Background Report Reference

AP-42 Section Number: 9.12.2

Background Chapter: 4

Reference Number: 2

Title: Source Test Report, Emissions from a Fermentation Tank at E7J Gallo Winery

California Air Resources Board

California Air Resources Board

October 1978

Ref 2

STATE OF CALIFORNIA
AIR RESOURCES BOARD

AP-42 Section 9.12.2
Reference
Report Sect. 4
Reference 2

SOURCE TEST REPORT

ON EMISSIONS FROM
A FERMENTATION TANK
AT E. & J. GALLO WINERY,
FRESNO, CALIFORNIA

OCTOBER 31, 1978

Stationary Source Control Division

ENGINEERING EVALUATION BRANCH

REPORT NO. C-8-050

Peter Ouchida
Peter Ouchida
Project Engineer

Approved: Francis R. Perry
Francis R. Perry, Chief
Engineering Evaluation Branch

Approved:
Harmon Wong-Woo, Chief
Stationary Source Control Division

SUMMARY

Project engineer Peter Ouchida Report number C-8-050

Source test conducted at: Date of test 9/20 - 9/21/78

Name E. & J. Gallo Winery

Address Clovis & Olive Avenues

Fresno, California

Telephone number (209) 521 - 3228

Company representative(s)	Title(s)
Mr. Art Caputi	Research Director
Mr. Erik Christianson	———

Source test requested by Don McNerny

Form of request verbal Date of request September 1978

Reason for request provide data to the organic solvent study group concerning emissions from winery fermentation tanks.

Item(s) tested Fermentation Tank #6033

Pollutant(s) measured and measurement method(s)

1. Total Hydrocarbons: Beckman Model 400, flame ionization detector (FID)

2. Moisture Content: EPA Reference Method 4

3. Condensibles: Condenser train using Greenberg - Smith type impingers in an ice bath.

4. CO_2, CO, O_2: Grab samples using scotch-pak bags and double ended flasks.

5. Analysis of Samples: AIHL Laboratory in Berkeley, California

TEST RESULTS

Total hydrocarbons emitted to atmosphere:

1.8 lbs/hr/tank for white wine fermentation*

* This emission value is specific for the tank geometry, fermentation product in the tank, and the test conditions (i.e., atmospheric temp. & pressure, vapor temp., temp. of fermentation juices, etc.) listed in this report.

TABLE OF CONTENTS

State of California

AIR RESOURCES BOARD

Source Test Report

I. INTRODUCTION

The Air Resources Board staff conducted a source test at the E. & J. Gallo Winery on the dates of 9/20 thru 9/21, 1978.

All witnesses to the test are identified in Table I.

Table I

Source Test Witnesses

Name	Title	Affiliation
Peter Ouchida	Project Engineer	Air Resources Board (ARB)
David Todd	Field Engineer	ARB
Jack LaBrue	Instrument Tech.	ARB
Dwight Warner	Instrument Tech.	ARB
Art Caputi	Research Director	E. & J. Gallo Winery
Erik Christianson	———	E. & J. Gallo Winery
Gary Martin	———	Fresno County APCD

During the testing the staff evaluated emissions from fermentation tank #6033 at the vent hatch. The contents of the tank was a white blending wine.

The purpose of the source test was to determine the volatile organic compound concentration in the gas vented directly to the atmosphere from fermentation tanks during the fermentation stage of the winery's production process. This data is to be furnished to the ARB Organic Solvent Study Group, E. & J. Gallo Winery The Fresno County APCD for additional analysis with respect to quantifying emissions from fermentation tanks.

Any other prior source tests conducted at The E. & J. Gallo Winery _____ are summarized in Table II.

Table II

Prior Source Tests
(if any)

Item tested	Organization performing test	Date of test	ARB report number (if applicable)
NO Prior Source Tests Were Conducted			

II. TEST RESULTS

Table III

Source Test Results

APCD Fresno County	foot notes	Allowable Emissions	Measured emissions			
			1			Average
Test number						
Date of test			9/20 - 9/21			
Duration of test, (hrs.)			24			
Process weight rate, lbs/hr			-			
Gas Flow rate acfh	1		8500			
Stack gas temp. °F			65			
CO_2 % by volume			21.5			
O_2 % by volume			15.4			
CO % by volume			0			
H_2O % by volume			3			
THC as propane (ppm)			864			
THC (lbs/hr)			0.86			
Instrument Correction Factor	2		2.17			
THC (lbs/hr) Corrected			1.87			
H_2O% by Volume in Condensibles			99			
Ethanol % by Vol. in Condensibles	3		<1			
HC% by Volume in Condensibles			<1			

1. acfh - actual cubic feet per hour
2. FID response corrected for oxygenated compounds
3. < = less than

*Corrected to ______ percent oxygen

Reviewed by Daniel F. Todd

Approved by [signature]
Manager, Testing Section

REMARKS CONCERNING MEASURED EMISSIONS

1. A post test investigation of the possible interference between CO_2 and hydrocarbons with respect to the analyzer's response was conducted. The results indicate that the output from the analyzer is not affected by CO_2.

