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American Petroleum Institute

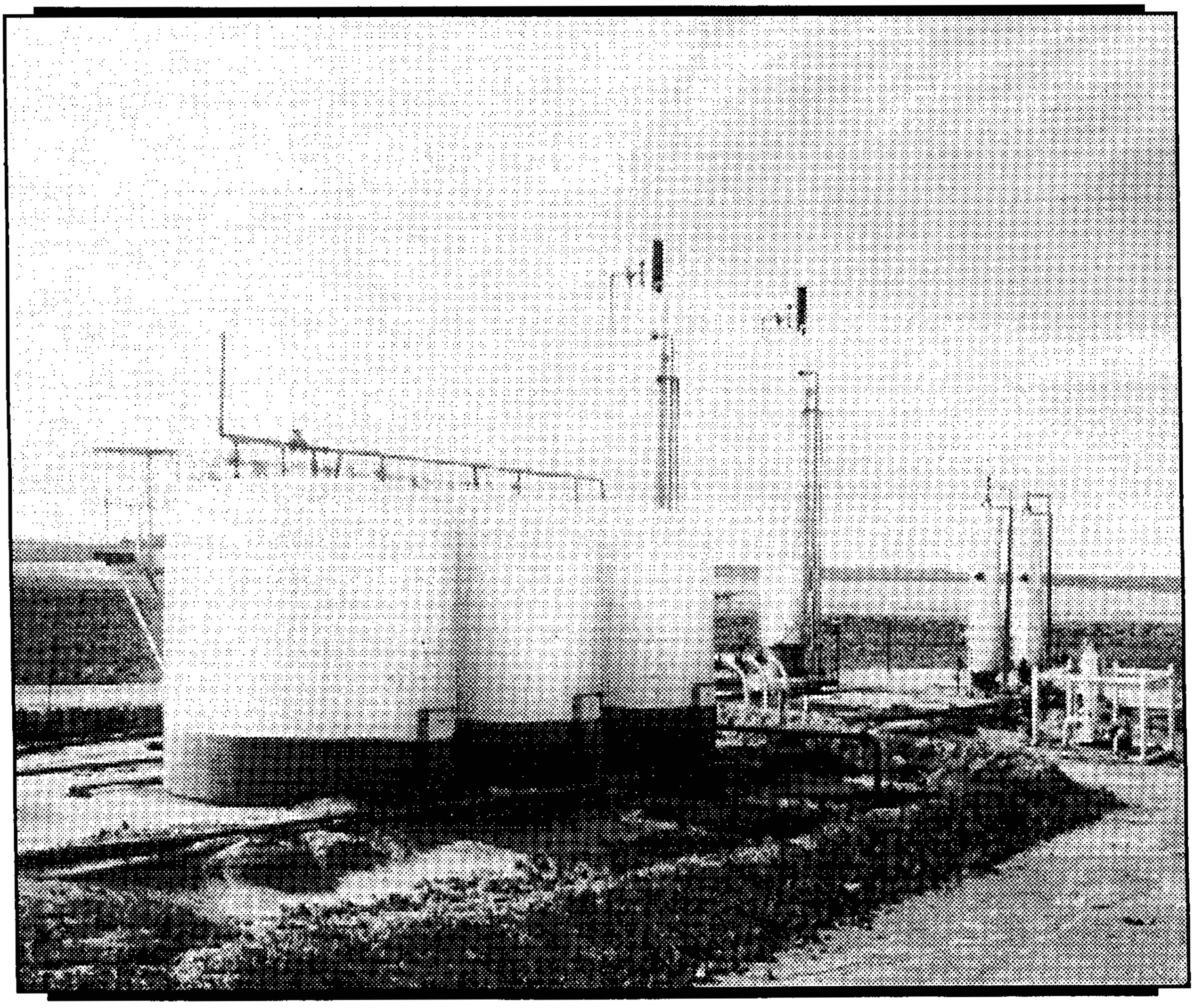
GRI®

STEP Strategies for Today's Environmental Partnership

EVALUATION OF A PETROLEUM PRODUCTION TANK EMISSIONS MODEL

APPENDICES

HEALTH AND ENVIRONMENTAL SCIENCES DEPARTMENT
PUBLICATION NUMBER 4662
OCTOBER 1997



STEP

Strategies for Today's Environmental Partnership

One of the most significant long-term trends affecting the future vitality of the petroleum industry is the public's concerns about the environment, health and safety. Recognizing this trend, API member companies have developed a positive, forward-looking strategy called STEP: Strategies for Today's Environmental Partnership. This initiative aims to build understanding and credibility with stakeholders by continually improving our industry's environmental, health and safety performance; documenting performance; and communicating with the public.

API ENVIRONMENTAL MISSION AND GUIDING ENVIRONMENTAL PRINCIPLES

The members of the American Petroleum Institute are dedicated to continuous efforts to improve the compatibility of our operations with the environment while economically developing energy resources and supplying high quality products and services to consumers. We recognize our responsibility to work with the public, the government, and others to develop and to use natural resources in an environmentally sound manner while protecting the health and safety of our employees and the public. To meet these responsibilities, API members pledge to manage our businesses according to the following principles using sound science to prioritize risks and to implement cost-effective management practices:

- To recognize and to respond to community concerns about our raw materials, products and operations.
- To operate our plants and facilities, and to handle our raw materials and products in a manner that protects the environment, and the safety and health of our employees and the public.
- To make safety, health and environmental considerations a priority in our planning, and our development of new products and processes.
- To advise promptly, appropriate officials, employees, customers and the public of information on significant industry-related safety, health and environmental hazards, and to recommend protective measures.
- To counsel customers, transporters and others in the safe use, transportation and disposal of our raw materials, products and waste materials.
- To economically develop and produce natural resources and to conserve those resources by using energy efficiently.
- To extend knowledge by conducting or supporting research on the safety, health and environmental effects of our raw materials, products, processes and waste materials.
- To commit to reduce overall emission and waste generation.
- To work with others to resolve problems created by handling and disposal of hazardous substances from our operations.
- To participate with government and others in creating responsible laws, regulations and standards to safeguard the community, workplace and environment.
- To promote these principles and practices by sharing experiences and offering assistance to others who produce, handle, use, transport or dispose of similar raw materials, petroleum products and wastes.

Evaluation of a Petroleum Production Tank Emissions Model

Appendices

Health and Environmental Sciences Department

API PUBLICATION NUMBER 4662

THE RESEARCH WAS PREPARED FOR:

AMERICAN PETROLEUM INSTITUTE,
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TABLE OF CONTENTS

Appendix A

MODEL RUNS

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 1

DESCRIPTIONS : Nominal 200 BOPD (Actual 187.9 BOPD)
API Gravity 38.57; RVP 8.03
Atmospheric Pressure 13.25 psia, 85F
Single-stage (AP-42) base case, 484 scf/day

SAMPLE IDENTIFICATION:

COMPONENT	MOL. WT.	SEPARATOR LIQUID MOLE %	AIR/GAS INPUT MOLE %
O2	31.999	0.0000	20.9460
CO2	44.010	0.0000	0.0330
N2	28.013	0.0098	79.0210
C1	16.043	0.4699	0.0000
C2	30.070	0.6298	0.0000
C3	44.097	3.1891	0.0000
i-C4	58.124	0.8898	0.0000
n-C4	58.124	4.7787	0.0000
i-C5	72.151	2.5032	0.0000
n-C5	72.151	3.3191	0.0000
HEXANES	84.000	2.9941	0.0000
HEPTANES	97.000	10.5171	0.0000
OCTANES	111.000	9.7873	0.0000
NONANES	123.000	5.1886	0.0000
BENZENE	78.110	0.1500	0.0000
TOLUENE	92.130	0.4798	0.0000
E-BENZENE	106.170	0.0900	0.0000
XYLENE	106.170	0.2298	0.0000
n-C6	86.178	2.2788	0.0000
C10+	228.000	52.4954	0.0000

SUMMARY

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 1

Production Rate : 187.90 Barrels per Day

Separator Pressure, psig	:	17.30
Separator Temperature, F	:	76.00
Tank Inlet Temperature, F	:	76.00
C10+ Characterization	:	Mol. Weight Method
Flash Loss at Tank Inlet	:	Adiabatic flash
Working and Standing Losses	:	Multi-Stage Distillation
API Gravity of Sales Oil	:	38.60
RVP of Sales Oil, psia	:	8.03
GAS/AIR INPUT	:	484.00 ft3 at STP per Day
HEAT INPUT	:	No
TOTAL HAPs	=	1.185 Tons per Year
BENZENE	=	0.050 Tons per Year
TOLUENE	=	0.053 Tons per Year
E-BENZENE	=	0.004 Tons per Year
XYLENE	=	0.008 Tons per Year
n-HEXANE	=	1.070 Tons per Year
TOTAL HC	=	100.520 Tons per Year
VOCs, C2+	=	95.951 Tons per Year
VOCs, C3+	=	85.077 Tons per Year

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CALCULATION DETAILS PAGE 1 of 2

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 1

Production Rate : 187.90 Barrels per Day

Separator Pressure, psig	:	17.30
Separator Temperature, F	:	76.00
Tank Inlet Temperature, F	:	76.00
C10+ Characterization	:	Mol. Weight Method
Flash Loss at Tank Inlet	:	Adiabatic flash
Working and Standing Losses	:	Multi-Stage Distillation
API Gravity of Sales Oil	:	38.60
RVP of Sales Oil, psia	:	8.03
GAS/AIR INPUT	:	484.00 ft3 at STP per Day
HEAT INPUT	:	No

REPORT BASIS: 1 MOLE SEPARATOR OIL INPUT

	--------- OIL PHASE ---------			------- VAPOR PHASE --------		
	SEPARATOR OIL	FLASH OIL	SALES OIL	FLASH GAS	WORKING & STANDING	TOTAL VENT
MOLE BASIS	1.0000	0.9817	0.9630	0.0183	0.0225	0.0409
COMPONENT	MOLE %	MOLE %	MOLE %	MOLE %	MOLE %	MOLE %
O2	0.0000	0.0000	0.0000	0.0000	3.5727	1.9700
CO2	0.0000	0.0000	0.0000	0.0000	0.0056	0.0031
N2	0.0098	0.0006	0.0000	0.5047	13.5027	7.6718
C1	0.4699	0.0850	0.0000	21.0755	3.6997	11.4945
C2	0.6298	0.3526	0.0345	15.4682	13.8813	14.5932
C3	3.1891	2.6213	1.8295	33.5850	35.9995	34.9163
i-C4	0.8898	0.8281	0.7458	4.1926	4.2040	4.1989
n-C4	4.7787	4.5711	4.2887	15.8899	15.8582	15.8724
i-C5	2.5032	2.4882	2.4594	3.3034	3.2957	3.2992
n-C5	3.3191	3.3210	3.3102	3.2184	3.2132	3.2155
HEXANES	2.9941	3.0342	3.0733	0.8457	0.8459	0.8458
HEPTANES	10.5171	10.6948	10.8789	1.0052	1.0059	1.0056
OCTANES	9.7873	9.9645	10.1509	0.3009	0.3012	0.3011
NONANES	5.1886	5.2845	5.3857	0.0560	0.0596	0.0580
BENZENE	0.1500	0.1523	0.1547	0.0257	0.0257	0.0257
TOLUENE	0.4798	0.4883	0.4973	0.0232	0.0233	0.0232
E-BENZENE	0.0900	0.0917	0.0934	0.0014	0.0015	0.0015
XYLENE	0.2298	0.2340	0.2385	0.0032	0.0032	0.0032
n-C6	2.2788	2.3120	2.3452	0.5007	0.5011	0.5009
C10+	52.4954	53.4759	54.5141	0.0001	0.0001	0.0001
MOL. WT. =	161.68	163.92	166.18	41.93	44.50	43.35
GAS GRAVTY =				1.45	1.54	1.50
GROSS HEATING VALUE, Btu/scf =				5265.88	4948.94	5091.12
GAS OIL RATIO, scf/Barrel =	27.39					

OIL CHARACTERIZATION AT 100 F (BASED ON PENG-ROBINSON MODEL)

BP, psia =	36.34	17.59	10.05
RVP,psia =	14.49	10.83	8.08
SP. GR. =	0.804	0.806	0.808

(NOTE: SP. GR. OF SALES OIL IS 0.807
BASED ON INPUT API GRAVTY AND ADJUSTED TO 121.3 F)

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PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 1

Production Rate : 187.90 Barrels per Day

Separator Pressure, psig	:	17.30
Separator Temperature, F	:	76.00
Tank Inlet Temperature, F	:	76.00
C10+ Characterization	:	Mol. Weight Method
Flash Loss at Tank Inlet	:	Adiabatic flash
Working and Standing Losses	:	Multi-Stage Distillation
API Gravity of Sales Oil	:	38.60
RVP of Sales Oil, psia	:	8.03
GAS/AIR INPUT	:	484.00 ft3 at STP per Day
HEAT INPUT	:	No

REPORT BASIS: 187.90 BARRELS PER DAY

COMPONENT	MOL. WT.	MOLE %	Lbs/Hr	Tons/Yr
O2	32.00	1.9700	0.357	1.562
CO2	44.01	0.0031	0.001	0.003
N2	28.01	7.6718	1.216	5.325
C1	16.04	11.4945	1.043	4.569
C2	30.07	14.5932	2.483	10.874
C3	44.10	34.9163	8.711	38.153
i-C4	58.12	4.1989	1.381	6.048
n-C4	58.12	15.8724	5.219	22.861
i-C5	72.15	3.2992	1.347	5.898
n-C5	72.15	3.2155	1.313	5.749
HEXANES	84.00	0.8458	0.402	1.761
HEPTANES	97.00	1.0056	0.552	2.417
OCTANES	111.00	0.3011	0.189	0.828
NONANES	123.00	0.0580	0.040	0.177
BENZENE	78.11	0.0257	0.011	0.050
TOLUENE	92.13	0.0232	0.012	0.053
E-BENZENE	106.17	0.0015	0.001	0.004
XYLENE	106.17	0.0032	0.002	0.008
n-C6	86.18	0.5009	0.244	1.070
C10+	228.00	0.0001	0.000	0.001

POSSIBLE VAPOR RECOVERY = 5.15 mscfd

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 1

DESCRIPTIONS : Nominal 200 BOPD (Actual 187.9 BOPD)
API Gravity 38.57; RVP 8.03
Atmospheric Pressure 13.25 psia, 85F
Single-stage (AP-42) base case, 484 scf/day

SAMPLE IDENTIFICATION:

COMPONENT	MOL. WT.	SEPARATOR LIQUID, MOLE %
N2	28.013	0.0098
C1	16.043	0.4699
C2	30.070	0.6298
C3	44.097	3.1891
i-C4	58.124	0.8898
n-C4	58.124	4.7787
i-C5	72.151	2.5032
n-C5	72.151	3.3191
HEXANES	84.000	2.9941
HEPTANES	97.000	10.5171
OCTANES	111.000	9.7873
NONANES	123.000	5.1886
BENZENE	78.110	0.1500
TOLUENE	92.130	0.4798
E-BENZENE	106.170	0.0900
XYLENE	106.170	0.2298
n-C6	86.178	2.2788
C10+	228.000	52.4954

SUMMARY

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 1

Production Rate : 187.90 Barrels per Day

Separator Pressure, psig	:	17.30	
Separator Temperature, F	:	76.00	
Tank Inlet Temperature, F	:	76.00	
C10+ Characterization	:	Mol. Weight Method	
Flash Loss at Tank Inlet	:	Adiabatic flash	
Working and Standing Losses	:	Multi-Stage Distillation	
API Gravity of Sales Oil	:	38.60	
RVP of Sales Oil, psia	:	8.03	
GAS/AIR INPUT	:	No	
HEAT INPUT	:	No	
TOTAL HAPs	=	1.001	Tons per Year
BENZENE	=	0.042	Tons per Year
TOLUENE	=	0.045	Tons per Year
E-BENZENE	=	0.003	Tons per Year
XYLENE	=	0.007	Tons per Year
n-HEXANE	=	0.903	Tons per Year
TOTAL HC	=	90.726	Tons per Year
VOCs, C2+	=	86.155	Tons per Year
VOCs, C3+	=	75.323	Tons per Year

File: c:\api\site1\S1SEP.REP   File time stamp: 01/10/97 17:42   Current time: 01/10/97 17:46   Page 1

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 1

Production Rate : 187.90 Barrels per Day

Separator Pressure, psig	:	17.30
Separator Temperature, F	:	76.00
Tank Inlet Temperature, F	:	76.00
C10+ Characterization	:	Mol. Weight Method
Flash Loss at Tank Inlet	:	Adiabatic flash
Working and Standing Losses	:	Multi-Stage Distillation
API Gravity of Sales Oil	:	38.60
RVP of Sales Oil, psia	:	8.03
GAS/AIR INPUT	:	No
HEAT INPUT	:	No

REPORT BASIS: 1 MOLE SEPARATOR OIL INPUT

	--------- OIL PHASE ---------			------- VAPOR PHASE --------		
	SEPARATOR OIL	FLASH OIL	SALES OIL	FLASH GAS	WORKING & STANDING	TOTAL VENT
MOLE BASIS	1.0000	0.9817	0.9658	0.0183	0.0158	0.0342
COMPONENT	MOLE %	MOLE %	MOLE %	MOLE %	MOLE %	MOLE %
N2	0.0098	0.0006	0.0000	0.5047	0.0344	0.2869
C1	0.4699	0.0850	0.0000	21.0755	5.2697	13.7539
C2	0.6298	0.3526	0.0370	15.4682	19.6142	17.3887
C3	3.1891	2.6213	1.9418	33.5850	44.0938	38.4529
i-C4	0.8898	0.8281	0.7665	4.1926	4.5847	4.3742
n-C4	4.7787	4.5711	4.3695	15.8899	16.8751	16.3463
i-C5	2.5032	2.4882	2.4733	3.3034	3.3977	3.3471
n-C5	3.3191	3.3210	3.3213	3.2184	3.2990	3.2557
HEXANES	2.9941	3.0342	3.0698	0.8457	0.8641	0.8542
HEPTANES	10.5171	10.6948	10.8531	1.0052	1.0293	1.0163
OCTANES	9.7873	9.9645	10.1227	0.3009	0.3094	0.3048
NONANES	5.1886	5.2845	5.3700	0.0560	0.0615	0.0585
BENZENE	0.1500	0.1523	0.1544	0.0257	0.0263	0.0260
TOLUENE	0.4798	0.4883	0.4959	0.0232	0.0239	0.0235
E-BENZENE	0.0900	0.0917	0.0931	0.0014	0.0015	0.0015
XYLENE	0.2298	0.2340	0.2378	0.0032	0.0033	0.0033
n-C6	2.2788	2.3120	2.3415	0.5007	0.5120	0.5059
C10+	52.4954	53.4759	54.3521	0.0001	0.0002	0.0002
MOL. WT. =	161.68	163.92	165.85	41.93	46.13	43.88
GAS GRAVTY =				1.45	1.59	1.51
GROSS HEATING VALUE, Btu/scf =				5265.89	5781.78	5504.86

GAS OIL RATIO, scf/Barrel = 22.89

OIL CHARACTERIZATION AT 100 F (BASED ON PENG-ROBINSON MODEL)

BP, psia =	36.34	17.59	10.40
RVP,psia =	14.49	10.83	8.33
SP. GR. =	0.804	0.806	0.808

(NOTE: SP. GR. OF SALES OIL IS 0.808
BASED ON INPUT API GRAVTY AND ADJUSTED TO 118.7 F)

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 1

Production Rate : 187.90 Barrels per Day

Separator Pressure, psig	:	17.30
Separator Temperature, F	:	76.00
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Flash Loss at Tank Inlet	:	Adiabatic flash
Working and Standing Losses	:	Multi-Stage Distillation
API Gravity of Sales Oil	:	38.60
RVP of Sales Oil, psia	:	8.03
GAS/AIR INPUT	:	No
HEAT INPUT	:	No

REPORT BASIS: 187.90 BARRELS PER DAY

COMPONENT	MOL. WT.	MOLE %	Lbs/Hr	Tons/Yr
N2	28.01	0.2869	0.038	0.166
C1	16.04	13.7539	1.044	4.571
C2	30.07	17.3887	2.473	10.832
C3	44.10	38.4529	8.020	35.126
i-C4	58.12	4.3742	1.202	5.267
n-C4	58.12	16.3463	4.494	19.682
i-C5	72.15	3.3471	1.142	5.003
n-C5	72.15	3.2557	1.111	4.866
HEXANES	84.00	0.8542	0.339	1.486
HEPTANES	97.00	1.0163	0.466	2.042
OCTANES	111.00	0.3048	0.160	0.701
NONANES	123.00	0.0585	0.034	0.149
BENZENE	78.11	0.0260	0.010	0.042
TOLUENE	92.13	0.0235	0.010	0.045
E-BENZENE	106.17	0.0015	0.001	0.003
XYLENE	106.17	0.0033	0.002	0.007
n-C6	86.18	0.5059	0.206	0.903
C10+	228.00	0.0002	0.000	0.001

POSSIBLE VAPOR RECOVERY = 4.30 mscfd

File: c:\api\site1\S1SEP.REP File time stamp: 01/10/97 17:42 Current time: 01/10/97 17:46 Page 2

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 1

DESCRIPTIONS : Nominal 200 BOPD (Actual 187.9 BOPD)
API Gravity 38.57; RVP 8.03
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C3	44.097	3.1891
i-C4	58.124	0.8898
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HEPTANES	97.000	10.5171
OCTANES	111.000	9.7873
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BENZENE	78.110	0.1500
TOLUENE	92.130	0.4798
E-BENZENE	106.170	0.0900
XYLENE	106.170	0.2298
n-C6	86.178	2.2788
C10+	228.000	52.4954

SUMMARY

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 1

Production Rate : 187.90 Barrels per Day

Separator Pressure, psig	:	17.30	
Separator Temperature, F	:	76.00	
Tank Inlet Temperature, F	:	76.00	
C10+ Characterization	:	Mol. Weight Method	
Flash Loss at Tank Inlet	:	Adiabatic flash	
Working and Standing Losses	:	AP-42 Method	
API Gravity of Sales Oil	:	38.60	
RVP of Sales Oil, psia	:	8.03	
TANK DIAMETER & HEIGHT, ft	:	13.5	16.1
AVG STOCK LIQUID HEIGHT, ft	:	8.0	
BREATHER VENT P SETTING, psi	:	0.120	
TANK SOLAR ABSORBANCE	:	0.540	
SOLAR INSOLATION,Btu/ft2.day	:	1437.000	
DAILY AMBIENT T MIN & MAX, F	:	59.0	85.3
TANK LIQUID BULK T, F	:	76.0	

TOTAL HAPs	=	0.661	Tons per Year
BENZENE	=	0.028	Tons per Year
TOLUENE	=	0.030	Tons per Year
E-BENZENE	=	0.002	Tons per Year
XYLENE	=	0.005	Tons per Year
n-HEXANE	=	0.597	Tons per Year
TOTAL HC	=	56.064	Tons per Year
VOCs, C2+	=	52.124	Tons per Year
VOCs, C3+	=	46.080	Tons per Year

File: c:\api\site1\S1SEP-AP.RE? File time stamp: 01/10/97 17:44 Current time: 01/10/97 17:46 Page 1

CALCULATION DETAILS   PAGE 1 of 2

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 1

Production Rate :   187.90 Barrels per Day

Separator Pressure, psig	:	17.30	
Separator Temperature, F	:	76.00	
Tank Inlet Temperature, F	:	76.00	
C10+ Characterization	:	Mol. Weight Method	
Flash Loss at Tank Inlet	:	Adiabatic flash	
Working and Standing Losses	:	AP-42 Method	
API Gravity of Sales Oil	:	38.60	
RVP of Sales Oil, psia	:	8.03	
TANK DIAMETER & HEIGHT, ft	:	13.5	16.1
AVG STOCK LIQUID HEIGHT, ft	:	8.0	
BREATHER VENT P SETTING, psi	:	0.120	
TANK SOLAR ABSORBANCE	:	0.540	
SOLAR INSOLATION,Btu/ft2.day	:	1437.000	
DAILY AMBIENT T MIN & MAX, F	:	59.0	85.3
TANK LIQUID BULK T, F	:	76.0	

REPORT BASIS: 1 MOLE SEPARATOR OIL INPUT

	--------- OIL PHASE	---------		------- VAPOR PHASE	--------	
	SEPARATOR OIL	FLASH OIL	SALES OIL	FLASH GAS	WORKING & STANDING	TOTAL VENT
MOLE BASIS	1.0000	0.9817	0.9788	0.0183	0.0029	0.0212
COMPONENT	MOLE %	MOLE %	MOLE %	MOLE %	MOLE %	MOLE %
N2	0.0098	0.0006	0.0000	0.5047	0.0002	0.4357
C1	0.4699	0.0850	0.0147	21.0755	4.0714	18.7480
C2	0.6298	0.3526	0.2509	15.4682	14.5402	15.3412
C3	3.1891	2.6213	2.3745	33.5850	41.4692	34.6642
i-C4	0.8898	0.8281	0.7992	4.1926	5.5690	4.3810
n-C4	4.7787	4.5711	4.4701	15.8899	21.4457	16.6504
i-C5	2.5032	2.4882	2.4774	3.3034	4.5597	3.4754
n-C5	3.3191	3.3210	3.3165	3.2184	4.4635	3.3888
HEXANES	2.9941	3.0342	3.0478	0.8457	1.1840	0.8920
HEPTANES	10.5171	10.6948	10.7595	1.0052	1.4146	1.0612
OCTANES	9.7873	9.9645	10.0303	0.3009	0.4253	0.3179
NONANES	5.1886	5.2845	5.3202	0.0560	0.0794	0.0592
BENZENE	0.1500	0.1523	0.1531	0.0257	0.0360	0.0271
TOLUENE	0.4798	0.4883	0.4915	0.0232	0.0327	0.0245
E-BENZENE	0.0900	0.0917	0.0923	0.0014	0.0021	0.0015
XYLENE	0.2298	0.2340	0.2356	0.0032	0.0046	0.0034
n-C6	2.2788	2.3120	2.3236	0.5007	0.7023	0.5283
C10+	52.4954	53.4759	53.8429	0.0001	0.0002	0.0002
MOL. WT. =	161.68	163.92	164.38	41.93	49.13	42.91
GAS GRAVTY =				1.45	1.70	1.48
GROSS HEATING VALUE, Btu/scf =				5265.89	6132.25	5384.48
GAS OIL RATIO, scf/Barrel =	14.48					

OIL CHARACTERIZATION AT 100 F (BASED ON PENG-ROBINSON MODEL)

BP, psia =	36.34	17.59	13.57
RVP,psia =	14.49	10.83	9.77
SP. GR. =	0.804	0.806	0.807

(NOTE: SP. GR. OF SALES OIL IS 0.825
BASED ON INPUT API GRAVTY AND ADJUSTED TO 76.0 F)

File: c:\api\site1\S1SEP-AP.REP   File time stamp: 01/10/97 17:44   Current time: 01/10/97 17:46   Page 2

CALCULATION DETAILS PAGE 2 of 2

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 1

Production Rate : 187.90 Barrels per Day

Separator Pressure, psig	:	17.30	
Separator Temperature, F	:	76.00	
Tank Inlet Temperature, F	:	76.00	
C10+ Characterization	:	Mol. Weight Method	
Flash Loss at Tank Inlet	:	Adiabatic flash	
Working and Standing Losses	:	AP-42 Method	
API Gravity of Sales Oil	:	38.60	
RVP of Sales Oil, psia	:	8.03	
TANK DIAMETER & HEIGHT, ft	:	13.5	16.1
AVG STOCK LIQUID HEIGHT, ft	:	8.0	
BREATHER VENT P SETTING, psi	:	0.120	
TANK SOLAR ABSORBANCE	:	0.540	
SOLAR INSOLATION,Btu/ft2.day	:	1437.000	
DAILY AMBIENT T MIN & MAX, F	:	59.0	85.3
TANK LIQUID BULK T, F	:	76.0	

REPORT BASIS: 187.90 BARRELS PER DAY

COMPONENT	MOL. WT.	MOLE %	Lbs/Hr	Tons/Yr
N2	28.01	0.4357	0.037	0.160
C1	16.04	18.7480	0.900	3.941
C2	30.07	15.3412	1.380	6.044
C3	44.10	34.6642	4.572	20.027
i-C4	58.12	4.3810	0.762	3.336
n-C4	58.12	16.6504	2.895	12.679
i-C5	72.15	3.4754	0.750	3.285
n-C5	72.15	3.3888	0.731	3.203
HEXANES	84.00	0.8920	0.224	0.982
HEPTANES	97.00	1.0612	0.308	1.349
OCTANES	111.00	0.3179	0.106	0.462
NONANES	123.00	0.0592	0.022	0.095
BENZENE	78.11	0.0271	0.006	0.028
TOLUENE	92.13	0.0245	0.007	0.030
E-BENZENE	106.17	0.0015	0.000	0.002
XYLENE	106.17	0.0034	0.001	0.005
n-C6	86.18	0.5283	0.136	0.597
C10+	228.00	0.0002	0.000	0.000

POSSIBLE VAPOR RECOVERY = 2.72 mscfd

File: c:\api\site1\S1SEP-AP.REI File time stamp: 01/10/97 17:44 Current time: 01/10/97 17:46 Page 3

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 2

DESCRIPTIONS : 1600 bbl/day
Separator T=112 F P=30 psig
Reference Atmospheric Pressure = 12.45 psia

SAMPLE IDENTIFICATION:

COMPONENT	MOL. WT.	SEPARATOR LIQUID, MOLE %
H2S	34.076	0.0100
CO2	44.010	0.0300
N2	28.013	0.0200
C1	16.043	0.2498
C2	30.070	2.3783
C3	44.097	6.9951
i-C4	58.124	2.0686
n-C4	58.124	7.2849
i-C5	72.151	3.3776
n-C5	72.151	4.7667
HEXANES	84.000	2.9979
HEPTANES	97.000	7.4348
OCTANES	111.000	11.1322
NONANES	123.000	17.2679
BENZENE	78.110	0.4497
TOLUENE	92.130	0.4297
E-BENZENE	106.170	0.2498
XYLENE	106.170	1.5889
n-C6	86.178	3.6275
C10+	484.500	27.6406

SUMMARY

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 2

Production Rate : 1600.00 Barrels per Day

Separator Pressure, psig	:	30.00	
Separator Temperature, F	:	112.00	
Tank Inlet Temperature, F	:	112.00	
C10+ Characterization	:	Mol. Weight Method	
Flash Loss at Tank Inlet	:	Adiabatic flash	
Working and Standing Losses	:	AP-42 Method	
API Gravity of Sales Oil	:	43.20	
RVP of Sales Oil, psia	:	8.70	
TANK DIAMETER & HEIGHT, ft	:	21.0	16.0
AVG STOCK LIQUID HEIGHT, ft	:	8.0	
BREATHER VENT P SETTING, psi	:	0.120	
TANK SOLAR ABSORBANCE	:	0.540	
SOLAR INSOLATION,Btu/ft2.day	:	1437.000	
DAILY AMBIENT T MIN & MAX, F	:	56.5	74.5
TANK LIQUID BULK T, F	:	112.0	

TOTAL HAPs	=	127.118	Tons per Year
BENZENE	=	12.482	Tons per Year
TOLUENE	=	4.739	Tons per Year
E-BENZENE	=	1.180	Tons per Year
XYLENE	=	6.629	Tons per Year
n-HEXANE	=	102.087	Tons per Year
TOTAL HC	=	3574.475	Tons per Year
VOCs, C2+	=	3557.747	Tons per Year
VOCs, C3+	=	3280.967	Tons per Year

File: c:\api\site2\S2SEP-AP.REP File time stamp: 01/10/97 10:11 Current time: 01/10/97 10:34 Page 1

CALCULATION DETAILS   PAGE 1 of 2

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 2

Production Rate :   1600.00 Barrels per Day

Separator Pressure, psig	:	30.00	
Separator Temperature, F	:	112.00	
Tank Inlet Temperature, F	:	112.00	
C10+ Characterization	:	Mol. Weight Method	
Flash Loss at Tank Inlet	:	Adiabatic flash	
Working and Standing Losses	:	AP-42 Method	
API Gravity of Sales Oil	:	43.20	
RVP of Sales Oil, psia	:	8.70	
TANK DIAMETER & HEIGHT, ft	:	21.0	16.0
AVG STOCK LIQUID HEIGHT, ft	:	8.0	
BREATHER VENT P SETTING, psi	:	0.120	
TANK SOLAR ABSORBANCE	:	0.540	
SOLAR INSOLATION,Btu/ft2.day	:	1437.000	
DAILY AMBIENT T MIN & MAX, F	:	56.5	74.5
TANK LIQUID BULK T, F	:	112.0	

REPORT BASIS: 1 MOLE SEPARATOR OIL INPUT

	--------- OIL PHASE	---------	---------	------- VAPOR PHASE	--------	--------
	SEPARATOR OIL	FLASH OIL	SALES OIL	FLASH GAS	WORKING & STANDING	TOTAL VENT
MOLE BASIS	1.0000	0.8440	0.8423	0.1560	0.0016	0.1577
COMPONENT	MOLE %	MOLE %	MOLE %	MOLE %	MOLE %	MOLE %
H2S	0.0100	0.0017	0.0016	0.0546	0.0448	0.0545
CO2	0.0300	0.0021	0.0017	0.1810	0.0994	0.1802
N2	0.0200	0.0002	0.0001	0.1269	0.0182	0.1258
C1	0.2498	0.0074	0.0053	1.5610	0.4982	1.5502
C2	2.3783	0.2803	0.2423	13.7252	9.7293	13.6845
C3	6.9951	2.0526	1.9352	33.7257	32.0275	33.7084
i-C4	2.0686	1.0751	1.0485	7.4414	7.9483	7.4466
n-C4	7.2849	4.4087	4.3289	22.8404	25.0711	22.8631
i-C5	3.3776	2.8793	2.8633	6.0727	7.0675	6.0828
n-C5	4.7667	4.3256	4.3100	7.1518	8.4461	7.1650
HEXANES	2.9979	3.2266	3.2308	1.7612	2.1734	1.7654
HEPTANES	7.4348	8.4933	8.5180	1.7101	2.1859	1.7150
OCTANES	11.1322	13.0206	13.0667	0.9191	1.2158	0.9221
NONANES	17.2679	20.3591	20.4356	0.5498	0.7504	0.5518
BENZENE	0.4497	0.4890	0.4898	0.2370	0.2924	0.2376
TOLUENE	0.4297	0.4951	0.4966	0.0763	0.0978	0.0765
E-BENZENE	0.2498	0.2930	0.2940	0.0165	0.0218	0.0165
XYLENE	1.5889	1.8656	1.8724	0.0925	0.1230	0.0928
n-C6	3.6275	3.9734	3.9804	1.7568	2.1893	1.7612
C10+	27.6406	32.7514	32.8790	0.0000	0.0000	0.0000
MOL. WT. =	198.25	225.06	225.39	53.25	56.16	53.28
GAS GRAVTY =				1.84	1.94	1.84
GROSS HEATING VALUE, Btu/scf =				6588.97	6934.92	6592.50
GAS OIL RATIO, scf/Barrel =		87.30				

OIL CHARACTERIZATION AT 100 F (BASED ON PENG-ROBINSON MODEL)

BP, psia =	46.35	12.19	11.58
RVP,psia =	22.00	8.14	7.90
SP. GR. =	0.590	0.592	0.592

(NOTE: SP. GR. OF SALES OIL IS 0.791
BASED ON INPUT API GRAVTY AND ADJUSTED TO 112.0 F)

File: c:\api\site2\S2SEP-AP.REP   File time stamp: 01/10/97 10:11   Current time: 01/10/97 10:34   Page 2

CALCULATION DETAILS PAGE 2 of 2

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 2

Production Rate : 1600.00 Barrels per Day

Separator Pressure, psig	:	30.00	
Separator Temperature, F	:	112.00	
Tank Inlet Temperature, F	:	112.00	
C10+ Characterization	:	Mol. Weight Method	
Flash Loss at Tank Inlet	:	Adiabatic flash	
Working and Standing Losses	:	AP-42 Method	
API Gravity of Sales Oil	:	43.20	
RVP of Sales Oil, psia	:	8.70	
TANK DIAMETER & HEIGHT, ft	:	21.0	16.0
AVG STOCK LIQUID HEIGHT, ft	:	8.0	
BREATHER VENT P SETTING, psi	:	0.120	
TANK SOLAR ABSORBANCE	:	0.540	
SOLAR INSOLATION,Btu/ft2.day	:	1437.000	
DAILY AMBIENT T MIN & MAX, F	:	56.5	74.5
TANK LIQUID BULK T, F	:	112.0	

REPORT BASIS: 1600.00 BARRELS PER DAY

COMPONENT	MOL. WT.	MOLE %	Lbs/Hr	Tons/Yr
H2S	34.08	0.0545	0.285	1.250
CO2	44.01	0.1802	1.218	5.334
N2	28.01	0.1258	0.541	2.370
C1	16.04	1.5502	3.819	16.728
C2	30.07	13.6845	63.192	276.780
C3	44.10	33.7084	228.268	999.815
i-C4	58.12	7.4466	66.468	291.130
n-C4	58.12	22.8631	204.075	893.848
i-C5	72.15	6.0828	67.398	295.202
n-C5	72.15	7.1650	79.388	347.720
HEXANES	84.00	1.7654	22.772	99.743
HEPTANES	97.00	1.7150	25.546	111.891
OCTANES	111.00	0.9221	15.719	68.848
NONANES	123.00	0.5518	10.423	45.652
BENZENE	78.11	0.2376	2.850	12.482
TOLUENE	92.13	0.0765	1.082	4.739
E-BENZENE	106.17	0.0165	0.269	1.180
XYLENE	106.17	0.0928	1.513	6.629
n-C6	86.18	1.7612	23.308	102.087
C10+	484.50	0.0000	0.000	0.000

POSSIBLE VAPOR RECOVERY = 139.68 mscfd

File: c:\api\site2\S2SEP-AP.REP File time stamp: 01/10/97 10:11 Current time: 01/10/97 10:34 Page 3

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 2

DESCRIPTIONS : 1600 bbl/day
Separator T=112 F P=30 psig
Reference Atmospheric Pressure = 12.45 psia

SAMPLE IDENTIFICATION:

COMPONENT	MOL. WT.	SEPARATOR LIQUID, MOLE %
H2S	34.076	0.0100
CO2	44.010	0.0300
N2	28.013	0.0200
C1	16.043	0.2498
C2	30.070	2.3783
C3	44.097	6.9951
i-C4	58.124	2.0686
n-C4	58.124	7.2849
i-C5	72.151	3.3776
n-C5	72.151	4.7667
HEXANES	84.000	2.9979
HEPTANES	97.000	7.4348
OCTANES	111.000	11.1322
NONANES	123.000	17.2679
BENZENE	78.110	0.4497
TOLUENE	92.130	0.4297
E-BENZENE	106.170	0.2498
XYLENE	106.170	1.5889
n-C6	86.178	3.6275
C10+	484.500	27.6406

SUMMARY

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 2

Production Rate : 1600.00 Barrels per Day

Separator Pressure, psig	:	30.00
Separator Temperature, F	:	112.00
Tank Inlet Temperature, F	:	112.00
C10+ Characterization	:	Mol. Weight Method
Flash Loss at Tank Inlet	:	Adiabatic flash
Working and Standing Losses	:	Multi-Stage Distillation
API Gravity of Sales Oil	:	43.20
RVP of Sales Oil, psia	:	8.70
GAS/AIR INPUT	:	No
HEAT INPUT	:	No

************************* WARNING *************************
* Cannot match specified RVP. Only flash loss reported. *
****

TOTAL HAPs	=	125.447	Tons per Year
BENZENE	=	12.321	Tons per Year
TOLUENE	=	4.675	Tons per Year
E-BENZENE	=	1.164	Tons per Year
XYLENE	=	6.537	Tons per Year
n-HEXANE	=	100.751	Tons per Year
TOTAL HC	=	3534.506	Tons per Year
VOCs, C2+	=	3517.840	Tons per Year
VOCs, C3+	=	3243.184	Tons per Year

File: c:\api\site2\S2SEP.REP File time stamp: 01/10/97 09:08 Current time: 01/10/97 09:49 Page 1

CALCULATION DETAILS   PAGE 1 of 2

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 2

Production Rate : 1600.00 Barrels per Day

Separator Pressure, psig	:	30.00
Separator Temperature, F	:	112.00
Tank Inlet Temperature, F	:	112.00
C10+ Characterization	:	Mol. Weight Method
Flash Loss at Tank Inlet	:	Adiabatic flash
Working and Standing Losses	:	Multi-Stage Distillation
API Gravity of Sales Oil	:	43.20
RVP of Sales Oil, psia	:	8.70
GAS/AIR INPUT	:	No
HEAT INPUT	:	No

REPORT BASIS: 1 MOLE SEPARATOR OIL INPUT

	OIL PHASE			VAPOR PHASE		
	SEPARATOR OIL	FLASH OIL	SALES OIL	FLASH GAS	WORKING & STANDING	TOTAL VENT
MOLE BASIS	1.0000	0.8440	0.8440	0.1560	0.0000	0.1560
COMPONENT	MOLE %	MOLE %	MOLE %	MOLE %	MOLE %	MOLE %
H2S	0.0100	0.0017	0.0017	0.0546	0.0000	0.0546
CO2	0.0300	0.0021	0.0021	0.1810	0.0000	0.1810
N2	0.0200	0.0002	0.0002	0.1269	0.0000	0.1269
C1	0.2498	0.0074	0.0074	1.5610	0.0000	1.5610
C2	2.3783	0.2803	0.2803	13.7252	0.0000	13.7252
C3	6.9951	2.0526	2.0526	33.7257	0.0000	33.7257
i-C4	2.0686	1.0751	1.0751	7.4414	0.0000	7.4414
n-C4	7.2849	4.4087	4.4087	22.8404	0.0000	22.8404
i-C5	3.3776	2.8793	2.8793	6.0727	0.0000	6.0727
n-C5	4.7667	4.3256	4.3256	7.1518	0.0000	7.1518
HEXANES	2.9979	3.2266	3.2266	1.7612	0.0000	1.7612
HEPTANES	7.4348	8.4933	8.4933	1.7101	0.0000	1.7101
OCTANES	11.1322	13.0206	13.0206	0.9191	0.0000	0.9191
NONANES	17.2679	20.3591	20.3591	0.5498	0.0000	0.5498
BENZENE	0.4497	0.4890	0.4890	0.2370	0.0000	0.2370
TOLUENE	0.4297	0.4951	0.4951	0.0763	0.0000	0.0763
E-BENZENE	0.2498	0.2930	0.2930	0.0165	0.0000	0.0165
XYLENE	1.5889	1.8656	1.8656	0.0925	0.0000	0.0925
n-C6	3.6275	3.9734	3.9734	1.7568	0.0000	1.7568
C10+	27.6406	32.7514	32.7514	0.0000	0.0000	0.0000
MOL. WT. =	198.25	225.06	225.06	53.25	0.00	53.25
GAS GRAVTY =				1.84	0.00	1.84
GROSS HEATING VALUE, Btu/scf =				6588.97	0.00	6588.97

GAS OIL RATIO, scf/Barrel = 86.38

OIL CHARACTERIZATION AT 100 F (BASED ON PENG-ROBINSON MODEL)

BP, psia =	46.35	12.19	12.19
RVP,psia =	22.00	8.14	8.14
SP. GR. =	0.590	0.592	0.592

(NOTE: SP. GR. OF SALES OIL IS 0.791
BASED ON INPUT API GRAVTY AND ADJUSTED TO 112.0 F)

File: c:\api\site2\S2SEP.REP   File time stamp: 01/10/97 09:08   Current time: 01/10/97 09:49   Page 2

CALCULATION DETAILS   PAGE 2 of 2

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 2

Production Rate :   1600.00 Barrels per Day

Separator Pressure, psig	:	30.00
Separator Temperature, F	:	112.00
Tank Inlet Temperature, F	:	112.00
C10+ Characterization	:	Mol. Weight Method
Flash Loss at Tank Inlet	:	Adiabatic flash
Working and Standing Losses	:	Multi-Stage Distillation
API Gravity of Sales Oil	:	43.20
RVP of Sales Oil, psia	:	8.70
GAS/AIR INPUT	:	No
HEAT INPUT	:	No

REPORT BASIS: 1600.00   BARRELS PER DAY

COMPONENT	MOL. WT.	MOLE %	Lbs/Hr	Tons/Yr
H2S	34.08	0.0546	0.283	1.239
CO2	44.01	0.1810	1.210	5.301
N2	28.01	0.1269	0.540	2.366
C1	16.04	1.5610	3.805	16.666
C2	30.07	13.7252	62.707	274.656
C3	44.10	33.7257	225.961	989.709
i-C4	58.12	7.4414	65.717	287.839
n-C4	58.12	22.8404	201.707	883.479
i-C5	72.15	6.0727	66.571	291.581
n-C5	72.15	7.1518	78.401	343.396
HEXANES	84.00	1.7612	22.477	98.450
HEPTANES	97.00	1.7101	25.203	110.390
OCTANES	111.00	0.9191	15.501	67.893
NONANES	123.00	0.5498	10.274	45.000
BENZENE	78.11	0.2370	2.813	12.321
TOLUENE	92.13	0.0763	1.067	4.675
E-BENZENE	106.17	0.0165	0.266	1.164
XYLENE	106.17	0.0925	1.492	6.537
n-C6	86.18	1.7568	23.002	100.751
C10+	484.50	0.0000	0.000	0.000

POSSIBLE VAPOR RECOVERY =   138.20 mscfd

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 3

DESCRIPTIONS : Day 1 Case
Separator pressure = 24.8 psig
Set separator temperature = 110 F
Oil into tank temperature = 87.7 F

SAMPLE IDENTIFICATION:

COMPONENT	MOL. WT.	SEPARATOR LIQUID, MOLE %
CO2	44.010	0.1300
C1	16.043	0.5698
C2	30.070	1.0696
C3	44.097	2.0792
i-C4	58.124	1.6693
n-C4	58.124	1.9092
i-C5	72.151	2.9788
n-C5	72.151	1.9692
HEXANES	84.000	4.4482
HEPTANES	97.000	10.5958
OCTANES	111.000	12.3950
NONANES	123.000	7.8769
BENZENE	78.110	2.4490
TOLUENE	92.130	5.3079
E-BENZENE	106.170	0.4598
XYLENE	106.170	4.0984
n-C6	86.178	2.6689
C10+	273.500	37.3251

SUMMARY

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 3

Production Rate : 432.00 Barrels per Day

Separator Pressure, psig	:	24.80	
Separator Temperature, F	:	112.00	
Tank Inlet Temperature, F	:	112.00	
C10+ Characterization	:	Mol. Weight Method	
Flash Loss at Tank Inlet	:	Adiabatic flash	
Working and Standing Losses	:	AP-42 Method	
API Gravity of Sales Oil	:	48.80	
RVP of Sales Oil, psia	:	8.07	
TANK DIAMETER & HEIGHT, ft	:	38.7	24.0
AVG STOCK LIQUID HEIGHT, ft	:	8.0	
BREATHER VENT P SETTING, psi	:	0.120	
TANK SOLAR ABSORBANCE	:	0.540	
SOLAR INSOLATION,Btu/ft2.day	:	1437.000	
DAILY AMBIENT T MIN & MAX, F	:	60.8	73.9
TANK LIQUID BULK T, F	:	112.0	

TOTAL HAPs	=	12.517	Tons per Year
BENZENE	=	3.703	Tons per Year
TOLUENE	=	3.064	Tons per Year
E-BENZENE	=	0.113	Tons per Year
XYLENE	=	0.895	Tons per Year
n-HEXANE	=	4.742	Tons per Year
TOTAL HC	=	198.542	Tons per Year
VOCs, C2+	=	188.146	Tons per Year
VOCs, C3+	=	161.215	Tons per Year

File: c:\api\site3\day1\S3SEP-AP.REP File time stamp: 01/10/97 10:13 Current time: 01/10/97 10:34 Page 1

CALCULATION DETAILS PAGE 1 of 2

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 3

Production Rate : 432.00 Barrels per Day

Separator Pressure, psig	:	24.80	
Separator Temperature, F	:	112.00	
Tank Inlet Temperature, F	:	112.00	
C10+ Characterization	:	Mol. Weight Method	
Flash Loss at Tank Inlet	:	Adiabatic flash	
Working and Standing Losses	:	AP-42 Method	
API Gravity of Sales Oil	:	48.80	
RVP of Sales Oil, psia	:	8.07	
TANK DIAMETER & HEIGHT, ft	:	38.7	24.0
AVG STOCK LIQUID HEIGHT, ft	:	8.0	
BREATHER VENT P SETTING, psi	:	0.120	
TANK SOLAR ABSORBANCE	:	0.540	
SOLAR INSOLATION,Btu/ft2.day	:	1437.000	
DAILY AMBIENT T MIN & MAX, F	:	60.8	73.9
TANK LIQUID BULK T, F	:	112.0	

REPORT BASIS: 1 MOLE SEPARATOR OIL INPUT

	--------- OIL PHASE	---------		------- VAPOR PHASE	--------	
	SEPARATOR OIL	FLASH OIL	SALES OIL	FLASH GAS	WORKING & STANDING	TOTAL VENT
MOLE BASIS	1.0000	0.9716	0.9671	0.0284	0.0046	0.0329
COMPONENT	MOLE %	MOLE %	MOLE %	MOLE %	MOLE %	MOLE %
CO2	0.1300	0.0389	0.0069	3.2481	0.9541	2.9311
C1	0.5698	0.0820	0.0001	17.2735	0.0430	14.8919
C2	1.0696	0.4671	0.1733	21.7031	13.5932	20.5821
C3	2.0792	1.4750	1.0526	22.7683	27.9752	23.4880
i-C4	1.6693	1.4427	1.2584	9.4295	14.2689	10.0984
n-C4	1.9092	1.7237	1.5653	8.2617	13.0473	8.9232
i-C5	2.9788	2.8978	2.8102	5.7545	9.7471	6.3064
n-C5	1.9692	1.9396	1.9010	2.9821	5.1147	3.2769
HEXANES	4.4482	4.5095	4.5281	2.3482	4.1408	2.5959
HEPTANES	10.5958	10.8434	10.9735	2.1133	3.7719	2.3426
OCTANES	12.3950	12.7311	12.9228	0.8858	1.5927	0.9835
NONANES	7.8769	8.1005	8.2309	0.2191	0.3960	0.2435
BENZENE	2.4490	2.4918	2.5096	0.9844	1.7437	1.0894
TOLUENE	5.3079	5.4428	5.5171	0.6889	1.2340	0.7642
E-BENZENE	0.4598	0.4726	0.4800	0.0221	0.0398	0.0245
XYLENE	4.0984	4.2129	4.2793	0.1744	0.3144	0.1937
n-C6	2.6689	2.7135	2.7312	1.1430	2.0232	1.2646
C10+	37.3251	38.4150	39.0595	0.0001	0.0001	0.0001
MOL. WT. =	160.53	163.89	165.25	45.23	57.46	46.92
GAS GRAVTY =				1.56	1.98	1.62
GROSS HEATING VALUE, Btu/scf =				5460.49	6999.38	5673.19
GAS OIL RATIO, scf/Barrel =		20.92				

RVP,psia =	12.34	7.54	5.67
SP. GR. =	0.694	0.695	0.696

(NOTE: SP. GR. OF SALES OIL IS 0.764
BASED ON INPUT API GRAVTY AND ADJUSTED TO 112.0 F)

OIL CHARACTERIZATION AT 100 F (BASED ON PENG-ROBINSON MODEL)

BP, psia = 34.77 13.29 7.40

File: c:\api\site3\day1\S3SEP-AP.REP File time stamp: 01/10/97 10:13 Current time: 01/10/97 10:34 Page 2

CALCULATION DETAILS   PAGE 2 of 2

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 3

Production Rate : 432.00 Barrels per Day

Separator Pressure, psig	:	24.80	
Separator Temperature, F	:	112.00	
Tank Inlet Temperature, F	:	112.00	
C10+ Characterization	:	Mol. Weight Method	
Flash Loss at Tank Inlet	:	Adiabatic flash	
Working and Standing Losses	:	AP-42 Method	
API Gravity of Sales Oil	:	48.80	
RVP of Sales Oil, psia	:	8.07	
TANK DIAMETER & HEIGHT, ft	:	38.7	24.0
AVG STOCK LIQUID HEIGHT, ft	:	8.0	
BREATHER VENT P SETTING, psi	:	0.120	
TANK SOLAR ABSORBANCE	:	0.540	
SOLAR INSOLATION,Btu/ft2.day	:	1437.000	
DAILY AMBIENT T MIN & MAX, F	:	60.8	73.9
TANK LIQUID BULK T, F	:	112.0	

REPORT BASIS: 432.00 BARRELS PER DAY

COMPONENT	MOL. WT.	MOLE %	Lbs/Hr	Tons/Yr
CO2	44.01	2.9311	1.282	5.613
C1	16.04	14.8919	2.374	10.396
C2	30.07	20.5821	6.149	26.931
C3	44.10	23.4880	10.290	45.070
i-C4	58.12	10.0984	5.831	25.541
n-C4	58.12	8.9232	5.153	22.569
i-C5	72.15	6.3064	4.520	19.799
n-C5	72.15	3.2769	2.349	10.288
HEXANES	84.00	2.5959	2.166	9.489
HEPTANES	97.00	2.3426	2.257	9.888
OCTANES	111.00	0.9835	1.085	4.751
NONANES	123.00	0.2435	0.298	1.303
BENZENE	78.11	1.0894	0.845	3.703
TOLUENE	92.13	0.7642	0.700	3.064
E-BENZENE	106.17	0.0245	0.026	0.113
XYLENE	106.17	0.1937	0.204	0.895
n-C6	86.18	1.2646	1.083	4.742
C10+	273.50	0.0001	0.000	0.001

POSSIBLE VAPOR RECOVERY = 9.04 mscfd

File: c:\api\site3\day1\S3SEP-AP.REP   File time stamp: 01/10/97 10:13   Current time: 01/10/97 10:34   Page 3

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 3

DESCRIPTIONS : Day 1 Case
Separator pressure = 24.8 psig
Set separator temperature = 110 F
Oil into tank temperature = 87.7 F

SAMPLE IDENTIFICATION:

COMPONENT	MOL. WT.	SEPARATOR LIQUID, MOLE %
CO2	44.010	0.1300
C1	16.043	0.5698
C2	30.070	1.0696
C3	44.097	2.0792
i-C4	58.124	1.6693
n-C4	58.124	1.9092
i-C5	72.151	2.9788
n-C5	72.151	1.9692
HEXANES	84.000	4.4482
HEPTANES	97.000	10.5958
OCTANES	111.000	12.3950
NONANES	123.000	7.8769
BENZENE	78.110	2.4490
TOLUENE	92.130	5.3079
E-BENZENE	106.170	0.4598
XYLENE	106.170	4.0984
n-C6	86.178	2.6689
C10+	273.500	37.3251

SUMMARY

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 3

Production Rate : 432.00 Barrels per Day

Separator Pressure, psig	:	24.80
Separator Temperature, F	:	112.00
Tank Inlet Temperature, F	:	112.00
C10+ Characterization	:	Mol. Weight Method
Flash Loss at Tank Inlet	:	Adiabatic flash
Working and Standing Losses	:	Multi-Stage Distillation
API Gravity of Sales Oil	:	48.80
RVP of Sales Oil, psia	:	8.07
GAS/AIR INPUT	:	No
HEAT INPUT	:	No

************************** WARNING **************************
* Cannot match specified RVP. Only flash loss reported. *
****

TOTAL HAPs	=	9.772	Tons per Year
BENZENE	=	2.893	Tons per Year
TOLUENE	=	2.388	Tons per Year
E-BENZENE	=	0.088	Tons per Year
XYLENE	=	0.697	Tons per Year
n-HEXANE	=	3.706	Tons per Year
TOTAL HC	=	164.790	Tons per Year
VOCs, C2+	=	154.363	Tons per Year
VOCs, C3+	=	129.807	Tons per Year

File: c:\api\site3\day1\S3SEP.REP File time stamp: 01/10/97 09:11 Current time: 01/10/97 09:50 Page 1

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 3

Production Rate : 432.00 Barrels per Day

Separator Pressure, psig	:	24.80
Separator Temperature, F	:	112.00
Tank Inlet Temperature, F	:	112.00
C10+ Characterization	:	Mol. Weight Method
Flash Loss at Tank Inlet	:	Adiabatic flash
Working and Standing Losses	:	Multi-Stage Distillation
API Gravity of Sales Oil	:	48.80
RVP of Sales Oil, psia	:	8.07
GAS/AIR INPUT	:	No
HEAT INPUT	:	No

REPORT BASIS: 1 MOLE SEPARATOR OIL INPUT

	--------- OIL PHASE ---------			------- VAPOR PHASE --------		
	SEPARATOR OIL	FLASH OIL	SALES OIL	FLASH GAS	WORKING & STANDING	TOTAL VENT
MOLE BASIS	1.0000	0.9716	0.9716	0.0284	0.0000	0.0284
COMPONENT	MOLE %	MOLE %	MOLE %	MOLE %	MOLE %	MOLE %
CO2	0.1300	0.0389	0.0389	3.2481	0.0000	3.2481
C1	0.5698	0.0820	0.0820	17.2735	0.0000	17.2735
C2	1.0696	0.4671	0.4671	21.7031	0.0000	21.7031
C3	2.0792	1.4750	1.4750	22.7683	0.0000	22.7683
i-C4	1.6693	1.4427	1.4427	9.4295	0.0000	9.4295
n-C4	1.9092	1.7237	1.7237	8.2617	0.0000	8.2617
i-C5	2.9788	2.8978	2.8978	5.7545	0.0000	5.7545
n-C5	1.9692	1.9396	1.9396	2.9821	0.0000	2.9821
HEXANES	4.4482	4.5095	4.5095	2.3482	0.0000	2.3482
HEPTANES	10.5958	10.8434	10.8434	2.1133	0.0000	2.1133
OCTANES	12.3950	12.7311	12.7311	0.8858	0.0000	0.8858
NONANES	7.8769	8.1005	8.1005	0.2191	0.0000	0.2191
BENZENE	2.4490	2.4918	2.4918	0.9844	0.0000	0.9844
TOLUENE	5.3079	5.4428	5.4428	0.6889	0.0000	0.6889
E-BENZENE	0.4598	0.4726	0.4726	0.0221	0.0000	0.0221
XYLENE	4.0984	4.2129	4.2129	0.1744	0.0000	0.1744
n-C6	2.6689	2.7135	2.7135	1.1430	0.0000	1.1430
C10+	37.3251	38.4150	38.4150	0.0001	0.0000	0.0001
MOL. WT. =	160.53	163.89	163.89	45.23	0.00	45.23
GAS GRAVTY =				1.56	0.00	1.56
GROSS HEATING VALUE, Btu/scf =				5460.49	0.00	5460.49
GAS OIL RATIO, scf/Barrel =		18.09				

OIL CHARACTERIZATION AT 100 F (BASED ON PENG-ROBINSON MODEL)

BP, psia =	34.77	13.29	13.29
RVP,psia =	12.34	7.54	7.54
SP. GR. =	0.694	0.695	0.695

(NOTE: SP. GR. OF SALES OIL IS 0.764
BASED ON INPUT API GRAVTY AND ADJUSTED TO 112.0 F)

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 3

Production Rate : 432.00 Barrels per Day

Separator Pressure, psig	:	24.80
Separator Temperature, F	:	112.00
Tank Inlet Temperature, F	:	112.00
C10+ Characterization	:	Mol. Weight Method
Flash Loss at Tank Inlet	:	Adiabatic flash
Working and Standing Losses	:	Multi-Stage Distillation
API Gravity of Sales Oil	:	48.80
RVP of Sales Oil, psia	:	8.07
GAS/AIR INPUT	:	No
HEAT INPUT	:	No

REPORT BASIS: 432.00 BARRELS PER DAY

COMPONENT	MOL. WT.	MOLE %	Lbs/Hr	Tons/Yr
CO2	44.01	3.2481	1.228	5.379
C1	16.04	17.2735	2.381	10.427
C2	30.07	21.7031	5.606	24.555
C3	44.10	22.7683	8.625	37.777
i-C4	58.12	9.4295	4.708	20.622
n-C4	58.12	8.2617	4.125	18.068
i-C5	72.15	5.7545	3.567	15.622
n-C5	72.15	2.9821	1.848	8.096
HEXANES	84.00	2.3482	1.694	7.422
HEPTANES	97.00	2.1133	1.761	7.713
OCTANES	111.00	0.8858	0.845	3.700
NONANES	123.00	0.2191	0.231	1.014
BENZENE	78.11	0.9844	0.661	2.893
TOLUENE	92.13	0.6889	0.545	2.388
E-BENZENE	106.17	0.0221	0.020	0.088
XYLENE	106.17	0.1744	0.159	0.697
n-C6	86.18	1.1430	0.846	3.706
C10+	273.50	0.0001	0.000	0.001

POSSIBLE VAPOR RECOVERY = 7.81 mscfd

File: c:\api\site3\day1\S3SEP.REP File time stamp: 01/10/97 09:11 Current time: 01/10/97 09:50 Page 2

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 3

DESCRIPTIONS : Day 3 Case: AP42 Case
Separator pressure = 21.8 psig
Set separator temperature = 112 F
Oil into tank temperature = 57.6 F

SAMPLE IDENTIFICATION:

COMPONENT	MOL. WT.	SEPARATOR LIQUID, MOLE %
CO2	44.010	0.1699
C1	16.043	0.4997
C2	30.070	1.4092
C3	44.097	2.3486
i-C4	58.124	1.7290
n-C4	58.124	1.9588
i-C5	72.151	3.0182
n-C5	72.151	1.9588
HEXANES	84.000	4.3574
HEPTANES	97.000	10.0040
OCTANES	111.000	12.9322
NONANES	123.000	7.4555
BENZENE	78.110	2.4385
TOLUENE	92.130	5.3368
E-BENZENE	106.170	0.4397
XYLENE	106.170	4.0076
n-C6	86.178	2.6584
C10+	275.500	37.2776

SUMMARY

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 3

Production Rate : 441.00 Barrels per Day

Separator Pressure, psig	:	21.80	
Separator Temperature, F	:	112.00	
Tank Inlet Temperature, F	:	112.00	
C10+ Characterization	:	Mol. Weight Method	
Flash Loss at Tank Inlet	:	Adiabatic flash	
Working and Standing Losses	:	AP-42 Method	
API Gravity of Sales Oil	:	48.80	
RVP of Sales Oil, psia	:	8.07	
TANK DIAMETER & HEIGHT, ft	:	38.7	24.0
AVG STOCK LIQUID HEIGHT, ft	:	8.0	
BREATHER VENT P SETTING, psi	:	0.120	
TANK SOLAR ABSORBANCE	:	0.540	
SOLAR INSOLATION,Btu/ft2.day	:	1437.000	
DAILY AMBIENT T MIN & MAX, F	:	32.8	38.6
TANK LIQUID BULK T, F	:	112.0	

TOTAL HAPs	=	14.325	Tons per Year
BENZENE	=	4.237	Tons per Year
TOLUENE	=	3.538	Tons per Year
E-BENZENE	=	0.124	Tons per Year
XYLENE	=	1.004	Tons per Year
n-HEXANE	=	5.422	Tons per Year
TOTAL HC	=	241.057	Tons per Year
VOCs, C2+	=	231.215	Tons per Year
VOCs, C3+	=	191.471	Tons per Year

File: c:\api\site3\day3\S3SEP AP.REP File time stamp: 01/10/97 10:15 Current time: 01/10/97 10:34 Page 1

CALCULATION DETAILS PAGE 1 of 2

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 3

Production Rate : 441.00 Barrels per Day

Separator Pressure, psig :	21.80	
Separator Temperature, F :	112.00	
Tank Inlet Temperature, F :	112.00	
C10+ Characterization :	Mol. Weight Method	
Flash Loss at Tank Inlet :	Adiabatic flash	
Working and Standing Losses :	AP-42 Method	
API Gravity of Sales Oil :	48.80	
RVP of Sales Oil, psia :	8.07	
TANK DIAMETER & HEIGHT, ft :	38.7	24.0
AVG STOCK LIQUID HEIGHT, ft :	8.0	
BREATHER VENT P SETTING, psi:	0.120	
TANK SOLAR ABSORBANCE :	0.540	
SOLAR INSOLATION,Btu/ft2.day:	1437.000	
DAILY AMBIENT T MIN & MAX, F:	32.8	38.6
TANK LIQUID BULK T, F :	112.0	

REPORT BASIS: 1 MOLE SEPARATOR OIL INPUT

	--------- OIL PHASE ---------			------- VAPOR PHASE --------		
	SEPARATOR OIL	FLASH OIL	SALES OIL	FLASH GAS	WORKING & STANDING	TOTAL VENT
MOLE BASIS	1.0000	0.9648	0.9606	0.0352	0.0042	0.0394
COMPONENT	MOLE %	MOLE %	MOLE %	MOLE %	MOLE %	MOLE %
CO2	0.1699	0.0436	0.0185	3.6276	2.1948	3.4761
C1	0.4997	0.0597	0.0074	12.5461	2.4817	11.4818
C2	1.4092	0.5427	0.3326	25.1333	21.3910	24.7375
C3	2.3486	1.5591	1.3249	23.9640	27.7763	24.3671
i-C4	1.7290	1.4482	1.3576	9.4154	12.0156	9.6904
n-C4	1.9588	1.7293	1.6530	8.2424	10.7354	8.5060
i-C5	3.0182	2.9182	2.8794	5.7554	7.7597	5.9674
n-C5	1.9588	1.9231	1.9072	2.9355	3.9860	3.0465
HEXANES	4.3574	4.4331	4.4479	2.2852	3.1562	2.3773
HEPTANES	10.0040	10.2970	10.3701	1.9839	2.7677	2.0668
OCTANES	12.9322	13.3710	13.4855	0.9183	1.2918	0.9578
NONANES	7.4555	7.7203	7.7903	0.2058	0.2915	0.2149
BENZENE	2.4385	2.4919	2.5038	0.9755	1.3511	1.0152
TOLUENE	5.3368	5.5065	5.5500	0.6896	0.9649	0.7187
E-BENZENE	0.4397	0.4550	0.4590	0.0210	0.0296	0.0219
XYLENE	4.0076	4.1478	4.1847	0.1696	0.2393	0.1769
n-C6	2.6584	2.7142	2.7263	1.1314	1.5674	1.1775
C10+	37.2776	38.6392	39.0017	0.0000	0.0001	0.0001
MOL. WT. =	160.77	164.97	165.55	45.96	52.45	46.65
GAS GRAVTY =				1.59	1.81	1.61
GROSS HEATING VALUE, Btu/scf =				5527.47	6357.34	5615.23
GAS OIL RATIO, scf/Barrel =		25.16				

OIL CHARACTERIZATION AT 100 F (BASED ON PENG-ROBINSON MODEL)

BP, psia =	35.95	13.33	9.48
RVP,psia =	13.62	7.82	6.59
SP. GR. =	0.693	0.695	0.696

(NOTE: SP. GR. OF SALES OIL IS 0.764
BASED ON INPUT API GRAVTY AND ADJUSTED TO 112.0 F)

File: c:\api\site3\day3\S3SEP-AP.REP File time stamp: 01/10/97 10:15 Current time: 01/10/97 10:34 Page 2

CALCULATION DETAILS PAGE 2 of 2

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 3

Production Rate : 441.00 Barrels per Day

Separator Pressure, psig	:	21.80	
Separator Temperature, F	:	112.00	
Tank Inlet Temperature, F	:	112.00	
C10+ Characterization	:	Mol. Weight Method	
Flash Loss at Tank Inlet	:	Adiabatic flash	
Working and Standing Losses	:	AP-42 Method	
API Gravity of Sales Oil	:	48.80	
RVP of Sales Oil, psia	:	8.07	
TANK DIAMETER & HEIGHT, ft	:	38.7	24.0
AVG STOCK LIQUID HEIGHT, ft	:	8.0	
BREATHER VENT P SETTING, psi	:	0.120	
TANK SOLAR ABSORBANCE	:	0.540	
SOLAR INSOLATION,Btu/ft2.day	:	1437.000	
DAILY AMBIENT T MIN & MAX, F	:	32.8	38.6
TANK LIQUID BULK T, F	:	112.0	

REPORT BASIS: 441.00 BARRELS PER DAY

COMPONENT	MOL. WT.	MOLE %	Lbs/Hr	Tons/Yr
CO2	44.01	3.4761	1.866	8.174
C1	16.04	11.4818	2.247	9.842
C2	30.07	24.7375	9.074	39.745
C3	44.10	24.3671	13.108	57.412
i-C4	58.12	9.6904	6.871	30.094
n-C4	58.12	8.5060	6.031	26.416
i-C5	72.15	5.9674	5.252	23.004
n-C5	72.15	3.0465	2.681	11.745
HEXANES	84.00	2.3773	2.436	10.670
HEPTANES	97.00	2.0668	2.446	10.712
OCTANES	111.00	0.9578	1.297	5.681
NONANES	123.00	0.2149	0.322	1.412
BENZENE	78.11	1.0152	0.967	4.237
TOLUENE	92.13	0.7187	0.808	3.538
E-BENZENE	106.17	0.0219	0.028	0.124
XYLENE	106.17	0.1769	0.229	1.004
n-C6	86.18	1.1775	1.238	5.422
C10+	275.50	0.0001	0.000	0.001

POSSIBLE VAPOR RECOVERY = 11.10 mscfd

File: c:\api\site3\day3\S3SEP-AP.REP File time stamp: 01/10/97 10:15 Current time: 01/10/97 10:34 Page 3

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 3

DESCRIPTIONS : Day 3 Case: AP42 Case
Separator pressure = 21.8 psig
Set separator temperature = 112 F
Oil into tank temperature = 57.6 F

SAMPLE IDENTIFICATION:

COMPONENT	MOL. WT.	SEPARATOR LIQUID, MOLE %
CO2	44.010	0.1699
C1	16.043	0.4997
C2	30.070	1.4092
C3	44.097	2.3486
i-C4	58.124	1.7290
n-C4	58.124	1.9588
i-C5	72.151	3.0182
n-C5	72.151	1.9588
HEXANES	84.000	4.3574
HEPTANES	97.000	10.0040
OCTANES	111.000	12.9322
NONANES	123.000	7.4555
BENZENE	78.110	2.4385
TOLUENE	92.130	5.3368
E-BENZENE	106.170	0.4397
XYLENE	106.170	4.0076
n-C6	86.178	2.6584
C10+	275.500	37.2776

SUMMARY

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 3

Production Rate : 441.00 Barrels per Day

Separator Pressure, psig	:	21.80
Separator Temperature, F	:	112.00
Tank Inlet Temperature, F	:	112.00
C10+ Characterization	:	Mol. Weight Method
Flash Loss at Tank Inlet	:	Adiabatic flash
Working and Standing Losses	:	Multi-Stage Distillation
API Gravity of Sales Oil	:	48.80
RVP of Sales Oil, psia	:	8.07
GAS/AIR INPUT	:	No
HEAT INPUT	:	No

************************* WARNING *************************
* Cannot match specified RVP. Only flash loss reported. *
****

TOTAL HAPs	=	12.291	Tons per Year
BENZENE	=	3.638	Tons per Year
TOLUENE	=	3.033	Tons per Year
E-BENZENE	=	0.106	Tons per Year
XYLENE	=	0.859	Tons per Year
n-HEXANE	=	4.655	Tons per Year
TOTAL HC	=	211.786	Tons per Year
VOCs, C2+	=	202.177	Tons per Year
VOCs, C3+	=	166.098	Tons per Year

File: c:\api\site3\day3\S3SEP.REP File time stamp: 01/10/97 09:12 Current time: 01/10/97 09:50 Page 1

CALCULATION DETAILS PAGE 1 of 2

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 3

Production Rate : 441.00 Barrels per Day

Separator Pressure, psig	:	21.80
Separator Temperature, F	:	112.00
Tank Inlet Temperature, F	:	112.00
C10+ Characterization	:	Mol. Weight Method
Flash Loss at Tank Inlet	:	Adiabatic flash
Working and Standing Losses	:	Multi-Stage Distillation
API Gravity of Sales Oil	:	48.80
RVP of Sales Oil, psia	:	8.07
GAS/AIR INPUT	:	No
HEAT INPUT	:	No

REPORT BASIS: 1 MOLE SEPARATOR OIL INPUT

	--------- OIL PHASE	---------		------- VAPOR PHASE	--------	
	SEPARATOR OIL	FLASH OIL	SALES OIL	FLASH GAS	WORKING & STANDING	TOTAL VENT
MOLE BASIS	1.0000	0.9648	0.9648	0.0352	0.0000	0.0352
COMPONENT	MOLE %	MOLE %	MOLE %	MOLE %	MOLE %	MOLE %
CO2	0.1699	0.0436	0.0436	3.6276	0.0000	3.6276
C1	0.4997	0.0597	0.0597	12.5461	0.0000	12.5461
C2	1.4092	0.5427	0.5427	25.1333	0.0000	25.1333
C3	2.3486	1.5591	1.5591	23.9640	0.0000	23.9640
i-C4	1.7290	1.4482	1.4482	9.4154	0.0000	9.4154
n-C4	1.9588	1.7293	1.7293	8.2424	0.0000	8.2424
i-C5	3.0182	2.9182	2.9182	5.7554	0.0000	5.7554
n-C5	1.9588	1.9231	1.9231	2.9355	0.0000	2.9355
HEXANES	4.3574	4.4331	4.4331	2.2852	0.0000	2.2852
HEPTANES	10.0040	10.2970	10.2970	1.9839	0.0000	1.9839
OCTANES	12.9322	13.3710	13.3710	0.9183	0.0000	0.9183
NONANES	7.4555	7.7203	7.7203	0.2058	0.0000	0.2058
BENZENE	2.4385	2.4919	2.4919	0.9755	0.0000	0.9755
TOLUENE	5.3368	5.5065	5.5065	0.6896	0.0000	0.6896
E-BENZENE	0.4397	0.4550	0.4550	0.0210	0.0000	0.0210
XYLENE	4.0076	4.1478	4.1478	0.1696	0.0000	0.1696
n-C6	2.6584	2.7142	2.7142	1.1314	0.0000	1.1314
C10+	37.2776	38.6392	38.6392	0.0000	0.0000	0.0000
MOL. WT. =	160.77	164.97	164.97	45.96	0.00	45.96
GAS GRAVTY =				1.59	0.00	1.59
GROSS HEATING VALUE, Btu/scf =				5527.47	0.00	5527.47
GAS OIL RATIO, scf/Barrel =		22.48				

OIL CHARACTERIZATION AT 100 F (BASED ON PENG-ROBINSON MODEL)

BP, psia =	35.95	13.33	13.33
RVP,psia =	13.62	7.82	7.82
SP. GR. =	0.693	0.695	0.695

(NOTE: SP. GR. OF SALES OIL IS 0.764
BASED ON INPUT API GRAVTY AND ADJUSTED TO 112.0 F)

CALCULATION DETAILS PAGE 2 of 2

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 3

Production Rate : 441.00 Barrels per Day

Separator Pressure, psig	:	21.80
Separator Temperature, F	:	112.00
Tank Inlet Temperature, F	:	112.00
C10+ Characterization	:	Mol. Weight Method
Flash Loss at Tank Inlet	:	Adiabatic flash
Working and Standing Losses	:	Multi-Stage Distillation
API Gravity of Sales Oil	:	48.80
RVP of Sales Oil, psia	:	8.07
GAS/AIR INPUT	:	No
HEAT INPUT	:	No

REPORT BASIS: 441.00 BARRELS PER DAY

COMPONENT	MOL. WT.	MOLE %	Lbs/Hr	Tons/Yr
CO2	44.01	3.6276	1.740	7.622
C1	16.04	12.5461	2.194	9.609
C2	30.07	25.1333	8.237	36.079
C3	44.10	23.9640	11.518	50.448
i-C4	58.12	9.4154	5.965	26.126
n-C4	58.12	8.2424	5.222	22.871
i-C5	72.15	5.7554	4.526	19.824
n-C5	72.15	2.9355	2.308	10.111
HEXANES	84.00	2.2852	2.092	9.164
HEPTANES	97.00	1.9839	2.097	9.187
OCTANES	111.00	0.9183	1.111	4.866
NONANES	123.00	0.2058	0.276	1.208
BENZENE	78.11	0.9755	0.831	3.638
TOLUENE	92.13	0.6896	0.692	3.033
E-BENZENE	106.17	0.0210	0.024	0.106
XYLENE	106.17	0.1696	0.196	0.859
n-C6	86.18	1.1314	1.063	4.655
C10+	275.50	0.0000	0.000	0.001

POSSIBLE VAPOR RECOVERY = 9.91 mscfd

File: c:\api\site3\day3\S3SEP.REP File time stamp: 01/10/97 09:12 Current time: 01/10/97 09:50 Page 2

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 4

DESCRIPTIONS : Production = 259 bbl/day
Heater Treater Pressure = 46.6 psig
Oil into Tank Temperature = 115.1
Sales Oil API Gravity = 36.8 RVP = 5.5 psi

SAMPLE IDENTIFICATION:

COMPONENT	MOL. WT.	SEPARATOR LIQUID, MOLE %
CO2	44.010	0.0300
C1	16.043	1.2098
C2	30.070	0.9768
C3	44.097	3.0395
i-C4	58.124	2.0896
n-C4	58.124	3.0495
i-C5	72.151	2.7095
n-C5	72.151	2.0496
HEXANES	84.000	2.2396
HEPTANES	97.000	9.4884
OCTANES	111.000	9.1584
NONANES	123.000	4.7892
BENZENE	78.110	0.2200
TOLUENE	92.130	0.8798
E-BENZENE	106.170	0.4099
XYLENE	106.170	0.8499
n-C6	86.178	1.7197
C10+	323.000	55.0906

SUMMARY

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 4

Production Rate : 259.00 Barrels per Day

Separator Pressure, psig	:	46.60	
Separator Temperature, F	:	145.00	
Tank Inlet Temperature, F	:	145.00	
C10+ Characterization	:	Mol. Weight Method	
Flash Loss at Tank Inlet	:	Adiabatic flash	
Working and Standing Losses	:	AP-42 Method	
API Gravity of Sales Oil	:	36.80	
RVP of Sales Oil, psia	:	5.50	
TANK DIAMETER & HEIGHT, ft	:	12.0	21.0
AVG STOCK LIQUID HEIGHT, ft	:	8.0	
BREATHER VENT P SETTING, psi	:	0.120	
TANK SOLAR ABSORBANCE	:	0.540	
SOLAR INSOLATION,Btu/ft2.day	:	1437.000	
DAILY AMBIENT T MIN & MAX, F	:	34.9	90.8
TANK LIQUID BULK T, F	:	145.0	

TOTAL HAPs	=	8.269	Tons per Year
BENZENE	=	0.623	Tons per Year
TOLUENE	=	1.071	Tons per Year
E-BENZENE	=	0.233	Tons per Year
XYLENE	=	0.434	Tons per Year
n-HEXANE	=	5.908	Tons per Year
TOTAL HC	=	258.932	Tons per Year
VOCs, C2+	=	247.158	Tons per Year
VOCs, C3+	=	231.318	Tons per Year

File: c:\api\site4\S4SEP-AP.REP File time stamp: 01/10/97 10:18 Current time: 01/10/97 10:35 Page 1

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 4

Production Rate : 259.00 Barrels per Day

Separator Pressure, psig :	46.60	
Separator Temperature, F :	145.00	
Tank Inlet Temperature, F :	145.00	
C10+ Characterization :	Mol. Weight Method	
Flash Loss at Tank Inlet :	Adiabatic flash	
Working and Standing Losses :	AP-42 Method	
API Gravity of Sales Oil :	36.80	
RVP of Sales Oil, psia :	5.50	
TANK DIAMETER & HEIGHT, ft :	12.0	21.0
AVG STOCK LIQUID HEIGHT, ft :	8.0	
BREATHER VENT P SETTING, psi:	0.120	
TANK SOLAR ABSORBANCE :	0.540	
SOLAR INSOLATION,Btu/ft2.day:	1437.000	
DAILY AMBIENT T MIN & MAX, F:	34.9	90.8
TANK LIQUID BULK T, F :	145.0	

REPORT BASIS: 1 MOLE SEPARATOR OIL INPUT

	--------- OIL PHASE ---------			------- VAPOR PHASE --------		
	SEPARATOR OIL	FLASH OIL	SALES OIL	FLASH GAS	WORKING & STANDING	TOTAL VENT
MOLE BASIS	1.0000	0.9209	0.9190	0.0791	0.0019	0.0810
COMPONENT	MOLE %	MOLE %	MOLE %	MOLE %	MOLE %	MOLE %
CO2	0.0300	0.0034	0.0022	0.3400	0.2338	0.3375
C1	1.2098	0.0608	0.0279	14.5826	5.8461	14.3751
C2	0.9768	0.1709	0.1315	10.3568	8.7133	10.3177
C3	3.0395	1.1328	1.0225	25.2304	26.5116	25.2608
i-C4	2.0896	1.2114	1.1569	12.3107	14.0366	12.3517
n-C4	3.0495	1.9987	1.9320	15.2795	17.7577	15.3384
i-C5	2.7095	2.2833	2.2544	7.6698	9.2356	7.7070
n-C5	2.0496	1.8103	1.7936	4.8348	5.8677	4.8594
HEXANES	2.2396	2.2539	2.2529	2.0739	2.5730	2.0858
HEPTANES	9.4884	9.9828	10.0069	3.7338	4.6960	3.7566
OCTANES	9.1584	9.8224	9.8578	1.4308	1.8213	1.4401
NONANES	4.7892	5.1734	5.1943	0.3181	0.4092	0.3202
BENZENE	0.2200	0.2255	0.2257	0.1553	0.1934	0.1562
TOLUENE	0.8798	0.9360	0.9389	0.2263	0.2858	0.2278
E-BENZENE	0.4099	0.4415	0.4432	0.0426	0.0544	0.0429
XYLENE	0.8499	0.9160	0.9196	0.0795	0.1017	0.0801
n-C6	1.7197	1.7528	1.7535	1.3350	1.6628	1.3427
C10+	55.0906	59.8241	60.0863	0.0000	0.0000	0.0000
MOL. WT. =	217.15	231.45	231.85	50.74	55.98	50.87
GAS GRAVTY =				1.75	1.93	1.76
GROSS HEATING VALUE, Btu/scf =				6284.30	6902.38	6298.98
GAS OIL RATIO, scf/Barrel =		40.94				

OIL CHARACTERIZATION AT 100 F (BASED ON PENG-ROBINSON MODEL)

BP, psia =	58.89	9.68	7.98
RVP,psia =	14.60	5.52	5.09
SP. GR. =	0.724	0.727	0.727

(NOTE: SP. GR. OF SALES OIL IS 0.810
BASED ON INPUT API GRAVTY AND ADJUSTED TO 145.0 F)

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 4

Production Rate : 259.00 Barrels per Day

Separator Pressure, psig	:	46.60	
Separator Temperature, F	:	145.00	
Tank Inlet Temperature, F	:	145.00	
C10+ Characterization	:	Mol. Weight Method	
Flash Loss at Tank Inlet	:	Adiabatic flash	
Working and Standing Losses	:	AP-42 Method	
API Gravity of Sales Oil	:	36.80	
RVP of Sales Oil, psia	:	5.50	
TANK DIAMETER & HEIGHT, ft	:	12.0	21.0
AVG STOCK LIQUID HEIGHT, ft	:	8.0	
BREATHER VENT P SETTING, psi	:	0.120	
TANK SOLAR ABSORBANCE	:	0.540	
SOLAR INSOLATION,Btu/ft2.day	:	1437.000	
DAILY AMBIENT T MIN & MAX, F	:	34.9	90.8
TANK LIQUID BULK T, F	:	145.0	

REPORT BASIS: 259.00 BARRELS PER DAY

COMPONENT	MOL. WT.	MOLE %	Lbs/Hr	Tons/Yr
CO2	44.01	0.3375	0.173	0.758
C1	16.04	14.3751	2.688	11.774
C2	30.07	10.3177	3.616	15.840
C3	44.10	25.2608	12.984	56.870
i-C4	58.12	12.3517	8.368	36.653
n-C4	58.12	15.3384	10.392	45.516
i-C5	72.15	7.7070	6.482	28.389
n-C5	72.15	4.8594	4.087	17.900
HEXANES	84.00	2.0858	2.042	8.945
HEPTANES	97.00	3.7566	4.247	18.604
OCTANES	111.00	1.4401	1.863	8.161
NONANES	123.00	0.3202	0.459	2.011
BENZENE	78.11	0.1562	0.142	0.623
TOLUENE	92.13	0.2278	0.245	1.071
E-BENZENE	106.17	0.0429	0.053	0.233
XYLENE	106.17	0.0801	0.099	0.434
n-C6	86.18	1.3427	1.349	5.908
C10+	323.00	0.0000	0.000	0.000

POSSIBLE VAPOR RECOVERY = 10.60 mscfd

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

Failure in COLUMN calculations. Please try SINGLE-STAGE option

@ 145°F Separator Temp.

