Appendix 1

Source Test Report Number 08-12
ORVR and Conventional Vehicles
August 17, 2007

California Environmental Protection Agency

Air Resources Board

MONITORING AND LABORATORY DIVISION
Stationary Source Testing Branch
Source Test Section

SOURCE TEST REPORT
TEST NUMBER 08-12

UNIT TESTED: ORVR and Conventional Vehicles
No Phase II Vapor Recovery
Summer Fuel
Rental Vehicle Facility
San Jose, California

TEST DATES: July 31, 2007 and August 1, 2007

REPORT DATE: May 9, 2008

B. Iqbal

Basharat Iqbal
TEST ENGINEER

Approved:

Angus MacPherson, Manager
SOURCE TEST SECTION

INTRODUCTION

On July 31, 2007 and August 1, 2007, Source Test Section staff conducted a mass emission determination for ORVR and conventional vehicles fueled with a gasoline distribution system with no Phase II vapor recovery. The determination was done at the request of Monitoring and Laboratory Division's Engineering and Certification Branch. Engineering and Certification Branch requested that the name and address of the tested facility not be disclosed.

The purpose of the test was to determine UST vent emissions and refueling emissions from ORVR vehicles with no Phase II vapor recovery. Several conventional vehicles were also tested. Testing was done in accordance with Air Resources Board Stationary Source Test Methods, Volume 2, Certification and Test Procedures for Gasoline Vapor Recovery Systems, Certification Procedure 201 and Test Procedure 201.2. Basharat Iqbal and Angus MacPherson were the project engineers for the test. Dan Leon was the instrument technician who assisted with the test.

Testing was done with summer fuel.

PROCESS DESCRIPTION

Phase I and Phase II vapor recovery systems are installed at California GDFs to control hydrocarbon emissions during the delivery and dispensing of gasoline. Phase I vapor recovery controls emissions of gasoline vapors by simultaneously returning headspace vapors from the UST to the cargo tank from which gasoline is delivered. Vapors transferred to the cargo tank are subsequently returned to a bulk terminal for processing. Phase II vapor recovery systems are designed to capture gasoline vapors displaced from the vehicle fuel tank during refueling and return them to the UST.

The tested facility has one tank and fuels only newer vehicles which are equipped with ORVR controls. For this reason, the gasoline system does not have Phase II vapor recovery. ORVR vehicle fuelings tend to cause system pressure to run negative (since gasoline product is removed from the tank and no vapor is returned to fill the void caused by the displaced gasoline). The facility does have Phase I installed and is equipped with a P/V valve. The settings of the P/V valve are plus 3.0 inches water column to minus 8.0 inches water column. The facility operates daily from 6 am to 10 pm.

TEST METHODOLOGY

Test Procedure 201.2 was used to measure hydrocarbon mass flux at the nozzle/vehicle interface and P/V valve exhaust during vehicle refueling. Concentration, volumetric, temperature and pressure data at each location are continuously recorded on strip charts and integrated by a data acquisition system that calculates mass flux. The Emission factor is the

hydrocarbon flux measured at the nozzle interface standardized to 1000 gallons gasoline dispensed.

Pre and post test static pressure integrity testing was preformed at the test facility directly before and after the emission factor testing was conducted. Static pressure integrity testing was completed by using ARB Vapor Recovery Test Procedure 201.3 "Determination of 2 Inch WC Static Pressure Performance for Vapor Recovery Systems of Dispensing Facilities." During the test, dry nitrogen was introduced to the UST headspace until the system pressure reached 2.2 inches water column. After declining to 2 inches water column, system pressure was recorded at one-minute intervals for a five-minute period. The allowable pressure decay is a function of initial pressure, the number of nozzles and UST ullage. The facility passed both the pre and post test static pressure integrity tests.

Phase I tests conducted at the facility prior to the vehicle fueling tests were ARB Vapor Recovery Test Procedure 201.1B "Static Torque of Rotatable Phase I Adaptors"; ARB Vapor Recovery Test Procedure 201.1C "Leak Rate of Drop Tube/Drain Valve Assembly"; and ARB Vapor Recovery Test Procedure 201.1E "Leak Rate and Cracking Pressure of Pressure/Vacuum Vent Valves". The facility passed all three of these Phase I tests.

Reid Vapor Pressure (RVP) was also taken at the test facility (on August 1, 2007) to verify that summer fuel was dispensed. The RVP of the gasoline was 6.93 psi.

TEST RESULTS AND DISCUSSION

Test results are summarized in Tables 1 and 2 at the end of this report.

Table 1 shows the 33 ORVR vehicles tested. Of these, data from 7 vehicles was discarded due to insufficient fueling volume. Data from 1 vehicle was unavailable because of data logger error. This results in 25 "good" ORVR vehicle fuelings. Vehicles were tested at high (12 vehicles) and low (13 vehicles) fueling clips (there was no medium fueling clip). The overall ORVR emission factor for the 25 fuelings was 0.042 lb/1000 gallons. The emission factor for the 12 ORVR vehicles fueled at high clip was 0.029 lb/1000 gallons and the emission factor for the 13 ORVR vehicles fueled at low clip was 0.054 lb/1000 gallons.

Table 2 shows the 9 conventional vehicles tested. Of these, data from 2 vehicles was discarded due to insufficient fueling volume. This results in 7 "good" conventional vehicle fuelings. All 7 conventional vehicles were tested at low fueling clips. The overall conventional emission factor for the 7 fuelings was 5.75 lb/1000 gallons.

Table 3 displays the facility's underground storage tank pressure (on an hourly basis). The data covers the time period from 7:00 am of 7-31-07 through 9:00 am of 8-1-07. Throughout the daytime hours, system pressure tended to stay between -7 and -10 inches water column. When the facility was closed for the night, system pressure slowly approached -5 inches

water column. However, system pressure quickly returned to the -8 to -10 range when fueling resumed. Chart 1 graphs the underground storage tank pressure data of Table 3. Note, a fuel delivery occurred at 1:36 pm on 7-31-07. This caused the tank pressure to approach -3 inches water column. However, the system pressure returned to normal after a few vehicle fuelings

No venting occurred resulting in a vent emission factor of 0.

RECOMMENDATIONS

Forward this report to Engineering and Certification Branch.

