTIONAL AREA (sq feet)	153.02
BAROMETRIC PRESSURE (inches Hg)	29.44
OXYGEN CONTENT (%)	14.4
CARBON DIOXIDE CONTENT (%)	4.7
MOISTURE CONTENT (%)	7.5
STACK TEMPERATURE (deg F)	296
STACK STATIC PRESSURE (inches water)	0.08
DRY STACK GAS MOLECULAR WEIGHT	29.33
VELOCITY PRESSURE (sq rt inches water)	0.88
PITOT TUBE CORRECTION FACTOR	0.84
VELOCITY (ft per sec)	60.00
EXHAUST GAS FLOW RATE (ACFM)	550,837
EXHAUST GAS FLOW RATE (DSCFM)	344,878

SAMPLING DATA

DRY GAS VOLUME SAMPLED (DCF)	184.674
DRY GAS VOLUME SAMPLED (DSCF)	179.364
DRY GAS METER TEMPERATURE (deg F)	66
DRY GAS METER GAMMA	0.99
AVERAGE ORIFICE PRESSURE (inches water)	1.80
TOTAL RUN TIME (min)	240
NOZZLE DIAMETER (inches)	0.250
ISOKINETIC (%)	97.3

LABORATORY DATA

MOISTURE RECOVERED (mls)	313.10

Engineering-Science, Pasadena, California

Plant: KRCC
Source: UNIT 2 STACK OUTLET
Date: 1/26/90
Run: AS 3
Standard Temp = 60 deg F Standard Press = 29.92 in Hg

FLOW DATA

STACK DIAMETER (inches)	167.50
STACK CROSS-SECTIONAL AREA (sq feet)	153.02
BAROMETRIC PRESSURE (inches Hg)	29.44
OXYGEN CONTENT (%)	14.4
CARBON DIOXIDE CONTENT (%)	4.7
MOISTURE CONTENT (%)	7.2
STACK TEMPERATURE (deg F)	296
STACK STATIC PRESSURE (inches water)	0.10
DRY STACK GAS MOLECULAR WEIGHT	29.33
VELOCITY PRESSURE (sq rt inches water)	1.41
PITOT TUBE CORRECTION FACTOR	0.84
VELOCITY (ft per sec)	96.07
EXHAUST GAS FLOW RATE (ACFM)	882,045
EXHAUST GAS FLOW RATE (DSCFM)	554,057

SAMPLING DATA

DRY GAS VOLUME SAMPLED (DCF)	261.977
DRY GAS VOLUME SAMPLED (DSCF)	248.080
DRY GAS METER TEMPERATURE (deg F)	70
DRY GAS METER GAMMA	0.97
AVERAGE ORIFICE PRESSURE (inches water)	4.50
TOTAL RUN TIME (min)	240
NOZZLE DIAMETER (inches)	0.240
ISOKINETIC (%)	91.3

LABORATORY DATA

MOISTURE RECOVERED (mls)	414.50

Engineering-Science, Pasadena, California

Plant: KRCC
Source: UNIT 2 STACK OUTLET
Date: 1/25/90
Run: AS 2
Standard Temp = 60 deg F Standard Press = 29.92 in Hg

FLOW DATA

STACK DIAMETER (inches)	167.50
STACK CROSS-SECTIONAL AREA (sq feet)	153.02
BAROMETRIC PRESSURE (inches Hg)	29.44
OXYGEN CONTENT (%)	14.4
CARBON DIOXIDE CONTENT (%)	4.7
MOISTURE CONTENT (%)	7.4
STACK TEMPERATURE (deg F)	303
STACK STATIC PRESSURE (inches water)	0.10
DRY STACK GAS MOLECULAR WEIGHT	29.33
VELOCITY PRESSURE (sq rt inches water)	1.43
PITOT TUBE CORRECTION FACTOR	0.84
VELOCITY (ft per sec)	97.93
EXHAUST GAS FLOW RATE (ACFM)	899,107
EXHAUST GAS FLOW RATE (DSCFM)	558,179

SAMPLING DATA

DRY GAS VOLUME SAMPLED (DCF)	284.365
DRY GAS VOLUME SAMPLED (DSCF)	268.973
DRY GAS METER TEMPERATURE (deg F)	71
DRY GAS METER GAMMA	0.97
AVERAGE ORIFICE PRESSURE (inches water)	4.80
TOTAL RUN TIME (min)	240
NOZZLE DIAMETER (inches)	0.240
ISOKINETIC (%)	98.2

LABORATORY DATA

MOISTURE RECOVERED (mls)	465.20

Engineering-Science, Pasadena, California

Plant: KRCC
Source: UNIT 2 STACK OUTLET
Date: 1/25/90
Run: AS 1
Standard Temp = 60 deg F Standard Press = 29.92 in Hg

FLOW DATA

STACK DIAMETER (inches)	167.50
STACK CROSS-SECTIONAL AREA (sq feet)	153.02
BAROMETRIC PRESSURE (inches Hg)	29.44
OXYGEN CONTENT (%)	14.4
CARBON DIOXIDE CONTENT (%)	4.7
MOISTURE CONTENT (%)	7.4
STACK TEMPERATURE (deg F)	295
STACK STATIC PRESSURE (inches water)	0.10
DRY STACK GAS MOLECULAR WEIGHT	29.33
VELOCITY PRESSURE (sq rt inches water)	1.30
PITOT TUBE CORRECTION FACTOR	0.84
VELOCITY (ft per sec)	88.55
EXHAUST GAS FLOW RATE (ACFM)	812,946
EXHAUST GAS FLOW RATE (DSCFM)	510,472

SAMPLING DATA

DRY GAS VOLUME SAMPLED (DCF)	255.205
DRY GAS VOLUME SAMPLED (DSCF)	245.599
DRY GAS METER TEMPERATURE (deg F)	61
DRY GAS METER GAMMA	0.97
AVERAGE ORIFICE PRESSURE (inches water)	4.10
TOTAL RUN TIME (min)	240
NOZZLE DIAMETER (inches)	0.240
ISOKINETIC (%)	98.1

LABORATORY DATA

MOISTURE RECOVERED (mls)	419.90

Engineering-Science, Pasadena, California

Plant: KRCC
Source: HRSG STACK OUTLET 2
Date: 1/23/90
Run: 1 (FUEL OIL)
Standard Temperature = 520 Deg. R

FUEL DATA	
HYDROGEN CONTENT (%)	15.12
CARBON CONTENT (%)	84.81
OXYGEN CONTENT (%)	0.10
NITROGEN CONTENT (%)	0.03
SULFUR CONTENT (%)	0.04
GROSS CALORIFIC VALUE (BTU/LB)	19440
FUEL CONSUMPTION (LBS/SEC)	11.26
F FACTOR (DSCF/MMBTU)	9362

POLLUTANT DATA	
NOX (PPM)	42.0
SO2 (PPM)	0.0
CO (PPM)	14.9
CH4 (PPM)	0.0
NMHC (PPM AS CH4)	0.0
OXYGEN (%)	14.3
CARBON DIOXIDE (%)	4.7

EMISSIONS DATA BY O2	
NOX (LBS/HR)	117.154
NOX (LBS/MMBTU)	0.149
SO2 (LBS/HR)	0.000
SO2 (LBS/MMBTU)	0.000
CO (LBS/HR)	25.306
CO (LBS/MMBTU)	0.032
CH4 (LBS/HR)	0.000
CH4 (LBS/MMBTU)	0.000
NMHC (LBS/HR)	0.000
NMHC (LBS/MMBTU)	0.000
CALCULATED STACK FLOW (DSCFM)	383789

