Appendix B
Analysis: Vapor to Liquid (V/L) Ratio Testing: ISD vs. V/L Method

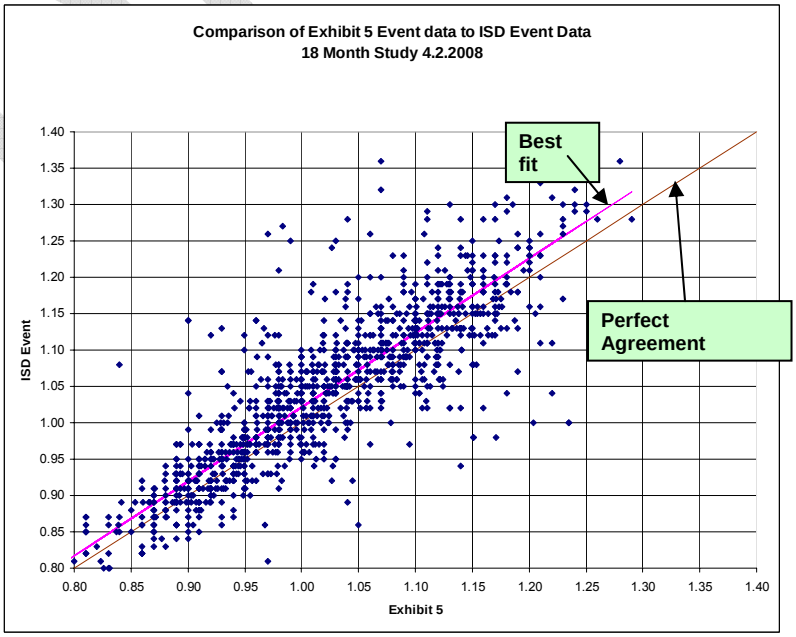
The ISD Field Study included the vapor to liquid (V/L) testing per modified Exhibit 5 of Executive Order VR-202-A to determine how closely the Healy including Veeder-Root ISD system compares to the Exhibit 5 V/L method.

Test data time was synchronized to the ISD system time to ensure proper correlation between data sets. It was only necessary to test the V/L accuracy on one side of the dispenser since there was only one flow meter in each dispenser. The opposite side of the dispenser being tested was removed from service to prevent dispensing of gasoline during the test.

The analysis used 1171 V/L data sets comparing Exhibit 5 V/L to the ISD V/L values. V/L tests included using different gasoline grades, and different fueling points if available at the time. Test protocol required the nozzle be returned to the dispenser after each test with a time of at least one minute between tests to ensure the ISD system recognized each test as a separate fueling event.

Statistical analysis was performed on the ISD and Exhibit 5 V/L values. The best fit line matched closely to the perfect agreement line (slope equal to 1). The average difference in values was 0.04 while the standard deviation was 0.06. Analysis showed that at the 95 percent confidence level (twice the standard deviation), the ISD V/L values were within 0.12 of Exhibit 5 V/L data and met the criteria (0.15) of the Exhibit 9 of VR-202-A.

Figure VI-B-1
Vapor/Liquid (V/L) Ratio Testing-Graph



Appendix C
Analysis: Vapor to Liquid (V/L) Ratio Testing: Malfunction Criteria

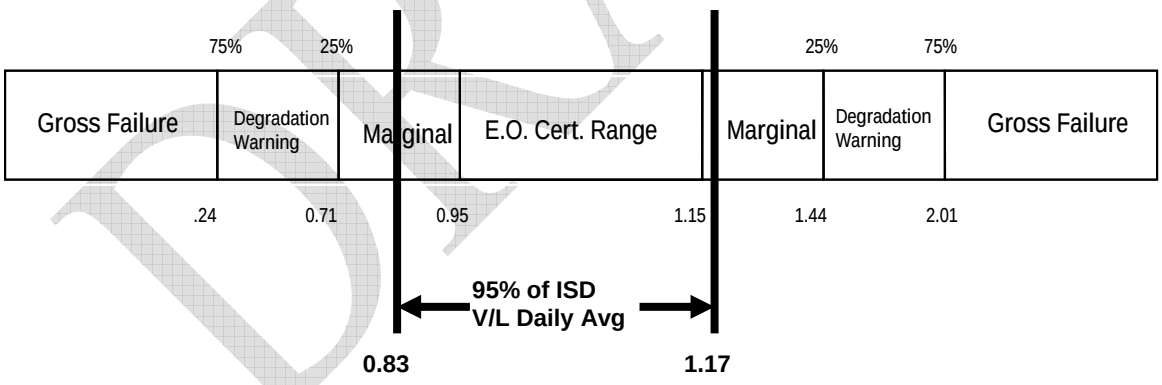
The V/L ratio testing was used to determine whether the V/L malfunction criteria for gross and degradation failures (Section 10.2.1 (b) and (c) of CP-201) could be modified to be more stringent without compromising the reliability of the system.