Table 1

ORVR Vehicle Phase II Testing
7/31/07 and 08/01/07

	ORVR Vehicles							VGR Values						
Vehicle Run (Number)	Vehicle Make	Vehicle Model	Vehicle Year	Mass Emissions (lb HC)	Gas Disp. (Gal)	Emission Factor (lb/1000 gal)		Channel 09 TSVO	Channel 06 ASC3	Channel 14 ASTE	Channel 12 IBAR	Channel 03 SKMS	Channel 05 SMAS	Channel 40 SVOL
1	Chevrolet	Malibu	2006	0.00012	13.30	0.00902	h	9.94	0.0535	71.6	29.88	0.11913	0.00012	1.95
2	Ford	Explorer	2007	0.00009	15.60	0.00577	h	10.14	0.0324	73.1	29.88	0.08901	0.00009	2.59
3	Chrysler	PT Cruiser	2007	VGR Error	11.90	VGR Error	h	VGR Error	VGR Error	VGR Error	VGR Error	VGR Error	VGR Error	VGR Error
4	Kia	Sedona	2005	0.00006	14.38	0.00417	h	9.14	0.0311	77.1	29.88	0.06488	0.00006	1.81
5	GM	DTS	2006	0.00068	3.40	Not Enough Gas	h	6.47	0.1699	76.6	29.89	0.68381	0.00068	3.51
6	Suzuki	XL7	2007	0.00007	11.43	0.00612	h	8.42	0.0248	76.6	29.89	0.07159	0.00007	2.42
7	Subaru	Outback	2007	0.00010	7.45	0.01342	h	6.51	0.0282	75.0	29.89	0.09932	0.00010	3.06
8	Mitsubishi	Outlander	2007	0.00272	13.72	0.19825	h	11.56	0.3323	76.8	29.89	2.72260	0.00272	8.32
9	Kia	Sportage	2007	0.00005	4.75	Not Enough Gas	h	7.00	0.0215	75.7	29.89	0.04582	0.00005	1.82
10	Mercury	Monterey	2006	0.00012	15.95	0.00752	h	9.97	0.0373	74.3	29.90	0.12313	0.00012	2.87
11	Chevrolet	TrailBlazer	2007	0.00065	16.00	0.04063	h	11.01	0.0665	75.9	29.90	0.64902	0.00065	8.48
12	Chrysler	Town &Country	2007	0.00007	6.40	0.01094	h	5.35	0.0272	74.4	29.89	0.06642	0.00007	2.11
13	Chevrolet	TrailBlazer	2007	0.00025	13.25	0.01887	h	9.12	0.0837	76.0	29.89	0.25405	0.00025	2.57
14	Ford	Explorer	2007	0.00019	17.00	0.01118	h	10.15	0.0498	77.7	29.89	0.18957	0.00019	3.32
15	Chevrolet	Malibu	2006	0.00007	10.60	0.00660	h	11.20	0.0240	76.5	29.90	0.07268	0.00007	2.56
16	Kia	Sportage	2007	0.00004	4.89	Not Enough Gas	h	7.15	0.0199	77.0	29.90	0.04384	0.00004	1.96
17	Chevrolet	TrailBlazer	2007	0.00114	10.10	0.11287	l	9.83	0.1214	76.6	29.91	1.14400	0.00114	8.18
18	Jeep	4x4	2007	0.00023	11.20	0.02054	l	9.92	0.0649	78.5	29.90	0.22980	0.00023	3.19
19	Hummer	H3	2006	0.00027	9.70	0.02784	l	9.34	0.0448	77.9	29.89	0.26717	0.00027	5.17
20	Subaru	Forester	2006	0.00022	13.10	0.01679	l	10.89	0.0610	86.7	29.89	0.22384	0.00022	3.15
21	Pontiac	G6	2006	0.00004	10.25	0.00390	l	9.66	0.0184	87.8	29.89	0.03530	0.00004	1.67
22	Dodge	Nitro	2007	0.00018	10.30	0.01748	l	8.95	0.0447	88.6	29.88	0.17505	0.00018	3.60
23	Ford	E350 Van	2006	0.00019	18.05	0.01053	l	12.87	0.0609	91.0	29.88	0.18507	0.00019	2.71
24	Pontiac	G6	2007	0.00006	11.60	0.00517	l	9.87	0.0258	88.0	29.87	0.05810	0.00006	1.95
25	Pontiac	G6	2007	0.00010	12.90	0.00775	l	9.35	0.0351	87.4	29.87	0.09999	0.00010	2.41
26	Mercury	Grand Marquis LS	2007	0.00035	4.90	Not Enough Gas	l	6.36	0.0588	87.3	29.88	0.34623	0.00035	4.94
27	Ford	Focus	2006	0.00041	3.40	Not Enough Gas	l	7.98	0.0786	88.4	29.87	0.40769	0.00041	4.51
28	Dodge	Grand Caravan	2006	0.00016	2.90	Not Enough Gas	l	8.47	0.0407	62.4	29.97	0.16386	0.00016	3.75
29	Pontiac	Grand Prix	2006	0.00157	9.65	0.16269	l	8.85	0.1868	63.9	29.98	1.57180	0.00157	7.05
30	Ford	Fusion	2007	0.00002	9.45	0.00212	l	8.67	0.0148	65.0	29.97	0.02306	0.00002	1.40
31	Ford	Mustang	2006	0.00019	4.00	Not Enough Gas	l	5.71	0.0523	66.1	29.97	0.19385	0.00019	3.12
32	Saturn	Car	2006	0.00415	11.80	0.35169	l	20.44	0.2066	69.3	29.96	4.15320	0.00415	17.64
33	Chrysler	Town &Country	2007	0.00008	13.65	0.00586	l	10.33	0.0262	70.0	29.97	0.07967	0.00008	2.62
			Totals	**0.01276**	**306.83**	**0.04159**								
			Hi Clip	**0.00451**	**155.08**	**0.02908**								
			Low Clip	**0.00825**	**151.75**	**0.05437**								

Table 2

ORVR Vehicle Phase II Testing
7/31/07

Conventional Vehicles							VGR Values						
Vehicle Run (Number)	Vehicle Make	Vehicle Model	Vehicle Year	Mass Emissions (lb HC)	Gas Disp. (Gal)	Emission Factor (lb/1000 gal)	Channel 09 TSVO	Channel 06 ASC3	Channel 14 ASTE	Channel 12 IBAR	Channel 03 SKMS	Channel 05 SMAS	Channel 40 SVOL
1	Saturn	Car	1995	0.03035	5.50	Not Enough Gas	20.00	1.5666	84.4	29.89	30.352	0.03035	15.86
2	Ford	Expedition	1998	0.08929	16.90	5.28343	37.71	2.4458	89.0	29.89	89.286	0.08929	31.69
3	Nissan	Pulsar NX	1988	0.06770	11.20	6.04464	30.33	2.4286	91.9	29.89	67.699	0.06770	25.74
4	Jeep	Comanche	1987	0.06482	10.90	5.94679	30.23	2.1321	93.7	29.89	64.818	0.06482	25.62
5	VW	Golf GT	1987	0.05139	9.25	5.55568	28.43	1.8002	94.6	29.89	51.394	0.05139	22.56
6	Datsun	310 GX	1979	0.04248	6.85	6.20146	25.84	1.7045	95.6	29.88	42.485	0.04248	20.86
7	Toyota	Corolla	1989	0.02980	5.00	Not Enough Gas	20.49	1.6118	95.2	29.88	29.799	0.02980	16.93
8	Chevrolet	Monte Carlo	1999	0.03876	6.50	5.96308	23.49	1.8937	96.2	29.88	38.756	0.03876	19.10
9	GMC	Safari Van	2002	0.00009	6.90	ORVR	13.43	0.0215	92.5	29.89	0.091	0.00009	3.68
			Totals	**0.35444**	**61.60**	**5.75390**							