CASE TITLE : API Tanks Site 4

DESCRIPTIONS : Production = 259 bbl/day
Heater Treater Pressure = 46.6 psig
Oil into Tank Temperature = 115.1
Sales Oil API Gravity = 36.8 RVP = 5.5 psi

SAMPLE IDENTIFICATION:

COMPONENT	MOL. WT.	SEPARATOR LIQUID, MOLE %
CO2	44.010	0.0300
C1	16.043	1.2098
C2	30.070	0.9768
C3	44.097	3.0395
i-C4	58.124	2.0896
n-C4	58.124	3.0495
i-C5	72.151	2.7095
n-C5	72.151	2.0496
HEXANES	84.000	2.2396
HEPTANES	97.000	9.4884
OCTANES	111.000	9.1584
NONANES	123.000	4.7892
BENZENE	78.110	0.2200
TOLUENE	92.130	0.8798
E-BENZENE	106.170	0.4099
XYLENE	106.170	0.8499
n-C6	86.178	1.7197
C10+	323.000	55.0906

File: c:\api\site4\S4SEP.REP File time stamp: 01/10/97 09:14 Current time: 01/10/97 09:50 Page 1

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 4

DESCRIPTIONS : Production = 259 bbl/day
Heater Treater Pressure = 46.6 psig
Oil into Tank Temperature = 115.1
Sales Oil API Gravity = 36.8 RVP = 5.5 psi

SAMPLE IDENTIFICATION:

COMPONENT	MOL. WT.	SEPARATOR LIQUID, MOLE %
CO2	44.010	0.0300
C1	16.043	1.2098
C2	30.070	0.9768
C3	44.097	3.0395
i-C4	58.124	2.0896
n-C4	58.124	3.0495
i-C5	72.151	2.7095
n-C5	72.151	2.0496
HEXANES	84.000	2.2396
HEPTANES	97.000	9.4884
OCTANES	111.000	9.1584
NONANES	123.000	4.7892
BENZENE	78.110	0.2200
TOLUENE	92.130	0.8798
E-BENZENE	106.170	0.4099
XYLENE	106.170	0.8499
n-C6	86.178	1.7197
C10+	323.000	55.0906

SUMMARY

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 4

Production Rate : 259.00 Barrels per Day

Separator Pressure, psig	:	80.00
Separator Temperature, F	:	145.00
Tank Inlet Temperature, F	:	141.00
C10+ Characterization	:	Mol. Weight Method
Flash Loss at Tank Inlet	:	Adiabatic flash
Working and Standing Losses	:	Multi-Stage Distillation
API Gravity of Sales Oil	:	36.80
RVP of Sales Oil, psia	:	5.50
GAS/AIR INPUT	:	No
HEAT INPUT	:	No

TOTAL HAPs	=	7.303	Tons per Year
BENZENE	=	0.553	Tons per Year
TOLUENE	=	0.936	Tons per Year
E-BENZENE	=	0.201	Tons per Year
XYLENE	=	0.375	Tons per Year
n-HEXANE	=	5.238	Tons per Year
TOTAL HC	=	242.337	Tons per Year
VOCs, C2+	=	230.482	Tons per Year
VOCs, C3+	=	214.843	Tons per Year

File: c:\api\site4\P80T145E.REP File time stamp: 01/15/97 16:47 Current time: 01/15/97 16:48 Page 1

CALCULATION DETAILS PAGE 1 of 2

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 4

Production Rate : 259.00 Barrels per Day

Separator Pressure, psig	:	80.00
Separator Temperature, F	:	145.00
Tank Inlet Temperature, F	:	141.00
C10+ Characterization	:	Mol. Weight Method
Flash Loss at Tank Inlet	:	Adiabatic flash
Working and Standing Losses	:	Multi-Stage Distillation
API Gravity of Sales Oil	:	36.80
RVP of Sales Oil, psia	:	5.50
GAS/AIR INPUT	:	No
HEAT INPUT	:	No

REPORT BASIS: 1 MOLE SEPARATOR OIL INPUT

	--------- OIL PHASE ---------			------- VAPOR PHASE --------		
	SEPARATOR OIL	FLASH OIL	SALES OIL	FLASH GAS	WORKING & STANDING	TOTAL VENT
MOLE BASIS	1.0000	0.9243	0.9227	0.0757	0.0016	0.0773
COMPONENT	MOLE %	MOLE %	MOLE %	MOLE %	MOLE %	MOLE %
CO2	0.0300	0.0036	0.0029	0.3528	0.3537	0.3529
C1	1.2098	0.0640	0.0379	15.2022	15.1697	15.2016
C2	0.9768	0.1807	0.1626	10.6985	10.7097	10.6987
C3	3.0395	1.1900	1.1479	25.6246	25.6296	25.6247
i-C4	2.0896	1.2572	1.2382	12.2557	12.2564	12.2557
n-C4	3.0495	2.0637	2.0412	15.0876	15.0886	15.0877
i-C5	2.7095	2.3247	2.3159	7.4095	7.4098	7.4095
n-C5	2.0496	1.8374	1.8326	4.6415	4.6417	4.6415
HEXANES	2.2396	2.2633	2.2639	1.9500	1.9502	1.9500
HEPTANES	9.4884	9.9819	9.9931	3.4620	3.4623	3.4620
OCTANES	9.1584	9.8011	9.8157	1.3105	1.3107	1.3105
NONANES	4.7892	5.1578	5.1661	0.2883	0.3008	0.2886
BENZENE	0.2200	0.2260	0.2262	0.1456	0.1456	0.1456
TOLUENE	0.8798	0.9348	0.9360	0.2091	0.2091	0.2091
E-BENZENE	0.4099	0.4403	0.4410	0.0390	0.0390	0.0390
XYLENE	0.8499	0.9135	0.9150	0.0726	0.0726	0.0726
n-C6	1.7197	1.7581	1.7590	1.2503	1.2504	1.2503
C10+	55.0906	59.6020	59.7048	0.0000	0.0000	0.0000
MOL. WT. =	217.15	230.84	231.15	50.01	50.02	50.01
GAS GRAVTY =				1.73	1.73	1.73
GROSS HEATING VALUE, Btu/scf =				6198.55	6200.63	6198.59
GAS OIL RATIO, scf/Barrel =	38.98					

OIL CHARACTERIZATION AT 100 F (BASED ON PENG-ROBINSON MODEL)

BP, psia =	58.89	10.08	8.97
RVP,psia =	14.60	5.71	5.42
SP. GR. =	0.724	0.727	0.727

(NOTE: SP. GR. OF SALES OIL IS 0.810
BASED ON INPUT API GRAVTY AND ADJUSTED TO 145.7 F)

CALCULATION DETAILS PAGE 2 of 2

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 4

Production Rate : 259.00 Barrels per Day

Separator Pressure, psig	:	80.00
Separator Temperature, F	:	145.00
Tank Inlet Temperature, F	:	141.00
C10+ Characterization	:	Mol. Weight Method
Flash Loss at Tank Inlet	:	Adiabatic flash
Working and Standing Losses	:	Multi-Stage Distillation
API Gravity of Sales Oil	:	36.80
RVP of Sales Oil, psia	:	5.50
GAS/AIR INPUT	:	No
HEAT INPUT	:	No

REPORT BASIS: 259.00 BARRELS PER DAY

COMPONENT	MOL. WT.	MOLE %	Lbs/Hr	Tons/Yr
CO2	44.01	0.3529	0.172	0.755
C1	16.04	15.2016	2.707	11.855
C2	30.07	10.6987	3.571	15.639
C3	44.10	25.6247	12.541	54.930
i-C4	58.12	12.2557	7.906	34.628
n-C4	58.12	15.0877	9.733	42.630
i-C5	72.15	7.4095	5.933	25.988
n-C5	72.15	4.6415	3.717	16.279
HEXANES	84.00	1.9500	1.818	7.963
HEPTANES	97.00	3.4620	3.727	16.325
OCTANES	111.00	1.3105	1.614	7.071
NONANES	123.00	0.2886	0.394	1.725
BENZENE	78.11	0.1456	0.126	0.553
TOLUENE	92.13	0.2091	0.214	0.936
E-BENZENE	106.17	0.0390	0.046	0.201
XYLENE	106.17	0.0726	0.086	0.375
n-C6	86.18	1.2503	1.196	5.238
C10+	323.00	0.0000	0.000	0.000

POSSIBLE VAPOR RECOVERY = 10.10 mscfd

File: c:\api\site4\P80T145E.REP File time stamp: 01/15/97 16:47 Current time: 01/15/97 16:48 Page 2

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 5

DESCRIPTIONS : 451 bbl/day
Separator T=112 F P=29 psig
Actual T=88.1F
API Gravity=48.8 RVP=7.40

SAMPLE IDENTIFICATION:

COMPONENT	MOL. WT.	SEPARATOR LIQUID, MOLE %
CO2	44.010	0.3200
N2	28.013	0.0100
C1	16.043	0.6199
C2	30.070	1.4398
C3	44.097	2.7597
i-C4	58.124	2.2898
n-C4	58.124	2.1798
i-C5	72.151	3.5496
n-C5	72.151	1.9898
HEXANES	84.000	3.8796
HEPTANES	97.000	6.8902
OCTANES	111.000	10.1289
NONANES	123.000	13.6885
BENZENE	78.110	1.7298
TOLUENE	92.130	3.4296
E-BENZENE	106.170	0.4999
XYLENE	106.170	6.0493
n-C6	86.178	2.3697
C10+	265.000	36.1760

SUMMARY

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 5

Production Rate : 451.00 Barrels per Day

Separator Pressure, psig	:	29.00	
Separator Temperature, F	:	112.00	
Tank Inlet Temperature, F	:	112.00	
C10+ Characterization	:	Mol. Weight Method	
Flash Loss at Tank Inlet	:	Adiabatic flash	
Working and Standing Losses	:	AP-42 Method	
API Gravity of Sales Oil	:	48.80	
RVP of Sales Oil, psia	:	7.40	
TANK DIAMETER & HEIGHT, ft	:	38.6	24.0
AVG STOCK LIQUID HEIGHT, ft	:	8.0	
BREATHER VENT P SETTING, psi	:	0.120	
TANK SOLAR ABSORBANCE	:	0.540	
SOLAR INSOLATION,Btu/ft2.day	:	1437.000	
DAILY AMBIENT T MIN & MAX, F	:	44.7	79.5
TANK LIQUID BULK T, F	:	112.0	

TOTAL HAPs	=	16.520	Tons per Year
BENZENE	=	4.176	Tons per Year
TOLUENE	=	3.155	Tons per Year
E-BENZENE	=	0.196	Tons per Year
XYLENE	=	2.098	Tons per Year
n-HEXANE	=	6.895	Tons per Year
TOTAL HC	=	341.263	Tons per Year
VOCs, C2+	=	328.277	Tons per Year
VOCs, C3+	=	282.729	Tons per Year

File: c:\api\site5\S5SEP-AP.REP File time stamp: 01/10/97 10:20 Current time: 01/10/97 10:35 Page 1

CALCULATION DETAILS PAGE 1 of 2

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 5

Production Rate : 451.00 Barrels per Day

Separator Pressure, psig	:	29.00	
Separator Temperature, F	:	112.00	
Tank Inlet Temperature, F	:	112.00	
C10+ Characterization	:	Mol. Weight Method	
Flash Loss at Tank Inlet	:	Adiabatic flash	
Working and Standing Losses	:	AP-42 Method	
API Gravity of Sales Oil	:	48.80	
RVP of Sales Oil, psia	:	7.40	
TANK DIAMETER & HEIGHT, ft	:	38.6	24.0
AVG STOCK LIQUID HEIGHT, ft	:	8.0	
BREATHER VENT P SETTING, psi	:	0.120	
TANK SOLAR ABSORBANCE	:	0.540	
SOLAR INSOLATION,Btu/ft2.day	:	1437.000	
DAILY AMBIENT T MIN & MAX, F	:	44.7	79.5
TANK LIQUID BULK T, F	:	112.0	

REPORT BASIS: 1 MOLE SEPARATOR OIL INPUT

	OIL PHASE			VAPOR PHASE		
	SEPARATOR OIL	FLASH OIL	SALES OIL	FLASH GAS	WORKING & STANDING	TOTAL VENT
MOLE BASIS	1.0000	0.9524	0.9473	0.0476	0.0051	0.0527
COMPONENT	MOLE %	MOLE %	MOLE %	MOLE %	MOLE %	MOLE %
CO2	0.3200	0.0651	0.0079	5.4197	1.1160	5.0020
N2	0.0100	0.0003	0.0000	0.2036	0.0002	0.1839
C1	0.6199	0.0559	0.0000	11.9016	0.0001	10.7466
C2	1.4398	0.4580	0.1419	21.0797	11.0995	20.1112
C3	2.7597	1.6498	1.1154	24.9625	29.0176	25.3560
i-C4	2.2898	1.8227	1.5568	11.6344	17.2091	12.1754
n-C4	2.1798	1.8569	1.6629	8.6391	13.4399	9.1050
i-C5	3.5496	3.4002	3.2846	6.5391	11.0452	6.9764
n-C5	1.9898	1.9452	1.9024	2.8823	4.9450	3.0825
HEXANES	3.8796	3.9739	3.9959	1.9931	3.5411	2.1433
HEPTANES	6.8902	7.1677	7.2726	1.3392	2.4213	1.4442
OCTANES	10.1289	10.6001	10.7928	0.7039	1.2885	0.7606
NONANES	13.6885	14.3544	14.6327	0.3688	0.6818	0.3992
BENZENE	1.7298	1.7833	1.8000	0.6595	1.1784	0.7098
TOLUENE	3.4296	3.5800	3.6397	0.4213	0.7655	0.4547
E-BENZENE	0.4999	0.5238	0.5336	0.0226	0.0415	0.0245
XYLENE	6.0493	6.3396	6.4602	0.2426	0.4461	0.2623
n-C6	2.3697	2.4388	2.4591	0.9870	1.7632	1.0623
C10+	36.1760	37.9845	38.7506	0.0001	0.0002	0.0001
MOL. WT. =	155.88	161.35	162.95	46.52	57.23	47.56
GAS GRAVTY =				1.61	1.98	1.64
GROSS HEATING VALUE, Btu/scf =				5494.06	6976.31	5637.91
GAS OIL RATIO, scf/Barrel =		34.68				

OIL CHARACTERIZATION AT 100 F (BASED ON PENG-ROBINSON MODEL)

BP, psia =	44.56	13.56	7.59
RVP,psia =	15.89	8.19	5.91
SP. GR. =	0.707	0.710	0.711

(NOTE: SP. GR. OF SALES OIL IS 0.764
BASED ON INPUT API GRAVTY AND ADJUSTED TO 112.0 F)

File: c:\api\site5\S5SEP-AP.REP File time stamp: 01/10/97 10:20 Current time: 01/10/97 10:35 Page 2

CALCULATION DETAILS PAGE 2 of 2

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 5

Production Rate : 451.00 Barrels per Day

Separator Pressure, psig	:	29.00	
Separator Temperature, F	:	112.00	
Tank Inlet Temperature, F	:	112.00	
C10+ Characterization	:	Mol. Weight Method	
Flash Loss at Tank Inlet	:	Adiabatic flash	
Working and Standing Losses	:	AP-42 Method	
API Gravity of Sales Oil	:	48.80	
RVP of Sales Oil, psia	:	7.40	
TANK DIAMETER & HEIGHT, ft	:	38.6	24.0
AVG STOCK LIQUID HEIGHT, ft	:	8.0	
BREATHER VENT P SETTING, psi	:	0.120	
TANK SOLAR ABSORBANCE	:	0.540	
SOLAR INSOLATION,Btu/ft2.day	:	1437.000	
DAILY AMBIENT T MIN & MAX, F	:	44.7	79.5
TANK LIQUID BULK T, F	:	112.0	

REPORT BASIS: 451.00 BARRELS PER DAY

COMPONENT	MOL. WT.	MOLE %	Lbs/Hr	Tons/Yr
CO2	44.01	5.0020	3.786	16.581
N2	28.01	0.1839	0.089	0.388
C1	16.04	10.7466	2.965	12.985
C2	30.07	20.1112	10.399	45.548
C3	44.10	25.3560	19.227	84.215
i-C4	58.12	12.1754	12.169	53.301
n-C4	58.12	9.1050	9.100	39.860
i-C5	72.15	6.9764	8.656	37.912
n-C5	72.15	3.0825	3.824	16.751
HEXANES	84.00	2.1433	3.096	13.560
HEPTANES	97.00	1.4442	2.409	10.551
OCTANES	111.00	0.7606	1.452	6.359
NONANES	123.00	0.3992	0.844	3.698
BENZENE	78.11	0.7098	0.953	4.176
TOLUENE	92.13	0.4547	0.720	3.155
E-BENZENE	106.17	0.0245	0.045	0.196
XYLENE	106.17	0.2623	0.479	2.098
n-C6	86.18	1.0623	1.574	6.895
C10+	265.00	0.0001	0.000	0.002

POSSIBLE VAPOR RECOVERY = 15.64 mscfd

File: c:\api\site5\S5SEP-AP.REP File time stamp: 01/10/97 10:20 Current time: 01/10/97 10:35 Page 3

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 5

DESCRIPTIONS : 451 bbl/day
Separator T=112 F P=29 psig
Actual T=88.1F
API Gravity=48.8 RVP=7.40

SAMPLE IDENTIFICATION:

COMPONENT	MOL. WT.	SEPARATOR LIQUID, MOLE %
CO2	44.010	0.3200
N2	28.013	0.0100
C1	16.043	0.6199
C2	30.070	1.4398
C3	44.097	2.7597
i-C4	58.124	2.2898
n-C4	58.124	2.1798
i-C5	72.151	3.5496
n-C5	72.151	1.9898
HEXANES	84.000	3.8796
HEPTANES	97.000	6.8902
OCTANES	111.000	10.1289
NONANES	123.000	13.6885
BENZENE	78.110	1.7298
TOLUENE	92.130	3.4296
E-BENZENE	106.170	0.4999
XYLENE	106.170	6.0493
n-C6	86.178	2.3697
C10+	265.000	36.1760

SUMMARY

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 5

Production Rate : 451.00 Barrels per Day

Separator Pressure, psig	:	29.00
Separator Temperature, F	:	112.00
Tank Inlet Temperature, F	:	112.00
C10+ Characterization	:	Mol. Weight Method
Flash Loss at Tank Inlet	:	Adiabatic flash
Working and Standing Losses	:	Multi-Stage Distillation
API Gravity of Sales Oil	:	48.80
RVP of Sales Oil, psia	:	7.40
GAS/AIR INPUT	:	No
HEAT INPUT	:	No

************************* WARNING *************************
* Cannot match specified RVP. Only flash loss reported. *
****

TOTAL HAPs	=	15.382	Tons per Year
BENZENE	=	3.893	Tons per Year
TOLUENE	=	2.934	Tons per Year
E-BENZENE	=	0.182	Tons per Year
XYLENE	=	1.947	Tons per Year
n-HEXANE	=	6.428	Tons per Year
TOTAL HC	=	333.360	Tons per Year
VOCs, C2+	=	319.287	Tons per Year
VOCs, C3+	=	271.003	Tons per Year

File: c:\api\site5\S5SEP.REP File time stamp: 01/10/97 09:18 Current time: 01/10/97 09:50 Page 1

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 5

Production Rate : 451.00 Barrels per Day

Separator Pressure, psig	:	29.00
Separator Temperature, F	:	112.00
Tank Inlet Temperature, F	:	112.00
C10+ Characterization	:	Mol. Weight Method
Flash Loss at Tank Inlet	:	Adiabatic flash
Working and Standing Losses	:	Multi-Stage Distillation
API Gravity of Sales Oil	:	48.80
RVP of Sales Oil, psia	:	7.40
GAS/AIR INPUT	:	No
HEAT INPUT	:	No

REPORT BASIS: 1 MOLE SEPARATOR OIL INPUT

	OIL PHASE			VAPOR PHASE		
	SEPARATOR OIL	FLASH OIL	SALES OIL	FLASH GAS	WORKING & STANDING	TOTAL VENT
MOLE BASIS	1.0000	0.9524	0.9469	0.0476	0.0055	0.0531
COMPONENT	MOLE %	MOLE %	MOLE %	MOLE %	MOLE %	MOLE %
CO2	0.3200	0.0651	0.0302	5.4197	6.0734	5.4874
N2	0.0100	0.0003	0.0000	0.2036	0.0555	0.1883
C1	0.6199	0.0559	0.0035	11.9016	9.0845	11.6099
C2	1.4398	0.4580	0.3286	21.0797	22.7427	21.2519
C3	2.7597	1.6498	1.5117	24.9625	25.4329	25.0112
i-C4	2.2898	1.8227	1.7652	11.6344	11.7157	11.6428
n-C4	2.1798	1.8569	1.8173	8.6391	8.6837	8.6437
i-C5	3.5496	3.4002	3.3818	6.5391	6.5547	6.5407
n-C5	1.9898	1.9452	1.9397	2.8823	2.8884	2.8830
HEXANES	3.8796	3.9739	3.9854	1.9931	1.9961	1.9934
HEPTANES	6.8902	7.1677	7.2015	1.3392	1.3413	1.3394
OCTANES	10.1289	10.6001	10.6575	0.7039	0.7052	0.7040
NONANES	13.6885	14.3544	14.4355	0.3688	0.3880	0.3708
BENZENE	1.7298	1.7833	1.7898	0.6595	0.6609	0.6596
TOLUENE	3.4296	3.5800	3.5983	0.4213	0.4223	0.4214
E-BENZENE	0.4999	0.5238	0.5267	0.0226	0.0227	0.0226
XYLENE	6.0493	6.3396	6.3750	0.2426	0.2433	0.2427
n-C6	2.3697	2.4388	2.4472	0.9870	0.9886	0.9872
C10+	36.1760	37.9845	38.2051	0.0001	0.0001	0.0001
MOL. WT. =	155.88	161.35	162.01	46.52	47.15	46.59
GAS GRAVTY =				1.61	1.63	1.61
GROSS HEATING VALUE, Btu/scf =				5494.06	5537.31	5498.54
GAS OIL RATIO, scf/Barrel =		34.79				

OIL CHARACTERIZATION AT 100 F (BASED ON PENG-ROBINSON MODEL)

BP, psia =	44.56	13.56	10.28
RVP,psia =	15.89	8.19	7.25
SP. GR. =	0.707	0.710	0.710

(NOTE: SP. GR. OF SALES OIL IS 0.757
BASED ON INPUT API GRAVTY AND ADJUSTED TO 130.9 F)

File: c:\api\site5\S5SEP.REP File time stamp: 01/10/97 09:18 Current time: 01/10/97 09:50 Page 2

CALCULATION DETAILS PAGE 2 of 2

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 5

Production Rate : 451.00 Barrels per Day

Separator Pressure, psig	:	29.00
Separator Temperature, F	:	112.00
Tank Inlet Temperature, F	:	112.00
C10+ Characterization	:	Mol. Weight Method
Flash Loss at Tank Inlet	:	Adiabatic flash
Working and Standing Losses	:	Multi-Stage Distillation
API Gravity of Sales Oil	:	48.80
RVP of Sales Oil, psia	:	7.40
GAS/AIR INPUT	:	No
HEAT INPUT	:	No

REPORT BASIS: 451.00 BARRELS PER DAY

COMPONENT	MOL. WT.	MOLE %	Lbs/Hr	Tons/Yr
CO2	44.01	5.4874	4.166	18.247
N2	28.01	0.1883	0.091	0.399
C1	16.04	11.6099	3.213	14.073
C2	30.07	21.2519	11.024	48.285
C3	44.10	25.0112	19.026	83.334
i-C4	58.12	11.6428	11.674	51.132
n-C4	58.12	8.6437	8.667	37.961
i-C5	72.15	6.5407	8.141	35.657
n-C5	72.15	2.8830	3.588	15.717
HEXANES	84.00	1.9934	2.889	12.652
HEPTANES	97.00	1.3394	2.241	9.816
OCTANES	111.00	0.7040	1.348	5.905
NONANES	123.00	0.3708	0.787	3.446
BENZENE	78.11	0.6596	0.889	3.893
TOLUENE	92.13	0.4214	0.670	2.934
E-BENZENE	106.17	0.0226	0.041	0.182
XYLENE	106.17	0.2427	0.444	1.947
n-C6	86.18	0.9872	1.468	6.428
C10+	265.00	0.0001	0.000	0.002

POSSIBLE VAPOR RECOVERY = 15.69 mscfd

File: c:\api\site5\S5SEP.REP File time stamp: 01/10/97 09:18 Current time: 01/10/97 09:50 Page 3

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 6a (NDR)

DESCRIPTIONS : 12 bbl/day
Separator T=90 F P=570 psig

API Gravity=55.5 RVP=11.1

SAMPLE IDENTIFICATION:

COMPONENT	MOL. WT.	SEPARATOR LIQUID, MOLE %
CO2	44.010	0.1737
N2	28.013	0.1022
C1	16.043	10.4741
C2	30.070	8.1341
C3	44.097	10.6274
i-C4	58.124	3.7605
n-C4	58.124	6.3765
i-C5	72.151	4.4553
n-C5	72.151	3.2802
HEXANES	84.000	3.8422
HEPTANES	97.000	9.2377
OCTANES	111.000	9.4012
NONANES	123.000	4.7006
BENZENE	78.110	0.7051
TOLUENE	92.130	2.1153
E-BENZENE	106.170	0.4701
XYLENE	106.170	4.5167
n-C6	86.178	2.5547
C10+	145.000	15.0725

SUMMARY

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 6a (NDR)

Production Rate : 12.00 Barrels per Day

Separator Pressure, psig	:	570.00	
Separator Temperature, F	:	86.00	
Tank Inlet Temperature, F	:	86.00	
C10+ Characterization	:	Mol. Weight Method	
Flash Loss at Tank Inlet	:	Adiabatic flash	
Working and Standing Losses	:	AP-42 Method	
API Gravity of Sales Oil	:	55.50	
RVP of Sales Oil, psia	:	11.10	
TANK DIAMETER & HEIGHT, ft	:	12.0	15.0
AVG STOCK LIQUID HEIGHT, ft	:	8.0	
BREATHER VENT P SETTING, psi	:	0.120	
TANK SOLAR ABSORBANCE	:	0.540	
SOLAR INSOLATION,Btu/ft2.day	:	1437.000	
DAILY AMBIENT T MIN & MAX, F	:	35.4	63.2
TANK LIQUID BULK T, F	:	86.0	

************************** WARNING *************************
* AP-42 failed for this case. Only flash loss reported. *
****

TOTAL HAPs	=	1.060	Tons per Year
BENZENE	=	0.140	Tons per Year
TOLUENE	=	0.126	Tons per Year
E-BENZENE	=	0.010	Tons per Year
XYLENE	=	0.080	Tons per Year
n-HEXANE	=	0.704	Tons per Year
TOTAL HC	=	95.348	Tons per Year
VOCs, C2+	=	81.602	Tons per Year
VOCs, C3+	=	62.918	Tons per Year

File: c:\api\site6\S6ASEP-A.REP File time stamp: 01/10/97 10:22 Current time: 01/10/97 10:35 Page 1

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 6a (NDR)

Production Rate : 12.00 Barrels per Day

Separator Pressure, psig :	570.00	
Separator Temperature, F :	86.00	
Tank Inlet Temperature, F :	86.00	
C10+ Characterization :	Mol. Weight Method	
Flash Loss at Tank Inlet :	Adiabatic flash	
Working and Standing Losses :	AP-42 Method	
API Gravity of Sales Oil :	55.50	
RVP of Sales Oil, psia :	11.10	
TANK DIAMETER & HEIGHT, ft :	12.0	15.0
AVG STOCK LIQUID HEIGHT, ft :	8.0	
BREATHER VENT P SETTING, psi:	0.120	
TANK SOLAR ABSORBANCE :	0.540	
SOLAR INSOLATION,Btu/ft2.day:	1437.000	
DAILY AMBIENT T MIN & MAX, F:	35.4	63.2
TANK LIQUID BULK T, F :	86.0	

REPORT BASIS: 1 MOLE SEPARATOR OIL INPUT

	OIL PHASE			VAPOR PHASE		
	SEPARATOR OIL	FLASH OIL	SALES OIL	FLASH GAS	WORKING & STANDING	TOTAL VENT
MOLE BASIS	1.0000	0.6751	0.6751	0.3249	0.0000	0.3249
COMPONENT	MOLE %	MOLE %	MOLE %	MOLE %	MOLE %	MOLE %
CO2	0.1737	0.0097	0.0097	0.5145	0.0000	0.5145
N2	0.1022	0.0004	0.0004	0.3137	0.0000	0.3137
C1	10.4741	0.1782	0.1782	31.8686	0.0000	31.8686
C2	8.1341	0.9276	0.9276	23.1086	0.0000	23.1086
C3	10.6274	3.9861	3.9861	24.4277	0.0000	24.4277
i-C4	3.7605	2.7200	2.7200	5.9225	0.0000	5.9225
n-C4	6.3765	5.5996	5.5996	7.9907	0.0000	7.9907
i-C5	4.4553	5.2958	5.2958	2.7089	0.0000	2.7089
n-C5	3.2802	4.1474	4.1474	1.4782	0.0000	1.4782
HEXANES	3.8422	5.4019	5.4019	0.6014	0.0000	0.6014
HEPTANES	9.2377	13.4660	13.4660	0.4516	0.0000	0.4516
OCTANES	9.4012	13.8616	13.8616	0.1327	0.0000	0.1327
NONANES	4.7006	6.9527	6.9527	0.0208	0.0000	0.0208
BENZENE	0.7051	1.0123	1.0123	0.0667	0.0000	0.0667
TOLUENE	2.1153	3.1087	3.1087	0.0509	0.0000	0.0509
E-BENZENE	0.4701	0.6946	0.6946	0.0034	0.0000	0.0034
XYLENE	4.5167	6.6768	6.6768	0.0279	0.0000	0.0279
n-C6	2.5547	3.6379	3.6379	0.3038	0.0000	0.3038
C10+	15.0725	22.3226	22.3226	0.0074	0.0000	0.0074
MOL. WT. =	80.65	102.24	102.24	35.78	0.00	35.78
GAS GRAVTY =				1.23	0.00	1.23
GROSS HEATING VALUE, Btu/scf =				4519.20	0.00	4519.20
GAS OIL RATIO, scf/Barrel =		465.31				

OIL CHARACTERIZATION AT 100 F (BASED ON PENG-ROBINSON MODEL)

BP, psia =	462.23	27.89	27.89
RVP,psia =	129.84	18.10	18.10
SP. GR. =	0.688	0.738	0.738

(NOTE: SP. GR. OF SALES OIL IS 0.744
BASED ON INPUT API GRAVTY AND ADJUSTED TO 86.0 F)

CALCULATION DETAILS PAGE 2 of 2

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 6a (NDR)

Production Rate : 12.00 Barrels per Day

Separator Pressure, psig	:	570.00	
Separator Temperature, F	:	86.00	
Tank Inlet Temperature, F	:	86.00	
C10+ Characterization	:	Mol. Weight Method	
Flash Loss at Tank Inlet	:	Adiabatic flash	
Working and Standing Losses	:	AP-42 Method	
API Gravity of Sales Oil	:	55.50	
RVP of Sales Oil, psia	:	11.10	
TANK DIAMETER & HEIGHT, ft	:	12.0	15.0
AVG STOCK LIQUID HEIGHT, ft	:	8.0	
BREATHER VENT P SETTING, psi	:	0.120	
TANK SOLAR ABSORBANCE	:	0.540	
SOLAR INSOLATION,Btu/ft2.day	:	1437.000	
DAILY AMBIENT T MIN & MAX, F	:	35.4	63.2
TANK LIQUID BULK T, F	:	86.0	

REPORT BASIS: 12.00 BARRELS PER DAY

COMPONENT	MOL. WT.	MOLE %	Lbs/Hr	Tons/Yr
CO2	44.01	0.5145	0.139	0.609
N2	28.01	0.3137	0.054	0.236
C1	16.04	31.8686	3.138	13.747
C2	30.07	23.1086	4.266	18.683
C3	44.10	24.4277	6.613	28.963
i-C4	58.12	5.9225	2.113	9.256
n-C4	58.12	7.9907	2.851	12.488
i-C5	72.15	2.7089	1.200	5.255
n-C5	72.15	1.4782	0.655	2.868
HEXANES	84.00	0.6014	0.310	1.358
HEPTANES	97.00	0.4516	0.269	1.178
OCTANES	111.00	0.1327	0.090	0.396
NONANES	123.00	0.0208	0.016	0.069
BENZENE	78.11	0.0667	0.032	0.140
TOLUENE	92.13	0.0509	0.029	0.126
E-BENZENE	106.17	0.0034	0.002	0.010
XYLENE	106.17	0.0279	0.018	0.080
n-C6	86.18	0.3038	0.161	0.704
C10+	145.00	0.0074	0.007	0.029

POSSIBLE VAPOR RECOVERY = 5.58 mscfd

File: c:\api\site6\S6ASEP-A.REP File time stamp: 01/10/97 10:22 Current time: 01/10/97 10:35 Page 3

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 6a (NDR)

DESCRIPTIONS : 12 bbl/day
Separator T=90 F P=570 psig

API Gravity=55.5 RVP=11.1

SAMPLE IDENTIFICATION:

COMPONENT	MOL. WT.	SEPARATOR LIQUID, MOLE %
CO2	44.010	0.1737
N2	28.013	0.1022
C1	16.043	10.4741
C2	30.070	8.1341
C3	44.097	10.6274
i-C4	58.124	3.7605
n-C4	58.124	6.3765
i-C5	72.151	4.4553
n-C5	72.151	3.2802
HEXANES	84.000	3.8422
HEPTANES	97.000	9.2377
OCTANES	111.000	9.4012
NONANES	123.000	4.7006
BENZENE	78.110	0.7051
TOLUENE	92.130	2.1153
E-BENZENE	106.170	0.4701
XYLENE	106.170	4.5167
n-C6	86.178	2.5547
C10+	145.000	15.0725

SUMMARY

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 6a (NDR)

Production Rate : 12.00 Barrels per Day

Separator Pressure, psig	:	570.00
Separator Temperature, F	:	86.00
Tank Inlet Temperature, F	:	86.00
C10+ Characterization	:	Mol. Weight Method
Flash Loss at Tank Inlet	:	Adiabatic flash
Working and Standing Losses	:	Multi-Stage Distillation
API Gravity of Sales Oil	:	55.50
RVP of Sales Oil, psia	:	11.10
GAS/AIR INPUT	:	No
HEAT INPUT	:	No

************************* WARNING *************************
* Cannot match specified RVP. Only flash loss reported. *
****

TOTAL HAPs	=	1.168	Tons per Year
BENZENE	=	0.154	Tons per Year
TOLUENE	=	0.140	Tons per Year
E-BENZENE	=	0.011	Tons per Year
XYLENE	=	0.088	Tons per Year
n-HEXANE	=	0.775	Tons per Year
TOTAL HC	=	105.203	Tons per Year
VOCs, C2+	=	91.288	Tons per Year
VOCs, C3+	=	71.058	Tons per Year

File: c:\api\site6\S6ASEP.REP File time stamp: 01/10/97 09:20 Current time: 01/10/97 09:51 Page 1

CALCULATION DETAILS PAGE 1 of 2

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 6a (NDR)

Production Rate : 12.00 Barrels per Day

Separator Pressure, psig	:	570.00
Separator Temperature, F	:	86.00
Tank Inlet Temperature, F	:	86.00
C10+ Characterization	:	Mol. Weight Method
Flash Loss at Tank Inlet	:	Adiabatic flash
Working and Standing Losses	:	Multi-Stage Distillation
API Gravity of Sales Oil	:	55.50
RVP of Sales Oil, psia	:	11.10
GAS/AIR INPUT	:	No
HEAT INPUT	:	No

REPORT BASIS: 1 MOLE SEPARATOR OIL INPUT

	OIL PHASE			VAPOR PHASE		
	SEPARATOR OIL	FLASH OIL	SALES OIL	FLASH GAS	WORKING & STANDING	TOTAL VENT
MOLE BASIS	1.0000	0.6751	0.6484	0.3249	0.0267	0.3516
COMPONENT	MOLE %	MOLE %	MOLE %	MOLE %	MOLE %	MOLE %
CO2	0.1737	0.0097	0.0000	0.5145	0.2455	0.4941
N2	0.1022	0.0004	0.0000	0.3137	0.0102	0.2907
C1	10.4741	0.1782	0.0000	31.8686	4.5114	29.7940
C2	8.1341	0.9276	0.0146	23.1086	23.1312	23.1104
C3	10.6274	3.9861	2.2169	24.4277	47.0215	26.1411
i-C4	3.7605	2.7200	2.5047	5.9225	7.9575	6.0768
n-C4	6.3765	5.5996	5.4163	7.9907	10.0588	8.1475
i-C5	4.4553	5.2958	5.3808	2.7089	3.2291	2.7484
n-C5	3.2802	4.1474	4.2453	1.4782	1.7668	1.5001
HEXANES	3.8422	5.4019	5.5939	0.6014	0.7301	0.6111
HEPTANES	9.2377	13.4660	13.9964	0.4516	0.5639	0.4601
OCTANES	9.4012	13.8616	14.4245	0.1327	0.1713	0.1356
NONANES	4.7006	6.9527	7.2373	0.0208	0.0298	0.0215
BENZENE	0.7051	1.0123	1.0505	0.0667	0.0827	0.0679
TOLUENE	2.1153	3.1087	3.2338	0.0509	0.0655	0.0520
E-BENZENE	0.4701	0.6946	0.7230	0.0034	0.0045	0.0035
XYLENE	4.5167	6.6768	6.9498	0.0279	0.0373	0.0286
n-C6	2.5547	3.6379	3.7722	0.3038	0.3722	0.3090
C10+	15.0725	22.3226	23.2399	0.0074	0.0109	0.0077
MOL. WT. =	80.65	102.24	104.61	35.78	44.49	36.44
GAS GRAVTY =				1.23	1.54	1.26
GROSS HEATING VALUE, Btu/scf =				4519.20	5576.04	4599.34

GAS OIL RATIO, scf/Barrel = 503.79

OIL CHARACTERIZATION AT 100 F (BASED ON PENG-ROBINSON MODEL)

BP, psia =	462.23	27.89	12.41
RVP,psia =	129.84	18.10	11.08
SP. GR. =	0.688	0.738	0.743

(NOTE: SP. GR. OF SALES OIL IS 0.732
BASED ON INPUT API GRAVTY AND ADJUSTED TO 112.3 F)

File: c:\api\site6\S6ASEP.REP File time stamp: 01/10/97 09:20 Current time: 01/10/97 09:51 Page 2

CALCULATION DETAILS PAGE 2 of 2

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 6a (NDR)

Production Rate : 12.00 Barrels per Day

Separator Pressure, psig	:	570.00
Separator Temperature, F	:	86.00
Tank Inlet Temperature, F	:	86.00
C10+ Characterization	:	Mol. Weight Method
Flash Loss at Tank Inlet	:	Adiabatic flash
Working and Standing Losses	:	Multi-Stage Distillation
API Gravity of Sales Oil	:	55.50
RVP of Sales Oil, psia	:	11.10
GAS/AIR INPUT	:	No
HEAT INPUT	:	No

REPORT BASIS: 12.00 BARRELS PER DAY

COMPONENT	MOL. WT.	MOLE %	Lbs/Hr	Tons/Yr
CO2	44.01	0.4941	0.145	0.633
N2	28.01	0.2907	0.054	0.237
C1	16.04	29.7940	3.177	13.914
C2	30.07	23.1104	4.619	20.230
C3	44.10	26.1411	7.661	33.557
i-C4	58.12	6.0768	2.348	10.282
n-C4	58.12	8.1475	3.147	13.786
i-C5	72.15	2.7484	1.318	5.773
n-C5	72.15	1.5001	0.719	3.151
HEXANES	84.00	0.6111	0.341	1.494
HEPTANES	97.00	0.4601	0.297	1.299
OCTANES	111.00	0.1356	0.100	0.438
NONANES	123.00	0.0215	0.018	0.077
BENZENE	78.11	0.0679	0.035	0.154
TOLUENE	92.13	0.0520	0.032	0.140
E-BENZENE	106.17	0.0035	0.002	0.011
XYLENE	106.17	0.0286	0.020	0.088
n-C6	86.18	0.3090	0.177	0.775
C10+	145.00	0.0077	0.007	0.032

POSSIBLE VAPOR RECOVERY = 6.05 mscfd

File: c:\api\site6\S6ASEP.REP File time stamp: 01/10/97 09:20 Current time: 01/10/97 09:51 Page 3

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 6b (COUNTY)

DESCRIPTIONS : 60 bbl/day
Separator T=80 F P=510 psig

API Gravity=58.4 RVP=15.0

SAMPLE IDENTIFICATION:

COMPONENT	MOL. WT.	SEPARATOR LIQUID, MOLE %
CO2	44.010	0.1500
N2	28.013	0.0900
C1	16.043	11.3511
C2	30.070	8.9609
C3	44.097	10.9611
i-C4	58.124	4.1904
n-C4	58.124	7.0307
i-C5	72.151	4.9705
n-C5	72.151	3.7404
HEXANES	84.000	3.8504
HEPTANES	97.000	8.9909
OCTANES	111.000	8.6909
NONANES	123.000	4.7105
BENZENE	78.110	0.7201
TOLUENE	92.130	2.1202
E-BENZENE	106.170	0.4600
XYLENE	106.170	4.2404
n-C6	86.178	2.3602
C10+	144.000	12.4112

SUMMARY

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 6b (COUNTY)

Production Rate : 60.00 Barrels per Day

Separator Pressure, psig	:	510.00	
Separator Temperature, F	:	72.00	
Tank Inlet Temperature, F	:	72.00	
C10+ Characterization	:	Mol. Weight Method	
Flash Loss at Tank Inlet	:	Adiabatic flash	
Working and Standing Losses	:	AP-42 Method	
API Gravity of Sales Oil	:	58.40	
RVP of Sales Oil, psia	:	15.00	
TANK DIAMETER & HEIGHT, ft	:	12.0	15.0
AVG STOCK LIQUID HEIGHT, ft	:	8.0	
BREATHER VENT P SETTING, psi	:	0.120	
TANK SOLAR ABSORBANCE	:	0.540	
SOLAR INSOLATION,Btu/ft2.day	:	1437.000	
DAILY AMBIENT T MIN & MAX, F	:	26.8	43.4
TANK LIQUID BULK T, F	:	72.0	

************************** WARNING **************************
• AP-42 failed for this case. Only flash loss reported. •
****

TOTAL HAPs	=	3.326	Tons per Year
BENZENE	=	0.492	Tons per Year
TOLUENE	=	0.403	Tons per Year
E-BENZENE	=	0.028	Tons per Year
XYLENE	=	0.221	Tons per Year
n-HEXANE	=	2.181	Tons per Year
TOTAL HC	=	478.154	Tons per Year
VOCs, C2+	=	400.701	Tons per Year
VOCs, C3+	=	295.263	Tons per Year

File: c:\api\site6\S6BSOLR2.REP File time stamp: 01/21/97 09:42 Current time: 01/21/97 09:46 Page 1

CALCULATION DETAILS PAGE 1 of 2

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 6b (COUNTY)

Production Rate : 60.00 Barrels per Day

Separator Pressure, psig :	510.00	
Separator Temperature, F :	72.00	
Tank Inlet Temperature, F :	72.00	
C10+ Characterization :	Mol. Weight Method	
Flash Loss at Tank Inlet :	Adiabatic flash	
Working and Standing Losses :	AP-42 Method	
API Gravity of Sales Oil :	58.40	
RVP of Sales Oil, psia :	15.00	
TANK DIAMETER & HEIGHT, ft :	12.0	15.0
AVG STOCK LIQUID HEIGHT, ft :	8.0	
BREATHER VENT P SETTING, psi:	0.120	
TANK SOLAR ABSORBANCE :	0.540	
SOLAR INSOLATION,Btu/ft2.day:	1437.000	
DAILY AMBIENT T MIN & MAX, F:	26.8	43.4
TANK LIQUID BULK T, F :	72.0	

REPORT BASIS: 1 MOLE SEPARATOR OIL INPUT

	--------- OIL PHASE ---------			------- VAPOR PHASE --------		
	SEPARATOR OIL	FLASH OIL	SALES OIL	FLASH GAS	WORKING & STANDING	TOTAL VENT
MOLE BASIS	1.0000	0.6724	0.6724	0.3276	0.0000	0.3276
COMPONENT	MOLE %	MOLE %	MOLE %	MOLE %	MOLE %	MOLE %
CO2	0.1500	0.0096	0.0096	0.4382	0.0000	0.4382
N2	0.0900	0.0004	0.0004	0.2740	0.0000	0.2740
C1	11.3511	0.2123	0.2123	34.2139	0.0000	34.2139
C2	8.9609	1.2201	1.2201	24.8492	0.0000	24.8492
C3	10.9611	4.9879	4.9879	23.2213	0.0000	23.2213
i-C4	4.1904	3.5294	3.5294	5.5471	0.0000	5.5471
n-C4	7.0307	7.0074	7.0074	7.0784	0.0000	7.0784
i-C5	4.9705	6.3270	6.3270	2.1862	0.0000	2.1862
n-C5	3.7404	4.9898	4.9898	1.1760	0.0000	1.1760
HEXANES	3.8504	5.5344	5.5344	0.3939	0.0000	0.3939
HEPTANES	8.9909	13.2416	13.2416	0.2663	0.0000	0.2663
OCTANES	8.6909	12.8914	12.8914	0.0692	0.0000	0.0692
NONANES	4.7105	7.0001	7.0001	0.0110	0.0000	0.0110
BENZENE	0.7201	1.0491	1.0491	0.0447	0.0000	0.0447
TOLUENE	2.1202	3.1381	3.1381	0.0310	0.0000	0.0310
E-BENZENE	0.4600	0.6833	0.6833	0.0019	0.0000	0.0019
XYLENE	4.2404	6.2992	6.2992	0.0148	0.0000	0.0148
n-C6	2.3602	3.4228	3.4228	0.1793	0.0000	0.1793
C10+	12.4112	18.4563	18.4563	0.0037	0.0000	0.0037
MOL. WT. =	77.06	97.96	97.96	34.16	0.00	34.16
GAS GRAVTY =				1.18	0.00	1.18
GROSS HEATING VALUE, Btu/scf =				4335.77	0.00	4335.77
GAS OIL RATIO, scf/Barrel =	488.40					

OIL CHARACTERIZATION AT 100 F (BASED ON PENG-ROBINSON MODEL)

BP, psia =	487.98	33.75	33.75
RVP,psia =	141.74	22.27	22.27
SP. GR. =	0.672	0.722	0.722

(NOTE: SP. GR. OF SALES OIL IS 0.739
BASED ON INPUT API GRAVTY AND ADJUSTED TO 72.0 F)

File: c:\api\site6\S6BSOLR2.REP File time stamp: 01/21/97 09:42 Current time: 01/21/97 09:46 Page 2

CALCULATION DETAILS PAGE 2 of 2

PRODUCTION TANK EMISSIONS MODEL (EPTANK v.3.0)

CASE TITLE : API Tanks Site 6b (COUNTY)

Production Rate : 60.00 Barrels per Day

Separator Pressure, psig	:	510.00	
Separator Temperature, F	:	72.00	
Tank Inlet Temperature, F	:	72.00	
C10+ Characterization	:	Mol. Weight Method	
Flash Loss at Tank Inlet	:	Adiabatic flash	
Working and Standing Losses	:	AP-42 Method	
API Gravity of Sales Oil	:	58.40	
RVP of Sales Oil, psia	:	15.00	
TANK DIAMETER & HEIGHT, ft	:	12.0	15.0
AVG STOCK LIQUID HEIGHT, ft	:	8.0	
BREATHER VENT P SETTING, psi	:	0.120	
TANK SOLAR ABSORBANCE	:	0.540	
SOLAR INSOLATION,Btu/ft2.day	:	1437.000	
DAILY AMBIENT T MIN & MAX, F	:	26.8	43.4
TANK LIQUID BULK T, F	:	72.0	

REPORT BASIS: 60.00 BARRELS PER DAY

COMPONENT	MOL. WT.	MOLE %	Lbs/Hr	Tons/Yr
CO2	44.01	0.4382	0.621	2.721
N2	28.01	0.2740	0.247	1.083
C1	16.04	34.2139	17.683	77.453
C2	30.07	24.8492	24.072	105.438
C3	44.10	23.2213	32.989	144.493
i-C4	58.12	5.5471	10.387	45.496
n-C4	58.12	7.0784	13.255	58.055
i-C5	72.15	2.1862	5.082	22.258
n-C5	72.15	1.1760	2.733	11.972
HEXANES	84.00	0.3939	1.066	4.669
HEPTANES	97.00	0.2663	0.832	3.645
OCTANES	111.00	0.0692	0.247	1.084
NONANES	123.00	0.0110	0.044	0.191
BENZENE	78.11	0.0447	0.112	0.492
TOLUENE	92.13	0.0310	0.092	0.403
E-BENZENE	106.17	0.0019	0.006	0.028
XYLENE	106.17	0.0148	0.051	0.221
n-C6	86.18	0.1793	0.498	2.181
C10+	144.00	0.0037	0.017	0.074

POSSIBLE VAPOR RECOVERY = 29.30 mscfd

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PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 6b (COUNTY)

DESCRIPTIONS : 60 bbl/day
Separator T=80 F P=510 psig

API Gravity=58.4 RVP=15.0

SAMPLE IDENTIFICATION:

COMPONENT	MOL. WT.	SEPARATOR LIQUID, MOLE %
CO2	44.010	0.1500
N2	28.013	0.0900
C1	16.043	11.3511
C2	30.070	8.9609
C3	44.097	10.9611
i-C4	58.124	4.1904
n-C4	58.124	7.0307
i-C5	72.151	4.9705
n-C5	72.151	3.7404
HEXANES	84.000	3.8504
HEPTANES	97.000	8.9909
OCTANES	111.000	8.6909
NONANES	123.000	4.7105
BENZENE	78.110	0.7201
TOLUENE	92.130	2.1202
E-BENZENE	106.170	0.4600
XYLENE	106.170	4.2404
n-C6	86.178	2.3602
C10+	144.000	12.4112

SUMMARY

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 6b (COUNTY)

Production Rate : 60.00 Barrels per Day

Separator Pressure, psig	:	510.00
Separator Temperature, F	:	72.00
Tank Inlet Temperature, F	:	72.00
C10+ Characterization	:	Mol. Weight Method
Flash Loss at Tank Inlet	:	Adiabatic flash
Working and Standing Losses	:	Multi-Stage Distillation
API Gravity of Sales Oil	:	58.40
RVP of Sales Oil, psia	:	15.00
GAS/AIR INPUT	:	No
HEAT INPUT	:	No

************************** WARNING **************************
* Cannot match specified RVP. Only flash loss reported. *
****

TOTAL HAPs	=	3.642	Tons per Year
BENZENE	=	0.539	Tons per Year
TOLUENE	=	0.443	Tons per Year
E-BENZENE	=	0.031	Tons per Year
XYLENE	=	0.244	Tons per Year
n-HEXANE	=	2.385	Tons per Year
TOTAL HC	=	522.800	Tons per Year
VOCs, C2+	=	444.108	Tons per Year
VOCs, C3+	=	328.071	Tons per Year

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PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 6b (COUNTY)

Production Rate : 60.00 Barrels per Day

Separator Pressure, psig	:	510.00
Separator Temperature, F	:	72.00
Tank Inlet Temperature, F	:	72.00
C10+ Characterization	:	Mol. Weight Method
Flash Loss at Tank Inlet	:	Adiabatic flash
Working and Standing Losses	:	Multi-Stage Distillation
API Gravity of Sales Oil	:	58.40
RVP of Sales Oil, psia	:	15.00
GAS/AIR INPUT	:	No
HEAT INPUT	:	No

REPORT BASIS: 1 MOLE SEPARATOR OIL INPUT

	--------- OIL PHASE ---------			------- VAPOR PHASE --------		
	SEPARATOR OIL	FLASH OIL	SALES OIL	FLASH GAS	WORKING & STANDING	TOTAL VENT
MOLE BASIS	1.0000	0.6724	0.6484	0.3276	0.0240	0.3516
COMPONENT	MOLE %	MOLE %	MOLE %	MOLE %	MOLE %	MOLE %
CO2	0.1500	0.0096	0.0000	0.4382	0.2696	0.4267
N2	0.0900	0.0004	0.0000	0.2740	0.0104	0.2560
C1	11.3511	0.2123	0.0000	34.2139	5.9521	32.2863
C2	8.9609	1.2201	0.0475	24.8492	32.9252	25.4000
C3	10.9611	4.9879	3.6954	23.2213	39.9366	24.3614
i-C4	4.1904	3.5294	3.4009	5.5471	7.0055	5.6466
n-C4	7.0307	7.0074	6.9477	7.0784	8.6238	7.1838
i-C5	4.9705	6.3270	6.4649	2.1862	2.5995	2.2144
n-C5	3.7404	4.9898	5.1222	1.1760	1.4078	1.1918
HEXANES	3.8504	5.5344	5.7213	0.3939	0.4817	0.3999
HEPTANES	8.9909	13.2416	13.7188	0.2663	0.3360	0.2710
OCTANES	8.6909	12.8914	13.3648	0.0692	0.0904	0.0706
NONANES	4.7105	7.0001	7.2583	0.0110	0.0161	0.0114
BENZENE	0.7201	1.0491	1.0859	0.0447	0.0558	0.0454
TOLUENE	2.1202	3.1381	3.2527	0.0310	0.0402	0.0316
E-BENZENE	0.4600	0.6833	0.7084	0.0019	0.0025	0.0019
XYLENE	4.2404	6.2992	6.5314	0.0148	0.0199	0.0151
n-C6	2.3602	3.4228	3.5412	0.1793	0.2215	0.1822
C10+	12.4112	18.4563	19.1386	0.0037	0.0054	0.0038
MOL. WT. =	77.06	97.96	100.04	34.16	41.72	34.67
GAS GRAVTY =				1.18	1.44	1.20
GROSS HEATING VALUE, Btu/scf =				4335.77	5250.34	4398.15
GAS OIL RATIO, scf/Barrel =		525.84				

OIL CHARACTERIZATION AT 100 F (BASED ON PENG-ROBINSON MODEL)

BP, psia =	487.98	33.75	16.97
RVP,psia =	141.74	22.27	15.01
SP. GR. =	0.672	0.722	0.726

(NOTE: SP. GR. OF SALES OIL IS 0.730
BASED ON INPUT API GRAVTY AND ADJUSTED TO 90.5 F)

CALCULATION DETAILS PAGE 2 of 2

PRODUCTION TANK EMISSIONS MODEL [EPTANK v.3.0]

CASE TITLE : API Tanks Site 6b (COUNTY)

Production Rate : 60.00 Barrels per Day

Separator Pressure, psig	:	510.00
Separator Temperature, F	:	72.00
Tank Inlet Temperature, F	:	72.00
C10+ Characterization	:	Mol. Weight Method
Flash Loss at Tank Inlet	:	Adiabatic flash
Working and Standing Losses	:	Multi-Stage Distillation
API Gravity of Sales Oil	:	58.40
RVP of Sales Oil, psia	:	15.00
GAS/AIR INPUT	:	No
HEAT INPUT	:	No

REPORT BASIS: 60.00 BARRELS PER DAY

COMPONENT	MOL. WT.	MOLE %	Lbs/Hr	Tons/Yr
CO2	44.01	0.4267	0.651	2.853
N2	28.01	0.2560	0.249	1.090
C1	16.04	32.2863	17.966	78.693
C2	30.07	25.4000	26.493	116.037
C3	44.10	24.3614	37.262	163.208
i-C4	58.12	5.6466	11.384	49.862
n-C4	58.12	7.1838	14.483	63.437
i-C5	72.15	2.2144	5.542	24.273
n-C5	72.15	1.1918	2.983	13.064
HEXANES	84.00	0.3999	1.165	5.103
HEPTANES	97.00	0.2710	0.912	3.994
OCTANES	111.00	0.0706	0.272	1.191
NONANES	123.00	0.0114	0.049	0.213
BENZENE	78.11	0.0454	0.123	0.539
TOLUENE	92.13	0.0316	0.101	0.443
E-BENZENE	106.17	0.0019	0.007	0.031
XYLENE	106.17	0.0151	0.056	0.244
n-C6	86.18	0.1822	0.545	2.385
C10+	144.00	0.0038	0.019	0.083

POSSIBLE VAPOR RECOVERY = 31.55 mscfd

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Appendix B

SAMPLING AND ANALYTICAL METHODS

SURFACE FLUID SAMPLING OF BLACK OIL RESERVOIRS

Separator Liquid Collection

The separator liquid sample collection point should be upstream of any metering device or flow restriction to ensure single phase flow. There is often a temperature reduction on the separator liquid flowline, but this does not alter the sample integrity. Conversely, if the flowline temperature is in excess of the operating temperature of the separator, it is advisable to sample directly from the sight gauge on the separator.

Care must be taken when sampling from the separator sight gauge. The upper and lower values installed on sight gauges have restricted flow orifices and check valves. Therefore, as fluids are removed through sight gauge valves, there is a preferred flow of the gas phase through the top valve. One must maintain the liquid level above the bottom sight glass valve while collecting the separator liquid samples. If the liquid level is allowed to decrease to the point of sample collection, excess gas will be drawn into the cylinder with the separator liquid, voiding the validity of the separator liquid sample.

Flexible lines used to connect the sample source to the sample cylinder should be as short as possible. One should check for entrained water in the liquid source stream. Water and any other contaminant must be removed completely prior to the collection of any separator liquid samples. It is advisable to re-check the sampling points and line for contaminants after completing the sampling procedure to ensure proper samples have been collected.

Separator Liquid Collection - Evacuated Cylinder Method

1. The cylinders should be evacuated by the laboratory before being sent to the field.

2. Select a sample point from which a representative first stage separator liquid sample can be collected.

3. Compare the pressure and temperature of the sample source to the maximum operating pressure and the current temperature of the sample cylinder to ensure that the cylinder will safely contain the liquid sample. The cylinder temperature should not be more than 10°F (6°C) lower than the source temperature. If it is, this technique should not be used. Low cylinder temperatures often cause the cylinder to fill completely with liquid, thus resulting in a serious hazardous situation when the cylinder is allowed to warm. To prevent the hazardous situation, an alternate technique, such as the Liquid Displacement Method, should be used. The cylinder must be an approved type with a current certification date for sample transport to the laboratory. In the United States, the cylinder must be an approved type with a current certification date for sample transportation to the laboratory. In the United States, the cylinder must be approved by the U.S. Department Of Transportation, while transporting a cylinder in many international locations requires certification by Lloyd's Register Industrial Services.

Separator Liquid Collection - Evacuated Cylinder Method

4. Connect the sampling line to the liquid source and the sample cylinder in the manner shown in Figure B-1, leaving the fitting on the cylinder end of the connector line finger tight.

5. Slowly purge the sample line to displace air and to vent sufficient liquid to clean the sample point and sampling system.

6. With a wrench, properly tighten the connecting line fitting to the cylinder fitting.

7. With the sample line purged and full of liquid and the separator liquid source valve fully open, hold cylinder in a vertical position with the inlet valve at the bottom and slowly (but fully) open the lower cylinder valve to admit liquid into the container. Refer to Figure B-1.

8. When the liquid stops flowing into the cylinder, close the inlet valve before moving the cylinder out of the vertical position. The sample collected in this manner will be in two phases, gas and liquid. The sample cylinder will have some portion of its volume as gas cap, which can safely accommodate any liquid expansion if the cylinder temperature increases during shipment to the laboratory.

9. Close the valves from the sample source and de-pressurize the connect line. Dismantle the sampling assembly and install the blow plug in the sample cylinder valve used for sample entry.

10. Fill in information on the sample tag as completely and accurately as possible and attach the tag to the sample cylinder. Also on a separate sheet of paper, make a list of all of the information recorded on the cylinder tag along with the cylinder number. Prepare the information for all cylinders involved in the sample collection on the sheet of paper for separate mailing to the laboratory.

11. Repeat the above procedures using all separator liquid cylinders provided.

NOTES:

Item Number 8

The (safe) situation of having a two phase system in the container will not change to an unsafe single liquid phase situation unless one or more of the following is allowed to occur:

1. Sample container is agitated while filling.

2. Containers being filled are much colder than the separator.

3. Containers are left on the pressure source for an extended length of time. It is not important to have the container completely full of sample. The representative liquid has been admitted to the cylinder and is not altered in composition; it merely has been flashed to a two phase condition for transport to the laboratory. When this sample is received in the laboratory, it is pressured up to considerably above the source pressure by mercury injection prior to removal of any portion of the contents. During the repressurization, the saturation pressure is measured to check the validity of the sampled contained. If the saturation pressure obtained does not approximate the separator conditions, any subsequent analysis performed using the sample will be in error.

Medium gravity, 20 to 27 API crude oils are particularly susceptible to foaming and, if sampled directly into an evacuated cylinder, could result in obtaining a cylinder virtually full of gas with a small amount of foamy oil. The procedure of sampling a liquid by gas displacement is used to overcome this potential foaming problem. The description of this procedure begins below.

Separator Liquid Collection - Gas Displacement Method

1. Select a sample point from which a representative first stage separator liquid sample can be collected.

2. Compare the pressure of the sample source to the maximum operating pressure of the sample cylinder to ensure that the cylinder safely contain the liquid sample. The cylinder must be an approved type with a current certification date for sample transport to the laboratory. In the United States, the cylinder must be approved by the U.S. Department of Transportation, while transporting a cylinder in many international locations requires certification by Lloyd's Register Industrial Services.

3. Fill the cylinder to be used for collecting separator liquid sample with equilibrium separator gas as per the procedure outlined in Separator Gas Collection - Evacuated Cylinder Method.

4. Connect the sampling line to the liquid sample source and to the gas filled liquid sample cylinder in the conventional manner shown in Figure B-1 leaving the fitting on the cylinder end of the connecting line finger tight.

5. Slowly purge the sample line to displace air and to vent enough liquid to clean the sample point and sampling system.

6. With a wrench, properly tighten the connecting line fitting to the cylinder fitting.

Separator Liquid Collection - Gas Displacement Method

7. With the sample line purged and full of liquid and the sample source valve fully opened, hold the cylinder in a vertical position as indicated in Figure B-1, with inlet valve at the bottom and <u>fully</u> open the lower cylinder valve.

8. Holding the cylinder vertical, <u>slowly</u> open the top valve of the cylinder to bleed gas at a <u>very low</u> rate. The low bleeding rate is necessary so no appreciable pressure drop occurs in the sampling system, thus maintaining the separator liquid in one phase while it enters the sample cylinder.

9. When separator liquid flows from the top valve, close first the top valve and second the bottom valve of the cylinder. Close the valve from the source and depressurize the sampling system.

10. Disconnect the sample cylinder from the sampling hose.

11. Holding the cylinder vertical, in a single motion <u>quickly</u> release a small amount of liquid from the bottom valve. This will relieve the dangerous situation of having a cylinder <u>completely</u> filled with liquid for transport to the laboratory without altering the sample. Creating a gas cap in this manner can easily alter the sample composition. In order to prevent the alternation of the sample composition, <u>the outline must be taken in one quick motion.</u>

12. Install blow plugs securely in both valves.

13. Fill in information on the sample tag as completely and accurately as possible and attach to the sample cylinder.

14. On a separate sheet of paper, list the cylinder number with all of the information recorded on the sample cylinder tag. Include this information for all cylinders involved in the sample collection on this same sheet of paper. Send this information under separate cover to the laboratory.

15. Repeat the above procedure using all separator liquid cylinders provided.

NOTES:

Medium gravity, 20 to 27 API, crude oils are particularly susceptible to foaming and if sampled directly into an evacuated cylinder, could result in obtaining a cylinder virtually full of gas with a small amount of foamy oil. The procedure of sampling a liquid by gas or liquid displacement is used to overcome this potential foaming problem.

Separator Liquid Collection - Liquid Displacement Method

1. Fill the cylinder with a suitable liquid which is more dense than, and immiscible with the separator liquid. Suitable liquids for use are displacement media which are: mercury, brine, glycol/water mixtures and water. The latter three should not be used in sour systems.

Separator Liquid Collection - Liquid Displacement Method

2. Select a sample point from which a representative first stage separator sample can be collected.

3. Compare the pressure of the sample source to the maximum operating pressure of the sample cylinder to ensure that the cylinder will safely contain the liquid sample. The cylinder must be an approved type with a current certification date for sample transport to the laboratory. In the United States, the cylinder must be approved by the U.S. Department of Transportation, while transporting a cylinder in many international locations requires certification by Lloyd's Register Industrial Services.

4. Connect the sample line to the separator liquid source and to the sample cylinder in a manner as shown in Figure B-2, leaving the fitting on the cylinder end of the connector line finger tight.

5. Partially open the separator liquid source valve, allowing a slow displacement of air from the connecting line. Continue venting sufficient liquid to clean the sample point and sampling system.

6. With a wrench, properly tighten the connecting line to the cylinder fitting.

7. Fully open the separator liquid source valve.

8. Maintain the cylinder in a vertical position with the inlet valve at the top throughout the sample collection procedure.

9. Fully open the upper cylinder valve.

10. With the cylinder perfectly vertical, slowly open the bottom valve of the cylinder to allow a slow (small) stream of displacement liquid to drain into a graduated cup.

11. Maintain the slow rate of displacement liquid removal so that no appreciable pressure drop occurs in the sampling system. One must not rush this procedure.

12. When 90% of the sample cylinder volume has been collected, close first the bottom valve and then the top valve of the sample cylinder.

13. With the top valve of the cylinder closed, slowly drain from the bottom of cylinder the remaining 10% of the displacement liquid. Close the bottom valve of the sample cylinder immediately when the separator liquid appears. Creating a gas cap in this manner is easily accomplished, perfectly safe and of very little risk to the integrity of the sample.

14. Close the valve from sample source and depressurize the sampling system.

15. Disconnect the sample cylinder from the sampling hose.

16. Securely install blow plugs into both sample cylinder valves.

17. Fill in information on the sample tags as completely and accurately as possible and attach to the sample cylinder.

18. On a separate sheet of paper, list the cylinder number with all of the information recorded on the sample cylinder tag. Include this information for all cylinders involved in the sample collection on this same sheet of paper. Send this information under separate cover to the laboratory.

19. Repeat the above procedure using all separator liquid cylinders provided.

Notes:

The Liquid Displacement sampling technique is generally utilized when collecting LPG and NGL samples. This procedure ensures a good gas cap inside the cylinder. Samples of these products can be extremely dangerous if the cylinder is absolutely liquid filled and allowed to warm while in transport to the laboratory.

Notes:

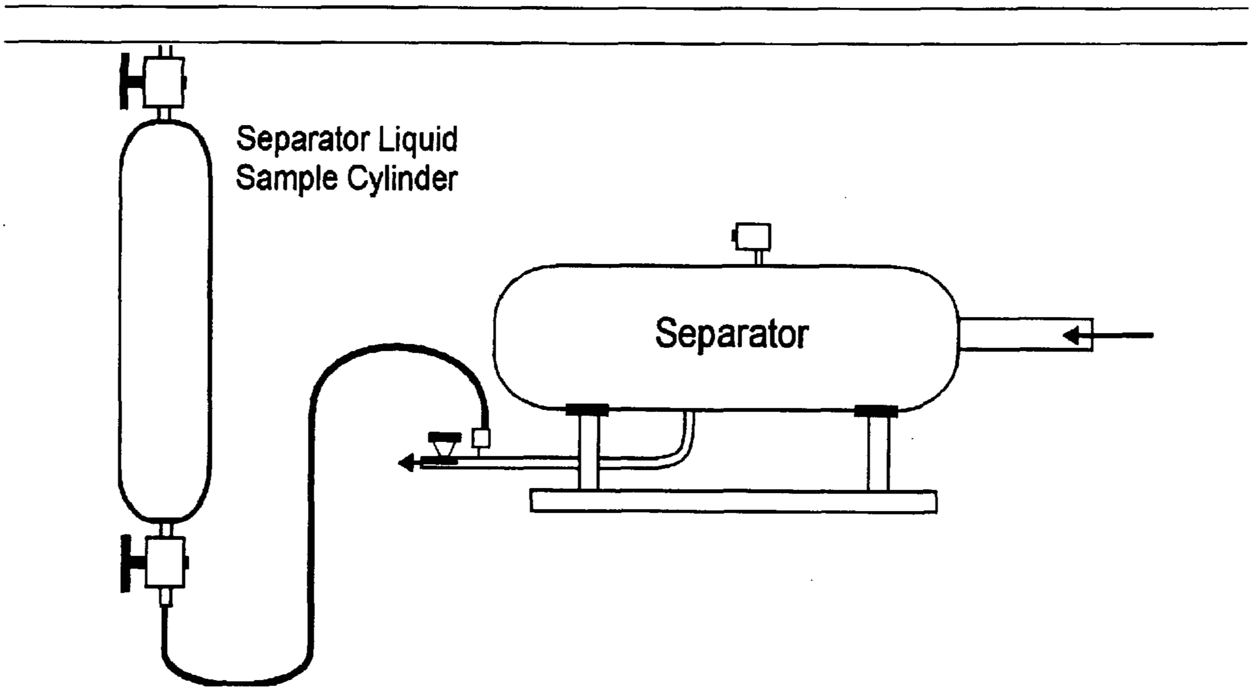


**Figure B-1 Separator Liquid Collection
Evacuated Cylinder Method
&
Gas Displacement Method**

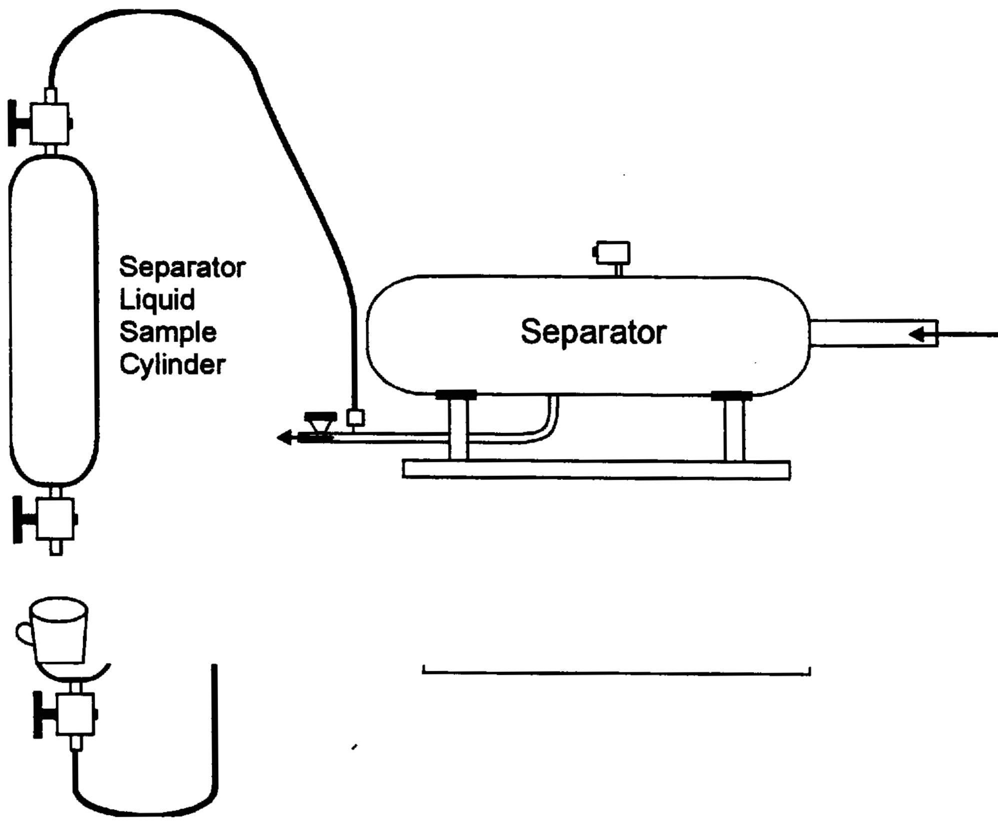


Figure B-2 Separator Liquid Collection
Liquid Displacement Method

Sampling Protocol
Separator Gas Option

The gas sampling method is important for accurate modeling results. The separator gas sample is typically collected from the gas line at the low pressure separator outlet. Operators have sampled separator gas for years by attaching a canister or high pressure cylinder directly to the separator's gas sampling port. The GRI-GlyCalc manual (GRI, 1996) recommends employing a manifold to remove entranced liquids from the sample probe when collecting the sample from the gas line. The manifold is necessary when measuring low concentration components such as HAPs (benzene, toluene, ethyl-benzene, xylene and x-hexane). The manual recommends the Gas Processors Association (GPA) standard 2166 as a gas sampling reference. Also, the manual indicates a modified EPA method T0-14, normally used for ambient air sampling, as a satisfactory method for gas sampling.

Appendix C

QUALITY CONTROL DATA

API TANKS: RELATIVE PERCENT DIFFERENCE OF DUPLICATE SAMPLES
SEPARATOR OIL DUPLICATES

Compound	Site 1 RPD (%)	Site 2 RPD (%)	Site 3 RPD (%)	Site 4 RPD (%)	Site 5 RPD (%)	Site 6a RPD (%)	Site 6b RPD (%)
Nitrogen	0	NC	0	0	0	NC	NC
Carbon Dioxide	0	NC	5.7	0	5.9	NC	NC
Methane	5.6	NC	2	2.5	5.3	NC	NC
Ethane	0	NC	2.8	1	6.7	NC	NC
Propane	0.3	NC	2.1	0.7	2.8	NC	NC
i-Butane	0	NC	1.9	0.5	2.1	NC	NC
n-Butane	0.8	NC	1.7	0.7	0.9	NC	NC
i-Pentane	1.2	NC	2	1.1	0	NC	NC
n-Pentane	0.9	NC	1.8	1	1	NC	NC
n-Hexane	0.4	NC	1.7	0.6	0.4	NC	NC
Hexanes	2	NC	1.9	0.4	2.8	NC	NC
Heptanes	1.1	NC	1.8	0.2	1.4	NC	NC
Octanes	1	NC	1.8	0.4	0.6	NC	NC
Nonanes	0.6	NC	2.2	0.6	0.1	NC	NC
Decanes+	0.8	NC	3.8	0.2	0.4	NC	NC
Benzene	6.9	NC	1.5	0	0.6	NC	NC
Toluene	0	NC	3.5	2.2	3.4	NC	NC
Ethylbenzene	0	NC	2.2	2.4	6.6	NC	NC
Xylenes	4.7	NC	1.7	1.1	0.3	NC	NC
Decanes+ Spec Grav	0.4	NC	2.4	0	0	NC	NC
Decanes+ Mol. Weight	0.1	NC	2.8	0	0	NC	NC

API TANKS: RELATIVE PERCENT DIFFERENCE OF DUPLICATE SAMPLES

SEPARATOR GAS DUPLICATES

Compound	Site 1 RPD (%)	Site 2 RPD (%)	Site 3 RPD (%)	Site 4 RPD (%)	Site 5 RPD (%)	Site 6a RPD (%)	Site 6b RPD (%)
Nitrogen	3.2	NC	0	200	0	NC	NC
Carbon Dioxide	6.5	NC	6	18	0.4	NC	NC
Methane	0.0	NC	0.4	0.1	1.1	NC	NC
Ethane	0.0	NC	0.1	0.7	0.2	NC	NC
Propane	2.0	NC	0.9	0.5	0.9	NC	NC
i-Butane	0.6	NC	3.8	1.8	2.8	NC	NC
n-Butane	0.8	NC	4.5	2.3	3.8	NC	NC
i-Pentane	3.7	NC	11	2.3	3.7	NC	NC
n-Pentane	3.0	NC	11	8.7	7.6	NC	NC
n-Hexane	17.0	NC	10	1.8	3.2	NC	NC
Hexanes	18.0	NC	11	3.1	1.1	NC	NC
Heptanes	20.0	NC	17	15	0.4	NC	NC
Octanes	2.4	NC	12	26	2.9	NC	NC
Nonanes	18.0	NC	18	48	0	NC	NC
Decanes+	40.0	NC	22	131	61	NC	NC
Benzene	19.0	NC	17	8.7	3.3	NC	NC
Toluene	36.0	NC	36	2.3	5.6	NC	NC
Ethylbenzene	0.0	NC	0	31	67	NC	NC
Xylenes	33.0	NC	29	93	15	NC	NC

NC = Not Collected

API TANKS: RELATIVE PERCENT DIFFERENCE OF DUPLICATE SAMPLES

SALES OIL DUPLICATES

Compound	Site 1 RPD (%)	Site 2 RPD (%)	Site 3 RPD (%)	Site 4 RPD (%)	Site 5 RPD (%)	Site 6a RPD (%)	Site 6b RPD (%)
Nitrogen	NC	NC	0	NA	0	NC	NC
Carbon Dioxide	NC	NC	NM	NA	NM	NC	NC
Methane	NC	NC	0	NA	40	NC	NC
Ethane	NC	NC	0	NA	6.9	NC	NC
Propane	NC	NC	7.6	NA	3.5	NC	NC
i-Butane	NC	NC	1.9	NA	2.2	NC	NC
n-Butane	NC	NC	1.6	NA	1.2	NC	NC
i-Pentane	NC	NC	0.8	NA	0.4	NC	NC
n-Pentane	NC	NC	1.2	NA	0.6	NC	NC
n-Hexane	NC	NC	0.3	NA	0.5	NC	NC
Hexanes	NC	NC	0.3	NA	0.2	NC	NC
Heptanes	NC	NC	1	NA	0.7	NC	NC
Octanes	NC	NC	1.2	NA	1.2	NC	NC
Nonanes	NC	NC	0.4	NA	1.3	NC	NC
Decanes+	NC	NC	0.5	NA	0	NC	NC
Benzene	NC	NC	NR	NA	0.4	NC	NC
Toluene	NC	NC	NR	NA	1.2	NC	NC
Ethylbenzene	NC	NC	NR	NA	0	NC	NC
Xylenes	NC	NC	NR	NA	1.3	NC	NC
API Gravity	NC	NC	0.04	14	0.4	NC	NC
Reid Vapor Pressure	NC	NC	1.7	8.7	0.3	NC	NC

NC = Not Collected
NA = Not Analyzed
NR = Not Reported

API TANKS CANISTER SAMPLES DUPLICATE ANALYSES

RELATIVE PERCENT DIFFERENCES BETWEEN DUPLICATES

Site 1					Site 2			
Compound	Concentration Dup #1	Concentration Dup #2	Mean	RPD	Concentration Dup #1	Concentration Dup #2	Mean	RPD
Oxygen	2.15	2.09	2.12	2.8	4.64	4.43	4.54	4.6
Nitrogen	10.4	10.08	10.24	3.1	19.9	18.9	19.4	5.2
Carbon Dioxide	0.26	0.22	0.24	16.7	0.62	0.7	0.66	-12.1
Methane	41.79	42.25	42.02	-1.1	14.6	14.1	14.4	3.5
Ethane	97225	98911	98068	-1.7	159500	160900	160200	-0.9
Propane	197974	198622	198298	-0.3	333000	331400	332200	0.5
Isobutane	19615	19582	19598.5	0.2	54770	56050	55410	-2.3
n-Butane	83038	82836	82937	0.2	186400	192100	189250	-3.0
Isopentane	15100	15069	15084.5	0.2	41390	45190	43290	-8.8
n-Pentane	15267	15211	15239	0.4	57700	64850	61275	-11.7
n-Hexane	2364	2359	2361.5	0.2	21790	20910	21350	4.1
Benzene	160	162	161	-1.2	2450	2311	2381	5.8
Toluene	193	195	194	-1.0	1524	1229	1377	21.4
Ethylbenzene	44	44	44	0.0	275	224	250	20.4
m/p-Xylene	29	29	29	0.0	718	604	661	17.2
o-Xylene	13	14	13.5	-7.4	236	184	210	24.8
Hexanes	7937	7929	7933	0.1	38260	33060	35660	14.6
Heptanes	5249	5228	5238.5	0.4	32790	26330	29560	21.9
Octanes	1043	1027	1035	1.5	10970	8912	9941	20.7
Nonanes	151	153	152	-1.3	2481	1791	2136	32.3
Decanes +	15	27	21	-57.1	300	162	231	59.7

CANISTER SAMPLES RPD OF DUPLICATE ANALYSES

Site 3 Can 1 Compound	Concentration Dup #1	Concentration Dup #2	Mean	RPD
Oxygen	7.69	7.49	7.59	2.6
Nitrogen	28.5	25.6	27.05	10.7
Carbon Dioxide	3.57	3.78	3.675	-5.7
Methane	20.2	21.9	21.05	-8.1
Ethane	159478	163375	161427	-2.4
Propane	107216	111484	109350	-3.9
Isobutane	40204	41003	40604	-2.0
n-Butane	32750	33484	33117	-2.2
Isopentane	18027	18388	18208	-2.0
n-Pentane	8437	8594	8516	-1.8
n-Hexane	2783	2855	2819	-2.6
Benzene	2436	2470	2453	-1.4
Toluene	1590	1594	1592	-0.3
Ethylbenzene	48	47	48	2.1
m/p-Xylene	233	230	232	1.3
o-Xylene	46	43	45	6.7
Hexanes	7781	7946	7864	-2.1
Heptanes	4791	4801	4796	-0.2
Octanes	1075	1058	1067	1.6
Nonanes	236	192	214	20.6
Decanes +	87	44	66	65.6

Site 3 Can 4	Concentration Dup #1	Concentration Dup #2	Mean	RPD
Oxygen	3.31	3.28	3.295	0.9
Nitrogen	12.9	12.5	12.7	3.1
Carbon Dioxide	5.23	5.41	5.32	-3.4
Methane	27.4	25.1	26.25	8.8
Ethane	215991	226221	221106	-4.6
Propane	139837	147466	143652	-5.3
Isobutane	49595	52105	50850	-4.9
n-Butane	41066	42954	42010	-4.5
Isopentane	21732	22773	22253	-4.7
n-Pentane	9948	10407	10178	-4.5
n-Hexane	2939	3074	3007	-4.5
Benzene	2527	2634	2581	-4.1
Toluene	1204	1275	1240	-5.7
Ethylbenzene	18	19	18.5	-5.4
m/p-Xylene	94	93	93.5	1.1
o-Xylene	13	13	13	0.0
Hexanes	7618	8056	7837	-5.6
Heptanes	3601	3783	3692	-4.9
Octanes	414	431	422.5	-4.0
Nonanes	32	30	31	6.5
Decanes +	4	3	3.5	28.6

CANISTER SAMPLES RPD OF DUPLICATE ANLAYSES

Site 4 Can 4 Compound					Site 5 Can 4			
Oxygen	2.45	2.24	2.35	9.0	4.98	4.94	4.96	0.8
Nitrogen	9.44	8.8	9.12	7.0	18.2	18.2	18.20	0.0
Carbon Dioxide	0.59	0.57	0.58	3.4	0.46	0.46	0.46	0.0
Methane	31.4	31.5	31.45	-0.3	16.2	16.2	16.20	0.0
Ethane	132100	130200	131150	1.4	193435	195091	194263	-0.9
Propane	229100	229500	229300	-0.2	148242	147414	147828	0.6
Isobutane	84320	84240	84280	0.1	63728	63076	63402	1.0
n-Butane	105300	105300	105300	0.0	49432	48913	49173	1.1
Isopentane	36630	36490	36560	0.4	29675	29386	29531	1.0
n-Pentane	21670	21550	21610	0.6	13936	13786	13861	1.1
n-Hexane	4705	4674	4690	0.7	4291	4246	4269	1.1
Benzene	601	598	600	0.5	3422	3393	3408	0.9
Toluene	452	447	450	1.1	1900	1909	1905	-0.5
Ethylbenzene	21	20	21	4.9	37	37	37	0.0
m/p-Xylene	49	47	48	4.2	199	201	200	-1.0
o-Xylene	14	14	14	0.0	31	30	31	3.3
Hexanes	9465	9436	9451	0.3	11633	11547	11590	0.7
Heptanes	4009	3999	4004	0.2	6331	6324	6328	0.1
Octanes	341	345	343	-1.2	892	924	908	-3.5
Nonanes	18	15	17	18.2	85	83	84	2.4
Decanes +	4	0	2	200.0	11	6	9	58.8

Site 6b Can 3 Compound				
Oxygen	0	0	0	ERR
Nitrogen	0.63	20.6	11	-188.1
Carbon Dioxide	0	0	0	ERR
Methane	33.3	2.53	18	171.8
Ethane	250457	289389	269923	-14.4
Propane	239298	281688	260493	-16.3
Isobutane	52943	60859	56901	-13.9
n-Butane	71955	84457	78206	-16.0
Isopentane	18350	21462	19906	-15.6
n-Pentane	12495	12495	12495	0.0
n-Hexane	2258	2258	2258	0.0
Benzene	598	718	658	-18.2
Toluene	847	1011	929	-17.7
Ethylbenzene	20	28	24	-33.3
m/p-Xylene	145	193	169	-28.4
o-Xylene	29	40	35	-31.9
Hexanes	4960	4968	4964	-0.2
Heptanes	1653	2484	2069	-40.2
Octanes	165	149	157	10.2
Nonanes	17	0	9	200.0
Decanes +	0	0	0	ERR

API TANKS: ON-SITE GC CALIBRATION CHECKS

	Site 1 Calibration Check Samples		
	Date	9/29/95	
	Std Conc	On-Site Conc	Recovery
Compound	ppm	ppm	(%)
Nitrogen	2.5	2.69	107.6
Carbon Dioxide	NA	NA	
Methane	88.76	86.74	97.7
Ethane	3.48	3.66	105.2
Propane	9950	9840	98.9
i-Butane	3980	4356	109.4
n-Butane	3980	4334	108.9
i-Pentane	1480	1551	104.8
n-Pentane	1490	1545	103.7
n-Hexane	498	457	91.8
Hexanes			
Heptanes	196	209	106.6
Octanes			
Nonanes			
Decanes+			
Benzene			
Toluene			
Ethylbenzene			
Xylenes			

	Site 1 Calibration Check Samples		
	Date	9/29/95	
	Std Conc	On-Site	Recovery
Compound	ppm	ppm	(%)
Nitrogen	9.04	8.43	93.3
Carbon Dioxide	NA	NA	
Methane	63.8	65.32	102.4
Ethane	12.6	12.02	95.4
Propane	70300	70300	100.0
i-Butane	30100	OV	0.0
n-Butane	30000	OV	0.0
i-Pentane	5070	5115	100.9
n-Pentane	5060	4985	98.5
n-Hexane			
Hexanes			
Heptanes			
Octanes			
Nonanes			
Decanes+			
Benzene			
Toluene			
Ethylbenzene			
Xylenes			

	Site 1 Calibration Check Samples		
	Date	9/30/95	
	Std Conc	On-Site C	Recovery
Compound	ppm	ppm	(%)
Nitrogen			
Carbon Dioxide	NA	NA	
Methane			
Ethane	2001	1783	89.1
Propane	2004	1930	96.3
i-Butane			
n-Butane	101	93	92.1
i-Pentane			
n-Pentane	101	96.3	95.3
n-Hexane	2001	2077	103.8
Hexanes			
Heptanes			
Octanes			
Nonanes			
Decanes+			
Benzene	99	97.4	98.4
Toluene	99	96.4	97.4
Ethylbenzene	99	97.6	98.6
Xylenes	99	95.5	96.5

	Site 1 Calibration Check Samples		
	Date	9/30/95	
	Std Conc	On-Site Conc	Recovery
Compound	ppm	ppm	(%)
Nitrogen	9.04	8.87	98.1
Carbon Dioxide	NA	NA	
Methane	63.8	63.95	100.2
Ethane	12.6	12.3	97.6
Propane	70300	69480	98.8
i-Butane	30100	OV	0.0
n-Butane	30000	OV	0.0
i-Pentane	5070	5039	99.4
n-Pentane	5060	4781	94.5
n-Hexane			
Hexanes			
Heptanes			
Octanes			
Nonanes			
Decanes+			
Benzene			
Toluene			
Ethylbenzene			
Xylenes			

	Site 1 Calibration Check Samples		
	Date	9/30/95	
	Std Conc	On-Site	Recovery
Compound	ppm	ppm	(%)
Nitrogen	2.5	2.73	109.2
Carbon Dioxide	NA	NA	
Methane	88.76	85.1	95.9
Ethane	3.48	3.86	110.9
Propane	9950	9840	98.9
i-Butane	3980	5574	140.1
n-Butane	3980	5568	139.9
i-Pentane	1480	1686	113.9
n-Pentane	1490	1706	114.5
n-Hexane	498	454	91.2
Hexanes			
Heptanes	196	210	107.1
Octanes			
Nonanes			
Decanes+			
Benzene			
Toluene			
Ethylbenzene			
Xylenes			

	Site 1 Calibration Check Samples		
	Date	10/01/95	
	Std Conc	On-Site C	Recovery
Compound	ppm	ppm	(%)
Nitrogen		94.1	
Oxygen	0.5	0.48	96.0
Methane			
Ethane	2001	1746	87.3
Propane	2004	1895	94.6
i-Butane			
n-Butane	101	89.9	89.0
i-Pentane			
n-Pentane	101	94.9	94.0
n-Hexane	2001	2080	103.9
Hexanes			
Heptanes			
Octanes			
Nonanes			
Decanes+			
Benzene	99	97	98.0
Toluene	99	96	97.0
Ethylbenzene	99	95.7	96.7
Xylenes	99	96.2	97.2

Compound	Site 1 Calibration Check Samples Date Std Conc ppm	10/01/95 On-Site Conc ppm	Recovery (%)
Nitrogen	9.04	8.32	92.0
Methane (TCD)	63.8	63.2	99.1
Ethane (TCD)	12.6	12	95.2
Ethane (FID)	1010	1058	104.8
Propane (FID)	994	998	100.4
Propane (TCD)	7.03	6.86	97.6
n-Butane	973	925	95.1
i-Pentane			
n-Pentane	1010	984	97.4
n-Hexane	1000	953	95.3
Hexanes			
Heptanes			
Octanes			
Nonanes			
Decanes+			
Benzene			
Toluene			
Ethylbenzene			
Xylenes			

1 to 10 Dilution Compound	Site 1 Calibration Check Samples Date Std Conc ppm	10/01/95 On-Site ppm	Recovery (%)
Nitrogen	2.5	2.45	98.0
Carbon Dioxide	NA	NA	
Methane	88.76	85.98	96.9
Ethane	3.48	3.43	98.6
Propane	9950	9650	97.0
i-Butane	3980	4040	101.5
n-Butane	3980	4100	103.0
i-Pentane	1480	1540	104.1
n-Pentane	1490	1580	106.0
n-Hexane	498	515	103.4
Hexanes			
Heptanes	196	268	136.7
Octanes			
Nonanes			
Decanes+			
Benzene			
Toluene			
Ethylbenzene			
Xylenes			

1 to 5 Dilution Compound	Site 1 Calibration Check Samples Date Std Conc ppm	10/02/95 On-Site C ppm	Recovery (%)
Nitrogen	2.5	2.41	96.4
Carbon Dioxide	NA	NA	
Methane	88.76	87.9	99.0
Ethane	3.48	3.49	100.3
Propane	9950	6200	62.3
i-Butane	3980	ND	0.0
n-Butane	3980	ND	0.0
i-Pentane	1480	1435	97.0
n-Pentane	1490	1425	95.6
n-Hexane	498	430	86.3
Hexanes			
Heptanes	196	196	100.0
Octanes			
Nonanes			
Decanes+			
Benzene			
Toluene			
Ethylbenzene			
Xylenes			

API Tanks Site 3: FID Calibration Data
SITE 3 **FID CAL CHECKS**

Standard: Can Mix 236
Date: Tuesday, January 30, 1996
Time 15:50:52
Filename: AD0181

Compound	Standard Concentration (ppmV)	Measured Concentration (ppmV)	Recovery (%)
Methane	1020		0.0%
Ethane	1010	1143	113.2%
Propane	994	1093	110.0%
n-Butane	973	1025	105.3%
n-Pentane	1010	960.8	95.1%
n-Hexane	1000	964.2	96.4%

Standard: VOC Std 905
Date: Wednesday, January 31, 1996
Time: 16:35:36
Filename: AD04829

Compound	Standard Concentration (ppmV)	Measured Concentration (ppmV)	Recovery (%)
Ethane	2000	1733	86.7%
Propane	2004	1896	94.6%
n-Butane	101	120.3	119.1%
n-Pentane	101	97.6	96.6%
n-Hexane	2001	1821.4	91.0%
Benzene	99	94	94.9%
Toluene	99	95.5	96.5%
Ethylbenzene	99	107	108.1%
p-Xylene	99	107	108.1%

API Tanks Site 3: FID Calibration Data

Standard:	Short Cylinder Dilution		
Date:	Thursday, February 01, 1996		
Time:	13:44:29		
Filename:	AD07354		
Compound	Standard Concentration (ppmV)	Measured Concentration (ppmV)	Recovery (%)
Methane/Ethane	20068.8	17665	88.0%
Propane	1231.3	998	81.1%

SITE 3 **QC CAL CHECK SAMPLES**
FID DECTECTOR

Standard: Can Mix 236
Date: Tuesday, January 30, 1996
Time 07:59:58
Filename: AD0101

Compound	Standard Concentration (ppmV)	Measured Concentration (ppmV)	Recovery (%)
Methane	1020		0.0%
Ethane	1010		0.0%
Propane	994	1014.3	102.0%
n-Butane	973	973	100.0%
n-Pentane	1010	953.6	94.4%
n-Hexane	1000	956	95.6%

Standard: Short Cylinder Dilution
Date: Wednesday, January 31, 1996
Time: 09:03:59
Filename: AD03920

Compound	Standard Concentration (ppmV)	Measured Concentration (ppmV)	Recovery (%)
Methane/Ethane	29190.9	26311.5	90.1%
Propane	1790.9	2394.6	133.7%

Standard: VOC Std 905
Date: Thursday, February 01, 1996
Time: 08:10:05
Filename: AD06748

Compound	Standard Concentration (ppmV)	Measured Concentration (ppmV)	Recovery (%)
Ethane	2000	1666	83.3%
Propane	2004	1794	89.5%
n-Butane	101	92.7	91.8%
n-Pentane	101	92.6	91.7%
n-Hexane	2001	1798	89.9%
Benzene	99	91.3	92.2%
Toluene	99	92.9	93.8%
Ethylbenzene	99	97.6	98.6%
p-Xylene	99	97	98.0%

Standard: Can Mix 236
Date: Friday, February 02, 1996
Time 07:35:04
Filename: AD09576

Compound	Standard Concentration (ppmV)	Measured Concentration (ppmV)	Recovery (%)
Methane	1020		0.0%
Ethane	1010		0.0%
Propane	994	481.8	48.5%
n-Butane	973	433.4	44.5%
n-Pentane	1010	884.1	87.5%
n-Hexane	1000	898.8	89.9%

API Tanks Site 3: TCD Calibration Data
SITE 3 TCD CAL CHECK SAMPLES

Standard: Calorimetric
Date: Tuesday, January 30, 1996
Time 07:59:58
Filename: AC0101

Compound	Standard Concentration (mole%)	Measured Concentration (mole%)	Recovery (%)
Nitrogen	2.5	3.47	139.0%
Methane	88.76	63.68	71.7%
Ethane	3.48	3.53	101.5%
Propane			ERR

Standard: High Ethane
Date: Tuesday, January 30, 1996
Time 15:50:52
Filename: AC0181

Compound	Standard Concentration (mole%)	Measured Concentration (mole%)	Recovery (%)
Nitrogen	9.04	8.62	95.4%
Methane	63.8	62.75	98.4%
Ethane	12.6	12.79	101.5%
Propane	7.03	9.85	140.1%

Standard: Short Cylinder 1:10
Date: Wednesday, January 31, 1996
Time 09:03:59
Filename: AC03920

Compound	Standard Concentration (mole%)	Measured Concentration (mole%)	Recovery (%)
Nitrogen	6.592	5.43	82.3%
Methane	3.011	0.00	0.0%
Ethane	0.2	0.00	0.0%
Propane	0.197	0.00	0.0%

Standard: Large cylinder
Date: Wednesday, January 31, 1996
Time 16:35:35
Filename: AC04829

Compound	Standard Concentration (mole%)	Measured Concentration (mole%)	Recovery (%)
Nitrogen	15.06	13.92	92.4%
Methane	24.98	25.70	102.9%
Ethane	25.01	27.39	109.5%
Propane	24.97	25.15	100.7%

Standard: Large cylinder
Date: Thursday, February 01, 1996
Time 08:10:05
Filename: AC6748

Compound	Standard Concentration (mole%)	Measured Concentration (mole%)	Recovery (%)
Nitrogen	15.06	13.76	91.4%
Methane	24.98	25.97	104.0%
Ethane	25.01	27.59	110.3%
Propane	24.97	27.04	108.3%

Standard: Short cylinder
Date: Thursday, February 01, 1996
Time 13:44:42
Filename: AC7354

Compound	Standard Concentration (mole%)	Measured Concentration (mole%)	Recovery (%)
Nitrogen	65.92	61.34	93.1%
Methane	30.11	30.58	101.6%
Ethane	2.00	2.13	106.6%
Propane	1.97		0.0%

Standard: High Ethane
Date: Friday, February 02, 1996
Time 07:35:04
Filename: AC09576

Compound	Standard Concentration (mole%)	Measured Concentration (mole%)	Recovery (%)
Nitrogen	9.04	8.77	97.0%
Methane	63.8	63.60	99.7%
Ethane	12.6	13.54	107.5%
Propane	7.03	5.37	76.4%

Site 4 FID QC hecks

Date	Sunday, March 31, 1996			Sunday, March 31, 1996			Sunday, March 31, 1996			Monday, April 01, 1996		
Time	09:06			10:22			18:22			06:45		
Compound	3-03101 area	Cal. Conc. ppmv	rpd %	FF 4843 area	Cal. Conc. ppmv	rpd %	VOC 906 area	Cal. Conc. ppmv	rpd %	3-03101 area	Cal. Conc. ppmv	rpd %
methane	43573240	615,930	-30.61	40772928	576,346	91.41				43877936	620,237	-30.12
ethene							3261367	1,858	-7.10			
propane	21728626	8,988	-9.67	27511936	11,381	-42.23	4934220	2,041	1.85	21730494	8,989	-9.66
isobutane	13882616	3,622	-8.99	Standard is overrange on the FID						13966947	3,644	-8.44
butane	13503613	3,058	-23.16				346684	79	-22.27	14136159	3,201	-19.56
neopentane	3272595	0	-100.00							3959462	0	-100.00
isopentane	5383146	1,204	-18.64							6284582	1,406	-5.02
pentane	5000429	1,185	-20.50				423685	100	-0.62	6234934	1,477	-0.87
hexane	1704385	370	-25.77				8835079	1,916	-4.24	2401411	521	4.59
heptane	739422	130	-33.56							1085891	191	-2.44
benzene							509612	90	-9.45			
toluene							613344	99	0.14			
ethylbenzene							681919	102	3.00			
p-xylene							679793	102	2.91			
o-xylene												

Note: Conden ation in the lines and sample loops interfered with some analyses.