The certified range limits of V/L for ISD are 0.95 to 1.15. ISD malfunction criteria for gross failure includes a daily assessment that limits V/L to 75 percent above or below the certified range resulting in limits of 0.24 and 2.01. One assessment outside of these limits will result in a warning alarm. Two failed assessments will result in a failure alarm.

ISD malfunction criteria for degradation warnings includes a weekly assessment that limits V/L to 25 percent above or below the certified range (0.95 to 1.15) resulting in limits of 0.71 and 1.44. One assessment outside of these limits will result in a warning alarm. Two failed assessments will result in a failure alarm.

Marginal limits are limits between the certified range and degradation warnings as shown in Figure VI-C-1.

Figure VI-C-1
V/L Certification Range and ISD Warning and Failure Limits

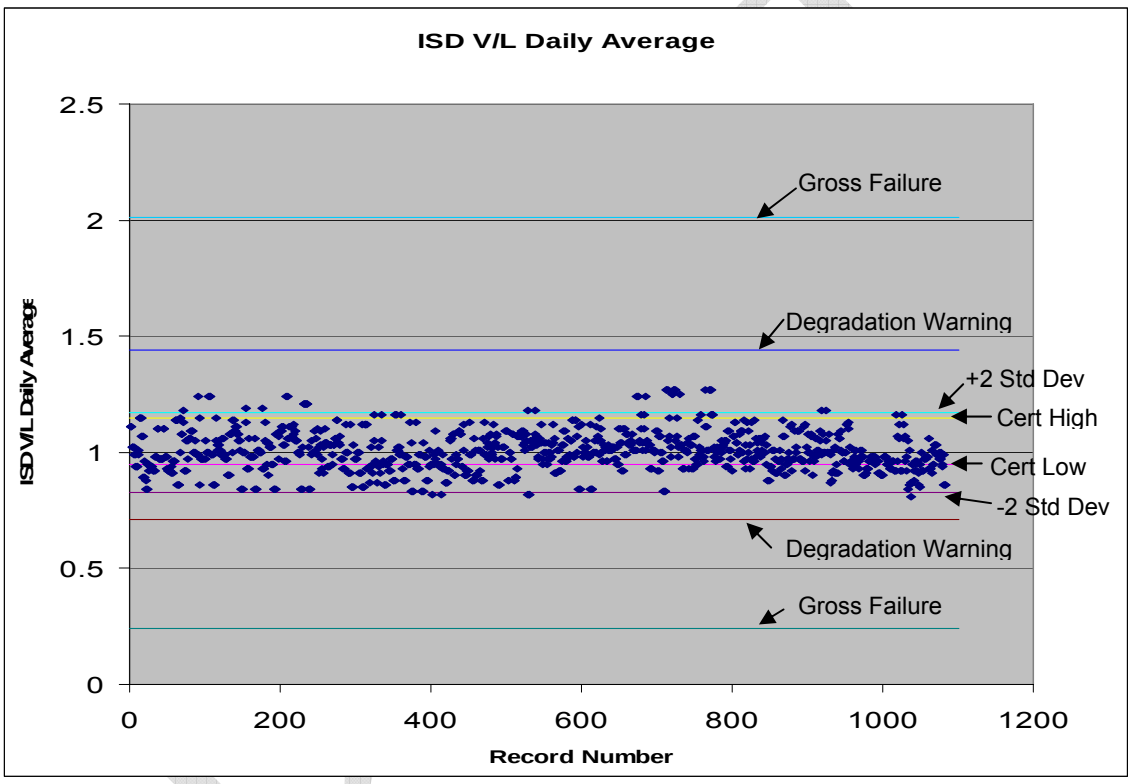


There were 1084 V/L data sets. The maximum ISD V/L daily average was 1.27 and the minimum was 0.81. These values were outside the E.O. certification range, but not within the degradation warning or the gross failure limits. Statistical analysis resulted in a mean of 1.000 while the standard deviation was 0.086. Analysis showed that at the 95 percent confidence level (twice the standard deviation), the ISD V/L values were within the certification range and marginal range limits, but not in the degradation warning or the gross failure limits.

