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Volume I

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EMISSION TEST REPORT

FUGITIVE TEST REPORT AT THE GULF VENICE GAS PLANT VOLUME I

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SECTION 1

INTRODUCTION

This report presents the results of testing for fugitive VOC (Volatile Organic Compounds) emissions at the Gulf Venice gas plant, Venice, La. The testing was performed by Radian Corporation on March 2 through March 13, 1981. This work was funded and administered by the Emission Measurement Branch of the U.S. Environmental Protection Agency. The purpose of this testing was to develop data to be used in support of New Source Performance Standards for onshore production facilities.

The specific objectives of the test program were to:

1) conduct a screening survey using a portable analyzer to obtain equipment inventories and leak frequencies by equipment type;

2) collect process information for each source including service, composition in the line, seal orientation, elevation, and accessability;

3) conduct a limited parallel screening survey using a soap scoring procedure for comparison to portable hydrocarbon analyzer screening results; and

4) perform emission measurements on selected sources that exhibit inconsistent results between portable analyzer screening and soap scoring, and for those sources where previous data are limited.

The following sections present a summary of results, a description of the process configuration, the testing methodology, and the sampling locations. A full listing of the data and other supplemental information are included in the appendices.

SECTION 2

SUMMARY OF RESULTS

This section presents a summary of the fugitive emission data gathered at the Gulf Venice gas plant. All data are presented in the appendices. Appendix A includes a more detailed listing of the mass emission sampling data, as well as an explanation of all coding conventions used on the field data sheets. Appendix B includes copies of the field data sheets.

The gas plant screening results are presented in Tables 2-1 and 2-2. Table 2-1 presents the distribution of VOC concentration readings for each source type, while Table 2-2 presents similar information for soap scores. These tables also give the population results by source type.

The results of the baggable sampling are presented in Table 2-3. The mass emission rates are presented in kilograms per day for each source type in terms of both methane and nonmethane hydrocarbons. The sources were rescreened both before and after sampling. The mean value of the rescreening is also presented in Table 2-3 for both the OVA and soap scoring. The original screening value is presented along with screening values taken immediately before and after sampling in Table 2-4. These data also present paired values for VOC concentrations and soap scores so that a comparison of the two survey methods can be made.

It should be noted that the source type called flanges actually includes a variety of pipe-to-pipe connections including threaded fittings, unions, and compression-type tubing fittings. Welded joints were not included in this survey. The "other" category represents a group of sources that were too few in number to warrant separate listing. Included in the "other"

TABLE 2-1. SUMMARY OF RESULTS: VOC CONCENTRATION OCCURRENCE DISTRIBUTION
GULF VENICE PLANT

OVA Screening Value (PPMV)	Flanges		Process Drains		Open Ended Lines		Relief Valves		Valves		Pump Seals		Compressors		Other	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
0 to 199	477	94.3	15	75.0	112	80.6	2	66.7	587	56.6	16	40.0	1	50.0	24	100.0
200 to 9,999	19	3.8	3	15.0	15	10.8	0	0.0	228	22.0	15	37.5	0	0.0	0	0.0
>= 10,000	10	2.0	2	10.0	12	8.6	1	33.3	223	21.5	9	22.5	1	50.0	0	0.0
Total Sources Screened	506	17.9	20	100.0	139	95.9	3	50.0	1038	91.4	40	100.0	2	50.0	24	96.0
Sources not Screened	2314*	82.1	0	0.0	6	4.1	3	50.0	98	8.6	0	0.0	2	50.0	1	4.0
Total Sources	2820*		20		145		6		1136		40		4		25	

- Number of Sources
% - Percent of Total Sources Screened
* Estimated Value - Every fifth flange was surveyed

TABLE 2-2. SUMMARY OF RESULTS: SOAP SCORING OCCURRENCE DISTRIBUTION GULF VENICE PLANT

	SOURCE TYPE															
	Flanges		Process Drains		Open Ended Lines		Relief Valves		Valves		Pump Seals		Compressors		Other	
Soap Score	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
0	17	94.4	0	--	3	100.0	0	--	15	53.6	0	--	0	--	0	--
1	0	0.0	0	--	0	0.0	0	--	2	7.1	0	--	0	--	0	--
2	0	0.0	0	--	0	0.0	0	--	5	17.9	0	--	0	--	0	--
3	1	5.6	0	--	0	0.0	0	--	3	10.7	0	--	0	--	0	--
4	0	0.0	0	--	0	0.0	0	--	3	10.7	0	--	0	--	0	--
Total Sources Soaped	18	0.6	0	0.0	3	2.1	0	0.0	28	2.5	0	0.0	0	0.0	0	0.0
Sources Not Soaped	2802*	99.4	20	100.0	142	97.9	6	100.0	1108	97.5	40	100.0	4	100.0	25	100.0
Total Sources	2820*		20		145		6		1136		40		4		25	

- Number of Sources
% - Percent of Total Sources Soaped
* - Estimated value - Every fifth flange was surveyed

TABLE 2-3. SUMMARY OF RESULTS: MASS EMISSIONS DATA
GULF VENICE PLANT

Source Type	Source ID	Mean OVA Screening Value	Mean Soap Screening Value	Nonmethane Leak Rates (Kg/Day)	Total HC Leak Rates (Kg/Day)
RELIEF VALVES	1183	100001	4.0	0.16150	0.16306
VALVES	19	60001	3.0	0.01666	0.01666
	20	100001	3.5	0.01332	0.01334
	22	100001	3.0	0.01776	0.01780
	227	53501	3.0	0.01256	0.01258
	272	62501	3.0	0.01612	0.01612
	275	55000	2.5	0.01488	0.01488
	276	27500	1.5	0.01064	0.01064
	286	100001	3.0	0.01354	0.01359
	388	100001	3.0	0.01008	0.01022
	403	100001	3.0	0.00062	0.00068
	405	3750	2.0	0.00604	0.00604
	51	34500	2.0	0.00089	0.00089
	65	100001	3.0	0.02076	0.02076
	160	22500	3.0	0.00625	0.00625

TABLE 2-3. (Continued)

Source Type	Source ID	Mean OVA Screening Value	Mean Soap Screening Value	Nonmethane Leak Rates (Kg/Day)	Total HC Leak Rates (Kg/Day)
VALVES	162	17501	3.0	0.02283	0.02285
	166	45000	3.0	0.00182	0.00182
	171	22500	2.0	0.00086	0.00086
	173	62501	2.5	0.00485	0.00486
	175	80001	3.5	0.00538	0.00538
	301	23000	2.0	0.00068	0.00068
	414	100001	4.0	0.07927	0.07991
	420	100001	2.5	0.02637	0.02637
	428	1750	2.0	0.00050	0.00050
	505	100001	2.0	0.00100	0.00100
	507	900	2.0	0.00018	0.00018
	932	2750	2.0	0.00109	0.00109
	931	4000	0.0	0.00262	0.00263
	933	500	.	0.00904	0.00904
	934	55001	0.0	0.00347	0.00347

TABLE 2-3. (Continued)

Source Type	Source ID	Mean OVA Screening Value	Mean Soap Screening Value	Nonmethane Leak Rates (Kg/Day)	Total HC Leak Rates (Kg/Day)
VALVES	950	7000	0.0	0.02695	0.02696
	968	100001	3.0	0.44088	0.44204
	972	100001	3.5	0.03812	0.03814
	978	65001	3.0	0.00000	0.00000
	980	100001	4.0	0.01769	0.01771
	983	100001	3.0	0.09325	0.09389
	1052	1000	0.0	0.00144	0.00144
	1070	13500	.	0.04612	0.04612
	1072	21500	.	0.40394	0.40439
	1091	1850	0.5	0.00325	0.00325
	1092	625	0.0	0.00308	0.00308
	647	100001	2.5	0.00737	0.00737
	650	100001	4.0	0.14687	0.14687
	656	100001	3.0	0.00793	0.00793
	1176	100001	2.5	0.00056	0.00204