Site 4 FID QC							Standard against itself					
Date	Monday, April 01, 1996			Tuesday, April 02, 1996			Tuesday, April 02, 1996			Tuesday, April 02, 1996		
Time	16:11			09:54			09:54			16:06		
Compound	VOC 905	Cal. Conc.	rpd	HL 1868	Cal. Conc.	rpd	HL 1868	Cal	rpd	3-03161	Cal. Conc.	rpd
	area	ppmv	%	area	ppmv	%	area	area	%	area	ppmv	%
methane										44094044	623,292	-29.78
ethane	3259469	1,857	-7.15									
propane	4886885	2,021	0.67							21654398	8,958	-9.97
isobutane										14245976	3,717	-6.61
butane	337489	76	-24.33							14430511	3,268	-17.89
neopentane										4100767	0	-100.00
isopentane										6492060	1,452	-1.88
pentane	424970	101	-0.32							6484881	1,536	3.11
hexane	8861190	1,922	-3.95							2539744	551	10.61
heptane										1174942	207	5.57
benzene	515416	91	-6.42	3556397	626	36.06	3556397	3351950	6.16			
toluene	631623	102	3.12	3507197	567	10.72	3507197	3244772	8.09			
ethylbenzene	724296	106	9.40									
p-xylene	726104	109	10.22									
o-xylene				1739732	166	-25.46	1739732	2334114	-25.46			
Note: Conden												

SITE 4 TCD QC Checks

Date	Sunday, March 31, 1996			Sunday, March 31, 1996			Sunday, March 31, 1996		
Time	09:06			10:22			18:22		
Compound	FF4843 area	Cal. Conc. ppmv	rpd %	FF 4843 area	Cal. Conc. ppmv	rpd %	3-03101 area	Cal. Conc. ppmv	rpd %
oxygen	27618								
nitrogen	1144194	460,508	-30.14	1401686	564,141	-14.42	57,177	23,012	-7.95
methane	474651	308,543	2.47	521402	336,933	12.57	1,450,389	942,814	6.22
ethane	275595	95,887	379.43	110933	38,597	92.98	108,687	37,815	8.66
propane	w	0	-100.00	144086	44,540	126.09			

NOTE: Standard 4843 ethane and propane do not agree with other standards.

NOTE: Cond nsation in the lines and sample loops interfers with some analyses

SITE 4 TCD									
Date	Monday, April 01, 1996			Monday, April 01, 1996			Tuesday, April 02, 1996		
Time	09:41			18:11			09:54		
Compound	FF 4843	Cal. Conc.	rpd	Air	Cal. Conc.	rpd	3-03101	Cal. Conc.	rpd
	area	ppmv	%	area	ppmv	%	area	ppmv	%
oxygen				470043					
nitrogen	1439121	579,208	-12.13	1718625	691,701	-12.55	33,927	13,655	-45.38
methane	525978	341,908	13.55				1,489,506	968,242	9.08
ethane	84914	29,544	47.72				113,694	39,557	13.67
propane	122919	37,996	92.88				49,110	15,181	52.57
NOTE: Stan									
NOTE: Cond									

SITE 4 TCD						
Date	Tuesday, April 02, 1996			Wednesday, April 03, 1996		
Time	18:06			09:56		
Compound	3-03101	Cal. Conc.	rpd	FF 4843	Cal. Conc.	rpd
	area	ppmv	%	area	ppmv	%
oxygen						
nitrogen	53,253	21,433	-14.27	1452762	584,698	-11.30
methane	1,474,620	958,565	7.99	524706	341,081	13.28
ethane	111,285	38,719	11.26	70485	24,524	22.62
propane	47,490	14,680	47.54	110748	34,234	73.78
NOTE: Stan						
NOTE: Cond						

QC Checks	SITE 5											
Date	Wednesday, May 01, 1996 FID				Wednesday, May 01, 1996 FID				Thursday, May 02, 1996 FID			
Time	07:12				20:52				09:38			
Compound	VOC 905	Cal. Conc.	Actual Conc.	rpd	3-03101	Cal. Conc.	Actual Conc.	rpd	VOC 905	Cal. Conc	Actual Conc.	rpd
	area	ppmv	ppmv	%	area	ppmv	ppmv	%	area	ppmv	ppmv	%
methane	3411387	68,003		ERR		0	887,630	-100.00%		0		ERR
propane	5154401	2,060	2,004	2.80%	23979572	9,584	9,950	-3.68%	8025850	3,208	2,004	60.06%
isobutane	43244	12		ERR	19155730	5,139	3,980	29.11%		0		ERR
butane	358953	98	101	-2.79%	22214950	6,076	3,980	52.68%	465334	127	101	26.02%
isopentane	6215	1		ERR	8121244	1,796	1,480	21.34%		0		ERR
pentane	443724	104	101	3.35%	8093013	1,904	1,490	27.77%	432739	102	101	0.79%
hexane	9153194	2,051	2,001	2.48%	2285376	512	498	2.81%	8987955	2,014	2,001	0.63%
heptane	985	0		ERR	1058062	211	196	7.55%		0		ERR
benzene	542803	88	99	-11.39%	0	0	0	ERR	527098	85	99	-13.96%
toluene	657341	105	99	6.47%	0	0	0	ERR	647257	104	99	4.84%
ethylbenzene	726748	105	99	5.96%	0	0	0	ERR	730145	105	99	6.46%
p-xylene	736514	107	99	8.32%	0	0	0	ERR	733980	107	99	7.95%
o-xylene	1815635	66		ERR	0	0	0	ERR		0		ERR

QC Checks	SITE 5							
Date	Thursday, May 02, 1996 FID				Thursday, May 02, 1996 FID			
Time	10:30				19:59			
Compound	3-03101	Cal. Conc.	ctual Conc	rpd	VOC 905	al. Conc	ctual Con	rpd
	area	ppmv	ppmv	%	area	ppmv	ppmv	%
methane	44616004	889,381	887,630	0.20%		0		ERR
propane	22254172	8,894	9,950	-10.61%	5097623	2,037	2,004	1.66%
Isobutane	15299603	4,104	3,980	3.12%		0		ERR
butane	15227045	4,165	3,980	4.65%	353414	97	101	-4.29%
Isopentane	6812918	1,507	1,480	1.79%		0		ERR
pentane	6771328	1,593	1,490	6.91%	440349	104	101	2.56%
hexane	2611931	585	498	17.50%	9135383	2,047	2,001	2.28%
heptane	1210667	241	196	23.06%		0		ERR
benzene	0	0	0	ERR	540671	87	99	-11.74%
toluene	0	0	0	ERR	661863	106	99	7.20%
ethylbenzene	0	0	0	ERR	775471	112	99	13.07%
p-xylene	0	0	0	ERR	781015	114	99	14.87%
o-xylene	0	0	0	ERR		0		ERR

QC Checks	SITE 5				
Date	Friday, May 03, 1996 FID				
Time	10:14				
Compound	VOC 905	Cal. Conc.	Actual Conc.	rpd	new rf
	area	ppmv	ppmv	%	
methane		0		ERR	
propane	180177	72	2,004	-96.41%	0.011122
isobutane		0		ERR	ERR
butane	81136	22	101	-78.03%	0.001245
isopentane		0		ERR	ERR
pentane	107965	25	101	-74.85%	0.000935
hexane	2256287	505	2,001	-74.74%	0.000887
heptane		0		ERR	ERR
benzene	239336	39	99	-60.93%	0.000414
toluene	294148	47	99	-52.36%	0.000337
ethylbenzene	346828	50	99	-49.43%	0.000285
p-xylene	346612	50	99	-49.02%	0.000286
o-xylene		0		ERR	

NOTE: Detector heater replaced on FID. May change response

QC Checks	TCD DETECTOR	SITE 6							TCD			
Date	Wednesday, May 01, 1996				Wednesday, May 01, 1996				Thursday, May 02, 1996			
Time	08:12				20:52				09:38			
Compound	CC43373	Cal. Conc.	Actual Conc.	rpd	3-03102	Cal. Conc.	Actual Conc.	rpd	FF4843	Cal. Conc.	Actual Conc.	rpd
	area	%	%	%	area	%	%	%	area	%	%	%
oxygen	0	0.00	0.00	ERR			0.0000	ERR			0.0000	ERR
nitrogen	201594	12.84	0.00	ERR	130254	8.2980	9.0000	-7.80%	558627	35.5879	65.9200	-46.01%
methane	625404	62.39	64.55	-3.35%	688134	68.6431	63.8020	7.59%	488900	46.7690	30.1100	61.97%
ethane	299331	19.48	19.98	-2.49%	218913	14.2478	12.5000	13.98%	170458	11.0940	2.0000	454.70%
propane	288489	14.16	14.97	-5.40%	168846	8.2888	7.0000	18.41%	173363	8.5105	1.9700	332.01%

NOTE: Ethane and propane in Std 4843 do not agree with other standards.

QC Checks	SITE 6			SITE 6					TCD			
Date	Thursday, May 02, 1996				Thursday, May 02, 1996				Friday, May 03, 1996			
Time	10:30				19:59				10:14			
Compound	CC43373	Cal. Conc.	Actual Conc.	rpd	FF4843	Cal. Conc.	Actual Conc.	rpd	FF4843	Cal. Conc.	Actual Conc.	rpd
	area	%	%	%	area	%	%	%	area	%	%	%
oxygen	0	0.00	0.00	ERR			0.0000	ERR			0.0000	ERR
nitrogen		0.00	0.00	ERR	963627	61.3889	65.9200	-6.87%	1025958	65.3596	65.9200	-0.85%
methane	603656	60.22	64.55	-6.71%	331059	33.0239	30.1100	9.68%	348389	34.7527	30.1100	15.42%
ethane	312414	20.33	19.98	1.77%	36096	2.3494	2.0000	17.47%	36043	2.3458	2.0000	17.29%
propane	327266	16.07	14.97	7.32%	42402	2.0815	1.9700	5.66%	49437	2.4269	1.9700	23.19%

NOTE: Ethane and propane in Std 4843 do not agree with other standards.

API Tank Site 4

Comparison of on-site GC, Radian VOC Lab, and Core Lab
Composition of canister gas (ppmV)

Compound	On-Site GC	Radian VOC Analysis 1	Radian VOC Analysis 2	Radian VOC Average	On-Site/Radian RPD	Core Labs	On-Site/Core RPD	Core/Radian
Oxygen	0	7,529	8,388	7,959	-200.00%	6,900	-200.00%	14.25%
Nitrogen	27,914	31,150	29,620	30,385	-8.48%	26,600	4.82%	13.28%
Methane	44,748	41,250	40,000	40,625	9.66%	46,400	-3.63%	-13.27%
Ethane	14,580	13,990	14,350	14,170	2.85%	15,100	-3.51%	-6.35%
Propane	23,563	24,630	25,180	24,905	-5.54%	25,600	-8.29%	-2.75%
I-Butane	5,227	9,468	9,656	9,562	-58.63%	9,000	-53.04%	6.06%
n-Butane	4,776	12,400	12,650	12,525	-89.58%	11,300	-81.17%	10.28%
I-Pentane	3,402	4,792	4,909	4,851	-35.10%	4,600	-29.94%	5.30%
n-Pentane	2,808	2,972	3,028	3,000	-6.62%	3,000	-6.62%	0.00%
n-Hexane	863	781	770	775	10.70%	700	20.85%	10.20%
Benzene	97	99	102	100	-3.31%	80	19.10%	22.37%
Toluene	190	129	132	131	37.14%	60	104.12%	74.15%
Ethylbenzene	44	18	17	17	88.19%	10	125.99%	52.34%
Xylenes	110	52	56	54	68.29%	60	58.82%	-10.53%
C5 Range	9	1,830	1,865	1,848	-198.05%	0	200.00%	200.00%
C6 Range	1,952	1,819	1,878	1,848	5.45%	2,570	-27.34%	-32.67%
C7 Range	1,772	1,196	1,216	1,206	37.99%	960	59.42%	22.71%
C8 Range	841	299	309	304	93.82%	250	108.36%	19.49%
C9 Range	148	90	96	93	45.97%	30	132.64%	102.26%
C10+	226	42	44	43	135.93%	0	200.00%	200.00%

QUALITY AUDIT REPORT

Evaluation of:
Field Sampling and Analysis Activities
for
Validation of Production Storage Tank Emission Models

Test Site #4

April 1, 1996

SUMMARY

On-site sampling and analysis activities at Test Site #4, were conducted according to approved plans and procedures. The field team, Dirk Reif and Duane Myers, exhibited a thorough understanding of the project objectives, competence in the test procedures, knowledge and appreciation for data quality requirements, and a conscientious commitment to collect valid, representative, reliable, meaningful, and useful data.

On-site activities were conducted according to the QAPP/Test Plan, with minor modifications, as dictated by the specific site conditions. No deficiencies in the sampling or on-site analysis activities were noted. There were some difficulties and situations to which the field crew responded with appropriate technical solutions. The crew maintained good field notes, documenting all pertinent test conditions, problems, and modifications necessary to effect a successful sampling campaign.

1.0 INTRODUCTION

In support of the field validation testing of the EPTANK emission model, a technical systems audit of field sampling and analysis activities was performed at project test site #4.

The audit was conducted by Don Burrows, a certified quality auditor with Radian's Quality Assurance staff. The principal reference document for the audit was the "QAPP/Test Plan for the Field Validation of the EPTANK and Conoco Models" (API Project Number: 0-08200-0520-SE95020). The purpose of the systems review was to identify and report to project management any potential quality problems, focusing on adherence to the Test Plan/QAPP, recordkeeping practices, sample tracking, and data reduction. Specific sampling and analysis procedures reviewed during the audit included:

- continuous analysis of emission gas samples by on-site GC;
- continuous monitoring of emission gas flow rate and temperature;
- collection of integrated emission gas samples; and
- collection of grab samples of separator flash gas, separator liquid, and sales oil.

Review of these activities included review of associated quality control activities and recordkeeping practices.

Observations of the auditor and any recommendations were discussed at the end of the day with the field team, Dirk Reif and Duane Myers, both of whom were completely cooperative, candid and responsive.

2.0 AUDIT RESULTS

The conclusion of the technical systems review is that on-site sampling and analysis activities are being conducted according to the approved plans and procedures; that appropriate documentation is being maintained to elucidate and support the results of the test effort; and that the scientist and engineer who compose the field team are cognizant of the program objectives, recognize the information critical to those objectives, and have the expertise to accomplish the task.

A brief discussion of each of the general areas of the audit is presented below.

General Practices

A current copy of the QAPP/Test Plan was present in the field lab. The Test Plan and procedures were followed with only minor deviations or modifications, dictated by site conditions. In each case, detailed notes were kept to document the circumstances, observations, and actions taken.

Field logbooks included an activity logbook with notes, observations, deviations, etc.; records of on-site measurement data; and a master sample log. Chain-of-custody forms were used to track samples and document custody. Electronic measurement data were backed up daily to diskettes. A hardcopy printout of GC results was also generated daily. Records were neat and legible, and maintained according to conventional practices, such as dating and signing daily entries, single-line strikeouts (dated and initialed), and Z-out of unused portions of logbooks.

On-site GC Analysis of Vent Gas

Emission gas samples were analyzed semi-continuously using gas chromatography with a thermal conductivity detector (TCD) for fixed gas and a flame ionization detector (FID) for hydrocarbons. The sample was continuously pumped from the emission gas vent pipe through a dilution and mixing chamber. The diluted sample was vented to atmosphere, allowing the GC to withdraw an sample for analysis. The dilution ratio was adjusted to obtain results within the calibration range of the detectors.

The continuous sample collection system had not been leak checked directly. There were only two connections between the vent pipe and the pump which were visually inspected. The gas was pumped under positive pressure to a mixing chamber that was vented to atmosphere. Under positive pressure, the potential for in-leakage of air should be minimal, and analysis of fixed gases would indicated serious leaks. Dirk proposed to run both blank (helium) and hydrocarbon samples through the system as a verification of sampling system integrity as well as GC performance.

The GC and detectors were calibrated as specified in the Test Plan/QAPP, using at least three upscale standards to develop a linear calibration response factor. Specific calibration standards were used to develop compound-specific response factors for each of the hydrocarbons listed in the Test Plan, except for octane, nonane, and decane. Little response was expected or seen in the range of these compounds, and the a carbon response factor derived from n-hexane was used to quantitate these or other unidentified hydrocarbons.

Continuous Monitoring of Vent Gas Flow Rate and Temperature

Vent gas flow rate and temperature were continuously monitored during the testing period. Gas flow rate was measured using a critical orifice and pressure transducer linked to a computer data collection system. The critical orifice plate was located near the vent pipe exit, away from pipe bends or other disturbances. Tank hatches were inspected for leaks and sealed (with garbage bags) as necessary to minimize fugitive vent gas emissions. Temperature was measured using a thermocouple and digital voltmeter interfaced with computer data collection.

The pressure transducers were calibrated prior to use in the field against standard manometers. The transducer calibration will be checked again at the conclusion of the test program. A precision voltmeter was used to check the temperature measurement system. The QAPP specified that the thermocouples would be checked in the field using an ice bath. Although calibration of the electronic readout is critical to this type of measurement system, fairly long lengths of thermocouple wire were necessary for some of the measurement points at this site, which can lead to some inaccuracy due to line loss. The field crew had checked the accuracy of the electronic readout devices, but had not conducted the ice bath QC checks of the overall thermocouple/readout system at the time of the audit, but indicated that they planned to do so before leaving the site.

The only problem that the field team was having with flow measurements was the potential fouling of the transducer by the hydrocarbon vent stream. As a preventative measure, two transducers were periodically exchanged for cleaning.

Collection of Integrated Vent Gas Sample

A 15-liter evaluated stainless steel canister was used to collect a 12-hour integrated sample of vent gas. A Veriflow regulator was used to control the sample collection rate over the 12-hour period. Canister pressures were checked on-site and recorded on the canister chain-of-custody form. No problems were noted with canister sampling of vent gas.

According to the field team, one of the canisters was to be pressurized after collection to facilitate removal of a sample aliquot to inject into the on-site GC system as a quality assurance check. This canister would then be routed to the off-site laboratories for comparison of results. This activity was not observed during the audit.

Collection of Grab Samples of Separator Flash Gas/Liquid, and Sales Oil

Grab samples of separator gas and liquid in steel canisters according to the procedures described in the QAPP/Test Plan. When collecting the liquid sample, the canister was first filled with gas at the pressure of the tank; oil was then collected in the pressurized sample container, replacing the gas and thus preventing a pressure drop in the liquid sample and sudden volatilization of dissolved gases.

The procedure for collecting sales oil sample, ASTM D4057, was modified slightly due to difficulties getting sufficient flow through the cooling coil. The coil was removed and the aluminum sample container was immersed in ice water during collection of the sample. This modification was documented in the field notebook.

When he began to flush the sales oil tank tap prior to collecting a sample, Duane observed that the liquid was aqueous. Rather than collect a sample, he obtained help from an IP technician who, upon measuring, confirmed that water covered the tap at the bottom of the tank. The field team and the IP technician worked to resolve the problem and collect a representative sample of sales oil. The situation was documented in the field logbook and served as an example of the field crew recognizing anomalies and responding effectively.

The existing gauges used to read pressure on the tanks were checked against independent gauges by the Radian field team. The temperature readouts were to be checked against independent measurement devices provided thermal wells were available in the tanks. The field crew had not requested gauge calibration or certification records from the plant personnel. Process information, such as hours of operation, production rate, and dump cycles were obtained from plant personnel and records

3.0 RESPONSE REQUIREMENTS

There were no findings of significant deficiencies during this review, and no corrective actions or formal response is required.

Appendix D

RAW DATA BY SITE

Site 1

API TANKS SITE 1 PROCESS DATA

DATE	TIME	SALES OIL METER (BBL)	PRODUCED GAS FLOW (MSCFD)	OIL TANK LIQUID TEMP. (DEG. F)	OIL TANK VENT GAS TEMP. (DEG. F	INLET SEPARATOR TEMP. (DEG F)	INLET SEPARATOR PRESS. (PSIG)	AMBIENT TEMP. (DEG F)	DRY GAS METER TANK VENT FLOW (CU FT)	DRY GAS METER DIFF. PRESS. ("H2O)	DRY GAS METER TEMP. (DEG. F)
9-29-95	07:55	5505.95				69	30-35				
9-29-95	11:05	5561.77	NT			77	24				
9-29-95	13:27	5561.77	155	79	96.5	77	20	83			
9-29-95	18:41	5613.93	157.1		92	77	18	83.5	908.1	0.73	
9-29-95	20:01	5613.93	135.7	82.5	79.6	77.6	18	76.7	96.595	0.633	
9-29-95	21:15				75			75.3			
9-30-95	07:39	5674.99	140.9	70.9	61	69.2	18	62.5	176	0.21	
9-30-95	08:45	5674.99	132.2	72.2	65.5	68	18	66	442.4	1	66
9-30-95	09:43	5674.99	146.1	72.3	73.8	71.5	17	70	970	2.2	72
9-30-95	10:50	5674.99	133.4	73.1	83.6	71.8	17	74.2	619	0.9	80
9-30-95	12:00	5674.99	141.7	72.5	85.4	73	17	74	198	2.5	84
9-30-95	12:35	5674.99	142.3	NT	89.6	74.8	17	77.1	460	0.8	86
9-30-95	13:15	5674.99	145.8	NT	88.4	77.2	17	76	543	0.04	88
9-30-95	13:50	5674.99	130.3	74.2	93.8	79.3	17	79	641	0.5	92
9-30-95	14:30	0	104.7	77.6	89	81	16	74.4	897	0.75	92
9-30-95	15:15	0	135.2	80.4	93.6	83.5	16.5	79.8	17.8	0.3	95
9-30-95	16:17	111.03	151.2	80.6	101.2	82.7	16.5	84.8	79	0.88	97
9-30-95	17:17	111.03	89.9	81.8	94	78.4	15.5	81.8	382	1.7	96
9-30-95	18:24	111.03	112.07	82.5	95.7	77.8	17	81.5	22.8	1.15	98
9-30-95	19:31	111.03	117.71	82.8	85	78.3	17	75.7	620.1	3.35	81
10-1-95	07:30	211.05	137.4	66.6	59.3	73.1	17	61.7	227	3.7	54
10-1-95	09:02	211.05	115.65	67.1	63.6	71.9	17	62.1	788.4	1.35	62
10-1-95	09:30	238.23	124.95	67.3	68.4	70.5	18	66.2	130	7.12	64
10-1-95	10:32	238.23	132.61	65.7	76.7	73	18	69.3	974.6	4.58	74
10-1-95	11:25	238.23	121.2	68.8	80.4	73.1	16	69	822	9	80
10-1-95	12:00	283.7	NT	NT	NT	NT	16.5	NT	460	6.2	81
10-1-95	12:24	283.7	117.68	73.3	85.6	78.2	17	76	764	1.81	84
10-1-95	13:05	283.7	103.57	72.4	87.1	72.1	18	77.2	317.6	4.76	85
10-1-95	13:41	283.7	120.89	78.9	100.1	74.5	16	78.6	994	10.01	95
10-1-95	13:53	NT	NT	NT	NT	NT	NT	NT	249.8	9.28	98
10-1-95	14:00	NT	NT	NT	NT	NT	NT	NT	375	9.1	94
10-1-95	14:31	283.7	121.3	80	99.1	84.1	16	81.6	741.5	2.96	93

API Tanks Site 1

Separator Gas Composition (Mole%)

Compound	SGCY01	SGCY02	SGCY03	SGCY03d	Average	SD	RSD
Date	9/29/95	10/1/95	10/2/95	10/2/95			
Time	8:06 PM	8:11 AM	10:30 AM	10:30 AM			
Oxygen	0.00	0.00	0.00	0.00	0.00	NA	NA
Nitrogen	4.48	4.82	4.39	4.25	4.54	0.22	4.9%
Carbon Dioxide	0.35	0.37	0.34	0.32	0.35	0.02	5.5%
Methane	57.30	58.40	58.01	58.03	57.91	0.40	0.7%
Ethane	9.80	9.60	10.20	10.20	9.87	0.28	2.9%
Propane	16.45	15.63	16.18	16.51	16.14	0.35	2.2%
Isobutane	1.64	1.61	1.58	1.59	1.61	0.02	1.5%
n-Butane	6.13	5.93	5.89	5.94	5.99	0.10	1.6%
Isopentane	1.23	1.14	1.09	1.05	1.15	0.07	6.3%
n-Pentane	1.16	1.08	1.02	0.99	1.08	0.07	6.5%
2,2-dimethylbutane	0.003	0.003	0.003	0.003	0.003	0.000	0.0%
2-Methylpentane	0.195	0.184	0.174	0.152	0.181	0.017	9.4%
3-Methylpentane	0.278	0.259	0.230	0.209	0.252	0.029	11.4%
n-Hexane	0.200	0.189	0.177	0.149	0.184	0.020	11.0%
Methylcyclopentane	0.213	0.202	0.189	0.143	0.194	0.028	14.6%
Benzene	0.015	0.015	0.017	0.014	0.015	0.001	7.2%
Cyclohexane	0.099	0.095	0.090	0.067	0.091	0.013	14.4%
2-Methylhexane	0.030	0.032	0.028	0.028	0.030	0.002	6.0%
3-Methylhexane	0.041	0.042	0.038	0.032	0.039	0.004	10.6%
Dimethylcyclopentan	0.115	0.112	0.103	0.065	0.104	0.021	20.3%
n-Heptane	0.046	0.048	0.042	0.042	0.045	0.003	6.2%
Methylcyclohexane	0.082	0.087	0.078	0.070	0.081	0.007	8.2%
Trimethylcyclopentan	0.030	0.031	0.026	0.018	0.028	0.005	19.7%
Toluene	0.016	0.019	0.027	0.039	0.023	0.010	42.1%
2-Methylheptane	0.016	0.017	0.012	0.016	0.016	0.002	12.8%
3-Methylheptane	0.017	0.019	0.015	0.017	0.017	0.001	8.6%
Dimethylcyclohexane	0.021	0.022	0.017	0.015	0.020	0.003	15.8%
n-Octane	0.015	0.015	0.011	0.017	0.015	0.002	14.9%
Ethylbenzene	0.001	0.001	0.001	0.001	0.001	0.000	24.4%
Xylenes	0.007	0.008	0.005	0.007	0.007	0.001	16.3%
C9 Unknowns	0.008	0.008	0.004	0.004	0.007	0.002	32.9%
n-Nonane	0.003	0.003	0.001	0.002	0.003	0.001	35.8%
Decanes+	0.012	0.012	0.012	0.008	0.011	0.002	15.8%

API Tanks Site 1

Separator Oil Composition (Mole%)

Compound	SCCY01	SCCY02	SCCY03	SCCY04	SCCY05	SCCY06	SCCY06d	Average	RSD
Date	9/29/95	9/30/95	9/30/95	10/1/95	10/1/95	10/2/95	10/2/95		
Time	7:35 PM	10:15 AM	7:23 PM	8:27 AM	6:42 PM	10:18 AM	10:18 AM		
Nitrogen	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.0%
Methane	0.39	0.45	0.45	0.52	0.47	0.52	0.55	0.47	11.6%
Ethane	0.65	0.66	0.58	0.64	0.59	0.64	0.64	0.63	4.6%
Propane	3.02	3.04	3.13	3.37	3.17	3.39	3.38	3.19	5.1%
i-Butane	0.90	0.91	0.88	0.88	0.89	0.88	0.88	0.89	1.3%
n-Butane	4.62	4.62	4.69	4.99	4.77	5.00	4.96	4.78	3.6%
i-Pentane	2.47	2.43	2.47	2.57	2.51	2.58	2.55	2.50	2.3%
n-Pentane	3.40	3.19	3.28	3.38	3.33	3.38	3.35	3.32	2.1%
n-Hexane	2.28	2.28	2.24	2.30	2.28	2.30	2.28	2.28	0.8%
Hexanes	3.04	3.03	2.92	2.99	2.97	3.00	2.94	2.99	1.4%
Benzene	0.15	0.15	0.14	0.15	0.14	0.15	0.14	0.15	3.4%
Heptanes	10.78	10.21	10.42	10.53	10.59	10.62	10.50	10.52	1.6%
Toluene	0.51	0.50	0.47	0.46	0.47	0.47	0.47	0.48	3.7%
Octanes	9.93	9.96	9.62	9.72	9.78	9.79	9.69	9.79	1.2%
Ethylbenzene	0.10	0.08	0.10	0.09	0.10	0.09	0.09	0.09	7.6%
Xylenes	0.27	0.26	0.20	0.21	0.21	0.22	0.21	0.23	11.4%
Nonanes	5.24	5.21	5.12	5.24	5.21	5.13	5.10	5.19	1.2%
Decanes Plus	52.24	53.01	53.27	51.96	52.51	51.83	52.25	52.51	1.0%
Decanes+ MW	229	227	226	230	228	230	229	228	0.6%
Decanes+ SG	0.899	0.898	0.898	0.901	0.900	0.901	0.900	0.899	0.1%

API Tanks Site 1

Sales Oil Composition (Mole%)

Compound	SOBT01	SOBT02	SOBT03	Average	RSD
Date	9/29/95	10/1/95	10/2/95		
Time	7:52 PM	8:48 AM	10:50 AM		
Nitrogen	0.00	0.00	0.00	0.00	NA
Methane	0.00	0.00	0.00	0.00	NA
Ethane	0.11	0.12	0.11	0.11	5.1%
Propane	1.81	1.82	1.86	1.83	1.4%
i-Butane	0.63	0.63	0.66	0.64	2.7%
n-Butane	3.94	3.99	4.05	3.99	1.4%
i-Pentane	2.25	2.31	2.36	2.31	2.4%
n-Pentane	3.04	3.10	3.12	3.09	1.3%
n-Hexane	2.32	2.37	2.39	2.36	1.5%
Hexanes	2.69	2.78	2.80	2.76	2.1%
Benzene	0.15	0.15	0.15	0.15	0.0%
Heptanes	11.09	11.19	11.17	11.15	0.5%
Toluene	0.54	0.54	0.54	0.54	0.0%
Octanes	10.15	10.22	10.16	10.18	0.4%
Ethylbenzene	0.09	0.09	0.09	0.09	0.0%
Xylenes	0.30	0.30	0.28	0.29	3.9%
Nonanes	5.28	5.29	5.34	5.30	0.6%
Decanes Plus	55.61	55.08	54.90	55.20	0.7%
Decanes+ MW	224	227	228	226	0.9%
Decanes+ SG	0.893	0.895	0.895	0.894	0.1%
API Gravity	38.23	38.39	39.08	38.57	1.2%
RVP	8.10	8.00	8.00	8.03	0.7%

STD.API/PETRO PUBL 4662-ENGL 1997 0732290 0608812 71T

API TANKS SITE 1
TANK VENT CANISTER SAMPLES

Field ID	API1-VGCA01	API1-VGCA02	API1-VGCA03	API1-VGCA04 Analysis 1	API1-VGCA04 Analysis 2	API1-VGCA04 Average	API1-VGCA05	API1-VGCA06	Average	RSD
Start Date	Sept 29, 1995	Sept 30, 1995	Sept 30, 1995			Oct 1, 1995	Oct 1, 1995	Oct 2, 1995		
End Date	Sept 30, 1995	Sept 30, 1995	Oct 1, 1995			Oct 1, 1995	Oct 2, 1995	Oct 2, 1995		
Start Time	7:10 PM	7:45 AM	6:55 PM			7:55 AM	6:09 PM	7:35 AM		
End Time	7:28 AM	5:11 PM	7:37 AM			12:37 PM	7:22 AM	12:58 PM		
ppmv										
ETHANE	98,838	115,026	115,226	97,225	98,991	98,108	94,962	100,197	103,726	8.67%
PROPANE	245,575	227,278	205,921	197,974	198,622	198,298	201,944	217,329	216,058	8.32%
ISOBUTANE	26,593	27,833	24,428	19,615	19,582	19,598	21,787	22,452	23,782	13.03%
N-BUTANE	111,641	107,205	94,799	83,038	82,836	82,937	89,294	93,948	96,637	11.23%
ISOPENTANE	21,464	21,940	19,018	15,100	15,069	15,085	17,418	17,488	18,735	14.00%
N-PENTANE	21,906	22,441	19,231	15,267	15,211	15,239	17,781	17,628	19,038	14.45%
N-HEXANE	3,415	3,460	2,942	2,364	2,359	2,361	2,760	2,661	2,933	14.79%
BENZENE	227	225	196	160	162	161	185	177	195	13.66%
TOLUENE	259	265	218	193	195	194	209	195	223	14.06%
ETHYLBENZENE	66	67	49	44	44	44	46	44	53	20.57%
M/P-XYLENE	51	55	40	29	29	29	38	37	42	23.59%
O-XYLENE	19	22	14	13	14	13	14	12	16	25.39%
OTHER C2	15,022	4,533	4,459	6,244	4,062	5,153	4,696	6,079	6,657	62.21%
OTHER C3	105	4	4	0	0	0	3	0	19	216.89%
OTHER C4	1,028	0	0	1,253	1,108	1,181	382	1,211	634	90.78%
OTHER C5	1,514	1,546	1,340	1,055	1,064	1,059	1,219	1,225	1,317	14.26%
OTHER C6	11,458	11,662	9,894	7,937	7,929	7,933	9,292	8,995	9,872	14.74%
OTHER C7	7,394	7,508	6,358	5,249	5,228	5,238	6,039	5,639	6,363	14.52%
OTHER C8	1,559	1,502	1,198	1,043	1,027	1,035	1,143	983	1,237	19.47%
OTHER C9	236	316	156	151	153	152	121	100	180	45.01%
OTHER C10	53	94	15	15	27	21	21	16	37	85.89%
Mole %										
OXYGEN	3.22	2.59	0.34	2.15	2.09	2.12	2.19	1.23	1.95	52.48%
NITROGEN	13.46	12.90	5.47	10.40	10.08	10.24	17.36	8.84	11.38	36.26%
METHANE	26.30	29.13	43.49	41.79	42.25	42.02	33.32	40.09	35.73	20.06%
CARBON DIOXIDE	0.18	0.21	0.24	0.26	0.22	0.24	0.19	0.20	0.21	11.40%

API TANKS SITE 1 — Flame Ionization Detector

ON-SITE GC DATA

CALIBRATIONS FID COMPOUND	RT	RF	CARBON RF
METH/ETHANE	3.28		0.001852
PROPANE	4.18	0.0006423	
ISOBUTANE	5.18	0.0004464	
N-BUTANE	5.72	0.0004523	
ISOPENTANE	7.86	0.000373	
N-PENTANE	8.68	0.0003809	
N-HEXANE	12.17	0.0003046	
BENZENE	14.1	0.0002632	
N-HEPTANE	15.51	0.0003152	
TOLUENE	17.5	0.0002246	
ETHYLBENZENE	20.31	0.000203	
P-XYLENE	20.5	0.0001966	

FILE: F192831 SAMPLE: Tank Vent Gas DATE 9-29-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PPM	RUN TIME
METH/ETHANE	OR	1		20:17
PROPANE	OR	1		20:17
ISOBUTANE	OR	1		20:17
N-BUTANE	OR	1		20:17
ISOPENTANE	2.2E+07	1	8371	20:17
N-PENTANE	2E+07	1	7700	20:17
N-HEXANE	1E+07	1	3107	20:17
BENZENE	1032478	1	272	20:17
N-HEPTANE	4082528	1	1287	20:17
TOLUENE	2432809	1	546	20:17
ETHYLBENZENE	448670	1	91	20:17
P-XYLENE	343956	1	88	20:17

FILE: F092941 SAMPLE: Tank Vent Gas DATE 9-29-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PPM	RUN TIME
METH/ETHANE	OR	10		10:25
PROPANE	OR	10		10:25
ISOBUTANE	7058176	10	31508	10:25
N-BUTANE	1.9E+07	10	84468	10:25
ISOPENTANE	8608120	10	24841	10:25
N-PENTANE	6267113	10	23871	10:25
N-HEXANE	1188939	10	3622	10:25
BENZENE	96356	10	254	10:25
N-HEPTANE	330466	10	1042	10:25
TOLUENE	200078	10	449	10:25
ETHYLBENZENE	12402	10	25	10:25
P-XYLENE	8267	10	16	10:25

FILE: F092961 SAMPLE: Tank Vent Gas DATE 9-29-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PPM	RUN TIME
METH/ETHANE		20		12:45
PROPANE	1.9E+07	20	241909	12:45
ISOBUTANE	5318989	20	47488	12:45
N-BUTANE	1.6E+07	20	148889	12:45
ISOPENTANE	5057094	20	37726	12:45
N-PENTANE	4773409	20	36364	12:45
N-HEXANE	899573	20	5480	12:45
BENZENE	65804	20	346	12:45
N-HEPTANE	238239	20	1502	12:45
TOLUENE	138017	20	620	12:45
ETHYLBENZENE	20426	20	83	12:45
P-XYLENE	11157	20	44	12:45

FILE: F092961 SAMPLE: Tank Vent Gas DATE 9-29-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PPM	RUN TIME
METH/ETHANE	OR	1		15:11
PROPANE	OR	1		15:11
ISOBUTANE	OR	1		15:11
N-BUTANE	OR	1		15:11
ISOPENTANE	OR	1		15:11
N-PENTANE	OR	1		15:11
N-HEXANE	1E+07	1	3114	15:11
BENZENE	1064366	1	280	15:11
N-HEPTANE	7400168	1	2333	15:11
TOLUENE	2460449	1	553	15:11
ETHYLBENZENE	389509	1	79	15:11
P-XYLENE	333832	1	66	15:11

FILE: F092982 SAMPLE: Tank Vent Gas DATE 9-29-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PPM	RUN TIME
METH/ETHANE	OR	1		16:07
PROPANE	OR	1		16:07
ISOBUTANE	OR	1		16:07
N-BUTANE	OR	1		16:07
ISOPENTANE	OR	1		16:07
N-PENTANE	OR	1		16:07
N-HEXANE	1E+07	1	3174	16:07
BENZENE	1132261	1	296	16:07
N-HEPTANE	7888512	1	2486	16:07
TOLUENE	2655761	1	596	16:07
ETHYLBENZENE	421159	1	85	16:07
P-XYLENE	355736	1	70	16:07

FILE: F0929103 SAMPLE: Tank Vent Gas DATE 9-29-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PPM
METH/ETHANE	OR	1	
PROPANE	OR	1	
ISOBUTANE	OR	1	
N-BUTANE	OR	1	
ISOPENTANE	OR	1	
N-PENTANE	OR	1	
N-HEXANE	1E+07	1	3196
BENZENE	1163389	1	306
N-HEPTANE	8090515	1	2550
TOLUENE	2748395	1	617
ETHYLBENZENE	435084	1	88
P-XYLENE	368630	1	72

ON-SITE GC DATA

CALIBRATIONS FID COMPOUND	RT	RF	CARBON RF
METH/ETHANE	3.28		0.001852
PROPANE	4.18	0.0006423	
ISOBUTANE	5.18	0.0004464	
N-BUTANE	5.72	0.0004523	
ISOPENTANE	7.86	0.000373	
N-PENTANE	8.68	0.0003809	
N-HEXANE	12.17	0.0003046	
BENZENE	14.1	0.0002632	
N-HEPTANE	15.51	0.0003152	
TOLUENE	17.5	0.0002246	
ETHYLBENZENE	20.31	0.000203	
P-XYLENE	20.5	0.0001966	

FILE: F929136 SAMPLE: Tank Vent Gas DATE 9-29-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PPM	RUN TIME
METH/ETHANE	OR	1		18:51
PROPANE	OR	1		18:51
ISOBUTANE	OR	1		18:51
N-BUTANE	OR	1		18:51
ISOPENTANE	OR	1	0	18:51
N-PENTANE	OR	1	0	18:51
N-HEXANE	1E+07	1	3182	18:51
BENZENE	1167954	1	307	18:51
N-HEPTANE	4490188	1	1415	18:51
TOLUENE	2688039	1	604	18:51
ETHYLBENZENE	429743	1	87	18:51
P-XYLENE	364370	1	72	18:51

FILE: F929147 SAMPLE: Tank Vent Gas DATE 9-29-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PPM	RUN TIME
METH/ETHANE	OR	1		20:43
PROPANE	OR	1		20:43
ISOBUTANE	OR	1		20:43
N-BUTANE	OR	1		20:43
ISOPENTANE	OR	1		20:43
N-PENTANE	OR	1		20:43
N-HEXANE	1E+07	1	3167	20:43
BENZENE	1148799	1	302	20:43
N-HEPTANE	4315254	1	1360	20:43
TOLUENE	2546468	1	572	20:43
ETHYLBENZENE	400244	1	81	20:43
P-XYLENE	314331	1	62	20:43

FILE: F929158 SAMPLE: Tank Vent Gas DATE 9-29-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PPM	RUN TIME
METH/ETHANE	OR	1		21:35
PROPANE	OR	1		21:35
ISOBUTANE	OR	1		21:35
N-BUTANE	OR	1		21:35
ISOPENTANE	OR	1		21:35
N-PENTANE	OR	1		21:35
N-HEXANE	1E+07	1	3165	21:35
BENZENE	1142432	1	301	21:35
N-HEPTANE	4216262	1	1329	21:35
TOLUENE	2457554	1	552	21:35
ETHYLBENZENE	382812	1	78	21:35
P-XYLENE	298797	1	59	21:35

FILE: F929169 SAMPLE: Tank Vent Gas DATE 9-29-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PPM	RUN TIME
METH/ETHANE	OR	1		22:25
PROPANE	OR	1		22:25
ISOBUTANE	OR	1		22:25
N-BUTANE	OR	1		22:25
ISOPENTANE	OR	1		22:25
N-PENTANE	OR	1		22:25
N-HEXANE	1E+07	1	3153	22:25
BENZENE	1133700	1	298	22:25
N-HEPTANE	4139674	1	1305	22:25
TOLUENE	2390519	1	537	22:25
ETHYLBENZENE	365713	1	74	22:25
P-XYLENE	286324	1	56	22:25

FILE: F9291710 SAMPLE: Tank Vent Gas DATE 9-29-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PPM	RUN TIME
METH/ETHANE	OR	1		23:14
PROPANE	OR	1		23:14
ISOBUTANE	OR	1		23:14
N-BUTANE	OR	1		23:14
ISOPENTANE	OR	1		23:14
N-PENTANE	OR	1		23:14
N-HEXANE	1E+07	1	3140	23:14
BENZENE	1125751	1	296	23:14
N-HEPTANE	4062320	1	1280	23:14
TOLUENE	2329997	1	523	23:14
ETHYLBENZENE	350278	1	71	23:14
P-XYLENE	277668	1	55	23:14

FILE: F9291811 SAMPLE: Tank Vent Gas DATE 9-30-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PPM
METH/ETHANE	OR	1	
PROPANE	OR	1	
ISOBUTANE	OR	1	
N-BUTANE	OR	1	
ISOPENTANE	OR	1	
N-PENTANE	OR	1	
N-HEXANE	1E+07	1	3130
BENZENE	1108282	1	292
N-HEPTANE	3956551	1	1247
TOLUENE	2256842	1	507
ETHYLBENZENE	339186	1	69
P-XYLENE	266341	1	52

ON-SITE GC DATA

CALIBRATIONS FID COMPOUND	RT	RF	CARBON RF
METH/ETHANE	3.28		0.001852
PROPANE	4.18	0.0006423	
ISOBUTANE	5.18	0.0004464	
N-BUTANE	5.72	0.0004523	
ISOPENTANE	7.86	0.000373	
N-PENTANE	8.68	0.0003809	
N-HEXANE	12.17	0.0003046	
BENZENE	14.1	0.0002632	
N-HEPTANE	15.51	0.0003152	
TOLUENE	17.5	0.0002246	
ETHYLBENZENE	20.31	0.000203	
P-XYLENE	20.5	0.0001966	

FILE: F930B1 SAMPLE: Tank Vent Gas DATE 9-30-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PPM	RUN TIME
METH/ETHANE	2631140	100	487287	10:26
PROPANE	4245225	100	272671	10:26
ISOBUTANE	637396	100	28453	10:26
N-BUTANE	2453741	100	110983	10:26
ISOPENTANE	606544	100	22624	10:26
N-PENTANE	573838	100	21857	10:26
N-HEXANE	115818	100	3528	10:26
BENZENE	9068	100	239	10:26
N-HEPTANE	31423	100	990	10:26
TOLUENE	18380	100	413	10:26
ETHYLBENZENE	2198	100	45	10:26
P-XYLENE	3080	100	80	10:26

FILE: F930C1 SAMPLE: Tank Vent Gas DATE 9-30-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PPM	RUN TIME
METH/ETHANE	1.1E+07	20	384070	11:19
PROPANE	1.6E+07	20	208897	11:19
ISOBUTANE	2623893	20	23426	11:19
N-BUTANE	1.1E+07	20	95631	11:19
ISOPENTANE	2586659	20	19296	11:19
N-PENTANE	2484893	20	18930	11:19
N-HEXANE	561966	20	3423	11:19
BENZENE	49841	20	262	11:19
N-HEPTANE	193618	20	1221	11:19
TOLUENE	147721	20	664	11:19
ETHYLBENZENE	29966	20	122	11:19
P-XYLENE	55166	20	217	11:19

FILE: F930D1 SAMPLE: Tank Vent Gas DATE 9-30-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PPM	RUN TIME
METH/ETHANE	OR	10	0	12:13
PROPANE	OR	10	0	12:13
ISOBUTANE	6725255	10	30022	12:13
N-BUTANE	1.8E+07	10	83054	12:13
ISOPENTANE	8522004	10	24327	12:13
N-PENTANE	6260504	10	23846	12:13
N-HEXANE	1280850	10	3901	12:13
BENZENE	105814	10	279	12:13
N-HEPTANE	393888	10	1242	12:13
TOLUENE	260040	10	584	12:13
ETHYLBENZENE	45347	10	92	12:13
P-XYLENE	25997	10	51	12:13

FILE: F930F1 SAMPLE: Tank Vent Gas DATE 9-30-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PPM	RUN TIME
METH/ETHANE	OR	10	0	14:16
PROPANE	OR	10	0	14:16
ISOBUTANE	6760797	10	30160	14:16
N-BUTANE	1.8E+07	10	83490	14:16
ISOPENTANE	6677757	10	24900	14:16
N-PENTANE	6452956	10	24579	14:16
N-HEXANE	1329387	10	4049	14:16
BENZENE	108841	10	286	14:16
N-HEPTANE	414183	10	1306	14:16
TOLUENE	268784	10	604	14:16
ETHYLBENZENE	45577	10	93	14:16
P-XYLENE	26859	10	52	14:16

FILE: F930H1 SAMPLE: Tank Vent Gas DATE 9-30-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PPM	RUN TIME
METH/ETHANE	1356521	20	50248	16:16
PROPANE	1.8E+07	20	228675	16:16
ISOBUTANE	3414299	20	30483	16:16
N-BUTANE	1.4E+07	20	125351	16:16
ISOPENTANE	3423262	20	25536	16:16
N-PENTANE	3319015	20	25284	16:16
N-HEXANE	723952	20	4410	16:16
BENZENE	60457	20	318	16:16
N-HEPTANE	233534	20	1472	16:16
TOLUENE	149092	20	670	16:16
ETHYLBENZENE	21386	20	87	16:16
P-XYLENE	33244	20	131	16:16

FILE: F930I1 SAMPLE: Tank Vent Gas DATE 9-30-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PPM
METH/ETHANE	OR	10	0
PROPANE	OR	10	0
ISOBUTANE	7035196	10	31405
N-BUTANE	1.9E+07	10	84614
ISOPENTANE	7034475	10	26239
N-PENTANE	6816180	10	25983
N-HEXANE	1405821	10	4282
BENZENE	113741	10	299
N-HEPTANE	435482	10	1373
TOLUENE	280210	10	629
ETHYLBENZENE	49038	10	100
P-XYLENE	30602	10	80

ON-SITE GC DATA

CALIBRATIONS FID COMPOUND	RT	RF	CARBON RF
METH/ETHANE	3.28		0.001852
PROPANE	4.18	0.0006423	
ISOBUTANE	5.18	0.0004464	
N-BUTANE	5.72	0.0004523	
ISOPENTANE	7.86	0.000373	
N-PENTANE	8.68	0.0003809	
N-HEXANE	12.17	0.0003046	
BENZENE	14.1	0.0002632	
N-HEPTANE	15.51	0.0003152	
TOLUENE	17.5	0.0002246	
ETHYLBENZENE	20.31	0.000203	
P-XYLENE	20.5	0.0001966	

FILE: F930P5 SAMPLE: Tank Vent Gas DATE 9-30-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PPM	RUN TIME
METH/ETHANE	OR	1	0	23:24
PROPANE	OR	1	0	23:24
ISOBUTANE	OR	1	0	23:24
N-BUTANE	OR	1	0	23:24
ISOPENTANE	OR	1	0	23:24
N-PENTANE	OR	1	0	23:24
N-HEXANE	9766130	1	2975	23:24
BENZENE	970314	1	255	23:24
N-HEPTANE	3457444	1	1090	23:24
TOLUENE	1926437	1	433	23:24
ETHYLBENZENE	289570	1	59	23:24
P-XYLENE	227070	1	45	23:24

FILE: F930Q6 SAMPLE: Tank Vent Gas DATE 10-01-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PPM	RUN TIME
METH/ETHANE	OR	1	0	00:15
PROPANE	OR	1	0	00:15
ISOBUTANE	OR	1	0	00:15
N-BUTANE	OR	1	0	00:15
ISOPENTANE	OR	1	0	00:15
N-PENTANE	OR	1	0	00:15
N-HEXANE	9692341	1	2952	00:15
BENZENE	951656	1	250	00:15
N-HEPTANE	3352443	1	1057	00:15
TOLUENE	1864912	1	419	00:15
ETHYLBENZENE	280413	1	57	00:15
P-XYLENE	221479	1	44	00:15

FILE: F930R7 SAMPLE: Tank Vent Gas DATE 10-01-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PPM	RUN TIME
METH/ETHANE	OR	1	0	01:06
PROPANE	OR	1	0	01:06
ISOBUTANE	OR	1	0	01:06
N-BUTANE	OR	1	0	01:06
ISOPENTANE	OR	1	0	01:06
N-PENTANE	OR	1	0	01:06
N-HEXANE	9540357	1	2906	01:06
BENZENE	915178	1	241	01:06
N-HEPTANE	3202365	1	1009	01:06
TOLUENE	1774778	1	399	01:06
ETHYLBENZENE	266963	1	54	01:06
P-XYLENE	208297	1	41	01:06

FILE: F930S8 SAMPLE: Tank Vent Gas DATE 10-01-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PPM	RUN TIME
METH/ETHANE	OR	1	0	01:57
PROPANE	OR	1	0	01:57
ISOBUTANE	OR	1	0	01:57
N-BUTANE	OR	1	0	01:57
ISOPENTANE	OR	1	0	01:57
N-PENTANE	OR	1	0	01:57
N-HEXANE	9426415	1	2871	01:57
BENZENE	890268	1	234	01:57
N-HEPTANE	3089510	1	974	01:57
TOLUENE	1715845	1	385	01:57
ETHYLBENZENE	258450	1	52	01:57
P-XYLENE	203868	1	40	01:57

FILE: F930T9 SAMPLE: Tank Vent Gas DATE 10-01-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PPM	RUN TIME
METH/ETHANE	OR	1	0	02:48
PROPANE	OR	1	0	02:48
ISOBUTANE	OR	1	0	02:48
N-BUTANE	OR	1	0	02:48
ISOPENTANE	OR	1	0	02:48
N-PENTANE	OR	1	0	02:48
N-HEXANE	9313367	1	2837	02:48
BENZENE	867771	1	228	02:48
N-HEPTANE	2997840	1	945	02:48
TOLUENE	1660449	1	373	02:48
ETHYLBENZENE	246306	1	50	02:48
P-XYLENE	196208	1	39	02:48

FILE: F930U10 SAMPLE: Tank Vent Gas DATE 10-01-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PPM
METH/ETHANE	OR	1	0
PROPANE	OR	1	0
ISOBUTANE	OR	1	0
N-BUTANE	OR	1	0
ISOPENTANE	OR	1	0
N-PENTANE	OR	1	0
N-HEXANE	9297002	1	2832
BENZENE	865838	1	228
N-HEPTANE	2963586	1	934
TOLUENE	1637898	1	368
ETHYLBENZENE	243108	1	49
P-XYLENE	187439	1	37

API TANKS SITE 1
ON-SITE GC DATA

PLAME IONIZATION DECTECTOR

CALIBRATIONS FID

COMPOUND	RT	RF	CARBON RF
METH/ETHANE	3.28		0.001852
PROPANE	4.18	0.0006423	
ISOBUTANE	5.16	0.0004494	
N-BUTANE	5.72	0.0004523	
ISOPENTANE	7.86	0.000373	
N-PENTANE	8.68	0.0003809	
N-HEXANE	12.17	0.0003048	
BENZENE	14.1	0.0002632	
N-HEPTANE	15.51	0.0003152	
TOLUENE	17.5	0.0002248	
ETHYLBENZENE	20.31	0.000203	
P-XYLENE	20.5	0.0001866	

FILE: F0929114
SAMPLE: Tank Vent Gas
DATE 9-29-95

COMPOUND	AREA COUNTS	DILUTION FACTOR	CONC PPM	RUN TIME
METH/ETHANE	OR	1		17:58
PROPANE	OR	1		17:58
ISOBUTANE	OR	1		17:58
N-BUTANE	OR	1		17:58
ISOPENTANE	OR	1		17:58
N-PENTANE	OR	1		17:58
N-HEXANE	1.1E+07	1	3214	17:58
BENZENE	1160373	1	311	17:58
N-HEPTANE	8315948	1	2621	17:58
TOLUENE	2768257	1	628	17:58
ETHYLBENZENE	442093	1	90	17:58
P-XYLENE	379314	1	75	17:58

FILE: F0929125
SAMPLE: Tank Vent Gas
DATE 9-29-95

COMPOUND	AREA COUNTS	DILUTION FACTOR	CONC PPM	RUN TIME
METH/ETHANE	OR	1		18:54
PROPANE	OR	1		18:54
ISOBUTANE	OR	1		18:54
N-BUTANE	OR	1		18:54
ISOPENTANE	OR	1		18:54
N-PENTANE	OR	1		18:54
N-HEXANE	1.1E+07	1	3207	18:54
BENZENE	1167580	1	307	18:54
N-HEPTANE	8219241	1	2591	18:54
TOLUENE	2746241	1	617	18:54
ETHYLBENZENE	440467	1	89	18:54
P-XYLENE	373238	1	73	18:54

ON-SITE GC DATA

CALIBRATIONS FID

COMPOUND	RT	RF	CARBON RF
METH/ETHANE	3.28		0.001852
PROPANE	4.18	0.0006423	
ISOBUTANE	5.16	0.0004494	
N-BUTANE	5.72	0.0004523	
ISOPENTANE	7.86	0.000373	
N-PENTANE	8.68	0.0003809	
N-HEXANE	12.17	0.0003048	
BENZENE	14.1	0.0002632	
N-HEPTANE	15.51	0.0003152	
TOLUENE	17.5	0.0002248	
ETHYLBENZENE	20.31	0.000203	
P-XYLENE	20.5	0.0001866	

FILE: F9291812
SAMPLE: Tank Vent Gas
DATE 9-30-95

COMPOUND	AREA COUNTS	DILUTION FACTOR	CONC PPM	RUN TIME
METH/ETHANE	OR	1		00:51
PROPANE	OR	1		00:51
ISOBUTANE	OR	1		00:51
N-BUTANE	OR	1		00:51
ISOPENTANE	OR	1		00:51
N-PENTANE	OR	1		00:51
N-HEXANE	1E+07	1	3101	00:51
BENZENE	1078625	1	283	00:51
N-HEPTANE	3793686	1	1196	00:51
TOLUENE	2154207	1	484	00:51
ETHYLBENZENE	320682	1	66	00:51
P-XYLENE	256211	1	50	00:51

FILE: F9292013
SAMPLE: Tank Vent Gas
DATE 9-30-95

COMPOUND	AREA COUNTS	DILUTION FACTOR	CONC PPM	RUN TIME
METH/ETHANE	OR	1		01:30
PROPANE	OR	1		01:30
ISOBUTANE	OR	1		01:30
N-BUTANE	OR	1		01:30
ISOPENTANE	OR	1		01:30
N-PENTANE	OR	1		01:30
N-HEXANE	1E+07	1	3081	01:30
BENZENE	1038350	1	273	01:30
N-HEPTANE	3831380	1	1146	01:30
TOLUENE	2050934	1	461	01:30
ETHYLBENZENE	307500	1	62	01:30
P-XYLENE	242341	1	48	01:30

FILE: F9292114
SAMPLE: Tank Vent Gas
DATE 9-30-95

COMPOUND	AREA COUNTS	DILUTION FACTOR	CONC PPM	RUN TIME
METH/ETHANE	OR	1		02:28
PROPANE	OR	1		02:28
ISOBUTANE	OR	1		02:28
N-BUTANE	OR	1		02:28
ISOPENTANE	OR	1		02:28
N-PENTANE	OR	1		02:28
N-HEXANE	1E+07	1	3048	02:28
BENZENE	1025865	1	270	02:28
N-HEPTANE	3534254	1	1114	02:28
TOLUENE	1990800	1	447	02:28
ETHYLBENZENE	295426	1	60	02:28
P-XYLENE	230842	1	46	02:28

FILE: F9292215
SAMPLE: Tank Vent Gas
DATE 9-30-95

COMPOUND	AREA COUNTS	DILUTION FACTOR	CONC PPM	RUN TIME
METH/ETHANE	OR	1		03:13
PROPANE	OR	1		03:13
ISOBUTANE	OR	1		03:13
N-BUTANE	OR	1		03:13
ISOPENTANE	OR	1		03:13
N-PENTANE	OR	1		03:13
N-HEXANE	9890963	1	3013	03:13
BENZENE	984079	1	259	03:13
N-HEPTANE	3365335	1	1061	03:13
TOLUENE	1885307	1	423	03:13
ETHYLBENZENE	278608	1	57	03:13
P-XYLENE	223368	1	44	03:13

FILE: F9292316
SAMPLE: Tank Vent Gas
DATE 9-30-95

COMPOUND	AREA COUNTS	DILUTION FACTOR	CONC PPM	RUN TIME
METH/ETHANE	OR	1		04:00
PROPANE	OR	1		04:00
ISOBUTANE	OR	1		04:00
N-BUTANE	OR	1		04:00
ISOPENTANE	OR	1		04:00
N-PENTANE	OR	1		04:00
N-HEXANE	9623547	1	2992	04:00
BENZENE	971787	1	256	04:00
N-HEPTANE	3300073	1	1040	04:00
TOLUENE	1842279	1	414	04:00
ETHYLBENZENE	270401	1	55	04:00
P-XYLENE	211639	1	42	04:00

FILE: F9292417
SAMPLE: Tank Vent Gas
DATE 9-30-95

COMPOUND	AREA COUNTS	DILUTION FACTOR	CONC PPM	RUN TIME
METH/ETHANE	OR	1		04:46
PROPANE	OR	1		04:46
ISOBUTANE	OR	1		04:46
N-BUTANE	OR	1		04:46
ISOPENTANE	OR	1		04:46
N-PENTANE	OR	1		04:46
N-HEXANE	9781318	1	2979	04:46
BENZENE	962075	1	253	04:46
N-HEPTANE	3238340	1	1021	04:46
TOLUENE	1804221	1	405	04:46
ETHYLBENZENE	262021	1	53	04:46
P-XYLENE	205991	1	40	04:46

ON-SITE GC DATA

CALIBRATIONS FID

COMPOUND	RT	RF	CARBON RF
METH/ETHANE	3.28		0.001852
PROPANE	4.18	0.0006423	
ISOBUTANE	5.16	0.0004494	
N-BUTANE	5.72	0.0004523	
ISOPENTANE	7.86	0.000373	
N-PENTANE	8.68	0.0003809	
N-HEXANE	12.17	0.0003048	
BENZENE	14.1	0.0002632	
N-HEPTANE	15.51	0.0003152	
TOLUENE	17.5	0.0002248	
ETHYLBENZENE	20.31	0.000203	
P-XYLENE	20.5	0.0001866	

FILE: F930J1
SAMPLE: Tank Vent Gas
DATE 9-30-95

COMPOUND	AREA COUNTS	DILUTION FACTOR	CONC PPM	RUN TIME
METH/ETHANE	OR	10	0	18:08
PROPANE	OR	10	0	18:08
ISOBUTANE	6688620	10	29659	18:08
N-BUTANE	1.8E+07	10	83636	18:08
ISOPENTANE	8762073	10	25223	18:08
N-PENTANE	6573012	10	25037	18:08
N-HEXANE	1403758	10	4270	18:08
BENZENE	116763	10	307	18:08
N-HEPTANE	466563	10	1471	18:08
TOLUENE	314720	10	707	18:08
ETHYLBENZENE	59348	10	121	18:08
P-XYLENE	37370	10	73	18:08

FILE: F930K1
SAMPLE: Tank Vent Gas
DATE 9-30-95

COMPOUND	AREA COUNTS	DILUTION FACTOR	CONC PPM	RUN TIME
METH/ETHANE	1.7E+07	20	630272	19:04
PROPANE	1.9E+07	20	241184	19:04
ISOBUTANE	4232188	20	37785	19:04
N-BUTANE	1.5E+07	20	139870	19:04
ISOPENTANE	4180375	20	31186	19:04
N-PENTANE	4061087	20	30837	19:04
N-HEXANE	888458	20	6412	19:04
BENZENE	75750	20	399	19:04
N-HEPTANE	298451	20	1861	19:04
TOLUENE	204878	20	920	19:04
ETHYLBENZENE	36907	20	149	19:04
P-XYLENE	20833	20	82	19:04

FILE: F930L1
SAMPLE: Tank Vent Gas
DATE 9-30-95

COMPOUND	AREA COUNTS	DILUTION FACTOR	CONC PPM	RUN TIME
METH/ETHANE	OR	1	0	19:56
PROPANE	OR	1	0	19:56
ISOBUTANE	OR	1	0	19:56
N-BUTANE	OR	1	0	19:56
ISOPENTANE	OR	1	0	19:56
N-PENTANE	OR	1	0	19:56
N-HEXANE	1E+07	1	3079	19:56
BENZENE	1063686	1	286	19:56
N-HEPTANE	4163185	1	1312	19:56
TOLUENE	2436044	1	547	19:56
ETHYLBENZENE	393761	1	80	19:56
P-XYLENE	305133	1	60	19:56

FILE: F930M2
SAMPLE: Tank Vent Gas
DATE 9-30-95

COMPOUND	AREA COUNTS	DILUTION FACTOR	CONC PPM	RUN TIME
METH/ETHANE	OR	1	0	20:48
PROPANE	OR	1	0	20:48
ISOBUTANE	OR	1	0	20:48
N-BUTANE	OR	1	0	20:48
ISOPENTANE	OR	1	0	20:48
N-PENTANE	OR	1	0	20:48
N-HEXANE	1E+07	1	3092	20:48
BENZENE	1079750	1	284	20:48
N-HEPTANE	4047350	1	1276	20:48
TOLUENE	2316543	1	521	20:48
ETHYLBENZENE	362767	1	74	20:48
P-XYLENE	283869	1	56	20:48

FILE: F930N3
SAMPLE: Tank Vent Gas
DATE 9-30-95

COMPOUND	AREA COUNTS	DILUTION FACTOR	CONC PPM	RUN TIME
METH/ETHANE	OR	1	0	21:40
PROPANE	OR	1	0	21:40
ISOBUTANE	OR	1	0	21:40
N-BUTANE	OR	1	0	21:40
ISOPENTANE	OR	1	0	21:40
N-PENTANE	OR	1	0	21:40
N-HEXANE	1E+07	1	3046	21:40
BENZENE	1036451	1	273	21:40
N-HEPTANE	3799970	1	1198	21:40
TOLUENE	2147837	1	482	21:40
ETHYLBENZENE	329464	1	67	21:40
P-XYLENE	256146	1	50	21:40

FILE: F930O4
SAMPLE: Tank Vent Gas
DATE 9-30-95

COMPOUND	AREA COUNTS	DILUTION FACTOR	CONC PPM	RUN TIME
METH/ETHANE	OR	1	0	22:32
PROPANE	OR	1	0	22:32
ISOBUTANE	OR	1	0	22:32
N-BUTANE	OR	1	0	22:32
ISOPENTANE	OR	1	0	22:32
N-PENTANE	OR	1	0	22:32
N-HEXANE	9830595	1	2994	22:32
BENZENE	987927	1	260	22:32
N-HEPTANE	3569486	1	1125	22:32
TOLUENE	2000664	1	449	22:32
ETHYLBENZENE	305600	1	62	22:32
P-XYLENE	238831	1	47	22:32

ON-SITE GC DATA

CALIBRATIONS FID

COMPOUND	RT	RF	CARBON RF
METH/ETHANE	3.28		0.001852
PROPANE	4.18	0.0006423	
ISOBUTANE	5.16	0.0004494	
N-BUTANE	5.72	0.0004523	
ISOPENTANE	7.86	0.000373	
N-PENTANE	8.68	0.0003809	
N-HEXANE	12.17	0.0003048	
BENZENE	14.1	0.0002632	
N-HEPTANE	15.51	0.0003152	
TOLUENE	17.5	0.0002248	
ETHYLBENZENE	20.31	0.000203	
P-XYLENE	20.5	0.0001866	

FILE: F930V11
SAMPLE: Tank Vent Gas
DATE 10-01-95

COMPOUND	AREA COUNTS	DILUTION FACTOR	CONC PPM	RUN TIME
METH/ETHANE	OR	1	0	04:28
PROPANE	OR	1	0	04:28
ISOBUTANE	OR	1	0	04:28
N-BUTANE	OR	1	0	04:28
ISOPENTANE	OR	1	0	04:28
N-PENTANE	OR	1	0	04:28
N-HEXANE	9233861	1	2813	04:28
BENZENE	850362	1	224	04:28
N-HEPTANE	2903991	1	915	04:28
TOLUENE	1601577	1	360	04:28
ETHYLBENZENE	236183	1	48	04:28
P-XYLENE	187020	1	37	04:28

FILE: F930W12
SAMPLE: Tank Vent Gas
DATE 10-01-95

COMPOUND	AREA COUNTS	DILUTION FACTOR	CONC PPM	RUN TIME
METH/ETHANE	OR	1	0	05:10
PROPANE	OR	1	0	05:10
ISOBUTANE	OR	1	0	05:10
N-BUTANE	OR	1	0	05:10
ISOPENTANE	OR	1	0	05:10
N-PENTANE	OR	1	0	05:10
N-HEXANE	9185033	1	2796	05:10
BENZENE	839059	1	221	05:10
N-HEPTANE	2841555	1	896	05:10
TOLUENE	1567957	1	352	05:10
ETHYLBENZENE	231091	1	47	05:10
P-XYLENE	181002	1	36	05:10

FILE: F930X13
SAMPLE: Tank Vent Gas
DATE 10-01-95

COMPOUND	AREA COUNTS	DILUTION FACTOR	CONC PPM	RUN TIME
METH/ETHANE	OR	1	0	06:00
PROPANE	OR	1	0	06:00
ISOBUTANE	OR	1	0	06:00
N-BUTANE	OR	1	0	06:00
ISOPENTANE	OR	1	0	06:00
N-PENTANE	OR	1	0	06:00
N-HEXANE	9121355	1	2778	06:00
BENZENE	825183	1	217	06:00
N-HEPTANE	2776931	1	875	06:00
TOLUENE	1529607	1	344	06:00
ETHYLBENZENE	223660	1	46	06:00
P-XYLENE	176645	1	36	06:00

FILE: F930Y14
SAMPLE: Tank Vent Gas
DATE 10-01-95

COMPOUND	AREA COUNTS	DILUTION FACTOR	CONC PPM	RUN TIME
METH/ETHANE	OR	1	0	06:50
PROPANE	OR	1	0	06:50
ISOBUTANE	OR	1	0	06:50
N-BUTANE	OR	1	0	06:50
ISOPENTANE	OR	1	0	06:50
N-PENTANE	OR	1	0	06:50
N-HEXANE	9062792	1	2761	06:50
BENZENE	818670	1	215	06:50
N-HEPTANE	2725110	1	859	06:50
TOLUENE	1495979	1	336	06:50
ETHYLBENZENE	218467	1	45	06:50
P-XYLENE	176514	1	35	06:50

FILE: F930Z15
SAMPLE: Tank Vent Gas
DATE 10-01-95

COMPOUND	AREA COUNTS	DILUTION FACTOR	CONC PPM	RUN TIME
METH/ETHANE	OR	1	0	07:49
PROPANE	OR	1	0	07:49
ISOBUTANE	OR	1	0	07:49
N-BUTANE	OR	1	0	07:49
ISOPENTANE	OR	1	0	07:49
N-PENTANE	OR	1	0	07:49
N-HEXANE	9071474	1	2763	07:49
BENZENE	811967	1	214	07:49
N-HEPTANE	2718333	1	857	07:49
TOLUENE	1493958	1	336	07:49
ETHYLBENZENE	220942	1	46	07:49
P-XYLENE	173558	1	34	07:49

API TANKS SITE 1
On-Site GC Data
Thermal Conductivity Detector
Calibrations:TCD

COMPOUND	RT	RF
OXYGEN	3.33	3.777E-05
NITROGEN	4.5	3.497E-05
METHANE	8.1	4.682E-05
ETHANE	21.6	2.778E-05
PROPANE	32.9	2E-05

FILE NO.: T192831
SAMPLE: TANK VENT GAS
DATE: 9-28-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PERCENT	RUN TIME
OXYGEN	102256	1	3.86	20:24
NITROGEN	456423	1	15.96	20:24
METHANE	570825	1	26.73	20:24
ETHANE	351263	1	9.76	20:24
PROPANE	ND	1	0.00	20:24

FILE NO.: T092941
SAMPLE: TANK VENT GAS
DATE: 9-29-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PERCENT	RUN TIME
OXYGEN	3365	10	1.27	10:37
NITROGEN	30226	10	10.57	10:37
METHANE	69452	10	32.52	10:37
ETHANE	41093	10	11.42	10:37
PROPANE	153036	10	30.61	10:37

NOTE: These may not be good
Problem with sample loop

FILE NO.: T092961
SAMPLE: TANK VENT GAS
DATE: 9-29-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PERCENT	RUN TIME
OXYGEN	21888	20	16.53	12:45
NITROGEN	104075	20	72.79	12:45
METHANE	38620	20	36.16	12:45
ETHANE	23450	20	13.03	12:45
PROPANE	59474	20	23.79	12:45

NOTE: These may not be good
Problem with sample loop

FILE NO.: T092961
SAMPLE: TANK VENT GAS
DATE: 9-29-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PERCENT	RUN TIME
OXYGEN	38567	1	1.46	15:11
NITROGEN	212680	1	7.44	15:11
METHANE	585144	1	27.40	15:11
ETHANE	384154	1	10.67	15:11
PROPANE	1274694	1	25.49	15:11

COMPOUND	RT	RF
OXYGEN	3.33	3.777E-05
NITROGEN	4.5	3.497E-05
METHANE	8.1	4.682E-05
ETHANE	21.6	2.778E-05
PROPANE	32.9	2E-05

FILE NO.: T9291710
SAMPLE: TANK VENT GAS
DATE: 9-29-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PERCENT	RUN TIME
OXYGEN	28704	1	1.08	23:14
NITROGEN	151804	1	5.31	23:14
METHANE	547568	1	25.64	23:14
ETHANE	397938	1	11.05	23:14
PROPANE	1348324	1	26.97	23:14

FILE NO.: T9291811
SAMPLE: TANK VENT GAS
DATE: 9-30-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PERCENT	RUN TIME
OXYGEN	27796	1	1.05	00:03
NITROGEN	147940	1	5.17	00:03
METHANE	548716	1	25.69	00:03
ETHANE	401729	1	11.16	00:03
PROPANE	1349396	1	26.99	00:03

FILE NO.: T9291912
SAMPLE: TANK VENT GAS
DATE: 9-30-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PERCENT	RUN TIME
OXYGEN	37870	1	1.43	00:51
NITROGEN	187528	1	6.56	00:51
METHANE	539490	1	25.26	00:51
ETHANE	393954	1	10.94	00:51
PROPANE	1326720	1	26.53	00:51

FILE NO.: T9292013
SAMPLE: TANK VENT GAS
DATE: 9-30-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PERCENT	RUN TIME
OXYGEN	45371	1	1.71	1:39
NITROGEN	216941	1	7.59	1:39
METHANE	530646	1	24.84	1:39
ETHANE	388653	1	10.80	1:39
PROPANE	1303736	1	26.07	1:39

COMPOUND	RT	RF
OXYGEN	3.33	3.777E-05
NITROGEN	4.5	3.497E-05
METHANE	8.1	4.682E-05
ETHANE	21.6	2.778E-05
PROPANE	32.9	2E-05

FILE NO.: T092992
SAMPLE: TANK VENT GAS
DATE: 9-29-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PERCENT	RUN TIME
OXYGEN	41676	1	1.57	16:07
NITROGEN	187314	1	6.55	16:07
METHANE	570954	1	26.73	16:07
ETHANE	404912	1	11.25	16:07
PROPANE	1287675	1	25.75	16:07

FILE NO.: T0929103
SAMPLE: TANK VENT GAS
DATE: 9-29-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PERCENT	RUN TIME
OXYGEN	36977	1	1.40	17:03
NITROGEN	172488	1	6.03	17:03
METHANE	568665	1	26.62	17:03
ETHANE	387815	1	10.77	17:03
PROPANE	1314799	1	26.30	17:03

FILE NO.: T0929114
SAMPLE: TANK VENT GAS
DATE: 9-29-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PERCENT	RUN TIME
OXYGEN	36137	1	1.36	17:59
NITROGEN	169857	1	5.94	17:59
METHANE	562013	1	26.31	17:59
ETHANE	393467	1	10.93	17:59
PROPANE	1314815	1	26.30	17:59

FILE NO.: T0929125
SAMPLE: TANK VENT GAS
DATE: 9-29-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PERCENT	RUN TIME
OXYGEN	40340	1	1.52	18:54
NITROGEN	196778	1	6.88	18:54
METHANE	543536	1	25.45	18:54
ETHANE	378522	1	10.52	18:54
PROPANE	1275420	1	25.51	18:54

COMPOUND	RT	RF
OXYGEN	3.33	3.777E-05
NITROGEN	4.5	3.497E-05
METHANE	8.1	4.682E-05
ETHANE	21.6	2.778E-05
PROPANE	32.9	2E-05

FILE NO.: T9292114
SAMPLE: TANK VENT GAS
DATE: 9-30-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PERCENT	RUN TIME
OXYGEN	44406	1	1.68	2:26
NITROGEN	212203	1	7.42	2:26
METHANE	534672	1	25.03	2:26
ETHANE	391321	1	10.87	2:26
PROPANE	1317876	1	26.36	2:26

FILE NO.: T9292215
SAMPLE: TANK VENT GAS
DATE: 9-30-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PERCENT	RUN TIME
OXYGEN	57110	1	2.16	3:13
NITROGEN	259266	1	9.07	3:13
METHANE	522092	1	24.44	3:13
ETHANE	380066	1	10.56	3:13
PROPANE	1281362	1	25.63	3:13

FILE NO.: T9292316
SAMPLE: TANK VENT GAS
DATE: 9-30-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PERCENT	RUN TIME
OXYGEN	57391	1	2.17	4:00
NITROGEN	261224	1	9.14	4:00
METHANE	525550	1	24.61	4:00
ETHANE	380718	1	10.58	4:00
PROPANE	1278965	1	25.58	4:00

FILE NO.: T9292417
SAMPLE: TANK VENT GAS
DATE: 9-30-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PERCENT	RUN TIME
OXYGEN	55182	1	2.08	4:46
NITROGEN	252413	1	8.83	4:46
METHANE	531573	1	24.89	4:46
ETHANE	385600	1	10.71	4:46
PROPANE	1286580	1	25.73	4:46

COMPOUND	RT	RF
OXYGEN	3.33	3.777E-05
NITROGEN	4.5	3.497E-05
METHANE	8.1	4.682E-05
ETHANE	21.6	2.778E-05
PROPANE	32.9	2E-05

FILE NO.: T929136
SAMPLE: TANK VENT GAS
DATE: 9-29-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PERCENT	RUN TIME
OXYGEN	37466	1	1.42	19:51
NITROGEN	187041	1	6.54	19:51
METHANE	546882	1	25.61	19:51
ETHANE	383828	1	10.66	19:51
PROPANE	1292966	1	25.86	19:51

FILE NO.: T929147
SAMPLE: TANK VENT GAS
DATE: 9-29-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PERCENT	RUN TIME
OXYGEN	35392	1	1.34	20:43
NITROGEN	178114	1	6.23	20:43
METHANE	545397	1	25.54	20:43
ETHANE	384176	1	10.67	20:43
PROPANE	1304800	1	26.10	20:43

FILE NO.: T929158
SAMPLE: TANK VENT GAS
DATE: 9-29-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PERCENT	RUN TIME
OXYGEN	33570	1	1.27	21:35
NITROGEN	170748	1	5.97	21:35
METHANE	545482	1	25.54	21:35
ETHANE	391213	1	10.87	21:35
PROPANE	1318342	1	26.37	21:35

FILE NO.: T929169
SAMPLE: TANK VENT GAS
DATE: 9-29-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PERCENT	RUN TIME
OXYGEN	30700	1	1.16	22:25
NITROGEN	160592	1	5.62	22:25
METHANE	545574	1	25.54	22:25
ETHANE	394458	1	10.96	22:25
PROPANE	1330326	1	26.61	22:25

COMPOUND	RT	RF
OXYGEN	3.33	3.777E-05
NITROGEN	4.5	3.497E-05
METHANE	8.1	4.682E-05
ETHANE	21.6	2.778E-05
PROPANE	32.9	2E-05

FILE NO.: T9292518
SAMPLE: TANK VENT GAS
DATE: 9-30-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PERCENT	RUN TIME
OXYGEN	53224	1	2.01	5:33
NITROGEN	245249	1	8.58	5:33
METHANE	535695	1	25.08	5:33
ETHANE	387171	1	10.76	5:33
PROPANE	1282642	1	25.65	5:33

FILE NO.: T9292619
SAMPLE: TANK VENT GAS
DATE: 9-30-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PERCENT	RUN TIME
OXYGEN	49876	1	1.88	6:19
NITROGEN	235086	1	8.22	6:19
METHANE	542236	1	25.39	6:19
ETHANE	390102	1	10.84	6:19
PROPANE	1292470	1	25.85	6:19

FILE NO.: T9292720
SAMPLE: TANK VENT GAS
DATE: 9-30-95

COMPOUND	AREA COUNTS	DILUTIO FACTOR	CONC PERCENT	RUN TIME
OXYGEN	46542	1	1.76	7:06
NITROGEN	222538	1	7.78	7:06
METHANE	556574	1	26.06	7:06
ETHANE	394264	1	10.95	7:06
PROPANE	951210	1	19.02	7:06

NOTE: PROPANE BIASED LOW

Site 2

API TANKS: SITE 2
PROCESS DATA

Date	Time	Separator Temp.(F)	Separator Press.(psig)	Oil Production (bopd)
Nov. 28,1995	9:00	124	30	1614
Nov. 29,1995	13:45	115	30	1614
	22:08	125	30	1614
Nov. 30,1995	8:30	123	NM	1614
	10:18	113	NM	1614
	10:25	111	NM	1614
	10:41	110	NM	1614
	11:50	113	30	1614
	12:23	112	NM	1614
	14:00	113	30	1614
	14:55	112	NM	1614
	15:10	110	NM	1614
Averages		115	30	1614
Average during flow and conc measurements		112		

API Tanks Site 2

Separator Gas Composition (Mole%)

Compound Date Time	Average
Oxygen	0.06
Nitrogen	6.53
Carbon Dioxide	0.75
Methane	24.81
Ethane	27.81
Propane	24.09
Isobutane	2.90
N-butane	7.97
Isopentane	1.56
N-pentane	1.90
2,2-dimethylbutane	0.026
2-Methylpentane	0.319
3-Methylpentane	0.225
N-hexane	0.383
Methylcyclopentane	0.138
Benzene	0.043
Cyclohexane	0.098
2-Methylhexane	0.051
3-Methylhexane	0.051
Dimethylcyclopentanes	0.063
n-Heptane	0.080
Methylcyclohexane	0.070
Trimethylcyclopentanes	0.013
Toluene	0.010
2-Methylheptane	0.013
3-Methylheptane	0.010
Dimethylcyclohexanes	0.007
n-Octane	0.011
Ethylbenzene	0.000
Xylenes	0.002
C9 Unknowns	0.001
n-Nonane	0.001
Decanes+	0.001

API Tanks Site 2

Separator Oil Composition (Mole%)

Compound	SCCY01	SCCY02	Average	RSD
Date	11/29/95	11/30/95		
Time	3:20 PM	10:25 AM		
Nitrogen	0.01	0.03	0.02	70.7%
Carbon Dioxide	0.03	0.02	0.03	28.3%
Hydrogen Sulfide	0.01	0.00	0.01	141.4%
Methane	0.20	0.30	0.25	28.3%
Ethane	2.31	2.44	2.38	3.9%
Propane	7.14	6.85	7.00	2.9%
i-Butane	2.11	2.02	2.07	3.1%
n-Butane	7.37	7.21	7.29	1.6%
i-Pentane	3.36	3.39	3.38	0.6%
n-Pentane	4.80	4.73	4.77	1.0%
n-Hexane	3.64	3.62	3.63	0.4%
Hexanes	3.04	2.95	3.00	2.1%
Benzene	0.43	0.46	0.45	4.8%
Heptanes	7.37	7.50	7.44	1.2%
Toluene	0.38	0.47	0.43	15.0%
Octanes	11.11	11.16	11.14	0.3%
Ethylbenzene	0.25	0.25	0.25	0.0%
Xylenes	1.57	1.60	1.59	1.3%
Nonanes	17.25	17.31	17.28	0.2%
Decanes Plus	27.62	27.70	27.66	0.2%
Decanes+ MW	485	484	485	0.1%
Decanes+ SG	0.883	0.878	0.881	0.4%

API Tanks Site 2

Sales Oil Composition (weight%)

Compound	SOBT01
Date	11/30/95
Time	2:40 PM
Nitrogen	0.00
Methane	0.00
Ethane	0.04
Propane	0.61
i-Butane	0.34
n-Butane	1.58
i-Pentane	1.04
n-Pentane	1.70
n-Hexane	0.00
Hexanes	3.09
Benzene	0.00
Heptanes	5.49
Toluene	0.00
Octanes	6.35
Ethylbenzene	0.00
Xylenes	0.00
Nonanes	4.68
Decanes Plus	75.07
API Gravity	43.23
RVP	8.70

API TANKS SITE 2

Tank Vent Gas Samples (Canister)

Compound	Sample 1 Conc (ppmv)	Analytical Dup Conc (ppmv)	Sample 1 Normalized Conc (ppmv)	Analytical Dup Norm. Conc (ppmv)	Average Normalized Conc (ppmv)
Ethane	159,500	160,900	137,086	138,290	137,688
Propane	333,000	331,400	286,204	284,831	285,517
Isobutane	54,770	56,050	47,073	48,174	47,623
N-butane	186,400	192,100	160,205	165,106	162,655
Isopentane	41,390	45,190	35,573	38,840	37,207
N-Pentane	57,700	64,850	49,591	55,737	52,664
N-hexane	21,790	20,910	18,728	17,972	18,350
Benzene	2,450	2,311	2,106	1,986	2,046
Toluene	1,524	1,229	1,310	1,056	1,183
Ethylbenzene	275	224	236	192	214
m,p-xylene	718	604	617	519	568
o-xylene	236	184	203	158	181
Other Ethanes	4,200	6,200	3,610	5,329	4,469
Other Propanes	0	0	0	0	0
Other Butanes	4,430	4,650	3,807	3,997	3,902
Other Pentanes	34,210	36,060	29,402	30,993	30,198
Other Hexanes	38,260	33,060	32,883	28,414	30,649
Heptanes	32,790	26,330	28,182	22,630	25,406
Octanes	10,970	8,912	9,428	7,660	8,544
Nonanes	2,481	1,791	2,132	1,539	1,836
Decanes	300	162	258	139	199
Other Hydrocarbons	0	0	0	0	0
Oxygen	46,380	44,270	0	0	0
Nitrogen	198,600	188,700	20,809	19,119	19,964
Methane	145,700	141,100	125,225	121,272	123,249
Carbon Dioxide	6,202	7,036	5,330	6,047	5,689
Total	1,384,276	1,374,223	1,000,000	1,000,000	1,000,000

Site 3

API Tanks Site 3

TANK VENT CANISTER SAMPLES
Normalized

Field ID	API3-VGCA01 Analysis 1	API3-VGCA01 Analysis 2	API3-VGCA01 Average	API3-VGCA02	API3-VGCA03	API3-VGCA04 Analysis 1	API3-VGCA04 Analysis 2	API3-VGCA04 Average	API3-VGCA05	API3-VGCA06	Average	RSD
Start Date			Jan. 30, 1996	Jan. 30, 1996	Jan. 31, 1996			Jan. 31, 1996	Feb. 1, 1996	Feb. 1, 1996		
End Date			Jan. 30, 1996	Jan. 31, 1996	Jan. 31, 1996			Feb. 1, 1996	Feb. 1, 1996	Feb. 2, 1996		
Start Time			8:15 AM	7:32 PM	8:01 AM			7:53 PM	8:13 AM	7:53 PM		
End Time			7:03 PM	7:49 AM	7:38 PM			7:47 AM	7:32 PM	7:08 AM		
ppmv												
ETHANE	159,478	163,375	161,426	169,916	177,493	215,991	226,221	221,106	200,903	199,600	188,408	11.96%
PROPANE	107,216	111,484	109,350	118,484	116,905	139,837	147,466	143,652	125,927	123,620	122,989	9.48%
ISOBUTANE	40,204	41,003	40,603	44,631	42,791	49,595	52,105	50,850	48,107	43,291	45,046	8.37%
N-BUTANE	32,750	33,484	33,117	36,221	34,295	41,066	42,954	42,010	38,111	34,017	36,295	9.16%
ISOPENTANE	18,027	18,388	18,208	19,839	18,351	21,732	22,773	22,253	19,929	17,531	19,352	8.83%
N-PENTANE	8,437	8,594	8,516	9,246	8,416	9,948	10,407	10,177	9,030	7,865	8,875	9.04%
N-HEXANE	2,783	2,855	2,819	2,936	2,573	2,939	3,074	3,006	2,696	2,268	2,718	9.95%
BENZENE	2,436	2,470	2,453	2,541	2,224	2,527	2,634	2,581	2,318	1,919	2,339	10.52%
TOLUENE	1,590	1,594	1,592	1,468	1,216	1,204	1,275	1,239	1,206	968	1,281	17.18%
ETHYLBENZENE	48	47	48	39	23	18	19	19	19	18	27	46.07%
M/P-XYLENE	233	230	231	185	108	94	93	93	86	78	130	48.19%
O-XYLENE	46	43	44	35	15	13	13	13	13	12	22	62.70%
OTHER C2	0	0	0	0	0	0	0	0	0	0	0	ERR
OTHER C3	0	0	0	0	0	0	0	0	0	0	0	ERR
OTHER C4	4,474	4,573	4,524	5,057	4,758	4,188	4,721	4,455	5,267	4,708	4,795	6.53%
OTHER C5	9,581	9,775	9,678	10,231	9,129	10,604	11,160	10,882	9,676	8,263	9,643	9.34%
OTHER C6	7,781	7,946	7,864	7,931	6,879	7,618	8,056	7,837	7,196	6,061	7,295	10.12%
C7	4,791	4,801	4,796	4,444	3,644	3,601	3,783	3,692	3,633	2,942	3,859	17.14%
C8	1,075	1,058	1,066	834	527	414	431	423	436	368	609	45.85%
C9	236	192	214	181	29	32	30	31	23	20	83	107.58%
C10+	87	44	66	40	8	4	3	3	5	0	20	133.90%
OXYGEN	76,870	74,910	75,890	70,624	74,114	33,127	32,808	32,968	57,514	56,218	61,221	28.41%
NITROGEN	284,609	256,471	270,540	244,206	272,551	128,890	124,663	126,777	203,156	213,158	221,731	24.62%
METHANE	201,529	218,924	210,226	212,585	183,901	274,249	251,234	262,742	218,564	227,752	218,962	11.81%
CARBON DIOXIDE	35,720	37,739	36,729	38,328	40,052	52,308	54,074	53,191	48,182	49,326	44,301	15.32%

API Tanks Site 3: FID Measurements

Sample	Comment	Date	Time	Dilution Factor	Actual Concentration (ppmv) Ethane	Propane	i-Butane	n-Butane	i-Pentane	n-Pentane	n-Hexane
AD0111	Syringe dilution	Tuesday, January 30, 1996	8:53:54 AM	10	387352	81840	45336	40600	21940	10285	3810.0
AD0121	Syringe dilution	Tuesday, January 30, 1996	9:53:18 AM	10	0	0	45931	41968	23156	11021	3869.0
AD0181	Many mis-ID	Tuesday, January 30, 1996	3:50:52 PM	11	0	12023	0	11275	0	10569	10606.2
AD0191		Tuesday, January 30, 1996	4:39:57 PM	11	442879	95872	53065	44866	25408	11828	3938.0
AD0201		Tuesday, January 30, 1996	5:27:08 PM	11	0	0	151	190	173	125	125.4
AD0212		Tuesday, January 30, 1996	6:16:40 PM	11	447857	98196	56024	50267	29021	13659	4588.1
AD0223		Tuesday, January 30, 1996	7:06:13 PM	11	450718	99246	57239	51952	29665	13704	4398.9
AD0234		Tuesday, January 30, 1996	7:56:08 PM	11	450387	99981	57934	53326	30796	14510	4571.6
AD0245		Tuesday, January 30, 1996	8:46:39 PM	11	448637	99341	57486	52370	30161	13976	4634.3
AD0256		Tuesday, January 30, 1996	9:37:15 PM	11	447004	98635	56562	51167	30022	14142	5003.9
AD0267		Tuesday, January 30, 1996	10:27:54 PM	11	449258	99955	58000	53137	31277	14715	5006.1
AD0278		Tuesday, January 30, 1996	11:18:34 PM	11	449737	100422	58479	53765	31793	14986	5247.0
AD0289		Wednesday, January 31, 1996	12:09:13 AM	11	448769	100382	58508	53855	31963	15070	5188.7
AD02910		Wednesday, January 31, 1996	12:59:51 AM	11	450286	101170	58968	54164	31978	15127	5220.6
AD03011		Wednesday, January 31, 1996	1:50:20 AM	11	449932	101321	59412	54724	31548	14636	4983.0
AD03112		Wednesday, January 31, 1996	2:40:09 AM	11	0	0	911	1106	2152	1912	2664.2
AD03213		Wednesday, January 31, 1996	3:29:22 AM	11	0	0	81	112	129	103	574.2
AD03314		Wednesday, January 31, 1996	4:18:18 AM	11	437141	96753	51921	41237	22565	10007	1276.0
AD03415		Wednesday, January 31, 1996	5:06:50 AM	11	0	0	250	322	425	358	917.4
AD03516		Wednesday, January 31, 1996	5:54:59 AM	11	0	0	157	178	235	174	313.5
AD03617		Wednesday, January 31, 1996	6:42:42 AM	11	0	80469	24824	16554	4513	1207	66.0
AD03718		Wednesday, January 31, 1996	7:30:09 AM	11	453758	101919	58927	53474	29185	13044	2646.6
AD03819		Wednesday, January 31, 1996	8:17:44 AM	11	455084	101969	58755	53192	29242	13299	3482.6
AD04122		Wednesday, January 31, 1996	10:41:46 AM	11	432872	92534	48623	38680	19548	8095	979.0
AD04223		Wednesday, January 31, 1996	11:29:57 AM	11	431318	92371	49619	40565	22081	10126	3065.7
AD04324		Wednesday, January 31, 1996	12:18:48 PM	11	432801	92962	50387	41758	23674	10999	3633.3
AD04425		Wednesday, January 31, 1996	1:08:15 PM	11	435560	93847	50991	42013	23772	11138	3857.7
AD04526		Wednesday, January 31, 1996	1:58:12 PM	11	432763	93016	50658	42271	24130	11315	4011.7
AD04627		Wednesday, January 31, 1996	2:48:14 PM	11	0	3190	2319	3160	6927	4847	2873.2
AD04728		Wednesday, January 31, 1996	3:38:16 PM	11	428261	90621	40059	27847	9271	3297	1344.2
AD04930		Wednesday, January 31, 1996	5:24:48 PM	11	0	0	106	156	328	249	542.3
AD05031		Wednesday, January 31, 1996	6:13:40 PM	11	0	298	95	91	95	75	129.8
AD05132		Wednesday, January 31, 1996	7:02:50 PM	11	0	39699	11507	8225	3507	1397	375.1
AD05233		Wednesday, January 31, 1996	7:51:53 PM	11	436085	94107	51015	41606	21858	9838	2428.8
AD05334		Wednesday, January 31, 1996	8:40:17 PM	11	434880	93143	50162	40905	22150	10013	2640.0