Appendix C
Analysis: V/L Ratio Testing: Malfunction Criteria

The test site data indicated that the malfunction criteria could be tightened without compromising the reliability of the assessment. Quantification of this is beyond the scope of the ISD Field Study. Any changes to the limits would require additional testing and evaluation as well as require regulatory development.

Figure VI-C-2
ISD V/L Daily Averages



Appendix D
Analysis: ORVR & Non-ORVR Vehicles

District staff collected data that identified vehicles as ORVR vehicles or non-ORVR vehicles at GDFs while the vehicles refueled. During vehicle refueling, the opposite side of the dispenser was removed from service to prevent dispensing during the test. Vehicle refuelings that were three gallons or less were invalid. ARB Staff matched the vehicle fueling time and the number of gallons dispensed to the corresponding V/L readings from the Veeder-Root TLS.

For vehicles manufactured during the ORVR transition years, district staff determined if the vehicle was equipped with ORVR. This determination was made by checking the emission label attached to the vehicle's hood or engine compartment.

Vehicles that require ORVR must have an identifying code in the emission label. However, some vehicles that had voluntary early implementation of ORVR may not have the code on the emission label since there is no legal requirement to identify the vehicle until the vehicle is required to have ORVR. Trucks were difficult to determine because the possible transition years were dependent on model year and gross vehicle weight rating (GVWR). Transition years are listed in Table VI-D-1.

Table VI-D-1
ORVR Transition Years

Light Duty Autos	Light Duty Trucks GVWR<5751 Lbs	Medium Duty & Light Heavy Duty GVWR 5751-10,000Lbs
1998, 1999	2001, 2002	2004, 2005

District staff collected data on 1490 vehicles (888 ORVR and 602 non-ORVR) through the ISD Field Study. The ISD blocked fueling events (V/L ≤0.51) were consistent with 78 percent (695) of the vehicles the district identified as ORVR. The ISD non-blocked fueling events (V/L >0.51) determinations were consistent with 96 percent (575) of the vehicles the district staff identified as being ORVR. Of the 22 percent (193) misidentified ORVR vehicles, 84 were light duty, medium duty, and light heavy duty trucks. Some of these trucks may have been incorrectly identified as being ORVR. These trucks had V/L >0.51 and their model year are part of the transition years. With the questionable trucks omitted from the study, the percentage of vehicles being consistent for ORVR increased from 78 percent to 86 percent.

Appendix D
Analysis: ORVR & Non-ORVR Vehicles

Table VI-D-2
ORVR and Non-ORVR Determinations by District Staff

	ORVR (888)	Non-ORVR (602)
ISD V/L Consistent w/ District Staff ID	78% (695)	96% (575)
ISD V/L Inconsistent w/ District Staff ID	22% (193) (V/L >0.51)	4% (27) (V/L ≤0.51)

As part of a separate analysis of the ORVR and non-ORVR vehicles, the light duty autos were classified strictly by their model year, and trucks were classified by model year and GVWR, if known, with the transition years omitted. This analysis resulted in a smaller subset of vehicles. The subset compared 1185 records of V/L values against the ORVR and non-ORVR status with similar results to the original analysis. Of the vehicles identified as ORVR, the ISD V/L confirmed 83 percent as ORVR. Of the vehicles identified as non-ORVR, the ISD V/L confirmed 95 percent of the vehicles as non-ORVR.