   Refer to Appendix D for test conditions.

2. The source test data was collected at the beginning of the fermentation process for a white blending wine. Also, the process temperature is typically lower when fermenting the juices to make white wines than for red wines. The above test conditions should be considered when analyzing the data. A higher emission rate may have been obtained if, for example:

   (a) a fermentation tank for a red wine was tested, or,

   (b) the test was conducted towards the middle of the fermentation process.

3. Per chemists at the AIHL Laboratory, Berkeley, California, CO_2 can migrate (permeate) through the scotch-pak bag material when persent in high concentrations. This may be the reason for relatively low CO_2 concentrations measured in the vented gas. (Grab samples were taken with scotch-pak bags) See 4b.

4. A relatively high concentration of O_2 was measured in the fermentation gas This may be attributable to one of the following:

   (a) Oxygen trapped in the deep liquid layer inside the tank is swept away by the escaping volume of CO_2 produced during fermentation.

   (b) The sample line used for grab sampling was not secure, thus allowing for leaks. This would dilute the grab sample with atmospheric air and cause high oxygen concentrations. This would also affect the CO_2 results. NOTE: hydrocarbon sampling was done with a different line.

III. PLANT DESCRIPTION

PRODUCT(S) MANUFACTURED OR SERVICE(S) PROVIDED

Services provided - fermentation & storage of grape juices & wine.

PLANT CAPACITY (lbs/hr, MW, etc.)

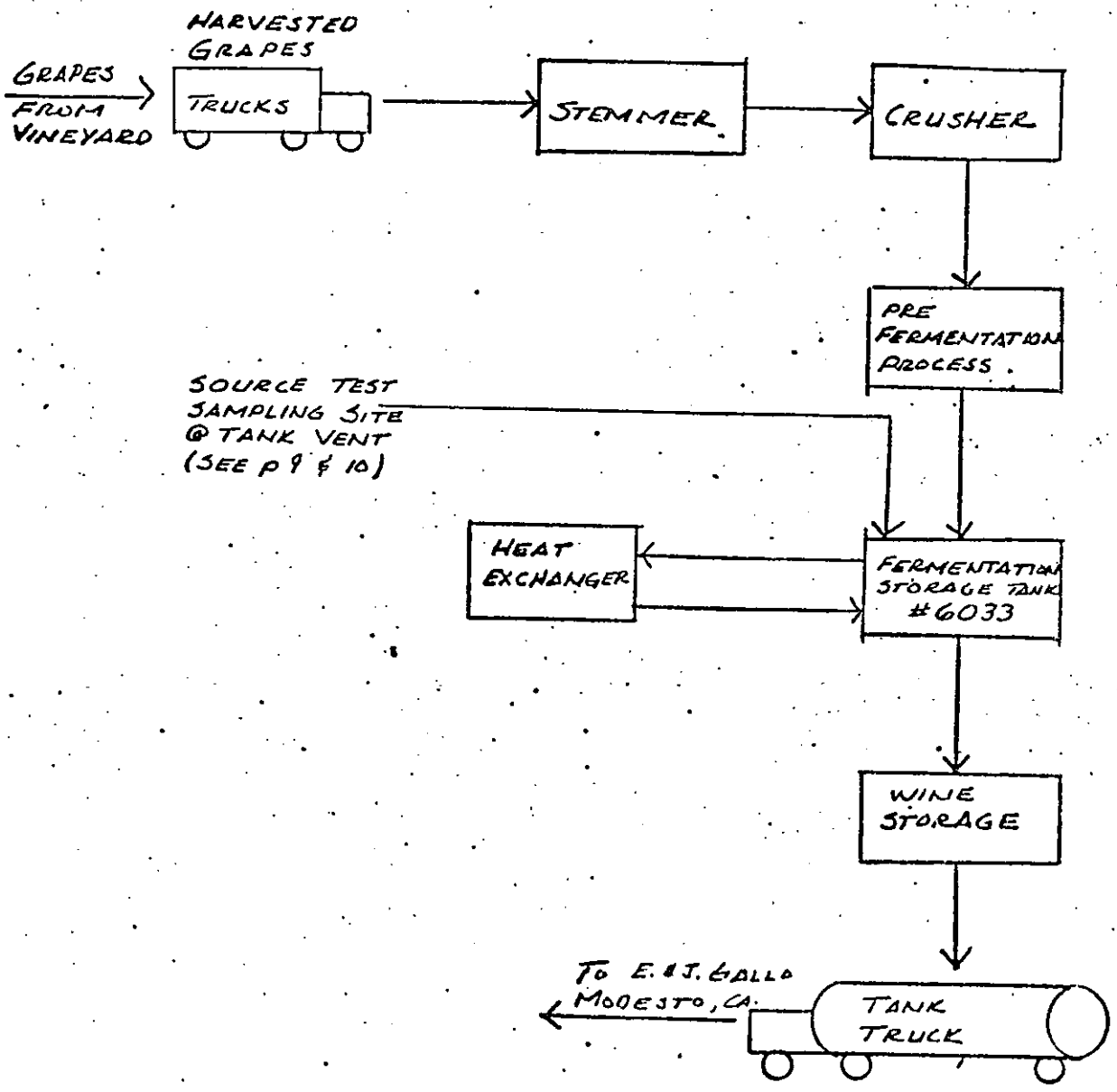
Approximately 165,000 tons of grapes crushed per crushing season

PROCESS DESCRIPTION

Delivery trucks bring harvested grapes from the vineyard to the E. & J. Gallo facility in Fresno, California. After being unloaded, the grapes are stemmed and crushed. The resulting juices are conditioned in a pre-fermentation process before being sent into fermentation tanks. After several days the fermentation is complete and the resulting wine is stored. From storage tanks, the wine is loaded into tanker trucks for transport to the E. & J. Gallo facility in Modesto, California, where it is prepared for bottling.

Figure I

Flow Schematic



IV. TEST METHODS

1. Total Hydrocarbon: A Beckman, Model 400, flame ionization detector (FID) continuously monitored total hydrocarbon concentrations at the vent hatch for 24 hours. Additionally, grab samples were collected in double-ended flasks.

2. Moisture Content: EPA Reference Method 4 was used to determine the moisture content of the vapors at the vent hatch.

3. Condensibles: A one hour sample of the vapors at the vent hatch was taken through a condenser.

4. CO_2, CO, O_2: Grab samples were taken of the vented vapors using Scotch-pak bags.

5. Analysis of Samples: Samples collected were delivered to the AIHL Laboratory in Berkeley, California for appropriate analysis.

V. TEST CONDITIONS

PLANT OPERATING CONDITIONS

Storage capacity of fermentation tank: 637,776 Gals

Quantity of grape juice in the tank during the test: 569,000 Gals.

Other comments: The test was conducted during the initial part of the fermentation process (the first 3 days).

Results of stack flow check for turbulent and cyclonic conditions:

Not applicable

Table IV

Weather Conditions

Date	Time	Barometric Pressure	Temperature
9/20/78	1000	29.77 in.Hg	73°F
"	1700	29.66	78
"	2400	29.65	67
9/21/78	0800	29.66	63
"	1000	29.67	71

See Appendix B, "Field Notes & Data Sheets," and refer to the field notes "Fresno Atmos. Pressure" for an hourly listing of ambient temperatures and pressures.

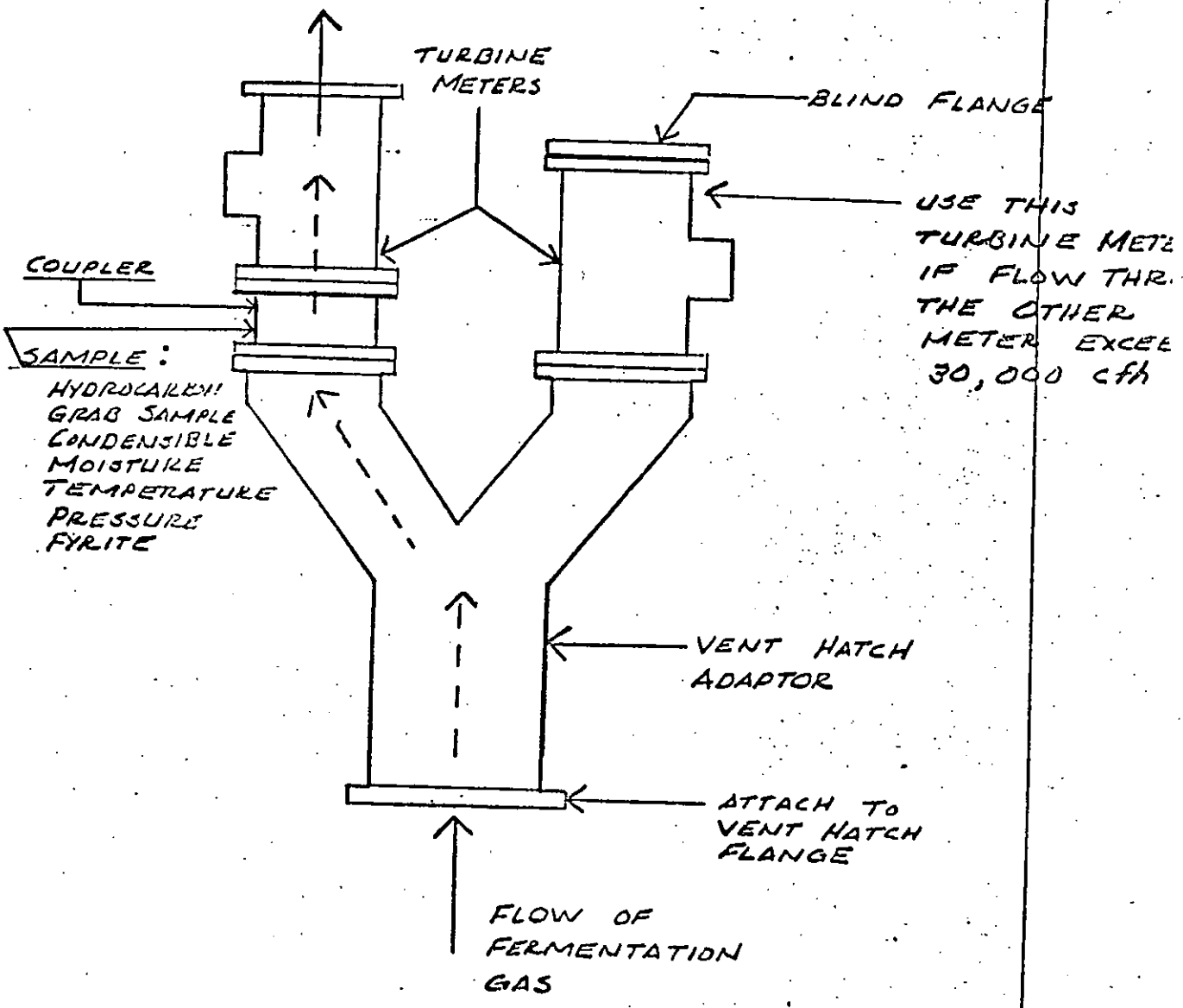
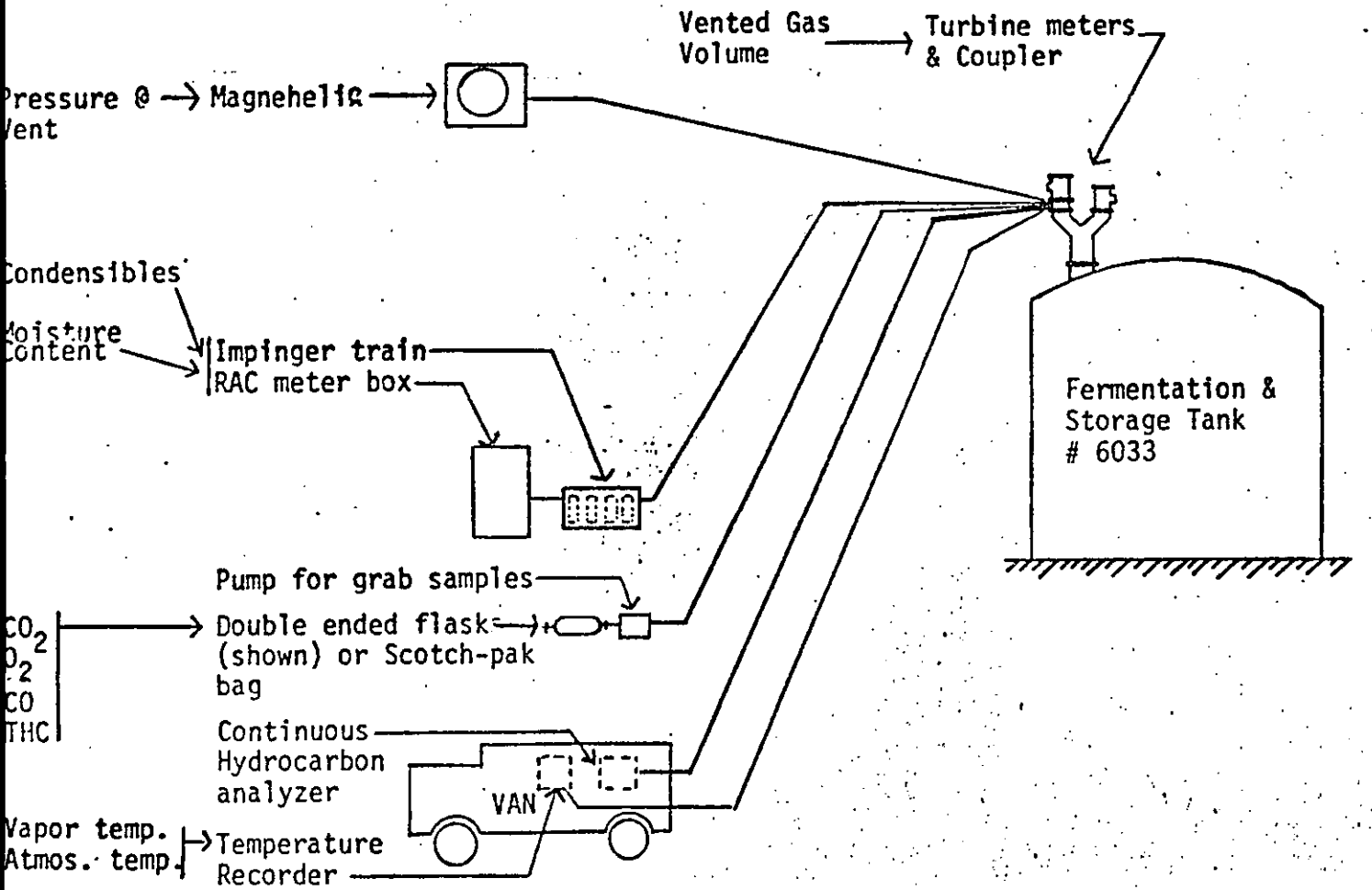


FIGURE II

VENT HATCH ADAPTOR & TURBINE METERS

FIGURE III

SOURCE TEST EQUIPMENT AND SAMPLING SITE



Appendix A

Preliminary Investigation Report

FILE NO. C-0-00-

DISTRIBUTION:

RECORD OF TELEPHONE CONVERSATION / CONFERENCE NOTES

SUBJECT: PRE SOURCE TEST PREPARATIONS

DATE: 9/12/78 TIME: 0850

TO/FROM: MR. ART CAPUTI — E & J GALLO WINERY — (209) 521-3228

Name — Agency — Telephone

COMMENTS: Gallo Winery is fabricating a cover plate for the ~~24~~ 24" diameter ~~vent~~ Manhole on the fermentation tanks. This plate will be placed over the vent opening and is ~~designed~~ designed to accommodate the ARS turbine meter. Also, a "burst batch" is provided to prevent the build up of excessive internal tank pressures.

NOTE:

Also contacted Mr. Gary Martin this Asm. concerning Gallo Winery preparations and our (APPA) test schedule.

Gary Martin
Fresno County APCD
209-488-3239

PETER OUCHIDA
BY Peter Ouchida

Appendix B

Field Notes

and

Data Sheets

State of California

File No. C8-050

AIR RESOURCES BOARD

WATER VAPOR CALCULATIONS

Standard Conditions 60°F and 29.92 in. Hg

Ambient Conditions 66 °F and 29.82 in. Hg

Time	Gas Volume Through Meter (Vm), Ft^3	Impinger Temp. (Ti), °F	Meter Temp. (Tm), °F	Orifice Pressure (Δh), in. H_2O	Volume of Water Collected in Impinger (V_{lc}), ml
0	48.700	60	63	1.90	Final 82.852
15	57.420	60	65	1.90	Initial 48.720
30	65.960	60	67	1.85	
45	74.502	63	69	1.95	
60	82.982	68	71	1.80	
				1.86	Net (V_{lc}) 34.132

A. Gas Volume Metered (V_{mstd})

$$P_{ma} = P_{bar} + (\Delta H/13.6) = (29.82\ ) + \frac{(1.86)}{13.6} = \underline{29.96}\ \text{in. Hg}$$

$$V_{mstd} = \frac{520\ ^\circ R}{29.92\ \text{in. Hg}} \cdot \frac{V_m\ P_{ma}}{T_m} = (17.38)\ \frac{(34.132)(29.96\ )}{(527\ )} = \underline{33.77}\ \text{SDCF}$$

B. Volume of Water Collected (V_{wstd})

$$V_{wstd} = (0.0464\ \frac{Ft^3}{ml})\ (V_{lc}) = (0.0464)\ (\ 12\ ) = \underline{0.5568}\ \text{SCF}$$

C. Volume of Water Vapor at Impinger Temp ($V_{wv_{std}}$)

V. P. = .5601 in. Hg at T_i = 62 °F

$$V_{wv_{std}} = \frac{(V_{m_{std}})\ (V.P.)}{(P_{ma} - V.P.)} = \frac{(33.77\ )(.5601\ )}{(29.96 - .5601)} = \underline{.6434}\ \text{SCF}$$

D. Moisture Content in Stack Gas (Bwo)

$$B_{wo} = \frac{B + C}{A+B+C} = \frac{(.5568 + .6434)}{(33.77 + .5568 + .6434)} = .034 \approx 3\%$$

E. Moisture Content at Saturation at T_s of _____ °F

B_{wo} = _____. Use E if D > E.

7
1600

Fresno Atmos Press (Ear. Elev. 327') use 350' for stack ht

9/20 sealevel - corr'td for tank → ambient temperature (°F)

1000 - 30.15 - 29.77	73°F	0900 - 30.04 - 29.66	67
1100 - 30.15 - 29.77	74	1000 - 30.05 - 29.67	71
1200 - 30.14 - 29.76	76	1100 - 30.04 - 29.66	
1300 - 30.12 - 29.74	77		
1400 - 30.10 - 29.72	79		
1500 - 30.08 - 29.70	79		
1600 - 30.05 - 29.67	80		
1700 - 30.04 - 29.66	78		
1800 - 30.03 - 29.65	77		
1900 - 30.02 - 29.64	75		
2000 - 30.02 - 29.64	74		
2100 - 30.03 - 29.65	73	Saci	
2200 - 30.03 - 29.65	70	9/20 0800 - 30.00 - 29.97	
2300 - 30.03 - 29.65	69	18 - 33 x met	
2400 - 30.03 - 29.65	67		
9/21 0100 - 30.03 - 29.65	65		
0200 - 30.03 - 29.65	64		
0300 - - (29.64)	63		
0400 - 30.01 - 29.63	62		
0500 - 30.00 - 29.62	61		
0600 30.01 - 29.63	61		
0700 - 30.00 - 29.62	60		
0800 - 30.04 - 29.66	63		

atm. press. → 29.67 in Hg

C-8-050

BRIX:

9/19 @ 2000 - 14.3 55°F
Alc: 2.60 %

9/20 @ 0700 13.8 50°F
2.87.

9/20 1000 13.4
9/20 2300 12.8 3.5% 52°F
9/21 0800 12.4
9/21 1000 3.9% 52°F

CALIFORNIA AIR RESOURCES BOARD
Engineering Evaluation Branch
Field Data

Brix = 14M sugar/100gm Sol.

COMPANY E. & J. GALLO WINERY File No. C-8-050
FACILITY FERMENTATION TANKS / WINE STORAGE TANKS
LOCATION CLOVIS & OLIVE AVENUES, FRESNO, CA.
PHYSICAL DESCRIPTION
Vol. 569,000 gal Blending Wine

DATE: 9/21/78

TIME	TURBINE METER #1	PRESSURE @ METER	AMBIENT TEMP. °F	VAPOR °F TEMP. °F	H.C. ppm	
9/20/78 1030	00487480	00300125			-	ATM. PRES.
1130	00491160		78	75	1080	
1330	00505040					
1430	00513200	0.4 in H_2O	79	85°F	820	
1630	00529200	+0.4" H_2O	80	83	800	
2300	00587900	0.5" H_2O	70	56	840	
9/21/78 0830	00673500	±0.5" H_2O	62	58	51.5 1030	29.7
0930	00682300	±0.5" H_2O	67	67	52.5 1050	
1030	00691700	0.6" H_2O	71	77	53.5 1070	
1100	00706400	0.5" H_2O				

Rec'd 10/6

State of California

AIR RESOURCES BOARD

Engineering Evaluation Branch
Testing Section

C-8-050

SUMMARY OF TEST DATA

COMPANY: GALLO Wine Co ADDRESS: OLIVE ST. FRESNO

POLLUTANT TESTED: _____ TEST METHOD: FID ITEM TESTED: TANK 6037 TESTED BY: ARB/SSC DATE TESTED: 9-20-78 9-21-78

TIME	1000	1100	1200	1300	[illegible]	1500	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	73	74	76	71	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	75	74	73	70	69	67	69	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	67
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HC CONCEN.		54	51	46	42	40	[illegible]	[illegible]	39	40	40	41	41	42	42	41	41	41	41	42	42	[illegible]	[illegible]	[illegible]
HC CONCEN. PPM		[illegible]	[illegible]	700	310	300	78	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

CONCENTRATIONS: SCALE:

REMARKS:

Appendix C

Summary of Test Data and Calculations

STATE OF CALIFORNIA — DEPARTMENT OF WATER RESOURCES — THE RESOURCES AGENCY

COMPUTATION SHEET

Project _____ Sheet _____

Feature _____ Designed _____ Date _____

Item _____ Checked _____ Date _____

SUMMARY OF DATA SAMPLED CONTINUOUSLY @ THE VENT

DATE	CLOCK TIME	AMB. TEMP. (°F)	VAPOR TEMP (°F)	H₂S CONC. (PPM)	METER READING	TURBINE METER CUBIC FEET IN TIME INTERVAL	FLOW RATE (CFH)
9/20/72	1000	73	75	—	00487480	3680 (1030 - 1134)	3680
	1100	74	81	1080	00491160		
	1200	76	85	1020		13880 (1130 - 1330)	6940
	1300	77	86	900	00505040		
	1400	79	85	840	00513200	8160 (1330 - 1430)	4080
	1500	79	83	800		16000 (1430 - 1630)	8000
	1600	80	78	780	00529200		
	1700	78	73	780			
	1800	77	68	780			
	1900	75	64	800		58700 (1630 - 2300)	9031
	2000	74	59	800			
	2100	73	58	820			
	2200	70	56	820			
	2300	69	55	840	00587900		
	2400	67	54	840			
9/21/72	0100	65	53	820			
	0200	64	52	820			
	0300	63	52	820			
	0400	62	52	820		85600 (2300 - 0830)	9011
	0500	61	52	840			
	0600	61	52	840			
	0700	60	54	880			
	0830	63	59	870	00673500		
	0930	67	66	1040	00682300	8800 (0830 - 0930)	8800
	1000	71	73	1060	00691700	9400 (0930 - 1030)	9400

FERMENTATION TANK

E. & J. GALLO WINERY
FRESNO, CA.

H.C. CONC. (AVE.) = 864 ppm (as read from the strip chart recordings.)

$$\frac{864 \text{ ppm}}{X \text{ ppm}} = \frac{.46}{1.0}$$

$$X = \frac{864}{.46} = 1878 \text{ ppm} \rightarrow \text{ETHANOL}$$

where .46 is the response factor of the the Beckman 400 to ethanol.

VAPOR TEMP. = 525°R

VAPOR PRESS. = 29.67

$$22.4 \frac{l}{mole}\left(\frac{525}{492}\right) = 23.9 \frac{l}{mole}$$

1878 ppm

$$(C)\left(\frac{l}{10^6 l}\right)\left(\frac{mole}{23.9\ l}\right)\left(\frac{46 \text{ gm}}{mole}\right)\left(\frac{lb}{454 \text{ gm}}\right)\left(\frac{28.3\ l}{ft^3}\right) = 2.155\,(10^{-4})\ \frac{lb}{ft^3}$$

FROM TURBINE METER

$$\frac{204220}{24} = 8509\ ft^3/hr$$

$$\therefore\ 2.155\,(10^{-4})\ \frac{lb}{ft^3} \times 8509\ \frac{ft^3}{hr} = 1.8\ \frac{lbs}{hr}$$

Appendix D

CO_2/Hydrocarbon Interference Test

Oct 30 - 1978

Beckman 400 ARB # 3587

Samp pressure	1.0 psig
H_2/N_2 fuel	25.0 psig
Instrument air	15.0 psig
Range	100

1. Zero with N_2 DVM = 0.0 mV
2. C_3H_8 Span 290 ppm DVM = 14.5 mV (0-200 F.S.)
3. Zero with N_2 DVM = 0.0 mV
4. CO_2 span 10.3% DVM = 0.0 mV

Span Cyl Scott Marrin # CC380
Carbon Dioxide in Air 10.3%

Span Cyl # SP 6498-2216
C_3H_8 290 ppm ± 8

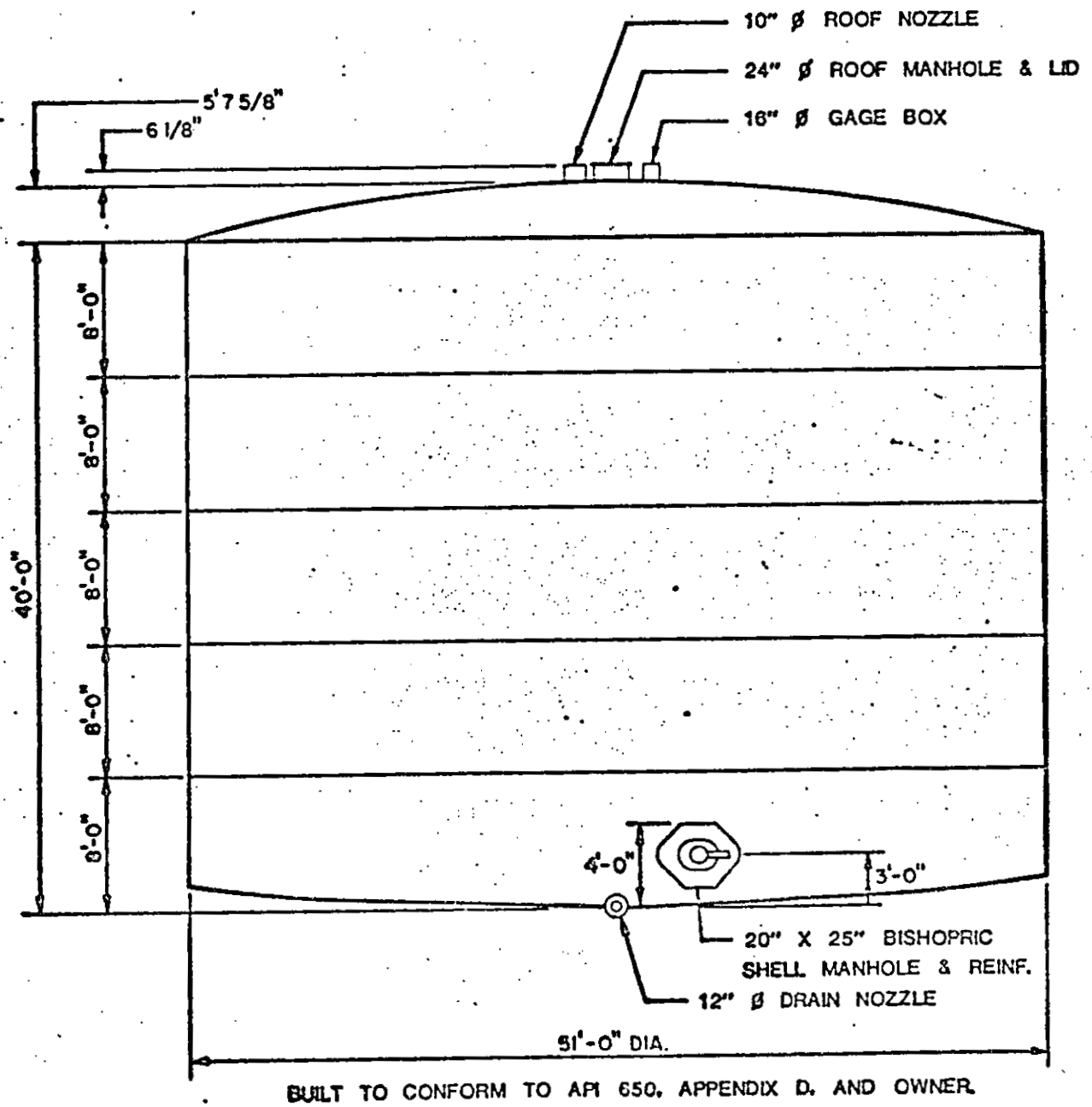
APPENDIX E

DESCRIPTION OF THE STEEL FERMENTATION AND STORAGE TANK

The tank tested is a white, cylindrical welded epoxy-lined, steel tank (number 6033), with a domed roof built to API 650 specifications. The height of the straight wall is 40 feet, and the diameter is 50 feet; capacity is 637,776 gallons. Height of the liquid level in the tank was about 37 feet, and the tank contained 569,000 gallons of grape juice that was fermenting into a blending white wine.

GALLO

600,000 GALLON STEEL FERMENTATION AND STORAGE TANK



BUILT TO CONFORM TO API 650, APPENDIX D, AND OWNER.

ELEVATION

NOT TO SCALE