TABLE 2-3. (Continued)

Source Type	Source ID	Mean OVA Screening Value	Mean Soap Screening Value	Nonmethane Leak Rates (Kg/Day)	Total HC Leak Rates (Kg/Day)
VALVES	1179	100001	3.5	0.00105	0.00689
	1184	100001	3.5	0.05388	0.49913
	1236	100001	4.0	0.00334	0.02154
	1240	100001	3.5	0.00027	0.00027
	1243	100001	4.0	0.01643	0.05503
	1244	100001	4.0	0.00583	0.11097
	1245	2750	2.0	0.00023	0.00023
	1247	5000	2.0	0.00018	0.00018
	1255	1000	1.5	0.00008	0.00008
	1257	3000	2.0	0.00013	0.00013
	1266	100001	3.0	0.00074	0.00599
	1267	80001	4.0	0.00483	0.05457
	1268	100001	4.0	0.00543	0.10671
	1366	2850	0.0	0.00016	0.00054
	577	47500	2.5	0.00218	0.00218

TABLE 2-3. (Continued)

Source Type	Source ID	Mean OVA Screening Value	Mean Soap Screening Value	Nonmethane Leak Rates (Kg/Day)	Total HC Leak Rates (Kg/Day)
VALVES	581	45000	2.0	0.00486	0.00486
	602	8000	2.0	0.00127	0.00127
	603	55501	3.0	0.00177	0.00177
	606	55001	3.5	0.00591	0.00595
	615	100001	3.0	0.00737	0.00737
	696	100001	3.0	0.00533	0.00563
	1292	475	0.5	0.00010	0.00024
	1631	600	0.0	0.00106	0.00106
	1634	125	0.0	0.00016	0.00017
	1637	800	2.0	0.00007	0.00063
	1650	100001	4.0	0.01281	0.05000
	1656	100001	4.0	0.07668	1.60123
	1692	100001	4.0	0.01591	0.16083
	1863	56001	3.0	0.00298	0.00303
	1874	100001	4.0	0.02281	0.02317

TABLE 2-3. (Continued)

Source Type	Source ID	Mean OVA Screening Value	Mean Soap Screening Value	Nonmethane Leak Rates (Kg/Day)	Total HC Leak Rates (Kg/Day)
PUMP SEALS	15	100001	.	4.71385	4.71127
	17	100001	.	6.62584	6.61516
	28	275	.	0.00200	0.00202
	2	100001	.	0.09927	0.09932
	6	3000	.	0.01803	0.01803
	7	2250	.	0.02197	0.02197
	8	70001	.	0.36374	0.36403
	9	100001	.	4.06538	4.06449
	12	100001	.	5.87409	5.87182
	14	2500	.	0.06334	0.06348
	35	6000	.	0.02989	0.02990
	41	4000	.	0.02951	0.02970
	42	8500	.	0.13196	0.13326
	44	8100	.	0.02348	0.02382
	31	40000	.	0.65928	0.68407

TABLE 2-3. (Continued)

Source Type	Source ID	Mean OVA Screening Value	Mean Soap Screening Value	Nonmethane Leak Rates (Kg/Day)	Total HC Leak Rates (Kg/Day)
PUMP SEALS	32	50000	.	0.09037	0.09090
	34	13500	.	0.05336	0.05336
	37	2000	.	0.00540	0.00542
COMPRESSORS	421	100001	.	1.01959	1.01959

TABLE 2-4
RESCREENING DATA SUMMARY
GULF, VENICE

SOURCE TYPE	ID	ORIGINAL SCREENING VALUE ANALYZER	ORIGINAL SCREENING VALUE SOAP	BEFORE MEASUREMENT ANALYZER	BEFORE MEASUREMENT SOAP	AFTER MEASUREMENT ANALYZER	AFTER MEASUREMENT SOAP
PRESSURE RELIEF DEVICES	1183	100001	-	100001	4	100001	4
VALVES	19	10001	-	100001	3	20000	3
	20	18000	-	100001	4	100001	3
	22	7000	2	100001	3	100001	3
	51	4000	2	9000	2	60000	2
	65	100001	4	100001	4	100001	2
	160	30000	-	15000	3	30000	3
	162	25000	-	25000	3	10001	3
	166	15000	-	20000	3	70000	3
	171	18000	-	20000	2	25000	2
	173	30000	-	100001	3	25000	2
	175	100001	-	60000	3	100001	4
	227	40000	-	7000	3	100001	3
	272	20000	-	100001	3	25000	3
	275	100001	-	60000	2	50000	3

TABLE 2-4
RESCREENING DATA SUMMARY
GULF, VENICE

SOURCE TYPE	ID	ORIGINAL SCREENING VALUE ANALYZER	ORIGINAL SCREENING VALUE SOAP	BEFORE MEASUREMENT ANALYZER	BEFORE MEASUREMENT SOAP	AFTER MEASUREMENT ANALYZER	AFTER MEASUREMENT SOAP
VALVES	276	10001	-	20000	2	35000	1
	286	10001	-	100001	3	100001	3
	301	12000	-	6000	2	40000	2
	388	1500	-	100001	3	100001	3
	403	10001	-	100001	3	100001	3
	405	2500	-	3500	2	4000	2
	414	100001	-	100001	4	100001	4
	420	100001	-	100001	3	100001	2
	428	3500	-	1500	2	2000	2
	505	5000	-	.	2	100001	2
	507	1500	-	1000	2	800	2
	577	100001	-	90000	2	5000	3
	581	100001	-	40000	2	50000	2
	602	100001	-	15000	2	1000	2
	603	100001	-	11000	3	100001	3

TABLE 2-4
RESCREENING DATA SUMMARY
GULF, VENICE

SOURCE TYPE	ID	ORIGINAL SCREENING VALUE ANALYZER	ORIGINAL SCREENING VALUE SOAP	BEFORE MEASUREMENT ANALYZER	BEFORE MEASUREMENT SOAP	AFTER MEASUREMENT ANALYZER	AFTER MEASUREMENT SOAP
VALVES	606	100001	-	100001	4	10001	3
	615	100001	-	100001	3	100001	3
	647	100001	-	100001	2	100001	3
	650	100001	-	100001	4	100001	4
	656	60000	-	100001	3	100001	3
	696	100001	-	100001	3	100001	3
	931	30000	-	5000	0	3000	0
	932	3000	-	3000	2	2500	2
	933	3000	-	600	-	400	-
	934	50000	-	100001	0	10001	0
	950	100001	-	9000	0	5000	0
	953	50000	-	100001	3	40000	3
	968	100001	-	100001	2	100001	4
	972	100001	-	100001	3	100001	4
	978	100001	-	100001	3	30000	3

TABLE 2-4
RESCREENING DATA SUMMARY
GULF, VENICE

SOURCE TYPE	ID	ORIGINAL SCREENING VALUE		BEFORE MEASUREMENT		AFTER MEASUREMENT	
		ANALYZER	SOAP	ANALYZER	SOAP	ANALYZER	SOAP
VALVES	980	100001	-	100001	4	100001	4
	983	100001	-	100001	3	100001	3
	1052	900	-	800	0	1200	0
	1070	12000	-	12000	-	15000	-
	1072	15000	-	18000	-	25000	-
	1091	1500	-	2500	0	1200	1
	1092	700	-	750	0	500	0
	1176	100001	-	100001	3	100001	2
	1179	100001	-	100001	4	100001	3
	1184	100001	-	100001	4	100001	3
	1236	100001	-	100001	4	100001	4
	1240	100001	-	100001	3	100001	4
	1243	100001	-	100001	4	100001	4
	1244	100001	-	100001	4	100001	4
	1245	4000	-	4000	2	1500	2