Engineering-Science, Pasadena, California

Plant: KRCC
Source: HRSG STACK OUTLET 2
Date: 1/23/90
Run: 2 (FUEL OIL)
Standard Temperature = 520 Deg. R

FUEL DATA	
HYDROGEN CONTENT (%)	15.12
CARBON CONTENT (%)	84.81
OXYGEN CONTENT (%)	0.10
NITROGEN CONTENT (%)	0.03
SULFUR CONTENT (%)	0.04
GROSS CALORIFIC VALUE (BTU/LB)	19440
FUEL CONSUMPTION (LBS/SEC)	11.21
F FACTOR (DSCF/MMBTU)	9362

POLLUTANT DATA	
NOX (PPM)	36.4
SO2 (PPM)	0.0
CO (PPM)	17.9
CH4 (PPM)	0.0
NMHC (PPM AS CH4)	0.0
OXYGEN (%)	14.5
CARBON DIOXIDE (%)	4.4

EMISSIONS DATA BY O2	
NOX (LBS/HR)	104.241
NOX (LBS/MMBTU)	0.133
SO2 (LBS/HR)	0.000
SO2 (LBS/MMBTU)	0.000
CO (LBS/HR)	31.212
CO (LBS/MMBTU)	0.040
CH4 (LBS/HR)	0.000
CH4 (LBS/MMBTU)	0.000
NMHC (LBS/HR)	0.000
NMHC (LBS/MMBTU)	0.000
CALCULATED STACK FLOW (DSCFM)	394025

Engineering-Science, Pasadena, California

Plant: KRCC
Source: HRSG STACK OUTLET 2
Date: 1/23/90
Run: 3 (FUEL OIL)
Standard Temperature = 520 Deg. R

FUEL DATA	
HYDROGEN CONTENT (%)	15.12
CARBON CONTENT (%)	84.81
OXYGEN CONTENT (%)	0.10
NITROGEN CONTENT (%)	0.03
SULFUR CONTENT (%)	0.04
GROSS CALORIFIC VALUE (BTU/LB)	19440
FUEL CONSUMPTION (LBS/SEC)	11.29
F FACTOR (DSCF/MMBTU)	9362

POLLUTANT DATA	
NOX (PPM)	36.3
SO2 (PPM)	0.0
CO (PPM)	17.3
CH4 (PPM)	0.0
NMHC (PPM AS CH4)	0.0
OXYGEN (%)	14.6
CARBON DIOXIDE (%)	4.6

EMISSIONS DATA BY O2	
NOX (LBS/HR)	106.359
NOX (LBS/MMBTU)	0.135
SO2 (LBS/HR)	0.000
SO2 (LBS/MMBTU)	0.000
CO (LBS/HR)	30.863
CO (LBS/MMBTU)	0.039
CH4 (LBS/HR)	0.000
CH4 (LBS/MMBTU)	0.000
NMHC (LBS/HR)	0.000
NMHC (LBS/MMBTU)	0.000

CALCULATED STACK FLOW (DSCFM) 403136

ENGINEERING SCIENCE, INC.
Pasadena, California

MOBILE SOURCE TEST VAN
CONTINUOUS EMISSIONS MONITORS DATA
CALIBRATION DRIFT CORRECTION

Project No. WA Turbine #1 Source Name KRCC

Test Location HRSG Stack Outlet Date 1/25/90

Test No.	Parameter	$\bar{C}$	C_o	C_m	C_{ma}	C_{gas}
1	NOx	46.5	0.05	51.4	51.4	46.3
	CO	13.1	0	12.95	12.91	13.1
	CO_2	4.8	0	9.75	9.8	4.8
	O_2	14.3	0	14.4	14.66	14.4
2	NOx	45.6	0	44.3	43.7	45.0
	CO	13.0	-0.1	21.8	21.83	13.1
	CO_2	4.7	0.02	9.6	9.64	4.7
3	O_2	14.0	0	14.35	14.64	14.3
	NOx	45.3	0	44.3	43.7	44.7
	CO	12.5	-0.1	21.8	21.83	12.6
	CO_2	4.5	0.02	9.4	9.64	4.5
	O_2	14.0	0	14.35	14.64	14.3

$$C_{gas} = (\bar{C} - C_o)(C_{ma} / (C_m - C_o))$$

C_{gas} - corrected gas concentration, ppm or %vol(dry)

$\bar{C}$ - analyzer gas concentration, ppm or % vol(dry)

C_o - average of initial and final zero drift, ppm or % vol(dry)

C_m - average of initial and final span drift, ppm or %vol(dry)

C_{ma} - span gas cylinder concentration, ppm or %vol(dry)

ENGINEERING SCIENCE
Pasadena, California
SUMMARY OF CEM DATA

Project KRCC source Test Date Jan 25, 1990 Sheet 1 of
Plant KRCC Fuel oil Fired Location Unit #2 Stack outlet
Operator DJW

Time	NO		NO_x		SO_2		CO		CO_2		O_2							
	% Chart	Conc. (ppm)	% Chart	Conc. (ppm)	% Chart	Conc. (ppm)	% Chart	Conc. (ppm)	% Chart	Conc. (%)	% Chart	Conc. (%)	% Chart	Conc.	% Chart	Conc.	% Chart	Conc.
Pre-Calib			0	0			0	0	0	0	0	0						
			51.2	51.4			25.9	12.91	49.0	9.64	59.0	14.66						
			13.1	13.55					17.8	3.41	12.3	3.04						
			0-100 F/s				0-50 F/s		(0-20% F/s)		(0-25% F/s)							
			44.5	43.7			25.5	12.71	48.3	9.64	58.4	14.66						
Run # 1																		
0920-0930			45.9	45.9			26.1	13.1	23.9	4.8	57.0	14.3						
0930-0945			46.6	46.4			24.3	13.1	24.0	4.8	57.0	14.3						
0945-1000			46.8	46.8			26.1	13.1	24.0	4.8	56.8	14.2						
1000-1020			46.8	46.8			24.2	13.1	24.0	4.8	56.7	14.2						
Ave Conc.				44.5				13.1		4.8		14.3	---					
Mid Calib			0.1	0			0	0	0	0	0	0						
			51.9	51.4			25.8	12.91	48.4	9.64	57.4	14.44						
			13.6	13.55														

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Pasadena, California
SUMMARY OF CEM DATA

Project KPCC Source Test Date Jan 25, 1990 Sheet 2 of
Plant KPCC Fuel oil fired Location Unit # 2 Stack outlet
Operator DJW

Time	NO		NO_x		SO_2		CO		CO_2		O_2							
	% Chart	Conc. (ppm)	% Chart	Conc. (ppm)	% Chart	Conc. (ppm)	% Chart	Conc. (ppm)	% Chart	Conc. (%)	% Chart	Conc. (%)	% Chart	Conc.	% Chart	Conc.	% Chart	Conc.
Run #2																		
1030 - 1045			45.5	45.5			26.2	13.1	23.8	4.8	56.2	14.1						
1045 - 1100			45.4	45.4			26.1	13.1	23.6	4.7	56.1	14.0						
1100 - 1115			45.6	45.6			25.6	12.8	23.3	4.7	56.1	14.0						
1115 - 1130			45.7	45.7			25.8	12.9	23.1	4.6	56.1	14.0						
Ave. Conc.				45.6				13.0		4.7		14.0						
Run #3																		
1130 - 1145			45.5	45.5			25.3	12.7	23.0	4.6	56.1	14.0						
1145 - 1200			45.3	45.3			25.3	12.7	22.9	4.6	56.0	14.0						
1200 - 1215			45.2	45.2			24.9	12.5	22.6	4.5	56.0	14.0						
1215 - 1230			45.3	45.3			24.5	12.3	22.3	4.5	56.0	14.0						
Ave. Conc.				45.3				12.5		4.5		14.0						
mid calib			0.1	0			-0.3	0	-0.2	0	0	0						
			44.8	43.7			43.6	21.83	46.8	9.64	57	14.66						
									48.2	9.64	58.6	14.66						