STD.API/PETRO PUBL 4662-ENGL 1997 ■ 0732290 0608825 378 ■

API Tanks Site 3: FID Measurements

Sample	Comment	Date	Time	Dilution Factor	Actual Concentration (ppmv) Ethane	Propane	i-Butane	n-Butane	i-Pentane	n-Pentane	n-Hexane
AD05435		Wednesday, January 31, 1996	9:28:35 PM	11	435901	93496	50690	41634	22746	10475	3206.5
AD05536		Wednesday, January 31, 1996	10:16:50 PM	11	434278	93107	50662	41758	22673	10380	3190.0
AD05637		Wednesday, January 31, 1996	11:05:03 PM	11	435518	93136	50354	41163	22513	10387	3323.1
AD05738		Wednesday, January 31, 1996	11:53:09 PM	11	436128	93541	50663	41546	22685	10458	3305.5
AD05839		Thursday, February 01, 1996	12:41:11 AM	11	436095	93449	50665	41195	22078	10086	3133.9
AD05940		Thursday, February 01, 1996	1:29:09 AM	11	435758	93105	50372	41170	22316	10262	3358.3
AD06041		Thursday, February 01, 1996	2:17:01 AM	11	436983	93244	50225	41118	22782	10489	3209.8
AD06142		Thursday, February 01, 1996	3:04:46 AM	11	436976	93256	50258	40774	21760	9899	3049.2
AD06243		Thursday, February 01, 1996	3:52:25 AM	11	435949	92952	50060	40730	22001	10104	3223.0
AD06344		Thursday, February 01, 1996	4:39:55 AM	11	428101	89836	43916	35592	21390	9931	2993.1
AD06445		Thursday, February 01, 1996	5:27:16 AM	11	410802	89421	47287	37874	20169	9174	2820.4
AD06546		Thursday, February 01, 1996	6:14:31 AM	11	437507	92873	49767	40236	21530	9800	2916.1
AD06950		Thursday, February 01, 1996	9:54:08 AM	11	439138	93867	50207	40137	20870	9286	2251.7
AD07051		Thursday, February 01, 1996	10:44:43 AM	11	438792	94040	51020	41876	22631	10349	3193.3
AD07152		Thursday, February 01, 1996	11:35:46 AM	11	439293	93867	50663	41404	22715	10418	3303.3
AD07253		Thursday, February 01, 1996	12:52:23 PM	16	72355	68203	14539	8112	1728	838	1774.4
AD07455		Thursday, February 01, 1996	2:35:40 PM	16	0	0	435	536	736	606	958.4
AD07758		Thursday, February 01, 1996	5:14:42 PM	16	0	114394	40429	31781	16674	7486	2032.0
AD07859		Thursday, February 01, 1996	6:03:29 PM	16	0	114003	40158	31534	16888	7654	2233.6
AD07960		Thursday, February 01, 1996	6:51:55 PM	16	0	114227	40510	31858	16963	7698	2348.8
AD08061		Thursday, February 01, 1996	7:40:36 PM	7.75	313166	68009	39252	35687	20313	9309	2865.2
AD08162		Thursday, February 01, 1996	8:28:49 PM	7.75	313750	68295	39358	35707	20046	9188	2852.0
AD08263		Thursday, February 01, 1996	9:16:50 PM	7.75	313065	67942	38984	35244	19767	9064	2769.9
AD08364		Thursday, February 01, 1996	10:04:41 PM	7.75	313999	68220	39172	35373	19600	8978	2751.3
AD08465		Thursday, February 01, 1996	10:52:24 PM	7.75	313911	68227	39178	35396	19662	8972	2748.2
AD08566		Thursday, February 01, 1996	11:39:52 PM	7.75	314369	68156	39040	35152	19580	8968	2782.3
AD08667		Friday, February 02, 1996	12:27:16 AM	7.75	310188	65633	34111	24713	9601	4264	2733.4
AD08768		Friday, February 02, 1996	1:14:29 AM	7.75	313872	67754	38731	34787	18995	8575	2456.0
AD08869		Friday, February 02, 1996	2:01:35 AM	7.75	313760	67762	38706	34760	19003	8591	2562.9
AD08970		Friday, February 02, 1996	2:48:36 AM	7.75	312998	67421	38435	34342	18764	8499	2520.3
AD09071		Friday, February 02, 1996	3:35:34 AM	7.75	314508	67764	38478	34129	18722	8451	2536.6
AD09172		Friday, February 02, 1996	4:22:22 AM	7.75	314001	67583	38429	34203	18988	3913	2587.7
AD09273		Friday, February 02, 1996	5:09:03 AM	7.75	0	0	176	226	1021	925	1895.7
AD09374		Friday, February 02, 1996	5:55:44 AM	7.75	313228	67062	37691	32713	16710	7276	1526.0
AD09475		Friday, February 02, 1996	6:42:21 AM	7.75	313746	67203	37901	33210	17820	8013	2151.4

API Site 3 On-Site GC (cont'd)

Benzene	n-Heptane	Toluene	Ethyl-Benzene	m,p-Xylene	o-Xylene	C6 Range	C7 Range	C8 Range	C9 Range	C10+	Total C4+
2931.0	1357.0	2121.0	163.0	364.0	225.0	10553.0	6294.0	0.0	0.0	0.0	145,979
2994.0	1362.0	2217.0	197.0	450.0	0.0	0.0	0.0	0.0	0.0	0.0	133,165
4.3	3.0	6.1	0.0	12.7	0.0	0.0	0.0	0.0	0.0	0.0	32,476
2509.1	1063.7	1094.5	41.5	124.3	88.7	11647.9	5949.9	2123.0	133.1	268.4	164,149
308.0	152.9	570.9	100.7	178.2	139.7	204.6	345.4	631.4	172.7	169.4	3,738
3177.9	1157.2	1233.1	33.7	105.5	56.9	13527.8	6810.1	2200.0	123.2	117.7	182,102
3274.7	1216.6	1519.1	35.8	107.5	49.5	13050.4	6708.9	2442.0	158.4	126.5	185,647
3440.8	1266.1	1659.9	40.2	117.7	432.3	13799.5	6928.9	2565.2	176.0	135.3	191,699
3481.5	1285.9	1758.9	51.3	140.8	57.6	13508.0	7015.8	2680.7	199.1	125.4	188,932
3808.2	1579.6	2239.6	99.2	228.8	112.2	14264.8	7958.5	3452.9	331.1	151.8	191,123
3817.0	1665.4	2472.8	130.9	293.7	145.2	14524.4	8031.1	3837.9	429.0	176.0	197,658
3983.1	1760.0	3007.4	140.8	326.7	165.0	15021.6	8455.7	4061.2	437.8	218.9	201,849
3953.4	1702.8	2570.7	161.7	360.8	199.1	14923.7	8297.3	3974.3	497.2	253.0	201,478
3984.2	1735.8	2625.7	168.3	380.6	215.6	15040.3	8380.9	4062.3	526.9	283.8	202,862
3800.5	1632.4	2489.3	161.7	369.6	200.2	14437.5	7979.4	3844.5	497.2	237.6	200,952
2044.9	882.2	1180.3	80.1	172.7	108.9	5723.3	4647.5	1947.0	211.2	151.8	25,894
867.9	863.5	1246.3	59.3	133.1	73.3	574.2	2461.8	2018.5	195.8	80.1	9,574
785.4	599.5	1340.9	86.8	205.7	102.2	6321.7	1691.8	1829.3	277.2	94.8	140,341
773.3	438.9	820.6	64.5	140.8	72.1	1505.9	1813.9	1269.4	199.1	68.8	9,439
457.6	330.0	701.8	64.2	126.5	70.0	466.4	972.4	1070.3	191.4	54.8	5,564
210.1	231.0	724.9	84.9	166.1	92.6	226.6	366.3	1015.3	234.3	210.1	50,726
1529.0	145.2	522.5	90.9	202.4	122.1	10058.4	2376.0	1023.0	177.1	119.9	173,643
2255.0	383.9	453.2	57.0	139.7	90.9	11517.0	4035.9	805.2	73.7	105.7	177,888
897.6	420.2	493.9	50.4	94.7	70.1	4292.2	1986.6	853.6	87.0	59.5	125,231
2306.7	723.8	832.7	40.6	103.2	64.5	9451.2	4376.9	1419.0	94.5	80.9	144,950
2753.3	980.1	1208.9	38.7	105.5	55.4	10695.3	5511.0	1942.6	123.2	59.5	153,925
2930.4	1087.9	1412.4	38.7	110.0	50.9	11191.4	5943.3	2205.5	147.4	50.9	156,940
3088.8	1177.0	1575.2	38.3	121.0	45.7	8971.6	6319.5	2409.0	161.7	35.9	156,329
2075.7	834.9	1146.2	38.5	105.1	42.6	7910.1	4357.1	1782.0	124.3	32.0	38,574
1464.1	1204.5	1670.9	57.0	134.2	70.2	2708.2	3994.1	2582.8	201.3	66.6	95,971
656.7	607.2	1009.8	49.6	117.7	57.2	771.1	1767.7	1563.1	178.2	58.3	8,217
217.8	347.6	906.4	64.8	147.4	71.0	204.6	592.9	1265.0	232.1	77.1	4,612
336.6	242.0	708.4	82.5	188.1	90.6	1090.1	739.2	1045.0	254.1	92.4	29,880
1604.9	269.5	488.4	78.1	198.0	102.3	8354.5	2674.1	784.3	173.8	94.9	141,569
1859.0	415.8	546.7	56.1	139.7	80.2	8668.0	3305.5	895.4	0.0	80.1	141,916

API Site 3 On-Site GC (cont'd)

Benzene	n-Heptane	Toluene	Ethyl-Benzene	m,p-Xylene	o-Xylene	C6 Range	C7 Range	C8 Range	C9 Range	C10+	Total C4+
2314.4	656.7	772.2	41.8	112.2	61.8	9837.3	4452.8	1280.4	95.3	59.7	148,436
2367.2	735.9	911.9	37.4	102.3	53.5	9708.6	4581.5	1455.3	102.7	49.6	148,769
2484.9	832.7	1039.5	30.8	90.2	40.7	9950.6	4923.6	1636.8	103.1	35.6	148,908
2462.9	821.7	1062.6	29.7	90.2	37.8	9981.4	4846.6	1635.7	76.0	28.8	149,731
2398.0	848.1	1133.0	28.6	88.0	33.9	9440.2	4721.2	1724.8	113.3	25.1	147,712
2542.1	851.4	1090.1	26.4	85.8	34.1	9927.5	5019.3	1665.4	72.6	25.1	148,818
2367.2	726.0	987.8	31.9	92.4	39.9	9873.6	4525.4	1488.3	108.2	26.4	148,090
2319.9	759.0	1007.6	26.4	80.3	33.0	9226.8	4485.8	1519.1	70.7	24.4	145,293
2426.6	774.4	1016.4	24.2	77.0	29.7	9688.8	4705.8	1538.9	94.4	17.6	146,511
2236.3	728.2	963.6	23.1	73.7	28.2	9211.4	4336.2	1457.5	68.3	15.0	132,963
2163.7	696.3	949.3	20.9	69.3	25.5	8567.9	3004.1	1391.5	64.0	16.7	134,293
2238.5	749.1	993.3	19.8	67.1	23.7	8884.7	4347.2	1482.8	62.3	17.5	143,135
1752.3	764.5	1031.8	31.9	89.1	38.5	7361.2	3776.3	1611.5	117.7	32.8	139,360
2404.6	833.8	1112.1	25.3	79.2	28.1	9777.9	4730.0	1676.4	76.1	13.4	149,826
2503.6	877.8	1182.5	23.1	77.0	26.6	9937.4	4935.7	1756.7	77.1	16.1	149,917
1606.4	851.2	1022.4	25.6	70.4	228.8	2982.4	3942.4	1732.8	82.7	3.5	39,541
822.4	590.4	948.8	32.0	86.4	35.2	1928.0	1996.8	1430.4	136.0	16.0	11,294
1499.2	371.2	531.2	49.6	123.2	67.2	6553.6	2696.0	851.2	100.8	54.4	111,299
1665.6	483.2	612.8	32.0	88.0	51.8	6968.0	3156.8	968.0	51.7	48.6	112,595
1784.0	587.2	771.2	24.0	75.2	36.8	7163.2	3475.2	1187.2	57.6	35.2	114,574
2135.9	705.3	921.5	24.8	76.7	32.6	8718.8	4209.8	1421.4	91.5	34.1	125,799
2141.3	724.6	973.4	24.8	76.7	29.5	8647.5	4205.2	1484.1	101.5	27.9	125,588
2102.6	727.7	996.7	24.0	75.2	27.1	8447.5	4124.6	1502.7	103.9	20.9	123,981
2083.2	709.1	975.7	24.8	78.3	27.9	8395.6	4070.3	1467.1	103.1	18.6	123,829
2089.4	713.0	980.4	24.0	77.5	26.8	8357.6	4081.2	1472.5	102.3	15.5	123,896
2115.8	693.6	950.2	21.7	71.3	24.0	8422.7	4103.6	1417.5	93.8	13.2	123,449
2104.1	760.3	995.9	25.6	73.6	25.6	6554.2	4323.0	1578.7	115.5	12.4	91,991
1868.5	661.1	967.2	25.6	79.8	26.4	7674.1	3619.3	1418.3	110.8	15.5	120,011
1954.6	651.8	915.3	22.5	76.0	24.8	7868.6	3756.4	1353.2	72.1	9.3	120,327
1932.1	644.0	901.3	21.7	71.3	24.0	7774.0	3709.2	1332.2	67.4	8.5	119,045
1953.0	658.0	908.3	20.2	67.4	20.9	7753.9	3768.8	1342.3	89.1	10.1	118,907
1965.4	647.1	898.2	9.3	66.7	21.7	12163.6	3778.9	1329.1	76.7	8.5	119,087
1539.9	664.2	817.6	21.4	63.9	21.5	3614.6	3533.2	1354.7	70.5	6.5	15,951
1118.3	586.7	1034.6	37.1	101.5	39.3	2587.0	2336.6	1417.5	148.0	20.7	105,343
1584.9	486.7	812.2	38.4	108.5	39.9	6990.5	2874.5	1180.3	140.3	22.5	113,374

API Tanks Site 3: On-Site GC TCD Measurements
Normalize TCD to 100%

Sample	Comment	Date	Time	Oxygen	Nitrogen	Methane	Ethane	Propane	Total
				Concentration (mole%)					
AC0131		Tuesday, January 30, 1996	10:40:58 AM	3.95	15.23	35.52	28.20	17.10	100
AC0141		Tuesday, January 30, 1996	11:42:01 AM	3.36	12.93	36.75	29.09	17.88	100
AC0151	After tank dump	Tuesday, January 30, 1996	12:33:36 PM	21.71	78.29	0.00	0.00	0.00	100
AC0161		Tuesday, January 30, 1996	1:14:37 PM	3.05	11.71	38.24	29.38	17.63	100
AC0171		Tuesday, January 30, 1996	2:11:01 PM	4.48	16.14	33.90	27.41	18.07	100
AC0191		Tuesday, January 30, 1996	4:39:58 PM	4.26	16.17	34.03	26.75	18.79	100
AC0201	Mostly air	Tuesday, January 30, 1996	5:27:09 PM	21.68	78.32	0.00	0.00	0.00	100
AC0212		Tuesday, January 30, 1996	6:16:43 PM	4.00	15.29	34.70	27.77	18.25	100
AC0223		Tuesday, January 30, 1996	7:06:17 PM	3.61	13.11	35.55	28.87	18.86	100
AC0234		Tuesday, January 30, 1996	7:56:15 PM	4.35	16.53	32.58	27.19	19.36	100
AC0245		Tuesday, January 30, 1996	8:46:49 PM	3.61	13.84	33.68	27.91	20.96	100
AC0256		Tuesday, January 30, 1996	9:37:26 PM	3.39	13.05	33.93	28.68	20.94	100
AC0267		Tuesday, January 30, 1996	10:28:08 PM	3.59	13.77	33.04	28.29	21.31	100
AC0278		Tuesday, January 30, 1996	11:18:50 PM	2.68	11.42	33.30	29.71	22.90	100
AC0289		Wednesday, January 31, 1996	12:09:31 AM	3.16	12.17	32.50	29.53	22.64	100
AC02910		Wednesday, January 31, 1996	1:00:12 AM	2.78	10.71	31.42	33.29	21.80	100
AC03011		Wednesday, January 31, 1996	1:50:43 AM	2.74	9.89	30.21	35.15	22.00	100
AC03112	Pump died	Wednesday, January 31, 1996	2:40:34 AM						
AC03718		Wednesday, January 31, 1996	7:30:48 AM	3.11	10.90	32.00	33.86	20.13	100
AC03819		Wednesday, January 31, 1996	8:18:25 AM	2.57	9.84	32.61	34.38	20.60	100
AC04122		Wednesday, January 31, 1996	10:41:51 AM	5.21	19.59	35.32	31.69	8.19	100
AC04223		Wednesday, January 31, 1996	11:30:04 AM	4.18	15.80	33.15	30.38	16.49	100
AC04324		Wednesday, January 31, 1996	12:18:57 PM	4.99	18.87	31.05	27.68	17.41	100
AC04425		Wednesday, January 31, 1996	1:08:15 PM	3.58	13.74	32.10	30.95	19.63	100
AC04526		Wednesday, January 31, 1996	1:58:14 PM	4.09	15.58	31.64	29.40	19.29	100
AC04627	Mostly air	Wednesday, January 31, 1996	2:48:18 PM	21.68	78.32	0.00	0.00	0.00	100
AC04728		Wednesday, January 31, 1996	3:38:23 PM	4.50	17.09	30.14	29.50	18.77	100
AC04930	Mostly air	Wednesday, January 31, 1996	5:24:49 PM	21.68	78.32	0.00	0.00	0.00	100
AC05031	Mostly air	Wednesday, January 31, 1996	6:13:44 PM	21.65	78.35	0.00	0.00	0.00	100
AC05132		Wednesday, January 31, 1996	7:02:49 PM	10.40	38.39	19.82	20.11	11.28	100
AC05233		Wednesday, January 31, 1996	7:51:55 PM	3.54	13.49	32.56	31.93	18.48	100
AC05334		Wednesday, January 31, 1996	8:40:21 PM	3.96	15.06	32.47	30.90	17.62	100
AC05435		Wednesday, January 31, 1996	9:28:41 PM	2.99	11.45	32.91	32.79	19.86	100
AC05536		Wednesday, January 31, 1996	10:16:58 PM	3.29	12.54	32.92	31.82	19.43	100
AC05637		Wednesday, January 31, 1996	11:05:14 PM	3.60	13.72	32.49	30.92	19.27	100
AC05738		Wednesday, January 31, 1996	11:53:22 PM	3.66	13.92	32.49	30.78	19.14	100
AC05839		Thursday, February 01, 1996	12:41:25 AM	4.88	18.52	30.93	27.69	17.97	100
AC05940		Thursday, February 01, 1996	1:29:26 AM	2.88	11.06	33.58	32.63	19.86	100
AC06041		Thursday, February 01, 1996	2:17:20 AM	3.79	14.42	32.53	30.52	18.75	100
AC06142		Thursday, February 01, 1996	3:05:07 AM	3.73	14.19	32.34	30.40	19.35	100
AC06243		Thursday, February 01, 1996	3:52:49 AM	3.84	15.90	32.11	29.58	18.56	100
AC06344		Thursday, February 01, 1996	4:40:20 AM	4.07	15.47	32.00	29.92	18.54	100
AC06445		Thursday, February 01, 1996	5:27:43 AM	10.28	37.86	20.34	19.54	11.99	100
AC06546		Thursday, February 01, 1996	6:15:01 AM	3.57	13.59	33.19	31.13	18.52	100
AC06647		Thursday, February 01, 1996	7:02:13 AM	2.29	8.87	35.43	34.74	18.68	100
AC06950		Thursday, February 01, 1996	9:54:10 AM	3.60	13.77	33.93	30.83	17.89	100
AC07051		Thursday, February 01, 1996	10:44:48 AM	3.52	13.53	34.34	30.73	17.88	100
AC07152		Thursday, February 01, 1996	11:35:53 AM	3.06	11.76	34.24	31.14	19.79	100
AC07253		Thursday, February 01, 1996	12:52:33 PM	4.33	16.44	31.97	28.85	18.42	100
AC07556		Thursday, February 01, 1996	3:34:59 PM	0.00	0.00	0.00	100.00	0.00	100
AC07657		Thursday, February 01, 1996	4:25:22 PM	5.10	19.26	30.52	28.68	16.45	100
AC07758		Thursday, February 01, 1996	5:14:42 PM	4.71	17.89	30.76	29.59	17.05	100
AC07859		Thursday, February 01, 1996	6:03:31 PM	4.69	17.78	30.73	29.62	17.18	100
AC07960		Thursday, February 01, 1996	6:51:59 PM	4.80	18.23	30.70	29.00	17.27	100
AC08061		Thursday, February 01, 1996	7:40:43 PM	4.89	18.51	31.28	29.70	15.61	100
AC08162		Thursday, February 01, 1996	8:28:57 PM	5.11	19.38	31.12	28.43	15.96	100
AC08263		Thursday, February 01, 1996	9:17:01 PM	5.13	19.44	30.82	27.92	16.69	100
AC08364		Thursday, February 01, 1996	10:04:54 PM	4.48	17.07	30.90	30.16	17.40	100
AC08465		Thursday, February 01, 1996	10:52:39 PM	4.59	17.48	30.99	29.86	17.08	100
AC08566		Thursday, February 01, 1996	11:40:10 PM	5.05	19.15	30.77	28.26	16.77	100
AC08667		Friday, February 02, 1996	12:27:35 AM	4.73	18.00	30.61	29.62	17.03	100
AC08768		Friday, February 02, 1996	1:14:50 AM	4.73	17.98	31.20	29.50	16.59	100
AC08869		Friday, February 02, 1996	2:01:58 AM	4.51	17.21	31.30	30.37	16.61	100
AC08970		Friday, February 02, 1996	2:49:02 AM	4.81	18.24	31.23	29.23	16.50	100
AC09071		Friday, February 02, 1996	3:36:02 AM	4.36	16.65	31.43	30.75	16.81	100
AC09172		Friday, February 02, 1996	4:22:52 AM	4.19	16.09	31.67	31.38	16.66	100
AC09273	Truck filling	Friday, February 02, 1996	5:09:35 AM	21.70	78.30	0.00	0.00	0.00	100
AC09374		Friday, February 02, 1996	5:56:18 AM	5.05	19.16	30.40	29.90	15.50	100
AC09475		Friday, February 02, 1996	6:42:57 AM	4.67	17.73	30.02	30.64	16.94	100

API Tanks Site 3

Sales Oil Composition (weight%)

Sample (API3-)	SOBT01	SOBT02	SOBT02d	SOBT03	Average
Date	1/30/96	2/1/96	2/1/96	2/1/96	
Time	12:10 PM	12:07 PM	12:10 PM	1:10 PM	
Nitrogen	0.00	0.00	0.00	0.00	0.00
Methane	0.00	0.00	0.00	0.00	0.00
Ethane	0.05	0.06	0.06	0.06	0.06
Propane	0.35	0.38	0.41	0.40	0.38
i-Butane	0.48	0.52	0.53	0.53	0.51
n-Butane	0.59	0.63	0.64	0.64	0.62
Neopentane	0.04	0.04	0.04	0.04	0.04
i-Pentane	1.25	1.31	1.32	1.33	1.30
n-Pentane	0.82	0.85	0.86	0.86	0.85
Hexanes	3.36	3.48	3.50	3.52	3.46
Heptanes	9.15	9.28	9.37	9.38	9.29
Octanes	9.32	9.10	9.21	9.21	9.23
Nonanes	8.34	8.29	8.32	8.28	8.31
Decanes Plus	66.25	66.06	65.74	65.75	65.97
API Gravity	48.75	48.84	48.82	48.77	48.78
RVP	7.45	8.34	8.48	8.36	8.07

API Tanks Site 3

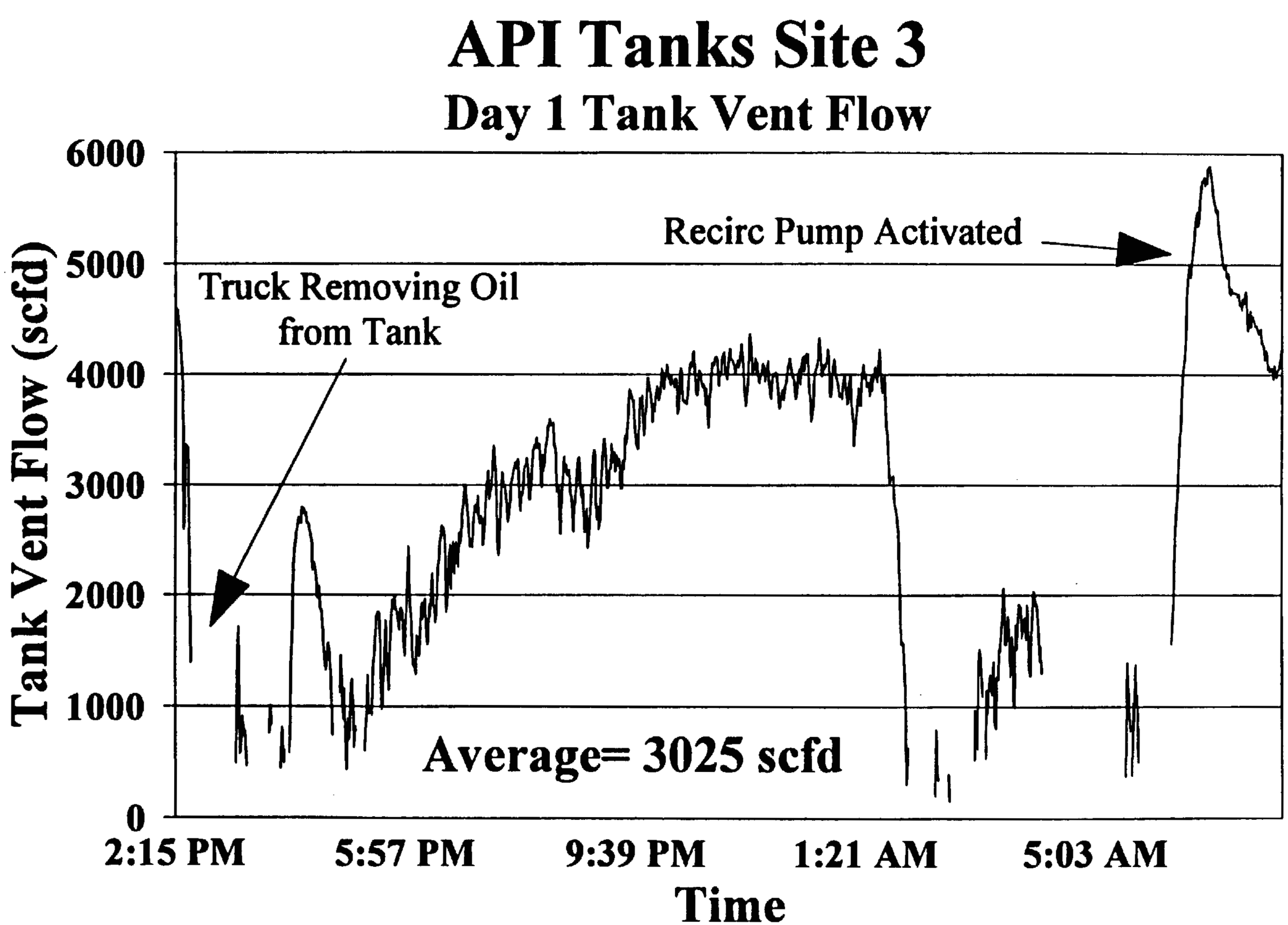
Separator Gas Composition (mole%)

API3-	SGCY01	SGCY02	SGCY02d	Day 2	SGCY03	Days 2&3
Date	1/30/96	1/31/96	1/31/96	Average	2/1/96	Average
Time	9:02 AM	9:13 AM	9:16 AM		9:34 AM	
Pressure (psig)	26	24	20	22	20	21.0
Oxygen	0.05	0.02	0.14	0.08	0.05	0.07
Nitrogen	0.59	0.59	0.59	0.59	0.89	0.74
Carbon Dioxide	2.97	9.89	10.50	10.20	9.67	9.93
Methane	98.35	46.59	46.41	46.50	52.71	49.61
Ethane	6.19	25.62	25.59	25.61	21.02	23.31
Propane	1.50	10.69	10.59	10.64	8.88	9.76
i-Butane	0.38	2.71	2.61	2.66	2.52	2.59
n-Butane	0.27	1.80	1.72	1.76	1.78	1.77
i-Pentane	0.18	0.89	0.80	0.85	0.96	0.90
n-Pentane	0.09	0.39	0.35	0.37	0.44	0.41
n-Hexane	0.042	0.103	0.091	0.097	0.127	0.11
Other Hexanes	0.143	0.417	0.373	0.395	0.512	0.45
Heptanes	0.085	0.132	0.110	0.121	0.193	0.16
Octanes	0.033	0.026	0.023	0.025	0.050	0.04
Nonanes	0.017	0.006	0.005	0.006	0.017	0.01
Decanes+	0.035	0.005	0.004	0.005	0.009	0.01
Benzene	0.026	0.081	0.068	0.075	0.104	0.09
Toluene	0.022	0.033	0.023	0.028	0.052	0.04
Ethylbenzene	0.002	0.001	0.001	0.001	0.002	0.00
Xylenes	0.014	0.004	0.003	0.004	0.017	0.01

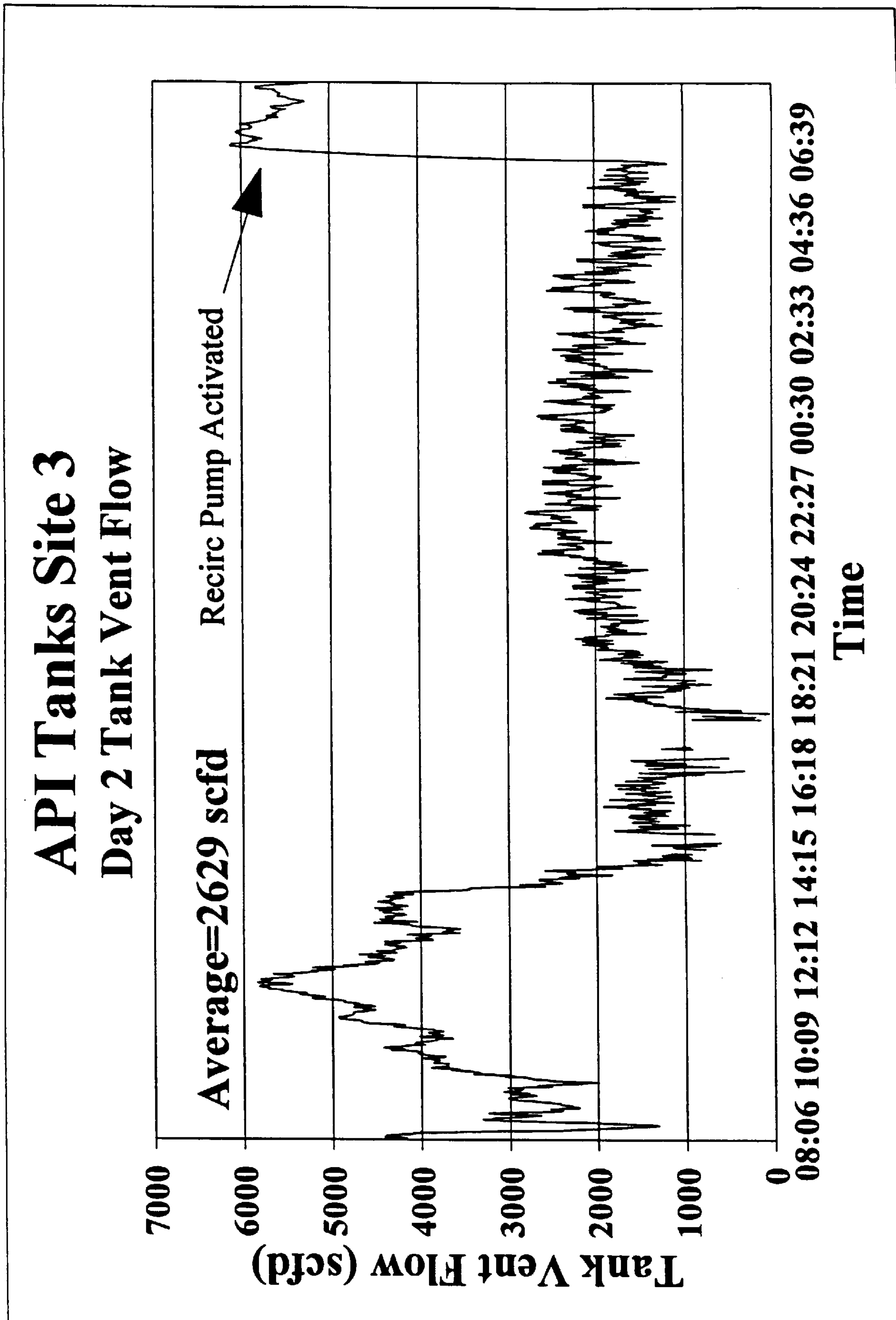
API Tanks Site 3

Separator Oil Composition (mole%)

API3-	SCCY01	SCCY02	Day 1	SCCY03	SCCY03d	SCCY04	Day 2	SCCY05	SCCY06	Day 3	Overall	RSD
Date	1/30/96	1/30/96	Average	1/31/96	1/31/96	1/31/96	Average	2/1/96	2/1/96	Average	Average	(Percent)
Time	9:15 AM	4:53 PM		9:38 AM	9:45 AM	4:32 PM		9:52 AM	4:26 PM			
Pressure (psig)	26	24		20	20	20		20	22		22.00	
Nitrogen	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ERR
Carbon Dioxide	0.12	0.14	0.13	0.17	0.18	0.16	0.17	0.15	0.19	0.17	0.16	14.38
Methane	0.63	0.51	0.57	0.46	0.47	0.41	0.44	0.51	0.48	0.50	0.50	13.27
Ethane	0.95	1.19	1.07	1.40	1.44	1.11	1.27	1.24	1.57	1.41	1.25	13.50
Propane	1.95	2.21	2.08	2.79	2.85	2.04	2.43	2.20	2.50	2.35	2.29	8.02
i-Butane	1.61	1.72	1.67	2.14	2.18	1.63	1.90	1.67	1.78	1.73	1.76	6.77
n-Butane	1.86	1.95	1.91	2.39	2.43	1.87	2.14	1.92	1.99	1.96	2.00	6.19
i-Pentane	2.94	3.02	2.98	3.54	3.61	2.95	3.26	3.04	2.99	3.02	3.09	4.99
n-Pentane	1.95	1.99	1.97	2.26	2.30	1.91	2.10	1.97	1.94	1.96	2.01	3.83
n-Hexane	2.67	2.66	2.67	2.89	2.94	2.66	2.79	2.69	2.63	2.66	2.70	2.67
Other Hexanes	4.42	4.47	4.45	4.78	4.87	4.36	4.59	4.40	4.31	4.36	4.46	2.69
Heptanes	10.46	10.74	10.60	10.55	10.74	9.99	10.32	10.08	9.93	10.01	10.31	2.89
Octanes	12.29	12.51	12.40	13.13	13.37	12.87	13.06	13.01	12.86	12.94	12.80	2.74
Nonanes	7.63	8.12	7.88	7.71	7.85	7.55	7.67	7.55	7.37	7.46	7.67	2.71
Decanes+	38.21	36.47	37.34	33.44	32.18	38.27	35.54	37.29	37.30	37.30	36.73	2.80
Benzene	2.46	2.43	2.45	2.58	2.62	2.44	2.52	2.46	2.42	2.44	2.47	1.82
Toluene	5.35	5.26	5.31	5.37	5.46	5.35	5.38	5.37	5.31	5.34	5.34	0.73
Ethylbenzene	0.46	0.45	0.46	0.44	0.45	0.42	0.43	0.45	0.43	0.44	0.44	2.59
Xylenes	4.03	4.17	4.10	3.98	4.05	3.99	4.00	4.03	3.98	4.01	4.04	1.38
Decanes+ SG	0.827	0.830	0.829	0.833	0.835	0.831	0.833	0.828	0.830	0.829	0.83	0.26
Decanes+ MW	272	275	273.5	286	294	271	280.5	274	277	275.5	276.50	1.30



API Tanks Site 3
Day 1 Tank Vent Flow
Tank Vent Flow (scfd)
6000
5000
4000
3000
2000
1000
0
Truck Removing Oil from Tank
Recirc Pump Activated
Average= 3025 scfd
2:15 PM
5:57 PM
9:39 PM
1:21 AM
5:03 AM
Time



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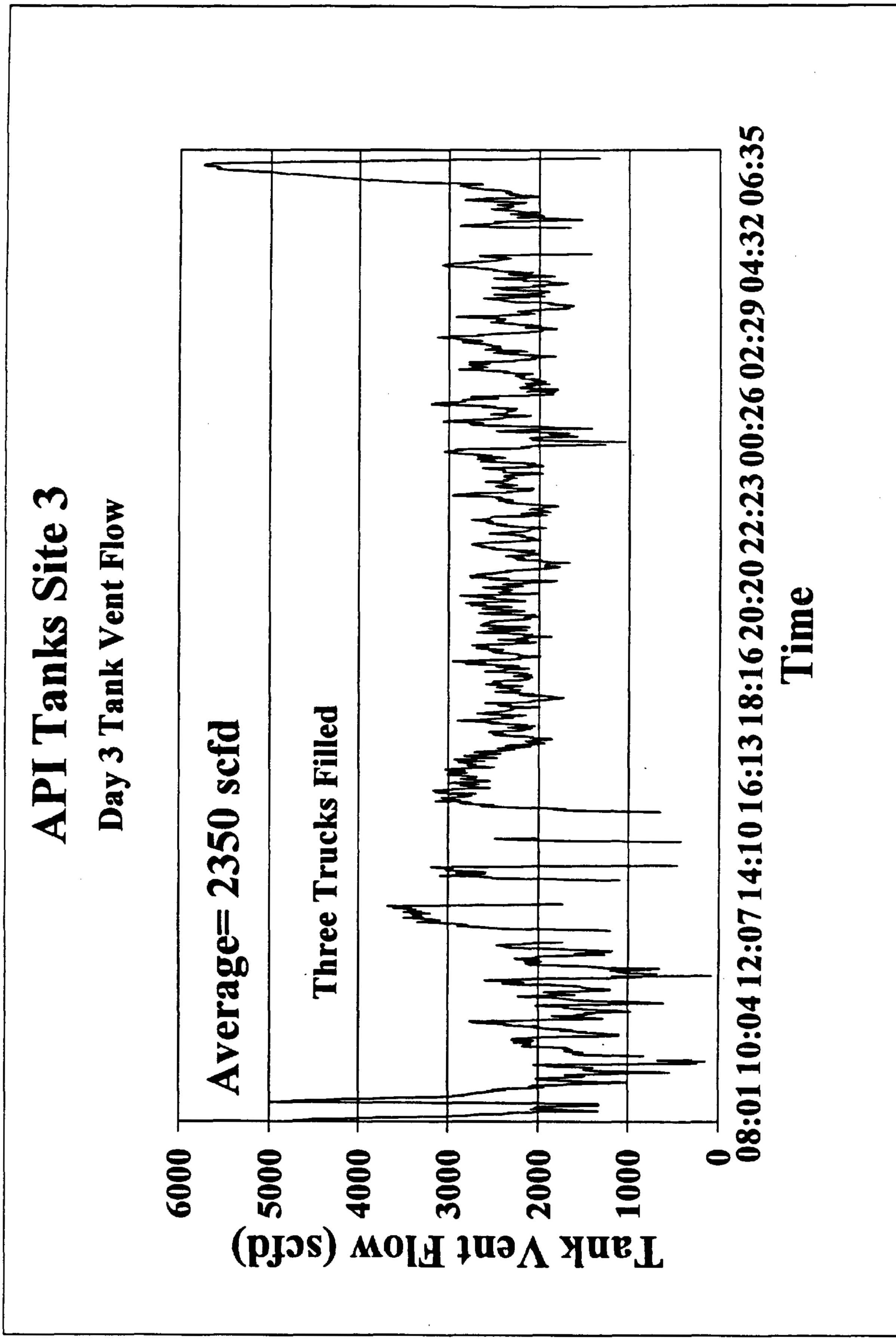
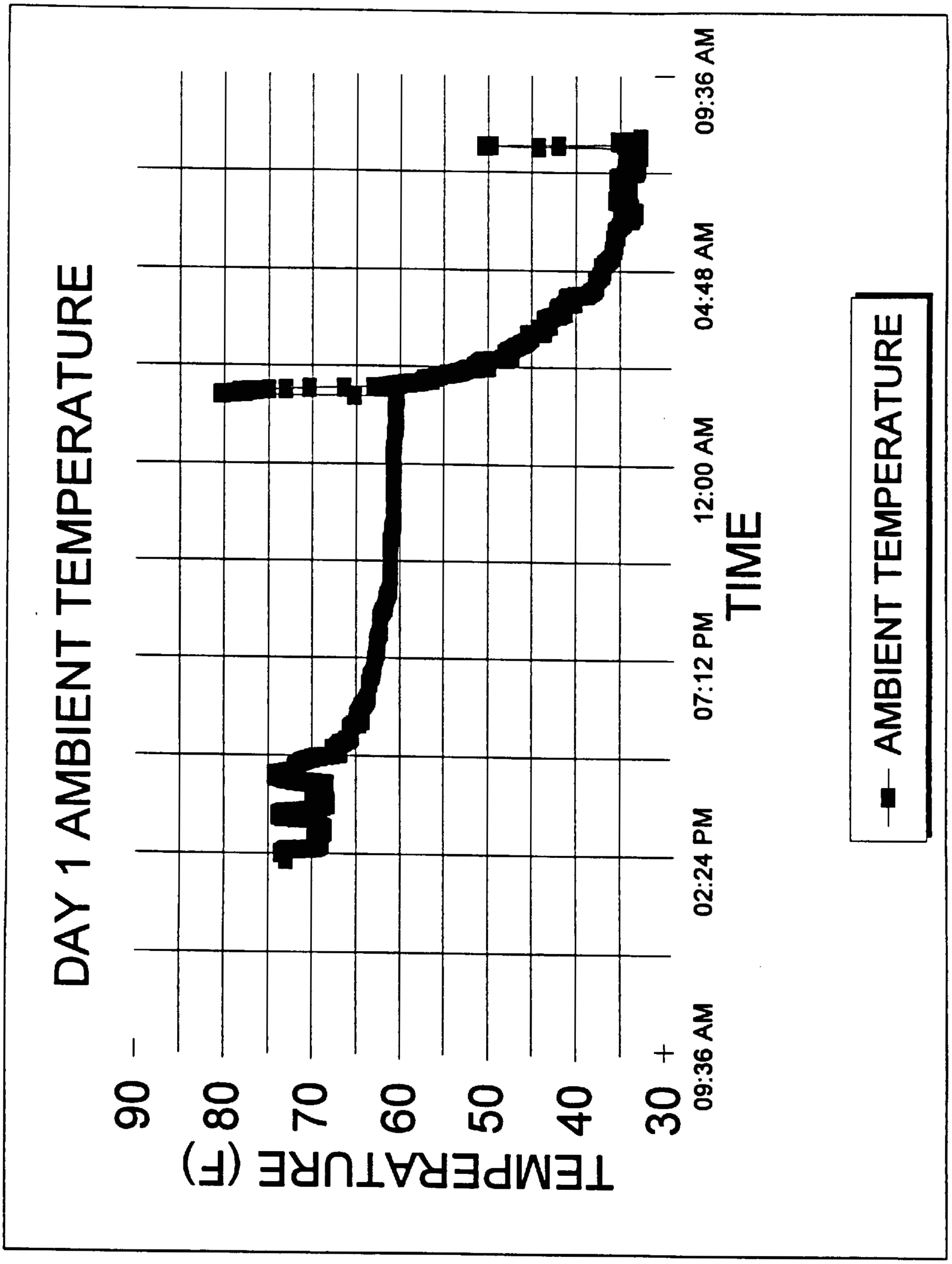
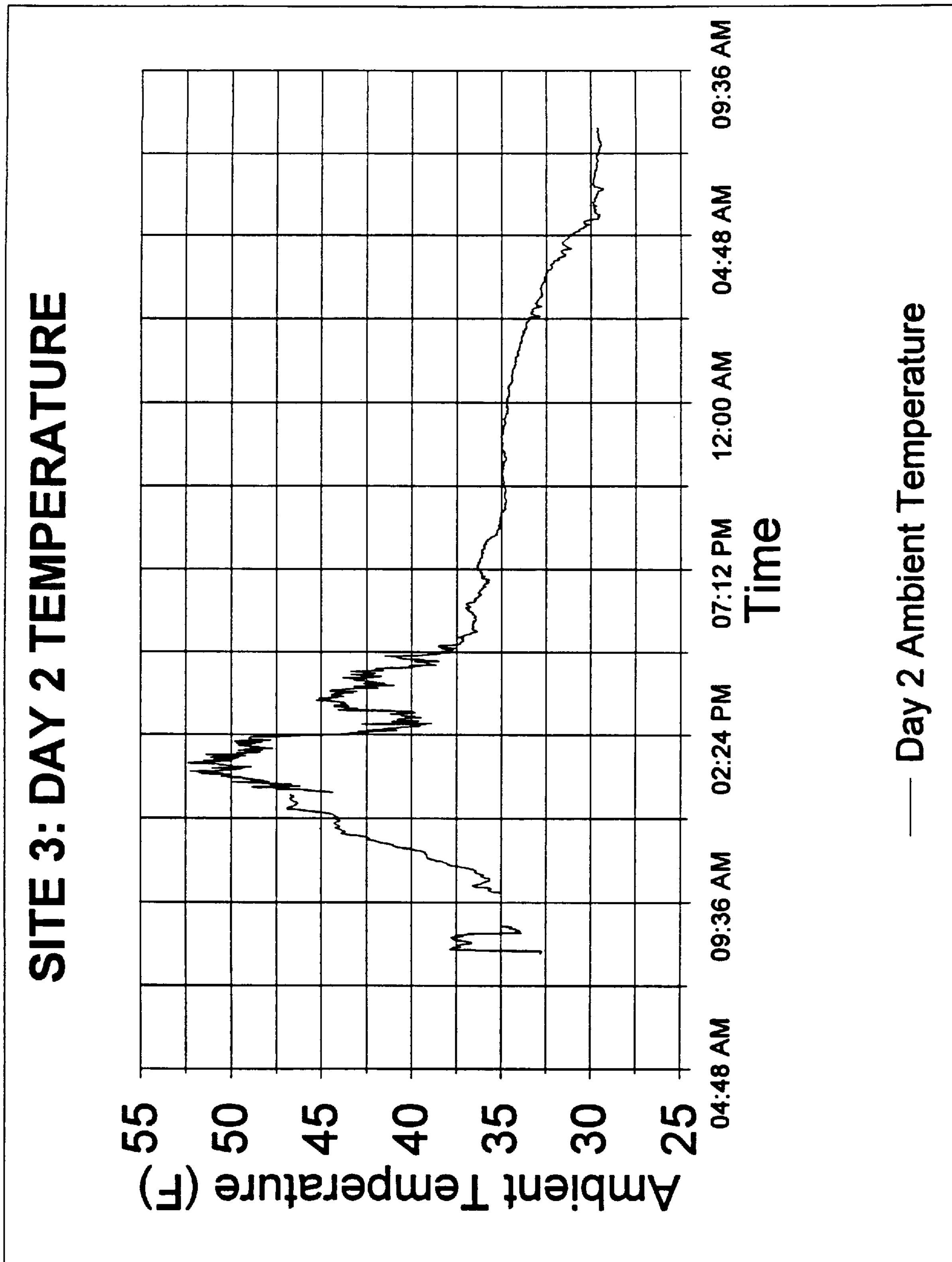
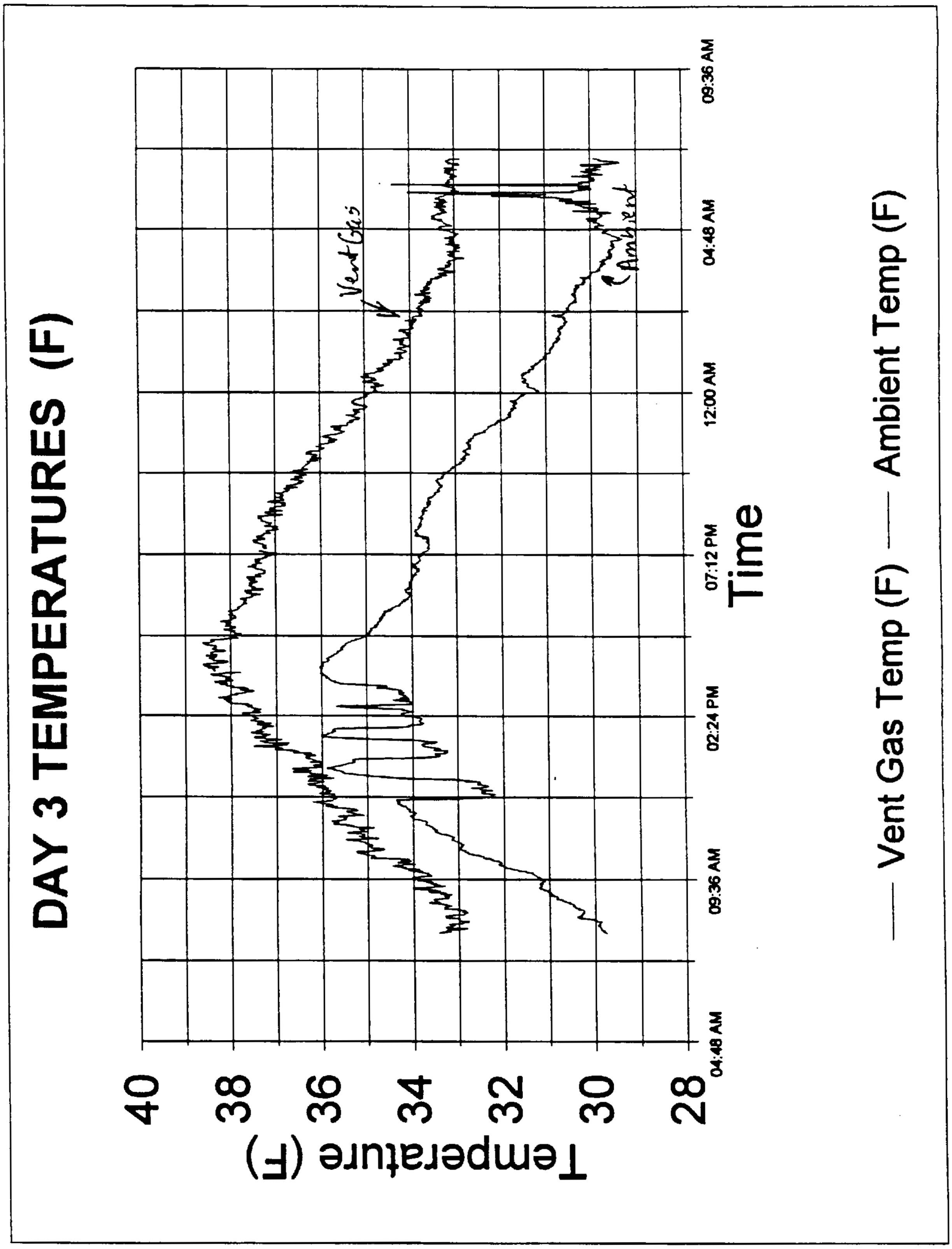
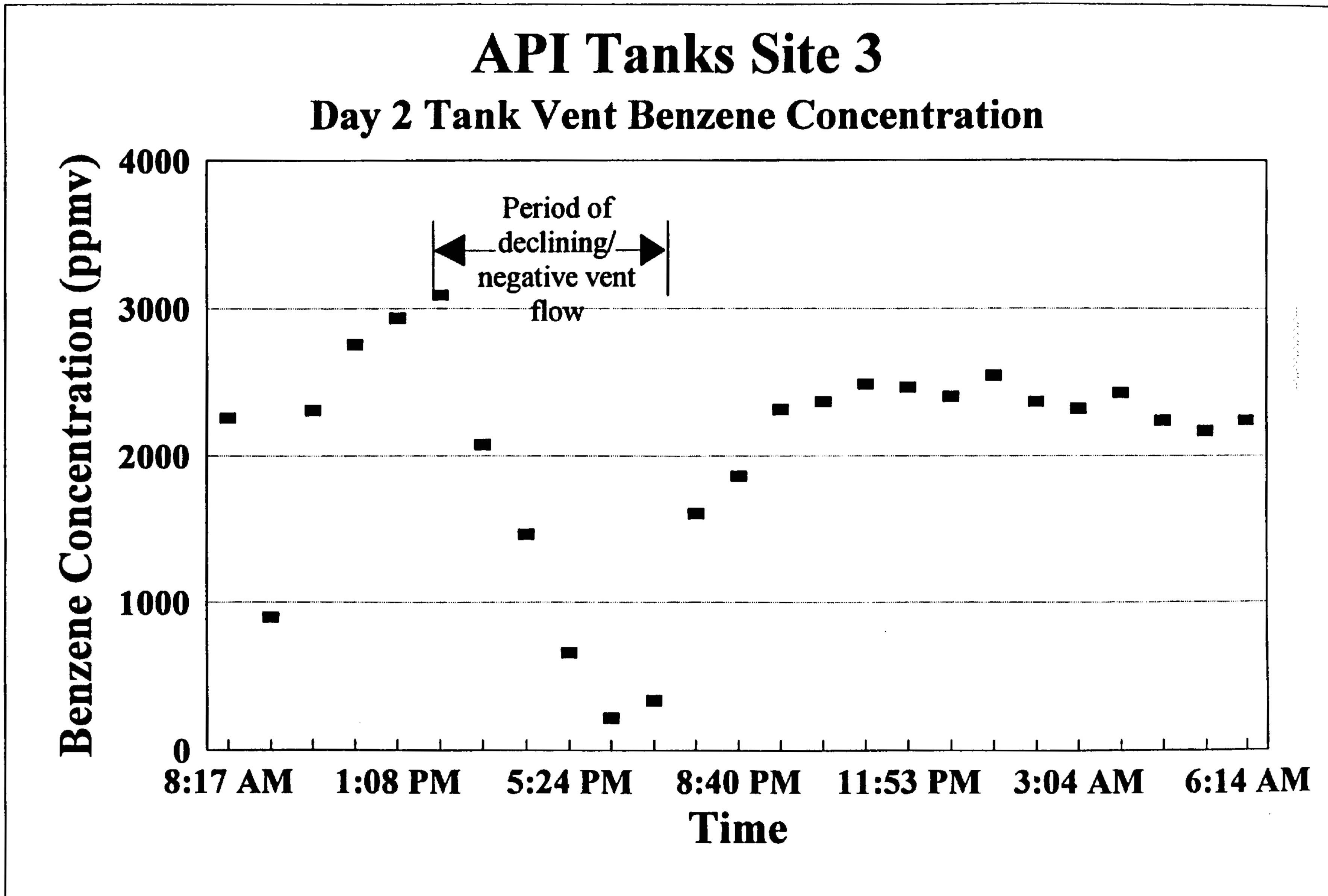

API Tanks Site 3
Day 3 Tank Vent Flow
Average= 2350 scfd
Three Trucks Filled
Tank Vent Flow (scfd)
0
1000
2000
3000
4000
5000
6000
08:01 10:04 12:07 14:10 16:13 18:16 20:20 22:23 00:26 02:29 04:32 06:35
Time


DAY 1 AMBIENT TEMPERATURE
TEMPERATURE (F)
90
80
70
60
50
40
30
09:36 AM
02:24 PM
07:12 PM
12:00 AM
04:48 AM
09:36 AM
TIME
AMBIENT TEMPERATURE


SITE 3: DAY 2 TEMPERATURE
Ambient Temperature (F)
55
50
45
40
35
30
25
04:48 AM
09:36 AM
02:24 PM
07:12 PM
12:00 AM
04:48 AM
09:36 AM
Time
— Day 2 Ambient Temperature


DAY 3 TEMPERATURES (F)
Temperature (F)
40
38
36
34
32
30
28
04:48 AM
09:36 AM
02:24 PM
07:12 PM
12:00 AM
04:48 AM
09:36 AM
Time
Vent Gas
Ambient
— Vent Gas Temp (F) — Ambient Temp (F)



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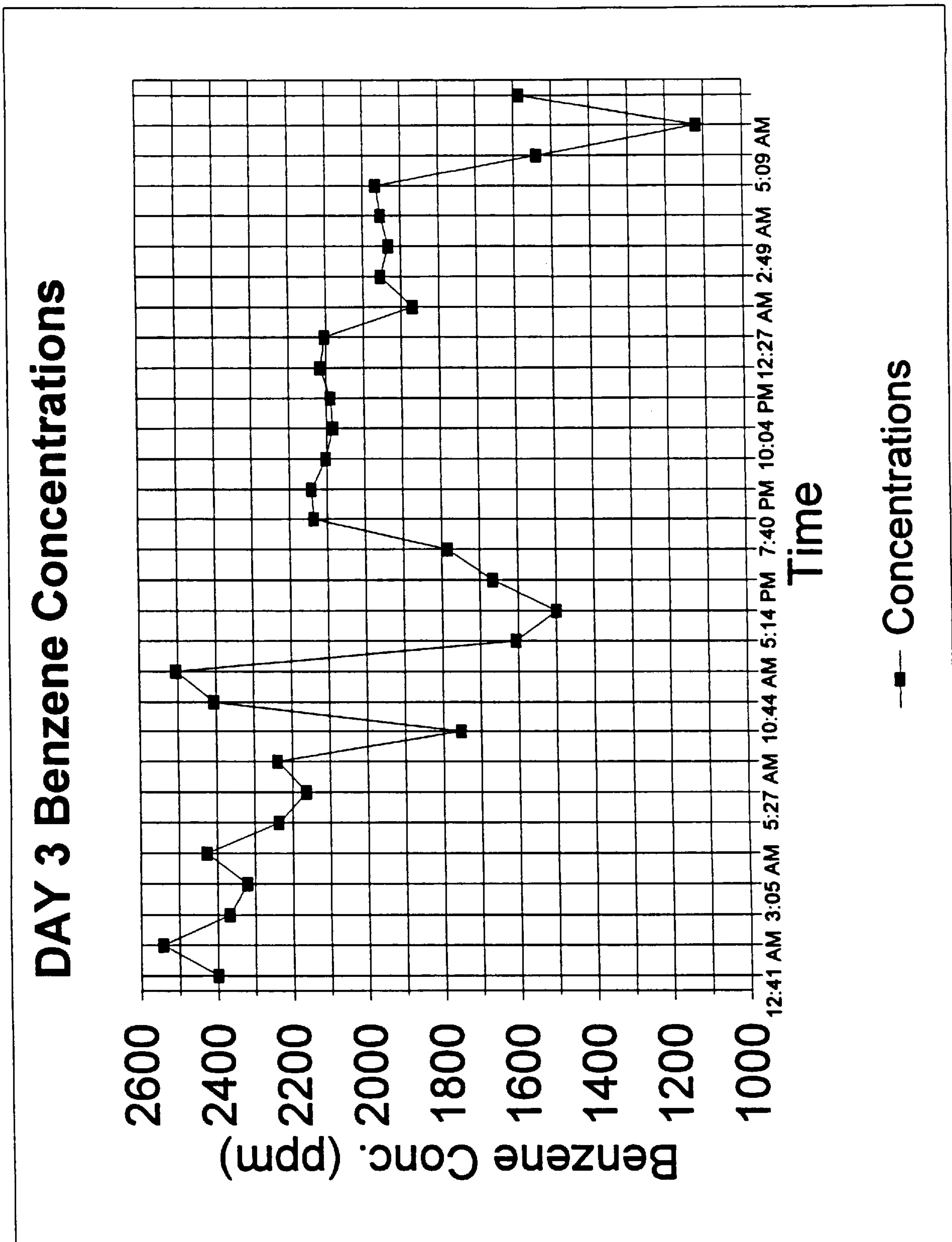

DAY 3 Benzene Concentrations
Benzene Conc. (ppm)
2600
2400
2200
2000
1800
1600
1400
1200
1000
12:41 AM
3:05 AM
5:27 AM
10:44 AM
5:14 PM
7:40 PM
10:04 PM
12:27 AM
2:49 AM
5:09 AM
Time
Concentrations

Site 4

API Tanks Site 4

Process Data

Day	Date	Time	Tank Vent Temperature deg. F	Heater Treater Pressure psig	Heater Treater Temperature deg. F	LP Separator Pressure psig	HP Separator Pressure psig	HP Separator Temperature deg. F	Sales Oil Temperature deg. F
0	Saturday, March 30, 1996	17:45	76.3	46	145	80	800	148	
0	Saturday, March 30, 1996	18:47	69.5						
1	Sunday, March 31, 1996	08:30	73.9	47	144	80	800	147	
1	Sunday, March 31, 1996	08:53	82.4						
1	Sunday, March 31, 1996	10:30	91.9	46	145	80	800	148	
1	Sunday, March 31, 1996	11:03	118.0						
1	Sunday, March 31, 1996	11:39	88.2						
1	Sunday, March 31, 1996	12:00	90.5	46	145	80	800	148	
1	Sunday, March 31, 1996	14:55	90.0	46	145	80	800	148	
1	Sunday, March 31, 1996	16:24							107.0
1	Sunday, March 31, 1996	17:15	69.5	46	145	80	800	148	
1	Sunday, March 31, 1996	18:01	65.7						
1	Sunday, March 31, 1996	18:53	62.4						
1	Monday, April 01, 1996	07:34	60.3	47	144	80	800	148	102.0
2	Monday, April 01, 1996	09:15	70.3	47	144	80	800	148	
2	Monday, April 01, 1996	10:25	78.6	46	144	80	800	148	
2	Monday, April 01, 1996	10:50	81.9						
2	Monday, April 01, 1996	11:20	83.8						
2	Monday, April 01, 1996	13:00	84.2	47	145	80	800	148	
2	Monday, April 01, 1996	13:35	90.1						96.0
2	Monday, April 01, 1996	13:52	100.6						
2	Monday, April 01, 1996	14:07	94.0						
2	Monday, April 01, 1996	14:11	92.4						
2	Monday, April 01, 1996	15:04	86.1						
2	Monday, April 01, 1996	15:51	88.4						
2	Monday, April 01, 1996	16:32	78.4						
2	Monday, April 01, 1996	17:40	66.3	47	145	80	800	149	92.5
2	Monday, April 01, 1996	18:50	56.6	46	145	80	800	148	
2	Tuesday, April 02, 1996	07:40	57.8	46	145	80	800	148	83.9
3	Tuesday, April 02, 1996	09:00	74.8						
3	Tuesday, April 02, 1996	10:21	85.9						
3	Tuesday, April 02, 1996	10:53	90.3	47	145	80	800	148	
3	Tuesday, April 02, 1996	13:09	100.4						
3	Tuesday, April 02, 1996	15:23	99.0						
3	Tuesday, April 02, 1996	16:38	79.6	47	145	80	800	148	
3	Tuesday, April 02, 1996	17:45	64.5	47	144	80	800	148	
3	Tuesday, April 02, 1996	18:23							90.5
3	Wednesday, April 03, 1996	07:39	62.6						
4	Wednesday, April 03, 1996	08:55	78.1	47	145	80	800	147	
4	Wednesday, April 03, 1996	09:43	88.3						98.0
4	Wednesday, April 03, 1996	10:46	86.4						
4	Wednesday, April 03, 1996	11:05	86.7						
4	Wednesday, April 03, 1996	11:55	91.2						
Average of Days 1-3 (test period)			81.2	46.5	144.7	80.0	800.0	148.0	95.3
Number of Points			34	15	15	15	15	15	6

API Tanks Site 4

Sales Oil Composition (weight%)

Sample (API4-)	SOBT01	SOBT02	SOBT03	SOBT03d	Average	Sample Taken at HT OIL1
Date	4/1/96	4/2/96	4/2/96	4/2/96		4/3/96
Time	8:53 AM	8:04 AM	6:38 PM	6:43 PM		8:50 AM
Nitrogen	0.00	0.00	0.00	N/A	0.00	0.00
Methane	0.00	0.00	0.00	N/A	0.00	0.00
Ethane	0.02	0.01	0.01	N/A	0.01	0.02
Propane	0.24	0.22	0.22	N/A	0.23	0.21
i-Butane	0.29	0.29	0.28	N/A	0.29	0.26
n-Butane	0.54	0.55	0.53	N/A	0.54	0.50
Neopentane	0.01	0.01	0.01	N/A	0.01	0.01
i-Pentane	0.67	0.68	0.66	N/A	0.67	0.64
n-Pentane	0.59	0.59	0.58	N/A	0.59	0.57
Hexanes	1.43	1.62	1.42	N/A	1.49	1.43
Heptanes	3.98	4.19	3.95	N/A	4.04	4.08
Octanes	2.87	3.07	2.88	N/A	2.94	3.01
Nonanes	2.94	3.15	2.89	N/A	2.99	3.07
Decanes Plus	86.42	85.62	86.57	N/A	86.20	86.20
API Gravity	36.9	28.6	35.5	30.8	32.88	36.8
RVP	5.2	5.4	5.5	6.0	5.45	N/A

API Tanks Site 4

Low Pressure Separator Gas Composition (mole%)

API4-	SGCY01	SGCY02	SGCY03	SGCY03d	Average	RSD
Date	03/31/96	04/01/96	04/02/96	04/02/96		
Time	09:34	10:06	09:45	09:45		
Pressure (psig)	80	80	80	80		
Oxygen	0.00	0.00	0.00	0.00	0.00	NA
Nitrogen	0.17	0.04	0.30	0.05	0.13	57.0%
Carbon Dioxide	0.69	0.69	0.68	0.69	0.69	0.5%
Methane	71.14	71.71	71.52	71.45	71.45	0.4%
Ethane	9.96	9.97	9.96	9.91	9.96	0.2%
Propane	9.10	9.02	8.98	8.99	9.04	0.7%
i-Butane	2.56	2.49	2.41	2.51	2.50	2.0%
n-Butane	3.08	2.93	2.79	2.99	2.97	3.4%
i-Pentane	1.21	1.12	0.91	1.13	1.12	8.8%
n-Pentane	0.84	0.71	0.59	0.73	0.74	12.6%
n-Hexane	0.188	0.190	0.134	0.211	0.183	5.1%
Other Hexanes	0.675	0.677	0.401	0.747	0.642	9.2%
Heptanes	0.241	0.291	0.290	0.371	0.288	15.7%
Octanes	0.057	0.076	0.302	0.120	0.115	72.9%
Nonanes	0.005	0.003	0.106	0.010	0.022	141.7%
Decanes+	0.001	0.013	0.455	0.026	0.085	159.0%
Benzene	0.050	0.023	0.016	0.026	0.031	51.6%
Toluene	0.019	0.025	0.068	0.033	0.032	53.0%
Ethylbenzene	0.001	0.001	0.014	0.001	0.003	118.4%
Xylenes	0.004	0.003	0.074	0.009	0.016	135.6%

API Tanks Site 4

Heater Treater Gas Composition (mole%)

Looks more like high pressure separator gas

API4-	HTFG01	HTFGO2	HTFG03	HTFG03d	Day 3	Average	RSD
Date	03/31/96	04/01/96	04/02/96	04/02/96	RPD		
Time	09:00	09:43	09:18	09:18			
Pressure (psig)	46	46	47	47			
Oxygen	0.00	0.00	0.00	0.00	ERR	0.00	NA
Nitrogen	0.15	0.28	0.00	0.16	-200.0%	0.17	59.7%
Carbon Dioxide	0.23	0.22	0.29	0.24	17.7%	0.24	9.5%
Methane	89.93	89.65	89.91	89.81	0.1%	89.81	0.2%
Ethane	4.91	4.86	4.87	4.91	-0.7%	4.89	0.4%
Propane	2.78	2.78	2.79	2.78	0.5%	2.78	0.2%
i-Butane	0.63	0.64	0.64	0.63	1.8%	0.64	0.7%
n-Butane	0.68	0.70	0.70	0.68	2.3%	0.69	1.3%
i-Pentane	0.23	0.25	0.25	0.24	2.3%	0.24	4.1%
n-Pentane	0.15	0.17	0.16	0.15	8.7%	0.16	6.3%
n-Hexane	0.039	0.054	0.049	0.050	-1.8%	0.048	16.1%
Other Hexanes	0.134	0.183	0.168	0.174	-3.1%	0.162	15.7%
Heptanes	0.058	0.109	0.093	0.108	-15.2%	0.089	30.5%
Octanes	0.012	0.044	0.037	0.048	-26.3%	0.033	54.9%
Nonanes	0.005	0.005	0.008	0.005	48.3%	0.006	16.6%
Decanes+	0.039	0.032	0.010	0.002	130.7%	0.026	68.5%
Benzene	0.004	0.007	0.005	0.005	8.7%	0.005	27.8%
Toluene	0.004	0.011	0.008	0.008	2.3%	0.008	45.6%
Ethylbenzene	0.001	0.001	0.001	0.001	30.8%	0.001	9.9%
Xylenes	0.003	0.004	0.005	0.002	92.7%	0.004	14.3%

API Tanks Site 4

Sales Oil Composition (weight%)

Sample (API4-)	SOBT01	SOBT02	SOBT03	SOBT03d	Average	Sample Taken at HT OIL1
Date	4/1/96	4/2/96	4/2/96	4/2/96		4/3/96
Time	8:53 AM	8:04 AM	6:38 PM	6:43 PM		8:50 AM
Nitrogen	0.00	0.00	0.00	N/A	0.00	0.00
Methane	0.00	0.00	0.00	N/A	0.00	0.00
Ethane	0.02	0.01	0.01	N/A	0.01	0.02
Propane	0.24	0.22	0.22	N/A	0.23	0.21
i-Butane	0.29	0.29	0.28	N/A	0.29	0.26
n-Butane	0.54	0.55	0.53	N/A	0.54	0.50
Neopentane	0.01	0.01	0.01	N/A	0.01	0.01
i-Pentane	0.67	0.68	0.66	N/A	0.67	0.64
n-Pentane	0.59	0.59	0.58	N/A	0.59	0.57
Hexanes	1.43	1.62	1.42	N/A	1.49	1.43
Heptanes	3.98	4.19	3.95	N/A	4.04	4.08
Octanes	2.87	3.07	2.88	N/A	2.94	3.01
Nonanes	2.94	3.15	2.89	N/A	2.99	3.07
Decanes Plus	86.42	85.62	86.57	N/A	86.20	86.20
API Gravity	36.9	28.6	35.5	30.8	32.88	36.8
RVP	5.2	5.4	5.5	6.0	5.45	N/A

API Tanks Site 4

Heater Treater Gas Composition (mole%)

Looks more like high pressure separator gas

API4-	HTFG01	HTFGO2	HTFG03	HTFG03d	Day 3	Average	RSD
Date	03/31/96	04/01/96	04/02/96	04/02/96	RPD		
Time	09:00	09:43	09:18	09:18			
Pressure (psig)	46	46	47	47			
Oxygen	0.00	0.00	0.00	0.00	ERR	0.00	NA
Nitrogen	0.15	0.28	0.00	0.16	-200.0%	0.17	59.7%
Carbon Dioxide	0.23	0.22	0.29	0.24	17.7%	0.24	9.5%
Methane	89.93	89.65	89.91	89.81	0.1%	89.81	0.2%
Ethane	4.91	4.86	4.87	4.91	-0.7%	4.89	0.4%
Propane	2.78	2.78	2.79	2.78	0.5%	2.78	0.2%
i-Butane	0.63	0.64	0.64	0.63	1.8%	0.64	0.7%
n-Butane	0.68	0.70	0.70	0.68	2.3%	0.69	1.3%
i-Pentane	0.23	0.25	0.25	0.24	2.3%	0.24	4.1%
n-Pentane	0.15	0.17	0.16	0.15	8.7%	0.16	6.3%
n-Hexane	0.039	0.054	0.049	0.050	-1.8%	0.048	16.1%
Other Hexanes	0.134	0.183	0.168	0.174	-3.1%	0.162	15.7%
Heptanes	0.058	0.109	0.093	0.108	-15.2%	0.089	30.5%
Octanes	0.012	0.044	0.037	0.048	-26.3%	0.033	54.9%
Nonanes	0.005	0.005	0.008	0.005	48.3%	0.006	16.6%
Decanes+	0.039	0.032	0.010	0.002	130.7%	0.026	68.5%
Benzene	0.004	0.007	0.005	0.005	8.7%	0.005	27.8%
Toluene	0.004	0.011	0.008	0.008	2.3%	0.008	45.6%
Ethylbenzene	0.001	0.001	0.001	0.001	30.8%	0.001	9.9%
Xylenes	0.003	0.004	0.005	0.002	92.7%	0.004	14.3%

API Tanks Site 4

Low Pressure Separator Gas Composition (mole%)

API4-	SGCY01	SGCY02	SGCY03	SGCY03d	Average	RSD
Date	03/31/96	04/01/96	04/02/96	04/02/96		
Time	09:34	10:06	09:45	09:45		
Pressure (psig)	80	80	80	80		
Oxygen	0.00	0.00	0.00	0.00	0.00	NA
Nitrogen	0.17	0.04	0.30	0.05	0.13	57.0%
Carbon Dioxide	0.69	0.69	0.68	0.69	0.69	0.5%
Methane	71.14	71.71	71.52	71.45	71.45	0.4%
Ethane	9.96	9.97	9.96	9.91	9.96	0.2%
Propane	9.10	9.02	8.98	8.99	9.04	0.7%
i-Butane	2.56	2.49	2.41	2.51	2.50	2.0%
n-Butane	3.08	2.93	2.79	2.99	2.97	3.4%
i-Pentane	1.21	1.12	0.91	1.13	1.12	8.8%
n-Pentane	0.84	0.71	0.59	0.73	0.74	12.6%
n-Hexane	0.188	0.190	0.134	0.211	0.183	5.1%
Other Hexanes	0.675	0.677	0.401	0.747	0.642	9.2%
Heptanes	0.241	0.291	0.290	0.371	0.288	15.7%
Octanes	0.057	0.076	0.302	0.120	0.115	72.9%
Nonanes	0.005	0.003	0.106	0.010	0.022	141.7%
Decanes+	0.001	0.013	0.455	0.026	0.085	159.0%
Benzene	0.050	0.023	0.016	0.026	0.031	51.6%
Toluene	0.019	0.025	0.068	0.033	0.032	53.0%
Ethylbenzene	0.001	0.001	0.014	0.001	0.003	118.4%
Xylenes	0.004	0.003	0.074	0.009	0.016	135.6%

Heater Treater Oil Composition (mole%)

API4-	HTFO01	HTFO02	Day 1	HTFO03	HTFO04	HTFO04d	Day 2	HTFO05	HTFO06	Day 3	Overall	Standard	RSD
Date	***********	***********	Average	***********	***********	***********	Average	***********	***********	Average	Average	Deviation	
Time	9:25 AM	5:11 PM		9:59 AM	5:23 PM	5:34 PM		9:36 AM	5:30 PM				
Pressure (psig)	46	46		46	47	47		47	47		46.6		
Nitrogen	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ERR
Carbon Dioxide	0.02	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.01	21.08
Methane	1.21	1.21	1.21	1.19	1.23	1.20	1.20	1.26	1.18	1.22	1.21	0.03	2.37
Ethane	0.97	0.97	0.97	0.97	0.98	0.97	0.97	1.02	0.94	0.98	0.97	0.03	2.66
Propane	3.05	3.03	3.04	3.05	3.07	3.05	3.06	3.08	2.94	3.01	3.04	0.05	1.66
i-Butane	2.11	2.09	2.10	2.12	2.11	2.10	2.11	2.09	2.02	2.06	2.09	0.04	1.74
n-Butane	3.12	3.09	3.11	3.13	3.05	3.03	3.09	3.03	2.95	2.99	3.06	0.07	2.19
i-Pentane	2.79	2.76	2.78	2.80	2.68	2.65	2.73	2.65	2.66	2.66	2.72	0.07	2.49
n-Pentane	2.10	2.07	2.09	2.11	2.05	2.03	2.08	2.02	1.97	2.00	2.05	0.05	2.55
n-Hexane	1.66	1.70	1.68	1.80	1.77	1.76	1.78	1.71	1.72	1.72	1.73	0.05	2.92
Other Hexanes	2.20	2.24	2.22	2.35	2.24	2.25	2.30	2.24	2.19	2.22	2.24	0.06	2.53
Heptanes	9.48	9.36	9.42	9.49	9.50	9.48	9.49	9.53	9.61	9.57	9.49	0.08	0.86
Octanes	8.87	8.42	8.65	8.75	9.48	9.52	9.13	9.47	9.58	9.53	9.10	0.48	5.27
Nonanes	4.80	4.95	4.88	5.05	4.70	4.73	4.88	4.66	4.70	4.68	4.81	0.16	3.27
Decanes+	55.26	55.79	55.53	54.76	54.68	54.79	54.75	54.86	55.15	55.01	55.09	0.41	0.75
Benzene	0.23	0.21	0.22	0.24	0.22	0.22	0.23	0.22	0.22	0.22	0.22	0.01	4.62
Toluene	0.90	0.88	0.89	0.89	0.90	0.88	0.89	0.87	0.86	0.87	0.88	0.02	1.85
Ethylbenzene	0.42	0.38	0.40	0.41	0.43	0.42	0.42	0.40	0.41	0.41	0.41	0.02	4.23
Xylenes	0.81	0.81	0.81	0.86	0.88	0.89	0.87	0.86	0.87	0.87	0.85	0.03	3.60
Decanes+ SG	0.880	0.880	0.880	0.880	0.880	0.880	0.88	0.880	0.880	0.880	0.880		
Decanes+ MW	323	323	323.0	323	323	323	323.0	323	323	323.0	323.0		

API TANKS SITE 4 TANK VENT CANISTER SAMPLES
As analyzed

Field ID	API4-VGCA01	API4-VGCA02	API4-VGCA03	API4-VGCA04 Analysis 1	API4-VGCA04 Analysis 2	API4-VGCA04 Average	API4-VGCA05	API4-VGCA06	Average	RSD
Start Date	03/31/96	03/31/96	04/01/96			04/01/96	04/02/96	04/02/96		
End Date	03/31/96	04/01/96	04/01/96			04/02/96	04/02/96	04/03/96		
Start Time	08:17	18:52	08:31			18:48	08:26	19:26		
End Time	18:25	08:17	18:40			08:10	19:17	08:10		
ppmv										
ETHANE	103,000	138,400	130,200	132,100	130,200	131,150	87,450	122,900	118,850	16.47%
PROPANE	213,800	241,200	256,900	229,100	229,500	229,300	156,500	203,300	216,833	16.22%
ISOBUTANE	68,050	86,110	80,450	84,320	84,240	84,280	56,830	71,540	74,543	15.04%
N-BUTANE	87,260	113,400	125,000	105,300	105,300	105,300	72,660	93,540	99,527	18.97%
ISOPENTANE	32,700	33,100	37,660	36,630	36,490	36,560	27,070	32,670	33,293	11.18%
N-PENTANE	20,050	19,480	22,820	21,670	21,550	21,610	16,490	19,510	19,993	10.82%
N-HEXANE	5,247	4,365	5,752	4,705	4,674	4,690	4,321	4,649	4,837	11.52%
BENZENE	680	563	730	601	598	600	553	591	619	11.35%
TOLUENE	861	547	869	452	447	450	764	611	684	25.42%
ETHYLBENZENE	104	49	108	21	20	20	108	49	73	52.34%
M/P-XYLENE	246	112	253	49	47	48	248	115	170	52.55%
O-XYLENE	76	37	78	14	14	14	75	38	53	51.25%
OTHER C2	1,600	33,300	4,500	3,700	3,300	3,500	4,070	25,300	12,045	113.23%
OTHER C3	0	0	0	0	0	0	0	0	0	ERR
OTHER C4	37,990	9,490	22,850	4,880	4,860	4,870	3,210	6,820	14,205	95.76%
OTHER C5	12,180	10,640	13,540	11,610	11,560	11,585	10,040	11,120	11,518	10.74%
OTHER C6	12,163	9,405	12,994	9,465	9,436	9,451	10,289	10,211	10,752	13.82%
C7	7,855	5,059	8,014	4,009	3,999	4,004	7,129	5,564	6,271	26.10%
C8	1,894	820	1,891	341	345	343	1,840	862	1,275	53.52%
C9	441	132	507	18	15	16	442	90	271	79.23%
C10+	85	22	100	4	0	2	99	12	53	86.32%
OXYGEN	51,540	38,280	21,780	24,480	22,430	23,455	94,020	41,240	45,053	58.80%
NITROGEN	199,000	136,000	82,670	94,370	88,020	91,195	313,500	151,500	162,311	52.58%
METHANE	262,200	279,300	298,800	314,200	315,100	314,650	223,800	288,500	277,875	11.47%
CARBON DIOXIDE	4,250	4,826	5,169	5,881	5,673	5,777	3,442	4,998	4,744	17.02%
Total	1,123,271	1,164,636	1,133,635	1,087,919	1,077,818	1,082,868	1,094,951	1,095,730	1,115,849	2.74%

API Tanks Site 4

Combination of TCD and FID Results

Assume FID concentrations for C4+ are correct and normalize TCD concentrations to make up the difference

Date	TCD Sample Time	FID Sample Time	Total FID C4+ Concentration ppmV	Total TCD Conc. Available ppmV	Oxygen ppmv	Nitrogen ppmv	Methane ppmv	Ethane ppmv	Propane ppmv	i-Butane ppmv	n-Butane ppmv	i-Pentane ppmv
Saturday, March 30, 1996	20:03	20:03	231,256	768,744	30,473	124,540	293,287	118,811	201,634	53,964	59,000	33,401
Sunday, March 31, 1996	11:17	11:17	80,941	919,059	42,127	171,773	353,249	152,186	199,725	18,105	31,336	9,503
Sunday, March 31, 1996	12:06	12:06	265,650	734,350	25,694	104,241	313,760	124,619	166,036	79,251	76,601	39,679
Sunday, March 31, 1996	12:55	12:55	270,499	729,501	25,798	104,844	291,964	123,107	183,789	79,946	76,883	40,984
Sunday, March 31, 1996	14:52	14:52	178,051	821,949	68,080	268,712	251,464	99,448	134,246	47,211	51,465	25,139
Sunday, March 31, 1996	15:46	15:46	245,143	754,857	47,538	189,384	254,563	111,762	151,610	69,140	72,096	36,103
Sunday, March 31, 1996	16:37	16:37	220,717	779,283	51,852	207,072	255,952	111,480	152,928	63,527	60,097	34,295
Sunday, March 31, 1996	19:14	19:14	230,009	769,991	44,837	179,956	265,717	116,812	162,670	68,954	69,822	34,358
Sunday, March 31, 1996	20:09	20:08	233,148	766,852	41,994	168,203	260,265	114,260	182,130	70,627	70,720	34,741
Sunday, March 31, 1996	21:04	21:04	233,050	766,950	41,099	164,872	264,838	116,209	179,932	71,659	71,137	34,766
Sunday, March 31, 1996	22:00	22:00	235,017	764,983	38,096	153,125	270,696	118,823	184,244	72,937	71,427	35,211
Sunday, March 31, 1996	22:55	22:55	236,037	763,963	34,498	139,391	280,363	122,538	187,174	73,890	71,725	35,477
Sunday, March 31, 1996	23:50	23:50	235,738	764,262	32,249	130,508	286,865	125,106	189,534	75,043	71,914	35,252
Monday, April 01, 1996	00:44	00:44	234,920	765,080	30,707	124,503	290,793	127,146	191,931	75,230	71,707	35,156
Monday, April 01, 1996	01:38	01:37	233,995	766,005	29,078	117,976	297,838	129,383	191,730	74,912	71,438	34,988
Monday, April 01, 1996	02:31	02:31	232,050	767,950	27,196	110,601	302,902	130,567	196,684	74,994	71,294	34,637
Monday, April 01, 1996	03:24	03:24	231,188	768,812	26,607	108,409	308,395	131,314	194,087	75,314	71,276	34,497
Monday, April 01, 1996	04:17	04:16	229,706	770,294	24,489	99,817	312,620	134,477	198,892	75,105	71,007	34,251
Monday, April 01, 1996	05:09	05:09	226,257	773,743	22,864	93,335	319,535	137,021	200,987	75,273	70,805	33,619
Monday, April 01, 1996	06:01	06:01	232,266	767,734	18,576	76,028	295,033	126,514	251,582	76,036	71,473	35,390
Monday, April 01, 1996	06:54	06:53	227,852	772,148	16,824	68,652	340,245	131,871	214,557	74,211	70,150	34,275
Monday, April 01, 1996	10:48	10:48	263,058	736,942	21,844	89,828	318,937	129,764	176,568	80,140	84,526	37,841
Monday, April 01, 1996	11:42	11:42	274,353	725,647	18,721	76,775	312,339	122,925	194,888	81,596	86,429	40,036
Monday, April 01, 1996	12:47	12:47	296,272	703,728	16,085	66,668	286,469	115,760	218,745	87,954	92,158	43,457
Monday, April 01, 1996	13:42	13:42	303,348	696,652	15,696	64,953	285,776	121,920	208,306	90,138	92,843	44,745
Monday, April 01, 1996	14:36	14:36	299,811	700,189	14,819	61,597	283,998	124,766	215,010	86,566	90,982	43,739
Monday, April 01, 1996	15:29	15:29	242,027	757,973	15,605	64,822	312,084	138,235	227,227	71,651	76,419	33,700
Monday, April 01, 1996	16:22	16:22	296,485	703,515	13,950	57,947	285,579	127,067	218,971	88,004	89,552	44,202
Monday, April 01, 1996	18:54	18:54	286,849	713,151	0	24,538	304,836	141,245	242,532	88,593	81,588	48,996
Monday, April 01, 1996	19:47	19:47	271,752	728,248	0	14,289	278,413	130,229	305,317	87,903	80,759	45,152
Monday, April 01, 1996	20:41	20:40	266,263	733,737	0	14,840	286,678	132,271	299,948	87,727	80,583	44,063
Monday, April 01, 1996	21:35	21:34	262,238	737,762	0	6,647	312,538	143,536	275,042	87,941	80,458	42,880
Monday, April 01, 1996	22:28	22:28	258,649	741,351	0	0	321,057	145,516	274,777	87,526	79,963	41,916
Monday, April 01, 1996	23:21	23:21	258,349	741,651	0	0	322,010	145,318	274,323	87,577	79,920	41,717
Tuesday, April 02, 1996	00:14	00:14	255,141	744,859	0	0	328,523	143,792	272,544	86,939	79,213	40,785
Tuesday, April 02, 1996	01:07	01:06	253,404	746,596	0	0	328,185	146,636	271,775	86,718	79,040	40,285
Tuesday, April 02, 1996	01:59	01:58	250,185	749,815	0	0	329,034	145,873	274,908	85,984	78,624	39,527
Tuesday, April 02, 1996	02:50	02:50	245,673	754,327	0	0	330,674	146,973	276,680	85,503	78,033	38,372

API Tanks Site 4

Combination of TCD and FID Results

Assume FID concentrations for C4+ are correct and normalize TCD concentrations to make up the difference