TABLE 2-4
RESCREENING DATA SUMMARY
GULF, VENICE

SOURCE TYPE	ID	ORIGINAL SCREENING VALUE ANALYZER	ORIGINAL SCREENING VALUE SOAP	BEFORE MEASUREMENT ANALYZER	BEFORE MEASUREMENT SOAP	AFTER MEASUREMENT ANALYZER	AFTER MEASUREMENT SOAP
VALVES	1247	5000	-	5000	2	5000	2
	1255	900	-	1200	2	600	1
	1257	4000	-	2500	2	3500	2
	1266	100001	-	100001	3	100001	3
	1267	50000	-	60000	4	100001	4
	1268	20000	-	100001	4	100001	4
	1292	400	-	600	0	350	1
	1366	10001	-	5000	0	700	0
	1631	700	-	500	0	700	0
	1634	250	-	150	0	100	0
	1637	700	-	700	2	900	2
	1650	100001	-	100001	4	100001	4
	1656	100001	-	100001	4	100001	4
	1692	100001	-	100001	4	100001	4
	1863	100001	-	100001	3	12000	3

TABLE 2-4
RESCREENING DATA SUMMARY
GULF, VENICE

SOURCE TYPE	ID	ORIGINAL SCREENING VALUE ANALYZER	ORIGINAL SCREENING VALUE SOAP	BEFORE MEASUREMENT ANALYZER	BEFORE MEASUREMENT SOAP	AFTER MEASUREMENT ANALYZER	AFTER MEASUREMENT SOAP
VALVES	1874	100001	-	100001	4	100001	4
PUMP SEALS	2	100001	-	100001	-	100001	-
	6	500	-	4500	-	1500	-
	7	1200	-	3000	-	1500	-
	8	50000	-	100001	-	40000	-
	9	100001	-	100001	-	100001	-
	12	20000	-	100001	-	100001	-
	14	400	-	3000	-	2000	-
	15	100001	-	100001	-	100001	-
	17	80000	-	100001	-	100001	-
	27	3000	-	4000	-	•	-
	28	150	-	350	-	200	-
	30	100001	-	0	-	•	-
	31	8000	-	20000	-	60000	-
	32	5000	-	40000	-	60000	-

TABLE 2-4
RESCREENING DATA SUMMARY
GULF, VENICE

SOURCE TYPE	ID	ORIGINAL SCREENING VALUE		BEFORE MEASUREMENT		AFTER MEASUREMENT	
		ANALYZER	SOAP	ANALYZER	SOAP	ANALYZER	SOAP
PUMP SEALS	34	8000	-	12000	-	15000	-
	35	10001	-	8000	-	4000	-
	37	8000	-	2000	-	.	-
	41	7000	-	4000	-	4000	-
	42	15000	-	12000	-	5000	-
	44	1500	-	15000	-	1200	-
COMPRESSOR SEALS	421	40000	-	100001	-	100001	-

category were sight glasses, vacuum breakers, meters, pig traps, control valve diaphragm vents, and thermowells.

No attempt has been made to summarize the process data collected. All of these data are contained in the field data sheets in Appendix B. This information will be used in structuring emission factor categories in a report covering all available gas plant fugitive emission data.

SECTION 3

PROCESS DESCRIPTION

This report presents the results of testing at the gas processing portion of the Gulf Oil plant located in Venice, Louisiana. The facility is a refrigerated oil absorption gas plant with a design capacity of 800 x 10^6 cubic feet per day. During the test period, the plant was processing approximately 450 x 10^6 cubic feet per day.

A simplified flow diagram for the plant is shown in Figure 3-1. The raw natural gas is delivered to the plant by pipeline at a relatively high pressure; therefore, there is no need for additional on-site compression. The gas is chilled by a propane refrigeration system and is fed to two parallel absorption trains. The natural gas liquids are absorbed from the gas by a kerosene-type absorption oil. The product gas (97 percent methane) is routed into a pipeline for distribution.

The natural gas liquids are stripped from the absorption oil, and separated into an ethane/propane stream, propane, normal butane, iso-butane, and natural gasoline by a series of distillation columns. The ethane-propane (E/P) stream is amine treated and transported by pipeline to a chemical company for processing. The other liquids are routed to storage in nearby salt dome caverns.

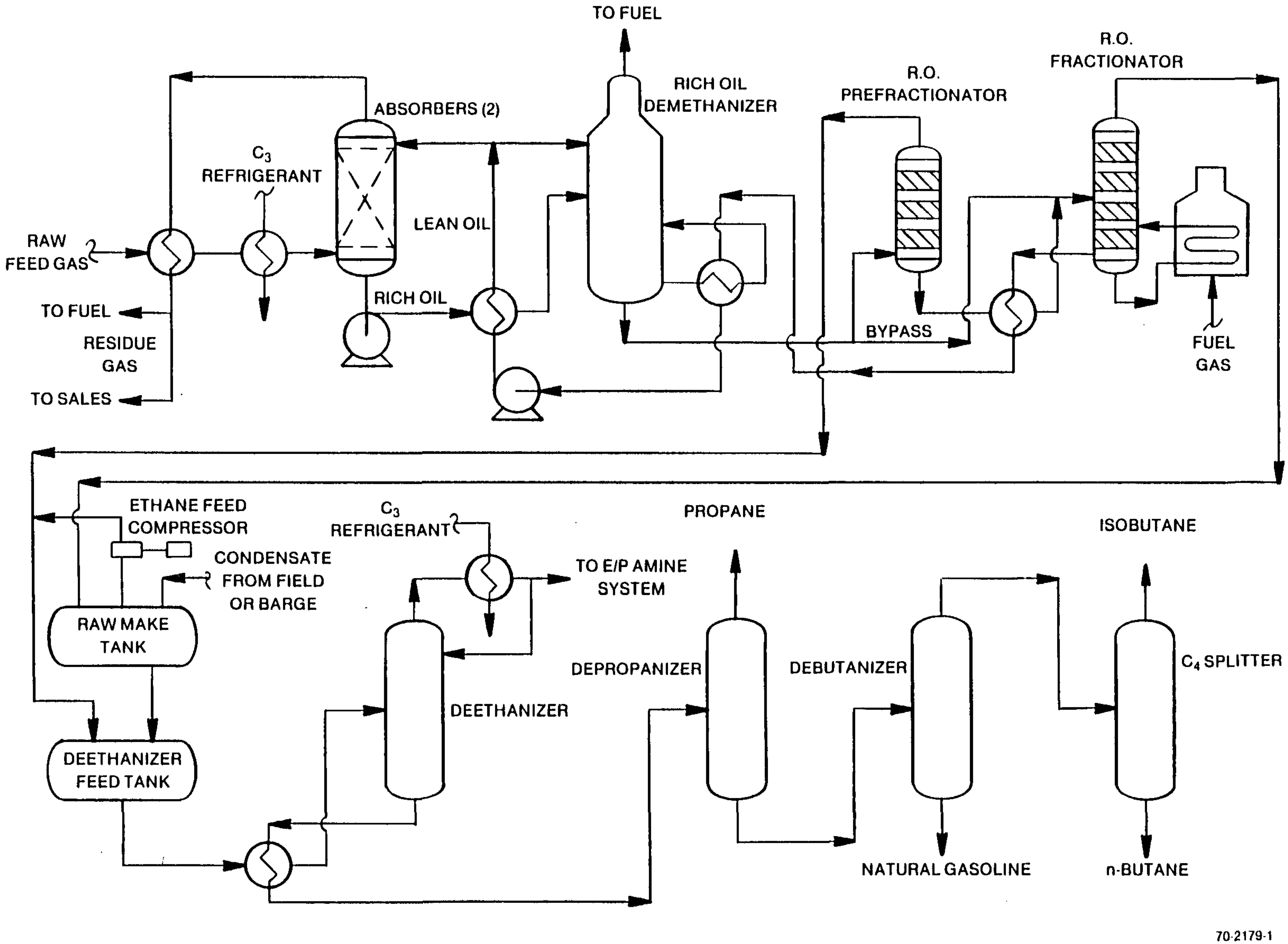

Figure 3-1. Schematic Flow diagram for the Gulf Venice Gas Plant.