Table 3

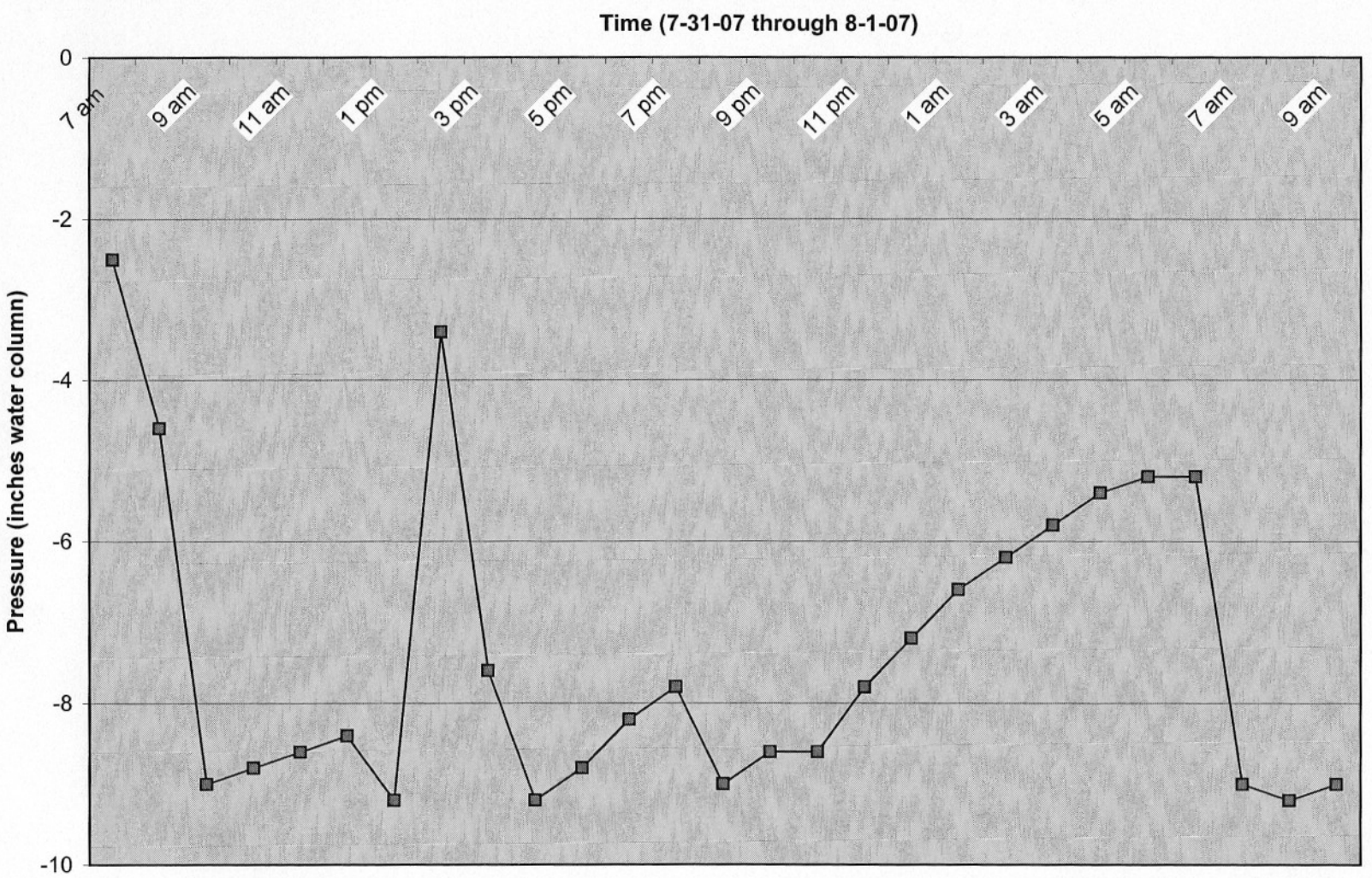
Pressure Data

ORVR Vehicle Phase II Testing

7/31/07 through 8/1/07

Date	Time	Pressure (in water column)	Notes
31-Jul	7 am	-2.5	
	8 am	-4.6	
	9 am	-9.0	
	10 am	-8.8	
	11 am	-8.6	
	12 pm	-8.4	
	1 pm	-9.2	100 gallons dropped
	2 pm	-3.4	to tank at 1:36 pm
	3 pm	-7.6	
	4 pm	-9.2	
	5 pm	-8.8	
	6 pm	-8.2	
	7 pm	-7.8	
	8 pm	-9.0	
	9 pm	-8.6	
	10 pm	-8.6	
	11 pm	-7.8	
1-Aug	12 am	-7.2	
	1 am	-6.6	
	2 am	-6.2	
	3 am	-5.8	
	4 am	-5.4	
	5 am	-5.2	
	6 am	-5.2	
	7 am	-9.0	
	8 am	-9.2	
	9 am	-9.0	

Chart 1
UST Pressure



Appendix 2

Source Test Report Number 08-13
ORVR and Conventional Vehicles
December 28, 2007

California Environmental Protection Agency

Air Resources Board

MONITORING AND LABORATORY DIVISION
Stationary Source Testing Branch
Source Test Section

SOURCE TEST REPORT
TEST NUMBER 08-13

UNIT TESTED: ORVR and Conventional Vehicles
No Phase II Vapor Recovery
Winter Fuel
Rental Vehicle Facility
San Jose, California

TEST DATES: December 4, 2007 and December 5, 2007

REPORT DATE: May 9, 2008

B. Iqbal

Basharat Iqbal
TEST ENGINEER

Approved:

Angus MacPherson, Manager
SOURCE TEST SECTION

INTRODUCTION

On December 4, 2007 and December 5, 2007, Source Test Section staff conducted a mass emission determination for ORVR and conventional vehicles fueled with a gasoline distribution system with no Phase II vapor recovery. The determination was done at the request of Monitoring and Laboratory Division's Engineering and Certification Branch. Engineering and Certification Branch requested that the name and address of the tested facility not be disclosed.

The purpose of the test was to determine UST vent emissions and refueling emissions from ORVR vehicles with no Phase II vapor recovery. Several conventional vehicles were also tested. Testing was done in accordance with Air Resources Board Stationary Source Test Methods, Volume 2, Certification and Test Procedures for Gasoline Vapor Recovery Systems, Certification Procedure 201 and Test Procedure 201.2. Basharat Iqbal and Angus MacPherson were the project engineers for the test. Dan Leon was the instrument technician who assisted with the test.

This testing was a follow up to testing conducted on July 31, 2007 and August 1, 2007 (Source Test Report Number 08-12). During the earlier test, summer fuel was used. This test used winter gasoline.

PROCESS DESCRIPTION

Phase I and Phase II vapor recovery systems are installed at California GDFs to control hydrocarbon emissions during the delivery and dispensing of gasoline. Phase I vapor recovery controls emissions of gasoline vapors by simultaneously returning headspace vapors from the UST to the cargo tank from which gasoline is delivered. Vapors transferred to the cargo tank are subsequently returned to a bulk terminal for processing. Phase II vapor recovery systems are designed to capture gasoline vapors displaced from the vehicle fuel tank during refueling and return them to the UST.

The tested facility has one tank and fuels only newer vehicles which are equipped with ORVR controls. For this reason, the gasoline system does not have Phase II vapor recovery. ORVR vehicle fuelings tend to cause system pressure to run negative (since gasoline product is removed from the tank and no vapor is returned to fill the void caused by the displaced gasoline). The facility does have Phase I installed and is equipped with a P/V valve. The settings of the P/V valve are plus 3.0 inches water column to minus 8.0 inches water column. The facility operates daily from 6 am to 10 pm.

TEST METHODOLOGY

Test Procedure 201.2 was used to measure hydrocarbon mass flux at the nozzle/vehicle interface and P/V valve exhaust during vehicle refueling. Concentration, volumetric,

temperature and pressure data at each location are continuously recorded on strip charts and integrated by a data acquisition system that calculates mass flux. The Emission factor is the hydrocarbon flux measured at the nozzle interface standardized to 1000 gallons gasoline dispensed.

Pre and post test static pressure integrity testing was preformed at the test facility directly before and after the emission factor testing was conducted. Static pressure integrity testing was completed by using ARB Vapor Recovery Test Procedure 201.3 "Determination of 2 Inch WC Static Pressure Performance for Vapor Recovery Systems of Dispensing Facilities". During the test, dry nitrogen was introduced to the UST headspace until the system pressure reached 2.2 inches water column. After declining to 2 inches water column, system pressure was recorded at one-minute intervals for a five-minute period. The allowable pressure decay is a function of initial pressure, the number of nozzles and UST ullage. The facility passed both the pre and post test static pressure integrity tests.

Phase I tests conducted at the facility prior to the vehicle fueling tests were ARB Vapor Recovery Test Procedure 201.1B "Static Torque of Rotatable Phase I Adaptors"; ARB Vapor Recovery Test Procedure 201.1C "Leak Rate of Drop Tube/Drain Valve Assembly"; and ARB Vapor Recovery Test Procedure 201.1E "Leak Rate and Cracking Pressure of Pressure/Vacuum Vent Valves". The facility passed all three of these Phase I tests.

Reid Vapor Pressure (RVP) was also taken at the test facility (on December 6, 2007) to verify that winter fuel was dispensed. The RVP of the gasoline was 11.88 psi.

TEST RESULTS AND DISCUSSION

Test results are summarized in Tables 1, 2 and 3 and Chart 1 at the end of this report.

Table 1 shows the 30 ORVR vehicles tested. Of these, data from 4 vehicles was discarded due to insufficient fueling volume. Data from 1 vehicle was unavailable because of data logger error. This results in 25 "good" ORVR vehicle fuelings. Vehicles were tested at medium (7 vehicles on dispenser 4) and low (18 vehicles on dispenser 3) fueling clips. The overall ORVR emission factor for the 25 fuelings was 0.101 lb/1000 gallons. The emission factor for the 7 ORVR vehicles fueled at medium clip on dispenser 4 was 0.149 lb/1000 gallons and the emission factor for the 18 ORVR vehicles fueled at low clip on dispenser 3was 0.077 lb/1000 gallons.

Table 2 shows the 10 conventional vehicles tested. All 10 vehicles were "good" as none were required to be discarded. All 10 conventional vehicles were tested at low fueling clips on dispenser 3. The overall conventional emission factor for the 10 fuelings was 9.20 lb/1000 gallons.

Table 3 displays the facility's underground storage tank pressure (on an hourly basis).

The data covers the time period from 8:00 pm of 12-3-07 through 9:00 am of 12-5-07. Throughout the daytime hours, system pressure tended to stay between -8 and -10 inches water column. When the facility was closed for the night, system pressure slowly approached -7 inches water column. However, system pressure quickly returned to the -8 to -10 range when fueling resumed. Chart 1 graphs the underground storage tank pressure data of Table 3. Note, a fuel delivery occurred at 7:30 am on 12-5-07. This caused the tank pressure to turn slightly positive. However, the system pressure returned to normal after a few vehicle fuelings

No venting occurred resulting in a vent emission factor of 0.

RECOMMENDATIONS

Forward this report to Engineering and Certification Branch.

Table 1

ORVR Vehicle Phase II Testing
12/4/07

			ORVR Vehicles					VGR Values						
Vehicle Run (Number)	Vehicle Make	Vehicle Model	Vehicle Year	Mass Emissions (lb HC)	Gas Disp. (Gal)	Emission Factor (lb/1000 gal)		Channel 09 Total Sleeve Volume (scf)	Channel 06 Avg Sleeve HC Conc. (%)	Channel 14 Avg Sleeve Temp (F)	Channel 12 Barometric Pressure (in Hg)	Channel 03 Sleeve Mass (lb HC x1000)	Channel 05 Sleeve Mass (lb HC)	Channel 40 Emission Sleeve Volume (scf)
1	Buick	Teraza	2007	0.00007	8.30	0.00843	l	8.55	0.0350	60.2	31.44	0.06573	0.00007	1.70
2	Pontiac	Grand Prix	2007	0.00076	7.10	0.10704	l	7.48	0.1032	60.6	31.44	0.76008	0.00076	6.48
3	Chrysler	PT Cruiser	2006	0.00030	13.15	0.02281	m	9.77	0.0491	63.4	31.44	0.29994	0.00030	5.31
4	Ford	Mustang	2007	0.00212	5.00	not enough gas	l	7.68	0.3182	62.3	31.43	2.11930	0.00212	5.83
5	Chevy	HHR	2007	0.00023	5.60	0.04107	l	8.41	0.0559	62.9	31.44	0.22800	0.00023	3.43
6	Chevy	Impala	2007	0.00024	13.85	0.01733	l	10.92	0.0465	64.6	31.44	0.24311	0.00024	4.66
7	Chevy	Malibu	2007	0.00033	9.35	0.03529	l	21.06	0.0398	65.3	31.44	0.33395	0.00033	7.47
8	Linclon	Signature	2007	0.00103	7.20	0.14306	l	8.02	0.1392	64.5	31.44	1.03400	0.00103	6.44
9	Pontiac	G6	2006	0.00024	6.70	0.03582	l	7.46	0.0559	63.9	31.43	0.23586	0.00024	3.67
10	Chevy	Impala	2006	0.00056	11.50	0.04870	m	9.38	0.0578	66.7	31.43	0.55913	0.00056	8.34
11	Buick	Lacrosse	2006	0.00071	4.00	not enough gas	l	5.91	0.1302	65.1	31.44	0.70836	0.00071	4.65
12	Ford	Taurus	2006	0.00808	10.75	0.75163	m	10.11	0.7499	66.8	31.44	8.07600	0.00808	9.21
13	Chevy	Uplander	2007	0.00024	9.40	0.02553	m	8.71	0.0596	66.1	31.44	0.23584	0.00024	3.28
14	Chevy	Uplander	2007	0.00014	16.60	0.00843	l	12.20	0.0441	70.1	31.43	0.14213	0.00014	2.90
15	Chevy	Uplander	2007	0.00043	19.30	0.02228	m	15.80	0.0634	73.2	31.43	0.42881	0.00043	5.94
16	Toyota	Sienna	2006	0.00017	7.40	0.02297	l	7.66	0.0316	68.7	31.44	0.17301	0.00017	4.75
17	Chrysler	PT Cruiser	2007	0.00013	6.75	0.01926	l	6.78	0.0389	68.6	31.43	0.13406	0.00013	2.88
18	Hummer	H3	2006	0.00050	7.75	0.06452	l	7.07	0.0669	68.2	31.43	0.49913	0.00050	6.43
19	Ford	Mustang	2006	0.00021	2.60	not enough gas	l	6.55	0.0519	68.7	31.44	0.21372	0.00021	3.78
20	Toyota	Avalon	2007	0.00057	10.20	0.05588	l	8.75	0.0919	67.8	31.43	0.56641	0.00057	5.45
21	Subaru	Forester	2007	0.00047	11.85	0.03966	l	12.25	0.1016	67.0	31.44	0.46949	0.00047	3.96
22	Pontiac	G6	2007	0.00007	12.75	0.00549	l	10.35	0.0301	69.4	31.44	0.06675	0.00007	1.98
23	Ford	Taurus	2006	0.00373	11.55	0.32294	m	9.70	0.3329	72.2	31.43	3.72660	0.00373	9.68
24	Ford	F150 Pickup	2006	0.00827	16.15	0.51207	l	12.44	0.6337	68.3	31.43	8.26500	0.00827	11.40
25	Saturn	Vue	2007	0.00003	7.30	0.00411	l	7.47	0.0225	65.2	31.43	0.02558	0.00003	1.00
26	Ford	E350 Van	2007	0.00013	14.70	0.00884	l	12.19	0.0446	66.7	31.44	0.13088	0.00013	2.60
27	Buick	Lacrosse	2006	0.00025	15.60	0.01603	m	11.97	0.0336	70.4	31.43	0.25133	0.00025	6.31
28	Chevy	Cobalt	2007	0.00006	5.60	0.01071	l	6.40	0.0240	70.5	31.43	0.05903	0.00006	2.06
29	Suzuki	XL7	2007	0.00000	10.80	not available	m			Data Logger not Reset.				
30	Ford	Mustang	2007	0.00023	5.20	not enough gas	l	8.59	0.0631	66.6	31.43	0.23062	0.00023	3.20
			Totals	**0.02703**	**266.40**	**0.10146**								
			Low Clip	**0.01344**	**175.15**	**0.07673**	**(Dispenser 3)**							
			Med Clip	**0.01359**	**91.25**	**0.14893**	**(Dispenser 4)**							

Table 2

ORVR Vehicle Phase II Testing
12/5/07

Conventional Vehicles							VGR Values						
Vehicle Run (Number)	Vehicle Make	Vehicle Model	Vehicle Year	Mass Emissions (lb HC)	Gas Disp. (Gal)	Emission Factor (lb/1000 gal)	Channel 09 Total Sleeve Volume (scf)	Channel 06 Avg Sleeve HC Conc. (%)	Channel 14 Avg Sleeve Temp (F)	Channel 12 Barometric Pressure (in Hg)	Channel 03 Sleeve Mass (lb HC x1000)	Channel 05 Sleeve Mass (lb HC)	Channel 40 Emission Sleeve Volume (scf)
1	Chevy	1500 Pickup	2002	0.12003	14.60	8.22123	34.72	3.0513	63.7	31.43	120.03	0.12003	34.49
2	Ford	Expedition	1998	0.19558	23.05	8.48503	49.08	3.4407	70.9	31.44	195.58	0.19558	49.33
3	Jeep	Pickup	1987	0.09515	10.20	9.32843	32.33	2.6112	74.3	31.43	95.152	0.09515	31.60
4	Honda	Accord	1991	0.06579	6.75	9.74667	37.20	1.6116	76.5	31.43	65.793	0.06579	36.14
5	Nissan	Pulsar NX	1989	0.09724	10.65	9.13052	34.12	2.5685	78.1	31.43	97.235	0.09724	32.97
6	Honda	Civic	1996	0.09792	9.85	9.94112	34.83	2.6645	79.6	31.43	97.915	0.09792	32.05
7	Lincoln	Mark 7	1987	0.11183	11.40	9.80965	41.37	2.4250	80.1	31.44	111.83	0.11183	40.38
8	Saturn	Car	1995	0.10200	10.60	9.62264	34.77	2.7214	82.2	31.43	102.00	0.10200	32.75
9	Mercury	Grand Marquis	1996	0.10926	10.85	10.07005	35.81	2.8104	83.4	31.43	109.26	0.10926	33.98
10	Chevy	Monte Carlo	1998	0.07080	7.90	8.96203	28.21	2.4010	77.4	31.44	70.801	0.07080	26.01
			Totals	**1.06560**	**115.85**	**9.19810**							

Low Clip (Dispenser 3)

Table 3

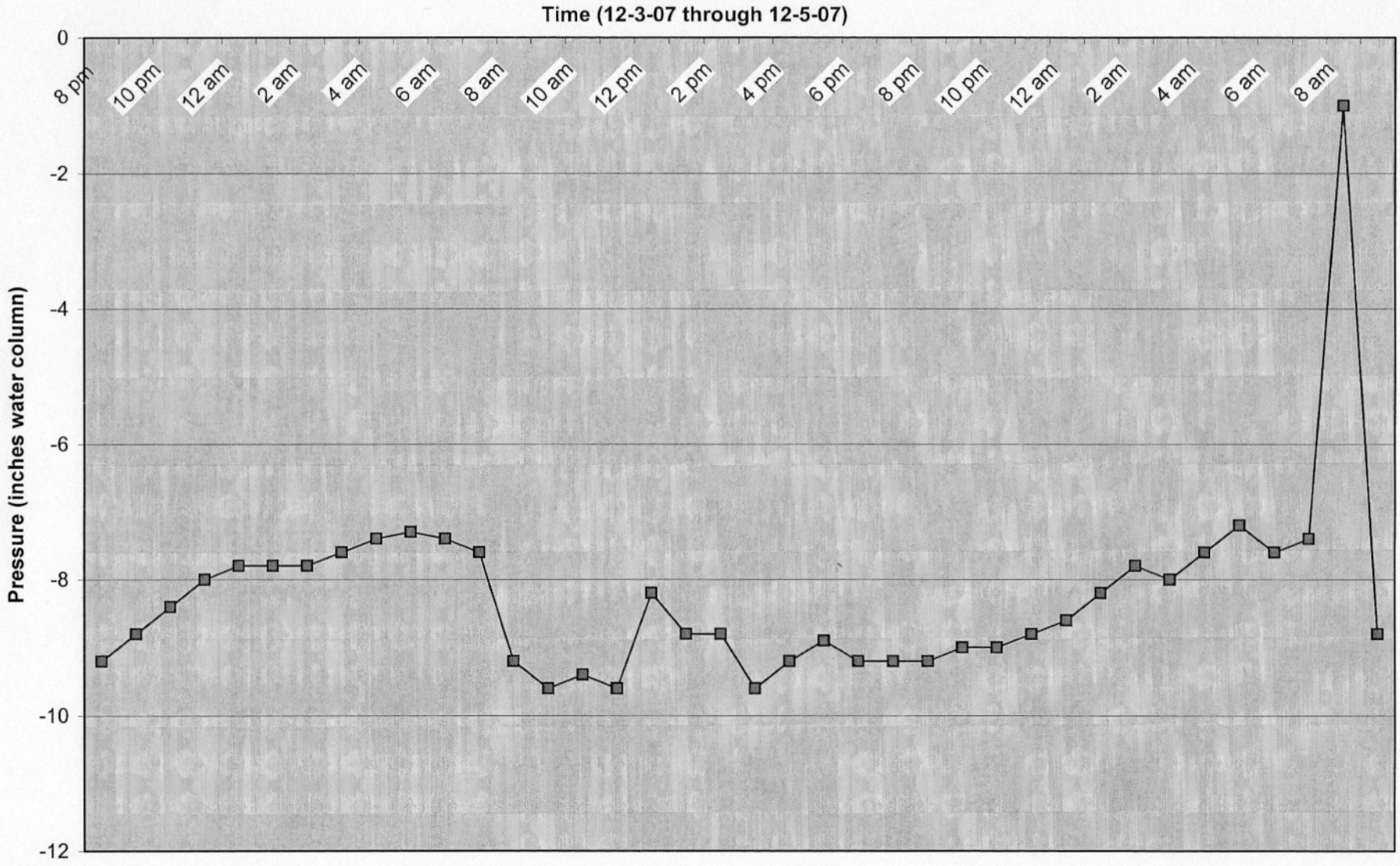
Pressure Data

ORVR Vehicle Phase II Testing

12/3/07 through 12/5/07

Date	Time	Pressure (in water column)	Notes
3-Dec	8 pm	-9.2	
	9 pm	-8.8	
	10 pm	-8.4	
	11 pm	-8.0	
4-Dec	12 am	-7.8	
	1 am	-7.8	
	2 am	-7.8	
	3 am	-7.6	
	4 am	-7.4	
	5 am	-7.3	
	6 am	-7.4	
	7 am	-7.6	
	8 am	-9.2	
	9 am	-9.6	
	10 am	-9.4	
	11 am	-9.6	
	12 pm	-8.2	
	1 pm	-8.8	
	2 pm	-8.8	
	3 pm	-9.6	
	4 pm	-9.2	
	5 pm	-8.9	
	6 pm	-9.2	
	7 pm	-9.2	
	8 pm	-9.2	
	9 pm	-9.0	
	10 pm	-9.0	
	11 pm	-8.8	
5-Dec	12 am	-8.6	
	1 am	-8.2	
	2 am	-7.8	
	3 am	-8.0	
	4 am	-7.6	
	5 am	-7.2	
	6 am	-7.6	
	7 am	-7.4	
	8 am	-1.0	Bulk Delivery
	9 am	-8.8	

Chart 1
UST Pressure



Appendix 3

Hourly UST Pressure Data and Data from Development of ARB Test Procedure 201.2F, Pressure Related Fugitive Emissions

Appendix 3: Hourly UST Pressure Data and Data from Development of ARB Test Procedure 201.2F, Pressure Related Fugitive Emissions

Table A3-1: Flow rate correction factors, CF, for actual flow rates

4.15 CFH at 2 inches WG

Assist Phase II Vapor Recovery System, 7 - 12 nozzles

P "WCG	Measured Q cfm	Correction factor for flow at given pressure, CF = Q at p_{actual} / Q at $p_{2\ inches\ water}$ =
3.5	0.0983	1.4200
3.25	0.0940	1.3581
3	0.0895	1.2927
2.75	0.0848	1.2250
2.5	0.0797	1.1516
2.25	0.0746	1.0772
2	0.0692	1.0000
1.8	0.0646	0.9339
1.6	0.0599	0.8658
1.4	0.0546	0.7892
1.2	0.0490	0.7081
1	0.0430	0.6209
0.8	0.0363	0.5249
0.6	0.0289	0.4168
0.4	0.0200	0.2893
0.3	0.0149	0.2159
0.25	0.0124	0.1790
0.2	0.0094	0.1363
0.15	0.0064	0.0921
0.1	0.0031	0.0442

Data From TP-201.2F Development, Joe Fischer, ARB Monitoring and Laboratory Division, October 8, 2003

Table A3-2: Summer Fuel, XXXX, 8/3/- 9/1/07

30 days of hourly-averaged pressure data, positive pressures only

Leak flow rate at 2 inches water = 2.19 CFH

Cracking pressure is 2.97 inches water

Sorted ARB Hourly Average Pressures, in water	Corrected ARB Hourly Average Pressures (1)	Correction factor CF from Table A3-1	Corrected flow Qc=Qp*CF at given pressure
2.97	2.90	1.29	2.83
2.96	2.88	1.29	2.83
2.87	2.79	1.22	2.68
2.85	2.77	1.22	2.68
2.85	2.77	1.22	2.68
2.79	2.71	1.22	2.68
2.78	2.70	1.22	2.68
2.76	2.69	1.22	2.68
2.70	2.62	1.15	2.52
2.69	2.61	1.15	2.52
2.67	2.59	1.15	2.52
2.66	2.59	1.15	2.52
2.66	2.59	1.15	2.52
2.58	2.50	1.15	2.52
2.51	2.44	1.15	2.52
2.50	2.43	1.15	2.52
2.50	2.42	1.15	2.52
2.49	2.42	1.15	2.52
2.39	2.31	1.08	2.36
2.38	2.31	1.08	2.36
2.38	2.31	1.08	2.36
2.32	2.25	1.08	2.36
2.21	2.14	1.08	2.36
2.18	2.11	1.08	2.36
2.11	2.03	1.00	2.19
2.00	1.92	1.00	2.19
1.97	1.89	1.00	2.19
1.91	1.84	0.93	2.05
1.89	1.82	0.93	2.05
1.85	1.78	0.93	2.05
1.83	1.76	0.93	2.05
1.76	1.69	0.87	1.90
1.75	1.67	0.87	1.90
1.74	1.67	0.87	1.90
1.70	1.62	0.93	2.05
1.67	1.60	0.87	1.90

Table A3-2: Summer Fuel, XXXX, 8/3/- 9/1/07

30 days of hourly-averaged pressure data, positive pressures only

Leak flow rate at 2 inches water = 2.19 CFH

Cracking pressure is 2.97 inches water

Sorted ARB Hourly Average Pressures, in water	Corrected ARB Hourly Average Pressures (1)	Correction factor CF from Table A3-1	Corrected flow Qc=Qp*CF at given pressure
1.64	1.57	0.87	1.90
1.60	1.53	0.87	1.90
1.60	1.53	0.87	1.90
1.58	1.51	0.87	1.90
1.53	1.46	0.79	1.73
1.46	1.38	0.79	1.73
1.40	1.32	0.79	1.73
1.39	1.32	0.79	1.73
1.39	1.32	0.79	1.73
1.38	1.31	0.79	1.73
1.32	1.25	0.71	1.55
1.24	1.17	0.71	1.55
1.23	1.16	0.71	1.55
1.23	1.16	0.71	1.55
1.21	1.14	0.71	1.55
1.18	1.11	0.71	1.55
1.18	1.11	0.71	1.55
1.17	1.10	0.71	1.55
1.17	1.10	0.71	1.55
1.13	1.06	0.62	1.36
1.08	1.01	0.62	1.36
0.96	0.89	0.62	1.36
0.87	0.80	0.52	1.15
0.86	0.79	0.52	1.15
0.84	0.77	0.52	1.15
0.83	0.76	0.52	1.15
0.83	0.76	0.52	1.15
0.82	0.75	0.52	1.15
0.81	0.75	0.52	1.15
0.75	0.68	0.42	0.91
0.69	0.62	0.42	0.91
0.67	0.61	0.42	0.91
0.55	0.48	0.29	0.63
0.52	0.45	0.29	0.63
0.52	0.45	0.29	0.63
0.50	0.43	0.42	0.91
0.50	0.43	0.42	0.91

Table A3-2: Summer Fuel, XXXX, 8/3/- 9/1/07

30 days of hourly-averaged pressure data, positive pressures only

Leak flow rate at 2 inches water = 2.19 CFH

Cracking pressure is 2.97 inches water

Sorted ARB Hourly Average Pressures, in water	Corrected ARB Hourly Average Pressures (1)	Correction factor CF from Table A3-1	Corrected flow Qc=Qp*CF at given pressure
0.45	0.38	0.29	0.63
0.44	0.37	0.29	0.63
0.44	0.37	0.29	0.63
0.39	0.32	0.22	0.47
0.39	0.32	0.22	0.47
0.38	0.31	0.22	0.47
0.36	0.30	0.22	0.47
0.36	0.29	0.22	0.47
0.35	0.28	0.22	0.47
0.33	0.26	0.18	0.39
0.29	0.22	0.14	0.30
0.26	0.19	0.14	0.30
0.25	0.18	0.09	0.20
0.23	0.16	0.09	0.20
0.17	0.11	0.04	0.10
0.17	0.11	0.04	0.10
0.17	0.10	0.04	0.10
0.16	0.09	0.04	0.10
0.16	0.09	0.04	0.10
0.15	0.08	0.04	0.10
0.13	0.06	0.04	0.10
0.13	0.06	0.04	0.10
0.12	0.06	0.04	0.10
0.12	0.06	0.04	0.10
0.10	0.04	0.04	0.10
0.09	0.02	0.04	0.10
0.08	0.02	0.04	0.10
0.08	0.02	0.04	0.10
0.08	0.02	0.04	0.10
0.08	0.01	0.04	0.10
0.07	0.01	0.04	0.10
0.07	0.00	0.04	0.10
0.06	0.00	0.04	0.10
0.06	0.00	0.04	0.10
0.05	0.00	0.04	0.10
0.05	0.00	0.04	0.10
0.05	0.00	0.04	0.10

Table A3-2: Summer Fuel, XXXX, 8/3/- 9/1/07

30 days of hourly-averaged pressure data, positive pressures only

Leak flow rate at 2 inches water = 2.19 CFH

Cracking pressure is 2.97 inches water

Sorted ARB Hourly Average Pressures, in water	Corrected ARB Hourly Average Pressures (1)	Correction factor CF from Table A3-1	Corrected flow Qc=Qp*CF at given pressure
0.04	0.00	0.04	0.10
0.04	0.00	0.04	0.10
0.03	0.00	0.04	0.10
0.03	0.00	0.04	0.10
0.02	0.00	0.04	0.10
0.02	0.00	0.04	0.10
0.01	0.00	0.04	0.10
		Total	145.14

(1) Corrected pressure was calculated using the 7/12/2007 calibration of the Campbell Scientific pressure transducer, because the calibration showed the Campbell was >0.05 in H2O different from the Ashcroft primary std. at some pressures. The 0.05 in water requirement for accuracy is from TP 201.3. See page A3-10-11, Campbell Calibration Form, 7/12/2007.

Table A3-3: Winter Fuel, XXXX, 12/3/07- 1/3/08

30 days of hourly-averaged pressure data, positive pressures only

Leak flow rate at 2 inches water (CFH) = 2.19

Cracking pressure is 2.97 inches water

Sorted ARB Hourly Average Pressures, inches water	Correction factor CF from Table A3-1	Corrected flow Qc=Qp*CF at given pressure
2.83	1.22	2.68
2.83	1.22	2.68
2.76	1.22	2.68
2.76	1.22	2.68
2.74	1.22	2.68
2.74	1.22	2.68
2.69	1.22	2.68
2.69	1.22	2.68
2.69	1.22	2.68
2.69	1.22	2.68
2.64	1.22	2.68
2.64	1.22	2.68
2.54	1.15	2.52
2.54	1.15	2.52
2.49	1.15	2.52
2.49	1.15	2.52
2.49	1.15	2.52
2.49	1.15	2.52
2.45	1.15	2.52
2.45	1.15	2.52
2.36	1.08	2.36
2.36	1.08	2.36
2.31	1.08	2.36
2.31	1.08	2.36
2.27	1.08	2.36
2.27	1.08	2.36
2.26	1.08	2.36
2.26	1.08	2.36
2.24	1.08	2.36
2.24	1.08	2.36
2.23	1.08	2.36
2.23	1.08	2.36
2.23	1.08	2.36
2.23	1.08	2.36
2.23	1.08	2.36
2.23	1.08	2.36
2.19	1.08	2.36
2.19	1.08	2.36

Table A3-3: Winter Fuel, XXXX, 12/3/07- 1/3/08

30 days of hourly-averaged pressure data, positive pressures only

Leak flow rate at 2 inches water (CFH) = 2.19

Cracking pressure is 2.97 inches water

Sorted ARB Hourly Average Pressures, inches water	Correction factor CF from Table A3-1	Corrected flow Qc=Qp*CF at given pressure
2.18	1.08	2.36
2.18	1.08	2.36
2.16	1.08	2.36
2.16	1.08	2.36
2.11	1.00	2.19
2.11	1.00	2.19
2.11	1.00	2.19
2.11	1.00	2.19
2.08	1.00	2.19
2.08	1.00	2.19
1.98	1.00	2.19
1.98	1.00	2.19
1.96	1.00	2.19
1.96	1.00	2.19
1.82	0.93	2.05
1.82	0.93	2.05
1.80	0.93	2.05
1.80	0.93	2.05
1.59	0.87	1.90
1.59	0.87	1.90
1.54	0.87	1.90
1.54	0.87	1.90
1.50	0.87	1.90
1.50	0.87	1.90
1.39	0.79	1.73
1.39	0.79	1.73
1.36	0.79	1.73
1.36	0.79	1.73
1.20	0.71	1.55
1.20	0.71	1.55
1.09	0.62	1.36
1.09	0.62	1.36
1.00	0.62	1.36
1.00	0.62	1.36
0.97	0.62	1.36
0.97	0.62	1.36
0.93	0.62	1.36
0.93	0.62	1.36
0.89	0.52	1.15
0.89	0.52	1.15

Table A3-3: Winter Fuel, XXXX, 12/3/07- 1/3/08

30 days of hourly-averaged pressure data, positive pressures only

Leak flow rate at 2 inches water (CFH) = 2.19

Cracking pressure is 2.97 inches water

Sorted ARB Hourly Average Pressures, inches water	Correction factor CF from Table A3-1	Corrected flow Qc=Qp*CF at given pressure
0.88	0.52	1.15
0.88	0.52	1.15
0.88	0.52	1.15
0.88	0.52	1.15
0.83	0.52	1.15
0.83	0.52	1.15
0.81	0.52	1.15
0.81	0.52	1.15
0.79	0.52	1.15
0.79	0.52	1.15
0.74	0.52	1.15
0.74	0.52	1.15
0.69	0.42	0.91
0.69	0.42	0.91
0.62	0.42	0.91
0.62	0.42	0.91
0.53	0.42	0.91
0.53	0.42	0.91
0.48	0.29	0.63
0.48	0.29	0.63
0.40	0.29	0.63
0.40	0.29	0.63
0.39	0.29	0.63
0.39	0.29	0.63
0.38	0.29	0.63
0.38	0.29	0.63
0.37	0.29	0.63
0.37	0.29	0.63
0.37	0.29	0.63
0.37	0.29	0.63
0.36	0.29	0.63
0.36	0.29	0.63
0.35	0.22	0.47
0.35	0.22	0.47
0.35	0.22	0.47
0.35	0.22	0.47
0.33	0.22	0.47
0.33	0.22	0.47
0.31	0.22	0.47
0.31	0.22	0.47

Table A3-3: Winter Fuel, XXXX, 12/3/07- 1/3/08

30 days of hourly-averaged pressure data, positive pressures only

Leak flow rate at 2 inches water (CFH) = 2.19

Cracking pressure is 2.97 inches water

Sorted ARB Hourly Average Pressures, inches water	Correction factor CF from Table A3-1	Corrected flow Qc=Qp*CF at given pressure
0.30	0.22	0.47
0.30	0.22	0.47
0.28	0.22	0.47
0.28	0.22	0.47
0.26	0.18	0.39
0.26	0.18	0.39
0.20	0.14	0.30
0.20	0.14	0.30
0.20	0.14	0.30
0.20	0.14	0.30
0.20	0.14	0.30
0.20	0.14	0.30
0.18	0.09	0.20
0.18	0.09	0.20
0.14	0.09	0.20
0.14	0.09	0.20
0.04	0.04	0.10
0.04	0.04	0.10
0.03	0.04	0.10
0.03	0.04	0.10
0.02	0.04	0.10
0.02	0.04	0.10
0.01	0.04	0.10
0.01	0.04	0.10
		€ 207.02

Campbell Scientific Calibration Form, 7/12/2007

Datalogger #: FRANCINE
Viatran Model #: IDP10 IDP10-V22A21F
Viatran S/N #: 1481839
Laptop #: 5 20020949
Calibration Date: 7/12/2007
Calibration By: D. Wilkerson/Ray H.

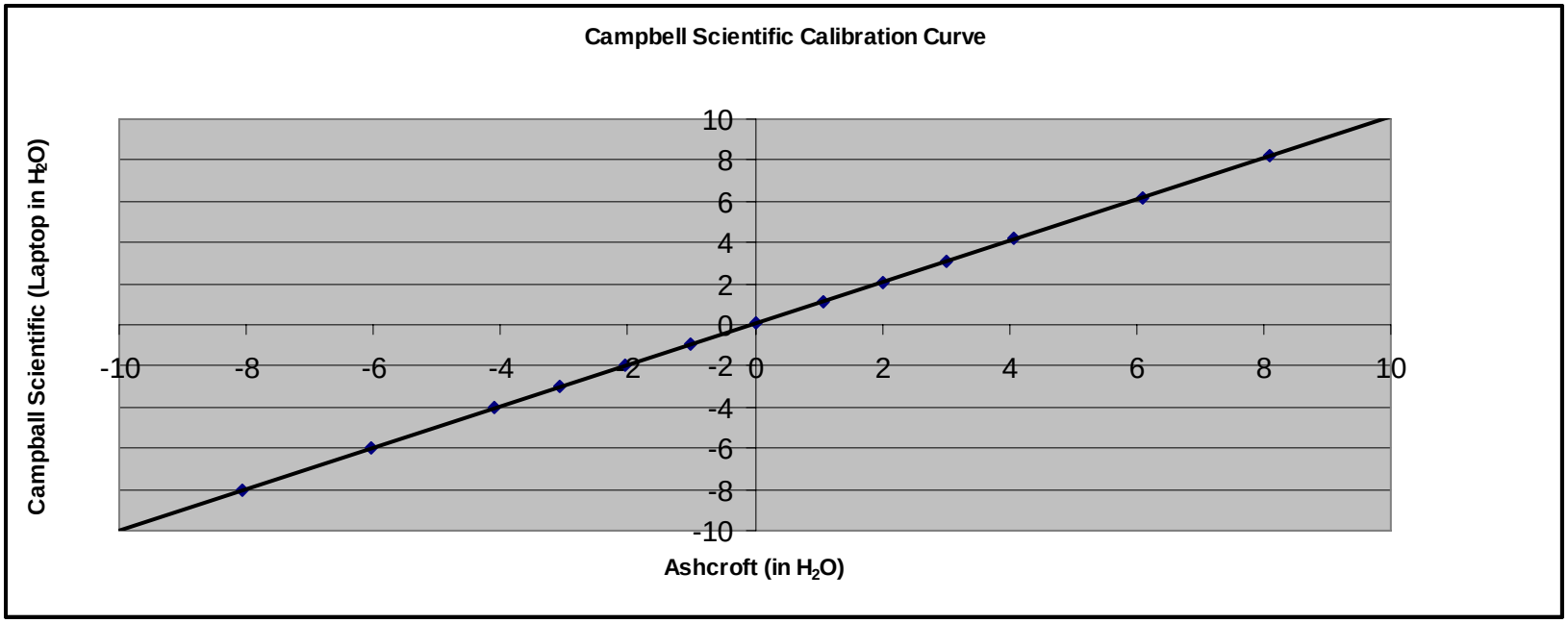
Standard Cal. Date: 12/13/2006
Span set: None
Room Temp. (^{o}F): 74.7

ASHCROFT AQS-1/FM
AQS-24260

Target Pressure (inH_2O)	Ashcroft Pressure (inH_2O)	Campbell Scientific Pressure (Laptop) (inH_2O)	Ashcroft Press - Campbell Press (inH2O)	Corrected Campbell value y=mx+b (inH2O)	Corected Ashcroft Press - Campbell Press (inH2O)
10	10.069	10.170	0.101	10.063	-0.006
8	8.079	8.180	0.101	8.081	0.002
6	6.085	6.180	0.095	6.089	0.004
4	4.071	4.160	0.089	4.078	0.007
3	3.023	3.100	0.077	3.022	-0.001
2	2.015	2.090	0.075	2.016	0.001
1	1.063	1.130	0.067	1.060	-0.003
0	0.003	0.070	0.067	0.004	0.001
-1	-1.025	-0.970	0.055	-1.032	-0.007
-2	-2.042	-1.980	0.062	-2.038	0.004
-3	-3.079	-3.030	0.049	-3.083	-0.004
-4	-4.088	-4.040	0.048	-4.089	-0.001
-6	-6.051	-6.010	0.041	-6.051	0.000
-8	-8.075	-8.040	0.035	-8.073	0.002
-10	-10.076	-10.050	0.026	-10.075	0.001

Slope: 1.004064705
Intercept: 0.065874254
Correlation: 0.999999783

Campbell Scientific Calibration Form, 7/12/2007, continued


Campbell Scientific Calibration Curve
Campball Scientific (Laptop in H2O)
Ashcroft (in H2O)
10
8
6
4
2
0
-2
-4
-6
-8
-10
-10
-8
-6
-4
-2
0
2
4
6
8
10