Date	TCD Sample Time	FID Sample Time	n-Pentane	n-Hexane	Benzene	n-Heptane	Toluene	Ethyl-Benzene	m,p-Xylenes	o-Xylene	C6 Range	C7 Range	C8 Range	C9 Range	C10+
			ppmv	ppmv	ppmv	ppmv	ppmv	ppmv	ppmv	ppmv	ppmv	ppmv	ppmv	ppmv	ppmv
Saturday, March 30, 1996	20:03	20:03	25,477	6,727	4,540	13,489	283	259	18	2,116	16,567	7,891	6,269	732	520
Sunday, March 31, 1996	11:17	11:17	6,652	2,164	240	815	583	137	187	136	4,283	3,681	2,537	306	276
Sunday, March 31, 1996	12:06	12:06	26,996	7,016	749	1,496	1,149	154	275	124	16,325	10,983	4,154	407	287
Sunday, March 31, 1996	12:55	12:55	27,746	7,083	767	1,950	1,055	111	209	94	16,290	11,874	4,849	455	203
Sunday, March 31, 1996	14:52	14:52	17,611	4,450	498	2,263	1,711	162	279	108	10,602	8,427	6,967	975	182
Sunday, March 31, 1996	15:46	15:46	24,728	6,398	686	1,887	1,311	181	307	136	14,924	10,547	5,596	840	264
Sunday, March 31, 1996	16:37	16:37	23,423	5,961	631	1,743	1,110	119	216	81	13,995	9,842	4,910	639	128
Sunday, March 31, 1996	19:14	19:14	23,036	5,374	557	1,329	813	70	128	53	13,174	8,297	3,593	389	63
Sunday, March 31, 1996	20:09	20:08	23,179	5,421	562	1,325	740	79	136	58	13,220	8,455	3,446	375	64
Sunday, March 31, 1996	21:04	21:04	23,019	5,191	535	1,245	707	72	124	57	12,819	8,039	3,265	352	62
Sunday, March 31, 1996	22:00	22:00	23,314	5,169	534	1,212	670	66	115	53	12,850	7,963	3,119	323	56
Sunday, March 31, 1996	22:55	22:55	23,392	5,133	528	1,146	629	60	105	48	12,843	7,778	2,936	295	51
Sunday, March 31, 1996	23:50	23:50	23,134	4,980	513	1,083	586	53	93	42	12,529	7,482	2,744	262	30
Monday, April 01, 1996	00:44	00:44	22,980	4,985	514	1,013	537	36	76	44	12,546	7,382	2,519	164	31
Monday, April 01, 1996	01:38	01:37	22,915	4,955	512	1,032	534	33	70	32	12,444	7,418	2,528	157	28
Monday, April 01, 1996	02:31	02:31	22,548	4,750	494	985	515	30	63	29	12,023	7,089	2,424	149	24
Monday, April 01, 1996	03:24	03:24	22,409	4,629	479	922	484	27	59	26	11,838	6,805	2,271	136	16
Monday, April 01, 1996	04:17	04:16	22,219	4,550	470	875	459	29	56	23	11,709	6,607	2,158	163	23
Monday, April 01, 1996	05:09	05:09	21,589	4,193	437	784	410	21	47	21	10,959	6,060	1,920	109	12
Monday, April 01, 1996	06:01	06:01	22,992	4,498	463	774	397	20	44	19	11,837	6,345	1,879	93	5
Monday, April 01, 1996	06:54	06:53	22,317	4,624	477	794	404	19	43	18	11,937	6,563	1,926	93	0
Monday, April 01, 1996	10:48	10:48	25,103	5,951	639	1,258	635	64	103	65	14,355	9,103	3,009	189	78
Monday, April 01, 1996	11:42	11:42	26,795	6,488	695	1,506	817	48	102	54	15,607	10,113	3,761	240	67
Monday, April 01, 1996	12:47	12:47	29,270	6,980	746	1,667	954	46	91	65	16,812	10,975	4,389	643	66
Monday, April 01, 1996	13:42	13:42	30,134	7,441	784	1,667	959	119	184	91	17,826	11,461	4,368	482	105
Monday, April 01, 1996	14:36	14:36	29,606	7,485	824	2,071	1,305	158	268	139	17,566	12,345	5,731	745	281
Monday, April 01, 1996	15:29	15:29	21,937	5,458	643	1,857	1,139	126	210	104	12,299	10,664	5,079	595	146
Monday, April 01, 1996	16:22	16:22	29,773	7,233	756	1,718	995	118	194	100	17,330	11,323	4,531	517	139
Monday, April 01, 1996	18:54	18:54	32,216	6,281	631	837	464	42	77	39	16,640	8,102	2,120	182	42
Monday, April 01, 1996	19:47	19:47	29,153	5,116	527	617	284	14	32	16	14,166	6,567	1,389	45	13
Monday, April 01, 1996	20:41	20:40	28,019	4,605	476	490	230	46	7	7	13,092	5,746	1,118	50	4
Monday, April 01, 1996	21:35	21:34	27,153	4,225	441	427	202	6	15	5	12,260	5,216	985	24	0
Monday, April 01, 1996	22:28	22:28	26,384	4,072	427	382	179	5	13	4	11,935	4,946	877	20	0
Monday, April 01, 1996	23:21	23:21	26,322	4,072	426	378	175	0	11	4	11,900	4,958	869	19	0
Tuesday, April 02, 1996	00:14	00:14	25,719	3,997	421	383	177	4	12	4	11,703	4,884	881	20	0
Tuesday, April 02, 1996	01:07	01:06	25,290	3,935	415	415	172	4	12	3	11,410	4,827	859	19	0
Tuesday, April 02, 1996	01:59	01:58	24,754	3,799	401	356	163	3	10	3	11,088	4,637	818	18	0
Tuesday, April 02, 1996	02:50	02:50	23,826	3,521	375	337	156	3	10	2	10,435	4,306	776	16	0

API Tanks Site 4

Combination of TCD and FID Results

Assume FID concentrations for C4+ are correct and normalize TCD concentrations to make up the difference

Date	TCD Sample Time	FID Sample Time	Total FID C4+ Concentration ppmV	Total TCD Conc. Available ppmV	Oxygen ppmv	Nitrogen ppmv	Methane ppmv	Ethane ppmv	Propane ppmv	I-Butane ppmv	n-Butane ppmv	I-Pentane ppmv
Tuesday, April 02, 1996	03:42	03:41	245,554	754,446	0	0	318,347	140,924	295,175	85,458	78,169	38,455
Tuesday, April 02, 1996	04:33	04:32	243,431	756,569	0	0	322,037	142,243	292,289	85,052	77,661	37,766
Tuesday, April 02, 1996	05:23	05:23	112,411	887,589	169,726	687,041	0	0	30,822	23,332	31,401	22,635
Tuesday, April 02, 1996	06:14	06:13	143,413	856,587	86,073	366,449	188,286	82,062	133,716	43,419	45,959	21,464
Tuesday, April 02, 1996	07:04	07:04	166,433	833,567	40,803	187,261	369,529	103,807	132,167	51,189	53,992	24,277
Tuesday, April 02, 1996	11:06	11:06	267,637	732,363	23,437	95,895	309,073	128,061	176,097	79,525	79,007	38,617
Tuesday, April 02, 1996	11:59	11:59	281,513	718,487	16,010	65,338	275,851	123,450	237,838	85,223	82,357	42,778
Tuesday, April 02, 1996	12:51	12:51	281,198	718,802	18,343	75,468	293,257	128,701	203,034	83,647	80,700	41,920
Tuesday, April 02, 1996	13:44	13:44	112,715	887,285	165,657	635,723	32,744	14,546	38,614	12,568	21,955	22,957
Tuesday, April 02, 1996	14:37	14:37	63,720	936,280	160,562	619,168	77,684	32,614	46,252	10,954	12,058	6,332
Tuesday, April 02, 1996	15:30	15:29	111,784	888,216	90,297	354,690	277,655	73,688	91,887	29,200	30,115	12,915
Tuesday, April 02, 1996	16:22	16:22	113,998	886,002	96,382	378,231	198,951	88,269	124,169	31,908	33,132	14,822
Tuesday, April 02, 1996	18:57	18:56	220,914	779,086	31,861	129,480	306,848	131,269	179,629	68,203	66,470	34,067
Tuesday, April 02, 1996	19:52	19:52	227,540	772,460	20,494	84,689	299,042	127,774	240,461	72,472	68,328	34,757
Tuesday, April 02, 1996	20:47	20:47	229,505	770,495	13,462	56,369	318,877	134,835	246,951	74,572	69,442	35,259
Tuesday, April 02, 1996	21:42	21:41	238,883	761,117	12,668	52,940	315,557	133,881	246,071	74,142	69,285	37,284
Tuesday, April 02, 1996	22:36	22:36	242,672	757,328	15,221	62,999	306,079	129,948	243,080	74,278	69,357	37,969
Tuesday, April 02, 1996	23:30	23:20	240,830	759,170	17,206	70,975	306,355	128,214	234,419	73,501	68,833	37,349
Wednesday, April 03, 1996	00:25	00:25	245,560	754,440	14,943	62,044	311,731	131,014	234,707	73,595	69,012	38,528
Wednesday, April 03, 1996	01:19	01:19	245,874	754,126	15,010	62,257	307,998	130,894	237,965	73,615	68,715	38,201
Wednesday, April 03, 1996	02:13	02:13	248,085	751,915	13,147	54,601	315,119	127,499	241,550	73,863	68,853	38,853
Wednesday, April 03, 1996	03:08	03:08	260,937	739,063	11,960	49,702	304,995	131,007	241,399	73,189	68,376	39,263
Wednesday, April 03, 1996	04:02	04:02	251,407	748,593	11,392	47,389	306,062	132,251	249,499	71,449	67,186	37,648
Wednesday, April 03, 1996	04:57	04:56	261,037	738,963	12,050	50,003	299,316	129,768	247,827	72,622	67,811	38,591
Wednesday, April 03, 1996	05:51	05:50	117,733	882,267	114,954	446,846	129,564	53,126	137,777	15,364	20,215	23,230
Wednesday, April 03, 1996	06:45	06:44	193,487	806,513	57,965	231,903	247,145	110,568	158,931	55,577	57,955	24,550
Wednesday, April 03, 1996	07:39	07:39	206,059	793,941	42,668	171,242	269,859	102,313	207,859	54,289	57,480	29,728
Average			229,225		32,488	131,606	282,127	119,987	204,566	69,875	68,114	34,905
Std. Dev.			52,921		37,856	148,194	65,399	28,775	61,093	19,487	16,874	8,572
RSD			23.1%		116.5%	112.6%	23.2%	24.0%	29.9%	27.9%	24.8%	24.6%
Day 1 average			225,612		34,510	139,070	290,853	124,232	185,723	69,568	68,219	33,616
Std Deviation			38,349		12,557	49,122	28,597	11,296	25,040	13,959	10,237	6,378
RSD			17.0%		36.4%	35.3%	9.8%	9.1%	13.5%	20.1%	15.0%	19.0%
Day 2 average			249,777		18,787	81,075	292,061	125,948	232,351	79,405	77,194	38,909
Std Deviation			48,912		39,100	159,137	73,485	32,375	67,623	17,327	14,869	7,324
RSD			19.6%		208.1%	196.3%	25.2%	25.7%	29.1%	21.8%	19.3%	18.8%
Day 3 average			211,958		44,350	175,352	264,262	110,168	193,910	60,625	58,938	32,074
Std Deviation			64,188		48,929	187,547	81,122	35,347	66,969	23,958	20,805	10,157
RSD			30.3%		110.3%	107.0%	30.7%	32.1%	34.5%	39.5%	35.3%	31.7%

API Tanks Site 4

Combination of TCD and FID Results

Assume FID concentrations for C4+ are correct and normalize TCD concentrations to make up the difference

Date	TCD Sample Time	FID Sample Time	n-Pentane	n-Hexane	Benzene	n-Heptane	Toluene	Ethyl-Benzene	m,p-Xylenes	o-Xylene	C6 Range	C7 Range	C8 Range	C9 Range	C10+
			ppmv	ppmv	ppmv	ppmv	ppmv	ppmv	ppmv	ppmv	ppmv	ppmv	ppmv	ppmv	ppmv
Tuesday, April 02, 1996	03:42	03:41	23,992	3,436	367	313	146	0	7	0	10,320	4,149	725	16	0
Tuesday, April 02, 1996	04:33	04:32	23,476	3,465	368	307	144	0	7	1	10,275	4,178	712	16	0
Tuesday, April 02, 1996	05:23	05:23	17,607	3,160	304	263	109	2	5	0	9,308	3,681	593	10	0
Tuesday, April 02, 1996	06:14	06:13	14,564	3,264	357	440	175	3	8	1	7,664	5,097	981	19	0
Tuesday, April 02, 1996	07:04	07:04	16,167	3,693	386	584	228	3	9	2	9,388	5,254	1,237	24	0
Tuesday, April 02, 1996	11:06	11:06	25,865	6,211	715	3,060	1,133	24	52	22	14,826	12,085	6,335	145	16
Tuesday, April 02, 1996	11:59	11:59	28,418	6,563	712	1,776	1,189	81	153	42	15,663	10,618	5,097	604	39
Tuesday, April 02, 1996	12:51	12:51	28,419	7,409	793	1,915	1,191	65	156	44	17,357	11,879	5,238	444	19
Tuesday, April 02, 1996	13:44	13:44	18,142	6,030	615	1,490	889	83	152	45	13,643	9,574	4,067	500	7
Tuesday, April 02, 1996	14:37	14:37	5,189	4,053	484	1,749	1,179	128	225	69	6,965	8,385	5,152	753	46
Tuesday, April 02, 1996	15:30	15:29	8,655	3,678	469	2,032	1,450	222	364	143	6,567	8,561	6,248	1,047	119
Tuesday, April 02, 1996	16:22	16:22	9,949	2,831	343	1,460	1,095	195	303	150	6,006	6,077	4,696	845	185
Tuesday, April 02, 1996	18:57	18:56	22,815	5,078	522	895	433	29	58	37	12,714	7,313	2,127	96	58
Tuesday, April 02, 1996	19:52	19:52	23,035	4,999	517	888	431	19	45	15	12,619	7,201	2,101	94	20
Tuesday, April 02, 1996	20:47	20:47	23,127	4,699	488	776	379	18	40	18	12,123	6,640	1,839	81	6
Tuesday, April 02, 1996	21:42	21:41	24,984	5,682	582	1,101	522	21	46	19	14,040	8,444	2,610	116	7
Tuesday, April 02, 1996	22:36	22:36	25,515	6,147	632	1,167	557	21	47	19	14,974	9,120	2,746	118	5
Tuesday, April 02, 1996	23:30	23:20	25,049	6,178	639	1,263	609	21	48	18	14,818	9,401	2,991	111	0
Wednesday, April 03, 1996	00:25	00:25	26,099	6,657	684	1,311	628	21	47	17	15,882	10,038	2,897	142	0
Wednesday, April 03, 1996	01:19	01:19	25,903	6,797	701	1,395	663	23	49	12	16,015	10,395	3,240	151	0
Wednesday, April 03, 1996	02:13	02:13	26,281	6,907	714	1,480	718	23	53	18	16,175	10,714	3,269	164	0
Wednesday, April 03, 1996	03:08	03:08	27,336	8,707	896	2,249	1,164	66	125	44	19,237	14,284	5,525	438	38
Wednesday, April 03, 1996	04:02	04:02	25,911	7,827	816	2,295	1,225	57	128	47	17,377	13,280	5,692	361	108
Wednesday, April 03, 1996	04:57	04:56	26,416	8,330	874	2,560	1,642	247	407	208	17,922	14,432	7,285	1,080	610
Wednesday, April 03, 1996	05:51	05:50	18,758	6,275	637	1,911	1,067	54	122	45	14,051	10,588	4,899	351	166
Wednesday, April 03, 1996	06:45	06:44	16,206	6,243	654	1,879	1,036	87	154	67	12,697	10,943	4,838	484	117
Wednesday, April 03, 1996	07:39	07:39	20,438	6,726	717	2,395	1,257	58	128	49	13,808	12,672	5,890	366	56
Average			23,218	5,363	567	1,250	704	60	108	48	13,097	8,325	3,224	298	68
Std. Dev.			5,428	1,410	148	623	400	56	91	42	3,082	2,631	1,720	269	78
RSD			23.4%	26.3%	26.1%	49.8%	56.8%	92.4%	84.1%	88.2%	23.5%	31.6%	53.3%	90.3%	114.9%
Day 1 average			22,310	5,076	532	1,234	740	74	132	60	12,457	7,882	3,287	334	90
Std Deviation			4,183	1,060	115	431	353	52	85	39	2,449	1,870	1,372	243	97
RSD			18.7%	20.9%	21.5%	35.0%	47.6%	70.5%	64.5%	65.7%	19.7%	23.7%	41.7%	72.7%	107.2%
Day 2 average			25,330	4,894	519	831	446	37	63	32	12,881	6,933	2,082	178	43
Std Deviation			4,538	1,495	163	620	391	50	81	43	2,992	2,934	1,720	245	71
RSD			17.9%	30.5%	31.5%	74.6%	87.8%	134.1%	128.2%	134.1%	23.2%	42.3%	82.6%	138.1%	166.8%
Day 3 average			21,932	6,092	646	1,684	930	71	132	52	13,895	10,120	4,308	386	74
Std Deviation			6,589	1,443	138	592	361	68	107	51	3,525	2,349	1,584	312	132
RSD			30.0%	23.7%	21.4%	35.1%	38.8%	96.1%	81.0%	97.1%	25.4%	23.2%	36.8%	80.9%	179.3%

API Tanks Site 4

Flowrate Calculation for Orifice Plate Meter
Setra Model 264 0-10"H2O Range
Calibrated Monday, March 25, 1996

Density=	0.1100 lb/ft3	Ao=	0.00136 ft2		
Do=	0.5 In	Ap=	0.02196 ft2		
Dp=	2.0067 In	gc=	32 ft/sec2		
C=	0.61	Y=	1		
K=	0.61	Viscosity=	7.392E-06 lb/ft-sec	(methane)	

Date	Time	Diff. Pres. Reading	Actual Diff. Pressure "H2O	Velocity Across Orifice ft/sec	Reynolds Number at Orifice	Volumetric Flow acfh	Temperature deg. F	Atm. Pressure psia	Volumetric Flow scfh
		1.31	1.26	37.81	281,330	185.6	73.0	14.70	181.1
		1.35	1.30	38.35	285,364	188.3	73.0	14.70	183.7
		1.34	1.29	38.26	284,677	187.8	73.0	14.70	183.3
		1.31	1.26	37.72	280,636	185.1	73.0	14.70	180.7
		1.23	1.17	36.46	271,272	179.0	73.0	14.70	174.6
		1.18	1.12	35.66	265,297	175.0	73.0	14.70	170.8

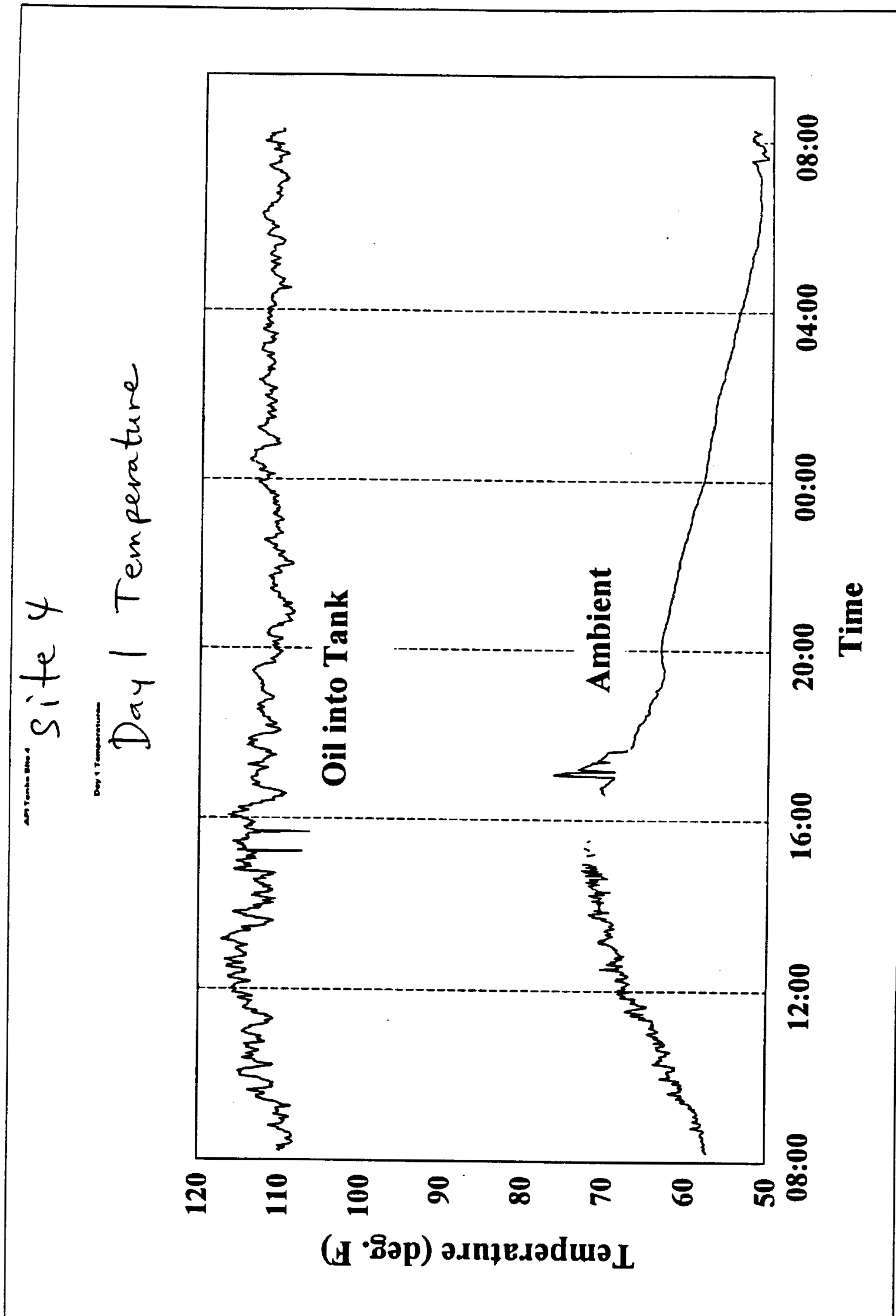
Site 4 Dilution Gauge Settings

Date	Time	Dilution Gauge	Dilution Flow mL/min	Sample Gauge	Sample Flow mL/min	Dilution Ratio
3-31-96	11:35	25	422.80	30	21.90	20.31
3-31-96	14:59	24	414.96	29.8	22.06	19.81
3-31-96	15:57	23.9	414.18	29.2	21.54	20.22
3-31-96	15:58	30	468.80	30	21.90	22.41
3-31-96	16:05	20	382.20	35	26.49	15.43
3-31-96	18:22	25	422.80	30	21.90	20.31
4-1-96	07:30	25	422.80	30.8	22.91	19.46
4-1-96	10:00	30	468.80	25	17.96	27.10
4-1-96	12:59	30	468.80	24.7	17.71	27.47
4-1-96	15:41	30.5	465.93	25.8	18.65	25.99
4-1-96	18:36	25	422.80	30	21.90	20.31
4-2-96	07:35	25	422.80	30	21.90	20.31
4-2-96	10:45	30	468.80	30	21.90	22.41
4-2-96	12:45	30	468.80	30	21.90	22.41
4-2-96	15:21	30	468.80	30	21.90	22.41
4-2-96	16:49	30	468.80	30	21.90	22.41
4-2-96	18:27	30	468.80	35	26.49	18.70
4-3-96	07:44	25	422.80	33.8	25.47	17.60

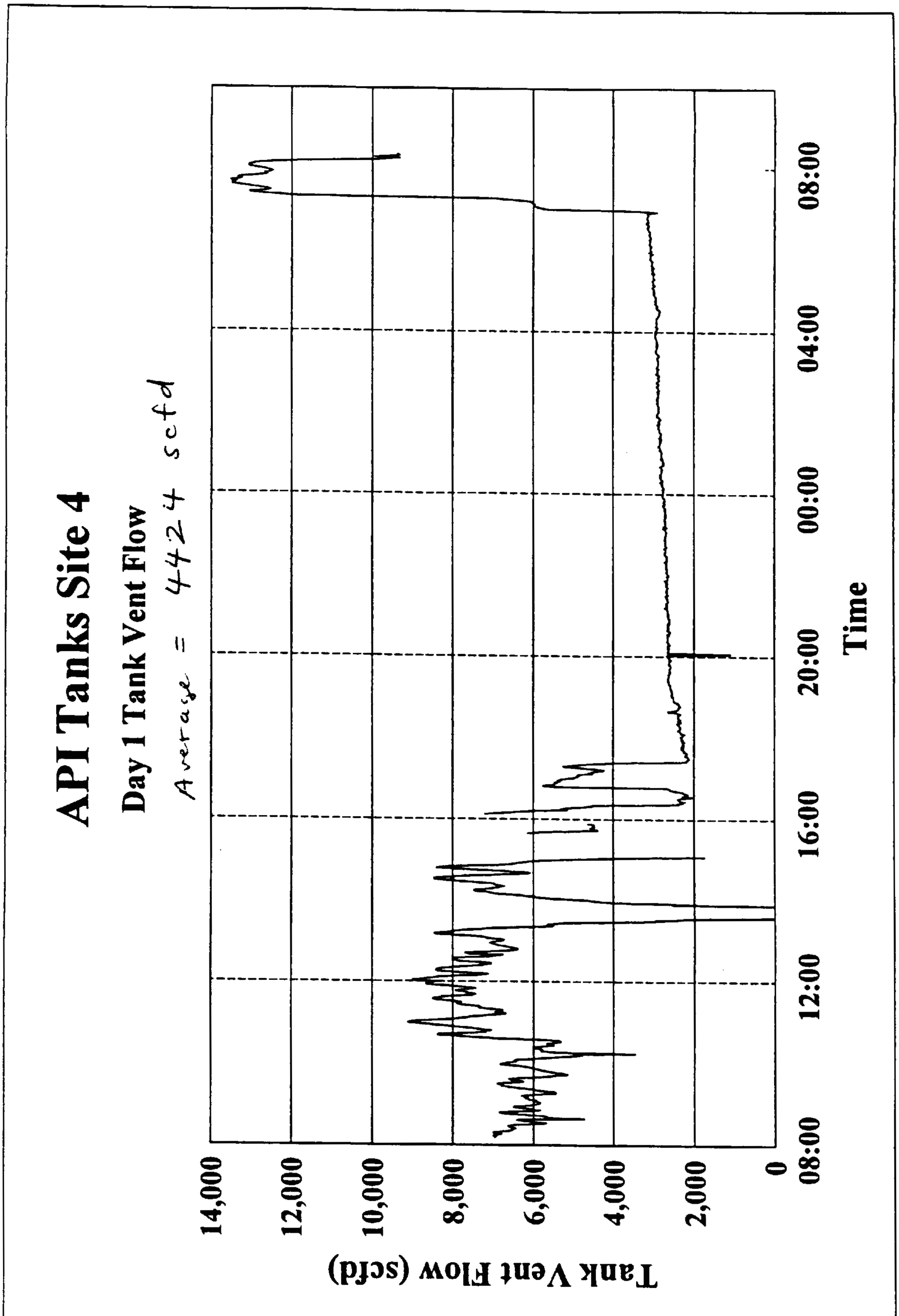
797 min

1.1 ratio change

1.38×10^{-3}/min



PETRO PUBL 4662-ENGL ■ 0732290 0608857 988 ■



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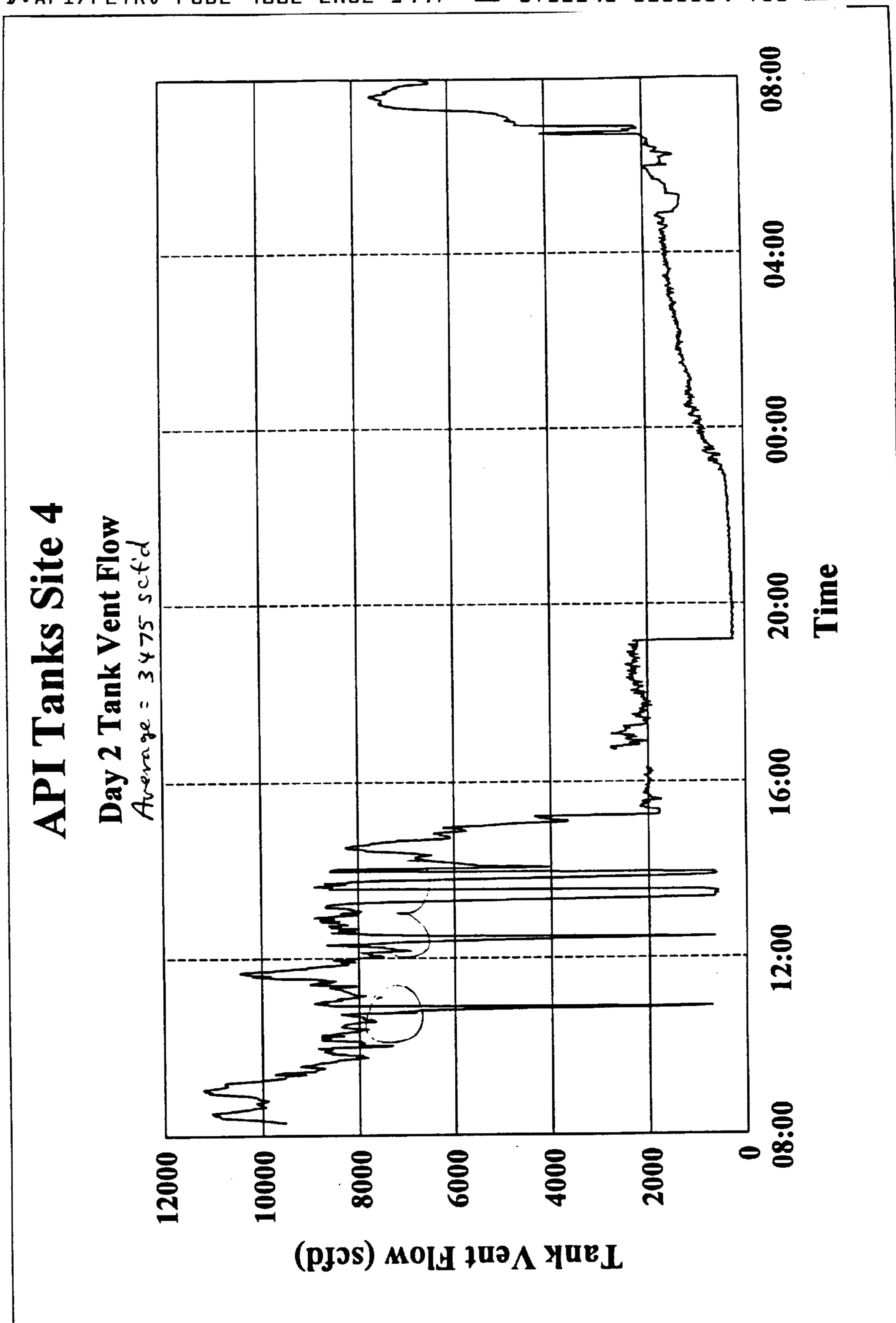
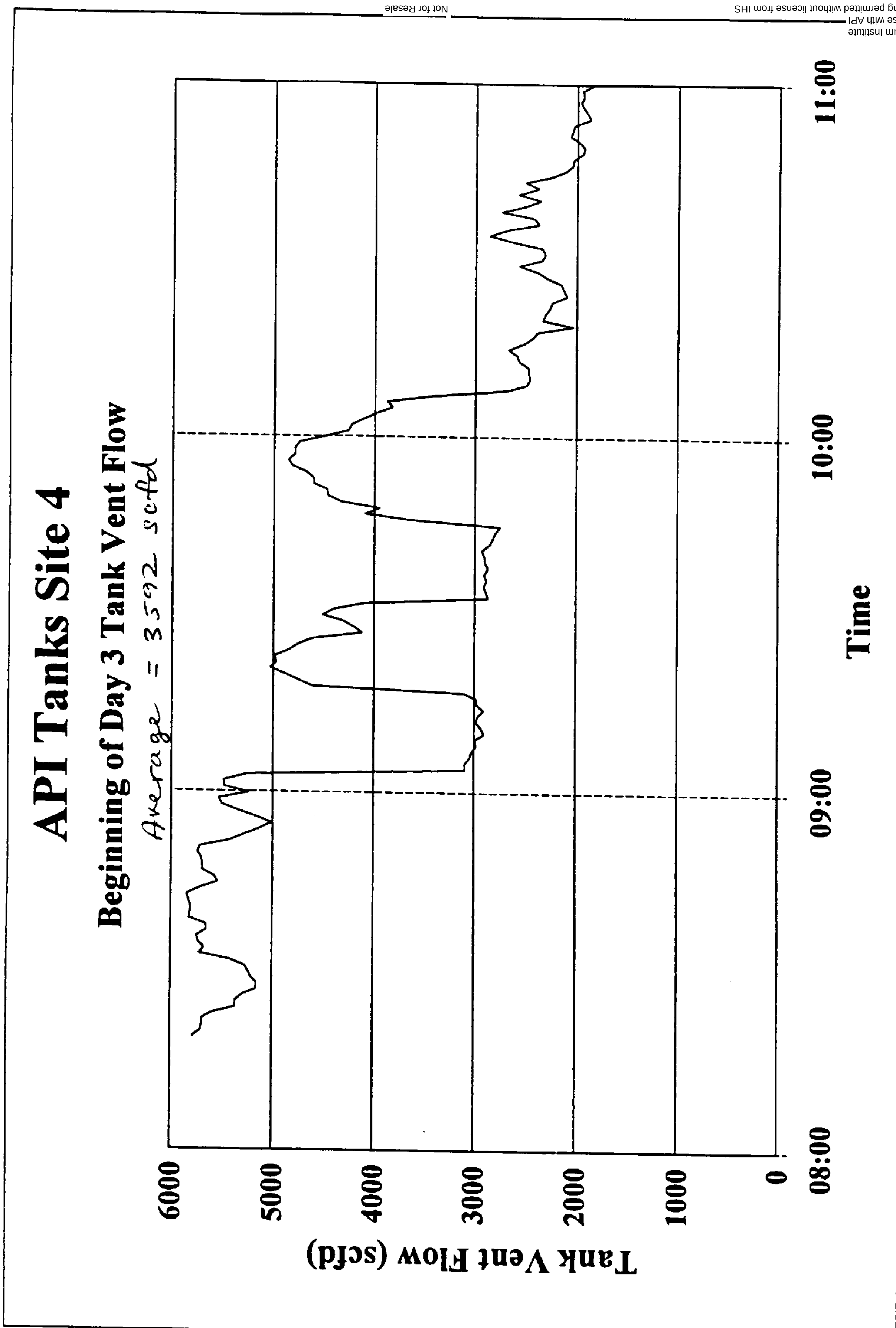

API Tanks Site 4
Day 2 Tank Vent Flow
Average = 3475 scfd
Tank Vent Flow (scfd)
12000
10000
8000
6000
4000
2000
0
08:00
12:00
16:00
20:00
00:00
04:00
08:00
Time



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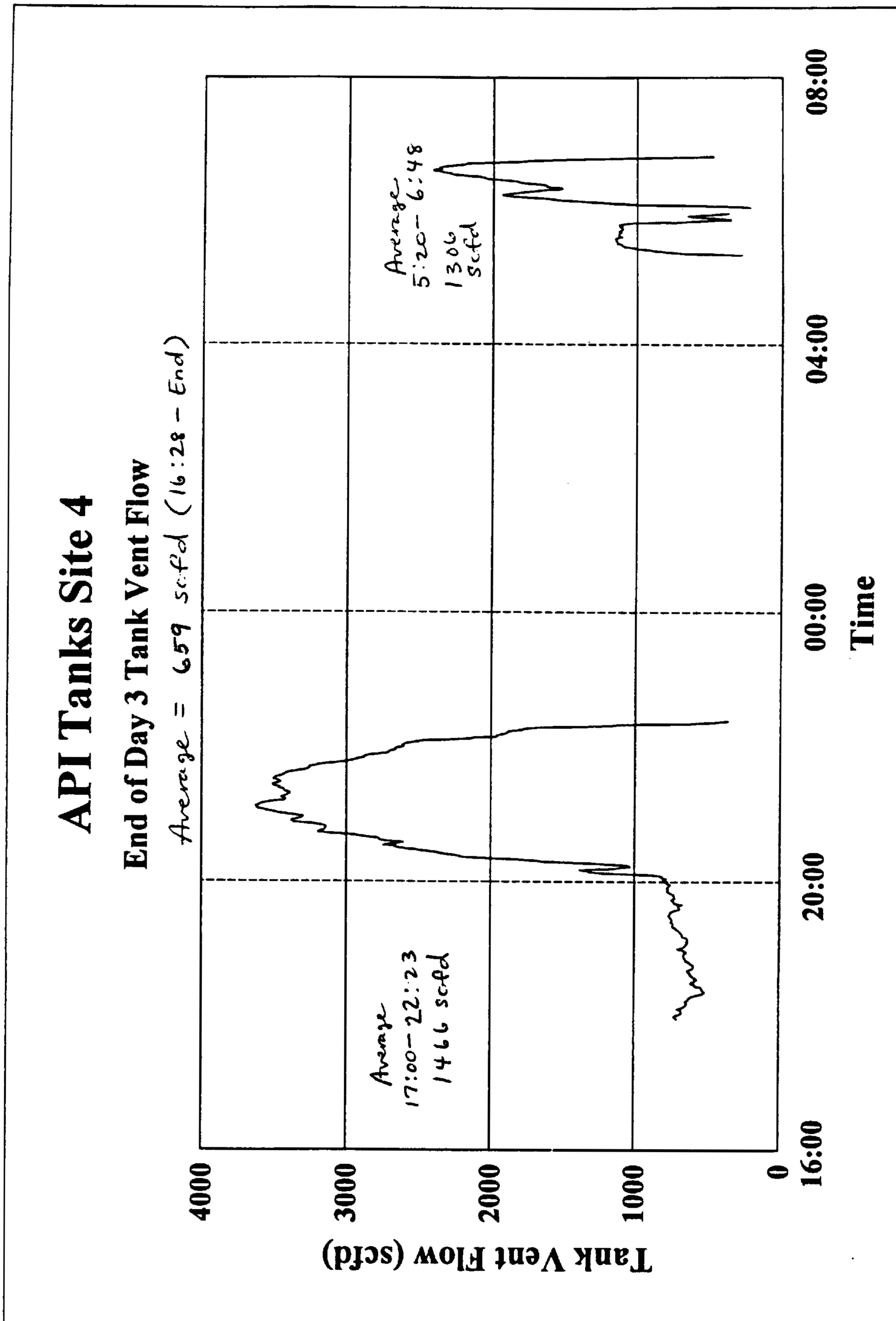

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Site 5

API Tanks Site 5

Process Data

Heater Treater Pressure

Date	Time	Pressure psig	Comment
04/30/96	09:51	28	
	11:09	28	sample
	15:45	30	
	19:30	30	
05/01/96	07:40	26	
	Day 1	28.4	
05/01/96	10:26	28	sample
	13:37	30	
	20:06	29	sample
	Day 2	29.0	
05/02/96	08:50	26	
	09:33	26	sample
	11:53	30	
	16:47	33	
	19:08	30	sample
05/03/96	09:00	26	
	Day 3	28.5	

Overall Average= 28.6 psig

Sales Oil Temperature

Date	Time	Temperature deg. F	
04/30/96	16:35	76	
05/01/96	14:45	84	
05/01/96	20:29	73	
05/02/96	17:00	86	
05/03/96	09:18	69	stagnant line

Production

7:00 a.m. - 7:00 a.m. Date	Day 1 04/30/96	Day 2 05/01/96	Day 3 05/02/96	Average
Oil Production (bbl)	457	458	439	451
Gas Production (MMscf)	10.9315	10.9293	10.6776	10.8461
LP Gas (Mscf)	164.3	157.5	153.9	158.6
Oil Withdrawn (bbl)	841.4	420.7	210.4	490.8

Truck Oil Withdraws

	Date	Time
1	04/30/96	12:00
2	04/30/96	16:15
3	04/30/96	20:05
4	05/01/96	03:40
5	05/01/96	16:30
6	05/02/96	03:40
7	05/03/96	03:40

Average truck size= 210.4 bbl

API Tanks Site 5

Sales Oil Composition (mole%)

Sample (API5-)	SOBT01	SOBT02	SOBT03	SOBT03d	Average
Date	04/30/96	05/01/96	05/03/96	05/03/96	
Time	16:27	20:38	09:21	09:23	
Nitrogen	0.00	0.00	0.00	0.00	0.00
Methane	0.03	0.03	0.03	0.02	0.03
Ethane	0.45	0.48	0.45	0.42	0.46
Propane	1.42	1.47	1.44	1.39	1.44
i-Butane	1.35	1.37	1.36	1.33	1.36
n-Butane	1.62	1.63	1.62	1.60	1.62
i-Pentane	2.74	2.73	2.75	2.74	2.74
n-Pentane	1.81	1.80	1.81	1.80	1.81
n-Hexane	2.12	2.08	2.11	2.12	
Hexanes	4.19	4.14	4.26	4.27	4.20
Heptanes	9.85	9.66	9.87	9.94	9.81
Octanes	11.81	11.72	12.14	11.99	11.87
Nonanes	6.92	6.87	6.90	6.99	6.91
Decanes Plus	44.40	44.87	44.03	44.03	44.43
Benzene	2.31	2.27	2.29	2.30	2.29
Toluene	5.00	4.93	4.98	5.04	4.98
Ethylbenzene	0.21	0.22	0.22	0.22	0.22
Xylenes	3.78	3.72	3.74	3.79	3.76
API Gravity	48.80	48.76	48.66	48.83	48.77
RVP	7.27	7.63	7.30	7.28	7.40

API Tanks Site 5

Sales Oil Composition (weight%)

Sample (API5-)	SOBT01	SOBT02	SOBT03	SOBT03d	Average
Date	04/30/96	05/01/96	05/03/96	05/03/96	
Time	16:27	20:38	09:21	09:23	
Nitrogen	0.00	0.00	0.00	0.00	0.00
Methane	0.00	0.00	0.00	0.00	0.00
Ethane	0.09	0.09	0.09	0.08	0.09
Propane	0.39	0.41	0.40	0.39	0.40
i-Butane	0.49	0.50	0.50	0.49	0.50
n-Butane	0.59	0.60	0.59	0.59	0.59
i-Pentane	1.25	1.24	1.25	1.24	1.25
n-Pentane	0.82	0.82	0.82	0.82	0.82
n-Hexane	1.15	1.13	1.14	1.15	
Hexanes	2.22	2.19	2.25	2.26	2.22
Heptanes	6.02	5.90	6.03	6.07	5.99
Octanes	8.26	8.20	8.49	8.38	8.30
Nonanes	5.36	5.32	5.35	5.41	5.35
Decanes Plus	66.68	67.00	66.44	66.39	66.70
Benzene	1.14	1.11	1.12	1.13	1.13
Toluene	2.90	2.86	2.88	2.92	2.89
Ethylbenzene	0.14	0.14	0.15	0.15	0.14
Xylenes	2.52	2.48	2.50	2.53	2.51
API Gravity	48.80	48.76	48.66	48.83	48.77
RVP	7.27	7.63	7.30	7.28	7.40

API Tanks Site 5

Separator Gas Composition (mole%)

API5-	SGCY01	SGCY02	SGCY03	SGCYO3d	Average	RSD
Date	04/30/96	05/01/96	05/02/96	05/02/96		
Time	10:52	10:15	09:25	09:25		
Pressure (psig)	32	32	30	30		
Oxygen	0.00	0.00	0.00	0.00	0.00	NA
Nitrogen	0.00	0.00	0.55	0.55	0.18	173.2%
Carbon Dioxide	9.81	9.42	9.63	9.67	9.62	2.0%
Methane	55.84	54.29	64.01	63.70	58.00	8.9%
Ethane	19.00	18.31	14.56	14.59	17.30	13.8%
Propane	8.33	9.03	5.76	5.81	7.72	22.1%
i-Butane	2.46	2.86	1.75	1.80	2.37	23.3%
n-Butane	1.80	2.10	1.30	1.35	1.74	22.4%
i-Pentane	1.02	1.25	0.79	0.82	1.03	21.7%
n-Pentane	0.48	0.67	0.38	0.41	0.51	27.1%
n-Hexane	0.152	0.230	0.153	0.158	0.179	24.6%
Other Hexanes	0.582	0.863	0.552	0.558	0.667	25.6%
Heptanes	0.213	0.409	0.265	0.266	0.296	34.4%
Octanes	0.062	0.133	0.069	0.067	0.088	45.1%
Nonanes	0.024	0.034	0.014	0.014	0.024	41.9%
Decanes+	0.028	0.036	0.012	0.023	0.027	34.5%
Benzene	0.118	0.198	0.120	0.124	0.146	30.9%
Toluene	0.056	0.133	0.070	0.074	0.087	46.9%
Ethylbenzene	0.002	0.002	0.001	0.002	0.002	16.3%
Xylenes	0.022	0.032	0.012	0.014	0.023	42.8%

API Tanks Site 5

Separator Oil Composition (mole%)

API5- Date Time Pressure (psig)	SCCY01 Tuesday, April 30, 1996 11:09 28	SCCY02 ********** 19:37 30	Day 1 Average	SCCY03 Wednesday, May 01, 1996 10:26 28	SCCY04 ********** 20:06 29	SCCY04d ********** 20:13 29	Day 2 Average	SCCY05 Thursday, May 02, 1996 09:33 26	SCCY06 ********** 19:08 30	Day 3 Average	Overall Average 28.6	RSD Percent 4.9
Nitrogen	0.01	0.02	0.02	0.01	0.01	0.01	0.01	0.02	0.01	0.02	0.01	36.6
Carbon Dioxide	0.28	0.34	0.31	0.29	0.35	0.33	0.32	0.34	0.33	0.34	0.32	8.3
Methane	0.67	0.58	0.63	0.70	0.55	0.58	0.63	0.67	0.58	0.63	0.62	9.6
Ethane	1.37	1.44	1.41	1.32	1.45	1.55	1.41	1.43	1.49	1.46	1.44	5.2
Propane	2.74	2.79	2.77	2.74	2.87	2.79	2.79	2.72	2.74	2.73	2.76	1.9
i-Butane	2.24	2.28	2.26	2.27	2.36	2.31	2.30	2.33	2.25	2.29	2.29	1.9
n-Butane	2.16	2.23	2.20	2.19	2.17	2.15	2.18	2.16	2.21	2.19	2.18	1.4
i-Pentane	3.61	3.46	3.54	3.56	3.58	3.58	3.57	3.55	3.51	3.53	3.55	1.4
n-Pentane	2.00	1.95	1.98	2.02	2.02	2.04	2.03	1.92	2.03	1.98	1.99	2.3
n-Hexane	2.43	2.26	2.35	2.37	2.36	2.37	2.37	2.43	2.36	2.40	2.37	2.4
Other Hexanes	3.82	3.84	3.83	3.87	3.83	3.94	3.88	3.97	3.83	3.90	3.88	1.5
Heptanes	7.25	6.62	6.94	6.90	6.97	6.87	6.91	7.05	6.60	6.83	6.89	3.3
Octanes	10.19	10.24	10.22	10.64	9.96	9.90	10.29	10.29	9.83	10.06	10.13	2.8
Nonanes	13.69	14.08	13.89	13.83	13.47	13.45	13.65	13.44	13.82	13.63	13.69	1.8
Decanes+	36.14	36.03	36.09	35.26	36.62	36.75	35.97	35.69	36.51	36.10	36.18	1.5
Benzene	1.75	1.80	1.78	1.78	1.71	1.72	1.75	1.74	1.64	1.69	1.73	3.0
Toluene	3.46	3.46	3.46	3.69	3.32	3.21	3.48	3.48	3.44	3.46	3.43	4.3
Ethylbenzene	0.57	0.49	0.53	0.52	0.44	0.47	0.49	0.52	0.49	0.51	0.50	8.3
Xylenes	5.62	6.09	5.86	6.04	5.96	5.98	6.01	6.25	6.33	6.29	6.05	3.8
Decanes+ SG	0.836	0.836	0.836	0.836	0.836	0.836	0.836	0.836	0.836	0.836	0.836	0.0
Decanes+ MW	265	265	265.0	265	265	265	265.0	265	265	265.0	265.0	0.0

API Tanks Site 5

Combination of TCD and FID Results

Assume FID concentrations for C4+ are correct and normalize TCD concentrations to make up the difference

Date	TCD Sample Time	FID Sample Time	Total FID C4+ Concentration ppmV	Total TCD Conc. Available ppmV	Oxygen ppmv	Nitrogen ppmv	Methane ppmv	Ethane ppmv	Propane ppmv	i-Butane ppmv	n-Butane ppmv	i-Pentane ppmv	n-Pentane ppmv
Tuesday, April 30, 1996	15:21	15:21	278,055	721,945	17,985	69,551	226,678	231,554	176,177	74,400	63,007	38,725	19,659
Tuesday, April 30, 1996	16:14	16:14	269,484	730,516	23,237	88,244	217,067	229,646	172,323	73,272	61,939	38,557	19,771
Tuesday, April 30, 1996	17:13	17:13	211,800	788,200	35,295	132,002	216,080	230,624	174,200	61,343	50,922	28,603	13,609
Tuesday, April 30, 1996	18:12	18:11	247,983	752,017	21,926	85,630	223,629	237,535	183,297	68,585	58,565	36,984	18,920
Tuesday, April 30, 1996	19:10	19:10	223,788	776,212	106,023	379,537	78,932	99,160	112,560	69,376	57,979	33,310	15,992
Tuesday, April 30, 1996	19:51	19:51	13,738	986,262	219,407	766,855	0	0	0	10	134	224	186
Tuesday, April 30, 1996	20:40	20:40	122,196	877,804	188,009	663,170	0	0	26,625	35,246	34,434	25,741	12,926
Tuesday, April 30, 1996	21:28	21:28	53,485	946,515	167,506	591,228	63,384	70,878	53,519	15,078	13,112	7,878	3,764
Tuesday, April 30, 1996	22:16	22:15	115,290	884,710	44,277	164,989	223,125	255,946	196,373	20,902	25,264	26,751	13,809
Tuesday, April 30, 1996	23:03	23:02	25,113	974,887	216,421	758,467	0	0	0	427	716	1,262	1,041
Tuesday, April 30, 1996	23:49	23:49	185,402	814,598	43,916	163,131	197,530	231,090	178,931	61,104	51,233	29,773	14,664
Wednesday, May 01, 1996	00:35	00:35	196,145	803,855	41,809	155,720	198,554	233,747	174,026	63,315	52,956	31,136	15,422
Wednesday, May 01, 1996	01:21	01:21	193,857	806,143	40,190	150,208	201,256	236,571	177,919	62,589	52,210	30,559	15,112
Wednesday, May 01, 1996	02:06	02:06	194,520	805,480	40,528	151,762	198,654	236,563	177,974	63,480	52,773	30,644	15,175
Wednesday, May 01, 1996	02:51	02:51	193,254	806,746	38,857	145,952	201,178	240,370	180,389	63,129	52,148	30,530	15,179
Wednesday, May 01, 1996	03:36	03:36	193,908	806,092	36,721	137,708	203,828	243,820	184,015	63,435	52,611	30,549	15,158
Wednesday, May 01, 1996	04:20	04:20	22,317	977,683	217,589	760,093	0	0	0	378	568	1,034	841
Wednesday, May 01, 1996	05:05	05:04	184,055	815,945	41,243	153,523	208,172	237,839	177,168	61,639	51,096	29,326	14,211
Wednesday, May 01, 1996	05:49	05:48	188,186	811,814	40,517	151,905	201,281	239,643	178,469	61,845	51,235	30,060	14,808
Wednesday, May 01, 1996	06:32	06:32	186,884	813,116	39,832	148,434	209,129	237,826	177,895	61,632	50,797	29,182	14,331
Wednesday, May 01, 1996	07:59	07:59	192,660	807,340	33,432	125,667	227,036	242,345	178,860	55,755	46,854	28,432	14,479
Wednesday, May 01, 1996	08:47	08:47	212,021	787,979	30,789	115,394	230,184	236,356	175,257	61,538	52,308	32,032	16,250
Wednesday, May 01, 1996	09:35	09:35	224,360	775,640	29,623	111,174	227,306	230,518	177,019	65,128	54,952	34,239	17,637
Wednesday, May 01, 1996	10:20	10:20	220,523	779,477	30,054	112,403	225,318	230,125	181,577	65,263	54,470	32,451	16,520
Wednesday, May 01, 1996	11:05	11:05	218,891	781,109	28,156	105,976	234,983	233,697	178,297	64,649	54,109	32,430	16,327

Assume FID concentrations for C4+ are correct and
normalize TCD concentrations to make up the difference

Date	TCD Sample Time	FID Sample Time	I-Pentane	n-Pentane	n-Hexane	Benzene	n-Heptane	Toluene	Ethyl-Benzene	m,p-Xylenes	o-Xylene	C6 Range	C7 Range	C8 Range	C9 Range	C10+
			ppmv	ppmv	ppmv	ppmv	ppmv	ppmv	ppmv	ppmv	ppmv	ppmv	ppmv	ppmv	ppmv	ppmv
Tuesday, April 30, 1996	15:21	15:21	38,725	19,659	8,665	2,539	9,902	2,800	196	379	52	22,336	27,674	5,627	1,614	461
Tuesday, April 30, 1996	16:14	16:14	38,557	19,771	8,264	4,236	7,204	3,259	290	486	81	22,545	21,848	5,467	1,894	369
Tuesday, April 30, 1996	17:13	17:13	28,603	13,609	4,237	2,216	6,774	4,897	396	642	110	12,681	14,978	7,245	2,552	595
Tuesday, April 30, 1996	18:12	18:11	36,964	16,920	7,341	4,380	4,133	3,853	480	792	147	20,769	15,895	4,413	1,929	775
Tuesday, April 30, 1996	19:10	19:10	33,310	15,992	4,651	3,238	3,643	3,648	389	658	142	13,269	12,210	3,243	1,265	773
Tuesday, April 30, 1996	19:51	19:51	224	186	367	490	1,368	2,102	363	624	117	536	2,634	2,631	1,223	730
Tuesday, April 30, 1996	20:40	20:40	25,741	12,926	2,948	1,191	489	653	193	349	90	2,962	3,357	669	347	603
Tuesday, April 30, 1996	21:28	21:28	7,878	3,764	1,604	1,279	517	438	115	207	55	4,238	3,955	460	167	418
Tuesday, April 30, 1996	22:16	22:15	26,751	13,609	4,166	2,218	688	643	68	152	37	13,503	6,098	347	90	331
Tuesday, April 30, 1996	23:03	23:02	1,262	1,041	3,430	2,418	1,263	702	39	87	21	4,922	8,208	329	61	185
Tuesday, April 30, 1996	23:49	23:49	29,773	14,664	4,044	2,033	854	1,069	65	158	28	13,695	5,338	845	251	229
Wednesday, May 01, 1996	00:35	00:35	31,136	15,422	4,850	2,609	1,145	900	48	129	22	15,138	7,542	464	99	169
Wednesday, May 01, 1996	01:21	01:21	30,559	15,112	4,826	2,869	1,263	952	38	100	18	14,996	7,751	387	71	116
Wednesday, May 01, 1996	02:06	02:06	30,644	15,175	4,652	2,790	1,240	954	31	82	15	14,673	7,458	364	60	130
Wednesday, May 01, 1996	02:51	02:51	30,530	15,179	4,636	2,787	1,208	945	25	69	13	14,737	7,336	345	51	119
Wednesday, May 01, 1996	03:36	03:36	30,549	15,156	4,647	2,795	1,191	941	21	61	11	14,692	7,299	337	47	113
Wednesday, May 01, 1996	04:20	04:20	1,034	841	2,858	2,297	1,306	748	14	40	6	3,650	8,169	308	30	68
Wednesday, May 01, 1996	05:05	05:04	29,326	14,211	3,610	2,102	1,063	1,522	21	65	10	12,977	5,165	603	106	98
Wednesday, May 01, 1996	05:49	05:48	30,060	14,606	4,379	2,559	943	988	2	60	9	14,143	6,404	573	94	85
Wednesday, May 01, 1996	06:32	06:32	29,182	14,331	4,462	2,659	1,104	951	20	71	7	14,070	6,952	490	80	76
Wednesday, May 01, 1996	07:59	07:58	28,432	14,479	5,766	3,809	3,130	3,061	65	196	22	16,071	12,689	1,721	365	224
Wednesday, May 01, 1996	08:47	08:47	32,032	16,250	6,207	3,940	2,979	3,004	122	341	35	17,620	12,954	1,794	494	401
Wednesday, May 01, 1996	09:35	09:35	34,239	17,637	6,682	4,016	3,005	2,852	118	325	34	19,474	13,391	1,762	474	268
Wednesday, May 01, 1996	10:20	10:20	32,451	16,520	6,552	4,128	3,077	2,923	117	314	33	18,443	13,753	1,810	474	194
Wednesday, May 01, 1996	11:05	11:05	32,430	16,327	6,457	4,119	3,140	3,051	126	351	37	17,771	13,698	1,906	509	207

API Tanks Site 5

Combination of TCD and FID Results

Assume FID concentrations for C4+ are correct and normalize TCD concentrations to make up the difference

Date	TCD Sample Time	FID Sample Time	Total FID C4+ Concentration ppmV	Total TCD Conc. Available ppmV	Oxygen ppmv	Nitrogen ppmv	Methane ppmv	Ethane ppmv	Propane ppmv	I-Butane ppmv	n-Butane ppmv	I-Pentane ppmv	n-Pentane ppmv
Wednesday, May 01, 1996	11:50	11:50	214,339	785,661	31,709	118,713	227,020	231,103	177,117	61,640	51,373	31,995	16,592
Wednesday, May 01, 1996	12:36	12:35	225,882	774,118	28,144	106,281	229,661	232,182	177,851	64,487	54,349	33,940	17,486
Wednesday, May 01, 1996	13:22	13:22	224,139	775,861	27,559	104,141	231,343	235,750	177,069	64,523	54,003	32,217	16,398
Wednesday, May 01, 1996	14:09	14:09	236,370	763,630	25,460	96,700	224,501	234,849	182,120	67,123	56,960	35,448	18,079
Wednesday, May 01, 1996	14:57	14:57	220,300	779,700	33,744	126,243	209,179	228,590	181,944	60,912	51,036	31,808	16,768
Wednesday, May 01, 1996	15:45	15:45	239,059	760,941	27,159	102,341	215,009	232,621	183,812	65,187	55,349	35,832	18,908
Wednesday, May 01, 1996	16:33	16:32	49,360	950,640	210,463	740,177	0	0	0	1,742	3,060	5,632	3,661
Wednesday, May 01, 1996	17:20	17:19	233,829	766,171	32,613	14,309	245,685	268,236	205,327	69,788	59,309	36,848	18,705
Wednesday, May 01, 1996	18:06	18:06	34,032	965,968	215,263	750,706	0	0	0	811	1,116	1,939	1,865
Thursday, May 02, 1996	12:01	12:00	224,726	775,274	30,333	113,746	226,488	229,972	174,734	64,111	54,695	34,293	17,509
Thursday, May 02, 1996	12:46	12:46	233,576	766,424	28,796	108,112	228,202	231,359	169,956	65,852	56,561	35,121	18,045
Thursday, May 02, 1996	13:33	13:33	222,235	777,765	26,312	99,447	235,926	239,028	177,052	61,251	52,572	33,782	17,577
Thursday, May 02, 1996	14:21	14:21	216,517	783,483	33,936	127,251	216,927	231,360	174,010	59,714	50,618	32,026	16,780
Thursday, May 02, 1996	15:10	15:10	265,092	734,908	23,384	88,577	219,527	228,108	175,312	72,414	62,507	39,971	20,617
Thursday, May 02, 1996	16:00	15:59	251,186	748,814	32,120	120,130	204,701	221,314	170,549	69,301	58,526	36,640	19,617
Thursday, May 02, 1996	16:49	16:49	186,812	813,188	17,787	68,725	249,284	264,458	212,934	50,452	39,029	17,828	10,706
Thursday, May 02, 1996	17:39	17:39	230,395	769,605	24,687	93,798	219,563	239,102	192,455	61,255	53,508	36,829	19,410
Thursday, May 02, 1996	18:28	18:27	231,180	768,820	24,709	93,533	222,665	241,451	186,461	59,418	53,996	37,773	19,514
Thursday, May 02, 1996	20:39	20:39	10,017	989,983	221,095	768,888	0	0	0	0	0	441	379
Thursday, May 02, 1996	21:25	21:25	225,386	774,614	29,538	110,419	211,432	239,732	183,494	64,220	48,115	55,237	21,647
Thursday, May 02, 1996	22:09	22:09	221,918	778,082	18,676	69,847	228,904	260,301	200,355	61,974	46,600	51,898	19,933
Thursday, May 02, 1996	22:54	22:54	229,783	770,217	17,799	66,569	228,622	261,636	195,590	61,134	46,362	53,258	21,596
Thursday, May 02, 1996	23:38	23:38	220,488	779,512	31,774	118,900	210,886	238,153	179,800	57,227	44,007	50,673	20,985
Friday, May 03, 1996	00:22	00:22	216,751	783,249	22,476	85,176	228,040	259,457	188,100	57,136	43,459	50,323	20,549
Friday, May 03, 1996	01:06	01:06	213,707	786,293	19,047	72,594	232,300	267,083	195,269	53,940	36,630	53,237	22,504
Friday, May 03, 1996	01:50	01:50	223,695	776,305	24,568	92,305	221,842	253,452	184,138	57,756	42,820	53,301	22,329
Friday, May 03, 1996	02:34	02:34	234,439	765,561	26,652	100,011	217,438	245,138	176,321	59,181	44,445	53,556	22,196
Friday, May 03, 1996	03:17	03:17	199,652	800,348	18,513	70,550	239,399	275,780	196,107	53,922	38,803	49,586	20,869
Friday, May 03, 1996	04:01	04:01	18,138	981,862	219,253	762,609	0	0	0	0	0	0	0
Friday, May 03, 1996	04:44	04:44	180,767	819,233	33,018	122,902	223,193	256,383	183,737	50,635	36,922	44,216	6,784
Friday, May 03, 1996	05:28	05:27	189,104	810,896	37,603	140,634	212,595	240,753	179,312	50,562	36,100	45,602	19,006
Friday, May 03, 1996	06:11	06:11	190,959	809,041	27,496	102,953	225,472	264,169	188,951	47,951	36,210	46,198	19,234
Friday, May 03, 1996	06:54	06:54	190,346	809,654	26,938	101,229	225,164	264,983	191,340	50,945	38,693	44,695	18,198
Friday, May 03, 1996	07:38	07:37	186,470	813,530	29,680	110,647	229,447	255,068	188,686	47,513	36,794	44,030	18,246
Friday, May 03, 1996	08:21	08:21	187,914	812,086	29,990	112,061	234,892	248,568	186,574	46,618	36,045	43,768	17,970
Average			185,905		58,706	210,176	185,762	204,313	155,138	51,861	42,609	32,570	15,200
Std. Dev.			68,546		65,456	227,525	79,863	87,369	64,158	21,580	17,877	14,645	6,207
RSD			36.9%		111.5%	108.3%	43.0%	42.8%	41.4%	41.6%	42.0%	45.0%	40.8%
Day 1 average			160,703		81,837	293,711	153,342	175,180	135,227	48,127	40,877	25,027	12,470
Std Deviation			75,914		73,660	254,445	89,533	101,420	73,135	25,610	20,822	11,956	5,901
RSD			47.2%		90.0%	86.6%	58.4%	57.9%	54.1%	53.2%	50.9%	47.8%	47.3%
Day 2 average			208,745		46,099	163,064	204,800	213,273	164,019	57,959	49,067	30,633	15,974
Std Deviation			57,651		55,574	195,100	68,890	71,745	55,535	19,354	16,243	9,865	4,807
RSD			27.6%		120.6%	119.6%	33.6%	33.6%	33.9%	33.4%	33.1%	32.2%	30.1%
Day 3 average			187,262		47,712	172,324	199,572	226,228	166,902	48,896	37,000	43,211	17,330
Std Deviation			65,466		62,979	216,820	73,019	82,977	61,047	18,532	14,387	16,310	7,143
RSD			35.0%		132.0%	125.8%	36.6%	36.7%	36.6%	37.9%	38.9%	37.7%	41.2%

Assume FID concentrations for C4+ are correct and
normalize TCD concentrations to make up the difference

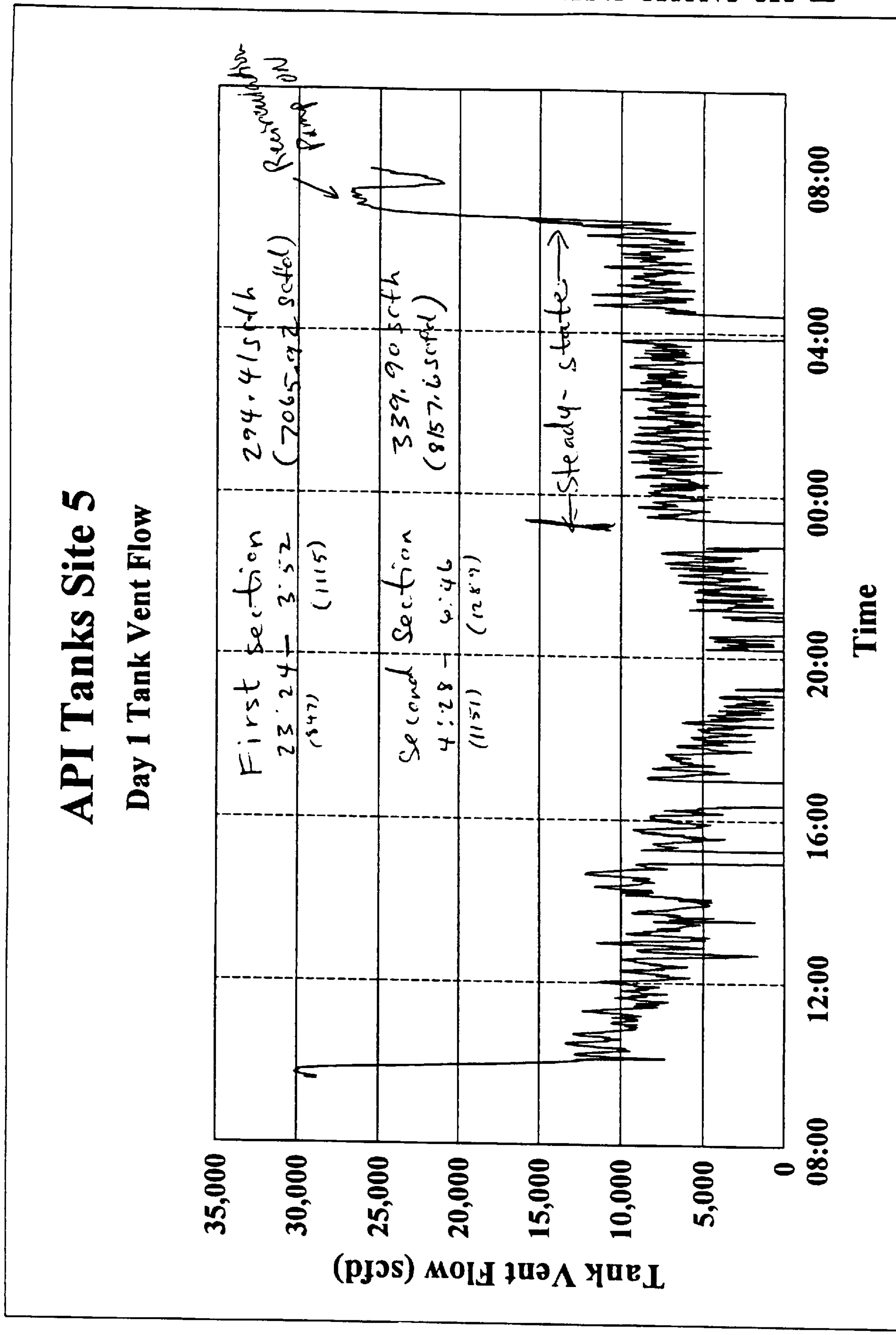
Date	TCD Sample Time	FID Sample Time	n-Hexane	Benzene	n-Heptane	Toluene	Ethyl-Benzene	m,p-Xylenes	o-Xylene	C6 Range	C7 Range	C8 Range	C9 Range	C10+
			ppmv	ppmv	ppmv	ppmv	ppmv	ppmv	ppmv	ppmv	ppmv	ppmv	ppmv	ppmv
Wednesday, May 01, 1996	11:50	11:50	6,573	4,119	3,164	3,165	150	398	44	18,616	13,734	2,008	555	214
Wednesday, May 01, 1996	12:36	12:35	6,808	4,263	3,426	3,515	171	448	49	19,451	14,326	2,310	639	212
Wednesday, May 01, 1996	13:22	13:22	7,095	4,384	3,541	3,653	179	484	54	19,422	14,902	2,385	661	239
Wednesday, May 01, 1996	14:09	14:09	7,135	4,444	3,710	3,855	199	543	60	19,960	15,323	2,558	723	250
Wednesday, May 01, 1996	14:57	14:57	7,417	4,522	3,635	3,712	214	561	64	20,557	15,581	2,506	759	247
Wednesday, May 01, 1996	15:45	15:45	7,715	4,853	3,933	4,206	230	631	70	21,833	16,442	2,774	804	292
Wednesday, May 01, 1996	16:33	16:32	3,112	2,643	3,710	3,377	171	417	47	6,402	11,990	2,534	708	153
Wednesday, May 01, 1996	17:20	17:19	6,613	3,675	1,546	1,957	390	890	119	19,703	10,824	2,051	963	449
Wednesday, May 01, 1996	18:06	18:06	3,586	2,597	2,107	1,872	136	321	52	6,341	9,527	1,200	310	252
Thursday, May 02, 1996	12:01	12:00	6,638	4,101	3,373	3,384	177	460	56	19,028	13,889	2,193	619	199
Thursday, May 02, 1996	12:46	12:46	7,031	4,486	3,637	3,592	174	473	57	20,040	15,430	2,228	606	243
Thursday, May 02, 1996	13:33	13:33	7,168	4,391	3,335	3,403	192	513	60	20,109	14,736	2,251	659	237
Thursday, May 02, 1996	14:21	14:21	7,115	4,453	3,565	3,534	184	488	62	19,478	15,331	2,263	623	285
Thursday, May 02, 1996	15:10	15:10	8,591	5,392	4,458	4,314	211	553	69	23,544	18,793	2,624	702	333
Thursday, May 02, 1996	16:00	15:59	8,563	5,195	3,837	3,814	229	582	74	24,030	17,327	2,416	704	331
Thursday, May 02, 1996	16:49	16:49	8,835	5,233	4,176	3,797	214	528	70	23,466	18,785	2,571	733	388
Thursday, May 02, 1996	17:39	17:39	7,461	4,430	3,485	3,580	224	589	82	21,054	14,801	2,328	716	643
Thursday, May 02, 1996	18:28	18:27	7,849	4,751	3,443	3,650	175	484	60	21,639	15,281	2,223	591	335
Thursday, May 02, 1996	20:39	20:39	1,109	916	689	353	64	209	112	1,278	4,138	329	0	0
Thursday, May 02, 1996	21:25	21:25	4,321	1,794	2,569	900	0	79	73	16,617	9,407	407	0	0
Thursday, May 02, 1996	22:09	22:09	5,243	2,588	3,008	1,210	0	55	0	16,033	12,639	737	0	0
Thursday, May 02, 1996	22:54	22:54	7,001	2,780	2,724	1,272	0	60	0	20,264	12,335	995	0	0
Thursday, May 02, 1996	23:38	23:38	7,197	2,850	2,748	1,260	0	53	0	21,136	11,454	897	0	0
Friday, May 03, 1996	00:22	00:22	6,794	2,730	2,574	1,209	0	0	0	19,618	11,776	583	0	0
Friday, May 03, 1996	01:06	01:06	6,696	2,771	2,730	1,261	0	26	0	20,942	12,345	625	0	0
Friday, May 03, 1996	01:50	01:50	7,323	2,729	2,479	1,187	0	0	0	21,534	11,951	287	0	0
Friday, May 03, 1996	02:34	02:34	8,114	3,109	2,313	1,472	0	0	0	22,642	16,259	1,151	0	0
Friday, May 03, 1996	03:17	03:17	6,169	2,534	2,874	1,171	0	0	0	16,040	7,306	379	0	0
Friday, May 03, 1996	04:01	04:01	0	1,585	2,364	173	0	0	0	2,692	11,150	173	0	0
Friday, May 03, 1996	04:44	04:44	5,334	1,679	467	789	0	103	0	28,039	4,463	1,337	0	0
Friday, May 03, 1996	05:28	05:27	6,415	2,535	2,018	756	0	0	0	18,520	7,376	214	0	0
Friday, May 03, 1996	06:11	06:11	6,434	2,427	2,206	931	0	0	0	19,167	10,201	0	0	0
Friday, May 03, 1996	06:54	06:54	5,803	2,305	2,196	994	0	0	0	17,033	9,317	165	0	0
Friday, May 03, 1996	07:38	07:37	6,304	2,448	2,193	1,033	0	0	0	17,943	9,800	167	0	0
Friday, May 03, 1996	08:21	08:21	6,297	2,587	2,865	1,346	0	63	0	17,623	11,779	952	0	0
Average			5,660	3,147	2,611	2,115	116	277	41	16,261	11,285	1,518	421	213
Std. Dev.			2,010	1,155	1,378	1,326	123	246	40	6,256	4,328	1,366	529	209
RSD			35.5%	36.7%	52.8%	62.7%	105.5%	88.5%	95.6%	38.5%	38.3%	90.0%	125.8%	97.9%
Day 1 average			4,309	2,559	2,037	1,662	134	251	48	12,214	8,565	1,572	539	310
Std Deviation			1,701	948	1,956	1,321	157	246	48	5,871	4,739	2,006	778	251
RSD			39.5%	37.1%	96.0%	79.5%	116.9%	97.8%	99.8%	48.1%	55.3%	127.6%	144.4%	80.8%
Day 2 average			6,826	4,257	3,373	3,360	187	486	59	18,873	14,549	2,213	640	288
Std Deviation			1,363	695	641	613	59	133	20	4,515	2,265	371	140	110
RSD			20.0%	16.3%	19.0%	18.3%	31.7%	27.5%	33.4%	23.9%	15.6%	16.8%	21.9%	38.4%
Day 3 average			5,800	2,507	2,359	1,165	13	63	14	17,709	10,499	646	33	19
Std Deviation			2,126	782	736	705	43	118	33	6,413	3,200	551	139	79
RSD			36.7%	31.2%	31.2%	60.5%	324.1%	187.9%	239.9%	36.2%	30.5%	85.3%	424.3%	424.3%

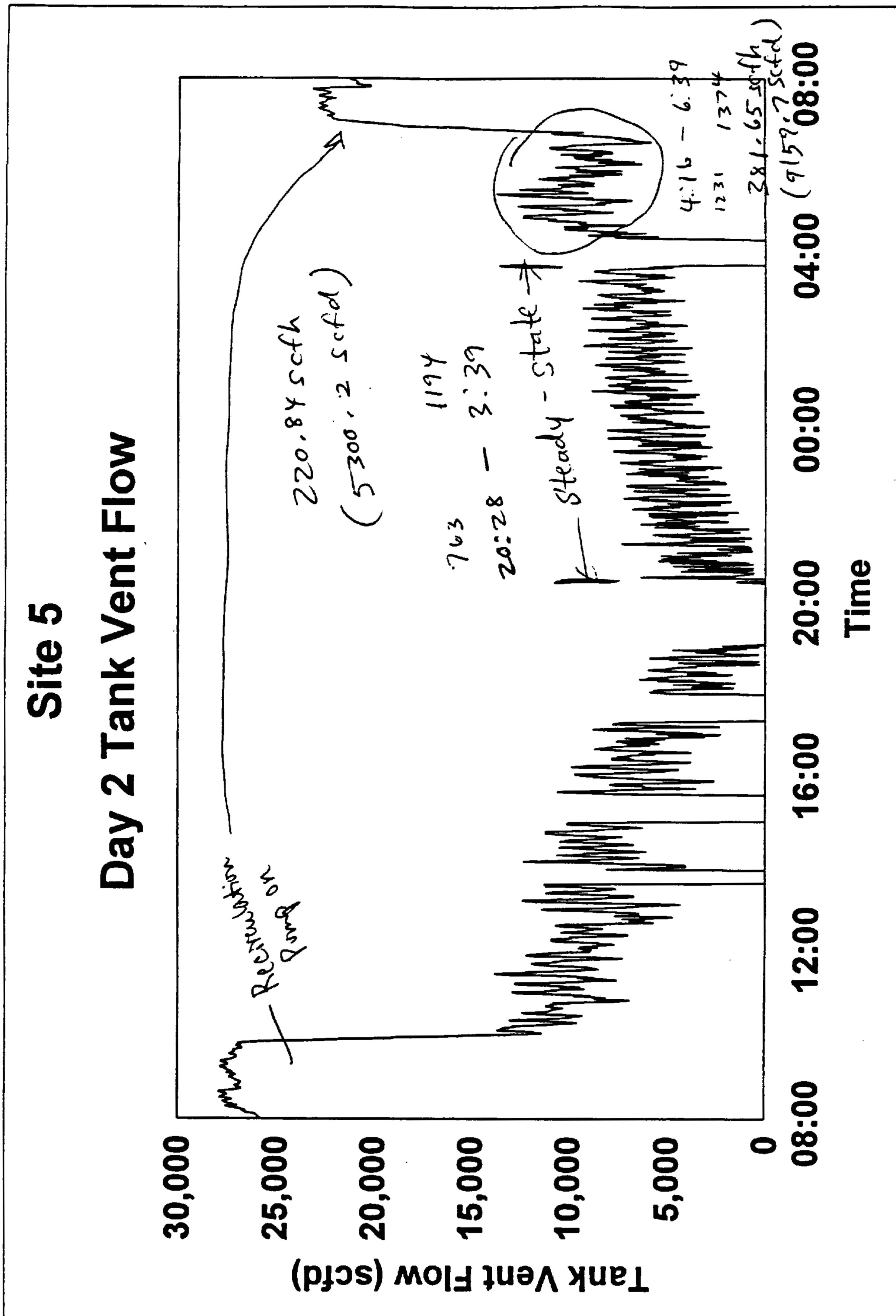
API Tan... Site 5

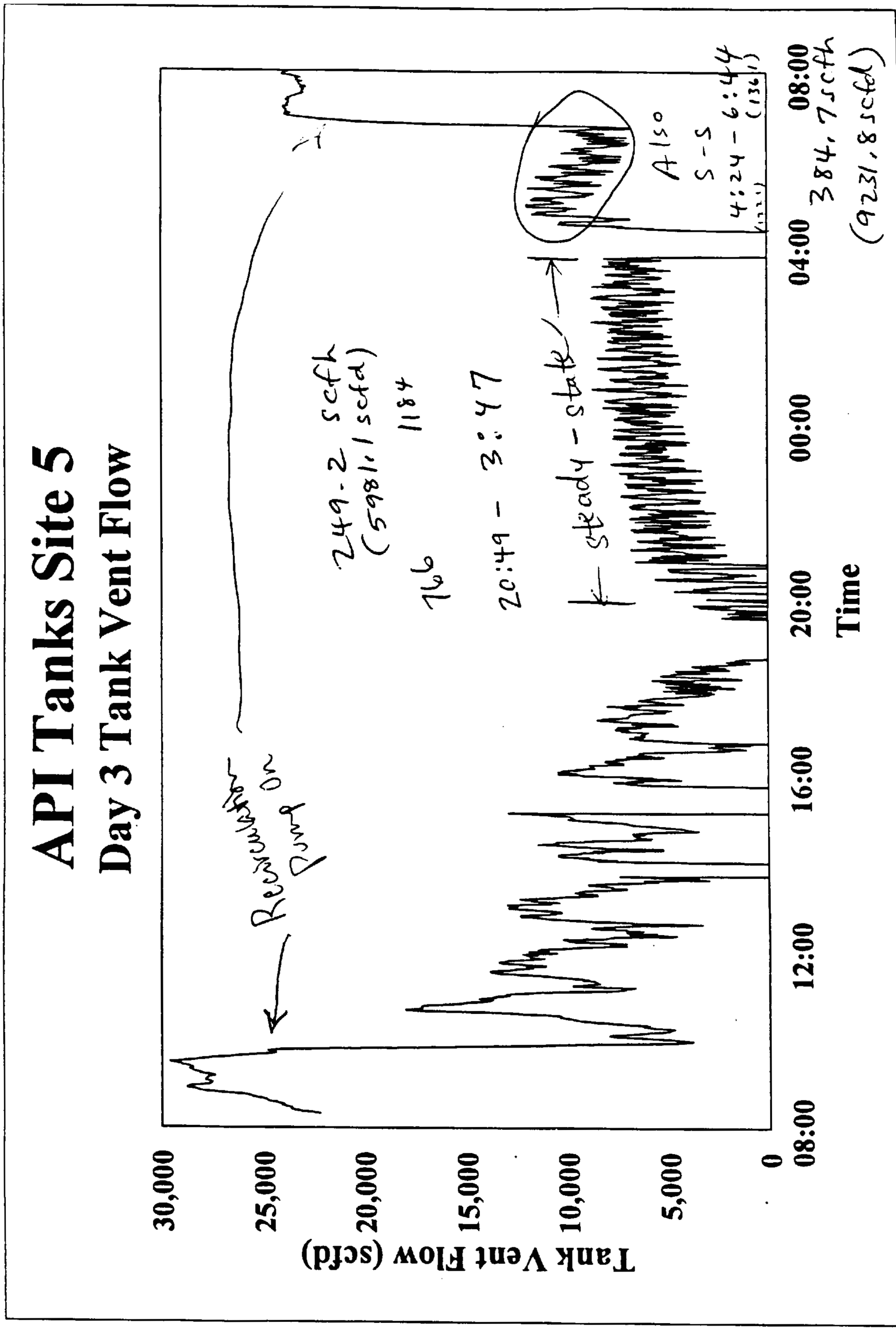
TANK VENT CANISTER SAMPLES

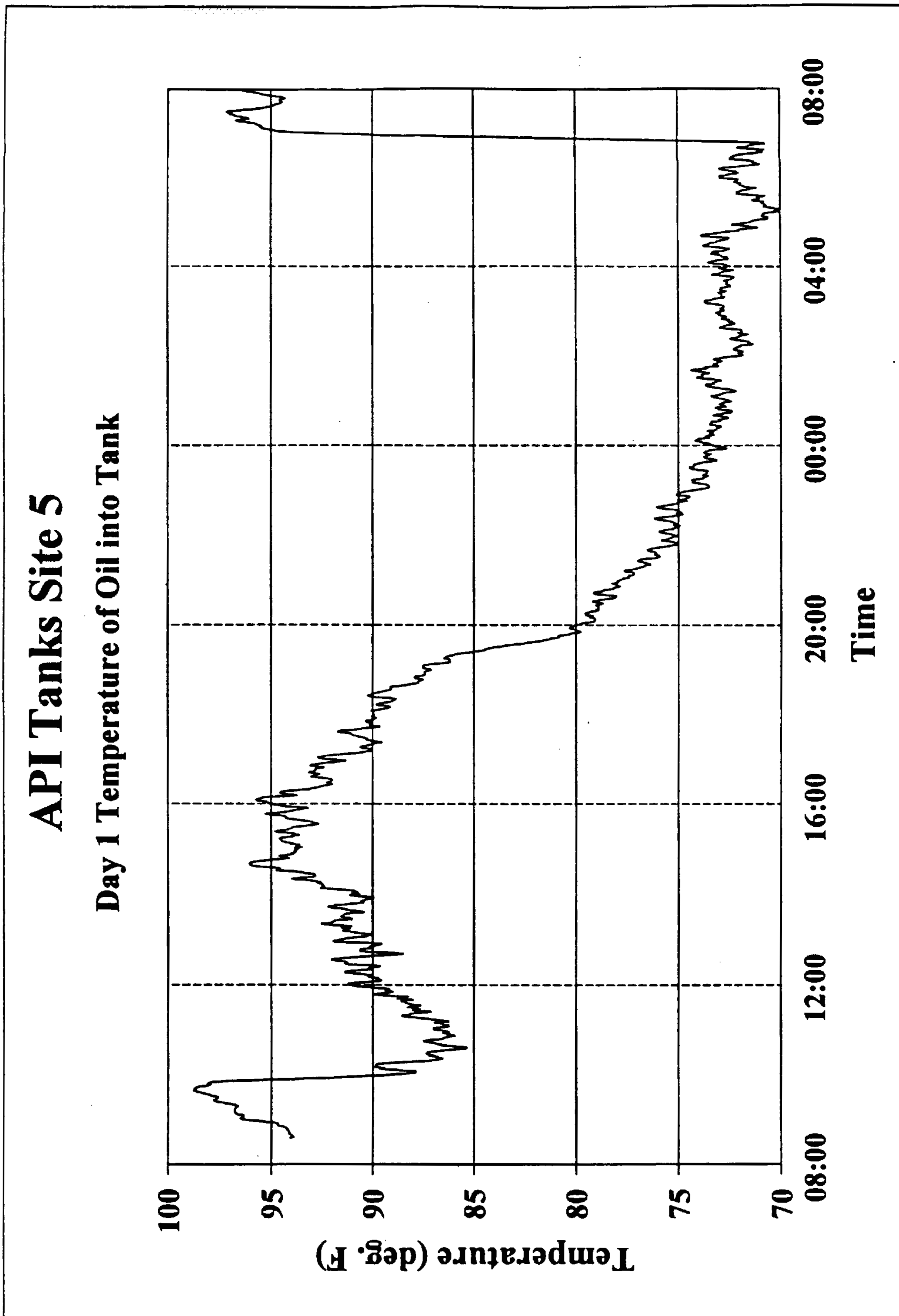
Normalized

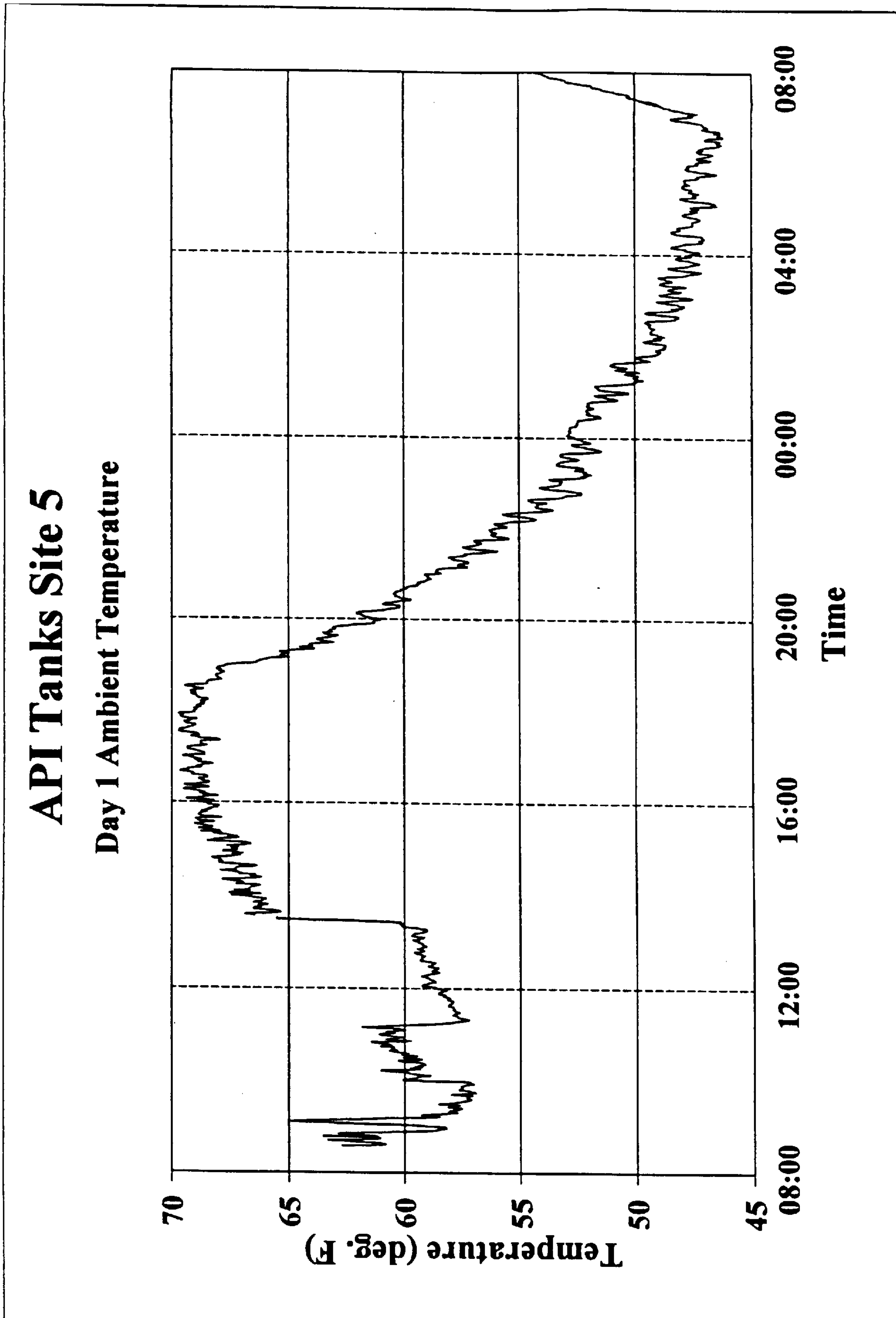
Field ID	API3-VGCA01 Analysis 1	API3-VGCA01 Analysis 2	API3-VGCA01 Average	API3-VGCA02	API3-VGCA03	API3-VGCA04 Analysis 1	API3-VGCA04 Analysis 2	API3-VGCA04 Average	API3-VGCA05	API3-VGCA06	Average	RSD
Start Date			04/30/96	04/30/96	05/01/96			05/01/96	05/02/96	05/02/96		
End Date			04/30/96	05/01/96	05/01/96			05/02/96	05/02/96	05/03/96		
Start Time			08:38	20:05	08:21			21:04	08:33	20:02		
End Time			19:54	08:04	20:49			08:16	19:45	08:44		
ppmv												
ETHANE	201,351	192,204	196,778	185,493	170,151	193,435	195,091	194,263	186,595	201,111	189,065	5.83%
PROPANE	153,572	148,977	151,274	140,482	132,387	148,242	147,414	147,828	148,471	151,673	145,352	5.17%
ISOBUTANE	65,478	62,894	64,186	58,318	58,404	63,728	63,076	63,402	65,925	66,329	62,781	5.70%
N-BUTANE	51,248	49,210	50,229	45,163	45,976	49,432	48,913	49,172	52,363	51,666	49,095	6.03%
ISOPENTANE	31,200	29,998	30,599	26,766	28,632	29,675	29,386	29,531	33,155	31,299	29,997	7.39%
N-PENTANE	14,767	14,198	14,483	12,456	13,686	13,936	13,786	13,861	15,987	14,769	14,207	8.33%
N-HEXANE	4,787	4,615	4,701	3,646	5,018	4,291	4,246	4,268	5,932	4,680	4,707	16.22%
BENZENE	3,919	3,777	3,848	2,892	4,252	3,422	3,393	3,407	4,995	3,738	3,855	18.70%
TOLUENE	2,676	2,610	2,643	1,414	4,388	1,900	1,909	1,904	4,553	2,183	2,847	46.35%
ETHYLBENZENE	65	81	83	22	153	37	37	37	151	44	82	70.95%
M/P-XYLENE	462	451	457	112	899	199	201	200	870	247	464	74.36%
O-XYLENE	77	75	76	15	130	31	30	31	142	38	72	74.86%
OTHER C2	9,712	16,937	13,324	11,610	17,150	15,035	17,528	16,282	22,104	12,470	15,490	25.17%
OTHER C3	0	0	0	0	0	0	0	0	0	0	0	ERR
OTHER C4	1,899	1,820	1,860	1,724	1,732	1,759	1,858	1,808	1,910	1,928	1,827	4.79%
OTHER C5	17,100	16,423	16,762	13,626	16,880	15,659	15,530	15,595	19,842	16,892	16,600	12.21%
OTHER C6	13,649	13,080	13,365	9,635	16,196	11,633	11,547	11,590	18,605	12,831	13,703	23.56%
C7	8,758	8,527	8,643	4,706	14,329	6,331	6,324	6,328	14,916	7,162	9,347	45.83%
C8	2,102	2,070	2,086	505	4,022	892	924	908	3,858	1,095	2,079	73.76%
C9	468	474	471	23	1,014	85	83	84	1,006	144	457	99.68%
C10+	61	67	64	0	1,331	11	6	8	210	14	271	193.61%
OXYGEN	36,134	34,287	35,210	65,668	50,234	49,792	49,421	49,607	35,905	48,960	47,597	23.57%
NITROGEN	135,708	131,282	133,495	232,380	203,016	182,289	181,506	181,888	142,988	166,796	176,760	21.05%
METHANE	195,888	218,242	207,065	141,018	170,151	161,958	161,962	161,960	174,772	153,796	168,127	13.41%
CARBON DIOXIDE	48,898	47,701	48,300	42,323	39,868	46,249	45,828	46,038	44,747	50,136	45,235	8.36%