SECTION 4

METHODOLOGY

The fugitive emissions testing at the Gulf Venice gas plant included both "screening" and "bagging" operations. Screening is a generic term covering any quick portable method of detecting fugitive emissions. Both instrumental screening (using the Century Systems OVA-108) and soap scoring were used in parallel on this task. Bagging refers to a quantitative emission measurement achieved by enclosing the source in a Mylar® shroud and analyzing an equilibrium flow of air through the enclosure.

The instrumental screening was done according to the procedures specified in EPA Proposed Method 21[1]. Method 21 only requires that the concentration be recorded (as specified in the standard) if it is over the leak definition specified in the applicable regulation. Since this effort was more oriented to regulatory support than to regulatory monitoring, however, the maximum screening value was recorded for all sources.

The soap scoring method was modeled after a method used in screening fugitive emissions from petroleum production facilities.[2] The soap solution was prepared from 100 ml. of rug shampoo (HR Professional Formula) mixed with a gallon of either distilled water or a mixture of distilled water and ethylene glycol. The solution was applied using a common garden sprayer.

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[1]Federal Register, Vol. 46 No. 2, Monday, Jan. 5, 1981, p. 1160.

[2]Eaton, W.S., et al. "Fugitive Hydrocarbon Emissions from Petroleum Production Operations." API Publication No. 4322, American Petroleum Institute (1980).

Each source was sprayed with soap solution, being sure to coat all areas of potential leakage. A careful inspection was then conducted to detect any bubble formation. A soap score was then assigned based on the estimated bubble volume generated in a six-second observation:

Soap Score	Estimated Bubble Volume
0	No detectable bubbles
1	0 to 1 cc/6 sec.
2	1 to 10 cc/6 sec.
3	10 to 100 cc/6 sec.
4	>100 cc/6 sec.

The screening methods outlined above were used on every accessible source except for flanges. Only 20 percent of the flanges were screened because of their large population. Sources screened included valves, flanges, pumps, compressors, open-ended lines, drains, relief valves, and many other miscellaneous sources. The survey was conducted on a line-by-line basis to minimize the time required to obtain process data, such as the composition and phase of the material in the line. A few sources were not screened due to either physical inaccessibility or safety problems which prevented close approach, but these sources were recorded on the data sheets to insure that a complete source inventory was obtained.

Bagging procedures were carried out according to methods developed in previous testing.[3] The leaking area of the source was completely enclosed in a shroud of Mylar® plastic to contain any emissions. A flow of dilution air was induced through the enclosure by the sampling train shown in Figure 4-1. The enclosure seal and the flow rate were varied to achieve

[3]Radian Corporation. "The Assessment of Atmospheric Emissions from Petroleum Refining, Volume 2, Appendix A," EPA Report No. 600/2-80-756, EPA/IERL/RTP, July, 1980.

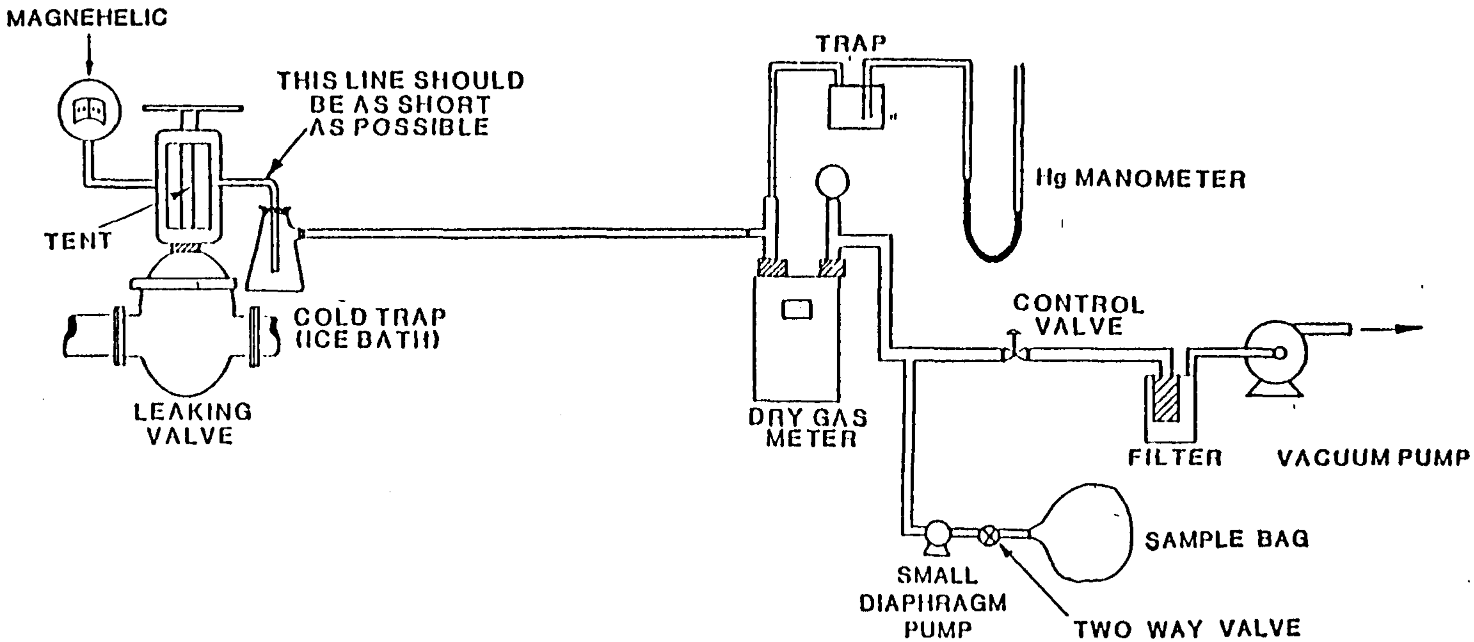

Figure 4-1. Sampling Train for Baggable Source of Hydrocarbon Emissions Using a Diaphragm Sampling Pump

a slight, but measurable, vacuum on the tent to insure that all emissions were contained. A cold trap was provided to collect any heavier components which might condense in the downstream lines. The flow rate was measured with a dry gas meter, at which both temperature and pressure were measured to allow a conversion to standard conditions. The discharge of the vacuum pump was monitored with an OVA to determine when steady-state conditions had been established. At that point, a Tedlar® sampling bag was filled from the discharge of the small Teflon® lined diaphragm pump. The sample bag was then analyzed for methane and total non-methane hydrocarbons on a Byron THC analyzer (GC/FID with backflush after methane). The THC was calibrated daily with a mixture of 728 ppmw propane and 263 ppmw methane in zero air.

Noncondensible mass emissions from the source were then calculated from the bagging data by the following equations:

$$E_G = \frac{K_1 \; DF \; (P - \Delta P) \; M \; (C_T - C_A)}{460 + T} \qquad (1)$$

where E_G = noncondensibel hydrocarbon emission rate in kg/day,

K_1 = 2.99×10^{-5} (a conversion constant),*

D = dry gas meter (DGM) correction factor,

F = flow rate in actual cubic feet per minute,

P = barometric pressure in inches of mercury,

ΔP = differential pressure at the DGM in inches of mercury,

M = molecular weight of the measured gas,

C_T = hydrocarbon concentration in the sample in ppmw,

C_A = ambient hydrocarbon concentration in ppmw,

T = temperature at the DGM in °F.

*The field data were taken in English units. This factor includes appropriate metric conversions as well as an adjustment to standard conditions of 60 °F and 29.92 inches of mercury.