ENGINEERING SCIENCE
Pasadena, California
SUMMARY OF CEM DATA

Project KRCC Source Test Date Jan 25, 1990 Sheet 3 of
Plant KRCC Fuel oil fired Location Unit #2 Stack outlet
Operator DJW

Time	NO		NO_x		SO_2		CO		CO_2		O_2							
	% Chart	Conc. (ppm)	% Chart	Conc. (ppm)	% Chart	Conc. (ppm)	% Chart	Conc. (ppm)	% Chart	Conc. (%)	% Chart	Conc. (%)	% Chart	Conc.	% Chart	Conc.	% Chart	Conc.
Run #4																		
1300-1315			44.2	44.2			24.5	12.3	22.7	4.5	57.9	14.5						
1315-1330			44.1	44.1			24.3	12.2	22.7	4.5	57.9	14.5						
1330-1345			44.8	44.8			24.1	12.1	22.4	4.5	57.9	14.5						
1345-1400			44.9	44.9			23.6	11.8	22.5	4.5	57.9	14.5						
Ave. Conc.				44.5				12.1		4.5		14.5						
Post Calib			0.9	0			-1.8	0	0	0	0	0						
			14.0	13.55			25.2	12.91	47.8	9.04	59.2	14.66						
			45.0	43.7			43.2	21.83										
Sample bias check			0.9	0			-0.1	0										
			13.8	13.55			24.8	21.91										

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ANALYZER CALIBRATION ERROR

Facility: KRCC Source Test
Source: RRCC
Location: Unit 2 stack outlet Fuel oil

Date: 11/25/90
Operator: DJW
Time:
Sheet 4 of

Run No. 1	Specie	Full Scale	Cylinder Value	Analyzer Reading	Absolute Diff.	Diff. % Span
Zero	NO_x	0-100 ppm	0	0	0	0
Upscale			51.4	51.2	-0.2	0.2
Zero	NO_x	0-100 ppm	0	0	0	0
Upscale			13.55	13.1	0.5	0.5
Zero	NO_x	0-100 ppm	0	0	0	0
Upscale			43.7	44.5	0.8	0.8
Zero	O_2	0-25%	0	0	0	0
Upscale			14.66	14.8	0.1	0.4
Zero	O_2	0-25%	0	0	0	0
Upscale			3.04	3.1	0.04	0.2
Zero	O_2					
Upscale						

Run No. ____	Specie	Full Scale	Cylinder Value	Analyzer Reading	Absolute Diff.	Diff. % Span
Zero	CO	0-50 ppm	0	0	0	0
Upscale			12.91	13.0	0.1	0.2
Zero	CO	0-50 ppm				
Upscale						
Zero	CO					
Upscale						
Zero	CO_2	0-20%	0	0	0	0
Upscale			9.64	9.8	0.2	0.8
Zero	CO_2	0-20%	0	0	0	0
Upscale			3.41	3.4	0.2	1.0
Zero	CO_2					
Upscale						

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CALIBRATION DRIFT TEST

Facility: KRCC Source Test
Source: Unit #2 Stack outlet. Fuel oil fired
Location: Bakersfield CA

Date: 1/25/90
Operator: DJW
Time:
Sheet 5 of

Run No. 1 0920-1020	Specie	Full Scale	Initial Response	Final Response	Drift (% Span)
Zero	NO_x	0-100 ppm	0	0.1	0.1
Upscale			51.2	51.9	0.7
Zero	NO_x				
Upscale					
Zero	CO	0-50 ppm	0	0	0
Upscale			13.0	12.9	-0.2
Zero	CO				
Upscale					
Zero	O_2	0-25%	0	0	0
Upscale			14.8	14.4	-1.0
Zero	CO_2	0-20%	0	0	0
Upscale			9.8	9.7	0.5

Run No. 2 & 3	Specie	Full Scale	Initial Response	Final Response	Drift (% Span)
Zero	NO_x	0-100 ppm	0	0	0
Upscale			43.7	44.8	1.1
Zero	NO_x				
Upscale					
Zero	CO	0-50 ppm	0	-0.2	
Upscale			12.9		
Zero	CO		0	0.2	0.4
Upscale			21.8	21.8	0
Zero	O_2	0-25%	0	0	0
Upscale			14.4	14.3	0.4
Zero	CO_2	0-20%	0	0.104	0.2
Upscale			9.7	9.4	1.5

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Pasadena, California

CALIBRATION DRIFT TEST

Facility: KRCC
Source: Unit #2 Final outlet, Fuel oil fired
Location: Bakersfield, CA

Date: 1/25/90
Operator: D.SW
Time:
Sheet 2 of

Run No. 4 1300-1400	Specie	Full Scale	Initial Response	Final Response	Drift (% Span)
Zero	NO_x	0-100 ppm	0	0	0
Upscale			44.8	45.0	0.2
Zero	NO_x				
Upscale					
Zero	CO	0-50 ppm	0.2	-0.9	-2.2
Upscale			21.8	21.6	-0.4
Zero	CO			0.9	
Upscale				12.4	
Zero	O_2	0-25%	0	0	0
Upscale			14.3	14.8	2.0
Zero	CO_2	0-20%	0.04	0	-0.2
Upscale			9.4	9.6	1.0

Run No. ____	Specie	Full Scale	Initial Response	Final Response	Drift (% Span)
Zero	NO_x				
Upscale					
Zero	NO_x				
Upscale					
Zero	CO				
Upscale					
Zero	CO				
Upscale					
Zero	O_2				
Upscale					
Zero	CO_2				
Upscale					

Appendix D
Example Calculations

Table 1

Flow print out — average values
DSCFM — Fuel oil print out, average value

Run # 1	383 789
# 2	394 025
# 3	403 136

393 650 dscft³/min

Table 2

Lab results, NW comp.

Table 3 lb/hr trace elements:

Parameter

Run #	1	2	3	4
ES #	900201	900202	900203	(Blank) 900204
ml (HNO₃)	620	780	780	700
ml (KMnO₄)	180	150	180	130
As	4.69	1.38	4.85	4.1
Be	<0.13	2.4	<0.16	<0.14
Cd	<4.96	<6.24	<6.24	<5.6
(WGAS) Cr^{6}	0.11	0.204	0.32	<0.64
Cr total	11	<5.95	8	<7.0
Cu	18.4	25.94	9.12	5.4
Hg	0.03	0.09	0.028	0.072
Mn	262.36	133.16	160.048	46.8
Ni	49.6	2496	20	<6.0
Pb	12.91	12.57	7.18	7.16
Se	<0.13	<0.16	<0.16	<0.14
Zn	246.8	2696.4	99.58	468.8