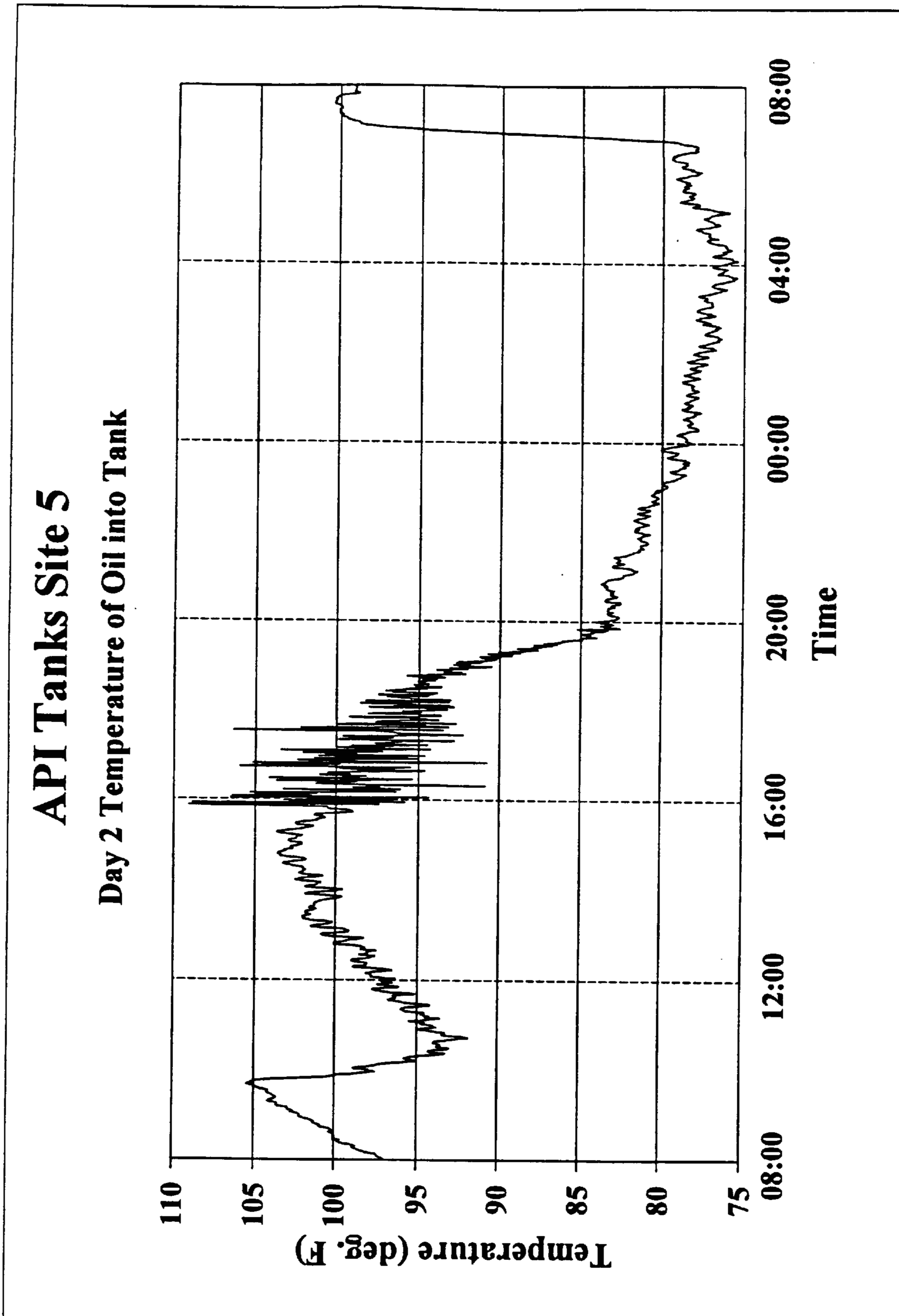

API Tanks Site 5
Day 1 Tank Vent Flow
Tank Vent Flow (scfd)
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
08:00
12:00
16:00
20:00
00:00
04:00
08:00
Time
First Section
23:24 - 3:52
(347)
(1115)
Second Section
4:28 - 6:46
(1151)
(1289)
294.41 scfh
(7065.92 scfd)
339.90 scfh
(8157.6 scfd)
Steady-state
Recirculation Pump ON


Site 5
Day 2 Tank Vent Flow
Tank Vent Flow (scfd)
30,000
25,000
20,000
15,000
10,000
5,000
0
08:00
12:00
16:00
20:00
00:00
04:00
08:00
Time

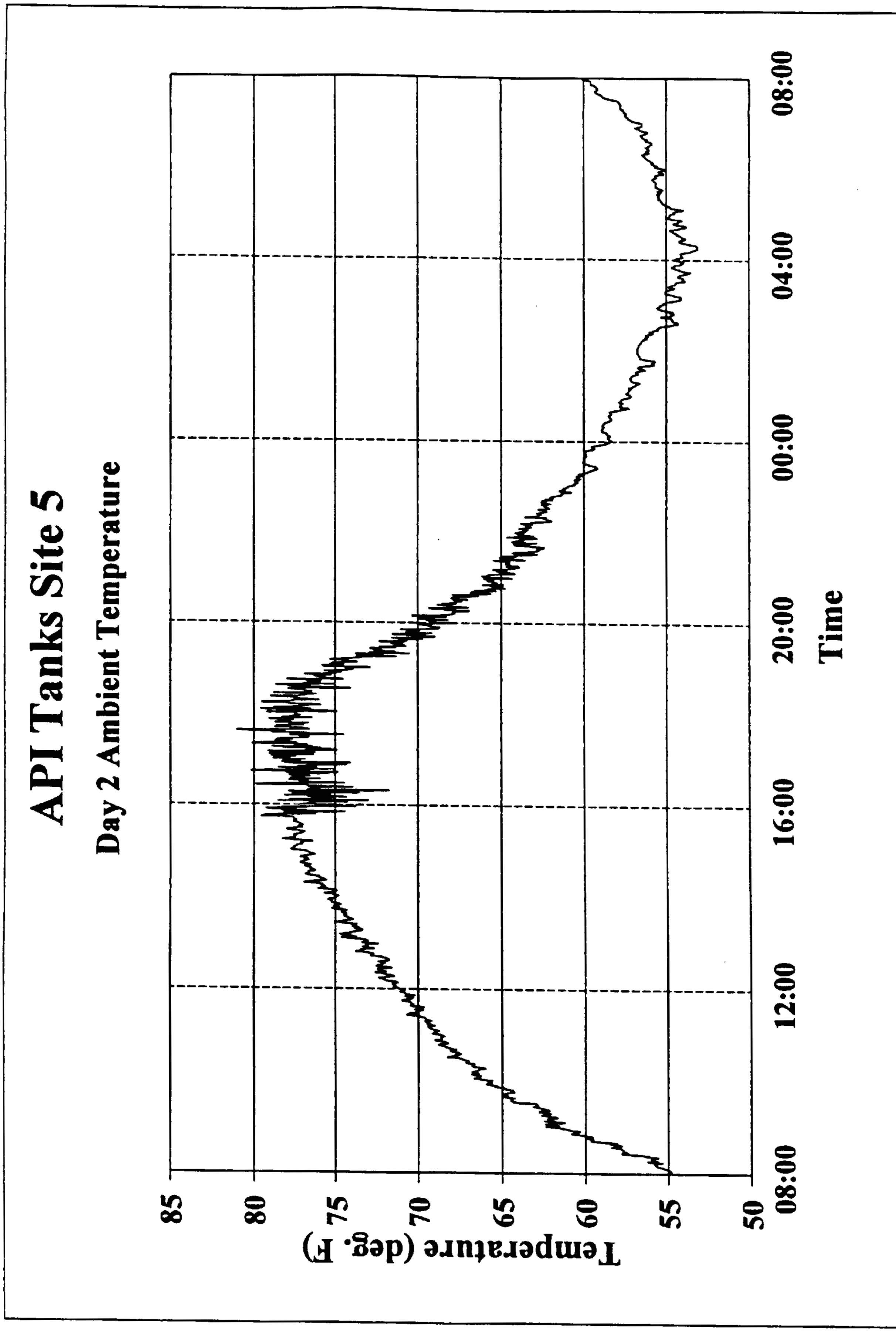

API Tanks Site 5
Day 3 Tank Vent Flow
Tank Vent Flow (scfd)
30,000
25,000
20,000
15,000
10,000
5,000
0
08:00
12:00
16:00
20:00
00:00
04:00
08:00
Time
Recirculation Pump On
249.2 scfh
(5981.1 scfd)
1184
766
20:49 - 3:47
steady - state
Also
S-S
4:24 - 6:44
384.7 scfh
(9231.8 scfd)

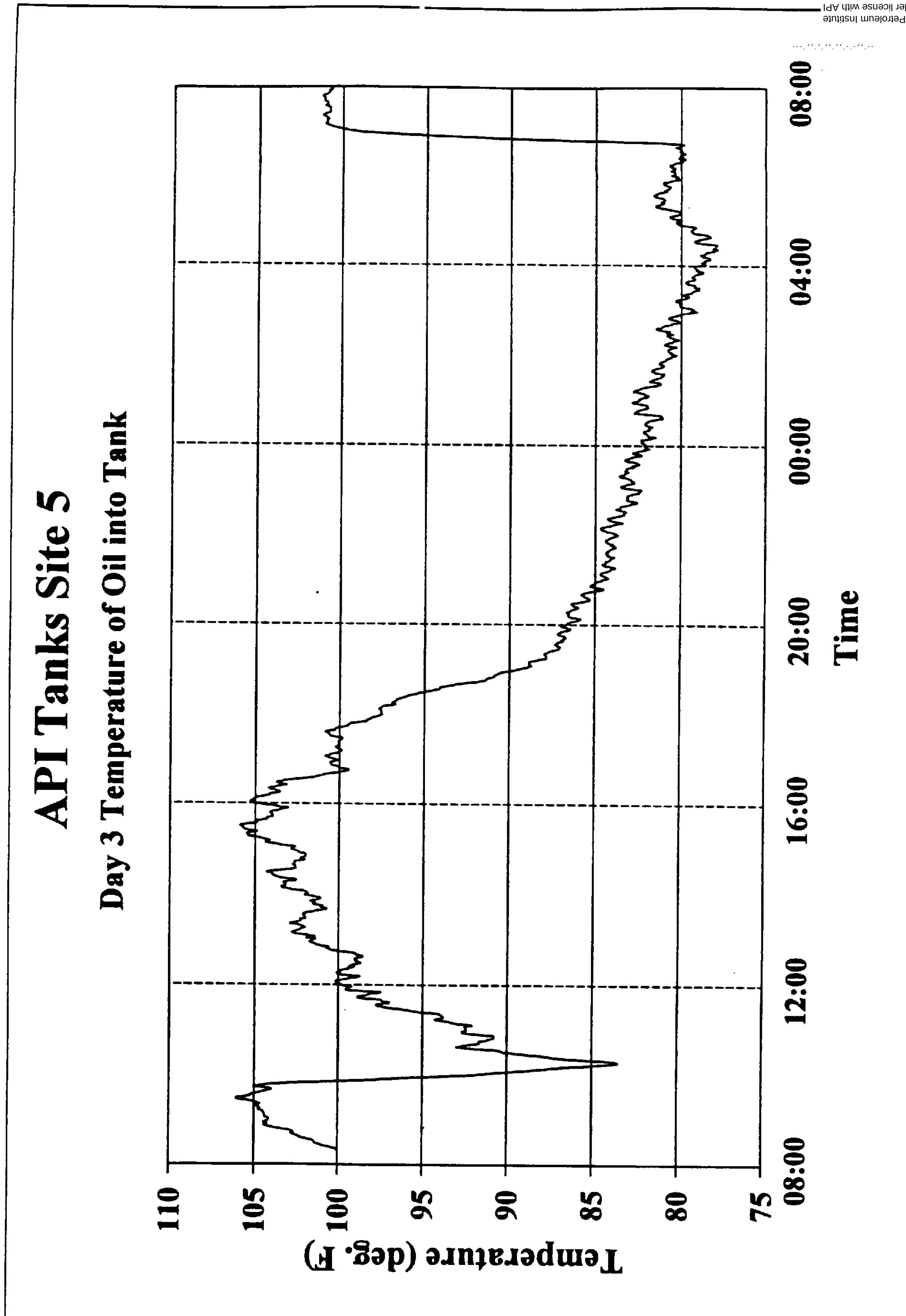

API Tanks Site 5
Day 1 Temperature of Oil into Tank
Temperature (deg. F)
100
95
90
85
80
75
70
08:00
12:00
16:00
20:00
00:00
04:00
08:00
Time


API Tanks Site 5
Day 1 Ambient Temperature
Temperature (deg. F)
70
65
60
55
50
45
08:00
12:00
16:00
20:00
00:00
04:00
08:00
Time



API Tanks Site 5
Day 2 Temperature of Oil into Tank
Temperature (deg. F)
110
105
100
95
90
85
80
75
Time
08:00
12:00
16:00
20:00
00:00
04:00
08:00


API Tanks Site 5
Day 2 Ambient Temperature
Temperature (deg. F)
85
80
75
70
65
60
55
50
08:00
12:00
16:00
20:00
00:00
04:00
08:00
Time



STD.API/PETRO PUBL 4662-ENGL 1997 ■ 0732290 0608880 260 ■

Site 6a and 6b

API SITES 6A AND 6B

PROCESS DATA

Site 6A	Date	Separator Temps (F)	Separator Press (psig)	Oil Production Rate (bopd)	Gas Production Rate (mcfd)
	Sept. 19, 1996	84	580	12	933
	Sept. 19, 1996	79	560		867
	Sept. 19, 1996	90	560		
	Sept. 19, 1996	86	560		
	Sept. 20, 1996	94	560	12	872
	Sept. 20, 1996	86	580		851
	Sept. 21, 1996	86	580	12	877
	Averages	86.4	568.6	12	880.0
	Std. Dev.	4.7	10.7		31.2
	RSD (%)	5.42%	1.88%		3.54%

Site 6B	Date	Separator Temps (F)	Separator Press (psig)	Oil Production Rate (bopd)	Gas Production Rate (bopd)
	Sept. 21, 1996	72	500	60	2803
	Sept. 22, 1996	71	490	60	
	Sept. 22, 1996	71	490		
	Sept. 22, 1996	72	500		
	Sept. 22, 1996	92*	500		
	Sept. 23, 1996	72	480	NM	
		71.6	493.3		2803
		0.5	8.2		
		0.76%	1.66%		

* Questionable, not used in averages

API Tanks Site 6

Separator Oil Composition (mole%)

API6-	MFTO01	MFTO02	MFTO03	MFTO04	MFTO05	MFTO06	6A		MCLTO0	MCLTO0	MCLTO03	6B
Date	09/18/96	09/19/96	09/19/96	09/20/96	09/20/96	09/21/96	Average	STD	09/22/96	09/22/96	09/23/96	Average
Time	17:27	07:40	16:54	07:34	18:18	14:54			09:01	17:14	07:52	
Pressure (psig)	580	560	560	560	580	580	570	10	490	560	480	510.0
Nitrogen	0.09	0.11	0.10	0.10	0.10	0.08	0.10	0.01	0.08	0.10	0.09	0.09
Carbon Dioxide	0.18	0.17	0.18	0.15	0.18	0.18	0.17	0.01	0.16	0.15	0.15	0.15
Methane	12.08	11.82	11.90	9.55	11.95	11.90	11.53	0.89	11.54	11.40	11.11	11.35
Ethane	8.98	8.78	8.99	8.28	8.95	9.02	8.83	0.26	9.08	9.10	8.71	8.96
Propane	10.53	10.39	10.44	10.18	10.48	10.35	10.40	0.11	10.71	10.99	11.18	10.96
i-Butane	3.69	3.86	3.64	3.55	3.69	3.63	3.68	0.09	4.28	4.18	4.11	4.19
n-Butane	6.20	6.29	6.11	6.33	6.25	6.25	6.24	0.07	7.08	7.03	6.98	7.03
i-Pentane	4.32	4.42	4.26	4.39	4.32	4.46	4.36	0.07	5.05	5.07	4.80	4.97
n-Pentane	3.16	3.17	3.12	3.28	3.22	3.31	3.21	0.07	3.71	3.74	3.77	3.74
n-Hexane	2.48	2.50	2.41	2.59	2.49	2.50	2.50	0.05	2.38	2.30	2.41	2.36
Other Hexanes	3.70	3.75	3.66	3.86	3.75	3.82	3.76	0.07	3.87	3.83	3.86	3.85
Heptanes	9.00	8.85	9.06	9.31	9.11	8.91	9.04	0.15	8.88	8.84	9.24	8.99
Octanes	9.19	8.89	9.20	9.33	9.23	9.35	9.20	0.15	8.73	8.59	8.75	8.69
Nonanes	4.64	4.64	4.52	4.66	4.55	4.60	4.60	0.05	4.88	4.62	4.64	4.71
Decanes+	14.30	14.76	14.86	16.61	14.09	13.87	14.75	0.90	12.02	12.60	12.60	12.41
Benzene	0.71	0.71	0.68	0.68	0.69	0.66	0.69	0.02	0.71	0.68	0.76	0.72
Toluene	2.02	2.01	2.04	2.14	2.06	2.16	2.07	0.06	2.14	2.12	2.11	2.12
Ethylbenzene	0.45	0.48	0.46	0.47	0.45	0.47	0.46	0.01	0.44	0.48	0.45	0.46
Xylenes	4.28	4.40	4.37	4.54	4.44	4.48	4.42	0.08	4.26	4.18	4.28	4.24
Decanes+ SG	0.895	0.895	0.895	0.895	0.895	0.895			0.885	0.885	0.885	0.893
Decanes+ MW	145	145	145	145	145	145			144	144	144	144.8

API TANKS SITE 6A

SALES OIL COMPOSITION (Weight Percent)

Sample No.	MNDR-01	MNDR-02	MNDR-03	MNDR-04	MNDR-05	Average	RSD
Date	9/18/96	9/19/96	9/19/96	9/20/96	9/21/96		(%)
Compound							
Nitrogen	0	0	0	0	0	0.00	0.0
Methane	0	0	0	0	0	0.00	ERR
Ethane	0.08	0.09	0.06	0.1	0.05	0.08	27.3
Propane	0.79	0.84	0.72	0.88	0.71	0.79	9.4
Isobutane	0.85	0.86	0.81	0.89	0.83	0.85	3.6
n-Butane	2.02	2	1.95	2.1	2	2.01	2.7
Isopentane	2.79	2.79	2.72	2.81	2.8	2.78	1.3
n-Pentane	2.51	2.53	2.46	2.51	2.51	2.50	1.0
n-Hexane	2.79	2.79	2.7	2.72	2.71	2.74	1.6
Hexanes	4.29	4.3	4.17	4.2	4.22	4.24	1.3
Benzene	1.05	1.03	1.02	1.03	1.01	1.03	1.4
Heptanes	16.15	16.14	15.41	15.46	15.43	15.72	2.5
Toluene	0.16	0.16	0.15	0.15	0.15	0.15	3.6
Octanes	27.29	26.99	25.46	25.51	25.35	26.12	3.6
Ethylbenzene	0.76	0.73	0.7	0.71	0.68	0.72	4.3
Xylenes	7.34	7.27	6.69	6.7	6.64	6.93	5.0
Nonanes	7.59	7.22	6.86	6.86	6.82	7.07	4.7
Decanes Plus	23.54	24.26	28.12	27.37	28.09	26.28	8.4
Decanes Plus MW	146	155	156	155	157	153.80	2.9
API Gravity	55.5	55.5	55.4	55.6	55.5	55.50	0.1
Reid Vapor Pressure	10.99	11.3	10.85	11.42	11.1	11.13	2.1

API TANKS SITE 6A

SALES OIL COMPOSITION (Mole Percent)

Sample No. Date	MNDR-01 9/18/96	MNDR-02 9/19/96	MNDR-03 9/19/96	MNDR-04 9/20/96	MNDR-05 9/21/96	Average	RSD (%)
Compound							
Nitrogen	0	0	0	0	0	0.00	0.0
Methane	0.01	0.02	0.01	0.2	0.01	0.05	167.9
Ethane	0.28	0.33	0.22	0.36	0.18	0.27	27.3
Propane	1.88	2.01	1.76	2.13	1.74	1.90	8.7
Isobutane	1.52	1.56	1.5	1.64	1.55	1.55	3.5
n-Butane	3.63	3.64	3.62	3.86	3.71	3.69	2.7
Isopentane	4.05	4.09	4.07	4.16	4.18	4.11	1.4
n-Pentane	3.65	3.71	3.68	3.72	3.75	3.70	1.0
n-Hexane	3.39	3.43	3.39	3.37	3.4	3.40	0.6
Hexanes	5.35	5.41	5.35	5.35	5.41	5.37	0.6
Benzene	1.42	1.4	1.41	1.41	1.4	1.41	0.6
Heptanes	17.45	17.61	17.12	17.02	17.15	17.27	1.4
Toluene	0.18	0.18	0.17	0.17	0.17	0.17	3.1
Octanes	25.77	25.73	24.73	24.54	24.62	25.08	2.5
Ethylbenzene	0.75	0.73	0.71	0.71	0.69	0.72	3.2
Xylenes	7.25	7.26	6.8	6.75	6.75	6.96	3.9
Nonanes	6.46	6.21	6.01	5.96	5.91	6.11	3.7
Decanes Plus	16.96	16.68	19.45	18.83	19.32	18.25	7.3
Decanes Plus MW	146	154	156	155	157	153.60	2.9
API Gravity	55.5	55.5	55.4	55.6	55.5	55.50	0.1
Reid Vapor Pressure	10.99	11.3	10.85	11.42	11.1	11.13	2.1

API TANKS SITE 6B

SALES OIL COMPOSITION (Weight Percent)

Sample No.	MCL-01	MCL-02	MCL-03	Average	RSD
Date	9/21/96	9/22/96	9/23/96		(%)
Compound					
Nitrogen	0	0	0	0.00	ERR
Methane	0	0	0	0.00	ERR
Ethane	0.05	0	0.09	0.05	96.6
Propane	1.16	0.08	1.49	0.91	81.0
Isobutane	1.44	0.55	1.64	1.21	48.0
n-Butane	3.34	1.8	3.7	2.95	34.2
Isopentane	3.88	3.29	4.06	3.74	10.8
n-Pentane	3.3	2.98	3.43	3.24	7.2
n-Hexane	2.88	2.94	2.89	2.90	1.1
Hexanes	4.71	4.72	4.75	4.73	0.4
Benzene	0.96	0.99	0.98	0.98	1.6
Heptanes	20.02	15.84	15.15	17.00	15.5
Toluene	0.14	0.14	0.13	0.14	4.2
Octanes	23.61	24.47	22.97	23.68	3.2
Ethylbenzene	0.62	0.66	0.6	0.63	4.9
Xylenes	6.14	6.28	5.83	6.08	3.8
Nonanes	6.46	6.55	6.11	6.37	3.6
Decanes Plus	21.29	28.71	26.18	25.39	14.9
Decanes Plus MW	172	150	161	161.00	6.8
API Gravity	58.2	58.2	58.7	58.37	0.5
Reid Vapor Pressure	14.98	14.73	15.82	15.18	3.8

API TANKS SITE 6B

SALES OIL COMPOSITION (Mole Percent)

Sample No.	MCL-01	MCL-02	MCL-03	Average	RSD
Date	9/21/96	9/22/96	9/23/96		(%)
Compound					
Nitrogen	0	0	0	ERR	ERR
Methane	0.01	0	0.01	0.01	86.6
Ethane	0.17	0	0.29	0.15	95.0
Propane	2.72	0.19	3.47	2.13	80.8
Isobutane	2.54	1.03	2.91	2.16	46.1
n-Butane	5.91	3.34	6.55	5.27	32.3
Isopentane	5.53	4.92	5.79	5.41	8.2
n-Pentane	4.7	4.45	4.88	4.68	4.6
n-Hexane	3.44	3.69	3.46	3.53	3.9
Hexanes	5.76	6.06	5.82	5.88	2.7
Benzene	1.27	1.37	1.29	1.31	4.0
Heptanes	21.22	17.61	16.06	18.30	14.5
Toluene	0.16	0.17	0.15	0.16	6.3
Octanes	21.87	23.76	21.28	22.30	5.8
Ethylbenzene	0.61	0.67	0.58	0.62	7.4
Xylenes	5.95	6.39	5.66	6.00	6.1
Nonanes	5.4	5.75	5.11	5.42	5.9
Decanes Plus	12.74	20.6	16.69	16.68	23.6
Decanes Plus MW	172	150	161	161.00	6.8
API Gravity	58.2	58.2	58.7	58.37	0.5
Reid Vapor Pressure	14.98	14.73	15.82	15.18	3.8

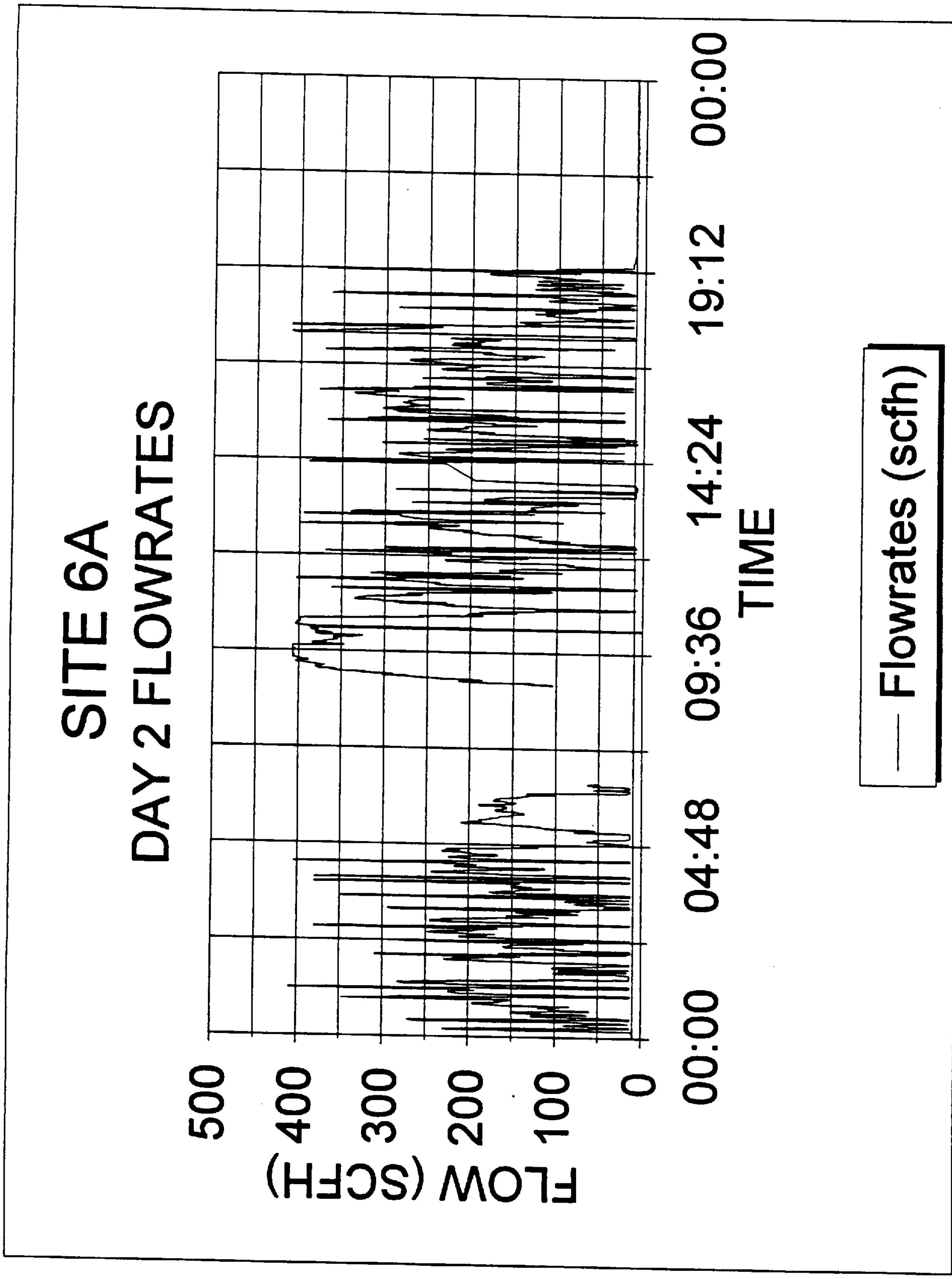
AF. . ANKS SITE 6 TANK VENT CANISTER SAMPLES (6A)
As analyzed

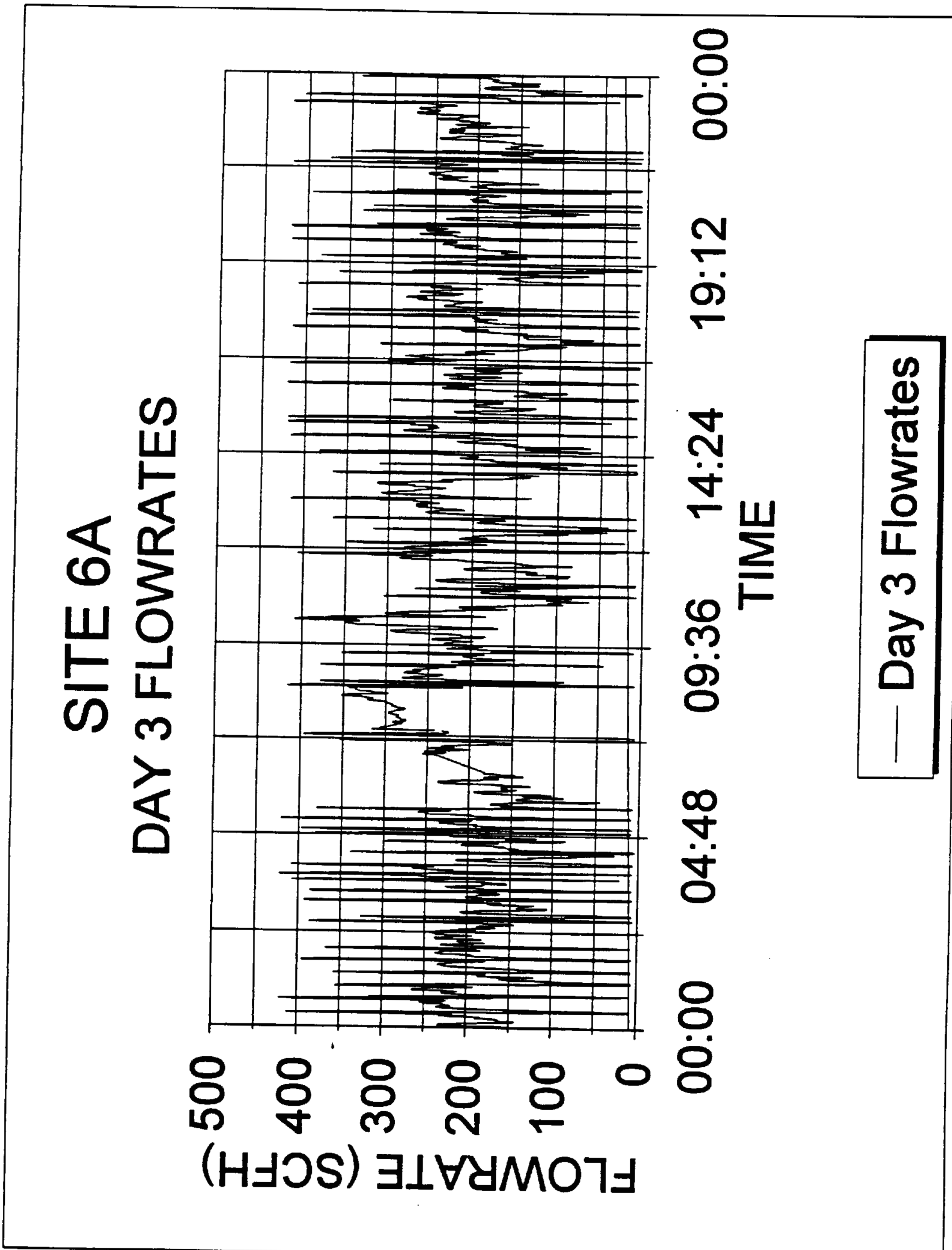
Field ID	API6-MFVRun1	API6-MFVRun2	API6-MFVRun3	API6-MFVRun4	API6-MFVRun5	API6-MFVRun6	API6-MFVRun7	API6-MFVRun8	Average	RSD
Start Date	09/17/96	09/18/96	09/18/96	09/19/96	09/19/96	09/20/96	09/20/96	09/21/96		
End Date	09/18/96	09/18/96	09/19/96	09/19/96	09/20/96	09/20/96	09/21/96	09/21/96		
Start Time	17:20	15:15	21:40	07:35	17:15	07:22	19:19	07:22		
End Time	07:25	21:30	07:20	17:13	07:12	19:14	07:13	15:41		
ppmv										
ETHANE	265,000	268,000	274,000	279,000	273,000	270,000	267,000	125,000	252,625	20.49%
PROPANE	256,000	261,000	265,000	261,000	262,000	265,000	270,000	125,000	245,625	19.91%
ISOBUTANE	66,100	68,500	68,300	65,600	68,100	68,900	73,000	32,900	63,925	19.92%
N-BUTANE	97,700	104,000	100,000	96,700	101,000	104,000	110,000	49,600	95,375	19.89%
ISOPENTANE	30,200	34,500	30,500	30,200	32,400	34,200	35,800	16,200	30,500	20.21%
N-PENTANE	17,700	21,100	17,800	18,000	19,400	20,900	21,700	9,850	18,306	20.59%
N-HEXANE	3,700	5,000	3,680	4,010	4,090	4,800	4,850	2,230	4,045	22.27%
BENZENE	1,240	1,680	1,220	1,350	1,360	1,610	1,640	748	1,356	22.50%
TOLUENE	2,060	2,910	2,040	2,590	2,370	3,070	3,070	1,430	2,443	23.81%
ETHYLBENZENE	39	66	37	78	58	90	71	43	60	31.94%
M/P-XYLENE	269	485	243	584	435	703	525	334	447	35.66%
O-XYLENE	46	82	42	107	90	134	93	61	82	38.11%
OTHER C2									ERR	ERR
OTHER C3									ERR	ERR
OTHER C4	1,000	1,000	1,000	1,000	1,000	1,000	1,000	600	950	14.89%
OTHER C5	10,000	10,000	10,000	10,000	10,000	10,000	10,000	6,000	9,500	14.89%
OTHER C6	10,000	10,000	10,000	10,000	10,000	10,000	10,000	6,000	9,500	14.89%
C7	5,000	7,000	5,000	6,000	5,000	7,000	7,000	3,000	5,625	25.03%
C8	300	600	300	700	500	800	700	400	538	35.77%
C9	10	70	10	100	80	200	90	100	83	72.66%
C10+	ND	ND	ND	ND	ND	ND	ND	ND	0	ERR
OXYGEN	0	0		0		0	0	0	0	ERR
NITROGEN	5,700	6,954	18,200	1,727	10,900	(119)	5,804	(4,286)	5,610	123.16%
METHANE	394,000	393,000	407,000	409,000	407,000	405,000	401,000	161,000	372,125	22.98%
CARBON DIOXIDE										
Total	1,166,064	1,195,947	1,214,373	1,197,746	1,208,783	1,207,288	1,223,343	536,210	1,118,719	21.09%

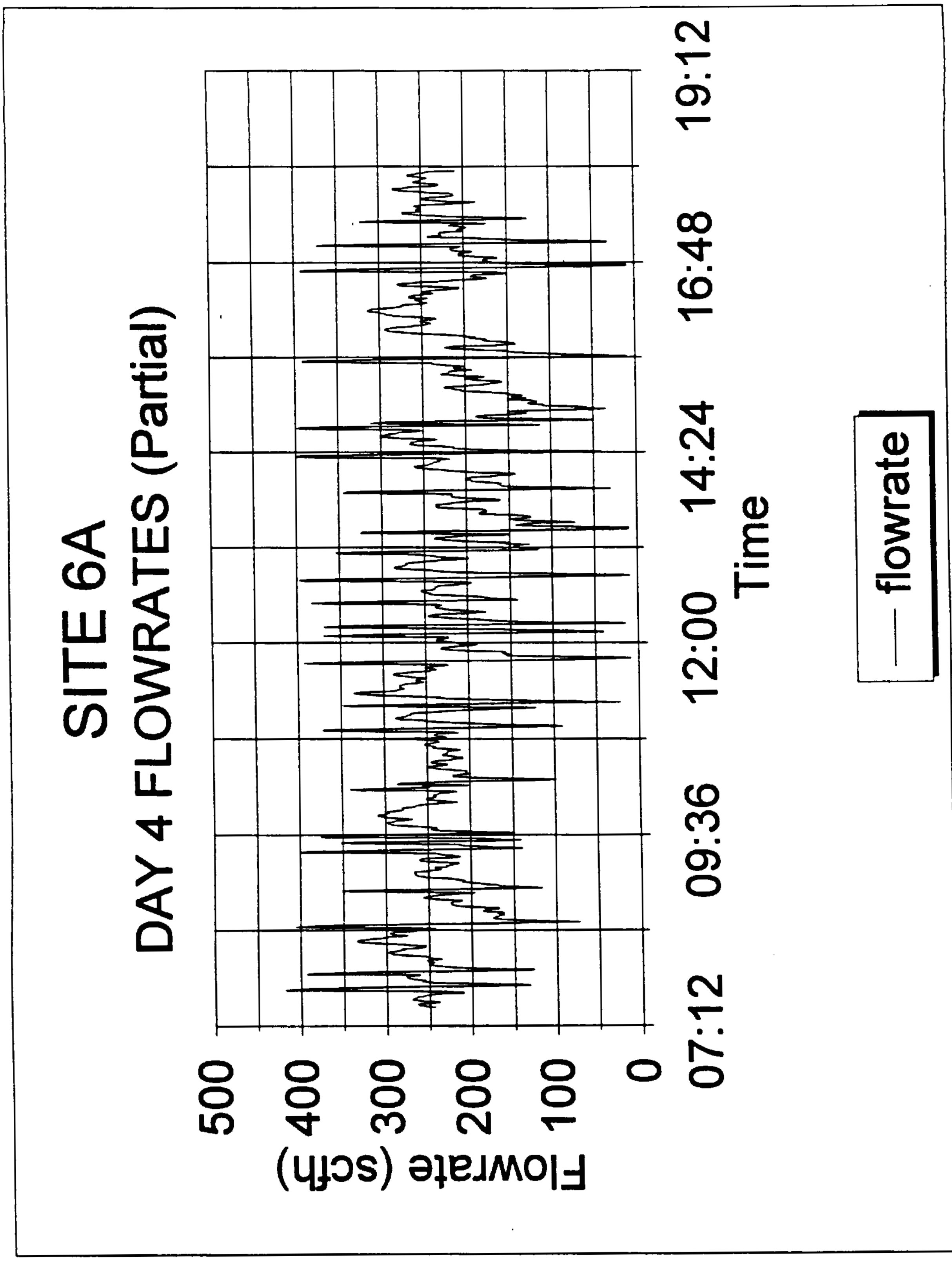
API Tanks Site 6 B

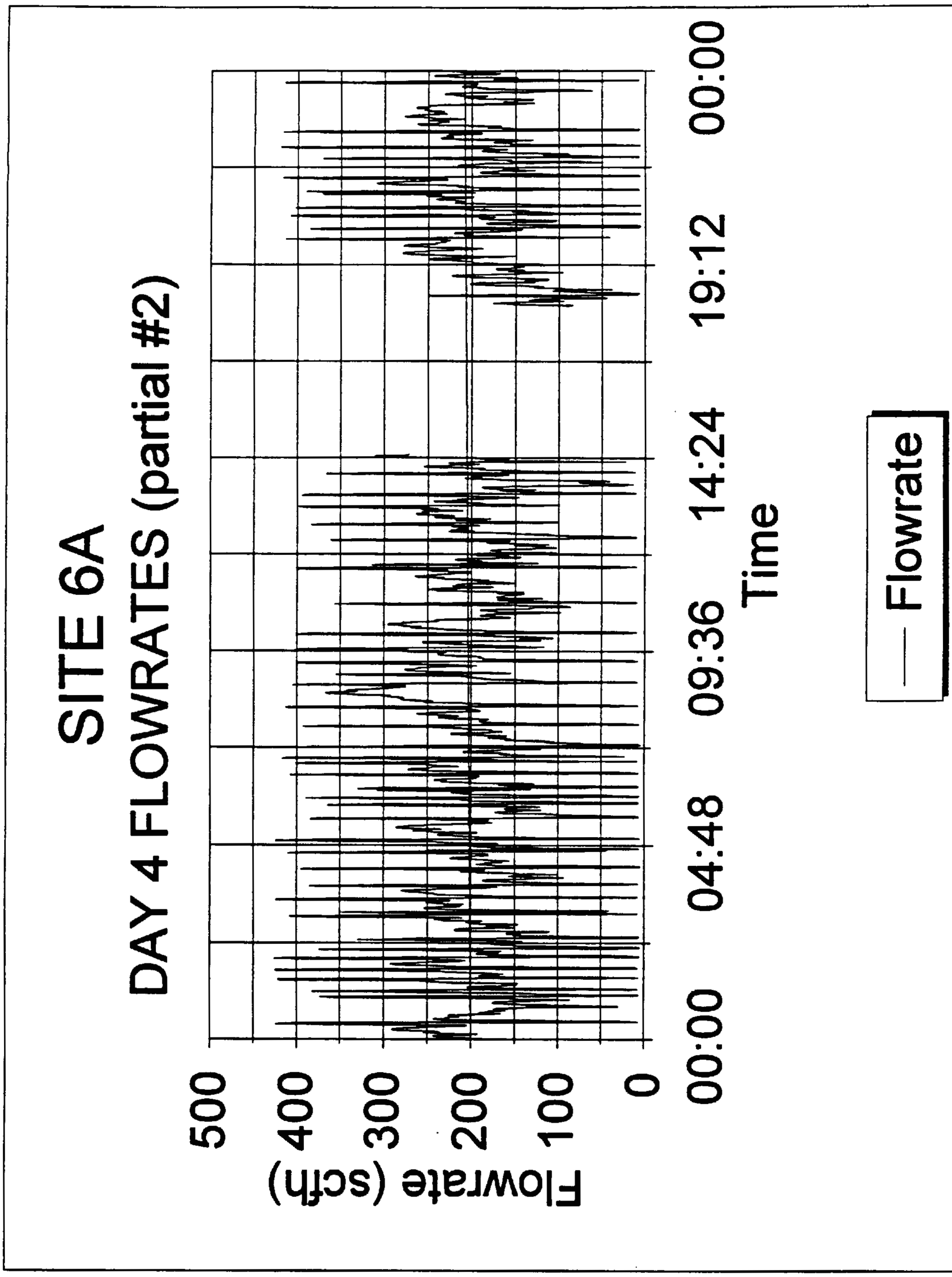
TANK VENT CANISTER SAMPLES
Normalized

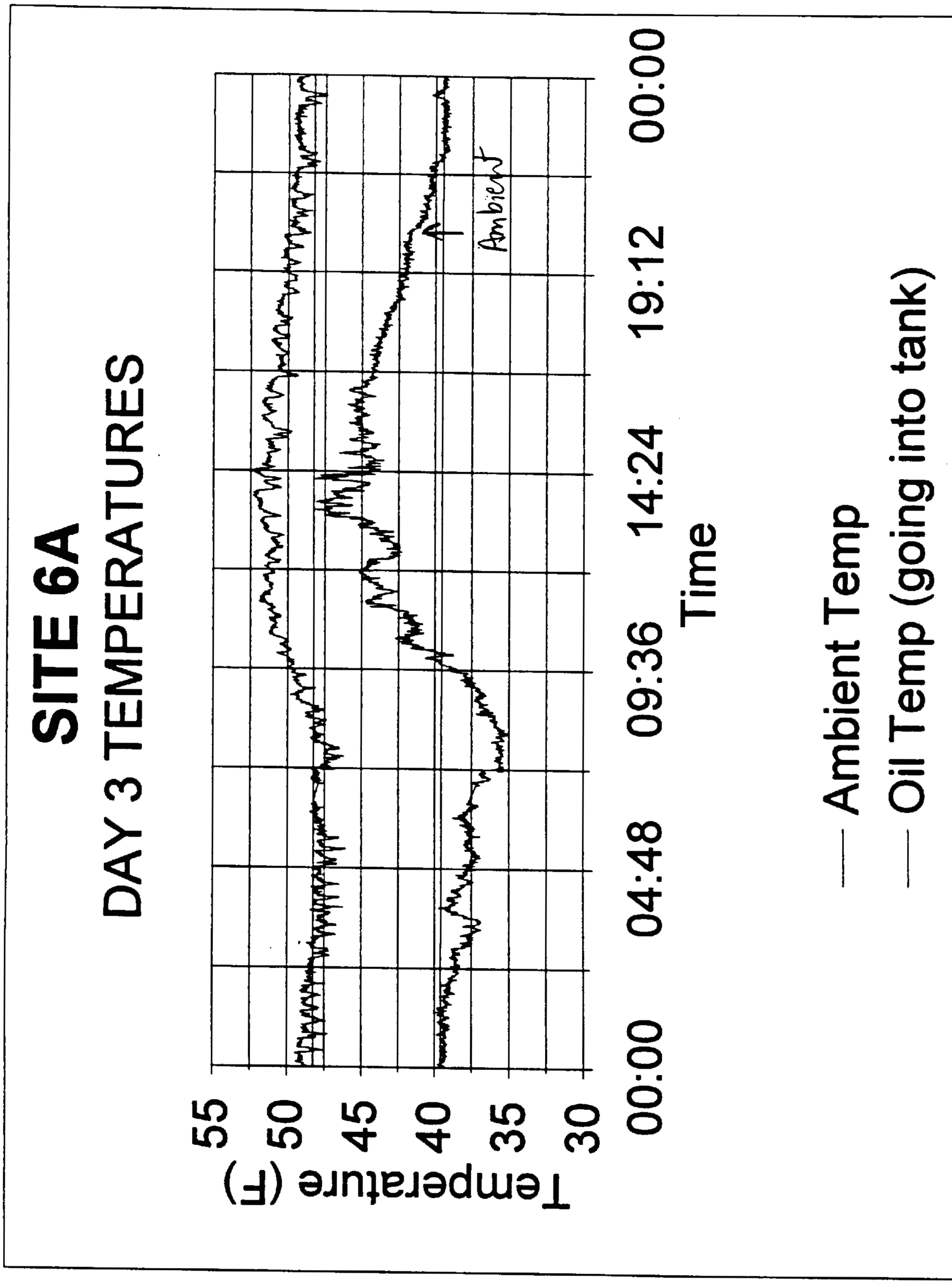
Field ID	API6-MCLRun1	API6-MCLRun2	API6-MCLRun3	API6-MCLRun3	Average	RSD
Start Date	09/21/96	09/22/96	09/22/96	09/22/96		
End Date	09/22/96	09/22/96	09/23/96	09/23/96		
Start Time	15:47	07:23	17:21	17:21		
End Time	07:11	17:01	07:36	07:36		
ppmv						
ETHANE	251,840	250,676	250,457	289,389	260,590	7.37%
PROPANE	237,026	241,071	239,298	281,688	249,771	8.54%
ISOBUTANE	52,096	51,864	52,943	60,859	54,441	7.91%
N-BUTANE	71,272	70,496	71,955	84,457	74,545	8.90%
ISOPENTANE	18,024	17,960	18,350	21,462	18,949	8.89%
N-PENTANE	10,535	10,469	10,704	12,495	11,051	8.76%
N-HEXANE	1,885	1,873	1,909	2,258	1,981	9.34%
BENZENE	601	592	598	718	627	9.66%
TOLUENE	881	855	847	1,011	898	8.50%
ETHYLBENZENE	24	20	20	28	23	15.31%
M/P-XYLENE	170	145	145	193	163	14.07%
O-XYLENE	32	29	29	40	32	16.39%
OTHER C2	0	0	0	0	0	ERR
OTHER C3	0	0	0	0	0	ERR
OTHER C4	741	768	744	994	812	15.02%
OTHER C5	5,761	5,763	5,786	4,968	5,569	7.20%
OTHER C6	4,938	4,802	4,960	4,968	4,917	1.58%
C7	1,646	1,921	1,653	2,484	1,926	20.42%
C8	165	192	165	149	168	10.65%
C9	33	0	17	0	12	127.52%
C10+	0	0	0	0	0	ERR
OXYGEN	0	0	0	0	0	ERR
NITROGEN	8,189	27,400	6,303	206,529	62,105	155.79%
METHANE	334,141	313,104	333,116	25,312	251,418	60.08%
CARBON DIOXIDE	0	0	0	0	0	ERR

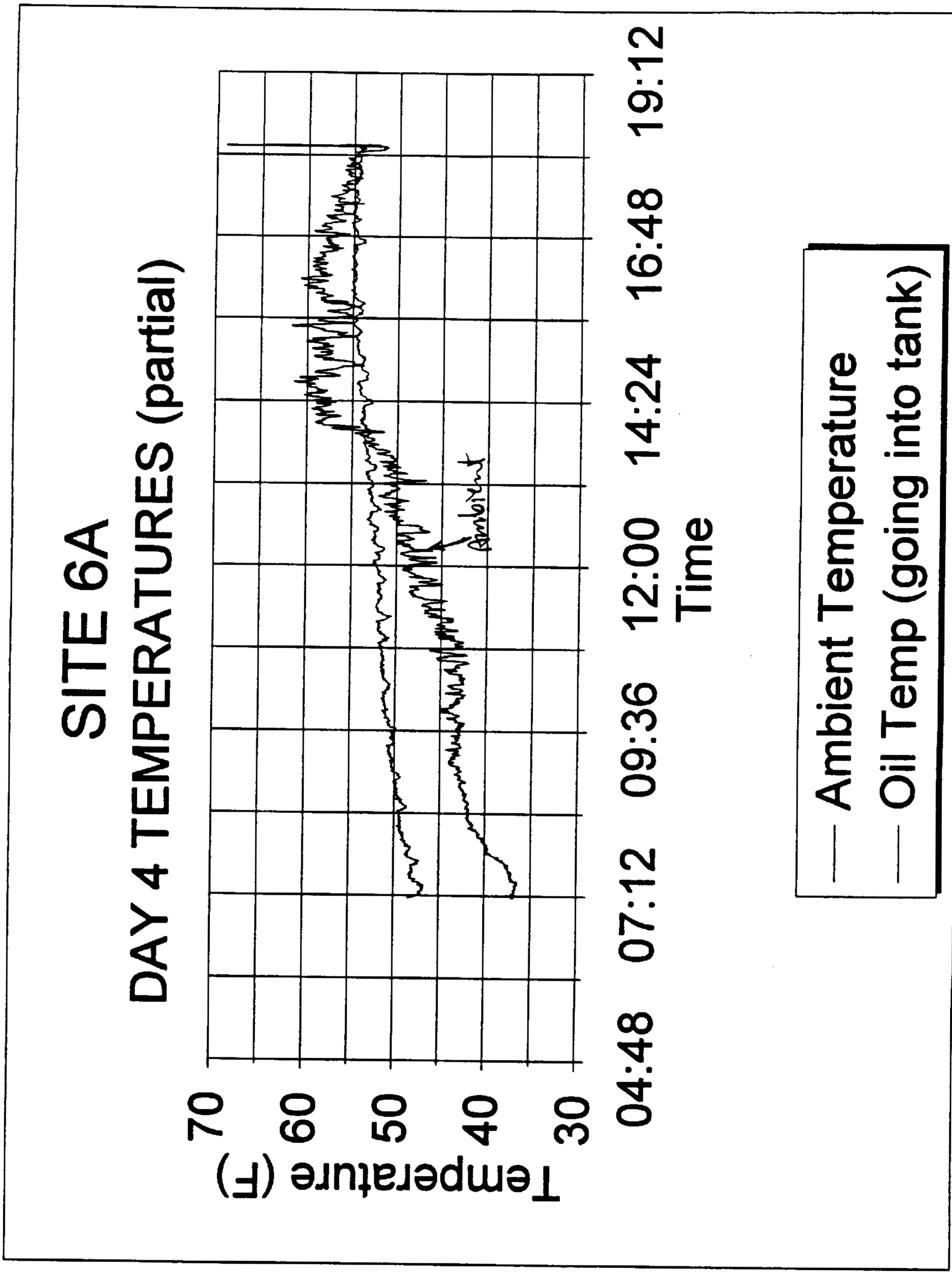

SITE 6A
DAY 2 FLOWRATES
FLOW (SCFH)
500
400
300
200
100
0
00:00
04:48
09:36
14:24
19:12
00:00
TIME
Flowrates (scfh)

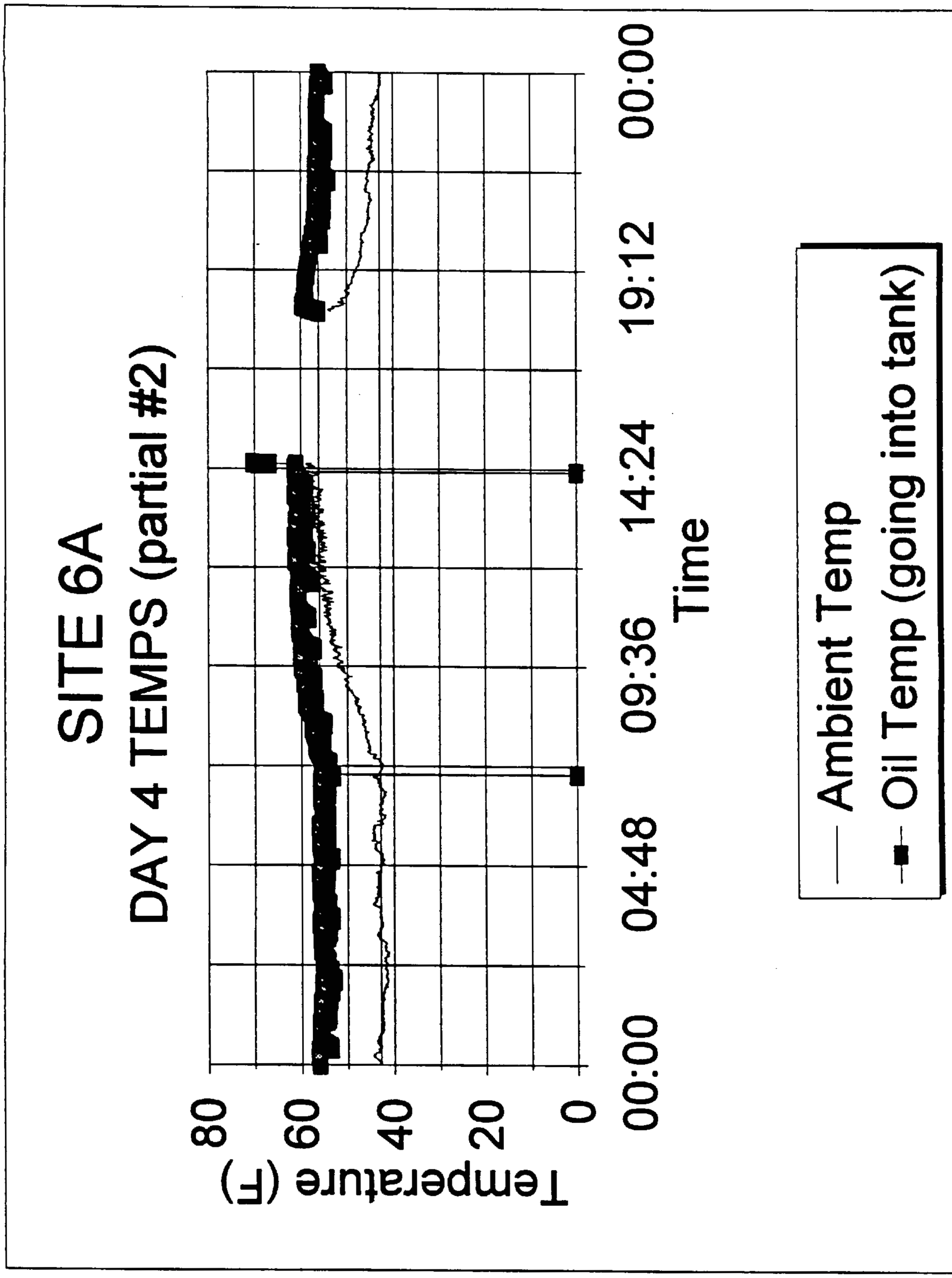

SITE 6A
DAY 3 FLOWRATES
FLOWRATE (SCFH)
500
400
300
200
100
0
00:00
04:48
09:36
14:24
19:12
00:00
TIME
— Day 3 Flowrates

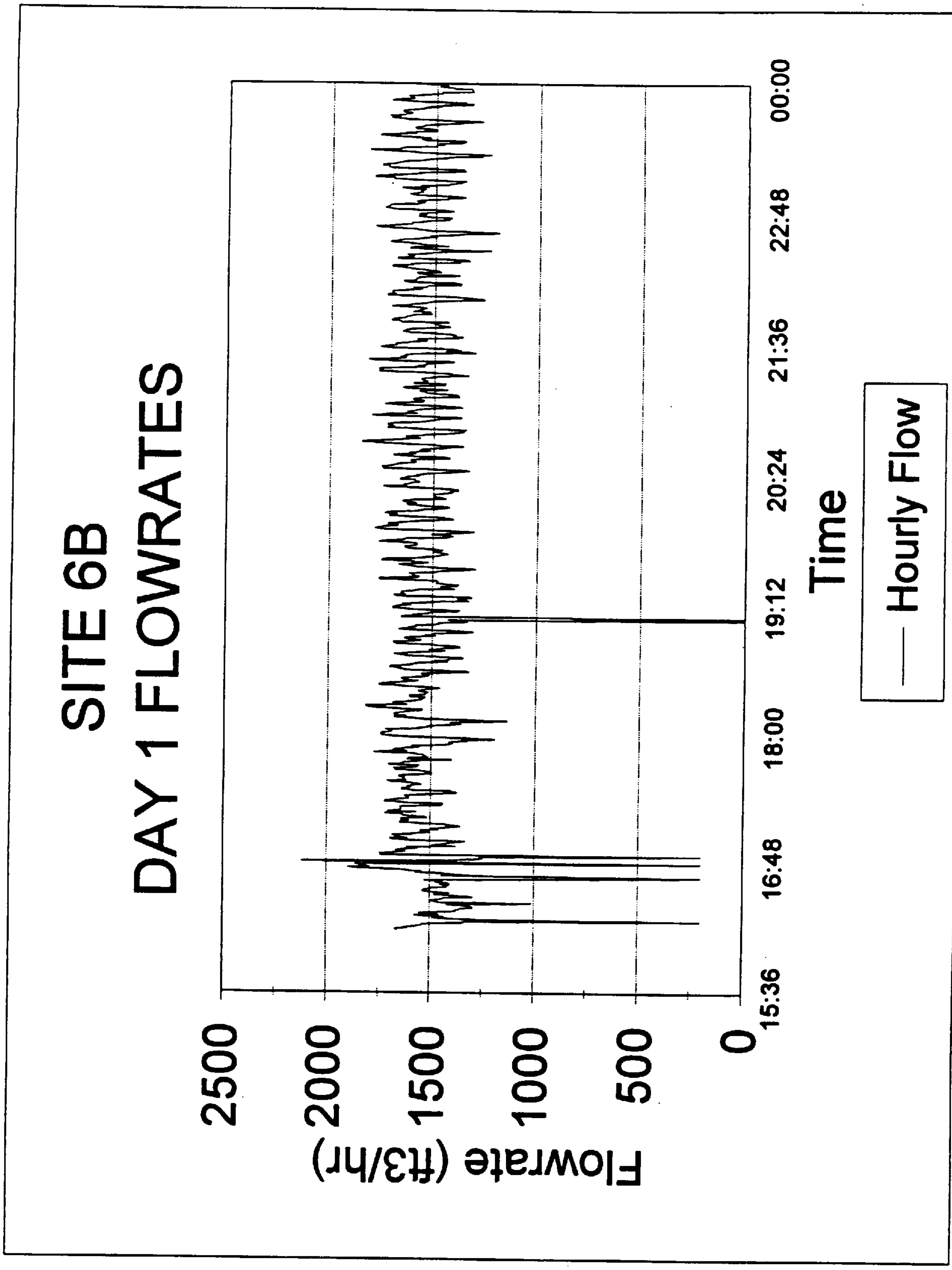

SITE 6A
DAY 4 FLOWRATES (Partial)
Flowrate (scfh)
500
400
300
200
100
0
07:12
09:36
12:00
14:24
16:48
19:12
Time
flowrate

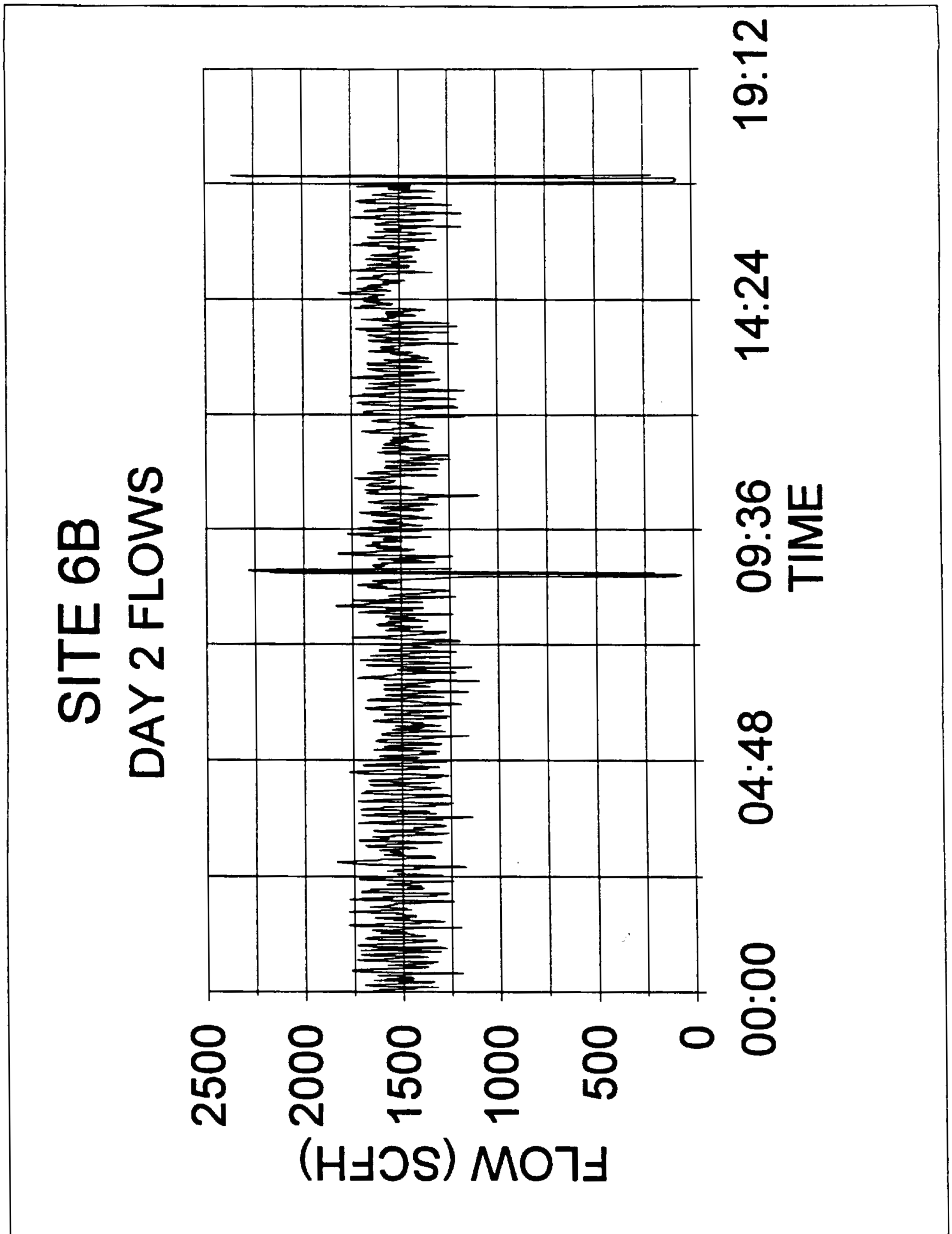

SITE 6A
DAY 4 FLOWRATES (partial #2)
Flowrate (scfh)
500
400
300
200
100
0
00:00
04:48
09:36
14:24
19:12
00:00
Time
— Flowrate

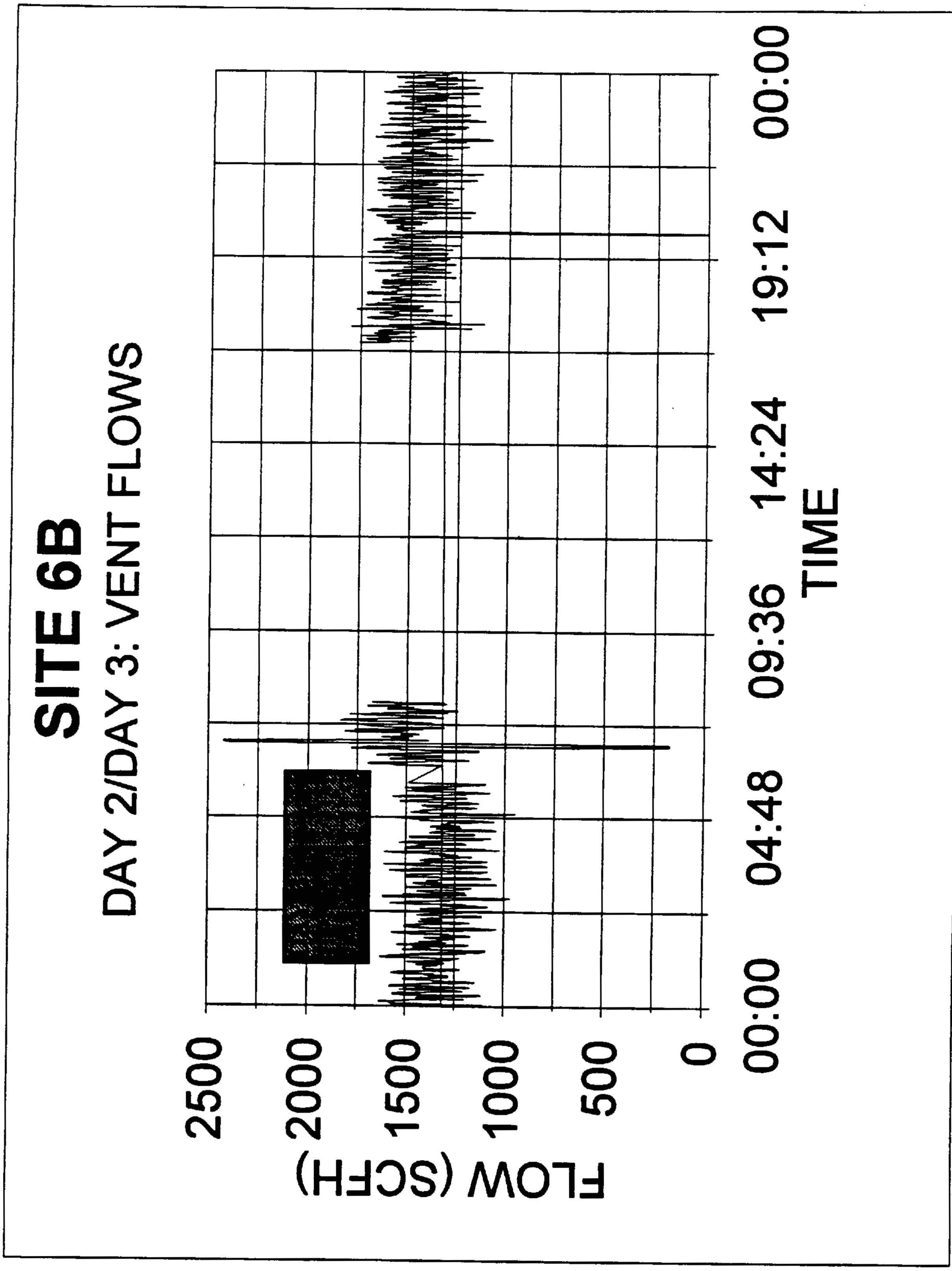

SITE 6A
DAY 3 TEMPERATURES
Temperature (F)
55
50
45
40
35
30
00:00
04:48
09:36
14:24
19:12
00:00
Time
Ambient
— Ambient Temp
— Oil Temp (going into tank)

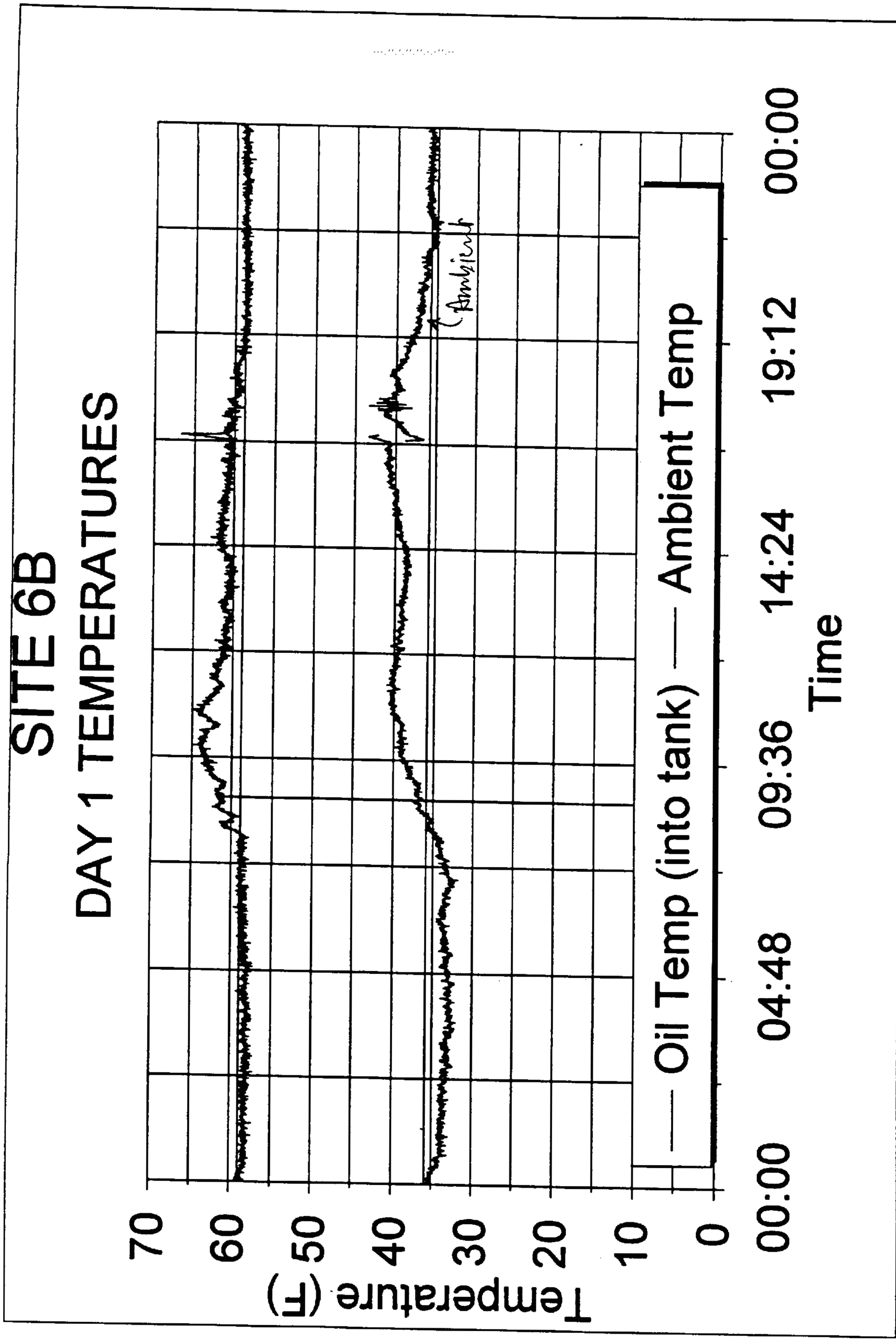

SITE 6A
DAY 4 TEMPERATURES (partial)
Temperature (F)
70
60
50
40
30
04:48
07:12
09:36
12:00
14:24
16:48
19:12
Time
Ambient Temperature
Oil Temp (going into tank)
ambient


SITE 6A
DAY 4 TEMPS (partial #2)
Temperature (F)
80
60
40
20
0
00:00
04:48
09:36
14:24
19:12
00:00
Time
Ambient Temp
Oil Temp (going into tank)


SITE 6B
DAY 1 FLOWRATES
Flowrate (ft3/hr)
2500
2000
1500
1000
500
0
15:36
16:48
18:00
19:12
20:24
21:36
22:48
00:00
Time
Hourly Flow


SITE 6B
DAY 2 FLOWS
FLOW (SCFH)
2500
2000
1500
1000
500
0
00:00
04:48
09:36
14:24
19:12
TIME


SITE 6B
DAY 2/DAY 3: VENT FLOWS
FLOW (SCFH)
2500
2000
1500
1000
500
0
00:00
04:48
09:36
14:24
19:12
00:00
TIME



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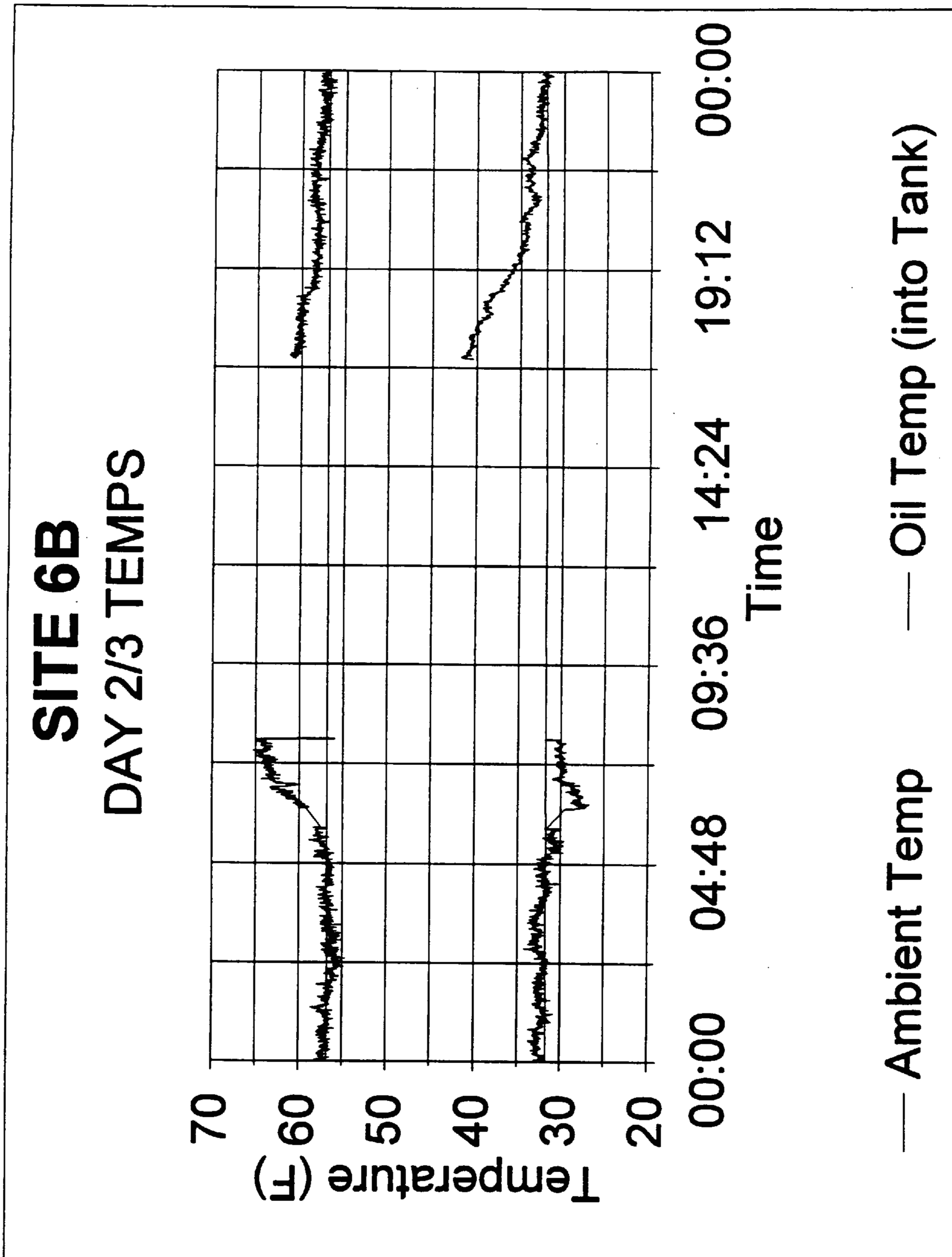
SITE 6B
DAY 2/3 TEMPS
Temperature (F)
70
60
50
40
30
20
00:00
04:48
09:36
14:24
19:12
00:00
Time
— Ambient Temp
— Oil Temp (into Tank)

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EVALUATION OF A PETROLEUM PRODUCTION TANK EMISSIONS MODEL

HEALTH AND ENVIRONMENTAL SCIENCES DEPARTMENT
PUBLICATION NUMBER 4662
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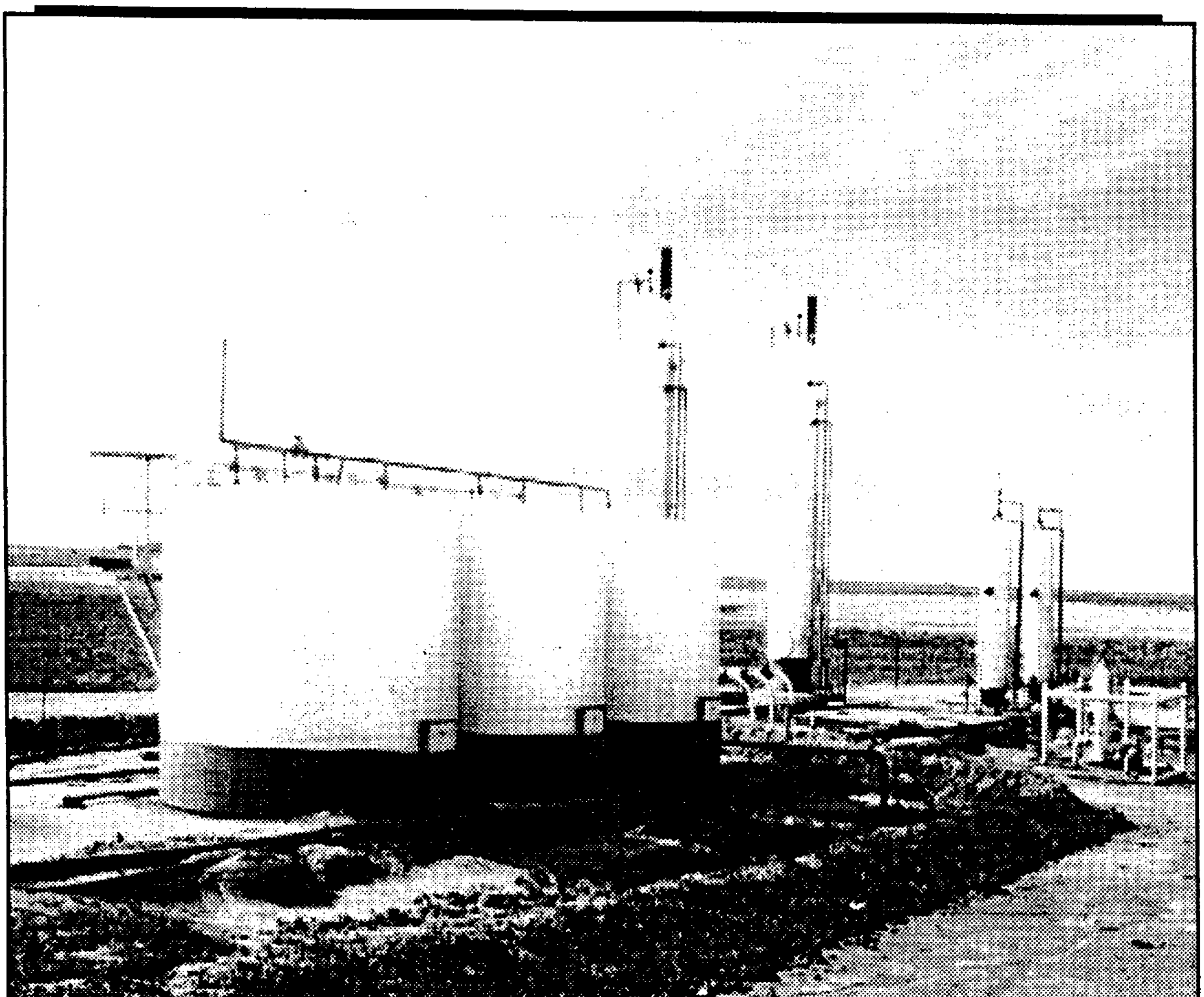

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Evaluation of a Petroleum Production Tank Emissions Model

Health and Environmental Sciences Department

API PUBLICATION NUMBER 4662

THE RESEARCH WAS PREPARED FOR:

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF TABLES (continued)

LIST OF TABLES (continued)

EXECUTIVE SUMMARY

The American Petroleum Institute (API), Gas Research Institute (GRI), and Canadian Association of Petroleum Producers (CAPP) have jointly sponsored a program to develop a personal computer model to accurately estimate tank emissions. The resulting model, E&P TANK, which is based on theoretical thermodynamic principles, estimates flashing, working, and standing emissions from oil field production tanks. It uses oil/condensate composition, oil production rates, separator temperatures, and separator pressures to calculate speciated Hazardous Air Pollutants (HAPs) and Volatile Organic Compounds (VOCs) emissions. A field sampling program of seven tank sites was implemented to provide measurement data for comparing model predictions to measured emissions.

Overall, the field study showed reasonably good agreement between model predictions and field data. The agreement between measured emissions and E&P TANK modeled emission estimates was excellent for three sites where there was a small temperature differential (less than 40°F) between the separator and ambient temperature. The model overestimated the emissions by a factor of 10 at one site where the emission rate was low, and where there was a 76°F temperature differential between the separator and ambient temperatures. Field evaluation measurements showed that the E&P TANK model, when used as designed, predicted conservative emission estimates for six out of seven sites and underpredicted emissions by a factor of 0.8 in the one remaining site.

It was found that HAP emissions are a small fraction of the total VOC emissions from production tanks. For the seven sites sampled, HAP emissions ranged from 1.3 to 5% of the total VOC emissions.

Section 1
INTRODUCTION

This section describes the background, project objective, and approach for evaluation of the E&P TANK model.[1]

PROJECT BACKGROUND

Emissions of hazardous air pollutants (HAPs) and volatile organic compounds (VOCs) from production storage tank vents have come under increased scrutiny in the oil and gas industry due to the Clean Air Act provisions and state permitting requirements. Production storage tank emissions have been estimated using a variety of methods including the EPA "Tanks" model.[2] The EPA Tanks model is useful in calculating working and standing losses from stable products, such as gasoline and fuel oil. The EPA Tanks model, however, does not adequately account for flashing losses which occur when the pressure of crude oil or condensate decreases from an elevated separator pressure, typically 20 to 60 psig, to atmospheric pressure in the tanks. Dissolved hydrocarbons in the oil evolve or "flash" from solution when the pressure is reduced, creating emissions in addition to the working and standing losses. Various calculation methods, including the Vasquez-Beggs[3] equation and off-the-shelf simulation models have been used to estimate these "flashing" losses.

The emission estimates from the various calculation methods can vary by an order of magnitude or more. In order to address the differences observed in estimating emissions from production tanks, the American Petroleum Institute (API), Gas Research Institute (GRI), and Canadian Association of Petroleum Producers (CAPP) have jointly sponsored a program to develop a personal computer model for accurately estimating the working, standing, and flashing components of storage tank emissions. The resulting model, called E&P TANK, is based on theoretical thermodynamic principles. The model uses the pressurized oil/condensate composition, oil production rate, separator temperature, separator pressure, and the sales oil's Reid Vapor

Pressure (RVP) and API Gravity or AP-42[4] parameters to calculate speciated HAP and VOC emissions. Collection and analysis of field samples of the pressurized separator oil and the sales oil are generally necessary to obtain input for this model.

The E&P TANK model uses an adiabatic flash calculation to estimate flash emissions as the separator oil decreases from the separator temperature and pressure to atmospheric pressure. Two methods of calculating working and standing losses have been included as options. One method is based on AP-42 methodology and uses the tank's dimensions, ambient temperatures, pressure relief devices and solar insolation to calculate working and standing losses. This option may not provide a solution under certain conditions (e.g., with a true vapor pressure equal to or greater than atmospheric pressure). A second option for calculating working and standing losses with E&P TANK uses a multi-stage distillation calculation to match a measured RVP of the sales oil.

The E&P TANK model is designed to estimate steady-state emissions from a particular site using the separator temperature, pressure, and oil composition as the primary input parameters. It does not take into account short term process fluctuations (e.g., oil recirculation), effects of wind velocity, leaking equipment, or phenomenon such as condensation in the tanks due to cold temperatures. All of these things have some effect on actual emission rates which will not be reflected in model predictions.

The development of E&P TANK was completed in mid-1995. This field sampling program was undertaken to evaluate the model by comparing measured emissions with model predictions. The field sampling program was also used to fine tune the E&P TANK model.

All model calculations reported in this document were performed on the DOS version of the model. This version was designated as EPTANK Version 3.0. A Windows™ based version, which uses the same calculation methods, was under development but not available at the time of this study. The Windows™ based version is designated

E&P TANK and is the version which will be released. Therefore, it is the version referenced in the body of this report. (However, you will note that the data sheets in Appendix A refer to the DOS version; EPTANK V. 3.0.)

PROJECT OBJECTIVE

The primary objective of this program was to obtain field measurement data for the evaluation and possible refinement of the E&P TANK model.

APPROACH

Seven tank sites were sampled under a variety of conditions and the results compared to those calculated by the model. Input parameters for the model were measured in addition to the tank vent gas flow rate and composition.

The E&P TANK model was used to calculate estimated emissions from the seven oil/condensate storage tanks based on measured inputs. The model results were then compared to emissions obtained by actual measurements. The E&P TANK model was refined by D. B. Robinson to correct some minor problems and to remove some input options to simplify model use.

The following general approach was used to implement the evaluation program:

- Identify suitable sites meeting defined criteria for sampling;
- Visit the sites and verify that they are suitable for sampling;
- Sample the chosen sites to collect 1) data and measurements which define the actual vent emissions; 2) data and measurements required to make emission estimates; and 3) ancillary data which can be used to troubleshoot problems;
- Compare model-calculated estimates to those measured at each site;

- Provide feedback to the API Tank Emissions Project Group and model developers on results of the model comparisons and any problems observed that need attention;
- Refine the measurement techniques and parameters for the next site to be sampled; and
- Compare emission estimates to measured emissions for each site using latest versions of the model.

REPORT ORGANIZATION

Section 2 of this report will present the experimental design for measuring emissions and obtaining model input parameters. Sampling and analytical methods will be discussed in Section 3. Section 4 will present site descriptions and measured emissions. Section 5 discusses model input parameters and compares the predicted model emissions to measured emissions on a site-by-site basis. Conclusions and Recommendations are included in Section 6.

Section 2
EXPERIMENTAL DESIGN

This section describes the E&P TANK computer model, including the inputs needed to estimate emissions and the types of output (i.e., the emissions). These inputs needed to estimate emissions and the actual tank emissions define most of the data that are needed from the field sampling program. This sampling program is described following the computer model description subsection.

MODEL DESCRIPTION

The E&P TANK model provides two options for calculating flashing, working, and standing losses. These methods include:

- An adiabatic flash for flashing emissions with a multi-stage (defaults to single-stage if the multi-stage does not converge) distillation calculation for working and standing losses, and
- An adiabatic flash for flashing emission with an AP-42 option for calculating working and standing losses.

For the AP-42 method, default values are provided for those inputs which may not be measured at each site (e.g., solar insolation).

The E&P TANK model input parameters include:

- Separator temperature (°F);
- Separator pressure (psig);
- The composition of the pressurized oil/condensate immediately after the separator/heater treater (mole%);
- Atmospheric pressure (psia);
- Sales oil API gravity;

- Daily production rate (bbl/day);
- Reid Vapor Pressure of the sales oil (psia);
- Sales oil temperature (°F); and
- The molecular weight and specific gravity of the C_{10+} components in the separator oil.

Optional input into the E&P TANK model includes the volume of dilution air that enters the tank during withdrawal cycles. Air input has been included since withdrawing oil from the storage tank is usually faster than the generation of vapor from flashing. The volume of the oil removed that is not replaced by flash gas is replaced by ambient air which is pulled into the tank as the oil is removed.

Outputs from the model include mole percent of each component calculated from the flash and from working and standing losses, plus total vent emissions. A summary of total hazardous air pollutants (HAPs) emissions, individual HAP emissions, C_{3+} VOC, C_{2+} VOC, and total hydrocarbon emissions is provided in tons/year and in pounds per hour. Examples of model output files representing estimated emissions from individual sites sampled during this project can be found in Appendix A.

FIELD MEASUREMENT PROGRAM

Sampling at six different sites was planned to obtain data under a number of different conditions to measure actual emissions and to fully evaluate the estimation procedures. However, a total of seven sites were actually tested (refer to Table 2-1.) Tests were conducted at each site under normal operating conditions. The host companies were asked not to schedule maintenance or avoidable non-routine activities during testing.

Figure 2-1 presents a typical arrangement for an oil production tank storage battery. Model evaluation sampling points are shown in the figure with an indication of the

Table 2-1. Tank Sites Tested

Tank Site	Location/Remarks
1	West Texas
2	Southeast Colorado
3	South Louisiana
4	Southeast Texas
5	Re-test of Site 3
6	Southwest Wyoming
7	Same location as Site 6 but 1.5 miles apart

samples to be collected at each point. Individual sites varied as to the number and sizes of tanks present, pressure of the oil coming into and out of the separator, separator temperature, and sales oil parameters; but the noted sample points should be representative of most sites encountered. Sales oil is defined in this document as the oil which is removed from the on-site storage tanks by pipeline or by truck for delivery and sale of the oil.

Testing generally consisted of one day to set up and check out the equipment, three days of data collection, and a portion of the fifth day to remove any modifications and equipment before leaving the site. During the three days of testing, data were collected 24 hours each day to reflect diurnal effects on tank emissions. As many of the tests as possible were automated to continuously collect data. In particular, the vent gas stream flow rate, composition [by on-site gas chromatography (GC)] and temperature measurements were automated for continuous data collection. Critical measurements made at each site are presented in Table 2-2. The parameters include both those needed to calculate actual tank vent emissions and those that are inputs to E&P TANK.