The molecular weight (M) was calculated by:

$$M = \frac{10^6}{\frac{C_T}{86} + \frac{10^6 - C_T}{29}} \; . \tag{2}$$

The emission rates for either the methane or the non-methane fractions can be calculated by the above equations by using the appropriate value of methane or non-methane concentration for C_T in equation (1). If any organic condensate was collected in the cold trap, its contribution to the emissions was calculated by:

$$E_L = 1.44 \frac{(SG)\ V}{t} \tag{3}$$

where E_L = condensible emissions kg/day,

SG = specific gravity of the condensate (used 0.75g/ml. if there was too little to measure the specific gravity),

V = volume of condensate collected in mls,

t = time of collection in minutes.

1.44 = units conversion constant from g/min. to kg./day.

The total hydrocarbon emissions would then be:

$$E_T = E_{GM} + E_{GNM} + E_L \tag{4}$$

where E_T = total hydrocarbon emissions in kg/day,

E_{GM} = methane emissions in kg/day,

E_{GNM} = non-mehtane hydrocarbon emissions in kg/day,

E_L = condensible hydrocarbon emissions in kg/day.

SECTION 5

SAMPLING LOCATIONS

The Gulf Venice plant included both a refinery and a natural gas processing facility. All of the testing described in this report was confined to the natural gas processing section. Screening for fugitive emissions was performed throughout the gas plant, with only a few associated processes excluded, and sources for bagging were selected from those screened. This section provides the details of what portions of the plant were screened and sampled.

The screening survey included all the process equipment in the gas plant with the following exceptions:

- the propane refrigeration system was not screened except for the propane compressor,
- the amine scrubbing system on the ethane/propane product was not screened, and
- the glycol regeneration system was not screened.

In those sections screened, all sources were screened with the exception of flanges. Only 20 percent of the flanges were screened because of their large population.

Instrumental screening was performed on all sources in the screening survey. Soap scoring was conducted in parallel to the instrumental screening for the first few days of testing. When it became necessary to start simultaneous bagging and screening, there was insufficient manpower to do soap scoring on the original screening survey.

Each source selected for bagging was rescreened immediately before and after sampling using both instrumental screening and soap scoring. This was done to provide data for correlations between screening values and mass emission rates, as well as to provide a comparison of soap scoring to instrumental screening.

The primary objective of the bagging effort was to accumulate mass emission data on those sources where existing data were scarce. It was also desired to measure mass emissions from sources where there was inconsistency between the two screening methods. The priorities for source sampling were, therefore:

1) compressor seals,
2) relief valves,
3) pump seals,
4) sources with inconsistent screening values, and
5) valves.

No sampling was done on flanges or open-ended lines since the existing data base covered them adequately.

The only compressor associated with the gas plant was the propane refrigeration compressor. This compressor was sampled.

Despite a high priority, only one relief valve was sampled. Other relief valves were not sampled due physical inaccessibility, venting to a flare, or a lack of utility stations close enough to operate the sampling train.

A total of 20 pump seals were sampled. This included all pump seals found leaking in the original screening survey.

The remainder of the sampling effort was devoted to valves. A total of 76 valves were sampled to fill out a matrix to provide a range of data with which to develop a screening value to leak rate correlation. The limited amount of soaping done on the original screening survey did not identify any sampling candidates due to inconsistencies between soap and instrumental screening. Some inconsistencies were noted, however, during the rescreening of sources chosen for sampling.

APPENDIX A

SUPPLEMENTAL INFORMATION

A-1 Coding Conventions

A-2 Summary of Sampling Data

A-3 Summary of QA/QC Data

A-1

CODING CONVENTIONS

TABLE A-1. DATA CODING CONVENTIONS

Columns	Coding
1,2	Month (i.e., May = 05, October = 10)
3,4	Day of the month
5,6	Year (19 8 0)
7,8	A sequential identification number assigned to each plant.
9,10	An identification number for each process unit encountered. For example: let 01 = Gas Plant - Adsorption 02 = Gas Plant - Cryogenic etc.
11,12,13	A unique identification number assigned to each screening team. Each team member is assigned a personal ID number between 0 and 9. Column 11 will then contain the ID for the soap score reader, column 12 will be the OVA operator, and column 13 will be the data recorder.
14,15	A sequential ID number assigned to each instrument used. Outside documentation should then include: Instrument 1 = OVA #2158 Instrument 2 = OVA #1575 etc.
16 - 21	A sequential ID number for each source encountered. Start back at No. 1 for each new plant.
22 - 28	The instrument screening value in ppmv.
29,30	Source Type Code Source — Code Flange — 1 Process drain — 2 Open-end line — 3 Agitator seal — 4 Relief valve — 5

TABLE A-1. DATA CODING CONVENTIONS (continued)

Columns		Coding	
29,30 (cont'd)		Source	Code
	Valves	Block valve - gate type	10
		Block valve - globe type	11
		Block valve - plug type	12
		Block valve - ball type	13
		Block valve - butterfly type	14
		Block valve - other types	15*
		Control valve - gate type	20
		Control valve - globe type	21
		Control valve - plug type	22
		Control valve - ball type	23
		Control valve - butterfly type	24
		Control valve - other types	25*
	On-line Pump Seals	Single, mechanical, emission point at seal	30
		Single, mechanical, emission point at vent	31
		Single, mechanical, other emission point	32*
		Double, mechanical, emission point at seal	33
		Double, mechanical, emission point at vent	34
		Double, mechanical, other emission point	35*
		Single, packed, emission point at seal	36
		Single, packed, emission point at vent	37
		Single, packed, other emission point	38*
		Sealless pumps	39*

*Explain in comment field.

TABLE A-1. DATA CODING CONVENTIONS (continued)

Columns		Coding	Code
29,30 (cont'd)		Source	Code
	Off-line Pump Seals	Single, mechanical, emission point at seal	40
		Single, mechanical, emission point at vent	41
		Single, mechanical, other emission point	42*
		Double, mechanical, emission point at seal	43
		Double, mechanical, emission point at vent	44
		Double, mechanical, other emission point	45*
		Single, packed, emission point at seal	46
		Single, packed, emission point at vent	47
		Single, packed, other emission point	48*
		Sealless pumps	49*
	On-line Compres-sor Seals	Single, mechanical, emission point at seal	50
		Single, mechanical, emission point at vent	51
		Single, mechanical, other emission point	52*
		Double, mechanical, emission point at seal	53
		Double, mechanical, emission point at vent	54
		Double, mechanical, other emission point	55*
		Single, packed, emission point at seal	56
		Single, packed, emission point at vent	57
		Single, packed, other emission point	58*
		Sealless compressors	59

*Explain in the comment field.

TABLE A-1. DATA CODING CONVENTIONS (continued)

Columns	Coding		
29,30 (cont'd)		Source	Code
	Off-line Compressor Seals	Single, mechanical, emission point at seal	60
		Single, mechanical, emission point at vent	61
		Single, mechanical, other emission point	62*
		Double, mechanical, emission point at seal	63
		Double, mechanical, emission point at vent	64
		Double, mechanical, other emission point	65*
		Single, packed, emission point at seal	66
		Single, packed, emission point at vent	67
		Single, packed, other emission point	68*
		Sealless compressors	69*
		Vacuum Breakers	70
		Expansion Joints	71
		Rupture Disks	72
		Sight Glass Seals	73
31	Service Code - 1 = Gas at Process Conditions; 2 = Light Liquids (naphthas and lighter with a vapor pressure ≥ 0.04 psi @ 20°C); 3 = Heavy Liquids (kerosene and less volatile liquids with a vapor pressure < 0.04 psi @ 20°C)		
32 - 35	Material Code - a unique sequential identification number for each new process stream encountered. The code should be explained on the "Material Coding Sheet" shown as Table A-2. The stream description should include information about specific components and their concentrations (i.e., depropanizer overhead - 80% propane, 11% propylene, 3% ethane, 6% isobutane).		

*Explain in the comment field.