Table VI-D-3
ORVR and Non-ORVR Determinations by MY and GVWR

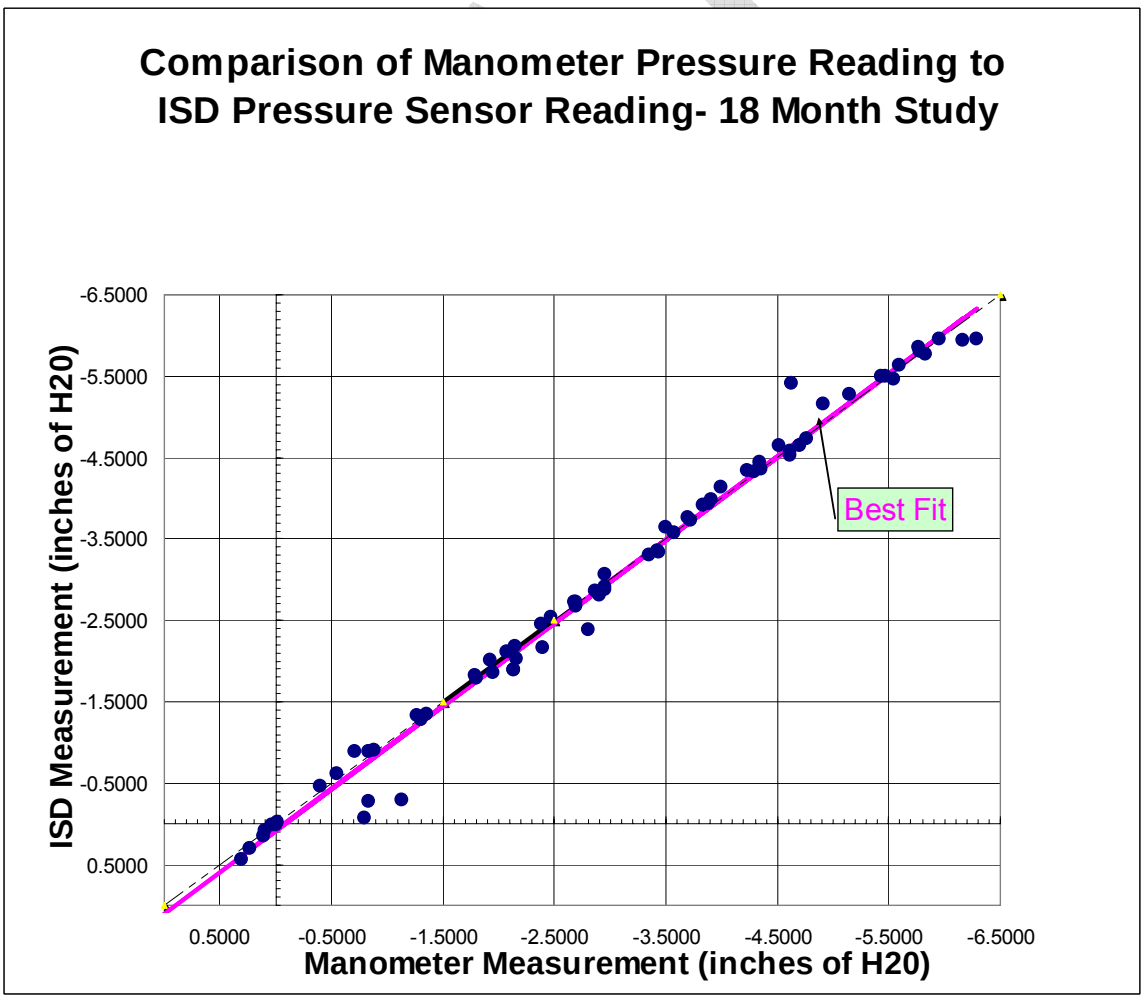
	ORVR (547)	Non-ORVR (638)
ISD V/L Consistent w/ MY & GVWR	83% (455)	95% (605)
ISD V/L Inconsistent w/ MY & GVWR	17% (92) (V/L >0.51)	5% (33) (V/L ≤0.51)

Appendix E
Analysis: Pressure Sensor Verification

The ISD Field Study compared pressure sensor values of underground storage tanks between the TLS reading of the Healy including Veeder-Root ISD system to actual manometer readings taken by ARB staff. The TLS is limited to a negative pressure reading of ±6.00 IWC.

A linear regression analysis identified the best fit line matches closely to the perfect agreement line (slope equal to one). The average difference of the ISD reading compared to the manometer reading was 0.12 IWC while the standard deviation was 0.20. The coefficient of determination R^2 for a linear regression is equal to the square of a correlation coefficient. Analysis calculated R^2 as 0.99. The ISD Field Study data analysis concluded the Healy including Veeder-Root ISD system pressure sensor value closely compares to the monitored value.

Figure VI-E-1
Pressure Sensor Verification-Graph



Appendix F
Analysis: Vapor Pressure Sensor Operability Test

The ISD Field Study also evaluated the vapor pressure sensor's ability to properly record data in accordance with the Healy including Veeder-Root ISD specifications. The pressure sensor criteria was ±0.2 IWC. There were 89 tests conducted. Results were recorded on the Vapor Pressure Sensor Ambient Reference Test data form and followed test protocol detailed in Appendix A. All vapor pressure sensor tests passed.

Appendix G
Analysis: Vapor flow Meter Operability Test

The test is defined in Exhibit 9 of Executive order VR-202-A. The analysis used the previous day's gross ISD V/L daily average and compares it to the calculated V/L values determined by VR-202-A Exhibit 5. The ISD vapor flow meter operating criteria is ±0.15 of the test value. If the ISD was not within those limits, further V/L tests were performed. The analysis included 585 tests of which 580 tests passed and only one failed. Four tests were inconclusive. The passing rate was 99.1 percent and the results verify that the flow meter was operating properly.