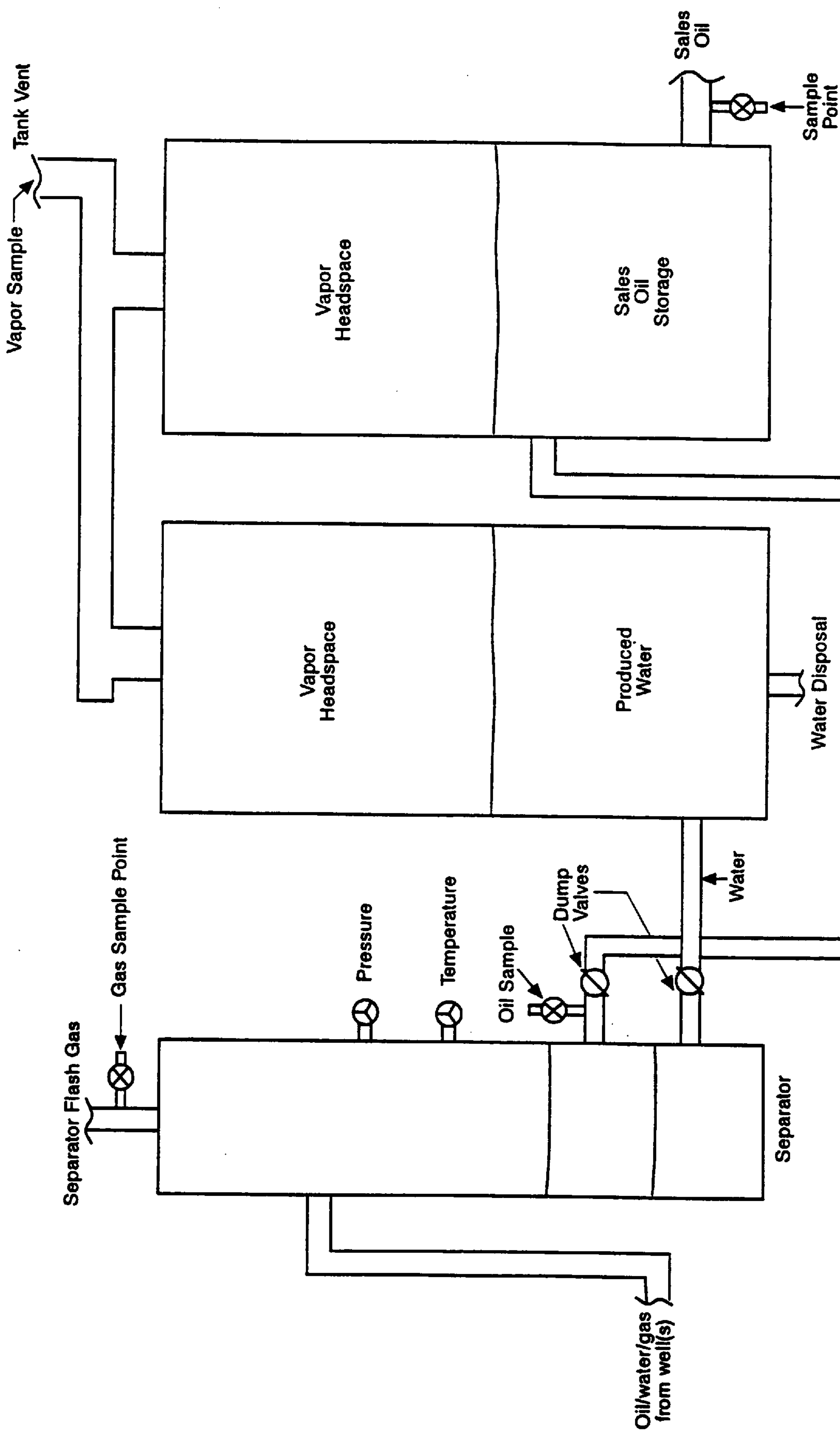

Figure 2-1. Typical Storage Tank Site

Table 2-2. Critical Data Collection Parameters

Data Collection Site	Parameter
Separator	1. Temperature (°F) 2. Pressure (psig) 3. Flash Gas Composition (mole% & specific gravity) 4. Oil Composition (mole%) [a]
Sales Oil Tank	1. Tank Capacity (bbls) and Dimensions (diameter & height) 2. Oil Withdrawal Cycle [b] 3. Tank Fill and Withdrawal Times [b] 4. Temperature of the Oil Entering the Tank (°F) 5. Number of Tanks
Tank Vent	1. Gas Temperature (°F) 2. Gas Composition (ppm/component) 3. Gas Flow Rate (scfm)
Sales Oil	1. Production Rate (bbl/day) 2. Temperature (°F) 3. Reid Vapor Pressure (psia) 4. API Gravity 5. Oil Composition (mole %)
Others	1. Ambient Pressure (psia) 2. Ambient Temperature (°F); Daily Minimum and Maximum 3. Annual Hours of Operation

[a] Includes molecular weight and specific gravity of the C_{10+} components.
[b] The tank may be emptied by Lease Automatic Custody Transfer (LACT) unit or by truck. Used to calculate the volume of air which may flow into the tank during the oil withdrawal cycle.

Non-critical measurements made at most sites are presented in Table 2-3. Some of these parameters, such as wind speed and wind direction were not made at all sites. These conditions are available at local airports for retrieval at any time that they are deemed necessary.

Table 2-3. Non-critical Measurements

Data Collection Site	Parameter
Production	1. Number of Wells Supplying the Site
Separator	1. Oil Transfer Cycle 2. Produced Water Transfer Cycle
Associated Gas from Separator	1. Daily Production Rate.
Produced Water Tank	1. Tank Withdrawal Cycle 2. Daily Production Rate
Atmospheric Conditions	1. Wind Speed and Direction [a] 2. Relative Humidity [a]
Oil Tank	1. Surface Temperature

[a] These conditions were obtained from a local airport at most sites.

The matrix used for sample collection at most sites, including quality control samples, is presented in Table 2-4. Because the separator flash gas composition was not used as an input to the model, but was used to compare to model predictions and to determine mass balances, one sample was collected each day.

The separator crude oil/condensate sample composition was a primary E&P TANK model input so it was collected twice each day using the Gas Displacement Method from the sampling protocol included in Appendix B. Samples were collected in the early morning and late afternoon approximately 12 hours apart. The flow rate of the pressurized oil leaving the separator was not measured as none of the host sites were configured to make this measurement and insertion of a flowmeter in the line would require major site modifications.

Time-integrated canister samples were collected from the tank vent over a 12-hour period (approximately 7:00 am to 7:00 pm and 7:00 pm to 7:00 am) each day. These samples provided time-integrated concentrations for C_1-C_{10+} hydrocarbons in the vent gas stream which could be used to calculate emissions on a twice daily basis or

Table 2-4. Sampling Matrix

Sampling Point	Sample Type	Day 1	Day 2	Day 3	Day 4	Day 5[a]	Total Samples
Separator - Flash Gas	Grab Sample High-Pressure Cylinder	0	1 1 FD	1 1 FB	1	---	3 1 FB/1 FD
Separator - Crude Oil and Condensate	Grab Sample High-pressure Cylinder	0	2	2	2 1 FD	---	6 1 FD
Tank Vent Gas	Time-Integrated Canister [b]	0	2	2	2	---	6
	Continuous GC	>2	Maximum Number Possible	Maximum Number Possible	Maximum Number Possible	---	Site Dependent [c]
	Flow Rate Temperature	>5	Maximum Number Possible	Maximum Number Possible	Maximum Number Possible	---	Site Dependent [c]
Sales Oil	Reid Vapor Pressure API Gravity Oil Composition	0	1	1 1 FD	1	---	3 1 FD
	Flow Rate Temperature	1	4	4	4	---	13

[a] Contingency sampling day.
[b] Samples integrated across 12-hour time periods.
[c] Dependent on site conditions, number of calibrations, etc.
FD = Field Duplicate
FB = Field Blank

averaged over the three days for comparison to model outputs during the same time periods. Compound concentrations determined from the canisters provide a time weighted average emission rate based on an average vent flow during collection time. Table 2-5 provides a list of the speciated hydrocarbons which were determined in the canister samples and by the semi-continuous GC system.

Table 2-5. Hydrocarbon Target Compound List

Compound	Number of Carbon Atoms
Methane	1
Ethanes	2
Propanes	3
I-Butane	4
n-Butane	4
Butanes	4
I-Pentane	5
n-Pentane	5
Pentanes	5
n-Hexane	6
Hexanes	6
Heptanes	7
Octanes	8
Nonanes	9
Decane	10
Benzene	6
Toluene	7
Ethylbenzene	8
Xylenes (total)	8
C_{10+}	> 10

The semi-continuous GC system was used on-site to monitor the vent gas stream for permanent gases (N_2, O_2, and CO_2) and as many of the speciated hydrocarbons as could be determined (methane through the xylenes). This system was used to determine short-term fluctuations in the composition which were then correlated with known activities, such as operation of the separator oil transfer valve or pumping the sales oil from the tank(s). In addition, permanent gases, primarily nitrogen and oxygen, were monitored to determine if air entered the tank(s) during sales oil removal. The concentrations of nitrogen and oxygen, plus the tank volume, were used to calculate the amount of air drawn into the tank(s). Since these compounds were measured on a semi-continuous basis, they were also used to determine the amount of air dilution and its effect on the tank emission estimates.

The GC data were also correlated with the vent flow rate measured at the time of sample analysis to obtain a flow rate averaged emission estimate. The flow averaged measurements were generally made during times of "steady-state" flow. Steady-state flow was defined as a period of time when external factors, such as sales oil removal or recirculation pump operation, were not influencing the emissions from the tank. At one site (Site 1), it was not possible to obtain a steady-state operation due to timed pumping cycles for numerous wells feeding the site. In these cases, an average flow rate was calculated from the measured flows.

The GC cycle time was approximately 40 minutes between injections. Therefore, approximately 25 to 30 samples were analyzed each day. The remaining analyses performed each day were required for calibration check samples and blanks.

Dilution of the sample to determine compound concentrations outside of the linear range of the instrument was necessary at most sites. The amount of dilution depended on the concentrations of the various target analytes and was site dependent. A dilution ratio was determined at each site which allowed accurate concentration measurements for the largest number of compounds while accurately measuring n-hexane and benzene, toluene, ethylbenzene, and xylenes (BTEX). Accurate measurement of the HAPs was considered the highest priority. Therefore, some of the hydrocarbons, such as n-butane and I-butane, were outside the calibration range of the instrument in order to accurately measure BTEX. Individual dilutions of the sample stream were performed to determine the concentration range of these compounds on selected samples so some information would be available.

The vent gas flow rate was measured on a continuous basis using an orifice plate and pressure transducers at all sites except during the initial shakedown test (Site 1). Gas flow rates varied greatly from site to site due to oil composition, production rates, tank capacity, separator temperatures and pressures, ambient temperatures, and the rate of removal of sales oil. Therefore, a range of orifice plates and pressure transducers was used to measure flow at the various sites. At Site 1, a dry gas meter was used to monitor flow.

Output from the differential pressure transducers was recorded by a computerized data system which was also used to continuously record temperatures from a number of locations. Calibration of the orifice plate and transducers allowed conversion of the recorded pressure differential to a flow measurement. The sizes of the vent pipe extensions and orifice plates were adjusted to the amount of vent gas flow at a particular site. Higher production sites and/or lighter oil required larger vent lines and orifice plates.

Sales oil samples for Reid Vapor Pressure, API gravity and oil composition were collected once each day at most sites. Daily collection was deemed to be sufficient since these parameters should remain relatively constant from day to day. The sales oil throughput was measured daily and integrated across the sampling period. In most cases, separator vent gas temperature, temperature of the oil going into the tank, and ambient temperature were measured on a continuous basis with thermocouples connected to a data logger system. Separator/heater treater operating temperatures were manually recorded several times each day. It was not possible to continuously record this temperature due to the physical distance from the separator/heater treater to the oil tanks. It was not possible to measure the sales oil temperature on a continuous basis since the only access to the sales oil was generally in stagnant lines coming off of the tank. Sales oil temperatures and samples were collected during oil removal from the tank.

Other critical measurements made at each site include:

- The tank oil withdrawal cycle was determined by physical observation;
- The time required for tank filling and product withdrawal was noted by physical observation and recorded in a field notebook; and
- Annual hours of operation were obtained from the site operator.

Section 3
SAMPLING AND ANALYTICAL METHODS

This section will describe the sampling methods used to collect valid samples for input into the models, for measurement of tank vent flow and composition, and the analytical methods utilized to measure sample composition for model input and calculating measured vent emissions.

SAMPLING METHODS

The test matrix found in Section 2 details the types of samples and collection methods that were used during this project. This section describes in greater detail the approach used to collect the various sample types and necessary process/field data. Sampling frequency, including field QC samples, is included in Table 2-3, Section 2. Table 3-1 presents a summary of sampling locations, types of samples collected, collection techniques, and frequency.

Table 3-1. Gas and Liquid Sample Collection

Location	Sample Stream	Collection Technique	Frequency
Separator	Flash Gas	GPA 2166 - High-Pressure Cylinder	1/day
	Oil/Condensate	Gas Displacement - High-Pressure Cylinder	2/day
Tank Vent	Vent Gas	Time-Integrated Canister (modified TO-14)	2/day
	Vent Gas	Stainless Steel Line to Gas Pump for On-Site Gas Chromatography	Semi-continuous
Sales Oil Line	Sales Oil	ASTM D4057 for Reid Vapor Pressure, API Gravity and Oil Composition	1/day

Gas and Liquid Sample Collection

The separator flash gas was collected in high-pressure gas cylinders using GPA Method 2166-86.[5] The sample lines were thoroughly flushed with sample to remove any liquids which may have condensed in the lines and to ensure that a representative sample of the separator flash gas was obtained. A gas sampling manifold system was used to exclude liquids during sampling. Care was taken to avoid the inclusion of air into the sample container during collection since air could cause a low bias for the gas component concentrations.

The composition of the pressurized oil/condensate exiting the separator/heater treater is a key component of the E&P TANK model input. Therefore, it is very important that this sample be collected carefully and before any pressure reduction occurs to avoid flashing dissolved gases from the oil. Sampling locations used at each site were located immediately after the separator/heater treater and before the oil transfer valve or any other pressure reducing equipment.

Crude oil or condensate was collected in high-pressure cylinders using the method found in the sampling protocol Separator Liquid Collection - Gas Displacement Method included in Appendix B. These samples were collected by first collecting a separator flash gas sample, as described in Method 2166-86, so that the cylinder was filled with flash gas at the separator/heater treater pressure. The oil line was purged to remove particulates and to ensure a representative sample could be collected. The cylinder was attached to the oil/condensate line in a vertical position, pointing upward. The valves from the oil line and on the bottom of the cylinder were opened. Liquid would not flow into the cylinder at this time since the cylinder gas pressure was equal to the oil pressure. The top valve on the cylinder was slowly opened to allow a <u>small</u> amount of gas to escape and oil to enter the cylinder. Gas in the cylinder was allowed to escape at a rate such that 2 to 5 minutes were required to displace the gas in the cylinder with the oil/condensate. Using this technique, the cylinder pressure was maintained very near the separator/heater treater pressure and dissolved gases in the oil did not have an opportunity to flash. When oil began to exit the cylinder, all valves were closed, and the oil sample cylinder was removed and capped for shipment to the analytical laboratory.

The liquid sample volume in the cylinders was determined by weighing the cylinders before and after sampling. Density measurements were made to convert the sample weight to volume. These measurements were used in conjunction with the known volume of the cylinders to ensure only liquid was collected in the field.

Samples of the tank vent gas were collected using time-integrated canister sampling. Either a 6-liter or a 15-liter SUMMA® polished stainless steel canister evacuated to a pressure of approximately 27 inches of mercury (i.e., 2 inches of mercury absolute) was used to collect a 12-hour integrated sample. Sample was collected from the vent approximately 2 feet before the orifice plates to avoid disturbances in flow measurement. The gas sample was collected through a clean 1/4-inch stainless steel line connected to the canister. In cold climates, this line was heated to avoid condensation which could cause biased results. A Veriflow™ vacuum flow regulator metered the sample into the 15-liter canister at a flow rate of approximately 1.0 L/hr (17 mL/min) for 12 hours to obtain approximately 12 liters of sample. Flow rates of 6 to 8 mL/min were used with 6-liter canisters. In most cases, the canister was under a slight vacuum after sample collection. However, in some cases, the canister came to atmospheric pressure within the 12-hour sampling period. The next sample was started if the previous canister came to atmospheric pressure before the 12-hour sampling period was complete. Starting and ending pressures were recorded in the field and checked upon receipt at the laboratory.

The vent gas sample for the on-site continuous GC was also taken at a point where flow measurement was not impacted. In the cases where sample collection from the vent line was near the tank, the GC sample line was inserted into the top of the tank by threading a 1/8-inch sample line through the vent pipe. This position was chosen to minimize the chances of collecting an air sample during times of negative flow. In the cases where the vent pipe extended a considerable distance from the tank, such as at Sites 3 and 5, the continuous GC sample line was inserted 2 to 3 feet into the vent line from a point approximately 2 feet in front of the orifice plate. Samples were delivered to the GC through stainless steel transfer lines. In cold climates, the sample lines were heated to avoid liquid condensation.

The on-site GC sample was continuously extracted from the vent using a small sample pump. The sample pump was used to pull the sample through fixed volume sample loops on the GC. A bypass valve was installed on the sample pump so that the sample flow rate could be controlled. A sample flow rate of approximately 20 mL/min was established in the field to ensure a representative sample. Sample gas in the loops was analyzed undiluted at Sites 1 and 2. However, it was determined that some of the target analytes were outside the calibration range of the instrument and others were giving responses greater than the voltage range of the instrument (i.e., were over-range). Therefore, a dilution apparatus was constructed to address these component concentrations.

At Sites 3, 4, and 5, the vapor sample from the vent line was diluted for the Flame Ionization Detector (FID) analysis due to the concentrations of C_1-C_6 hydrocarbons. A representative dilution factor was established at each site to maximize the information generated. In general, a dilution factor in the range of 10:1 to 20:1 was used for the FID analysis. Accurate determination of the HAP concentrations was given priority over the VOC compounds when the dilution factors were determined. For example, the sample was not diluted to the point where n-butane could be measured if this dilution resulted in dilution of the xylenes to concentrations below the instrument detection limits. Vent gas samples analyzed using the Thermal Conductivity Detector (TCD) were not diluted before analysis. The on-site GC was not used at Sites 6 and 7.

Sales oil samples for Reid Vapor Pressure, API gravity, and oil composition were collected from the sales oil line as close to the storage tank as possible during an oil withdrawal cycle. Samples were collected using ASTM Method D4057[6] in 1-liter aluminum containers (70 to 80% full) by passing the oil through a cooling coil in an ice water bath into the sample container which was also held at ice water temperatures. The sample was capped, stored under ice (4°C or less), and shipped to the laboratory for analysis. The samples for API gravity and oil composition were taken from sample remaining after analysis for Reid Vapor Pressure.

Other Process Measurements

Additional information collected at each site for model input included the separator temperature and pressure, ambient (barometric) pressure, sales oil throughput and temperature, tank capacity, and annual hours of operation (if available). Optional input for the model for which information was collected included the temperature of the oil entering the tank. During the Site 3 sampling effort, it was determined that the temperature of the oil entering the tank was an important variable and could be significantly different from the separator/heater treater temperatures. This measurement was made at each subsequent site.

A number of other process measurements were made when available. These included:

- The number of wells pumping to the site;
- Separator flash gas daily production volume;
- Produced water daily production volume;
- Frequency of activation for the separator oil and water transfer valves;
- Ambient temperature;
- Wind speed;
- Wind direction;

- Physical characteristics of the tank (diameter, height and liquid levels);
- Surface temperature of the tank; and
- Time required for each withdrawal cycle.

Critical and non-critical measurements are detailed in Tables 2-2 and 2-3 in Section 2. All process measurements to be made are shown in Table 3-2.

Table 3-2. Process Measurements

Location	Measurement	Technique	Frequency
General	No. of Wells Pumping to Site Tank Capacity Annual Hours of Operation Physical Characteristics of Tank	Manual Manual Manual Manual	Once Once Once Once
Separator	Temperature Pressure Flash Gas Production Produced Water Production Oil Transfer Valve Cycle Time Water Transfer Valve Cycle Time	Thermocouple or Gauge Gauge Meter Meter Manual Observation Manual Observation	≥ 4/day ≥ 4/day Daily Daily 4/day 4/day
Sales Oil	Temperature Production Rate Withdrawal Cycle Frequency Withdrawal Cycle Duration	Thermocouple Sales Meter Manual Observation Manual Observation	Daily [a] 4/day As occurs As occurs
Ambient Conditions	Temperature Wind Speed Wind Direction Barometric Pressure	Thermocouple Local Airport Local Airport Local Airport	Continuous 2/day 2/day 2/day
Optional	Oil Temperature (into tank) Tank Surface Temperature	Thermocouple Thermocouple	Continuous Continuous

[a] Generally taken during tank withdrawal cycles.

Temperature measurements were made with calibrated thermocouples in locations where they could be recorded continuously with a data logger system. Generally, the tank vent gas, ambient temperature, and the oil temperature as it entered the tank could be recorded continuously. The physical distance between the tanks and the separator/heater treater made continuously recording the separator temperature impractical. In most cases, separator/heater treater temperatures were recorded manually from gauges on the vessel. Temperatures were also recorded manually using a hand held meter and a calibrated thermocouple when the separator/heater treater had a thermowell that could be used to obtain an accurate temperature. In most cases, a thermowell was not available so periodic readings of the temperature were manually recorded from site thermocouples or gauges. Every effort was made to verify the accuracy of the site supplied thermocouple or gauge, but this was not always possible. In most cases, the separator/heater treater temperature was checked by placing a thermocouple on the oil line as it exited the vessel and comparing this temperature to the separator gauge. In addition, the location of the gauge was checked for proper placement so an accurate temperature of the heated oil could be obtained.

The tank vent gas temperature was recorded by a thermocouple inserted into the vent gas stream. Ambient temperature and the surface temperature of the sales oil tank were recorded using thermocouples in appropriate locations, which were determined on site. The temperature of the oil going into the tank was recorded manually at Site 3 using a hand-held, infrared temperature meter. At Sites 4 through 7, this temperature was recorded continuously using a thermocouple attached to the oil line immediately before it entered the tank. This thermocouple was protected from the sun to avoid inaccurate readings.

The temperature of the sales oil was recorded by physically purging some of the oil from the tank and measuring the temperature of this oil. Use of a thermocouple inside the tank was originally proposed to measure this temperature. However, difficulty obtaining a gas tight seal around the wire was encountered and this method was discontinued. Sales oil temperature measurements were taken while the tank was being emptied or by purging sufficient oil to ensure a representative sample could be collected and measured.

Barometric pressure was recorded by calling a local airport (within 50 miles of the site) and obtaining barometric pressure or by retrieving the data via computer modem. Wind speed and wind direction data were available at local airports, but generally were not used in any calculations.

The separator/heater treater pressure was manually recorded at least four times each day by reading a calibrated gauge on site. Generally, a gauge was present on the separator/heater treater which indicated the operational pressure. At some sites, this gauge was located in the produced gas line exiting the separator/heater treater. In the situations where the gauge could be isolated from the pressure vessel, the vessel gauge was removed and a calibrated gauge substituted to determine the accuracy of the host site gauge. In all cases, the existing gauge recorded within 1 psig of the calibrated gauge.

Sales oil throughput was recorded at least twice per day by reading the production meter on site. No attempt was made to calibrate the sales meter. At Sites 4, 6, and 7, production was recorded by gauging the tank before sales oil removal. The time required for each tank withdrawal cycle was manually noted, recorded, and compared with flow rates calculated from the sales oil meter. Other data recorded once each day included the separator flash gas and produced water volumes (recorded from site meters). These parameters were not available at all sites.

The pressurized oil flow rate between the separator and the tank could have an impact on short term emissions (i.e., minutes to hours), but should be averaged out over longer periods of time (over the course of days). Therefore, the sales oil production rate was used in all calculations. Each site was checked for the presence of a flowmeter between the separator and tanks, but none of the sites had such an arrangement. Since most sites had a very short distance (generally less than two feet) between the separator/heater treater and the oil transfer valve, addition of a flowmeter would have required significant modifications and would have stopped production while modifications were being made. Future sampling efforts will evaluate other means of measuring this flow rate, such as an ultrasonic flow device, to determine its effect on comparison between the model and measured emissions.

Data recorded once at each site included the number of wells pumping to the tank battery, the tank volumes (taken from the tank faceplate), physical characteristics of the tanks (tape measure), and annual hours of operation (from site operator).

ANALYTICAL METHODS

This section outlines the analytical procedures that were used during the course of this study. Table 3-3 presents a summary of methods associated with each type of sample analysis.

Tank Vent Gas Canister Sample - Hydrocarbons and Permanent Gases by GC-FID and GC-TCD

Sample Preparation. Pre- and post-collection canister pressures were measured in the laboratory under relatively constant temperature and ambient pressure conditions to allow sample collection volumes to be calculated. Laboratory recorded pressures were checked against those recorded in the field as a possible indication of canister leakage in transit. Canisters were pressurized to approximately 15 psig with ultra-high purity (UHP) helium before analysis. A dilution factor was calculated from the sample volume and the final post-dilution canister pressure.

Table 3-3. General Analytical Methods

Sample	Method	Target Analytes	Laboratory
Separator Gas	GPA 2261-90	C_1-C_5 Hydrocarbons, N_2, CO_2, H_2S, O_2	CORE
	GPA 2286-86	C_6-C_{10+} Hydrocarbons, Aromatics	
Crude Oil/Condensate Gas and Liquid Fractions	GPA 2261-90 (gas)	C_1-C_5 Hydrocarbons, N_2, CO_2, H_2S, O_2	CORE
	GPA 2186-86 (liquid)	C_6-C_{10+} Hydrocarbons, Aromatics	
Tank Vent Emissions	ASTM D1946-90 EPA Method TO-14	N_2, CO_2, O_2, CO, CH_4 Benzene, Toluene, Ethylbenzene, Xylenes, C_1-C_{10+} Hydrocarbons	Radian
	EPA Method 18	C_1-C_{10+} Hydrocarbons, N_2, O_2, CO, CH_4	On-Site GC/FID/TCD
Sales Oil	ASTM D-323 - 94	Reid Vapor Pressure	CORE
	ASTM D-1298 - 85	API Gravity	CORE
	GPA 2186-86	C_1-C_{10+} Hydrocarbons, Aromatics	CORE

<u>Sample Analysis for Hydrocarbons and Permanent Gases</u>. Canister samples were analyzed by a modification of EPA Compendium Method TO-14[7] for the hydrocarbons and ASTM Method D1946-90[8] for the permanent gases. Analytical instrument conditions for the hydrocarbon and permanent gas analyses are shown in Tables 3-4 and 3-5, respectively. All samples were stored and analyzed at room temperature. The target analytes for this method were selected C_2-C_{10+} hydrocarbons, including benzene, toluene, ethylbenzene, and xylenes. Quantitation of the target compounds was based on averaged individual response factors. Non-target compounds were quantitated using a carbon response factor for the FID instrument based on the response of hexane. Quantitation for permanent gases was based on individual response factors for each of the permanent gases. Gas samples collected in canisters were analyzed within 21 days of sample collection.

Table 3-4. Conditions for Tank Vent Gas Canister Samples Hydrocarbon Analysis

Operating Parameter	Operating Conditions
Instrument	Hewlett-Packard 5880 or Varian 3700
Data System	PE Nelson TurboChrom
Detectors	Flame Ionization and Photoionization Detectors
Injection System	Cryogenic Focusing/Thermal Desorption or Fixed Loop Injection
Column	60 m x 0.32mm id DB-1, 1 μm Film Thickness Fused Silica Capillary, J&W or 60 m x 0.32mm id RTX-1, 3 μm Film Thickness Fused Silica Capillary, Restek
Carrier Gas	Helium
Carrier Flow Rate	~3 mL/min
Make-up Gas	Nitrogen @ 30 mL/min
Temperature Program	-50°C for 2 min.; Programmed at 6°C/min to 150°C, Then 150°C to 250°C at 20°C/min; No Final Hold
Cryogenic Trap Temperature	-186°C
Trap Desorption Temperature	180°C

Table 3-5. Conditions for Tank Vent Gas Canister Samples Permanent Gas Analysis

Operating Parameter	Operating Conditions
Instrument	Hewlett-Packard 5710A
Data System	PE Nelson TurboChrom
Detector	Thermal Conductivity
Injection System	Fixed Volume Loop (0.5 mL)
Column(s)	1.5 ft x 1/4 inch o.d. Glass Column, Mole Sieve 5A, 80/100 Mesh Packing 2.7 ft x 1/4 inch o.d. Glass Column, Porapak Q, 80/100 Mesh Packing
Carrier Gas	Helium
Carrier Flow Rate (each column)	40 mL/min
Temperature Program	50°C, Isothermal

Tank Vent - EPA Method 18:[9] On-Site GC Determination of Hydrocarbons and Permanent Gases by GC-FID/TCD

Sample Preparation. Vent gas sample was extracted directly from the vent gas line through heat traced (in cold weather) 1/4-inch stainless steel tubing, into the GC sample loops, through a small sample pump and then vented to the atmosphere (Sites 1 and 2). The fixed volume of the sample loops was injected directly into the GC. A nominal loop size of 0.5 mL was used for the FID, and a nominal 1.0 mL loop was used for the TCD system. Sample flowed continuously through the sample lines and pump to avoid condensation or losses on the walls of the tubing.

At Sites 3, 4, and 5, dilution of the sample was necessary for the FID instrument in order to quantitate the high levels of compounds in the C_1-C_6 range. The sample was carefully diluted to avoid diluting target analytes, such as ethylbenzene and the xylenes, below the detection range of the instrument. Therefore, precise control of the dilution ratio was required and was site specific, although dilution factors were in the range of 10 to 20. These dilution factors were established at each site and were verified through the analysis of diluted standards. Samples analyzed on the TCD for permanent gases and C_1-C_3 hydrocarbons were not diluted.

Sample Analysis. Gas samples delivered directly to the on-site analytical system were semi-continuously analyzed for hydrocarbons (C_4-C_{10+}) using a gas chromatograph equipped with a FID. Analytical system operating conditions are listed in Table 3-6.

Table 3-6. On-Site Gas Analysis for C_4-C_{10+} Hydrocarbons

Operating Parameter	Operating Conditions
Instrument	Tracor 540
Data System	PE Nelson 2600
Injection System	Automated Fixed Volume Loop
Column	5 µm film RTX-1, 60 Meters by 0.53 mm id. Capillary
Carrier Gas/Flow Rate	Helium, Flow Rate 6 mL/min
Make-up Gas/Flow Rate	Helium, Flow Rate 30 mL/min
Fuel Gases Hydrogen Air	 35 mL/min 350 mL/min
Temperature Program [a]	40°C for 5 Minutes, Programmed at 8°C/min to 200°C, Hold for 11 Minutes

[a] Nominal temperature program. An appropriate temperature program was used to obtain the best separation for the simultaneous FID and TCD analysis based on concentrations and conditions encountered at each site.

Concurrent with the GC-FID analysis, permanent gases and C_1-C_3 hydrocarbons were analyzed using a thermal conductivity detector system (TCD). Analytical conditions for the TCD system are presented in Table 3-7. The instrument was configured with two gas sampling valves to perform the simultaneous analyses. Each column/detector system employed a loop injection valve for introducing a fixed volume of sample onto the column. The sample loops for the FID and TCD were simultaneously filled before injection. Quantitation of target analytes was based upon compound-specific response factors, where calibration standards were available for the target compounds and a carbon response factor derived from n-hexane for all compounds for which a standard was not available.

Table 3-7. On-Site Gas Analysis for Permanent Gases and C_1-C_3 Hydrocarbons

Operating Parameter	Operating Conditions
Instrument	Tracor 540
Data System	PE Nelson 2600
Injection System	Automated Fixed Volume Loop
Column	10 ft. by 1/8" o.d. Stainless Steel Packed with Molecular Sieve 13X
Carrier Gas/Flow Rate	Helium, Flow Rate = 30 mL/min
Pre-Column	18" x 1/8" o.d. Stainless Steel Packed with 3% OV-101 on Chromosorb
Pre-Column Backflush Gas/Flow Rate	Helium, Flow Rate = 30 mL/min
Temperature Program [a]	40°C for 5 Minutes, Programmed at 8°C/min to 200°C, Hold for 11 Minutes

[a] Nominal temperature program. An appropriate temperature program was used to obtain the best separation for the simultaneous FID and TCD analysis based on concentrations and conditions encountered at each site.

Separator Flash Gas - Hydrocarbons and Permanent Gases by GC-FID/TCD (Analyzed by Core Laboratories)

Sample Preparation. Samples received in the laboratory at pressure were bled down to approximately 30 psig in cases where the separator/heater treater pressures were more than 30 psig. Samples were heated to 140°F and allowed to equilibrate at that temperature for 2 hours prior to analysis. Samples were stored at room temperature when not in the analysis queue.

Sample Analysis for Hydrocarbons and Permanent Gases by GC-FID/TCD. Samples collected in high-pressure cylinders were analyzed for C_1-C_5 hydrocarbons, nitrogen, carbon dioxide, hydrogen sulfide, and oxygen using GPA Method 2261-90.[10] Analysis of C_6-C_{10+} hydrocarbons and aromatic compounds followed GPA Method 2286-86.[11] Analytical conditions for both methods appear in Table 3-8. Target analyte concentrations were derived from individual compound response factors.

Liquid Samples

Two types of liquid samples were collected, sales oil and the pressurized liquid crude oil/condensate from the separator/heater treater.

Separator Crude Oil/Condensate - Hydrocarbons by GC-FID. The liquid sample volume in the cylinders was determined by weighing the cylinders before and after sampling. Density measurements were either made or assumed to convert the sample weight to volume. These measurements were used in conjunction with the known volume of the cylinders as a check that liquid was collected in the field. Hydrocarbon analysis for C_1-C_{10+} hydrocarbons, including benzene, toluene, ethylbenzene, xylenes, and other aromatics, was performed according to GPA Method 2186-86.[12] The liquid oil/condensate samples collected in the high-pressure cylinders were above atmospheric pressure (at the separator/heater treater pressure) and were known to contain dissolved gases. The gas and liquid phases were not separated prior to analysis. The analytical method, GPA 2186-86, uses a pressurized loop injection system to introduce the sample into the instrument. In this manner, liquid components and dissolved gases are analyzed in one chromatographic run. Analytical system conditions were similar to those found in Table 3-8 under C_6-C_{10+} hydrocarbon analysis with the exception of the injection system. Target analyte concentrations were derived from individual response factors.

Table 3-8. Conditions for Separator Flash Gas Sample Analysis

Permanent Gas and C_1-C_5 Hydrocarbon Analysis	
Instrument	GC/TCD
Detector	Thermal Conductivity Detector
Injection System	Fixed Volume Loop
Column(s)	Mole Sieve 13X/Silicon Oil DC200-500
Carrier Gas	Helium
Carrier Flow Rate	~35 mL/min
Temperature Program	135°C
C_6-C_{10+} Hydrocarbon Analysis	
Instrument	GC/FID
Detector	Flame Ionization Detector
Injection System	Fixed Volume Loop/Pressure Differential
Column	Methyl Siloxane, 50 m x 0.32 mm id, 2 μm Film Thickness
Carrier Gas	Helium
Carrier Flow Rate	~1.0 mL/min
Temperature Program	40°C for 5 min, 6.5°C/min to 80°C hold 0.1 min., 15°C/min to 200°C hold 15 minutes

Sales Oil - Reid Vapor Pressure/API Gravity. The Reid Vapor Pressure and API gravity of sales oil samples were determined by ASTM D-323[13] and ASTM D-1298[14], respectively. The composition of the sales oil was determined by GC/FID using GPA Method 2186-86 for the extended analysis of hydrocarbon liquids. One sample was analyzed from each collection day.

Section 4
SITE SELECTION, DESCRIPTIONS AND EMISSION MEASUREMENTS

This section will describe the criteria used in site selection, a description of each of the sites sampled, and the emission measurement results at each site.

SITE SELECTION

Site selection was based primarily on the physical characteristics of the crude oil or condensate and the site applicability to the program objectives. An API gravity for the crude oil of between 20 and 40 was desired; and for the condensate, the desired API gravity was 40 to 65. A single vent from one set of oil/condensate tanks was desired for each site. In addition, it was highly desirable that the oil tanks vent line be isolated from any produced water tanks and their vent line(s). Bolted tanks were not considered as potential sampling candidates due to the difficulty in assuring a leak-free system. The welded tank criteria eliminated a very large percentage of potential sites.

Suitability for sampling was also based on the following, less critical criteria:

- Oil throughput;
- Separator/heater treater temperatures and pressures;
- Tank integrity;
- Sample port availability;
- Accessibility of tank vents;
- Site locations;
- Safety considerations (e.g., presence of H_2S);
- Required site modifications; and
- Mobile laboratory space and power considerations.

Proposed sampling sites were screened by site visits before sampling to determine the suitability of the site. All sites were reviewed and approved by the API project group chairman before sampling was initiated. Due to different configurations at each site, modifications were made as necessary to obtain the information critical to model evaluation. These modifications will be described below. A summary of the site characteristics of each site sampled is included in Table 4-1.

Table 4-1. Summary of Site Characteristics

Site Number	Production Rate (bopd) [a]	API Gravity	Reid Vapor Pressure (psia)	Separator Temperature (°F)	Separator Pressure (psig)
1	188	38.6	8.03	76	17
2	1600	43.2	8.70	112	30
3	440	48.8	8.07	112	22
4	259	36.8	5.50	145	46
5	451	48.8	7.40	112	29
6	12	55.5	11.1	86	570
7	60	58.4	15.2	72	495

Average values for the sampling period.
[a] bopd = Barrels of oil per day

SITE DESCRIPTIONS AND EMISSION MEASUREMENTS

A detailed description of each site sampled during the course of this project is included in this section. Any site modifications or difficulties with collecting valid samples are discussed. Site conditions during sampling and emission measurements are also included and discussed.

Emissions from each site are presented in pounds per hour to accurately reflect measured emissions across the measurement periods of one to four days. Model predictions recorded in Section 5 are also presented in pounds per hour for direct comparison. The emissions can easily be converted to tons/year; but since measured temperatures, pressures, etc., do not reflect yearly averages, these units have not been used to report results.

Site 1 Description

Site 1 was located in West Texas. It consisted of three 410-barrel tanks which included a produced water tank, an oil production tank, and a reserve oil tank. All three tanks were connected by a common 2-inch vent line. Other site characteristics are presented in Table 4-2. Separator gas samples were collected from the heater treater fuel gas line immediately after it split from the sales gas line. Pressurized oil samples were collected from a sample port on the upstream side of the separator transfer valve. This valve remained closed until a certain liquid level was achieved in the separator and then it opened to allow oil flow to the tank. Therefore, the samples were collected before the valve since a pressure drop and possible flashing occurred between this valve and the tank. The separator temperature was monitored by inserting a thermocouple into the thermowell normally occupied by the heater treater thermocouple. The heater portion of the separator was not operational during sampling. The separator flash gas production rate was determined from an on-site sales gas meter.

Sales oil samples were collected from a sample port immediately after the oil tank level controller. Since the line contained stagnant oil, sales oil samples were only collected during tank pumping cycles or by thoroughly purging the oil line to get a representative sample from the tank. Sales oil temperatures were recorded several times each day by purging oil from the line until a representative sample was obtained before measuring the temperature.

The vent gas flow rate and composition samples were taken from a 4-inch port in the upper edge of the reserve oil tank and not from the normal vent line. The 4-inch line was reduced to 2 inches and finally to 1 inch in order to connect the dry gas meter used

Table 4-2. Site 1: Characteristics During Sampling

Characteristic	Measurement
Number of Tanks	Three
Size of Tanks	410 bbl each
Produced Water Flash Included in Vent	Yes
Vapor Recovery Unit	Yes, Bypassed for Testing
Number of Wells	Eight
Wells Continuously Producing	No, Production on Timers
LACT Unit	Yes
Tanks Level Controlled	Yes
Oil Production	188 bbl/day
Separator Gas Production	120 Mscfd
Separator Pressure	17.3 psig
Separator Temperature	75.6°F
Average Vent Gas Flow Rate	8.33 scfm
Sales Oil API Gravity	38.6°
Sales Oil Reid Vapor Pressure	8.03 psia

to measure vent flow. An orifice plate was not used at this site to measure flow due to the failure of both the primary and backup data system computers. Canister samples were collected from a 2-inch section of line extending from the tank. Continuous GC samples were taken from inside the tank by running 1/8-inch stainless steel tubing through the 2-inch line into the top of the tank. This action was taken to minimize the amount of ambient air sampled during periods of negative flow.

Daily oil production was recorded from an on-site sales oil meter. Generally, the tank levels were automatically controlled between 5.5 and 7.5 feet leaving approximately 9 feet of headspace in the primary oil tank. The lease custody automatic transfer (LACT) unit removed oil from the tank approximately four times each day at a rate of about 1.3 barrels/minute. It generally operated about 40 minutes and pumped about 50 barrels of oil into the pipeline. The produced water tank was operated automatically at similar levels with the water going to a central injection well. The produced water meter was not operational, so the amount of water could not be recorded. However, site personnel indicated that approximately one barrel of water was produced for two barrels of oil. The reserve oil tank was empty during sampling. The vent gas at the top of the reserve oil tank was a composite of the gas emissions from the oil and produced water tanks. The contribution from the produced water tank could not be separated from the oil tank emissions at this site.

Site 1 Emission Measurements

Vent flow rates were measured using a 4-inch port in the upper edge of the reserve oil tank and not the 2-inch vent line. The vent line was sealed by an Enardo™ pressure equalization valve which opened at approximately 2 ounces per square inch (osi) of pressure or vacuum. Therefore, the Enardo™ acted as a pressure-relief valve; only opening when the pressure on the tanks exceeded 2 osi or where a corresponding vacuum was pulled on the tank. During times of high production, with six or more wells pumping, vent gas pressure opened the Enardo™ valve and some vapor escaped unmeasured. It was estimated emissions lost through the Enardo™ constituted 10% or less of the total vent flow during times of high production.

The tank Thief hatches were also designed to open and relieve pressure (or vacuum) at 2 to 4 ounces per square inch. It was determined that these Thief hatches were continually leaking vapors around the seals. Measured flow rates were lower than actual due to the amount of vapor escaping around the hatch lids. Host site personnel replaced the gaskets in the oil tank Thief hatches and a solid gasket was fashioned for the water tank hatch. In addition, each hatch was bagged using two heavy duty plastic bags taped to the exterior of the hatch. These 35-gallon bags indicated the magnitude of the leak around the hatches by the amount of time required to fill them.

The Rockwell dry gas meter measuring vent flow had a flow of around 500 scfh at a pressure of 1 to 1.5 inches of water column under average flow conditions. During times of high flow, the dry gas meter recorded flow as great as 970 scfh at a backpressure of seven or more inches of water. Some gas was lost through the Enardo™ valve and through diffusion at the bagged hatches during these times. Since the higher flows were above the calibration range of the gas meter, an additional calibration point was added at the higher levels after completing the sampling effort. The dry gas meter was accurate in the flow ranges measured.

During the times when no wells were pumping, oil was being pumped from the tank, or when water was pumped from the produced water tank, the dry gas meter ran backwards as air flowed back into the tank to replace the volume of oil or water removed. These times of negative flow were averaged into the flow measurements recorded from the dry gas meter. Therefore, during each measurement period of approximately 45 minutes, the dry gas meter reading would reflect the amount of gas exiting the vent minus the amount of air flowing back into the tank. Added to the wells turning on and off at preset intervals, the periods of positive and negative flow resulted in highly variable vent flow rates as shown in Figures 4-1 and 4-2. The variability in flow was observed to be more of a function of the number of wells pumping at any given time, though some contribution from ambient heating was observed.

The average flow measured over three days was 8.33 scfm with a standard deviation of 4.92 scfm. The measured flow rates represent only daytime contribution. Since the measurements were made manually, flows were not measured at night (approximately 8:00 pm until 7:00 am). Therefore, the average flow rates do not reflect the nighttime well pumping schedule or variations caused by cooling ambient temperatures. Based on the average vent flow rate, the volume of the three tanks connected by the common

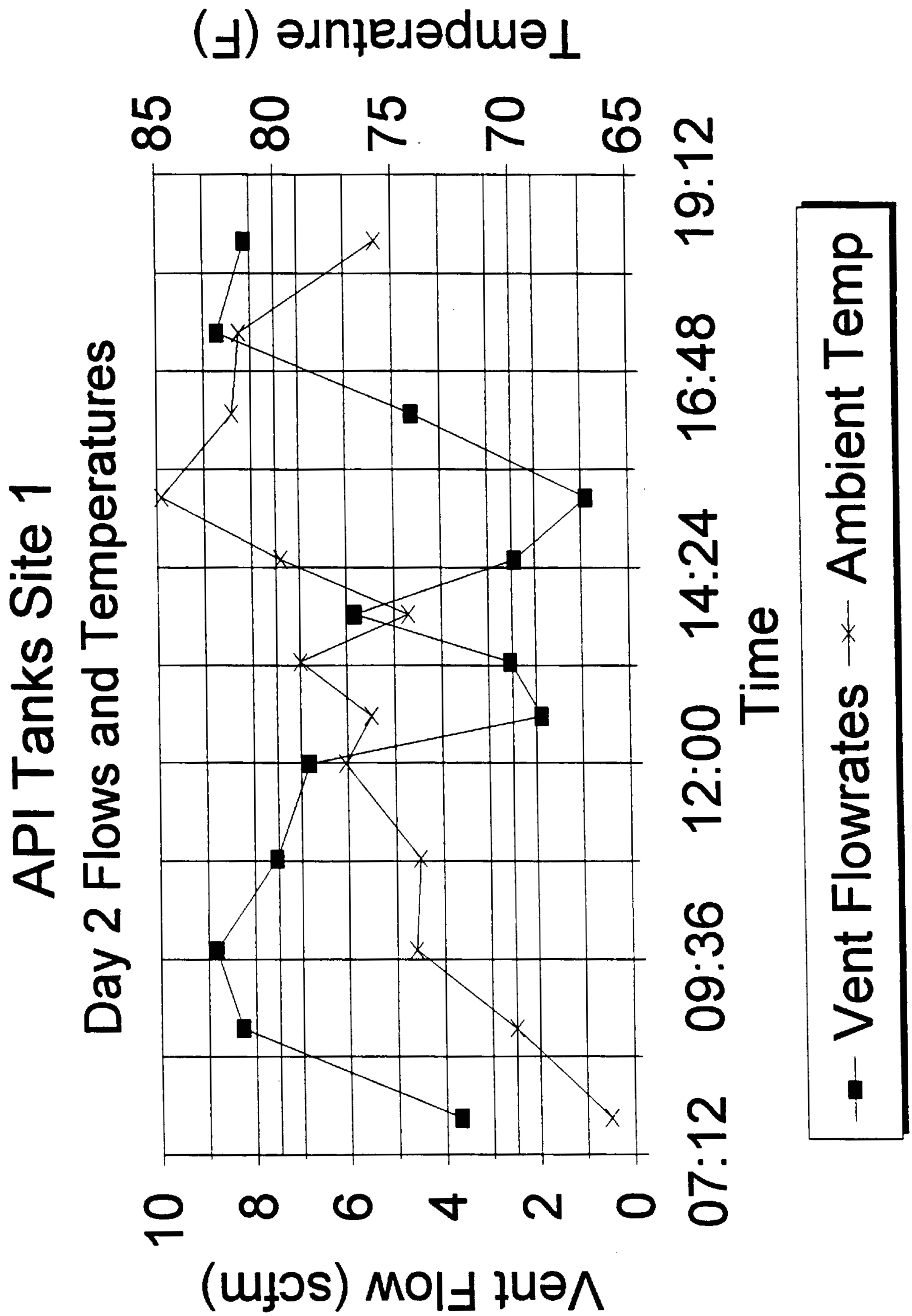

Figure 4-1. Site 1, Day 2: Vent Flows and Ambient Temperature

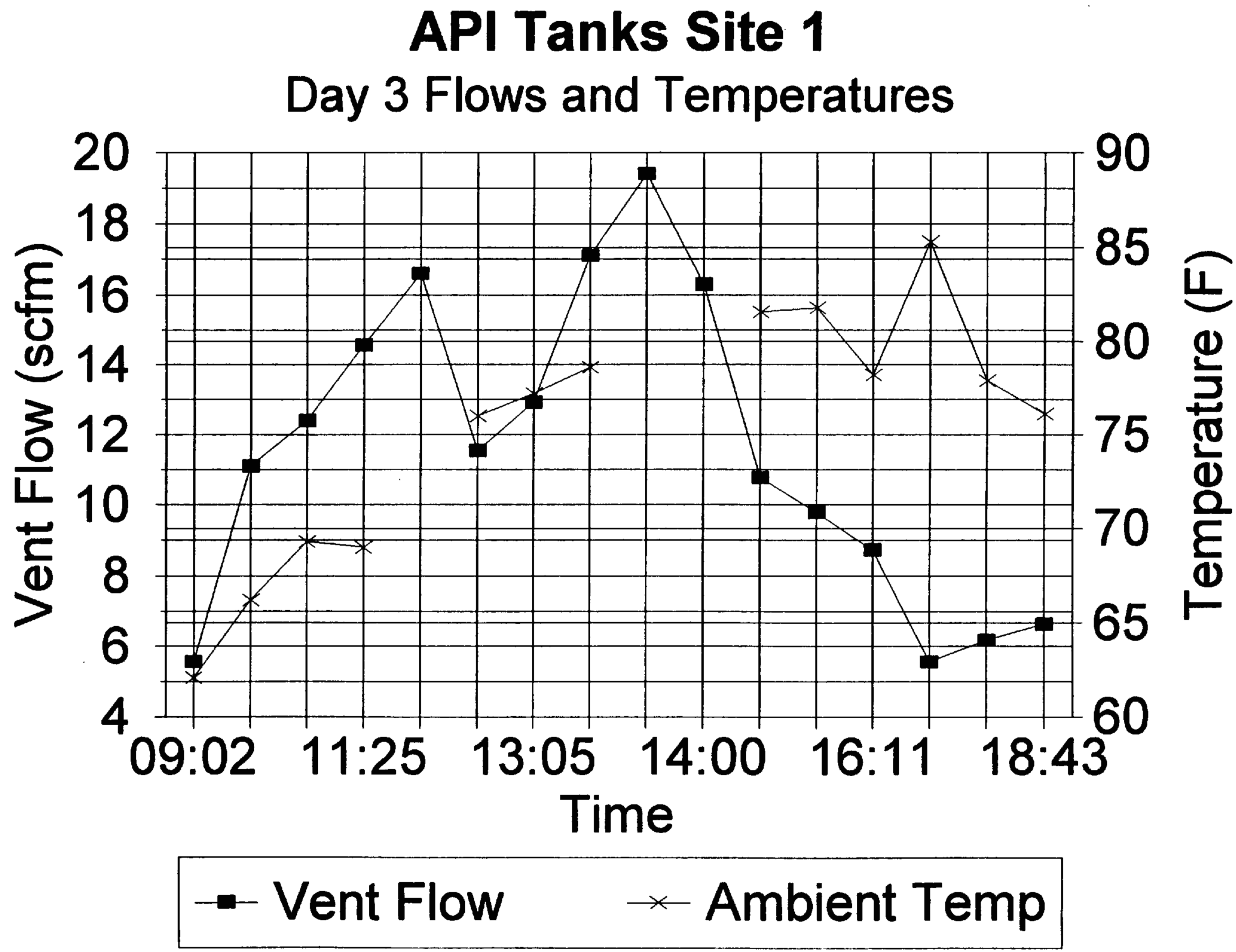

Figure 4-2. Site 1, Day 3: Vent Flows and Ambient Temperature

vent, and estimated liquid levels of 8 feet in both the oil and water tanks, the vapor residence time in the tanks could be as long as 9.2 hours, assuming steady-state flow rates.

The vent gas composition was measured by on-site GC approximately every 40 minutes (day and night) over the three day monitoring period. The concentrations were averaged over the monitoring period to reflect an average concentration (presented in Table 4-3). The relative standard deviations (RSDs) are included as a measure of the variability of the concentration measurements. The RSDs represent variability in the gas stream composition plus any contribution from the sampling and analytical systems. For most compounds, the variability in the RSDs over the monitoring period was less than 20% indicating a relatively constant vent gas composition. The concentrations for the various components of the vent gas have been used with the average vent flow rate to calculate emissions in pounds per hour. These average measured emissions will be compared to the model output in Section 5.

As shown in Table 4-3, the butanes and pentanes were measured fewer times than the other compounds. These compounds were over-ranged on the GC/FID and were not measured on the TCD. The 16 measurements were syringe dilutions of the vent gas stream to quantify these compounds. All other compound concentrations were the averages of 57 to 65 analyses made over the three-day sampling period.

It should be noted that the compound concentration measurements were made on a 24 hour basis, but flow measurements were made on a 13 hour basis. Therefore, the calculated emissions do not represent 24 hour per day operation. The calculated emissions were considered to be an inadequate test for the E&P TANK model because continuous measurements were not made for comparison purposes.

Twelve-hour composite canister samples were also analyzed for the target hydrocarbons. As with the on-site GC concentrations, the canister concentrations were

Table 4-3. Site 1: Average Emission Measurements from On-Site GC and Canisters

Compound	On-Site GC Measurements				Canister Sample Measurements			
	Concentration (ppmv)	RSD (%)	No. of Meas.	Emissions (lbs/hr)	Concentration (ppmv)	RSD (%)	No. of Meas.	Emissions (lbs/hr)
Oxygen	8,425	170	57	0.36	19,500	52.5	6	0.82
Nitrogen	54,478	99.4	57	2.01	113,800	36.3	6	4.20
Methane	331,436	20.3	59	7.00	357,300	20.1	6	7.55
Ethane	102,053	19.6	58	4.04	110,383	8.7	6	4.38
Propane	241,779	7.7	57	14.04	216,077	8.3	6	12.54
i-Butane	27,537	17.6	16	2.11	23,782	13.0	6	1.82
n-Butane	98,910	18.6	16	7.57	97,271	11.2	6	7.46
i-Pentane	22,655	17.0	16	2.15	18,735	14.0	6	1.78
n-Pentane	22,287	17.1	16	2.12	19,038	14.5	6	1.81
n-Hexane	3,187	15.2	64	0.36	2,933	14.8	6	0.33
n-Heptane	1,249	33.4	65	0.16	-	-	-	-
Benzene	264	11.7	64	0.03	195	13.7	6	0.02
Toluene	488	22.7	64	0.06	223	14.1	6	0.03
Ethylbenzene	70	26.0	64	0.01	53	20.6	6	0.01
m,p-Xylene	53	39.9	62	0.01	42	23.6	6	0.01
o-Xylene	23	40.9	63	<0.0	16	25.4	6	<0.0
Other C_5	-	-	-	-	1,317	14.3	6	0.13
Other C_6	8,021	24.3	65	0.91	9,872	14.7	6	1.12
Other C_7	10,228	16.0	65	1.35	6,363	14.5	6	0.84
C_8	4,338	23.6	65	0.65	1,237	19.5	6	0.19
C_9	1,189	38.8	65	0.20	180	45.0	6	0.03
C_{10+}	631	83.8	64	0.12	37	85.9	6	0.01
Total	939,302	-	-	-	998,354	-	-	-
Total BTEX	-	-	-	0.11	-	-	-	0.06
Total HAP	-	-	-	0.47	-	-	-	0.39
Total C_{3+} VOC	-	-	-	31.92	-	-	-	28.04
Total C_{2+} VOC	-	-	-	35.80	-	-	-	32.38
Total HC	-	-	-	42.86	-	-	-	40.13

averaged over the three-day period (a total of six canisters). The average canister concentrations and the emission measurements from these samples based on the average vent flow rate of 8.33 scfm are also presented in Table 4-3. Measurements from individual canisters can be found in Appendix D.

Comparison of emissions measured with canisters to those measured with the on-site GC show good agreement for most of the target analytes. The canister samples reflect more ambient air flow back into the tank than the on-site GC samples due to placement of the sample line. The on-site GC also provides higher concentrations for the C_7-C_{10+} hydrocarbons. These higher concentrations may be due to condensation in the vent or sample lines or possibly condensation in the canister. A small amount of condensation was observed in the vent lines and in the dry gas meter during sampling.

The on-site GC measured toluene approximately two times higher than the canister sample. The toluene discrepancy is likely due to a co-eluting hydrocarbon on the on-site GC column which is identified and quantitated as toluene. This results in increased BTEX and HAP emission estimates from the on-site GC. Toluene emissions from the canister samples will be used in the model comparisons in Section 5.

All quality control samples called for in the Quality Assurance Project Plan (QAPP) were collected at Site 1. The results from the analysis of QC samples are presented in Appendix C. In general, duplicate samples gave very low relative percent differences (RPDs) for most compounds. As can be expected, compounds measured near the detection limits exhibited higher RPDs in duplicate samples.

<u>Site 2 Description</u>

Site 2 was a water flooded oil field in southeastern Colorado. It consisted of four 1000-barrel tanks connected by a common 3-inch vent line. The production rate was 1600 barrels of oil per day. The site also had two 300-barrel test tanks which had their own vent system. These test tanks were not used during emissions testing. The produced water flowed directly into a 5000-barrel raw water tank which was used to supply the injection wells. The site also had a 1500-barrel water tank and three 300-barrel water tanks. All water tanks were blanketed with produced gas from the heater treater and had no emissions. Other site characteristics are provided in Table 4-4.

Table 4-4. Site 2: Characteristics During Sampling

Characteristic	Measurement
Number of Oil Tanks	Four
Size of Oil Tanks	1000 bbl
Produced Water Flash Included	No, Produced Water Separate
Vapor Recovery Unit	No
Number of Wells	Seven
Wells Continuously Produce	Yes, Water Flooded Field
LACT Unit	Yes
Tanks Level Controlled	No, Product Trucked from Site
Oil Production	1600 bbls/day
Gas Production	Not Measured
Separator/Heater Treater Pressure	30 psig
Separator/Heater Treater Temperature	112°F
Average Vent Gas Flow Rate	74.9 scfm
Oil API Gravity	43.2°
Oil Reid Vapor Pressure	8.7 psia

Produced oil and water from this site went into a large horizontal heater treater operating at 30 psig and 112°F. The heater treater was fired using flash gas from this separation. Excess flash gas was used as blanket gas on the water tanks. Vent lines were present which would allow a very small amount of flash gas to be vented to the atmosphere, but gas flow from these lines was not observed. Total production of flash gas was not recorded, but it was a relatively small amount compared to the oil production. The pressure differential between the oil at the wells and the 30 psig heater treater was not determined.

Separator gas samples were collected from the feed gas line on the heater treater. Pressurized oil samples were collected from pipes in the end of the heater treater which extended into the oil. The heater treater temperature and pressure were recorded manually from the site-supplied thermometer and gauge, respectively.

Sales oil samples were collected from a sample port in the oil line immediately before the sales meter. Oil samples were only collected during pumping cycles. Oil was removed by truck with each truck carrying approximately 190 barrels. Eight to nine trucks per day were required to remove the 1600 barrels of oil produced. Each truck required approximately 30 minutes to fill. Negative vent gas flows were not observed during oil removal cycles.

Site 2 Emission Measurements

Vent gas flow rate and composition samples were collected from 2-inch extensions of the 3-inch vent pipe. The Enardo™ valve was removed and the 3-inch vent pipe was extended to the catwalk for easy access. Initially, a single 2-inch extension with a 1.25-inch orifice plate was used in an attempt to measure the gas flow rate. This arrangement provided too much backpressure on the tanks causing the Thief hatch valves to open and vent gas. The Thief hatch seals were replaced in an attempt to make the system leak tight. Vent gas flow rates were then measured using a tee system and two 2-inch lines with orifice plates in each to avoid adding backpressure. Total flow was determined by adding the two individual flows together. However, it was determined that the 3-inch vent line was too small to accommodate the amount of gas produced or was partially obstructed near the tanks. The resulting backpressure caused the Thief hatch vents to open and vent a portion of the gas. It was estimated that the amount of gas lost through the vents was 10% of the total flow.

Due to the problems noted above, the flow was only monitored for a period of five hours on one day. This time period reflected the best conditions of sealing the hatches and measuring flow using the dual orifice system. Despite the maintenance and precautions taken, some vent gas was lost through the Thief hatches during this measurement period. As noted above, it was estimated to be approximately 10% of the total flow. Therefore, the average flow rate during this time, 74.9 scfm with a RSD of 13.6% should be used as a minimum. Data have not been corrected for unmeasured emissions. Flow was positive at all times, including truck loading periods.

One on-site GC analysis was performed during the vent flow measurements. Due to the warmth of the oil entering the tank (~100°F) and the cold ambient temperatures (20 to 30°F at night), condensation was observed in the vent line, GC sample lines, and in the GC injection loops. Numerous attempts to heat the lines and clean out the liquids resulted in one valid sample analysis during the monitoring period. The results of the on-site GC analysis are shown in Table 4-5.

The compounds normally analyzed on the TCD could not be quantitated. The response for methane, ethane, and propane on the FID, even at a 1 to 10 dilution, was over-ranged on the FID and could not be quantitated. Therefore, a total C_{2+} VOC and total hydrocarbons could not be quantitated for this analysis. However, total BTEX, total HAP, and an estimate of the total C_{3+} VOC emissions were made.

A canister sample was collected during the time the vent flow was measured. The results from the analysis of this canister are presented in Table 4-5. The results of this time-integrated canister do not agree with the on-site GC as well as those from Site 1, presumably due to the problems with condensation in sample collection lines. As a general rule, the on-site GC provided higher concentrations for the heavier

Table 4-5. Site 2: Average Emission Measurements from On-Site GC and Canisters

Compound	On-Site GC Measurements		Canister Measurements	
	Concentration (ppmv)	Emissions (lbs/hr)	Concentration (ppmv)	Emissions (lb/hr)
Oxygen	NM [a]	-	0 [b]	0
Nitrogen	NM [a]	-	20,809	7.11
Carbon Dioxide	-	-	5,689	3.06
Methane	NM [a]	-	123,249	24.17
Ethane	NM [a]	-	142,157	52.21
Propane	182,700 [c]	98.50	285,517	153.67
I-Butane	71,600	50.84	47,623	33.74
n-Butane	127,000	90.06	166,557	118.33
I-Pentane	49,500	43.55	37,207	32.60
n-Pentane	57,600	50.84	82,862	72.96
n-Hexane	15,700	16.53	18,350	19.31
n-Heptane	6,000	7.36	-	-
Benzene	3,823	3.65	2,046	1.95
Toluene	4,240	4.77	1,183	1.33
Ethylbenzene	63.3	0.08	214	0.28
m,p-Xylenes	183	0.24	568	0.74
o-Xylene	129	0.17	181	0.23
Other C_6	19,852	20.91	30,649	32.38
Other C_7	5,477	6.70	25,406	31.01
C_8	8,570	11.95	8,544	11.92
C_9	3,195	5.02	1,836	2.87
C_{10+}	2,987	5.20	199	0.35
Total	552,619	-	1,000,846	-
Total BTEX	-	8.91	-	4.54
Total HAP	-	25.54	-	23.94
Total C_{3+}VOC	-	416.33	-	513.91
Total C_{2+} VOC	-	NM	-	566.12
Total Hydrocarbon	-	NM	-	590.29

[a] Not Measured
[b] Normalized for the amount of oxygen. No oxygen was detected in the pressurized oil sample.
[c] Estimation; peak over range on GC.

components. However, due to the problems with condensation observed with the GC, the canister sample is considered to be more representative of the vent flow composition and site emissions. The canister sample analysis is used in Section 5 for model comparison.

Since measurements were made over a relatively short time period during one day, the measured emissions from this site may not totally consider diurnal fluctuations. However, the production rate at this site was high and the oil very warm, both of which tend to negate the effects of ambient heating and cooling cycles on measured emissions.

The numerous problems with measuring vent flows encountered at this site precluded the collection of the planned QC samples. During the short collection and measurement period, individual samples of the separator gas, separator oil, and sales oil were collected. No duplicate samples were collected.

Site 3 Description

Site 3 consisted of a condensate collection facility associated with natural gas production located in southern Louisiana. The site produced approximately 11 MMscfd of natural gas and approximately 500 bbl/day of condensate. Other site characteristics are provided in Table 4-6.

A high-pressure separator removed the liquids and dropped the pressure from over 1000 psig to 60 psig. The condensate then went to a heater treater operating at 22 psig and 112°F. The flash gas from this heater treater was used as fuel gas for the heater treater and other processes. Gas samples and pressurized condensate samples were collected at the heater treater before pressure reduction. Temperatures for the heater treater condensate were taken from a site-supplied thermocouple, but these readings were from near or within the firebox and were considered to be higher than the actual condensate temperature. Therefore, the temperature of the condensate

Table 4-6. Site 3: Characteristics During Sampling

Characteristic	Measurement
Number of Tanks	Two
Size of Tanks	5000 bbl
Produced Water Flash Included in Vent	No, separate Vent
Vapor Recovery Unit	Yes, Bypassed for Testing
Number of Wells	Two
Wells Continuously Producing	Yes
LACT Unit	Yes
Tanks Level Controlled	No, Product Trucked from Site
Oil Production	438 bbl/day
Separator/Heater Treater Gas Production	Not Measured
Separator/Heater Treater Pressure	21.8 psig
Separator/Heater Treater Temperature	112°F
Average Vent Gas Flow Rate	1.59 scfm
Sales Oil API Gravity	48.8°
Sales Oil Reid Vapor Pressure	8.07 psia

exiting the heater treater was measured with a thermocouple placed on the oil line. This value was approximately eight degrees less than the measurement at the firebox and was used as the heater treater operating temperature during emission estimates.

The heated condensate flowed through an above-ground pipe more than 300 feet from the heater treater to the primary oil tank. At the time of sampling, ambient temperatures were cool, allowing the condensate to cool from 112°F at the heater treater to approximately 60°F entering the tank.

The condensate flowed into a 5000-barrel tank. A second, empty 5000-barrel tank was connected to the main oil tank through vent lines and an overflow pipe. A 4-inch vent pipe connected each tank and conveyed the flash vapors to a Vapor Recovery Unit (VRU) located at ground level. The VRU was bypassed for testing purposes. The vent gas flow rate was measured using an orifice plate in a 2-inch line connected to a liquid knockout immediately before the VRU.

Daily oil production was recorded from an on-site meter. Generally, the condensate in the primary tank was maintained at a level between 9 and 12 feet. The spare oil tank was empty. Oil was trucked from the site approximately two to three times per day. Each truck held approximately 185 barrels. Sales oil samples were collected during truck loading. No oil was removed on January 31, 1996, the second day of sampling. The oil sample for this day was collected on the third day of sampling when four trucks were filled.

Site 3 Emission Measurements

Due to the cold temperatures (three-day average of 46°F) encountered during this sampling event, vent gas flow rates were very low. Minimal leakage was observed around the Thief hatches and around the pressure-relief valves. It is estimated that less than 1% of the total flow was lost due to leakage. Air was observed to flow into the tank during truck loading cycles. However, during periods when no trucks were being loaded and no plant upsets were noted; the vent flow remained positive, relatively constant, and very low. These times of constant flow were used to estimate steady-state emissions. The average vent flow rate for the three-day sampling period, including periods with upsets and negative flow was 95.5 scfh with a standard deviation of 59 scfh. This average flow included periods of approximately three hours each morning when a recirculation pump removed a portion of the oil from the tank and recirculated it through the heater treater. Vent flow rates were observed to increase significantly during this time period.

Steady-state vent gas flow determined during the first day of sampling was taken between 17:18 and 01:40 and averaged 135 scfh. The ambient temperature was much warmer this day (65.7°F) than the other two days of sampling. A steady-state flow was measured between 19:10 and 06:10 on the second day and averaged 81.2 scfh. The average ambient temperature was 36.5°F. Steady-state flow was recorded between 17:00 and 04:28 on the third day of sampling. The average flow rate and temperature were 96.8 scfh and 35.6°F, respectively.

The steady-state periods and compound concentrations from the on-site GC analysis were used to calculate the emissions shown in Table 4-7 for the three sampling days. As can be observed from the tables, emissions were much higher during Day 1 when the average ambient temperature was higher. As the temperature cooled during Days 2 and 3, the emissions of the heavier compounds ($>C_4$) dropped. The lower emissions were a function of a lower vent flow rate combined with lower relative concentrations of these compounds.

Presumably, the emissions dropped as a function of temperature due to the large volume of the tanks and their ability to act like a large condenser. The tank skin temperature was determined to be approximately 47°F during Day 3. The temperature of the oil going into the tank and the sales oil were both measured at 59°F. It is thought that many of the heavier compounds were condensing on the tank walls and running back into the sales oil. This postulation is supported by the fact that little liquid (approximately 75 mL/day) was collected in the liquid knockout immediately before the orifice meter, despite the 36°F ambient temperature. Condensable material had obviously been removed in the tank or in the overhead vent lines before reaching the liquid knockout.

Since individual concentration measurements are available from the on-site GC and flow measurements are available for the same time period, the emissions were calculated for each GC measurement and then averaged. Little difference was noted

Table 4-7. Site 3: Emission Measurements from Days 1, 2, and 3 Steady-State Conditions

Compound	Day 1		Day 2		Day 3	
	Conc. (ppmv)	Emissions (lbs/hr)	Conc. (ppmv)	Emissions (lbs/hr)	Conc. (ppmv)	Emissions (lbs/hr)
Oxygen	0[a]	0.00	0[a]	0.00	0[a]	0.00
Nitrogen	162,520	1.62	140,176	0.84	158,376	1.13
Carbon Dioxide	40,240	0.63	54,390	0.51	52,390	0.59
Methane	254,767	1.45	282,199	0.97	273,904	1.12
Ethane	227,167	2.44	267,903	1.72	260,855	2.00
Propane	160,060	2.51	164,074	1.55	147,830	1.66
I-Butane	52,615	1.09	49,721	0.62	38,865	0.57
n-Butane	48,083	0.99	40,521	0.50	33,644	0.50
I-Pentane	28,036	0.72	22,046	0.34	18,238	0.34
n-Pentane	13,150	0.34	10,093	0.16	7,974	0.15
n-Hexane	4,452	0.14	3,057	0.06	2,585	0.06
n-Heptane	1,378	0.05	705	0.02	649	0.02
Benzene	3,366	0.09	2,270	0.04	1,960	0.04
Toluene	2,013	0.07	926	0.02	887	0.02
Ethylbenzene	102	0.00	34	<0.0	25	<0.00
Xylenes	398	0.02	142	0.00	110	0.00
Other C_6	12,937	0.40	9,380	0.17	8,098	0.18
C_7	6,992	0.25	4,281	0.09	3,805	0.10
C_8	3,068	0.13	1,425	0.03	1,342	0.04
C_9	323	0.01	86	0.00	89	0.00
C_{10+}	181	0.01	37	0.00	22	0.00
Total	1,021,746	12.93	1,053,466	7.64	964,488	8.50
Total BTEX	-	0.18	-	0.06	-	0.06
Total HAP	-	0.31	-	0.12	-	0.12
Total C_{3+} VOC	-	6.79	-	3.60	-	3.67
Total C_{2+} VOC	-	9.23	-	5.31	-	5.68
Total HC	-	10.69	-	6.29	-	6.79

[a] Normalized for the amount of oxygen. No oxygen was detected in the pressurized oil sample.

between point averaging and time averaging during the steady-state flow periods as shown in Table 4-8, though point-averaged emissions were slightly lower.

Calculation of the point-averaged emissions was based on individual on-site GC analyses. The one-minute average vent gas flow rate recorded at the time that the GC sample was collected was used to calculate the emissions. In other words, only one flow rate was used out of the 40+ which were collected during a GC analysis. The overall emission averages used average flow rates from every one-minute measurement and average compound concentrations from the 22 or more GC analyses made each day.

For comparison, the average flow rate for all three days was used with the average canister concentrations to determine emissions. These data are also presented in Table 4-8. Data from the individual canister samples using the average flow rate for that period has been included in Appendix D. Table 4-8 shows that the average emissions over the three days are very similar to those measured during Days 2 and 3 using the GC data and steady-state conditions. Oxygen has been included in the emission estimates to reflect the amount of air flowing into the tank during negative flow. It should also be noted that the flow rate during negative flow could not be measured using the orifice meter. Therefore, negative flow is represented by 0 scfh and emission estimates reported in Table 4-8 only reflect positive flow (i.e., reflect actual emissions).

Measurement results from QC samples collected at Site 3 are included in Appendix C. Duplicate samples generally had very low RPDs for compounds present at concentrations well above the detection limits. This fact indicates that the sampling and analytical techniques are introducing very little variability into the measurement and that the sample streams tend to be homogeneous.

Table 4-8. Site 3: Average Emissions Calculations from On-Site GC and Canisters

	On-Site GC Calculations				Canister Calculations	
Compound	Average (ppmv)	RSD (%)	Emissions (Overall Average) (lbs/hr)	Emissions (Point Averaged) (lbs/hr)	Conc. (ppmv)	Emissions (lbs/hr)
Oxygen	50,155	88.4	0.40	0.31	61,221	0.47
Nitrogen	187,578	84.4	1.32	1.03	221,731	1.48
Carbon Dioxide	-	-	-	-	44,301	0.46
Methane	255,573	32.6	1.03	0.80	218,962	0.83
Ethane	239,405	32.4	1.81	1.41	188,408	1.35
Propane	145,104	33.8	1.61	1.25	122,989	1.29
I-Butane	42,919	37.3	0.63	0.49	45,046	0.62
n-Butane	36,581	39.2	0.53	0.42	36,295	0.50
I-Pentane	20,188	41.3	0.37	0.29	19,352	0.33
n-Pentane	9,206	42.7	0.17	0.13	8,875	0.15
n-Hexane	2,959	41.0	0.06	0.05	2,716	0.05
n-Heptane	817	47.1	0.02	0.02	NM	NM
Benzene	2,229	39.3	0.04	0.03	2,339	0.04
Toluene	1,141	49.0	0.03	0.02	1,281	0.03
Ethylbenzene	48	78.7	0.00	<0.0	27	<0.0
Xylenes	194	81.0	0.00	<0.0	152	<0.0
C_6 Range	8,814	41.8	0.19	0.15	7,295	0.15
C_7 Range	4,467	41.7	0.11	0.09	9,643	0.17
C_8 Range	1,760	47.7	0.05	0.04	609	0.02
C_9 Range	147	78.3	0.00	<0.0	83	<0.0
C_{10+}	68	104.9	0.00	<0.0	20	<0.0
Total	1,009,353	-	-	-	995,476	8.12
Total BTEX	-	-	0.08	0.06	-	0.08
Total HAP	-	-	0.14	0.11	-	0.13
Total C_{3+} VOC	-	-	3.83	2.98	-	3.53
Total C_{2+} HC	-	-	5.63	4.38	-	4.88
Total HC	-	-	6.66	5.18	-	5.70

Site 4 Description

Site 4 was a water flooded field in southeast Texas. The oil at this field was very warm and exited the wells at high pressure. There were numerous wells at the site, but each well had its own separators, heater treater, and tanks. Each site had four 400-barrel tanks, three steel oil tanks and one fiberglass produced water tank, all connected by a common 2-inch vent line. The produced water tank was not used as a water tank. The produced water was pumped directly back to tanks at the injection well for reinjection into the formation. Other site characteristics are presented in Table 4-9.

Table 4-9. Site 4: Characteristics During Sampling

Characteristic	Measurement
Number of Tanks	Four
Size of Tanks	400 bbl
Produced Water Flash Included in Vent	Yes, But No Water and No Flash Gas Sent to Tank
Vapor Recovery Unit	No
Number of Wells	One
Wells Continuously Producing	Yes
LACT Unit	No
Tanks Level Controlled	No, Product Trucked from Site
Oil Production	259 bbl/day
Separator/Heater Treater Gas Production	40 Mscfd
Separator/Heater Treater Pressure	92 psig Low-Pressure Separator, 46 psig Heater Treater Pressure
Separator/Heater Treater Temperature	145°F
Average Vent Gas Flow Rate	3.07 scfm
Sales Oil API Gravity	36.8°
Sales Oil Reid Vapor Pressure	5.5 psia

The oil flowed into a high-pressure separator at 1000 psig and 146°F. The low-pressure separator operated at the same temperature and at 92 psig. Approximately 40 Mscfd of gas was produced from the low-pressure separator. The oil then flowed into a heater treater operated at 145°F and 46 psig. No gas was removed from the heater treater.

The gas produced in the heater treater was reported to be routed through a backpressure valve into the produced water tank. This backpressure valve was set several psig above the heater treater operating pressure. The gas line from the heater treater to the water tank was broken to measure flow of the flash gas, but gas never flowed through this piping. The destination of the heater treater flash gas was never determined. This gas did not appear to be flowing with the oil into the produced oil tanks (emission levels also indicate that the flash gas is not venting into the oil tanks). It is suspected that the heater treater flash gas was exiting with the water via a gas/liquid equalization leg on the side of the heater treater. Since the water went back to tanks at the injection well and not to the production tanks, this gas would not be measured as a part of the emissions. Therefore, all emission measurements are based on the heater treater operating pressure of 46 psig and a flash to atmospheric pressure.

Pressurized oil samples were collected from both the heater treater and the low-pressure separator. However, samples collected from the low-pressure separator were found to be primarily water due to the manner in which the separator was being operated. There was insufficient oil in this sample to analyze. Valid pressurized oil and gas samples were collected from the heater treater. Composition of the heater treater oil was used as the input to the E&P TANK model.

Sales oil from this site had a high paraffinic content and appeared to layer in the tanks. Sales oil samples from the bottom of the production tank had lower API gravities (approximately 30) than those of the oil coming into the tank (approximately 36). A portion of the oil used to flush the lines during collection of a sales oil sample from a port near the bottom of the tank solidified at ambient temperatures of 35° to 36°F when allowed to sit undisturbed overnight.

Site 4 Emission Measurements

Vent gas flow rates were measured with an orifice plate near the end of the vent gas line. Thief hatches were sealed with new gaskets and were bagged to prevent vapor losses. Very little gas was observed escaping from Thief hatches, and it is believed that most of the emissions (>95%) were measured. Pressure tranducers would occasionally stop measuring flow rate accurately due to condensation of heavy hydrocarbons in the transducer. Taking the transducer apart and cleaning it would correct the problem. Flows were checked with a hand-held differential pressure meter several times during the monitoring period and compared to the continuous readings from the transducers. If agreement was not good, such as the transducer recorded a pressure differential one half of the hand-held meter, the transducer was taken out of service and cleaned.

Vent gas samples were collected for on-site GC analysis and with time-integrated canisters. The vent flow was diluted with nitrogen before analysis by GC/FID to bring as many analytes into the linear range of the detector as possible. Samples analyzed by GC/TCD were not diluted. Vent gas, oil going into the tank, and ambient temperatures were recorded on a continuous basis. Emissions calculated from the average vent gas flow rate and GC concentration measurements are presented in Table 4-10. Emissions calculated from the analysis of canister samples are also shown in Table 4-10.

Emissions measured with the on-site GC varied more at Site 4 than at the other sites as noted by the range of RSDs shown in Table 4-10. These RSDs are a result of both variability in concentrations across the three days (generally on the order of 30%) and variations in flow rate. Problems with the on-site GC analysis were noted due to

Table 4-10. Site 4: Average Emissions Measurements from On-Site GC and Canisters

Compound	On-Site GC Measurements*			Canister Measurements	
	Concentration (ppmv)	RSD (%)	Emissions (lbs/hr)	Tank Vent Conc. (ppmv)	Emissions (lbs/hr)
Oxygen	26,226	129	0.54	40,521	0.49
Nitrogen	107,745	124	1.92	145,941	1.53
Carbon Dioxide	-	-	-	4,254	0.07
Methane	293,076	62	2.14	249,181	1.50
Ethane	125,346	60	1.67	106,421	1.20
Propane	290,804	60	4.06	194,047	3.20
I-Butane	69,875	66	1.85	66,752	1.45
n-Butane	68,114	66	1.83	89,048	1.94
I-Pentane	34,905	64	1.16	29,842	0.81
n-Pentane	23,218	64	0.78	17,921	0.48
n-Hexane	5,363	68	0.23	4,335	0.14
n-Heptane	1,250	78	0.07	-	-
Benzene	567	68	0.02	555	0.02
Toluene	704	82	0.04	612	0.02
Ethylbenzene	60	116	<0.0	65	<0.0
m,p-Xylene	108	107	0.01	152	0.01
o-Xylene	48	114	<0.0	47	<0.0
Other C_4	-	-	-	12,630	0.28
Other C_5	-	-	-	10,323	0.28
Other C_6	13,097	66	0.55	9,635	0.31
Other C_7	8,325	70	0.44	5,615	0.21
C_8	3,224	80	0.21	1,140	0.05
C_9	298	110	0.02	242	0.01
C_{10+}	68	170	0.01	48	0.00
Total	991,421	-	-	989,327	-
Total BTEX	-	-	0.07	-	0.05
Total HAP	-	-	0.31	-	0.19
Total C_{3+} VOC	-	-	11.29	-	9.21
Total C_{2+} VOC	-	-	12.95	-	10.41
Total HC	-	-	15.09	-	11.91

* Emissions are calculated by point averaging.

condensation of heavy hydrocarbons in the sample lines and injection loops. All emissions from the on-site GC provided in Table 4-10 have been point averaged by using the flow rate at the time of analysis to calculate the compound's emission rate and then summing emissions across the three-day period.

Results for the quality control samples collected at Site 4 are included in Appendix C. The on-site GC calibration check samples displayed much more variability than those at previous sites. This variability was thought to be due to the condensation in the lines and sample loops.

A canister sample was collected at this site and analyzed by the on-site GC. It was then sent to Radian's VOC laboratories and to Core Laboratories as a blind audit sample. The results from this audit sample are also included in Appendix C along with the report from an on-site QA audit conducted by the Radian project QA officer.

The audit sample results generally compared well among the three laboratories for the permanent gas compounds, methane through propane, pentanes and hexanes. The on-site GC appeared to measure the C_4 compounds 50 to 80% lower than the other two laboratories. It is likely the C_4 compounds are over-range on the FID causing a low bias. The on-site GC measured BTEX and C_7 and larger compounds at higher concentrations than either of the other two labs, although Radian's VOC laboratory measured higher concentrations than Core. This potential bias between the on-site GC and canister samples had not been noted at previous sites and is likely due to condensation in the canister or sampling lines before analysis at the other two labs.

Site 5 Description

Site 5 was the same location as Site 3. It consisted of a condensate collection facility associated with natural gas production in southern Louisiana. The site produced approximately 11 MMscfd of natural gas and 500 bbl/day of condensate. Other site characteristics at the time of sampling are provided in Table 4-11.

Table 4-11. Site 5: Characteristics During Sampling

Characteristic	Measurement
Number of Tanks	Two
Size of Tanks	5000 bbl
Produced Water Flash Included in Vent	No, Separate Vent
Vapor Recovery Unit	Yes, Bypassed for Testing
Number of Wells	Two
Wells Continuously Producing	Yes
LACT Unit	Yes
Tanks Level Controlled	No, Product Trucked from Site
Oil Production	451 bbl/day
Separator/Heater Treater Gas Production	Not Measured
Separator/Heater Treater Pressure	29 psig
Separator/Heater Treater Temperature	112°F
Average Vent Gas Flow Rate	5.63 scfm
Sales Oil API Gravity	48.8°
Sales Oil Reid Vapor Pressure	7.40 psia

Due to the low ambient temperatures which resulted in low emissions during the first sampling episode (Site 3), this site was resampled during warmer weather (Site 5). The temperature of the oil as it entered the tank was measured on a continuous basis as possible input to the model, in an attempt to better match estimated emissions with actual emissions.

As was described with the first sampling effort at this site, the heated condensate flowed through an above-ground pipe more than 300 feet from the heater treater to the primary oil tank. At the time of this sampling effort, the weather was much warmer than that encountered during the Site 3 sampling. The condensate retained more of its heat between the heater treater and the tanks, entering the tanks at an average temperature of 88°F as opposed to the temperatures of 60°F or less measured at the tank during Site 3 sampling. However, the temperature of the condensate going into the tank fluctuated almost 30°F each day (from about 75°F to 105°F). The condensate temperature tracked very well with ambient temperature except during times of oil recirculation from the tank to the heater treater.

Site 5 Emission Measurements

Minimal leakage was observed around the Thief hatches and around the pressure-relief valves. It is estimated that less than 1% of the total flow was lost due to leakage. Air was observed to flow into the tank during truck loading cycles. However, during periods when no trucks were being loaded and no plant upsets (such as oil recirculation) were noted; the vent flow remained relatively constant. These times of constant flow were used to estimate steady-state emissions. The average vent flow rate for the three-day sampling period during times of steady-state flow was 338 scfh. A daily period of approximately three hours when the recirculation pump was on and flow increased accordingly was excluded from the steady-state flow rates.

Emission measurements based on average concentrations determined from the on-site GC and the average vent flow rate are presented in Table 4-12. Average emission estimates from the canister sample compound concentrations and the steady-state flow rate are also shown in Table 4-12. These emissions can be compared to those found in Table 4-7 for the Site 3 on-site GC and canister samples. Due to instrument problems, the on-site GC was not operational over a portion of the sampling period.

Since temperature appears to have a significant impact on vent gas emissions, particularly at this site, plots of compound concentrations versus vent gas flow rate and the vent gas temperature were made to determine this correlation. Figure 4-3 presents the plot of benzene concentration versus vent gas flow rates for one day at Site 5. The

Table 4-12. Site 5: Emission Measurements from On-Site GC and Canisters with Steady-State Flow Conditions

Compound	On-Site GC Measurements[a]		Canister Measurements	
	Tank Vent Concentration (ppmv)	Emissions (lbs/hr)	Concentration (ppmv)	Emissions (lbs/hr)
Oxygen	28,693	0.82	47,597	1.35
Nitrogen	118,848	2.96	176,760	4.40
Carbon Dioxide	NA	NA	45,235	1.77
Methane	224,414	3.20	168,127	2.40
Ethane	248,757	6.65	189,065	5.05
Propane	186,020	7.29	145,352	5.70
I-Butane	32,543	1.68	62,761	3.24
n-Butane	26,621	1.37	49,095	2.54
I-Pentane	19,874	1.27	29,997	1.92
n-Pentane	9,277	0.60	14,207	0.91
n-Hexane	3,379	0.26	4,707	0.36
n-Heptane	1,820	0.13	-	-
Benzene	2,006	0.16	3,855	0.27
Toluene	1,490	0.14	2,847	0.23
Ethylbenzene	81	0.01	82	0.01
Xylenes	197	0.02	536	0.05
Other C_4	96,590	4.99	1,827	0.09
Other C_5	NA	NA	16,600	1.06
Other C_6	NA	NA	13,703	1.05
Other C_7	1,583	0.14	9,347	0.83
C_8	NA	NA	2,079	0.21
C_9	NA	NA	457	0.05
C_{10+}	NA	NA	271	0.03
Total	1,002,193	-	984,507	-
Total BTEX	-	0.33	-	0.55
Total HAP	-	0.59	-	0.91
Total C_{3+} VOC	-	18.06	-	18.57
Total C_{2+} VOC	-	24.71	-	23.62
Total HC	-	27.91	-	26.01

[a] Emissions calculated from averaged concentrations and average flow rate.

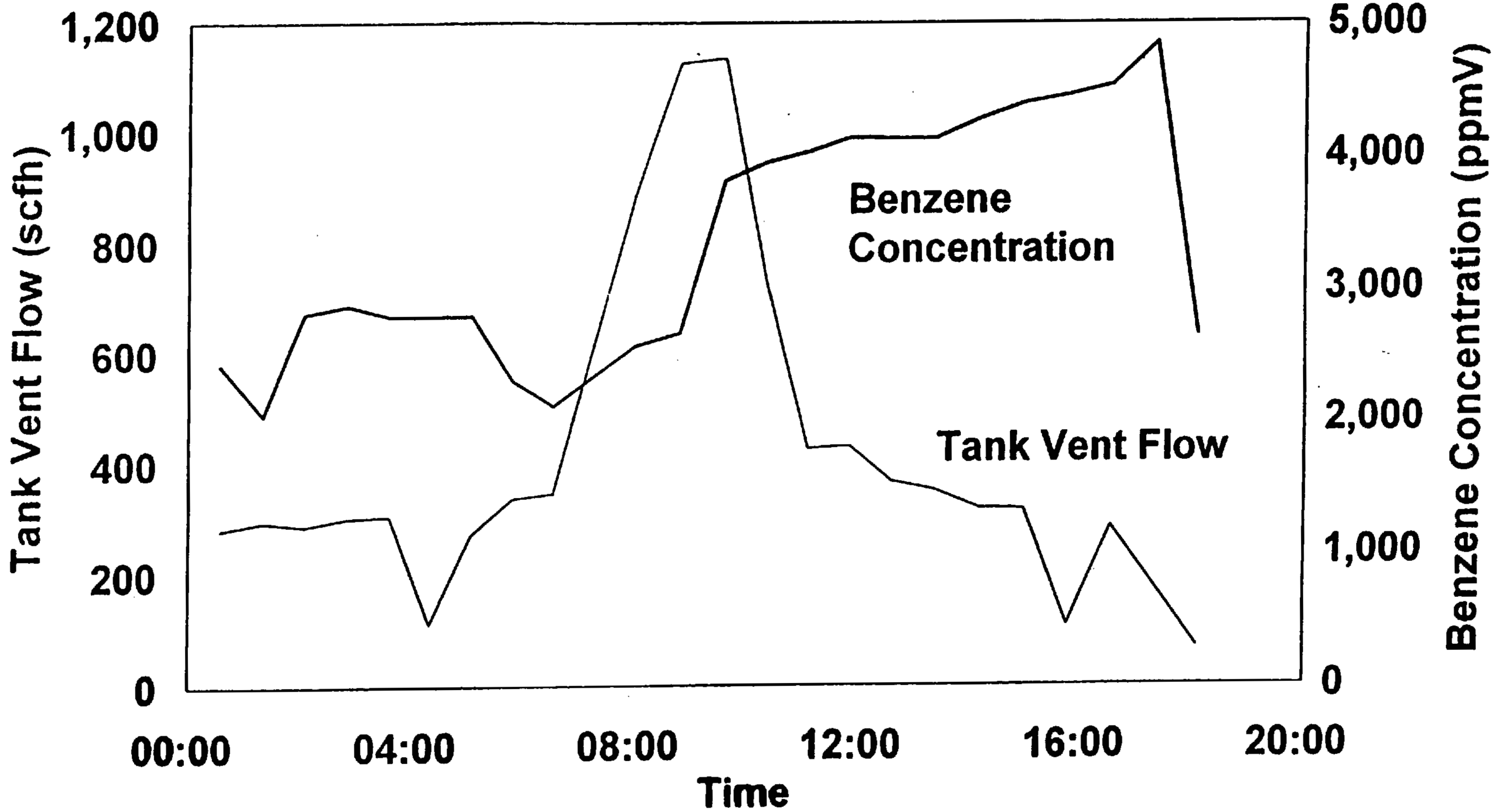

Figure 4-3. Site 5: Benzene Concentration Versus Vent Flow

benzene concentrations did not correlate well with vent flows, particularly during the time around 8:00 am when oil recirculation resulted in higher vent flows. However, the vapor residence time in the tanks was calculated to be as long as 5.8 days at steady-state vent flow rates, an average liquid height of eight feet in the primary oil tank, and the combined volume of both tanks. Assuming that the vapors do not go into the empty oil tank, the residence time in the primary tank would be approximately two days.

Figure 4-4 shows benzene concentration as a function of the vent gas temperature. As can be observed, the concentration tends to show the same trend as the temperature. Though not plotted, similar trends in benzene concentration are expected with ambient temperature and the temperature of the oil as it goes into the tank. Both of these temperatures have a direct effect on the vent gas temperature. It is also expected that the lighter compounds (more volatile) will not correlate as well with temperature.

Sites 6 and 7 Descriptions

Sites 6 and 7 were condensate production sites associated with natural gas wells. They were located in southwestern Wyoming. The two sites were physically located approximately 1.5 miles apart and were both sampled due to the differences in production rate and their proximity to one another. They also represent the highest API gravities and Reid Vapor Pressures of any of the sites sampled. The site characteristics for each site are presented in Table 4-13.

These sites were also of interest because of the operating pressures of the heater treaters. Both sites had a three-stage pressure reduction between the heater treater and the tanks. The first stage dropped the pressure from heater treater operating pressure to around 100 psig. The second stage dropped the pressure to around 40 psig and the final stage from approximately 40 psig to atmospheric pressure. Flash gas from each pressure reduction stage was routed to the tanks. Therefore, the emissions represent a flash from operating pressures, 570 psig for Site 6 and 495 psig for Site 7, to atmospheric pressure.

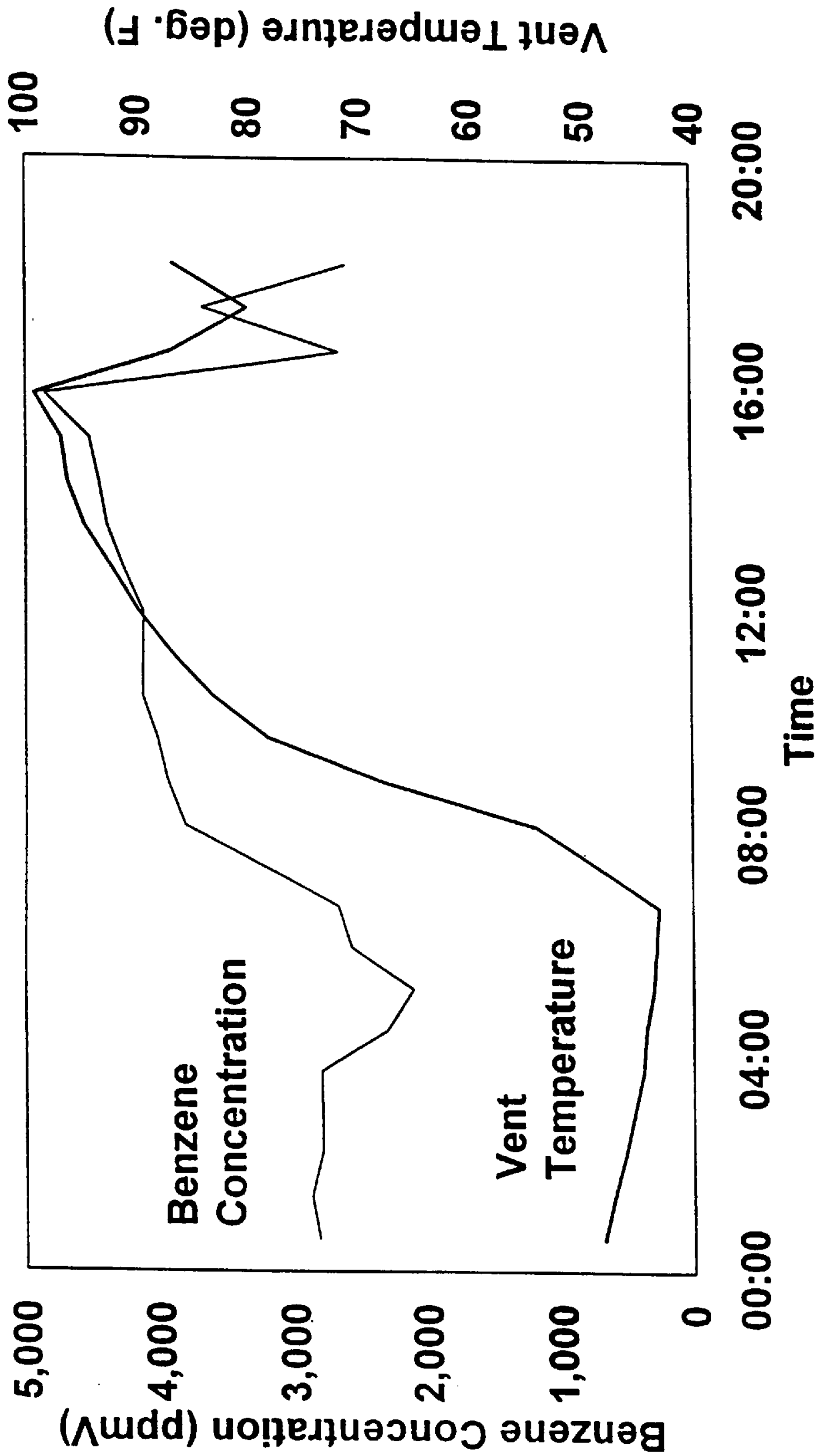

Figure 4-4. Site 5: Benzene Concentration Versus Vent Temperature

Table 4-13. Sites 6 and 7: Characteristics During Sampling

Characteristic	Measurement 6	Measurement 7
Number of Tanks	Three	Three
Size of Tanks	300 bbl	300 bbl
Produced Water Flash Included in Vent	No, Separate Tank and Vent	No, Separate Tanks and Vent
Vapor Recovery Unit	No, Emissions Flared	Yes, Bypassed for Testing
Number of Wells	One	One
Wells Continuously Producing	Yes	Yes
LACT Unit	No	No
Tanks Level Controlled	No, Product Trucked	No, Product Trucked
Oil Production	12 bbl/day	60 bbl/day
Gas Production Rates	900 Mscfd	2800 Mscfd
Separator/Heater Treater Pressure	570 psig	495 psig
Separator/Heater Treater Temperature	86°F	72°F
Average Vent Gas Flow Rate	207 scfh	1476 scfh
Sales Oil API Gravity	55.5°	58.4°
Sales Oil Reid Vapor Pressure	11.1 psia	15.2 psia

Both sites had emission control devices which were bypassed for testing. Site 6 emissions were controlled by a flare. Site 7 had a flare at the time of the site visit, but between the site visit and actual sampling, a VRU and an internal combustion engine were installed to compress the tank vent emissions to sales gas line pressure for recovery. Both sites had separate tanks for the produced water. The emissions from these tanks were not included in the vent gas stream from the oil tanks.

Both Sites 6 and 7 were identical with three 300-barrel tanks and a 4-inch vent line. At Site 6, a 4-inch plug was removed from the top of one of the tanks to measure vent gas flow rate and temperature. The 4-inch line was reduced to 2-inch and an orifice plate with a 0.5-inch orifice installed to continuously measure pressure differentials and flow. Canister samples for vent gas composition were taken from fittings in the 2-inch line over 12-hour periods, including the overnight hours. On-site GC analyses were not conducted at either site due to the remoteness of the locations, absence of suitable power, and the cost to ship and maintain the instrument. For Site 7, the 4-inch vent line was broken near the flare and an orifice plate with a 1.5-inch bore was installed to measure pressure differentials and flow rates. At both sites, ambient, vent gas, and oil inlet temperatures were recorded on a continuous basis with calibrated thermocouples.

The pressurized oil at both sites flowed through a transfer valve immediately after the heater treater. The only sample port was downstream of this transfer valve. To avoid collecting samples after the pressure was reduced at the transfer valve, a shutoff valve downstream of the sample port was closed and the pressure inside the line after the transfer valve was allowed to come to the pressure of the separator/heater treater. A separator/heater treater gas sample was collected and used to carefully collect the pressurized oil sample according to the sampling protocol in Appendix B. After collection of the separator pressurized oil sample, the shutoff valve was opened to allow the oil to flow to the tanks.

Sites 6 and 7 Emission Measurements

Since the rate the oil entered the tanks at both sites was controlled by transfer valves that were level operated, some short-term fluctuations were observed in the vent flow. However, averaged over a longer period of time, the vent flow rates were relatively constant. Oil production was fairly constant at both sites. Therefore, the vent gas flow rates were averaged over the monitoring periods, part of four separate days at Site 6 and over two days at Site 7.

The vent gas flow rates from Site 6 averaged 207 scfh with a RSD of 9.2% over the four-day monitoring period. Time periods when tank vent hatches were opened or when pressurized oil samples were being collected were excluded from this average. Canister samples collected from the vents, and used for emission calculations, had RSDs from around 2% for the light hydrocarbons to 38% for the xylenes. Variations in the heavier hydrocarbons may be a function of their lower concentrations (variability in measurement) and also because they are more affected by the colder temperatures observed at night. The emissions calculations for Site 6 derived from the average vent flow and average compound concentrations from canisters are shown in Table 4-14.

The vent gas flow rate for Site 7 averaged 1476 scfh with a RSD of approximately 11% over the two-day monitoring period. Times of flow interruption were excluded from the averaged measurements. Analysis of canister samples collected over the same time periods provided relatively consistent compound concentrations. Most compounds had RSDs of around 9%. As with Site 6, some of the heavier compounds which were present at lower levels exhibited larger RSDs. Emission calculations from Site 7 based on the averaged flow rates and average compound concentrations from the canister samples are also presented in Table 4-14.

Quality control samples were not collected at Sites 6 and 7. Duplicate samples were not collected due to the extended sampling periods caused by bad weather conditions and the unavailability of sufficient sample containers. Site 7 was sampled as an opportunistic site (originally unplanned). Therefore, few additional sample containers were included for sampling Site 6. The sample containers were conserved to ensure a sufficient number were available to sample both sites.

SUMMARY OF RESULTS FROM THE FIELD SAMPLING EFFORT

A number of observations can be made from the results of the field sampling effort which impact comparison to emissions estimated from the E&P TANK model. Many of the observations revolve around the difficulty in accurately measuring vent gas

Table 4-14. Sites 6 and 7: Average Emissions Calculations from Canister Samples

Compound	Site 6		Site 7	
	Tank Vent Concentration (ppmv)	Measured Emissions (lbs/hr)	Tank Vent Concentration ppmv	Measured Emissions (lbs/hr)
Oxygen	0	0.00	0.0	0.00
Nitrogen	5,217	0.08	62,105	6.76
Carbon Dioxide	0	0.00	0.0	0.00
Methane	352,661	3.08	251,419	15.67
Ethane	237,051	3.88	260,591	30.44
Propane	230,644	5.54	249,771	42.78
I-Butane	60,035	1.90	54,441	12.29
n-Butane	89,691	2.84	74,545	16.83
I-Pentane	28,776	1.13	18,949	5.31
n-Pentane	17,309	0.68	11,051	3.10
n-Hexane	3,843	0.18	1,981	0.66
Benzene	1,289	0.05	627	0.19
Toluene	2,336	0.12	898	0.32
Ethylbenzene	58	<0.0	23	0.01
m,p-Xylenes	437	0.03	163	0.07
o-Xylene	81	<0.0	32	0.01
Other C_4	876	0.03	812	0.18
Other C_5	8,760	0.34	5,570	1.56
Other C_6	8,760	0.41	4,917	1.65
Other C_7	5,400	0.29	1,926	0.75
C_8	521	0.03	168	0.08
C_9	85	0.01	12	0.01
Other C_{10+}	0	0.00	0	0.00
Total BTEX	-	0.20	-	0.60
Total HAP	-	0.38	-	1.27
Total VOC	-	13.59	-	85.80
Total C2+ HC	-	17.47	-	116.24
Total HC	-	20.55	-	131.91
Total Stream	-	23.63	-	138.67

emissions even though the sites used in this project were carefully selected to maximize the probability of success. The use of bolted tanks or tanks with other places where flash gas can escape, multiple oil lines (and associated separators) feeding one set of tanks, and inaccessibility of the vent lines makes measuring actual emissions at many sites very difficult, if not impossible.

The greatest difficulty encountered during emissions measurement was obtaining a leak-free system where all of the gas could be channeled through an orifice plate for flow and composition measurements. At most of the sites, Thief hatches and Enardo™ valves were leaking vapors continuously at the time of the site visits. Replacement of the gaskets before sampling would minimize this leakage, but some vapor leakage was still observed. Bagging the valves and hatches with heavy plastic also helped to minimize the leakage, but the construction of the hinge supports on some Thief hatches would not allow them to be bagged tightly.

Sizing the flow measurement devices (dry gas meter at Site 1 and orifice plates with pressure transducers at all other sites) such that accurate flow measurements were possible was also a challenge. At the low flow sites, such as Sites 3 and 4, flow measurements were being made at the lower end of the operational range of the differential pressure transducers which may have affected the accuracy of the measurement. Condensation in the pressure transducers was also observed at some sites which affected the flow measurements if not closely monitored and corrected. Finally, the operation of transfer valves on the separators would deliver the oil to the tanks in discrete "plugs" which would cause sudden increases in flash emissions. While these spikes in flow would average over time, the orifice plates and pressure transducers had to be sized to accommodate the highest flows.

Site 1 presented challenges to vent emissions measurements due to the number of wells at the site and their operation on timers. If a majority of the wells were operating, the resulting flashing losses would open pressure relief valves on the tanks or vent lines resulting in unmeasured emissions. At the times when none or only one well was pumping, emissions were so low they were difficult to measure. Flow variations were observed at other sites also and were generally associated with process changes or equipment operation, such as the operation of oil recirculation pumps.

Vent flows appeared to be affected by temperature, primarily heating and cooling of the oil lines and tank surfaces. Measurement of emissions on a cold day will result in fewer vent emissions. In addition, it is likely that vent gas compositional changes would be observed between cold and warm ambient temperatures due to condensation of heavier compounds at the lower ambient temperatures. This supposition is supported by the factor of two increase in measured HAPs and BTEX at Site 5 when compared to Site 3 measurements recorded at lower ambient temperatures. Therefore, measurements of emissions on any single day will only reflect emissions under that set of conditions. These emissions cannot be converted to an annual basis with any meaning unless the conditions on the measurement day are representative of the yearly "averages."

Section 5
MODEL RESULTS

This section will present the following for each site:

1. The measured input parameters for E&P TANK;
2. Calculated emissions using the E&P TANK model and a discussion of how the model was run; and
3. Comparison of model-calculated emissions with measured emissions. (This comparison is in tabular form only.)

At the end of the section, a table is presented showing emission measurements compared to model predictions for all of the sites. A brief discussion of these results is also given.

SITE 1 MODEL RESULTS

Site 1 Model Input Parameters

Samples of the pressurized oil exiting the separator/heater treater were collected and analyzed to provide the primary compositional input for the E&P TANK model, including the molecular weight of the C_{10+} components. The separator/heater treater operational temperature, pressure, and atmospheric pressure were recorded as model inputs for E&P TANK. Sales oil parameters, including throughput, API gravity, Reid Vapor Pressure, and temperature, were measured for use with the E&P TANK model. The temperature of the oil going into the tank was not measured at this site.

Measurements of each of the model input parameters were made across parts of four days. No measurements were made at night (approximately 8:00 pm until 7:00 am). The measured parameters were averaged over the four-day period to obtain the model input parameters. The averages are presented in Table 5-1. Two pressurized

Table 5-1. Site 1: Measured Model Input Parameters

Measurement	Value (units)
Separator Temperature	75.6°F
Separator Pressure	17.3 psig
Atmospheric Pressure	13.25 psia
Sales Oil Production	187.9 bbl/day
API Gravity	38.57°
Reid Vapor Pressure	8.03 psia
Sales Oil Temperature	75.0°F
Annual Hours of Operation	8760
Tank Capacity	3 @ 410 bbls each
Tank Dimensions	13.5 ft. dia. x 16 ft. high
Minimum Temperature	59°F
Maximum Temperature	85.3°F
Separator Gas Specific Gravity	0.975°

separator oil samples were collected each day and analyzed for mole percent composition. These values, the average from all samples, and a RSD across the monitoring period are presented in Table 5-2. The RSD for seven samples (includes one duplicate) are very low indicating little variation in the oil composition, in the analytical technique, or in the pressurized sample collection method. The results from the analysis of the pressurized separator/heater treater oil samples indicate that these pressurized samples can be reproducibly collected and analyzed. The results from the analysis of the separator gas and sales oil compositions can be found in Appendix D.

Table 5-2. Site 1: Pressurized Separator Oil Sample Composition with Concentrations in Mole Percent

Sample No. Date Time	SCCY01 9/29 19:35:00	SCCY02 9/30 10:15:00	SCCY03 9/30 19:23:00	SCCY04 10/1 08:27:00	SCCY05 10/1 18:42:00	SCCY06 10/2 10:18:00	SCCY06d 10/2 10:18:00	Average	RSD (%)
Nitrogen	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.0
Methane	0.39	0.45	0.45	0.52	0.47	0.52	0.55	0.47	11.6
Ethane	0.65	0.66	0.58	0.64	0.59	0.64	0.64	0.63	4.6
Propane	3.02	3.04	3.13	3.37	3.17	3.39	3.38	3.19	5.1
I-Butane	0.90	0.91	0.88	0.88	0.89	0.88	0.88	0.89	1.3
n-Butane	4.62	4.62	4.69	4.99	4.77	5.00	4.96	4.78	3.6
I-Pentane	2.47	2.43	2.47	2.57	2.51	2.58	2.55	2.50	2.3
n-Pentane	3.40	3.19	3.28	3.38	3.33	3.38	3.35	3.32	2.1
n-Hexane	2.28	2.28	2.24	2.30	2.28	2.30	2.28	2.28	0.8
Hexanes	3.04	3.03	2.92	2.99	2.97	3.00	2.94	2.99	1.4
Benzene	0.15	0.15	0.14	0.15	0.14	0.15	0.14	0.15	3.4
Heptanes	10.78	10.21	10.42	10.53	10.59	10.62	10.50	10.52	1.6
Toluene	0.51	0.50	0.47	0.46	0.47	0.47	0.47	0.48	3.7
Octanes	9.93	9.96	9.62	9.72	9.78	9.79	9.69	9.79	1.2
Ethylbenzene	0.10	0.08	0.10	0.09	0.10	0.09	0.09	0.09	7.6
Xylenes	0.27	0.26	0.20	0.21	0.21	0.22	0.21	0.23	11.4
Nonanes	5.24	5.21	5.12	5.24	5.21	5.13	5.10	5.19	1.2
Decanes Plus	52.24	53.01	53.27	51.96	52.51	51.83	52.25	52.51	1.0
Decanes+ (MW)	229	227	226	230	228	230	229	228	0.6
Decanes+(SG)	0.899	0.898	0.898	0.901	0.900	0.901	0.900	0.899	0.1

MW = Molecular Weight
SG = Specific Gravity

Comparison of Model Results to Measured Emissions for Site 1

The emission estimation results from the E&P TANK model using the measured inputs are shown in Table 5-3 using three different options. The Reid Vapor Pressure option with a multi-stage distillation and with 484 ft^3/day air input into the system is presented as the first case. Air input was included since air was pulled into the tank during relatively frequent (~4x/day) product pumping cycles. The amount of air used as input was based on that measured in the field measurements.

The second case includes an adiabatic flash with no air input and the multi-stage distillation RVP option to calculate working and standing emissions. The third case includes the AP-42 method to calculate working and standing losses after an adiabatic flash to estimate flashing emissions.

The AP-42 model option was run using default values for average liquid stock height (8 feet), solar absorbance, and solar insolation. A breather vent pressure of 0.12 psig was used to reflect the release pressures of the Enardo™ valve and tank hatches. Measured values were used for the bulk liquid temperature (taken from sales oil temperature), tank dimensions, and maximum and minimum temperatures. Measured parameters for AP-42 are included in Table 5-1. The maximum and minimum ambient temperatures recorded over the measurement period were used with the AP-42 option.

As can be observed, the measured emissions of some compounds, primarily the light gases (methane, ethane, and propane) are greater than those predicted by the E&P TANK model. A review of the solubility of these compounds in the separator oil, the pressurized separator oil composition, and the separator gas composition at the recorded temperatures and pressures indicates that the amounts of these compounds measured in the vent gas are greater than the amount which could be expected in the pressurized oil going to the tank. Attempts to find the source of additional methane, ethane, and propane were unsuccessful. However, it is postulated that some of the separator gas was escaping through the separator oil transfer valve into the pressurized

Table 5-3. API Tanks Site 1: Comparison of Emission Estimates and Field Measurement Results

Compound	E&P TANK			Measured Emissions[b] (lbs/hr)
	Multi-Stage w/RVP and Air Input[a] (lbs/hr)	Multi-Stage w/RVP Option (lbs/hr)	AP-42 Option (lbs/hr)	
Methane	1.04	1.04	0.90	7.01
Ethane	2.48	2.47	1.38	4.05
Propane	8.71	8.02	4.57	14.06
I-Butane	1.38	1.20	0.76	2.11
n-Butane	5.22	4.49	2.90	7.58
I-Pentane	3.30	1.14	0.75	2.16
n-Pentane	3.22	1.11	0.73	2.12
n-Hexane	0.24	0.51	0.14	0.36
n-Heptane	NA	NA	NA	0.16
Benzene	0.01	0.01	0.006	0.03
Toluene	0.01	0.01	0.007	0.03[c]
Ethylbenzene	0.001	0.001	0.000	0.01
Xylenes	0.002	0.002	0.001	0.01
Other C_6	0.40	0.34	0.22	0.91
Other C_7	0.55	0.47	0.31	1.35
C_8	0.19	0.30	0.11	0.65
C_9	0.04	0.03	0.02	0.20
C_{10+}	0.00	0.00	0.00	0.12
Total BTEX	0.02	0.02	0.014	0.11
Total HAP	0.26	0.53	0.15	0.42
Total C_{3+} VOC	20.05	17.63	10.52	32.45
Total C_2+ VOC	22.53	20.10	11.90	36.50
Total HC	23.57	21.14	12.80	43.51

[a] Simulated with 484 ft^3/day of air pulled into tank.
[b] Emissions with on-site GC measurements.
[c] Toluene emissions from canister concentrations.

oil going to the tank. The valve construction would allow separator gas to enter the oil line at a small leak or inadequate seal at the primary diaphragm. Alternately, the concentration of light gases could be enriched at night when cooling is occurring. Also, measured emissions only reflect daytime operation and not nighttime well pumping cycles or cooling effects.

SITE 2 MODEL RESULTS

Site 2 Model Input Parameters

Due to the problems sealing the tanks and accurately measuring flow rates at Site 2, only two samples of the pressurized separator oil and one sample of sales oil were collected for the three-day period. These samples were collected during the same time that flow measurements were being made to provide a direct comparison with the measured emissions. The model input parameters measured for Site 2 are presented in Table 5-4.

Average compositional data from the two separator/heater treater oil samples are given in Table 5-5. Standard deviations for the two measurements are very low indicating a relatively constant oil composition. It should be noted that very little methane was observed at this site.

Comparison of Model Results to Measured Emissions for Site 2

Emission estimate comparisons to measured emissions are presented in Table 5-6. Table 5-6 represents the emissions from a multi-stage flash with a RVP of 8.7 and the AP-42 method of calculating working and standing losses. The model would not match the measured RVP using the multi-stage option resulting in flash emission estimates only for this option.

As was noted in Section 4, the vent line pipes were either obstructed or undersized for the amount of vent gas flow at this site. Therefore, the measured emissions reported in Table 5-6 may be biased low by as much as 10% due to the amount of unmeasured emissions which escaped around the Thief hatches during pressure relief events. Measured emissions presented in Table 5-6 have not been corrected for the amounts thought to have been lost. However, adding 10% to the measured emissions makes the comparison between measured emissions and model estimates even better.

Table 5-4. Site 2: Measured Model Input Parameters

Measurement	Value (units)
Separator Temperature	112°F
Separator Pressure	30.0 psig
Atmospheric Pressure	12.45 psia
Sales Oil Production	1600 bbl/day
API Gravity	43.23°
Reid Vapor Pressure	8.70 psia
Sales Oil Temperature	95°F
Annual Hours of Operation	8760
Tank Capacity	4 @ 1000 bbls each
Tank Dimensions	21 ft. dia x 16 ft. high
Minimum Temperature	56.6°F
Maximum Temperature	74.5°F
Separator Gas Specific Gravity	1.23°

The AP-42 option of the E&P TANK model was run with actual tank sizes and measured temperatures. Default values for the AP-42 option were very similar to those measured at the site.

SITE 3 MODEL RESULTS

Site 3 Model Input Parameters

Measurements of the model input parameters, the separator gas composition, and sales oil composition were made over a three-day period. The measured model input parameters are presented in Table 5-7. Due to the long distance from the heater treater to the tanks and subsequent cooling of the oil, oil inlet temperatures into the tank were measured with a hand-held meter on the third day. Separator temperatures have

Table 5-5. Site 2: Separator Oil Composition

Compound	Mole %
Nitrogen	0.02
Carbon Dioxide	0.03
Hydrogen Sulfide	0.01
Methane	0.25
Ethane	2.38
Propane	7.00
I-Butane	2.07
n-Butane	7.29
I-Pentane	3.38
n-Pentane	4.77
n-Hexane	3.63
Other Hexanes	3.00
Benzene	0.45
Heptanes	7.44
Toluene	0.43
Octanes	11.14
Ethylbenzene	0.25
Xylenes	1.59
Nonanes	17.28
Decanes Plus	27.66
Decanes+ (MW)	484.5
Decanes+ (SG)	0.881

MW = Molecular Weight
SG = Specific Gravity

Table 5-6. Site 2: Emissions Comparison of Model and Field Results

Compound	E&P TANK Multi-Stage w/RVP[a] (lbs/hr)	E&P TANK AP-42 Option (lbs/hr)	Measured Emissions[b] (lbs/hr)
Methane	3.81	3.82	24.17
Ethane	62.71	63.19	52.21
Propane	226.0	228.3	153.67
I-Butane	65.72	66.47	33.74
n-Butane	201.7	204.1	118.33
I-Pentane	66.57	67.40	32.60
n-Pentane	78.40	73.39	72.96
n-Hexane	23.00	23.31	19.31
n-Heptane	NA	NA	NA
Benzene	2.81	2.85	1.95
Toluene	1.07	1.08	1.33
Ethylbenzene	0.27	0.27	0.28
Xylenes	1.49	1.51	0.97
Other C_6	22.48	22.77	32.38
Other C_7	25.20	25.55	31.01
C_8	15.50	15.72	11.92
C_9	10.27	10.42	2.87
C_{10+}	0.00	0.00	0.35
Total BTEX	5.64	5.71	4.54
Total HAP	28.64	29.02	23.94
Total C_{3+}VOC	740.5	749.1	513.91
Total C_{2+}VOC	803.2	812.3	566.12
Total HC	807.0	816.1	590.29

[a] Model could not match the specified RVP. Only flash losses reported.
[b] Emissions calculated from canister measurements.

been used as inputs in this section to estimate emissions. The oil temperature measurements at the tank have been averaged and used as model inputs in lieu of the separator temperatures to predict emissions in the discussions on temperature effects included at the end of this section.

Table 5-7. Site 3: Measured Model Input Parameters

Measurement	Value (units)
Separator Temperature	112°F
Separator Pressure	21.8 psig
Atmospheric Pressure	13.25 psia
Sales Oil Production	438 bbl/day
API Gravity	48.8°
Reid Vapor Pressure	8.07 psia
Sales Oil Temperature	61.1°F
Annual Hours of Operation	8760
Day 3 Separator Oil into Tank	59°F
Tank Dimensions	38 ft. 8 in. dia x 24 ft. high
Tank Capacity	2 @ 5,000 bbls each
Day 1 Minimum and Maximum Temperatures	Min 60.8°F Max 73.9°F
Day 3 Minimum and Maximum Temperatures	Min 32.8°F Max 38.6°F
Separator Gas Specific Gravity	0.976°

Due to the wide variation in ambient temperatures, 66°F on the first day of testing, 36.5°F on the second day, and 35.6°F on the third day, the average values for RVP and the sales oil temperature shown in Table 5-7 may be somewhat misleading. Values for the sales oil temperature and Reid Vapor Pressure appear to be related to the ambient temperature causing a large variance in these values during the three-day monitoring period.

Pressurized separator oil samples were collected twice each day during each of the three measurement days. The composition of the oil did not vary more than approximately 10% during the measurement period. Separator gas samples were collected each day. Gas collected the first day had very high methane levels and did not match with those from the other two days. The values from this sample were not used in any calculations. Sales oil samples were collected on Days 1 and 3 during trucking of the oil. Since the oil was trucked from the facility on an irregular basis, no oil was removed the second day of testing; therefore, sales oil samples were not collected on this day. When sales oil was removed from the tank, negative vent flow was observed. Individual results from sample measurements can be found in Appendix D.

Comparison of Model Results to Measured Emissions for Site 3

Due to the changing process conditions, model predictions will be based on individual days. In addition, periods of oil recirculation and sales oil removal caused variations in vent gas flow. In order to make a fair comparison to the model predictions (the model calculates a steady-state emission and does not take into account these short-term fluctuations), only periods of steady-state flow have been used for the comparisons.

Table 5-8 presents the estimated emissions from E&P TANK model compared to the measured emissions for the first day. As before, two scenarios are presented for the E&P TANK model, an RVP estimation and one based on AP-42. All model predictions are based on a separator temperature of 112°F (measured at the outlet of the heater/treater) and the separator pressure of 24.8 psig measured for this day. Measured emissions are based on times of steady-state flow and the on-site GC concentrations. Table 5-9 presents the model predictions versus measured emissions for Day 3 using the measured separator pressure of 21.8 psig for that day. The AP-42 option for the model was run using measured tank sizes, sales oil temperatures, and ambient temperature maximums and minimums for each day reported.

As can be noted from Tables 5-8 and 5-9, the measured emissions are five to more than ten times less than E&P TANK emission estimates. The low vent flows were noted during the field measurements and prompted tracing a number of pipes going into and out of the tanks to ensure all emissions were measured and the measurement

Table 5-8. Site 3: Comparison of Model and Field Results (Day 1)

Compound	E&P TANK		Measured Emissions[b] (lbs/hr)
	Multi-Stage w/RVP[a] (lbs/hr)	AP-42 Option (lbs/hr)	
Methane	2.38	2.37	1.45
Ethane	5.61	6.15	2.43
Propane	8.63	10.29	2.51
I-Butane	4.71	5.83	1.09
n-Butane	4.13	5.15	1.00
I-Pentane	3.57	4.52	0.72
n-Pentane	1.85	2.35	0.34
n-Hexane	0.85	1.08	0.14
n-Heptane	NA	NA	0.05
Benzene	0.66	0.85	0.09
Toluene	0.55	0.70	0.07
Ethylbenzene	0.02	0.03	0.00
Xylenes	0.16	0.20	0.02
Other C_6	1.69	2.17	0.40
Other C_7	1.76	2.26	0.25
C_8	0.85	1.09	0.13
C_9	0.23	0.30	0.01
C_{10+}	0.00	0.00	0.01
Total BTEX	1.39	1.78	0.18
Total HAP	2.24	2.86	0.32
Total C_{3+} VOC	29.66	36.82	6.82
Total C_{2+} VOC	35.27	42.97	9.25
Total HC	37.65	45.34	10.70

[a] Model could not match the specified RVP. Only flash losses reported.
[b] Emissions with on-site GC measurements.

of the oil temperature at the tank on the third day. Cooling of the oil between the separator and the tank and cooling of the tank walls and sales oil were suspected as contributors to the low measured emissions. These temperature effects will be discussed in greater detail at the end of this section.

Table 5-9. Site 3: Emissions Comparison of Model and Field Results (Day 3)

Compound	E&P TANK		Measured Emissions [b] (lbs/hr)
	Multi-Stage w/RVP [a] (lbs/hr)	AP-42 Option (lbs/hr)	
Methane	2.19	2.25	1.12
Ethane	8.24	9.07	2.00
Propane	11.52	13.11	1.66
I-Butane	5.96	6.87	0.58
n-Butane	5.22	6.03	0.50
I-Pentane	4.53	5.25	0.34
n-Pentane	2.31	2.68	0.15
n-Hexane	1.06	1.24	0.06
n-Heptane	NA	NA	0.02
Benzene	0.83	0.97	0.04
Toluene	0.69	0.81	0.02
Ethylbenzene	0.02	0.03	0.00
Xylenes	0.20	0.23	0.00
Other C_6	2.09	2.44	0.18
Other C_7	2.10	2.45	0.10
C_8	1.11	1.30	0.04
C_9	0.28	0.32	0.00
C_{10+}	0.00	0.00	0.00
Total BTEX	1.74	2.03	0.06
Total HAP	2.81	3.27	0.12
Total C_{3+} VOC	37.92	43.71	3.67
Total C_{2+} VOC	46.16	52.78	5.67
Total HC	48.35	55.03	6.79

[a] Using separator temperature of 112°F.
[b] Emissions with on-site GC measurements.

SITE 4 MODEL RESULTS

Site 4 Model Input Parameters

Measurement of the model input parameters, plus the separator gas and sales oil compositions were made over a four-day period. The average measured model input parameters are presented in Table 5-10. As noted in Section 4, the sales oil was thought to be layering in the tank. Therefore, the API gravities and RVPs varied with the times the samples were collected. A single sample was collected as the oil entered the tank for the API gravity measurement. This sample, API gravity of 36.8, was used in all model inputs. It matched well with the API gravities measured by the site personnel. The average RVP of 5.5 was used for model input.

This site had a two-stage flash, from approximately 90 psig at the low-pressure separator to approximately 45 psig at the heater treater and then from the heater treater to atmosphere at the tanks. However, since the gas from the first flash was not going to the produced water tank as expected and there was no indication that the gas was coming into the tank with the oil, this flash was not used in the model predictions. The flash used was from the heater treater at 46.6 psig to atmospheric pressure. The heater treater operated at a temperature of 145°F. The oil cooled between the heater treater and the tank to an average temperature of 115°F over the measurement period.

Pressurized heater treater oil samples were collected twice each day for three days. The composition of the this oil varied very little from day to day. Heater treater gas samples were collected daily and analyzed for composition. Sales oil samples were collected once each day from the bottom of the production tank. API gravities of these samples varied from 28.6 to 36.9. The results of each of these measurements can be found in Appendix D.

Comparison of Model Results to Measured Emissions for Site 4

Table 5-11 presents the data for the comparison of the predicted emissions to measured emissions. The E&P TANK model has been run with the multi-stage RVP and AP-42 working and standing loss calculations. All emission estimations are based on the heater treater oil temperature of 145°F and a RVP of 5.5. Measured emissions are based on concentrations calculated from the on-site GC data. Canister samples collected at this site had more air and lower hydrocarbon concentrations than

Table 5-10. Site 4: Measured Model Input Parameters

Measurement	Value (units)
Separator Temperature	145°F
Separator Pressure	46.6 psig
Atmospheric Pressure	14.8 psia
Sales Oil Production	259 bbl/day
API Gravity	36.8°
Reid Vapor Pressure	5.5 psia
Oil Temperature into Tank	115°F
Annual Hours of Operation	8760
Tank Capacity	4 @ 400 bbls each
Sales Oil Temperature	97.8°F
Tank Dimensions	12 ft. dia x 20 ft. high
Minimum Temperature	34.9°F
Maximum Temperature	90.8°F
Separator Gas Specific Gravity	0.648°

the on-site GC data. The average vent flow rate was used to calculate measured emissions. Due to the problems observed with hydrocarbon buildup in the differential pressure transducers which required them to be cleaned on a regular basis, the flow rates, and thus the measured emissions, are likely biased low. The magnitude of the bias cannot be established.

The E&P TANK model would not converge to a solution with the measured separator temperature of 145°F for the multi-stage or single-stage working and standing losses options. The AP-42 method, however, did calculate these emissions. Separator temperatures were dropped to the point where the multi-stage calculation would

Table 5-11. Site 4: Emissions Comparison of Model and Field Results

Compound	E&P TANK		Measured Emissions[b] (lbs/hr)
	Multi-Stage w/RVP[a] (lbs/hr)	AP-42 Option (lbs/hr)	
Methane	2.71	2.69	2.14
Ethane	3.57	3.62	1.67
Propane	12.54	12.98	4.06
I-Butane	7.91	8.64	1.85
n-Butane	9.73	10.39	1.83
I-Pentane	5.93	6.48	1.16
n-Pentane	3.72	4.09	0.78
n-Hexane	1.20	1.35	0.23
n-Heptane	NA	NA	0.07
Benzene	0.13	0.14	0.02
Toluene	0.21	0.25	0.04
Ethylbenzene	0.05	0.05	<0.01
Xylenes	0.09	0.10	0.01
Other C_6	1.82	2.04	0.55
Other C_7	3.73	4.25	0.44
C_8	1.61	1.86	0.21
C_9	0.39	0.46	0.02
C_{10+}	0.00	0.00	<0.01
Total BTEX	0.48	0.54	0.07
Total HAP	1.68	1.89	0.31
Total C_{3+} VOC	49.05	53.08	11.29
Total C_{2+} VOC	52.62	56.70	12.95
Total HC	55.33	59.39	15.09

[a] Multi-stage and single-stage RVP option would not work at a separator temperature of 145°F. The highest temperature which allowed the model to operate was 141°F.

[b] Emissions with on-site GC measurements.

converge to estimate emissions. A separator temperature of 141°F did allow the model to converge and was used to calculate the working and standing losses using the multi-stage method. These emissions are reported in Table 5-11. The AP-42 option for the model was based on actual tank dimensions and measured ambient temperatures.

SITE 5 MODEL RESULTS

Site 5 Model Input Parameters

Site 5 was the same as Site 3. This site was resampled during warmer weather to determine if the model predictions were closer to the measured predictions and to observe the temperature of the oil going into the tank more closely. The model input parameters are presented in Table 5-12.

The separator temperature was very similar to that measured during Site 3 sampling. However, the operating pressure had increased from 21.8 to 28.6 psig between sampling episodes. The ambient temperatures were much warmer during the second sampling episode, resulting in the oil going into the tank being warmer at an average temperature of 88°F. Sales oil production was similar to the first sampling effort.

Separator oil samples were collected twice each day over a three-day period. The composition had very little variation over this time period. Separator gas samples were collected daily over the three-day period. The composition of the separator gas did vary as much as 46% for some of the heavier compounds. Sales oil samples were collected daily during oil removal by truck. API gravities and Reid Vapor Pressures were very consistent over the three-day sampling period. Results of each of these measurements can be found in Appendix D.

Comparison of Model Results to Measured Emissions for Site 5

Predicted emissions from the E&P TANK model are compared to measured emissions in Table 5-13. The E&P TANK model emissions include the multi-stage RVP calculations and the AP-42 calculation methods. The multi-stage option would not converge on the measured RVP and only reported flashing losses. AP-42 was used with the actual tank dimensions and measured minimum and maximum temperatures during the monitoring period.

Table 5-12. Site 5: Measured Model Input Parameters

Measurement	Value (units)
Separator Temperature	112°F
Separator Pressure	28.6 psig
Atmospheric Pressure	14.8 psia
Sales Oil Production	451 bbl/day
API Gravity	48.77°
Reid Vapor Pressure	7.40 psia
Sales Oil Temperature	79.8°F
Annual Hours of Operation	8760
Separator Oil Temperature at Tank	88.1°F
Tank Capacity	2 @ 5,000 bbls each
Tank Dimensions	38 ft. 8 in. dia x 24 ft. high
Minimum Temperature	44.7°F
Maximum Temperature	79.5°F
Separator Gas Specific Gravity	0.916°

Measured emissions have been based on average hydrocarbon concentrations from the canister samples and averaged flow rates during times of steady-state flow. Aberrations caused by recycling the oil from the storage tank, oil removal by truck, or process fluctuations have been removed. Hydrocarbon concentrations from the on-site GC are not available for a portion of the monitoring period due to instrument failure. The detector heater failed causing large fluctuations in the GC data. Comparison of the GC data to the canister data during times when both are operational shows fairly good agreement with the GC results being slightly higher.

Table 5-13. Site 5: Emissions Comparison of Model and Field Results

Compound	E&P TANK		Measured Emissions[b] (lbs/hr)
	Multi-Stage w/RVP[a] (lbs/hr)	AP-42 Option (lbs/hr)	
Methane	3.21	2.97	2.40
Ethane	11.02	10.40	5.06
Propane	19.03	19.23	5.70
I-Butane	11.67	12.17	3.25
n-Butane	8.67	9.10	2.54
I-Pentane	8.14	8.66	1.93
n-Pentane	3.59	3.82	0.91
n-Hexane	1.47	1.57	0.36
n-Heptane	NA	NA	0.16
Benzene	0.89	0.95	0.27
Toluene	0.67	0.72	0.23
Ethylbenzene	0.04	0.05	0.01
Xylenes	0.44	0.50	0.05
Other C_4	NA	NA	0.09
Other C_5	NA	NA	1.07
Other C_6	2.89	3.10	1.05
Other C_7	2.24	2.41	0.83
C_8	1.35	1.45	0.21
C_9	0.79	0.84	0.05
C_{10+}	0.00	0.00	0.03
Total BTEX	2.04	2.22	0.56
Total HAP	3.51	3.79	0.92
Total C_{3+} VOC	61.88	64.57	18.57
Total C_{2+} VOC	72.90	74.97	23.62
Total HC	76.11	77.94	26.02

[a] Model could not match the specified RVP. Only flash losses reported.
[b] Emissions from canister measurements.

Agreement between the measured emissions and predicted emissions are better for this sampling episode than for the Site 3 comparison. HAPs and C_{3+} VOCs were overpredicted by E&P TANK by approximately a factor of four.

SITES 6 AND 7 MODEL RESULTS

Sites 6 and 7 Model Input Parameters

The model input parameters for Sites 6 and 7 are presented in Table 5-14. These sites were within approximately one mile of each other and were associated with condensate from natural gas production. They were of particular interest because of the magnitude of emissions associated with relatively small production and high-pressure flash to atmospheric pressure. Both sites had multiple flashes between the high-pressure separator and the tanks, but all flash gas was directed to the tanks. Both sites also had emission control systems which were bypassed for testing.

The separator temperatures were relatively cool when compared to other sites. However, the pressures were much higher than those found at previous sites. Ambient temperatures were cool during the sampling episode, which may have helped to moderate the emissions. Below freezing temperatures with ice and snow were encountered during two of the scheduled sampling days. However, samples were not collected on those days.

Separator oil samples were collected once each day on 9/18/96 and 9/21/96 and then twice each day on 9/19/96 and 9/20/96 at Site 6. Two samples were collected at Site 7 on 9/22/96 and one was collected on 9/23/96. The separator oil composition from each site showed very little variation across the samples collected. Separator gas samples were not collected at these sites in order to have enough cylinders to collect pressurized oil samples at both sites. Sales oil samples were collected at the same time intervals as the separator oil samples. API gravities and Reid Vapor Pressures were relatively consistent over the sampling period. Results of each of these measurements can be found in Appendix D.

Table 5-14. Sites 6 and 7: Measured Model Input Parameters

Measurement	Site 6 Value (units)	Site 7 Value (units)
Separator Temperature	86.4°F	72°F
Separator Pressure	570 psig	495 psig
Atmospheric Pressure	14.8 psia	14.7 psia
Sales Oil Production	12 bbl/day	60 bbl/day
API Gravity	55.5°	58.4°
Reid Vapor Pressure	11.1 psia	15.18 psia
Sales Oil Temperature	43°F	50°F
Annual Hours of Operation	8760	8760
Separator Oil Temperature at Tank	50°F	59°F
Tank Capacity	3 @ 400 bbls each	3 @ 400 bbls each
Tank Dimensions	12 ft. dia x 15 ft. high	12 ft. dia x 15 ft. high
Minimum Temperature	35.4°F	26.8°F
Maximum Temperature	63.2°F	43.4°F
Separator Gas Specific Gravity	Not Measured	Not Measured

Comparison of Model Results to Measured Emissions for Sites 6 and 7

Predicted emissions are compared to measured emissions in Tables 5-15 and 5-16, for Sites 6 and 7, respectively. The E&P TANK model emissions include the multi-stage RVP calculations and the AP-42 calculation methods using the recorded separator temperatures, tank sizes, and ambient conditions.

Measured emissions have been based on average hydrocarbon concentrations from time-integrated canister samples and averaged flow rates across the entire sampling times. Short-term (2 to 5 minute) fluctuations in the vent flow were observed due to the operation of the separator oil transfer valves. However, averaged over a longer period

Table 5-15. Site 6: Emissions Comparison of Model and Field Results

Compound	E&P TANK		Measured Emissions [c] (lbs/hr)
	Multi-Stage w/RVP [a] (lbs/hr)	AP-42 Option [b] (lbs/hr)	
Methane	3.18	3.14	3.08
Ethane	4.62	4.27	3.89
Propane	7.66	6.61	5.55
I-Butane	2.35	2.11	1.90
n-Butane	3.15	2.85	2.84
I-Pentane	1.32	1.20	1.13
n-Pentane	0.72	0.66	0.68
n-Hexane	0.18	0.16	0.18
n-Heptane	NA	NA	NA
Benzene	0.04	0.03	0.05
Toluene	0.03	0.03	0.12
Ethylbenzene	0.00	0.00	0.00
Xylenes	0.02	0.02	0.03
Other C_4	NA	NA	0.03
Other C_5	NA	NA	0.34
Other C_6	0.34	0.31	0.41
Other C_7	0.30	0.27	0.29
C_8	0.10	0.09	0.03
C_9	0.02	0.02	0.01
C_{10+}	0.01	0.01	0.00
Total BTEX	0.09	0.08	0.20
Total HAP	0.27	0.24	0.38
Total C_{3+} VOC	16.24	14.37	13.69
Total C_{2+} VOC	20.86	18.64	17.49
Total HC	24.04	21.78	20.57

[a] Model could not match the specified RVP. Only flash losses reported.
[b] AP-42 option failed for this case. Only flash losses reported.
[c] Emissions with canister measurements.

of time, the flow rates remained relatively constant over the sampling periods at these sites. On-site GC data are not available for these sites due to the lack of electrical power and cost of getting the GC to the site.

Table 5-16. Site 7: Emissions Comparison of Model and Field Results

Compound	E&P TANK Multi-Stage w/RVP [a] (lbs/hr)	E&P TANK AP-42 Option [b] (lbs/hr)	Measured Emissions [c] (lbs/hr)
Methane	17.97	17.68	15.67
Ethane	26.49	24.07	30.44
Propane	37.26	32.99	42.78
I-Butane	11.38	10.39	12.29
n-Butane	14.48	13.26	16.83
I-Pentane	5.54	5.08	5.31
n-Pentane	2.98	2.73	3.10
n-Hexane	0.55	0.50	0.66
n-Heptane	NA	NA	NA
Benzene	0.12	0.11	0.19
Toluene	0.10	0.09	0.32
Ethylbenzene	0.01	0.01	0.01
Xylenes	0.06	0.05	0.08
Other C_4	NA	NA	0.18
Other C_5	NA	NA	1.56
Other C_6	1.17	1.07	1.65
Other C_7	0.91	0.83	0.75
C_8	0.27	0.25	0.08
C_9	0.05	0.04	0.01
C_{10+}	0.02	0.02	0.00
Total BTEX	0.29	0.26	0.60
Total HAP	0.84	0.76	1.27
Total C_{3+} VOC	74.90	67.42	85.80
Total C_{2+} VOC	101.4	91.49	116.24
Total HC	119.40	109.17	131.91

[a] Model could not match the specified RVP. Only flash losses reported.
[b] AP-42 option failed for this case. Only flash losses reported.
[c] Emissions with canister measurements.

Site 7 had very high Reid Vapor Pressures, averaging 15.18 psia over the three sales oil samples collected. In addition, this site had a heat exchanger between the separator and tank inlet which cooled the oil before it entered the tank. All E&P TANK model runs were made with the average separator temperatures for both sites. Neither option, multi-stage nor AP-42, would calculate working and standing emissions at Sites 6 and 7. Only flashing losses were reported at both sites.

EFFECTS OF TEMPERATURE ON EMISSION ESTIMATES

It was noted at Site 3 that the temperature of the oil going into the tank was significantly different from the separator temperature. This temperature differential was due to cooling of the oil as it flowed through exposed pipes from the heater treater to the tanks. The cooler oil resulted in fewer emissions. It is also postulated that some of the emissions were moderated due to condensation on the walls of the tank at the cool ambient temperatures. Condensation was noted in vent pipes at Sites 1, 2, and 4. Condensation was also collected in a liquid knockout in-line immediately before the point where flow measurements were made at Sites 3 and 5.

Using the separator temperature to estimate emissions compared to those actually measured on a cool day results in overprediction of the emissions as can be observed in Table 5-9 for Site 3 on Day 3, which had an average ambient temperature of 36°F. The average oil temperature as it entered the tank was 57.6°F; a significant cooling from the separator temperature of 112°F. The average oil temperature as it flowed into the tank was used in the E&P TANK model to predict emissions to see if they matched better with observed emissions. The results of these model runs are included in Table 5-17. As can be observed, the BTEX and HAP emission estimates are approximately a factor of eight times less than those predicted at the separator temperature, though a factor of three or more greater than the measured emissions. Similarly, the predicted C_{3+} VOC emissions are reduced by a factor of four using the oil temperature as it enters the tank.

Similar results can be observed for Site 4 where the heater treater temperature was 145°F, but the oil as it entered the tank averaged 115°F. The results of running the E&P TANK model at a 115°F separator temperature are shown in Table 5-18. As

Table 5-17. Site 3: Emissions Comparison of Model and Field Results (Day 3) at 57°F

Compound	E&P TANK Multi-Stage w/RVP[a] (lbs/hr)	E&P TANK AP-42 Option[a] (lbs/hr)	Measured Emissions[b] (lbs/hr)
Methane	2.04	1.88	1.12
Ethane	4.20	4.88	2.00
Propane	3.51	4.31	1.66
I-Butane	1.33	1.66	0.58
n-Butane	1.06	1.33	0.50
I-Pentane	0.74	0.94	0.34
n-Pentane	0.35	0.45	0.15
n-Hexane	0.13	0.16	0.06
n-Heptane	NA	NA	0.02
Benzene	0.10	0.13	0.04
Toluene	0.07	0.90	0.02
Ethylbenzene	0.00	0.00	0.00
Xylenes	0.02	0.02	0.00
Other C_6	0.26	0.33	0.18
Other C_7	0.22	0.28	0.10
C_8	0.10	0.12	0.04
C_9	0.02	0.03	0.00
C_{10+}	0.00	0.00	0.00
Total BTEX	0.19	0.24	0.06
Total HAP	0.32	0.40	0.12
Total C_{3+} VOC	7.92	9.84	3.67
Total C_{2+} VOC	12.12	14.72	5.67
Total HC	14.16	16.60	6.79

[a] Using separator temperature of 57.6°F.
[b] Emissions with on-site GC measurements.

with the Site 3 results, the emissions are reduced and are closer to the measured emissions at these temperatures.

The use of separator temperatures to model emissions is a very conservative approach which should overpredict emissions unless significant heating takes place between the separator and the storage tank. The effects of temperature on emissions also point out

Table 5-18. Site 4: Emissions Comparison of Model and Field Results at 115°F.

Compound	E&P TANK Multi-Stage w/RVP [a] (lbs/hr)	E&P TANK AP-42 Option [a] (lbs/hr)	Measured Emissions [b] (lbs/hr)
Methane	2.77	2.65	2.14
Ethane	3.96	3.28	1.67
Propane	11.84	10.10	4.06
I-Butane	6.29	5.51	1.85
n-Butane	7.29	6.42	1.83
I-Pentane	3.85	3.41	1.16
n-Pentane	2.32	2.05	0.78
n-Hexane	0.64	0.57	0.23
n-Heptane	NA	NA	0.07
Benzene	0.07	0.06	0.02
Toluene	0.11	0.09	0.04
Ethylbenzene	0.02	0.02	<0.01
Xylenes	0.04	0.03	0.01
Other C_6	1.00	0.89	0.55
Other C_7	1.87	1.66	0.44
C_8	0.75	0.67	0.21
C_9	0.17	0.15	0.02
C_{10+}	0.00	0.00	<0.01
Total BTEX	0.23	0.21	0.07
Total HAP	0.87	0.78	0.31
Total C_{3+} VOC	36.26	31.62	11.29
Total C_{2+} VOC	40.22	34.91	12.95
Total HC	42.99	37.56	15.09

[a] Based on an oil temperature of 115°F.
[b] Emissions with on-site GC measurements.

the problems with measuring emissions on a particular day(s) and making annual emission estimates based on those data.

It may be possible to correct the modeled emissions for ambient temperature effects on predicted emissions. Table 5-19 presents measured temperatures for the oil going into the tank, tank vent gas, separator temperatures, and average ambient temperatures measured during monitoring. It also presents the ratio between the E&P TANK

Table 5-19. Measured Temperatures and Ratio of Measured-to-Modeled Predictions

Site	Tank Inlet Temp. (°F)	Tank Vent Temp. (°F)	Separator Temp. (°F)	Ambient Temp. (°F)	Emission Ratio for C_{3+} VOCs Measured/ Modeled
2	112 [a]	93	112	66	0.69
3 (Day 1)	88 [a]	65	112	67	0.23
3 (Day 3)	58	42	112	36	0.097
4	115	78	145	63	0.23
5	88	67	112	62	0.30
6	50	49	86	49	0.84
7	59	53	72	35	1.15

Site 1 excluded.
[a] Not Measured. Separator temperature or estimated oil temperature used.

multi-stage model predictions (using the separator temperatures) and measured emissions for the C_{3+} VOCs. The temperatures reported in Table 5-19 were used in various combinations in an attempt to define a relationship between the temperature and the ratio of measured-to-modeled emissions. A plot of the separator temperatures minus the ambient temperature versus the ratio of measured-to-modeled predictions for the C_{3+} VOC emissions shows a somewhat linear relationship (r^2 = 0.8) as shown in Figure 5-1.

Correction of the predicted emissions at Sites 3, 4, and 5 for the difference in separator and ambient temperatures taken from this graph results in E&P TANK multi-stage option model predictions within a factor of two of the measured predictions. These data indicate that corrections for ambient temperatures can be determined even with the limited number of data points available. Additional data points should further refine this temperature correction.

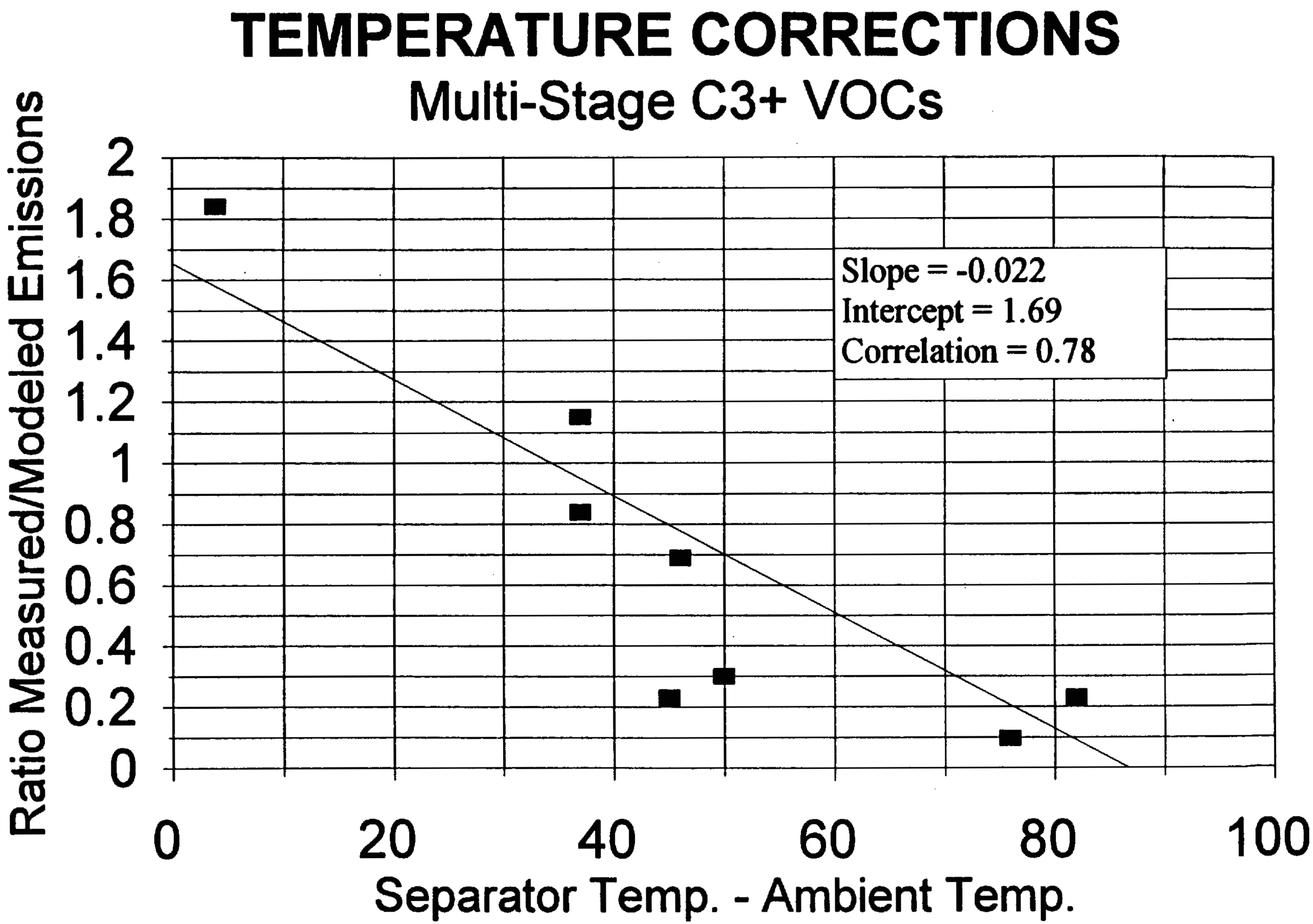

Figure 5-1. Temperature Correction for Multi-Stage Option C_{3+} VOCs

Plots of temperature corrections for the multi-stage method of calculating working and standing losses for HAPs and total hydrocarbons are shown in Figures 5-2 and 5-3, respectively. The linear fit for the HAP plot has the same slope (i.e., corrects to the same modeled-to-measured ratios) as the C_{3+} VOC plot shown in Figure 5-1, but the correlation coefficient (r^2) is not as good. Temperature corrections for the total hydrocarbons result in a slightly different slope and a better correlation coefficient than was observed for the HAPs.

The AP-42 option of E&P TANK was also corrected for the separator minus the ambient temperature. Plots of the C_{3+} VOCs, HAPs, and total hydrocarbons are presented in Figures 5-4, 5-5, and 5-6, respectively. This option did not correct as well as the multi-stage option. However, all modeled-to-measured ratios corrected to within approximately a factor of three as shown in Table 5-20.

Table 5-20 presents the corrected ratios of model calculated emissions to measured emissions for the sites with an average temperature differential (of greater than 40°F but less than 80°F) between the separator and ambient temperatures. Sites 2, 3, 4, and 5 have been corrected for the temper.ature differentials between the separator and ambient temperature using the graphs in Figures 5-1 through 5-6. The ratios of model calculated emissions to measured emissions were derived by first multiplying the slope of the line (in units of ratio/°F) by the difference in the separator and ambient temperatures (ΔT, °F). The product of the slope and ΔT was then divided into the measured emission rate (tons/yr) of each site to obtain a corrected model emission rate (tons/yr). Finally, the corrected model emission rate was divided by the measured emissions for each site to obtain the ratios of corrected model to measured emissions shown in Table 5-20. Site 1 was excluded from all calculations for the reasons previously discussed on pages 5-4 and 5-5. Sites 6 and 7 had average ambient temperatures within 40°F of the separator temperature, and model results agreed well with the measured emissions. As can be noted in the table, the HAPs corrections

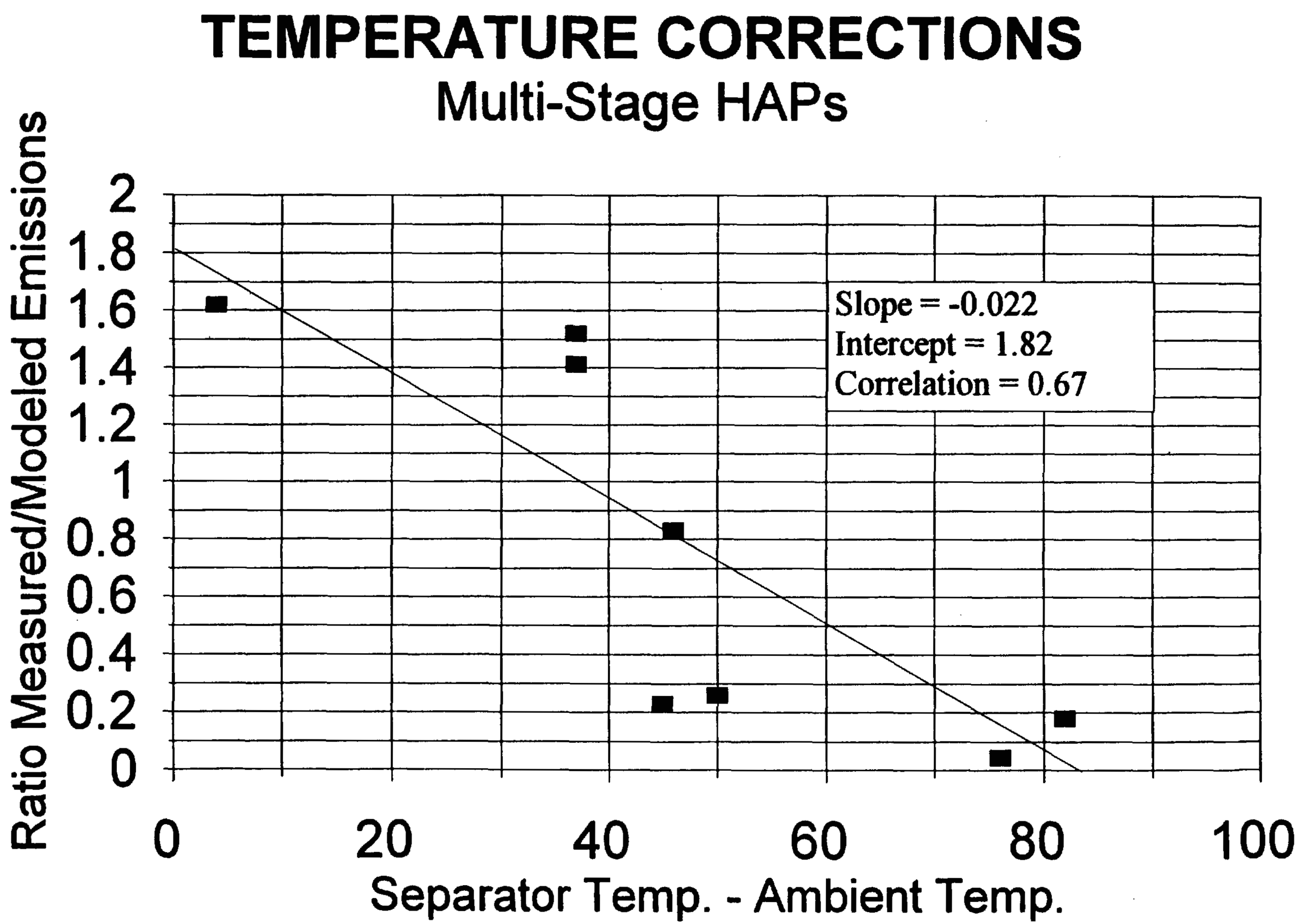

Figure 5-2. Temperature Correction for Multi-Stage Option HAPs

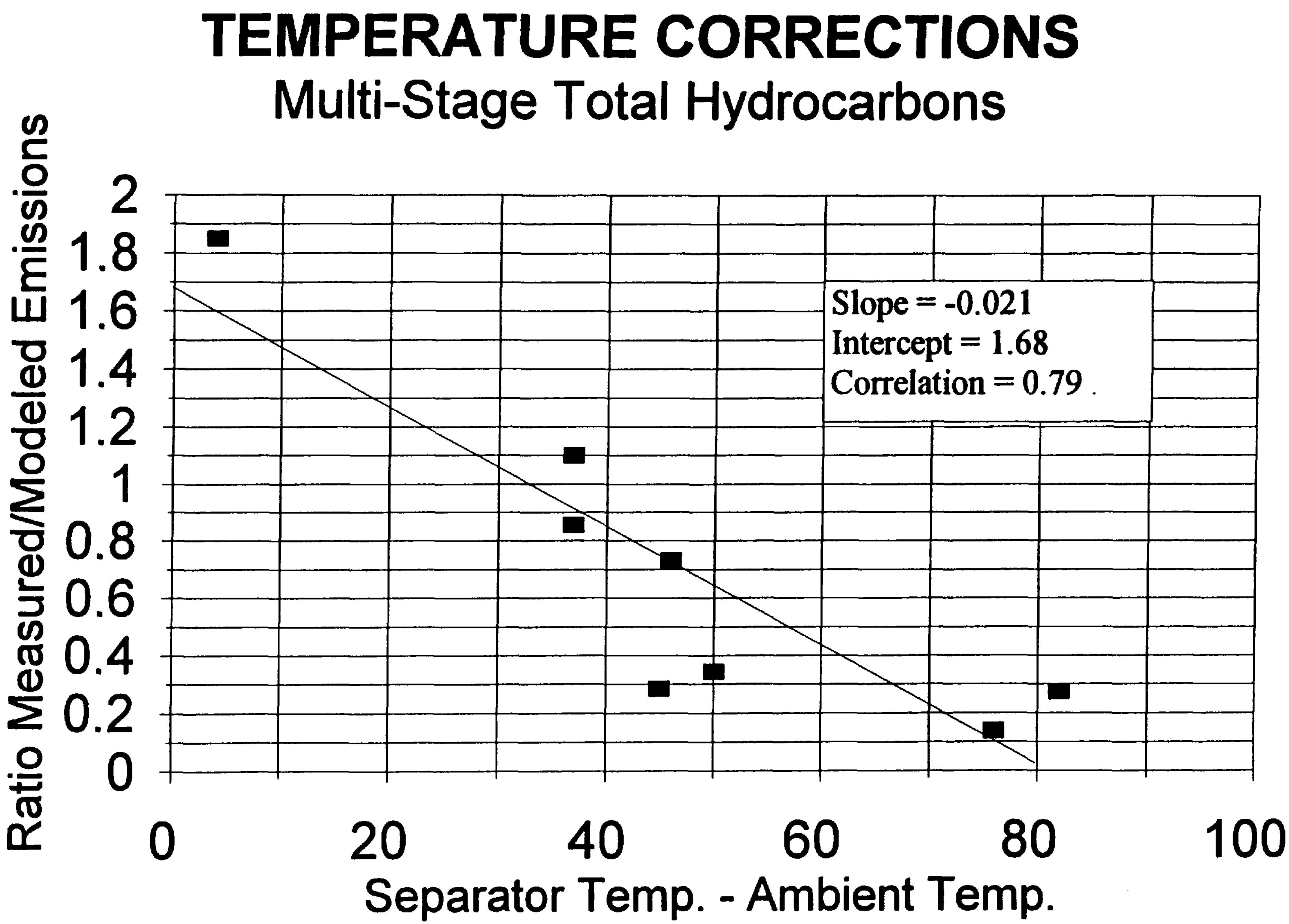

Figure 5-3. Temperature Correction for Multi-Stage Option Total Hydrocarbons

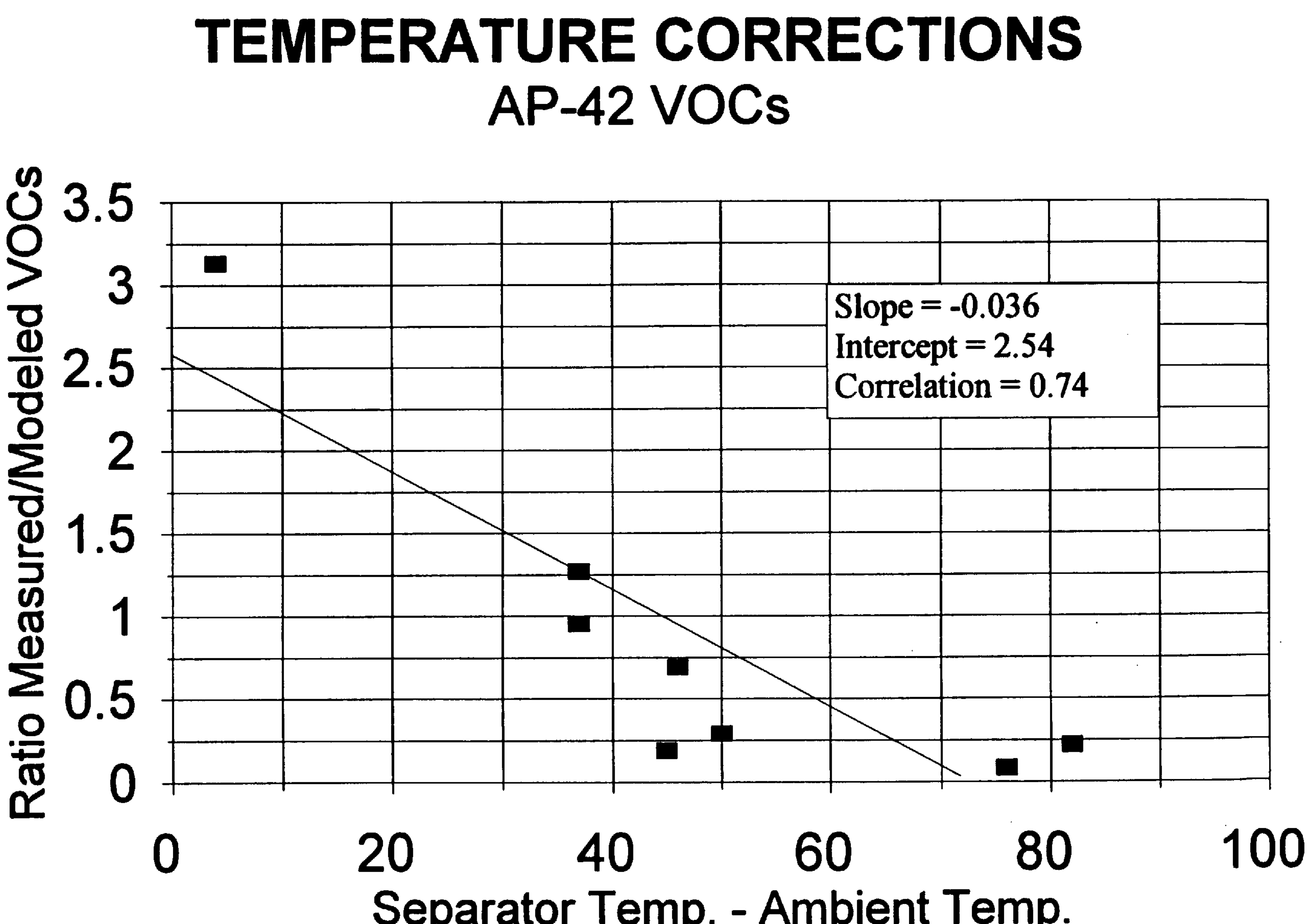

Figure 5-4. Temperature Correction for AP-42 Option C_{3+} VOCs

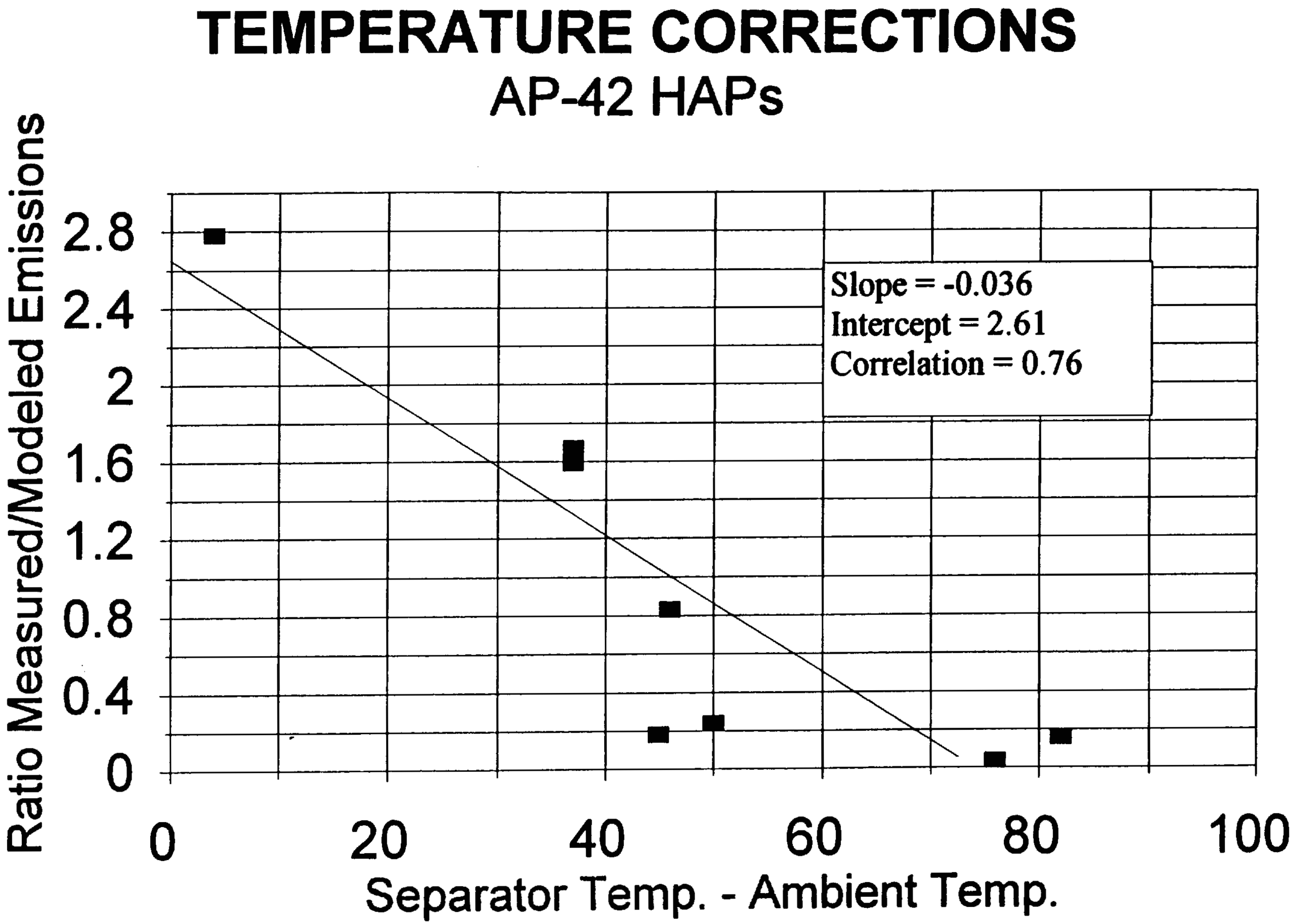

Figure 5-5. Temperature Correction for AP-42 Option HAPs

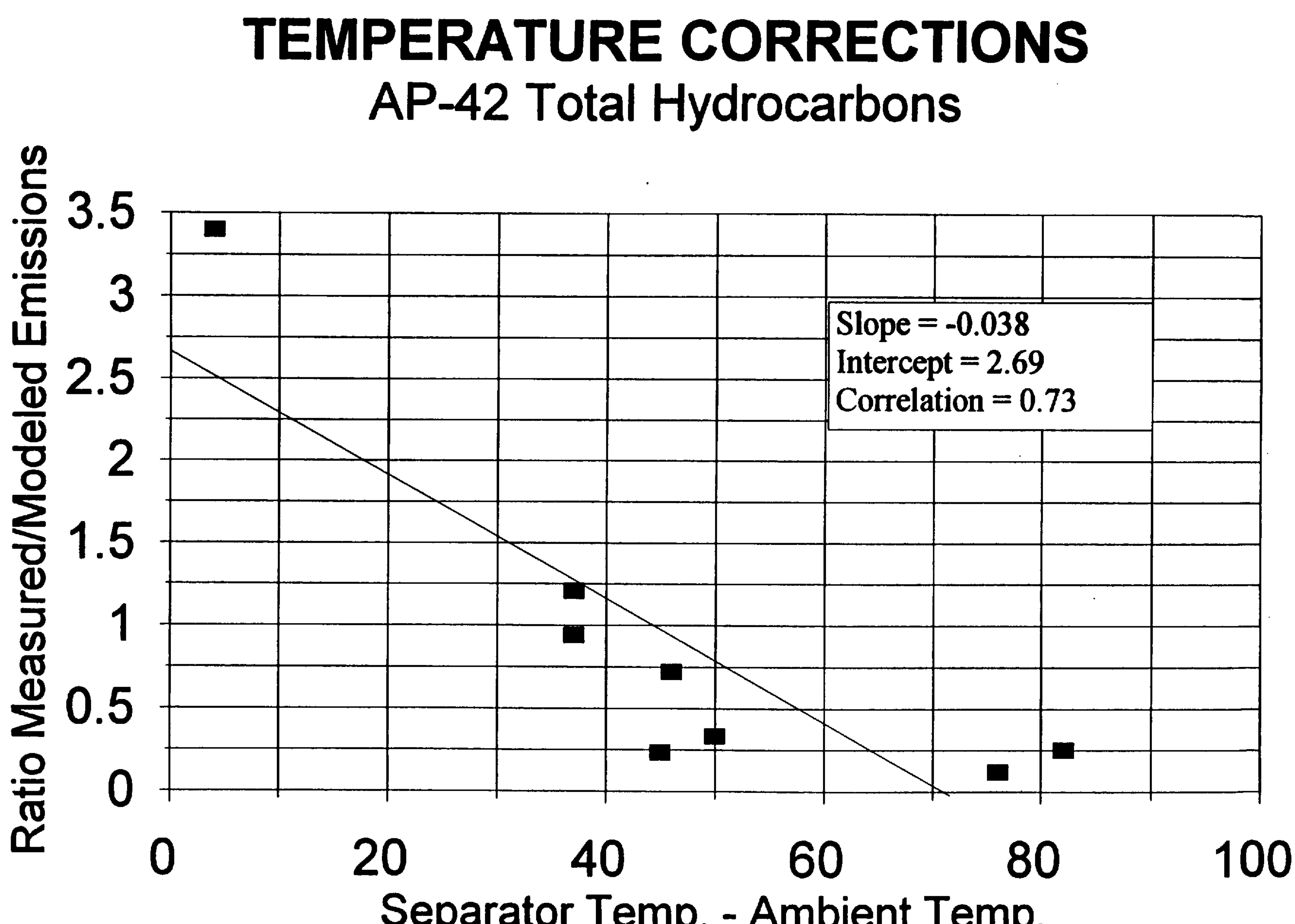

Figure 5-6. Temperature Correction for AP-42 Option Total Hydrocarbons

Table 5-20. Temperature Corrected Model Calculated to Measured Emission Ratios

Site	Separator Temp. (°F)	Temp. Differential (Sep-Amb) (°F)	E&P TANK Multi-Stage			E&P TANK AP-42		
			HAPs	VOCs	THC	HAPs	VOCs	THC
2	112	46	0.99	0.99	1.04	0.60	0.60	0.57
3 (Day 1)	112	45	1.01	1.01	1.06	0.62	0.62	0.59
3 (Day 3)	112	76	0.59	0.59	0.63	0.37	0.37	0.33
4	145	82	0.56	0.56	0.58	0.34	0.34	0.32
5	112	50	0.91	0.91	0.95	0.56	0.56	0.53

agreed exactly with those calculated for the VOCs. The linear fit from the HAPs plots were not as good as those for the C_{3+} VOCs.

Table 5-20 indicates that the E&P TANK model predictions can be corrected for temperature using measured temperature differences between the average separator and average ambient temperatures for the monitoring period. These temperature corrections adjust the model predictions to within a factor of two of the predictions for the multi-stage option and very close to a factor of three for the AP-42 option.

SUMMARY OF RESULTS

Table 5-21 presents a summary of model-calculated emission estimates compared to the measured emissions at every site. Comparisons for total HAPs and C_{3+} VOCs are presented. Measured and estimated emissions for individual compounds can be found in the tables previously presented in this section.

Several observations can be made from the data presented in Table 5-21:

Table 5-21. Summary of Model Comparison to Measured Emissions for Each Site

Site	Oil Data	Measured Emissions (lbs/hr)		Predicted Emissions (lbs/hr)		
		HAPs	C_{3+} VOCs	E&P TANK Model	HAPs	C_{3+} VOCs
Site 2	APIG = 43.2 RVP = 8.70 BOPD = 1600	23.9	515	Multi-Stage Option AP-42 Option	28.6 29.0	741 749
Site 3, Day 1	APIG = 48.8 RVP = 8.07 BOPD = 440	0.32	6.82	Multi-Stage Option AP-42 Option	1.39 1.78	29.7 36.8
Site 3, Day 3	APIG = 48.8 RVP = 8.07 BOPD = 440	0.12	3.67	Multi-Stage Option AP-42 Option	2.81 3.27	37.9 43.7
Site 4	APIG = 36.8 RVP = 5.50 BOPD = 259	0.31	11.3	Multi-Stage Option AP-42 Option	1.68 1.89	49.1 53.1
Site 5	APIG = 48.8 RVP = 7.40 BOPD = 451	0.92	18.6	Multi-Stage Option AP-42 Option	3.51 3.79	61.9 64.6
Site 6	APIG = 55.5 RVP = 11.1 BOPD = 12	0.38	13.7	Multi-Stage Option AP-42 Option	0.27 0.24	16.2 14.4
Site 7	APIG = 58.4 RVP = 15.2 BOPD = 60	1.27	85.8	Multi-Stage Option AP-42 Option	0.84 0.76	74.9 67.4

APIG = API gravity.
RVP = Reid Vapor Pressure.
BOPD = Barrels of oil per day.
E&P TANK multi-stage option = Model run with adiabatic flash and multi-stage distillation for working and standing losses.
E&P TANK AP-42 = Model run with adiabatic flash and AP-42 option for working and standing losses.

- The E&P TANK model overpredicted HAPs and VOC emissions at sites where emission rates were low, but none of these sites exceeded 10 tpy HAPs or 100 tpy of VOCs.

- Agreement between measured emissions and E&P TANK model emission estimates were excellent for Sites 2, 6, and 7 where oil production was constant and there was a small differential between the separator temperature and oil temperature as it entered the tank.

- The measured HAPs emissions are 5% or less of the C_{3+} VOC emissions at all sites. Predicted HAPs emissions are less than 8% of the C_{3+} VOCs.

- Total C_{3+} VOC emissions for the sites tested ranged from 0.2 lbs/barrel of oil to 34 lbs/barrel of oil. Variables such as oil gravity and composition, separator temperature and pressure, and ambient conditions contributed to this wide range of total C_{3+} VOC emissions.

- The E&P TANK option using multi-stage distillation or AP-42 to calculate working and standing losses with an adiabatic flash from the separator temperatures are conservative estimations that generally overpredict emissions.

- Site 1, where the E&P TANK model underpredicted emissions, was not a fair challenge for the model since all vent flow rate measurements were made during the daytime when significant heating of the oil between the separator and tank and heating of the tank surface was occurring. In addition, a suspected separator gas leak into the tanks may have contributed to the measured emissions. In spite of these difficulties, the E&P TANK multi-stage option predicted emissions within a factor of two of the measured emissions.

- Measured C_{3+} VOCs emissions varied by a factor of five on measurements taken at the same site under different sets of conditions. (Site 3, Day 3 and Site 5).

As noted above, Site 1 may not be a fair comparison for the model. Emission flow measurements were made during daylight hours in West Texas where daytime temperatures reached the middle to upper 80s. Oil from the separator flowed through black above-ground lines to the tank and absorbed a significant amount of heat before entering the tank. The temperature of the oil going into the tank was not measured at this site. However, the vent gas temperature, which exceeded 100°F during the middle of the day on two of the monitoring days, indicated that solar heating of the oil and the tank likely contributed to the measured emissions.

The differences in measured emissions at Sites 3 and 5 (same site sampled at two different times) during the two different sampling periods is thought to be primarily due to ambient temperature differentials. The cool ambient temperatures which were encountered at Site 3 were thought to reduced the flash by cooling the oil before it entered the tank and to also cause condensation of some of the flash vapors in the tank. How much of the overprediction is due to tank cooling/condensation is unknown.

In general, model overprediction also may be a function of the difficulty experienced in capturing all of the emissions from the storage tanks due to leaky thief hatches, loss of vapors through other process equipment, and/or the relatively short time frames available to conduct measurements under steady-state conditions. In all cases, the use of the separator temperatures is certainly the most conservative method to estimate emissions.

Table 5-22 presents the model predictions as a ratio of the measured emissions in order to directly compare estimation results. This table also contains the separator temperature and pressure for each site.

As can be observed from Table 5-22, the E&P TANK multi-stage option met the desired criterion of being within a factor of two of the measured emissions at Sites 1, 2, 6, and 7. The AP-42 option met the criterion at Sites 2, 6, and 7. The E&P TANK multi-stage option did not meet the criterion at Sites 3, 4, and 5 (3 and 5 were the same site) where considerable oil cooling was observed between the heater/treater and the tanks. In these cases, using the separator temperatures resulted in conservative overprediction of emissions. However, application of a temperature correction, as discussed earlier, resulted in predicted emissions within a factor of two of the measured emissions at these three sites for the multi-stage option for calculating working and standing losses.

Table 5-22. Ratio of Model Calculated Emissions to Measured Emissions

Site	Separator Temp. (°F)	Separator Press. (psig)	Multi-Stage Option			Option AP-42		
			HAPs	VOCs	THC	HAPs	VOCs	THC
1	75.6	17.3	1.26	0.54	0.49	0.36	0.32	0.29
2	112	30	1.20	1.44	1.37	1.21	1.45	1.38
3 (Day 1[a])	112	24.8	4.34	4.35	3.52	5.56	5.40	4.24
3 (Day 3[a])	112	21.8	23.4	10.3	7.12	27.3	11.9	8.10
4[a]	145	46.6	5.42	4.35	3.67	6.10	4.70	3.94
5[a]	112	28.6	3.82	3.33	2.93	4.12	3.47	3.00
6	86.4	570	0.71	1.18	1.17	0.63	1.05	1.06
7	72	495	0.66	0.88	0.91	0.60	0.79	0.83

[a] Uncorrected; application of a temperature correction factor based on separator temperatures, average ambient temperatures, and the measured-to-predicted emissions ratios results in these sites having predicted emissions within a factor of two for the multi-stage option and very close to a factor of three for the AP-42 option.

Section 6
CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

E & P Production Tank Emissions

HAPs emissions are a small fraction of the total VOC emissions from the production tanks. For the seven sites sampled, HAP emissions ranged from 1.3 to 5% of the total C_{3+} VOCs.

Tank vent gas emissions are highly dependent on ambient conditions. Therefore, HAP and VOC emissions will fluctuate significantly both daily and seasonally. Emission estimates reported on a yearly basis, such as tons/year, cannot be made by direct measurement of the emissions across a short time period, such as three days, unless that particular time period is representative of annual averages for temperatures, solar insolation, production rate, API gravity, Reid Vapor Pressure, etc. Conducting physical measurement of emissions sufficient to define a particular site's annual emissions would be very cost prohibitive, likely on the order of $40,000 to $60,000 per site.

General Performance of the E&P TANK Model

Estimated emissions from the two E&P TANK model options were very similar in most cases. The multi-stage option for calculating working and standing emissions could not meet the specified RVP at five of the seven sites because of the interactive nature of the calculation method. The AP-42 working and standing losses calculation method is used when the multi-stage calculation option does not converge to a solution. The multi-stage option also would not converge to a solution with the Site 4 separator temperature of 145°F. A separator temperature of 141°F was required for this option to estimate emissions at this site. This model option either overpredicted emissions or underpredicted by less than a factor of two.

The AP-42 option of E&P TANK failed at two sites (6 and 7) and only reported flash losses. As with the multi-stage option, it overpredicted emissions or underpredicted by a factor of two or less (Site 1 excluded since it only represents daytime emissions). Both options of E&P TANK predicted the two highest emission sites within 45% of the measured emissions. The four lower emission sites, excluding Site 1, were significantly overpredicted, but were well within the 10 ton/year HAP and 100 ton/year VOC action levels.

When significant heating/cooling of the fluid between the low-pressure separator/heater treater and the tank inlet occurred, using the temperature of the oil as it enters the tank instead of the separator temperature resulted in predicted emissions closer to those measured. However, using the conditions from any particular day or days will not necessarily be representative of actual emissions across annual time frames.

Emission estimates from the E&P TANK model are sensitive to the measured RVP. Therefore, a representative sample of the sales oil must be collected and correctly analyzed for RVP to accurately estimate emissions. Collecting a representative RVP sample in accordance with the ASTM method can be a challenge at many sites primarily due to limited access to the sales oil. Grab samples can be collected at most sites during trucking or pumping operations using the open tank method of ASTM Method D 4057, but this method is prone to some volatile losses.

Tank Emissions Sampling and Analytical Techniques

Measuring actual tank emissions is an expensive and challenging undertaking. The seven sites sampled were a small percentage of the number screened as candidates for this program. Many sites were deemed unacceptable for the program objectives. Many different tank configurations were encountered from which representative samples could not be collected. For example, bolted tanks were not sampled since they could not be completely sealed. Other sites were unacceptable because multiple destinations were available for produced vapors or vent lines were inaccessible.

Collection of pressurized oil samples at the separator was considered to be one of the greatest sampling challenges during this effort. For these samples to be representative, they must be collected under pressure in a manner such that the dissolved gases do not have an opportunity to flash. They also must be analyzed as a pressurized sample to measure the composition of the oil and the dissolved gases for accurate E&P TANK model predictions. Pressurized oil samples from each site exhibited relatively small compositional changes from day to day indicating the oil composition was not varying much at each site, that the sampling technique retained the dissolved gases during sample collection, and that the analytical techniques employed by the laboratory were providing consistent results. Therefore, it has been shown in this program that these samples can be accurately and reproducibly collected and analyzed.

Use of orifice plates to measure the low flow rates associated with the tank vents was an acceptable measurement method at most sites, though measurements were being made at the lower end of the transducer range at the low flow sites. Flow measurement at the lower end of the transducer range adds to the variabililty of the measurement. For most sites, a 2-inch vent line with a 1-inch or smaller orifice plate and a pressure transducer in the range of either 0 to 3 or 0 to 10 inches of water was used to measure vent stream flows on a continuous basis.

The vent gas stream composition also varied considerably at some sites based on ambient temperatures and on the amount of air entering the tank during withdrawl cycles. The on-site GC provided numerous instantaneous compositional measurements which could be evaluated with the flow rate measured at that same time increment. These GC measurements could also be averaged to obtain average compositions. Since the point-in-time measurements made with the on-site GC did not show large measurement-to-measurement fluctuations, time averaging or flow averaging data gave essentially the same results. In addition, since small changes in composition as a function of time were observed, similar results between canister and on-site GC data should have been observed. Taking into account the fact that the sample lines for the two techniques were placed in different locations at most sites and that on-site GC analyses reflecting collection of ambient air (e.g., during withdrawal cycles) was not included in averages, comparison between the composite canister samples and averages of the on-site GC measured concentrations was very good.

As a general rule, the on-site GC provided slightly higher emissions than those measured with canisters. The differences between canisters and the on-site GC were the most pronounced at the heavier oil sites, presumably due to the condensation of a portion of the heavier compounds in sample lines and/or on the walls of the canister. Very little difference was observed between the canisters and the on-site GC at sites with condensate.

At most sites, some maintenance was required to the gaskets on Thief hatches and Enardo™ valves to minimize the vapor leakage around these devices. Generally, with maintenance, it was possible to prevent the loss of all but a small portion, generally less than 5%, of the flash gas from the tanks. However, at some sites, it was very difficult to determine if all of the emissions were being captured. In particular, Sites 3, 4, and 5 had numerous pipes into and out of the separator and storage tanks which could have resulted in the loss of some of the flash gas. These pipes were traced as thoroughly as possible to ensure emissions were not lost through them to another, untested vent.

At sites which did not have LACT units, collection of representative sales oil samples was difficult. In some cases, sample ports were not available on the sales oil lines. In these cases, grab samples of the sales oil from the tank or the truck was necessary. Sampling with grab samples increased the likelihood of some volatile losses and a biased RVP measurement. Collection of a representative sales oil sample for the determination of RVP and API gravity is important to the ability of the E&P TANK model to accurately predict emissions.

RECOMMENDED AREAS FOR FUTURE INVESTIGATION

The project team identified the following as areas for possible future investigation that could enhance the use of E&P TANK:

- Although the sampling and analytical techniques used in this project appear to be satisfactory, future work might consider alternative test methods (e.g., tracer gas releases) to confirm the measurements from this study. This study indicated that some emission measurement problems (e.g., Site 4) were encountered in measuring vent gas flows because of hydrocarbon buildup in the pressure transducer that may have biased the flow measurements low.

- Cooling of the oil between the separator and the tanks may contribute to the differences observed at some sites between the measured and predicted emissions. Further investigations, with additional test methods, may be needed to determine if condensation at cooler temperatures is occurring inside the tanks and reducing emissions.

- A field guide for collecting representative samples and process conditions for model input parameters should be developed.

- Development of a protocol for using the model(s) to develop annual emissions estimates should be considered.

- Use of a pilot-scale separator and tank at some sites to carefully control temperatures, pressures, and vapor leaks during emission measurements should be considered. A skid-mounted pilot unit could also be used to vary separator temperatures and pressures to determine the effect of these parameters on emissions at a particular site.

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