TABLE A-1. DATA CODING CONVENTIONS (continued)

Columns	Coding
36	Elevation Code - 0 = Below ground level (pits, etc.) 1 = Ground level 2 = 1st Platform above ground 3 = 2nd Platform above ground etc.
37	Accessibility Code - Blank = normal (easy) accessibility 1 = accessible with a free standing ladder or a minor amount of scaffolding 2 = accessible only with a crane, cherry picker, or major scaffolding 3 = physically accessible, but not safe to approach 4 = emission point inaccessible because it is hard piped to a control device 5 = shrouds or other safety devices prevent access to the seal area ? = Other codes may be assigned and documented in the field
38	Soap Score Code - 0 = No detectable bubbling during the six second observation period 1 = Zero to 1 cc total bubble volume in six seconds 2 = 1 cc to 10 cc per six seconds 3 = 10 cc to 100 cc per six seconds 4 = > 100 cc per six seconds, which is characterized by bubbles popping before the 6 second period is up and/or the soap solution being blown away from the seal area
39	Orientation Code - 1 = Horizontal seal interface (vertical-mounted valve) 2 = Vertical seal interface (horizontal-mounted valve) 3 = Diagonal seal interface 4 = Rotating seal, no soap score possible

TABLE A-1. DATA CODING CONVENTIONS (continued)

Columns	Coding
40 - 79	Comments - Free form alpha-numeric field which can be used to describe any significant information noted about the source, such as: VISIBLE LIQUID EMISSION, VISIBLE VAPOR EMISSION, HOT SOURCE, SOAP VAPORIZING, COLD SOURCE, ICE FORMING, SEAL AREA VENTED TO FLARE, SCREENED AT SEAL OIL VENT, etc.

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TABLE A-1. MATERIAL CODING SHEET

Plant ID ___ 4, Process Unit ID ___ 1

(1) (2) (3) (4)

Stream Description	Code			
Raw Gas to Absorbers 92% CH_4, 3% C_2H_6, 1.5% CO_2, 1% C_3H_8	(5)	(6)	(7)	1 (8)
Residue Gas · 96% CH_4, 2.5% C_2H_6, 0.75% N_2, 0.75% CO_2	(13)	(14)	(15)	3 (16)
Lean Oil from Fractionator (Kerosene-type absorption oil)	(21)	(22)	(23)	4 (24)
Rich Oil from Absorber	(29)	(30)	(31)	5 (32)
Gas from Rich Oil Flash Drum 98% CH_4	(37)	(38)	(39)	6 (40)
Rich Oil Demethanizer Overhead Stream 98.5% CH_4 1.5% CO_2	(45)	(46)	(47)	7 (48)
Prefractionator Overhead Stream 20% C_2H_6, 35% C_3H_8, 30% butanes, 15% C_5^+	(53)	(54)	(55)	8 (56)
Fractionator Overhead 30% C_2H_6, 35% C_3H_8	(61)	(62)	(63)	9 (64)
Raw Make Tank Overhead Gas to Ethane Feed Compressor	(69)	(70)	1 (71)	0 (72)
Raw Make Tank Liquid	(77)	(78)	1 (79)	1 (80)

TABLE A-1. MATERIAL CODING SHEET

Plant ID ___ (1) 4 (2), Process Unit ID ___ (3) 1 (4)

Stream Description	Code			
✓ Ethane - Propane Stream 75% Ethane 25% Propane	___ (5)	___ (6)	1 (7)	2 (8)
✓ Depropanizer Feed 44% C_3H_8, 36% butanes, 20% C_5 plus	___ (13)	___ (14)	1 (15)	3 (16)
✓ Propane Product Stream 96% propane, 4% butanes.	___ (21)	___ (22)	1 (23)	4 (24)
✓ Depropanizer Bottoms Stream 32% i-butane, 32% n-butane, 36% pentane plus	___ (29)	___ (30)	1 (31)	5 (32)
✓ Debutanizer Overhead Stream 52% n-butane, 48% i-butane	___ (37)	___ (38)	1 (39)	6 (40)
✓ Natural Gasoline 9.0 psi RVP	___ (45)	___ (46)	1 (47)	7 (48)
✓ Isobutane Product Stream 96% isobutane, 4% n-butane	___ (53)	___ (54)	1 (55)	8 (56)
✓ Normal Butane Product Stream 96% normal butane, 4% iso-butane	___ (61)	___ (62)	1 (63)	9 (64)
✓ Lean Oil to Intermediate Reboilers (Kerosene)	___ (69)	___ (70)	2 (71)	0 (72)
✓ Deethanizer Feed 30% ethane 36% propane, 21% mixed butane, 11% pentane + heavier 1% methane, 1% CO_2	___ (77)	___ (78)	2 (79)	1 (80)

TABLE A-1. MATERIAL CODING SHEET

Plant ID ___ (1) 4 (2), Process Unit ID ___ (3) 1 (4)

Stream Description	Code			
Propane Refrigerant 99% C_3H_8	(5)	(6)	2 (7)	2 (8)
Lean Oil to Absorber (Kerosene)	(13)	(14)	2 (15)	3 (16)
Residue Gas to Fuel System 96% CH_4	(21)	(22)	2 (23)	4 (24)
Presaturator Separator Gas to Fuel 98% CH_4, 2% C_2H_6	(29)	(30)	2 (31)	5 (32)
Raw Condensate from Oil Field 90% mixed butanes, 7% propane, 3% C_5^+	(37)	(38)	2 (39)	6 (40)
	(45)	(46)	(47)	(48)
	(53)	(54)	(55)	(56)
	(61)	(62)	(63)	(64)
	(69)	(70)	(71)	(72)
	(77)	(78)	(79)	(80)

TABLE A-1. MATERIAL CODING SHEET

Plant ID __ (1) 4 (2), Process Unit ID __ (3) 2 (4)

Stream Description	Code			
Glycol and Water Stream	5	6	7	2 (8)
	13	14	15	16
	21	22	23	24
	29	30	31	32
	37	38	39	40
	45	46	47	48
	53	54	55	56
	61	62	63	64
	69	70	71	72
	77	78	79	80

A-2

SUMMARY OF SAMPLING DATA

TABLE A-2
SUMMARY OF SAMPLING DATA
GULF, VENICE

SOURCE ID	F CFM	D	P (IN HG)	DELTA P (IN HG)	T (DEG F)	CT(PPMW) M	CT(PPMW) NM	CA(PPMW) M	CA(PPMW) NM	V (ML)	T (MIN)	S.G. (G/ML)
******	*****	***	*******	*******	*******	*********	*********	*********	*********	****	*****	******
2	0.06	1	29.69	1.80	67	19.0	37500.0	2.0	16.0	.	.	.
6	0.05	1	29.69	1.65	64	2.0	7180.0	2.0	52.0	.	.	.
7	0.05	1	29.69	1.65	64	3.0	8650.0	3.0	52.0	.	.	.
8	0.05	1	29.69	1.67	63	135.0	141000.0	5.0	52.0	.	.	.
9	0.05	1	29.69	1.70	64	404.0	811000.0	7.0	161.0	.	.	.
12	0.04	1	29.69	1.70	66	270.0	999730.0	7.0	161.0	.	.	.
14	0.05	1	29.69	1.50	67	67.0	25400.0	7.0	161.0	.	.	.
15	0.04	1	29.59	1.50	65	500.0	939000.0	3.0	29.0	.	.	.
17	0.05	1	29.59	1.30	65	1150.0	998850.0	3.0	29.0	.	.	.
19	0.06	1	30.01	1.32	66	2.0	6260.0	2.0	66.0	.	.	.
20	0.06	1	30.01	1.35	64	14.0	5130.0	3.0	66.0	.	.	.
22	0.06	1	30.01	1.65	75	19.0	6330.0	6.0	41.0	.	.	.
28	0.05	1	29.59	1.25	66	10.0	892.0	3.0	29.0	.	.	.
31	0.54	1	30.01	1.80	62	1010.0	25600.0	32.0	173.0	70	12	0.75
32	0.06	1	30.01	1.75	72	800.0	32900.0	585.0	112.0	.	9	0.75