F Factor DSCFM

		DSCF	Metals	C_s
Run # 1	883789	Run # 1	166.6X4 ft^3	178.64X ft^3
2	394025	2	159.W1	178.079
3	403 13X	3	16X.X5	177.497
Average #	393 650 DSCFM			

$$lb/hr = \frac{mg\ sample \times \frac{10^{-6}\ gram}{mg} \times \frac{lb}{453.59\ gram}}{DSCF\ (ft^3)} DSCFM \frac{ft^3}{min} \times \frac{60\ min}{hr}$$

$$= 1.32 \times 10^{-7} \left(\frac{mg}{DSCF} \right) DSCFM$$

	Run # 1 lb/hr	Run # X lb/hr	Run # 3 lb/hr	Ave	lb/MMBtu
As	1.47×10^{-3}	4.51×10^{-4}	1.56×10^{-3}	$1X \times 10^{-3}$	1.5×10^{-6}
Be	< 4.06×10^{-5}	7.85×10^{-4}	< 5.13×10^{-5}	< 7.9×10^{-4}	3.1×10^{-7}
Cd	< 1.55×10^{-3}	< 7.04×10^{-3}	< 7.00×10^{-3}	< 1.9×10^{-3}	7.4×10^{-6}
Cr6	3.46×10^{-5}	6.67×10^{-5}	1.03×10^{-4}	6.8×10^{-5}	8.6×10^{-8}
Cr(total)	3.44×10^{-3}	< 1.95×10^{-3}	7.57×10^{-3}	7.7×10^{-3}	3.4×10^{-6}
Cu	5.75×10^{-3}	8.48×10^{-3}	7.93×10^{-3}	5.7×10^{-3}	7.3×10^{-6}
Hg	~~9.38×10^{-6}~~ ~~8.90×10^{-7}~~ V	7.94×10^{-5}	7.70×10^{-5}	1.5×10^{-6}	2.0×10^{-9}
Mn	~~8.30×10^{-7}~~ ~~1.55×10^{-7}~~ V	4.16×10^{-7}	5.14×10^{-7} V	5.8×10^{-7} V	7.4×10^{-5}
Ni	1.55×10^{-7} ~~4.03×10^{-3}~~	8.16×10^{-1}	6.47×10^{-3}	2.8×10^{-1}	3.5×10^{-4}
Pb	4.49×10^{-3} ~~4.00×10^{-5}~~	4.11×10^{-3}	2.30×10^{-3}	3.8×10^{-3}	4.4×10^{-3}
Se	< 4.06×10^{-5}	5.73×10^{-5}	5.13×10^{-5}	4.8×10^{-5}	6.1×10^{-8}
Zn	7.71×10^{-7}	$8.8X \times 10^{-1}$	3.20×10^{-7}	3.3×10^{-1}	4.2×10^{-7}

MMBtu/hr = 787.3X MMBtu/hr

ES ENGINEERING-SCIENCE

Client ICRCC | Job No. | Sheet 4 of 4

Subject Dioxins/Furans NEW DSCFM | By PA | Date

Checked | Rev.

	SPIKED Blank	Run # 1	RUN # 2	RUN # 3	Method
Furans		picogram	picogram	picogram	picogram
TCDF	<16	26	45	1600	<7.7
Pe CDF	<14	19	120	2200	<1.3
Hx CDF	<3.3	14	94	1100	<0.59
Hp CDF	<20	76	110	660	<1.3
OCDF	52	<72	120	250	<4
Dioxins					
TCDD	<15	<9.2	<19	160	<4.0
Pe CDD	<9.7	<4.2	<14	340	<1.5
Hx CDD	<7.0	43	43	370	<1.9
Hp CDD	90	200	210	460	<11
OCDD	1600	1600	2000	2500	<190
		4U 711	4U 994	SU 317	
DSCFM = 393 650		Run #1	# 2	#3	
DSCF (ft³)		172.758	184.841	151.345	

$$lb/hr = \frac{\text{picogram} \times \frac{10^{-12}\ \text{gram}}{\text{pg}} \times \frac{1\ lbs}{453.59\ \text{grams}}}{\text{DSCF (ft}^3\text{)}} \times 393\,650 \frac{ft^3}{min} \times \frac{60\ min}{hr}$$

TCDF	7.8×10^{-9}	~~1.4×10^{-8}~~	1.5×10^{-8}	5.5×10^{-7}	1.9×10^{-7}	7.4×10^{-10}
Pe CDF	5.7×10^{-9}	~~9.0×10^{-7}~~	4.0×10^{-8}	2.6×10^{-7}	2.7×10^{-7}	3.4×10^{-10}
Hx CDF	4.2×10^{-9}	~~7.3×10^{-7}~~	3.0×10^{-8}	3.8×10^{-7}	1.4×10^{-7}	1.8×10^{-10}
Hp CDF	2.3×10^{-8}	~~4.8×10^{-7}~~	3.7×10^{-8}	2.3×10^{-7}	1.0×10^{-7}	1.2×10^{-10}
OCDF	$< 5.4\times10^{-9}$	$< 9.4\times10^{-7}$	2.2×10^{-8}	6.7×10^{-8}	3.1×10^{-8}	4.0×10^{-11}
TCDD	$< 4.5\times10^{-9}$		$< 6.4\times10^{-9}$	5.5×10^{-8}	$< 2.2\times10^{-8}$	7.8×10^{-11}
Pe CDD	$< 2.8\times10^{-9}$		$< 4.7\times10^{-9}$	1.2×10^{-7}	$< 4.2\times10^{-8}$	5.4×10^{-10}
Hx CDD	1.3×10^{-8}		1.4×10^{-8}	1.3×10^{-7}	5.2×10^{-8}	6.6×10^{-11}
Hp CDD	3.3×10^{-8}		4.0×10^{-8}	1.3×10^{-7}	6.8×10^{-8}	8.6×10^{-10}
OCDD	$< 5.7\times10^{-8}$ ~~4.6×10^{-7}~~		1.3×10^{-7}	1.4×10^{-7}	1.1×10^{-7}	1.4×10^{-10}

Arsenic

Run #	ug/l	l	ug	DSCF	DSCFM	lb/hr
1	7.54	.835	7.17	245.359	393 650	4.5×10^{-4}
2	1.57	.790	1.24	248.973		2.3×10^{-4}
3	0.40	1.140	0.40	248.080		8.4×10^{-5}
4 Blank	<0.42	.830	<0.33	←		

$\bar{x} = 2.5 \times 10^{-4}$

$= 3.2 \times 10^{-7}$

$$\text{lb/hr} = \frac{\text{ug sample} \times \frac{10^{-6}\text{ gram}}{\text{ug}} \times \frac{\text{lb}}{453.59\text{ gram}} \times \text{DSCFM} \frac{\text{ft}^3}{\text{min}} \times \frac{60\text{ min}}{\text{hr}}}{\text{DSCF (ft}^3\text{)}}$$

$$= \frac{\text{ug}}{\text{DSCF}} \times \frac{393\,650 \times 10^{-6} \times 60}{453.59}$$

$$= 0.052 \frac{\text{ug}}{\text{DSCF}}$$

A. Field Data Summary

This form is required for Kern County use. Other forms may be used to present the data on the following pages.

ARSENIC

		Station	KERR	MB X88 UNIT 2 HRSG
		Run #	1	2 3
V1c	-	Volume of water collected, ml	419.90	465.20 414.5
Vm	-	Gas volume, meter cond., dcf	255.05	264.36 261.977
Y	-	Meter calibration factor	0.97	0.97 0.97
Pbar	-	Barometric pressure, in Hg.	29.44	29.44 29.44
Pg	-	Stack static pressure, in H2O	0.10	0.10 0.10
ΔH	-	Avg meter press. diff., in H2O	4.10	4.80 4.50
Tm	-	Absolute meter temperature, °R	521	531 520
Vm(std)	-	Standard sample gas vol, dscf	245.599	268.973 248.080
Bws	-	Water vapor part in gas stream	7.4	7.4 7.2
CO2	-	Dry concentration, volume %	4.7	4.7 4.7
O2	-	Dry concentration, volume %	14.4	14.4 14.4
Md	-	Mol wt stack gas, dry, g/gmole	29.32	29.32 29.32
Ms	-	Mol wt stack gas, wet, g/gmole	28.48	28.48 28.50
Cp	-	Pitot tube coeff., dimensionless	0.84	0.84 0.84
Δp	-	Avg of square roots of each Δp	1.30	1.43 1.41
Ts	-	Absolute stack temperature, °R	755	763 756
A	-	Area of stack, square feet	153.0	153.0 153.0
Qstd	-	Volumetric flowrate, dscfm	210539	258 251 254129
An	-	Area of nozzle, square feet	3.12×10^{-4}	3.12×10^{-4} 3.12×10^{-4}
θ	-	Sampling time, minutes	240	240 240
I	-	Isokinetic variation, percent	98.5	98.6 91.6

KRCC NSTS88

Arsenic from $\mu g/l \times l = \mu g$ sample

$$lb/hr = \frac{\mu g \times 10^{-3}\, mg/\mu g}{DSCF (ft^3)} \times \frac{lb}{453.59\ gram \times 10^{3}\, \frac{mg}{gram}} \times \frac{ft^3}{min} \times \frac{60\ min}{hr}$$

$= [illegible] \times 10^{[illegible]} \frac{\mu g}{DSCF}$ DSCFM

[illegible] = ([illegible] $\mu g/l$) ([illegible] l) = [illegible] μg

Arsenic	DSCF	DSCFM	$\mu g/l$	l	μg	lb/hr	
1	[illegible]	[illegible]	[illegible]	[illegible]	2.1?	$5.8? \times 10^{-4}$	✓
2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$3.? \times 10^{-4}$	
3	[illegible]	[illegible]	[illegible]	[illegible]	?.4	$?.19 \times 10^{-4}$	

[illegible] Mean Values

[illegible]

[illegible]

[illegible]

RR-✓

Ferric Chloride

	mg	lb/hr
	NA < 1	
	1.71 mg	0.93
	1.45 mg	0.37
	1.60 mg	0.4

$$\text{lb/hr} = \frac{\text{g}}{\text{ft}^3} \times \frac{\text{mg}}{\text{g}} \times \frac{\text{ft}^3}{\text{min}} \times \frac{60\ \text{min}}{\text{hr}}$$

RR-3

trace formaldehyde

		Vol @ 190 ml	mg
Blank	< 0.1 mg/l		
Run 1	0.12 mg/l	195 ml	0.03
	0.12 mg/l	190 ml	0.03
	0.10 mg/l	210 ml	0.03 ✓

RK-f

Trace Elements : in ug

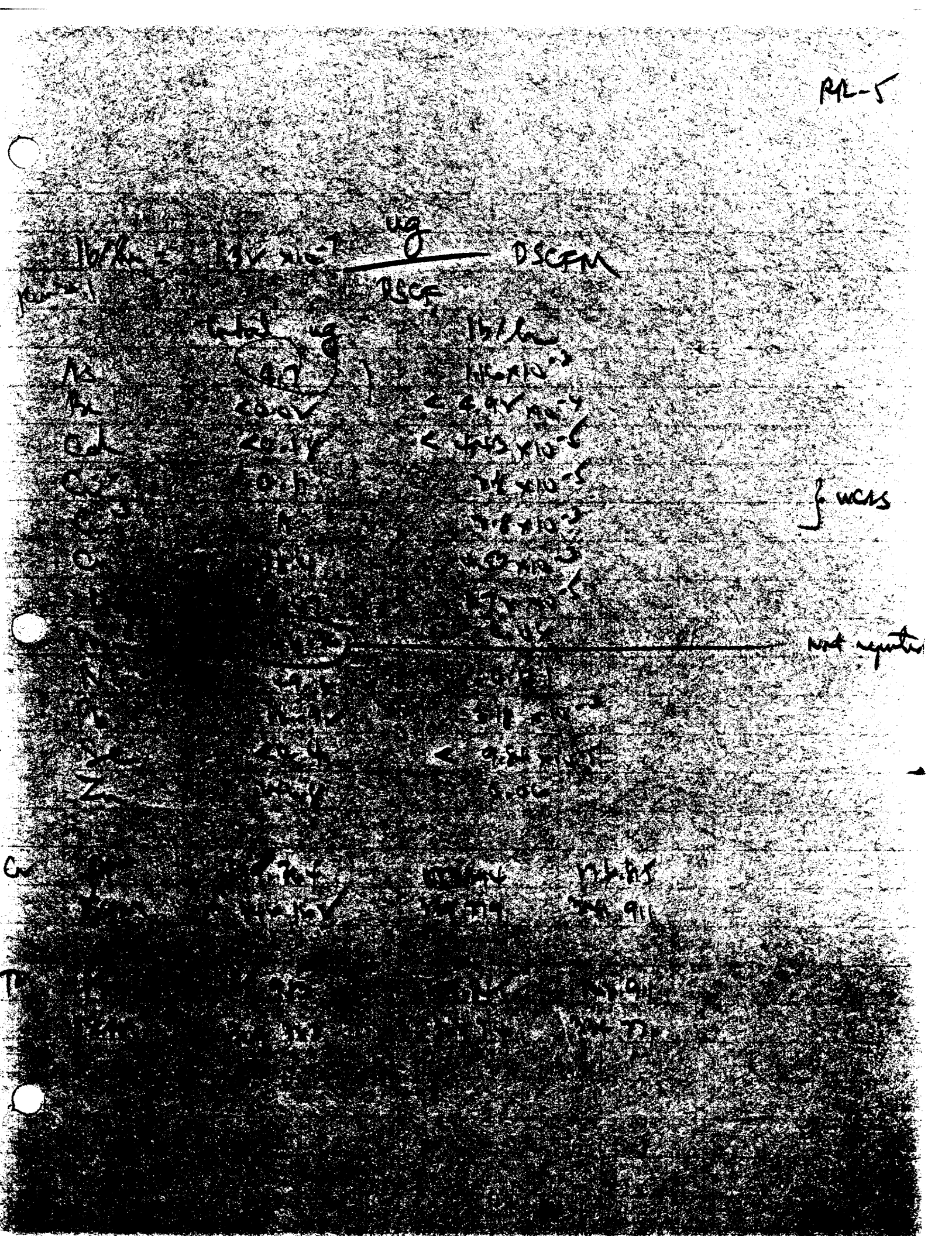
Analyte	A =	B =	C = [illegible] ml	D = [illegible] ml		Total ug
As	[illegible]	[illegible]	[illegible]	0.47	=	4.7 ✓
Be					=	ND = < 0.01
Cd					=	ND < 0.1
Co						0.11
Cr				9.1 ✓	=	90.1 ✓ (11)
Cu				17.4	=	18.4
Hg	[illegible]	[illegible]	[illegible]	[illegible]	=	0.07
Mn				4.1	=	40.3
Ni				4.0	=	4.0
Pb				4.1	=	12.9 ✓
Se					=	ND < 0.4
Zn				15.1 ✓	=	151.4

under [illegible] Blank not subtracted out
values are atypical

Analyte A = [illegible] ug for whole filter
B = [illegible] ug for whole filter
C = [illegible] ml [illegible] solution
D = [illegible] ml [illegible] solution

[illegible] ug/g = [illegible] x [illegible]

RL-5



RR-C

3-23-KR

~~PRINCE~~

KRCC FUEL OIL

lb/hr emissions → lb/MMBTU

$$\text{Fuel Consumption Ave} = \frac{11.21 + 11.26 + 11.29}{3} = 11.25 \text{ lbs/sec}$$

Gross Calorific Value = 19440 BTU/lb fuel.

$$\therefore \simeq 11.25 \frac{\text{lbs fuel}}{\text{sec}} \times \frac{3600 \text{ sec}}{\text{hr}} \times 19440 \frac{\text{BTU}}{\text{lb fuel}} \times \frac{\text{MMBTU}}{10^6 \text{ BTU}}$$

$$\simeq 787.32 \text{ MMBTU/hr.}$$

∴ → From KRCC tables for any element or parameter w/ lb/hr value divide the average value:

$$= \frac{\text{lbs/hr Element}}{\text{MMBTU/hr}}$$

$$= \text{lbs Element/MMBTU}$$

← Add new column.

↓ Since no process data = inspection of raw bus

Example Table 6

$$\text{Arsenic} \simeq \frac{9.57 \times 10^{-4} \text{ lb/hr}}{787.32 \text{ MMBTU/hr}}$$

$$= 1.22 \times 10^{-6}$$

KRCC MB V38

Table 4

lb/hr computation;

DSCFM = ~~421,133~~ ft³/min ave

TCDF 557 picogram/sample

$$\#/hr = \frac{mg \quad 10^{-9} \frac{gram}{ng}}{ft^3 \times 0.028317 \frac{m^3}{ft^3}} \times \frac{23.69}{MW} \times 1.58 \times 10^{-7} \; MW \; Q$$

$$= \frac{picogram}{ft^3} \times Q \quad \frac{10^{-9} \times 23.69 \times 1.58 \times 10^{-7}}{0.028317}$$

$$= 1.386 \times 10^{-13} \quad \frac{picogram}{ft^3} \; Q$$

1 milligram
10^{-6} microgram
10^{3} nanogram
10^{3} picogram

A. Field Data Summary

This form is required for Kern County use. Other forms may be used to present the data on the following pages.

CHROMIUM+6 HCl

	Station	ICRCC	AB7588	UNIT 2 HRSG
	Run #	1	2	3
Vlc	- Volume of water collected, ml	313.1	297.7	299.3
Vm	- Gas volume, meter cond., dcf	184.674	176.514	177.677
Y	- Meter calibration factor	0.99	1.04	1.04
Pbar	- Barometric pressure, in Hg.	29.44	29.44	29.44
Pg	- Stack static pressure, in H2O	0.08	0.08	0.08
ΔH	- Avg meter press. diff., in H2O	1.80	1.80	1.80
Tm	- Absolute meter temperature, °R	530	530	530
Vm(std)	- Standard sample gas vol, dscf	178.644	178.079	177.497
Bws	- Water vapor part in gas stream	7.5	7.2	7.3
CO2	- Dry concentration, volume %	4.7	4.7	4.7
O2	- Dry concentration, volume %	14.4	14.4	14.4
Md	- Mol wt stack gas, dry, g/gmole	29.32	29.32	29.32
Ms	- Mol wt stack gas, wet, g/gmole	28.47	28.50	28.49
Cp	- Pitot tube coeff., dimensionless	0.84	0.84	0.84
Δp	- Avg of square roots of each Δp	0.88	0.84	0.87
Ts	- Absolute stack temperature, °R	756	760	755
A	- Area of stack, square feet	153.0	153.0	153.0
Qstd	- Volumetric flowrate, dscfm	344837	337070	341942
An	- Area of nozzle, square feet	3.41×10^{-4}	3.41×10^{-4}	3.41×10^{-4}
θ	- Sampling time, minutes	240	240	240
I	- Isokinetic variation, percent	96.9	98.8	99.2

A. Field Data Summary

This form is required for Kern County use. Other forms may be used to present the data on the following pages.

		Station	KRCC TRACE	AB 688 UNIT 7 HRSG
		Run #	1	2	3
Vlc	-	Volume of water collected, ml	254.6	279.7	281.60
Vm	-	Gas volume, meter cond., dcf	160.980	170.053	172.782
Y	-	Meter calibration factor	1.04	0.99	0.99
Pbar	-	Barometric pressure, in Hg.	29.44	29.44	29.44
Pg	-	Stack static pressure, in H2O	0.05	0.05	0.05
ΔH	-	Avg meter press. diff., in H2O	1.48	1.50	1.60
Tm	-	Absolute meter temperature, °R	516	523	540
Vm(std)	-	Standard sample gas vol, dscf	166.674	159.501	167.755
Bws	-	Water vapor part in gas stream	6.6	7.5	7.5
CO2	-	Dry concentration, volume %	4.7	4.7	4.7
O2	-	Dry concentration, volume %	14.4	14.4	14.4
Md	-	Mol wt stack gas, dry, g/gmole	29.32	29.32	29.32
Ms	-	Mol wt stack gas, wet, g/gmole	28.57	28.44	28.44
Cp	-	Pitot tube coeff., dimensionless	0.84	0.84	0.84
Δp	-	Avg of square roots of each Δp	0.78	0.82	0.85
Ts	-	Absolute stack temperature, °R	755	755	755
A	-	Area of stack, square feet	153.02	153.02	153.02
Qstd	-	Volumetric flowrate, dscfm	308 274	321 479	333 490
An	-	Area of nozzle, square feet	3.27×10^{-4}	3.27×10^{-4}	3.27×10^{-4}
θ	-	Sampling time, minutes	240	240	240
I	-	Isokinetic variation, percent	105.3	96.4	94.8

A. Field Data Summary

This form is required for Kern County use. Other forms may be used to present the data on the following pages.

DIOXINS

		Station	KRCC	MBY588	UNIT 2 HRSG
		Run #	1	2	3
Vlc	-	Volume of water collected, ml	289.0	295.4	146.90
Vm	-	Gas volume, meter cond., dcf	173.407	158.887	156.167
Y	-	Meter calibration factor	1.01	1.01	1.01
Pbar	-	Barometric pressure, in Hg.	29.44	29.44	29.44
Pg	-	Stack static pressure, in H2O	0.08	0.08	0.08
ΔH	-	Avg meter press. diff., in H2O	1.75	1.30	1.30
Tm	-	Absolute meter temperature, °R	521	530	536
Vm(std)	-	Standard sample gas vol, dscf	171.75	154.84	151.054
Bws	-	Water vapor part in gas stream	7.2	8.2	4.9
CO2	-	Dry concentration, volume %	4.7	4.7	4.7
O2	-	Dry concentration, volume %	14.4	14.4	14.4
Md	-	Mol wt stack gas, dry, g/gmole	29.32	29.32	29.32
Ms	-	Mol wt stack gas, wet, g/gmole	28.50	28.39	28.77
Cp	-	Pitot tube coeff., dimensionless	0.84	0.84	0.84
Δp	-	Avg of square roots of each Δp	1.05	1.30	1.30
Ts	-	Absolute stack temperature, °R	763	761	756
A	-	Area of stack, square feet	153.94	153.94	153.94
Qstd	-	Volumetric flowrate, dscfm	410,712	404994	401317
An	-	Area of nozzle, square feet	2.76×10^{-4}	1.92×10^{-4}	1.92×10^{-4}
θ	-	Sampling time, minutes	240	240	240
I	-	Isokinetic variation, percent	97.1	101.4	96.0

Appendix E
Quality Assurance Data

Page 1 of 2

Use Pair Prg On Air Filters.

ENGINEERING SCIENCE, INC.
75 N. Fair Oaks Ave.
Pasadena, California
(818) 440-6000

CHAIN OF CUSTODY RECORD

Project No.	Project Name	Project Manager	ANALYSIS REQUIRED								SENT TO: TMA-ARLI
WA0889	KRCC	DPB	Hg	As	Metals						SHIPPED VIA:
Samples Collected By:		Phone:									SHIPPED BY:

ES Lab No.	Test Date	Sample Description (Container, Media, Volume, etc.)								Remarks
900201-A		½ Air Filter, Run 1	✓	✓						
900201-B		½ Air Filter, Run 1		✓	✓ = Pair Prg					
900201-C		KMnO4 Solution, Run 1	✓							
900201-D		HNO3/H2O2, Solution Run 1			✓ = Pair Prg					
900202-A		½ Air Filter, Run 2	✓	✓						
900202-B		½ Air Filter, Run 2		✓	✓ = Pair Prg					
900202-C		KMnO4 Solution, Run 2	✓							
900202-D		HNO3/H2O2 Solution, Run 2			✓					
900203-A		½ Air Filter, Run 3	✓	✓						
900203-B		½ Air Filter, Run 3		✓	✓					

Relinquished by:	Date/Time	Received by:	Reason for Exchange:	Comments:
Phone: (818) 440-6049	2-2-90 12:05	Of: ES	Delivery	
Relinquished by: Phone:	Date/Time 2-7-90 11:00	Received by: Of: TMA	Reason for Exchange:	Comments:
Relinquished by: Phone:	Date/Time	Received by: Of:	Reason for Exchange:	Comments:
Relinquished by: Phone:	Date/Time	Received by: Of:	Reason for Exchange:	Comments:

* All Metals = Be, Cd, Ni, As, Cu, Pb, Mn, Hg, Cr, P, Se, Zn, Ni

Use The Pass Prep On Air Filters

ENGINEERING SCIENCE, INC.
375 W. Fair Oaks Ave.
Pasadena, California
(818) 440-6000

CHAIN OF CUSTODY RECORD

Project No.	Project Name	Project Manager	ANALYSIS REQUIRED								SENT TO: TMA-ARLI
WA0087	KRCC	DPB	Hg	As	All Metals*						SHIPPED VIA:
Samples Collected By:		Phone:									SHIPPED BY:

ES Lab No.	Test Date	Sample Description (Container, Media, Volume, etc.)	Hg	As	All Metals*						Remarks
900203-C		$KMnO_4$ Solution, Run 3	✓		✓						
900203-D		HNO_3/H_2O_2 Solution, Run 3			✓						
900204-A		Air Filter, Blank	✓	ND							
900204-B		Air Filter, Blank		ND	✓						
900204-C		$KMnO_4$, Blank	✓								
900204-D		HNO_3/H_2O_2, Blank			✓						
900170		Cask 423 Train		✓							
900171		" " "		✓							
900172		" " "		✓							
900173		" " "		✓							

Relinquished by:	Date/Time	Received by:	Reason for Exchange:	Comments:
Ramiro Cardenas Phone: (626) 440-6014	2-2-90 12:05	Of: C-E	Delivery	
Relinquished by: Phone:	Date/Time 2-2-90 4:00	Received by: Of: TMA	Reason for Exchange:	Comments: If questions call Ramiro 440-6014 or Shirley 440-6161
Relinquished by: Phone:	Date/Time	Received by: Of:	Reason for Exchange:	Comments:
Relinquished by: Phone:	Date/Time	Received by: Of:	Reason for Exchange:	Comments:

* All Metals Be, Cd, Ni, As, Cu, Pb, Mn, Hg, Cr, P, Se, Zn, Ni

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Pasadena, California
(818) 440-6000

CHAIN OF CUSTODY RECORD

(818) 440-6000

Project No.	Project Name	Project Manager	ANALYSIS REQUIRED								SENT TO:
	KRCC Toxic Hot Spots	DENNIS BECVAR	Gross Alpha w/ coprecipitation	Gamma (Rush)	2588 Metals **	Chloride					SHIPPED VIA:
Samples Collected By:		Phone:									SHIPPED BY:

ES Lab No.	Test Date	Sample Description (Container, Media, Volume, etc.)	Gross Alpha w/ coprecipitation *	Gamma (Rush) *	2588 Metals **	Chloride					Remarks
900152	1-25-90	1 Liter glass of fuel oil sample.	To TMA Norcal	To TMA Norcal	Glass ✓	Glass ✓					

Relinquished by:	Date/Time	Received by:	Reason for Exchange:	Comments:
H. Damiada Phone: (818) 440-6054	1/29/90 0800 hrs	S. Ruby Of: ES		* Ship 700 ml of fuel oil To Dr Karkar at Norcal for
Shirley Ruby Phone: 440-6161	1/29/90 1:34 pm	Robert Meeker Of:		Comments: Rush analysis of Gross Alpha, Gross Beta and Gamma.
Relinquished by: Phone:	Date/Time	Received by: Of:	Reason for Exchange:	Comments:
Relinquished by: Phone:	Date/Time	Received by: Of:	Reason for Exchange:	Comments:

* 588 Metals: Pb, Cd, Cr, Cu, Be, Hg, As, Mn, Ni, Zn, Se

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Pasadena, California
(818) 440-6000

CHAIN OF CUSTODY RECORD

818 440 6000

Project No.	Project Name	Project Manager	ANALYSIS REQUIRED	SENT TO:
	KRCC INJT SPTS	DPB		SHIPPED VIA: RUSH
Samples Collected By:	Phone:			SHIPPED BY:
DECKAR & CREW				

ES Lab No.	Test Date	Sample Description (Container, Media, Volume, etc.)				Remarks
	1-29-90	900148 @ 1000 ml	✓	✓	✓	C/O WCAS
	"	900149 @ 1000 ml	✓	✓	✓	MESSRS. BOB OLSON
	"	900150 @ 850 ml	✓	✓	✓	JACK NORTHINGTON ✓
	"	900151 @ 1000 ml	✓	✓	✓	Chloride - ion chromatography
						Cr^{+6} - with precon-
		4 Samples Cr^{+6} — Rush — need preconcentration				Total Cr centration
		total Cr — No Rush				DIONEX
		total Cl — No Rush				C/O R. RUSARIO
		Thanks R.R.				S. KIRBY
						D. DECKAR

Relinquished by:	Date/Time	Received by:	Reason for Exchange:	Comments:
Phone: R. RUSARIO ES	1-29-90	Of: ES	DELIVERY	
Relinquished by: Jenna A. Kaufhold Phone: ES	Date/Time	Received by: Mary Odenwald Of: WCAS	Reason for Exchange: ANALYSIS.	Comments: 814701 8:45 A.m. / 1-29-90
Relinquished by: Phone:	Date/Time	Received by: Of:	Reason for Exchange:	Comments:
Relinquished by: Phone:	Date/Time	Received by: Of:	Reason for Exchange:	Comments:

ENGINEERING SCIENCE, INC.
75 N. Fair Oaks Ave.
Pasadena, California
(818)440-6000

CHAIN OF CUSTODY RECORD

Project No.	Project Name	Project Manager	ANALYSIS REQUIRED								SENT TO:
WA005	KRCC	H. Dernada	Benzene	Acrolein	1,3 Butadiene	Propylene	Toluene	xylene			ARLI
Samples Collected By:		Phone:									SHIPPED VIA: car
											SHIPPED BY:

ES Lab No.	Test Date	Sample Description (Container, Media, Volume, etc.)									Remarks
900159	1/26/90	Turbine #2 Stack Outlet Sample	✓	✓	✓	✓	✓	✓			
900160	1/25/90	" #2 " Outlet Sample	✓	✓	✓	✓	✓	✓			
900161	1/25/90	" #2 " Outlet Sample	✓	✓	✓	✓	✓	✓			

Relinquished by:	Date/Time	Received by:	Reason for Exchange:	Comments:
H. Dernada Phone: (818)440-6054	1/30/90 0930	Senen Q. Kawitanok Of: ES	Delivery to lab	
Relinquished by: Phone:	Date/Time	Received by: Of:	Reason for Exchange:	Comments:
Relinquished by: Phone:	Date/Time	Received by: Of:	Reason for Exchange:	Comments:
Relinquished by: Senen Q. Kawitanok Phone: 440 6211	Date/Time 10:15 AM 1-30-90	Received by: Brian Davis Of: TMA	Reason for Exchange: Analysis	Comments:

ENGINEERING SCIENCE
Pasadena, California

POST-TEST METER BOX CALIBRATION WORKSHEET

Meter Box No. BLUE # 1 Date 2-12-90 Box Operator SK

Barometric Pressure (P_b) 29.25 Ambient Temp 61 Published Y_i 0.9738

Project No. WA005 KRCC H Run 4.0 Vacuum Run 17" Calibration Operator Init. SK

Run#		V_w (ft^3)	V_d (ft^3)	T_w (°F)	T_d (°F)	T_i (min.)	Y_i (each)
01	Initial	497.253	453.645	61	70	7.43	
	Final	509.782	466.596	61	70	7.54	0.9743
	Net	12.529	12.951	61	70	7.55	
02	Initial	509.782	466.596	61	70	7.56	
	Final	526.175	483.570	61	75	8.10	0.9819
	Net	16.393	16.974	61	75	8.11	
03	Initial	526.175	483.570	61	75	8.12	
	Final	539.877	498.084	61	78	8.23	0.9652
	Net	13.702	14.514	61	78	8.24	

FINAL LEAK CHECK	FINAL METER READING	Y_i AVERAGE
26 "Hg , 005 CFM	498.084	0.9738

METER BOX CALIBRATION HISTORY

Date Last Calibration 9-6-89 Calibrated by A. GARVER

H of Calibration @ 2.00 Y_i of Calibration 0.97

ENGINEERING SCIENCE
Pasadena, California

POST-TEST METER BOX CALIBRATION WORKSHEET

Meter Box No. BUE #2 Date 2-2-90 Box Operator SK

Barometric Pressure (P_b) 29.32 Ambient Temp 62 Published Y_i 0.9857

Project No. WA 005 KRCC H Run 2.8 Vacuum Run 18 Calibration Operator Init. SK

Run#		V_w (ft^3)	V_d (ft^3)	T_w (°F)	T_d (°F)	T_i (min.)	Y_i (each)
01	Initial	343.555	865.286	55	60	9.20	
	Final	354.192	875.880	55	60	9.32	1.0067
	Net	10.637	10.594	55	60	9.33	
02	Initial	354.192	875.880	55	60	9.34	
	Final	364.813	886.722	55	60	9.45	0.9822
	Net	10.621	10.842	55	60	9.46	
03	Initial	364.813	886.722	55	60	9.47	
	Final	375.046	897.360	55	62	10.00	0.9682
	Net	10.233	10.638	55	62	10.01	

FINAL LEAK CHECK	FINAL METER READING	Y_i AVERAGE
27 " Hg . 002 CFM	1.001	0.9857

METER BOX CALIBRATION HISTORY

Date Last Calibration 10-12-89 Calibrated by SK

H of Calibration @ 1.970 Y_i of Calibration 1.001

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POST-TEST METER BOX CALIBRATION WORKSHEET

Meter Box No. BWE #3 Date 2-2-95 Box Operator SK

Barometric Pressure (P_b) 29.32 Ambient Temp 68 Published Y_i 1.0259

Project No. WA005 / KRCC H Run 4.2 Vacuum Run 17 Calibration Operator Init. SK

Run#		V_w (ft^3)	V_d (ft^3)	T_w (°F)	T_d (°F)	T_i (min.)	Y_i (each)
01	Initial	305.874	981.128	59	65	8.33	
	Final	319.190	994.360	59	65	8.43	1.0074
	Net	13.316	13.232	59	65	8.44	
02	Initial	319.190	994.360	59	65	8.45	
	Final	330.380	005.296	60	68	8.53	1.0281
	Net	11.190	10.936	60	68	8.54	
03	Initial	330.380	005.296	60	68	8.55	
	Final	343.555	017.948	62	68	9.05	1.0423
	Net	13.175	12.652	62	68	906	

FINAL LEAK CHECK	FINAL METER READING	Y_i AVERAGE
27 " "Hg .002 CFM	017.948	1.0259

METER BOX CALIBRATION HISTORY

Date Last Calibration 10-17-89 Calibrated by A.GARVER

H of Calibration @ 1.749 Y_i of Calibration 1.036

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POST-TEST METER BOX CALIBRATION WORKSHEET

Meter Box No. YELLOW #1 Date 2-9-90 Box Operator slc

Barometric Pressure (P_b) 29.44 Ambient Temp 60 Published Y_i 1.0301

Project No. WAQF H Run 4.0 Vacuum Run 15" Calibration Operator Init. slc
KRCC

Run#		V_w (ft^3)	V_d (ft^3)	T_w (°F)	T_d (°F)	T_i (min.)	Y_i (each)
01	Initial	462.040	305.690	60	70	11.07	
	Final	473.577	317.964	60	70	11.17	0.9486
	Net	11.537	12.274	60	70	11.18	
02	Initial	473.577	317.964	60	70	11.19	
	Final	485.910	329.360	60	73	11.28	1.0983
	Net	12.333	11.396	60	73	11.29	
03	Initial	485.910	329.360	60	73	11.30	
	Final	497.252	340.432	60	75	11.38	1.0435
	Net	11.342	11.072	60	75	11.39	

FINAL LEAK CHECK	FINAL METER READING	Y_i AVERAGE
25 " "Hg .002 CFM	340.432	1.0301

METER BOX CALIBRATION HISTORY

Date Last Calibration 10-17-89 Calibrated by A. GARVER

H of Calibration @ 1.712 Y_i of Calibration 1.038

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Pasadena, California

POST-TEST METER BOX CALIBRATION WORKSHEET

Meter Box No. RED #2 Date 2-2-90 Box Operator SK

Barometric Pressure (P_b) 29.32 Ambient Temp 86 Published Y_i _____

Project No. WMU5 KRCE H Run 4.7 Vacuum Run 14 Calibration Operator Init. SK

Run#		V_w (ft^3)	V_d (ft^3)	T_w (°F)	T_d (°F)	T_i (min.)	Y_i (each)
01	Initial	265,680	172,433	56	75	7.33	
	Final	278,342	185,064	56	75	7.43	1.0273
	Net	12,662	12,631	56	75	7.44	
02	Initial	278.342	185.064	56	75	7.45	
	Final	294,205	201,236	56	80	7.56	1.0146
	Net	15.863	16,172	56	80	7.57	
03	Initial	294.205	201,236	56	80	7.58	
	Final	305,773	213,168	56	86	8.07	1.0139
	Net	11.568	11.932	56	86	8.08	

FINAL LEAK CHECK	FINAL METER READING	Y_i AVERAGE
26 " "Hg .003 CFM	213.168	1.0186

METER BOX CALIBRATION HISTORY

Date Last Calibration 10-16-89 Calibrated by A. GARVER

H of Calibration @ 1.629 Y_i of Calibration 0.994