TABLE A-2
SUMMARY OF SAMPLING DATA
GULF, VENICE

SOURCE ID	F CFM	D	P (IN HG)	DELTA P (IN HG)	T (DEG F)	CT(PPMW) M	CT(PPMW) NM	CA(PPMW) M	CA(PPMW) NM	V (ML)	T (MIN)	S.G. (G/ML)
34	0.05	1	30.01	1.85	70	48.0	23600.0	48.0	32.0	.	.	.
35	0.06	1	29.69	1.70	69	4.0	11400.0	1.0	22.0	.	.	.
37	0.05	1	30.01	1.60	56	10.0	2260.0	2.0	5.0	.	.	.
41	0.06	1	29.69	1.75	75	66.0	10300.0	1.0	19.0	.	.	.
42	0.06	1	29.69	1.65	70	504.0	49000.0	1.0	19.0	.	.	.
44	0.06	1	29.69	1.77	73	128.0	6850.0	1.0	19.0	.	.	.
51	0.06	1	30.40	1.45	60	56.0	308.0	56.0	12.0	0	.	.
65	0.06	1	30.40	1.75	60	100.0	7100.0	100.0	12.0	0	.	.
160	0.05	1	30.40	2.20	66	6.0	2480.0	4.0	27.0	.	.	.
162	0.07	1	30.40	1.75	65	11.0	6993.0	4.0	27.0	.	.	.
166	0.06	1	30.40	1.60	63	5.0	665.0	4.0	27.0	.	.	.
171	0.06	1	30.40	1.80	66	4.0	333.0	4.0	27.0	.	.	.
173	0.06	1	30.40	2.90	64	6.0	1909.0	4.0	27.0	.	.	.
175	0.06	1	30.40	1.75	67	6.0	1916.0	4.0	27.0	.	.	.
227	0.06	1	30.01	1.65	60	22.0	4700.0	15.0	50.0	.	.	.

TABLE A-2
SUMMARY OF SAMPLING DATA
GULF, VENICE

SOURCE ID	F CFM	D	P (IN HG)	DELTA P (IN HG)	T (DEG F)	CT(PPMW) M	CT(PPMW) NM	CA(PPMW) M	CA(PPMW) NM	V (ML)	T (MIN)	S.G. (G/ML)
272	0.06	1	30.01	1.57	70	1.0	6090.0	1.0	31.0	.	.	.
275	0.06	1	30.01	1.55	70	1.0	5610.0	1.0	31.0	.	.	.
276	0.06	1	30.01	1.50	73	2.0	4000.0	1.0	31.0	.	.	.
286	0.06	1	30.01	1.65	62	33.0	5130.0	15.0	50.0	.	.	.
301	0.05	1	30.40	1.55	62	2.0	279.0	2.0	21.0	.	.	.
388	0.06	1	30.01	1.65	76	56.0	3840.0	1.0	34.0	.	.	.
403	0.06	1	30.01	1.60	78	26.0	247.0	4.0	19.0	.	.	.
405	0.06	1	30.01	1.50	76	4.0	2940.0	2.0	660.0	.	.	.
414	0.06	1	30.40	1.75	62	223.0	26467.0	4.0	0.0	.	.	.
420	0.06	1	30.40	1.75	63	3.0	8953.0	3.0	0.0	.	.	.
421	0.05	1	30.00	1.20	56	8.0	306833.0	3.0	1762.0	.	.	.
428	0.06	1	30.40	1.85	62	5.0	183.0	4.0	11.0	.	.	.
505	0.06	1	30.40	1.75	62	3.0	347.0	3.0	1.0	.	.	.
507	0.06	1	30.40	1.65	63	4.0	62.0	4.0	1.0	.	.	.
577	0.05	1	30.01	1.30	64	4.0	960.0	4.0	24.0	.	.	.

TABLE A-2
SUMMARY OF SAMPLING DATA
GULF, VENICE

SOURCE ID	F CFM	D	P (IN HG)	DELTA P (IN HG)	T (DEG F)	CT(PPMW) M	CT(PPMW) NM	CA(PPMW) M	CA(PPMW) NM	V (ML)	T (MIN)	S.G. (G/ML)
581	0.05	1	30.01	1.30	64	4.0	2039.0	4.0	24.0	.	.	.
602	0.05	1	30.01	1.30	65	4.0	589.0	4.0	24.0	.	.	.
603	0.04	1	30.01	1.30	65	4.0	877.0	4.0	24.0	.	.	.
606	0.05	1	30.01	1.30	63	19.0	2480.0	4.0	24.0	.	.	.
615	0.05	1	30.01	1.30	64	5.0	3145.0	5.0	67.0	.	.	.
647	0.05	1	30.17	1.45	62	5.2	2843.0	5.2	14.0	.	.	.
650	0.05	1	30.17	1.65	62	3.9	54800.0	3.9	14.0	.	.	.
656	0.05	1	30.17	1.45	63	4.1	3264.0	4.1	14.0	.	.	.
696	0.05	1	30.01	1.30	64	4.0	2310.0	4.0	67.0	.	.	.
931	0.06	1	30.39	1.80	60	4.0	922.0	3.0	48.0	.	.	.
932	0.06	1	30.40	1.70	62	2.0	374.0	2.0	0.0	.	.	.
933	0.69	1	30.39	1.80	59	3.0	323.0	3.0	48.0	.	.	.
934	0.06	1	30.39	1.80	58	4.0	1220.0	3.0	48.0	3	.	.
950	0.06	1	30.39	1.85	61	3.0	9070.0	2.0	39.0	.	.	.
968	0.06	1	30.39	1.90	60	398.0	133200.0	2.0	123.0	.	.	.

TABLE A-2
SUMMARY OF SAMPLING DATA
GULF, VENICE

SOURCE ID	F CFM	D	P (IN HG)	DELTA P (IN HG)	T (DEG F)	LT(PPMW) M	LT(PPMW) NM	CA(PPMW) M	CA(PPMW) NM	V (ML)	T (MIN)	S.G. (G/ML)
******	*****	***	*******	*******	*******	*********	*********	*********	*********	****	*****	******
972	0.06	1	30.39	2.20	63	10.0	13350.0	3.0	32.0	.	.	.
978	0.06	1	30.39	2.30	62	0.0	0.0	0.0	0.0	.	.	.
980	0.06	1	30.39	2.30	62	7.0	6190.0	3.0	32.0	.	.	.
983	0.06	1	30.39	2.30	60	226.0	31900.0	2.0	123.0	.	.	.
1052	0.06	1	30.39	2.20	61	2.0	522.0	2.0	23.0	.	.	.
1070	0.05	1	30.39	1.85	61	1.0	18333.0	1.0	42.0	.	.	.
1072	0.06	1	30.39	1.65	62	173.0	136667.0	2.0	42.0	5	4	0.75
1091	0.05	1	30.39	2.25	64	3.0	1337.0	3.0	12.0	.	.	.
1092	0.05	1	30.39	2.15	63	2.0	1232.0	2.0	12.0	.	.	.
1176	0.05	1	30.17	1.40	65	668.0	273.0	65.0	44.0	.	.	.
1179	0.05	1	30.17	1.55	65	2384.0	458.0	65.0	44.0	.	.	.
1183	0.06	1	30.30	1.50	59	598.0	58267.0	7.0	2.0	.	.	.
1184	0.06	1	30.17	1.35	64	176059.0	18367.0	65.0	44.0	.	.	.
1236	0.06	1	30.30	2.00	61	9571.0	1320.0	2599.0	53.0	.	.	.
1240	0.06	1	30.30	1.45	59	1633.0	151.0	1633.0	53.0	.	.	.

TABLE A-2
SUMMARY OF SAMPLING DATA
GULF, VENICE

SOURCE ID	F CFM	D	P (IN HG)	DELTA P (IN HG)	T (DEG F)	CT(PPMW) M	CT(PPMW) NM	CA(PPMW) M	CA(PPMW) NM	V (ML)	T (MIN)	S.G. (G/ML)
******	*****	***	*******	*******	*******	*********	*********	*********	*********	****	*****	******
1243	0.06	1	30.30	1.25	59	12542.0	5673.0	20.0	133.0	.	.	.
1244	0.05	1	30.17	1.60	65	44144.0	2387.0	60.2	31.5	.	.	.
1245	0.06	1	30.30	1.60	59	1258.0	139.0	1258.0	53.0	.	.	.
1247	0.06	1	30.30	1.45	59	1101.0	119.0	1101.0	53.0	.	.	.
1255	0.06	1	30.30	1.60	62	81.0	81.0	81.0	53.0	.	.	.
1257	0.06	1	30.30	1.60	62	143.0	100.0	143.0	53.0	.	.	.
1266	0.06	1	30.30	1.70	74	1948.0	295.0	40.0	27.0	.	.	.
1267	0.06	1	30.30	1.60	61	21002.0	1809.0	2599.0	53.0	.	.	.
1268	0.06	1	30.30	1.55	75	34843.0	1840.0	40.0	27.0	.	.	.
1292	0.05	1	30.01	1.25	63	145.0	68.0	85.0	27.0	.	.	.
1366	0.04	1	30.30	0.90	74	639.0	135.0	451.0	58.0	.	.	.
1631	0.05	1	30.01	1.30	6	4.0	532.0	4.0	106.0	.	.	.
1634	0.05	1	30.01	1.60	63	11.0	174.0	7.0	106.0	.	.	.
1637	0.05	1	30.01	1.30	60	239.0	36.0	6.0	8.0	.	.	.
1650	0.05	1	30.01	1.20	61	15625.0	5293.0	19.0	10.0	.	.	.

TABLE A-2
SUMMARY OF SAMPLING DATA
GULF, VENICE

SOURCE ID	F CFM	D	P (IN HG)	DELTA P (IN HG)	T (DEG F)	CT(PPMW) M	CT(PPMW) NM	CA(PPMW) M	CA(PPMW) NM	V (ML)	T (MIN)	S.G. (G/ML)
1656	0.06	1	30.01	1.00	63	973451.0	26549.0	68.0	21.0	.	.	.
1692	0.05	1	30.01	1.20	62	62897.0	6550.0	27.0	18.0	.	.	.
1863	0.05	1	30.00	1.30	59	27.0	1212.0	6.0	18.0	.	.	.
1874	0.06	1	30.00	1.30	60	137.0	8233.0	6.0	14.0	.	.	.

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SUMMARY OF QA/QC DATA

TABLE A-3.2. OVA RESPONSE TIME DETERMINATION

Instrument ID Century Systems OVA-108 Serial Number: 2158

Calibration Gas Concentration 7990 ppmv

1-9-81

90% Response Time:

	Without Dilution Probe	With Dilution Probe
1.	5.8 Seconds	7.1 Seconds
2.	7.0 Seconds	9.5 Seconds
3.	5.5 Seconds	7.0 Seconds
Mean Response Time	6.1 Seconds	7.8 Seconds

TABLE A-3.1. OVA CALIBRATION ERROR DETERMINATION

Instrument ID Century Systems OVA-108

Serial Number: 2158

Calibration Gas Data

1-9-81

Calibration = 7990 ppmv

Run No.	Instrument Meter Reading, ppm	Difference[1] ppm
1.	8000	-10
2.	8200	-210
3.	8000	-10
4.	8000	-10
5.	8000	-10
6.	8400	-410
7.	8100	-110
8.	8500	-510
9.	8200	-210
Mean Difference		-166

$$\text{Calibration Error} = \frac{\text{Mean Difference}^{(2)}}{\text{Calibration Gas Concentration}} \times 100 \qquad -2.1$$

[1] Calibration Gas Concentration - Instrument Reading

Plant 4

TABLE 7-1

CALIBRATION CHECKING FORM

1 Month	3 Day	5 Instrument	6 Screening Team	8 Low standard 490 ppm calibration	14 High standard 7990 ppm calibration	20 Dilution Probe Calibration	26
03	02	1	59	420	8500	800	4
03	04	1	50	410	6200	570	
03	05	1	50	420	8800	700	
03	06	1	50	400	9000	1100	
03	09	1	50	446	8500	600	
03	10	1	59	380	8600	890	
03	11	1	05	450	9000	1300	
03	12	1	59	440	8800	750	
03	13	1	59	430	6500	830	

Comments:

Plant 4

TABLE 7-2

REPEAT SCREENING FORM

1 [illegible]	3 Day	5 [illegible]	7 [illegible]	9 [illegible]	10 Source ID	15 Screening Value	22 SOAP Ambient Air	25 Rescreening Value No. 1	32 Rescreening Value No. 2
03	05	05	1	1	21	100001	233	100001	100001
03	05	05	1	1	19	80000	334	100001	100001
03	05	05	1	1	22	40000	433	100001	100001
03	06	50	1	1	19	100001	333	100001	100001
03	06	50	1	1	20	100001	443	100001	100001
03	06	50	1	1	22	45000	333	100001	100001
03	06	50	1	1	21	100001	222	80000	100001
03	09	50	1	1	21	100001	233	100001	100001
03	09	50	1	1	19	100001	233	100001	100001
03	09	50	1	1	20	100001	444	100001	100001
03	09	50	1	1	22	100001	333	100001	100001
03	10	59	1	1	21	100001	333	100001	100001
03	10	59	1	1	1091	35000	000	2800	3000

Comments:

TABLE 7-2

REPEAT SCREENING FORM

Plant 4

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Source ID	Screening Value	Ambient Air (SCAP)	Rescreening Value No. 1	Rescreening Value No. 2
03	10	5?	1	1	1092	950	0	700	100
03	10	59	1	1	19	100001	333	30000	100001
03	10	59	1	1	20	100001	44-	100001	100001
03	10	59	1	1	22	100001	333	100001	100001
03	11	50	1	1	19	300000	333	100001	60000
03	11	50	1	1	20	100000	444	100001	100001
03	11	50	1	1	22	100001	333	100001	100001
03	10	50	1	1	21	100001	333	100001	70000
03	10	50	1	1	1091	35000	000	32000	3500
03	10	50	1	1	1092	500	011	450	350
03	12	59	1	1	1091	25000	000	4000	3900
03	12	59	1	1	1092	950	000	750	850
03	12	59	1	1	21	100001	444	100001	100001

Comments:

03 12 59 1 1 19, 1 0 0 0 0 1 3 3 3 4 0 0 0 0 6 0 0 0 0

03 12 59 1 1 20 1 0 0 0 0 1 4 4 4 1 0 0 0 0 1 1 0 0 0 0 1

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Plant 1

TABLE 7-2

REPEAT SCREENING FORM

1	3	5 Screening Date	7	8	10 Source ID	15 Screening Value	22 Ambient Air (SOAP)	25 Rescreening Value No. 1	32 Rescreening Value No. 2
03	12	59	1	1	19	100001	333	40000	60000
03	12	59	1	1	20	100001	444	100001	190001
03	12	59	1	1	22	100001	333	100001	100001

Comments:

Plant 4

TABLE 7-2

REPEAT SCREENING FORM

1	3	5			Sample ID	15 Screening Value	22 SOAP	25 Rescreening Value No. 1	32 Rescreening Value No. 2
03	13	59	1	1	1092	550	010	700	750
03	13	59	1	1	1091	42000	000	3500	3200
03	13	59	1	1	21	100001	333	100001	100001
03	13	59	1	1	19	100001	333	100001	50000
03	13	59	1	1	20	100001	444	100001	100001
03	13	59	1	1	22	100001	333	100001	100001

Comments: