California Air Resources Board
P.O Box 2815, Sacramento, CA 95812
http://www.arb.ca.gov/cap/cap.htm

What is In-Station Diagnostics (ISD)

ISD systems monitor vapor recovery equipment to ensure that it is functioning normally by:

- Automatically identifying failures
- Notifying station operators
- Tying into existing underground storage tank (UST) vapor leak monitors

California Gas Station ISD Requirements *

Annual throughput (gal)	ISD Requirement
More than 1.8 million	Install ISD by September 2009
Less than 1.8 million, but more than 600,000	Install ISD by September 2010
Less than 600,000	Exempt from ISD

*** ISD is required for all new installations or major mdifications of existing facilities statewide for both attainment and non-attainment areas for ozone.**

There are 2 approved ISD systems:

INCON - Franklin Fueling Systems
TS-550, TS-5000, TS-EMS

and

VEEDER-ROOT
TLS-350

An ISD system has 3 components that interface between the dispenser and the monitoring console.

Vapor Flow Meter (1 per dispenser)
Measures the amount of gasoline vapor flow returning from a vehicle

Vapor Pressure Sensor
(1 per station)
Monitors system pressure

Tank Inventory Probe
(1 per tank)
Measures fuel levels, vapor space (ullage), and detects deliveries

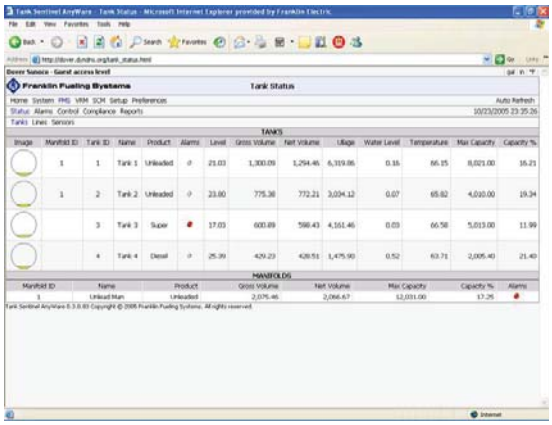
Types of Vapor Recovery Monitoring

Vapor Collection Monitoring:
Each fuel delivery transaction is recorded. Vapor-to-Liquid (V/L) ratio is calculated, and a daily or weekly average is determined for all Non-ORVR (Onboard Refueling Vapor Recovery) V/L ratios.
V/L Averages are compared to the upper and lower allowable limits: Daily Average must be > 0.33 or < 1.90. Weekly average must be >0.81 or <1.32.
Minimum number of samples required to make assessments: Daily - 15 Non-ORVR vehicles per fueling point. Weekly - 30 Non-ORVR vehicles per fueling point. (If the number of vehicles is not met, Vapor Recovery Monitoring will report insufficient samples.)
Vapor Containment Monitoring:
Monitors vapor containment area for over-pressurization on a weekly and monthly basis.
Vapor Recovery Monitoring limits will alarm for over-pressurization if: Weekly - +1.3 IWC* > 5% of time Monthly - +0.3 IWC > 25% of time
Vapor Leakage Testing:
Monitors the tightness of the vapor containment area.
Test gathers data during periods of inactivity and monitors pressure profiles.
Containment Leakage - > 8-14 CFH (cubic feet per hour) leak at 2 IWC
Daily alarms shutdown after 24 hour assessment period(INCON) Weekly alarms shutdown after 7 day assessment period
Shutdown = No deliveries or dispensing

* Inches water column

How do I Interface with the Console?

Push button Commands (Veeder-Root TLS-350) or Standard Web Browser (INCON)



Results Options:

For Veeder-Root - Printout from the TLS-350 Console
For INCON - Receive printout directly from the touchscreen, or
Both Systems - Save file to PC, then send to external printer.

Inspecting the INCON ISD

ARB Executive Order #VR-202H, Exhibit 10 - Healy Phase II EVR System Including ISD System, INCON Vapor Recovery Monitoring Operability Test Procedure

1. **Inspection Points -** The following components are authorized:

- Console TS-550 or TS-5000 - Dependent on station size.
- Console TS-EMS - Contains just Vapor Recovery Monitoring (VRM) application. Veeder-Root protocol compatible.
- Vapor Flow Meter - TS-VFM - 1 per dispenser; measures volume of vapor returning to UST. Site glass on end to view leaks.
- Vapor Pressure Sensor - TS-VPS - 1 per station. Measures ullage pressure in UST. Used in leakage and over-pressurization testing.
- Dispenser Shutdown Relay Module(s) - Shuts down individual dispensers.
- Data Transfer Units TS-DTU (optional) - 1 per dispenser. VFM and VPS data is transmitted via the dispenser power wires.
- Label on unit contains model and serial numbers.

2. Connecting a PC to the Console

- Use COMM PORT 1, using the standard IP address: 192.168.33.1
- Use an Ethernet crossover cable with the unit IP address:
  Configure IP settings (requires ADMIN password),
  Find IP address at:
    1. Network connections - LAN connections,
    2. Properties - TCP/IP - Properties,
    3. Enter IP address (less one from last number), and Subnet Mask.

3. Retrieving Reports from the INCON ISD

INCON ISD LCD touchscreen interface - 3 access levels:

- GUEST - Access menu options, view reports, check system configurations.
- USER - Limited control functions i.e. leak tests, re-enable dispensers. Cannot clear alarms.
- ADMIN - Full set-up and control ability. Run manual V/L reports. Authorized to clear alarms.

4. Types of Reports - Daily Report (day, month or year)

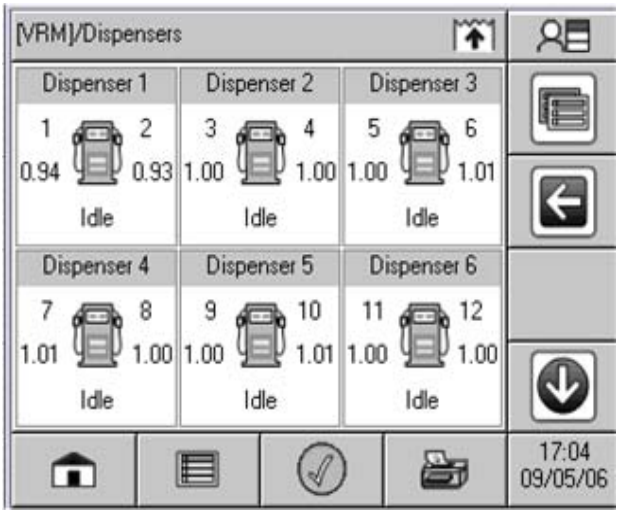
Monthly Report (month, year, prior years) * Best overview *

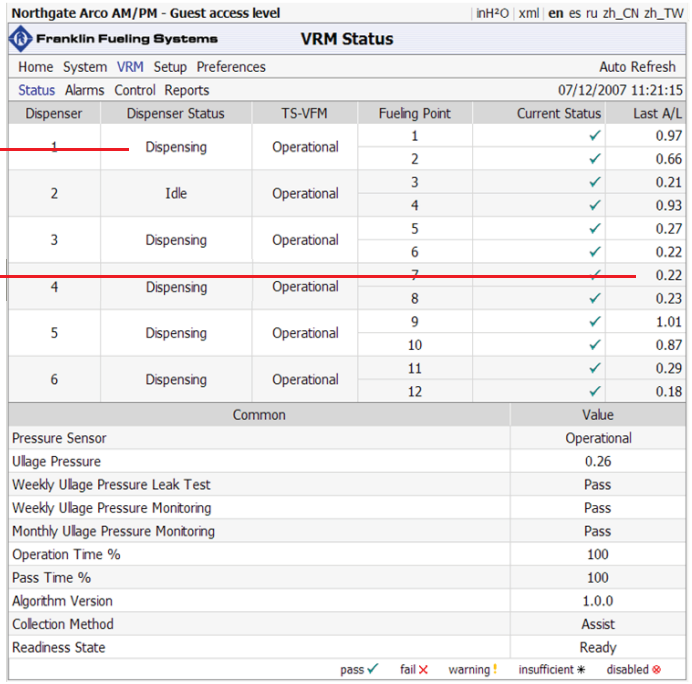
5. Types of Warnings, Failures, and Shutdowns

- Vapor Flow Meter or Probe Module Failure - A Gross Daily V/L will occur after Day 1. A shutdown of the dispenser will follow at the end of Day 2.
- Degradation Warning/Failure - A weekly warning alarm will occur when A/L is out of range based on a minumum of 30 non-ORVR dispensing events. With two consecutive failed assessments, a failure alarm is activated, recorded, and fuel dispensing is shut down from the affected fueling point(s).
- Vapor Pressure Sensor or 4-20mA Module Failure - A Weekly Pressure Monitoring Warning/Failure will occur after Week 1 and 2. A shutdown of all the dispensers will follow Week 2.
- Ullage Pressure Degradation - Monthly Assessment: warning alarm when pressure exceeds 0.5 IWC 25% of time. With two consecutive failed assessments, a failure alarm is activated, recorded, and fuel dispensing is shut down from the affected fueling point(s).
- Pressure Integrity Test - Weekly system leak detection: Warning alarm for rates at least 2 times the rate allowed in CP-201, Static Pressure Performance 4.2. With two consecutive failed assessments, a failure alarm is activated, recorded, and fuel dispensing is shut down from the affected fueling point(s).
- Vapor Processing Monitoring - Daily assessment, malfunction shall activate a warning alarm. After 2 malfunctions, failure alarm and fuel stops dispensing.

6. Vapor Recovery Monitoring Status Page

- Shows Dispenser state and status
- Shows Vapor/Liquid (V/L) result from last dispensed





7. Vapor Recovery Monitoring Daily Report

Northgate Arco AM/PM
4747 Northgate Blvd
Sacramento CA
ISD Certification Site
with Healy Systems

June 2007

07/11/2007 10:05:09

Daily ISD Report

ISD version 1.0.0

ISD Up Time 100%

Performance Indicators

Vapor Containment Pressure

Daily V/L Test results

pass ✓ fail ✕ warning ! insufficient ✳ disabled ⊗

Date	ISD Up Time	ISD Pass Time	Pressure				Fueling Points A/L Ratio							
			max	min	75th	95th	1	2	3	4	5	6	7	8
06/01/2007	100	100	-3.26	-8.40	-6.81	-5.65	✓0.93	✓0.92	✓0.98	✓0.98	✓0.96	✓0.98	✓0.98	✓1.02
06/02/2007	100	100	-1.08	-8.41	-6.					✓0.93	✓0.96	✓0.98	✓0.96	✓0.99
06/03/2007	100	100	-4.49	-8.41	-7.34	-5.65	✓0.98	✓1.00	✓0.95	✓0.99	✓0.98	✓0.96	✓1.00	✓1.03
06/04/2007	100	100	-2.77	-8.40	-4.51	-2.82	✓0.95	✓0.96	✓1.00	✳0.00	✓0.91	✓0.96	✓0.96	✓0.95
06/05/2007	100	100	-5.62	-8.41	-7.56	-6.28	✓0.93	✓0.94	✓0.98	✓0.94	✓0.91	✓0.97	✓0.96	✓0.99
06/06/2007	100	100	-1.04	-8.45	-6.99	-1.69	✓0.95	✓0.97	✓1.00	✓0.99	✓0.99	✓0.96	✓0.99	✓1.02
06/07/2007	100	100	-0.97	-8.42	-7.15	-2.70	✓0.96	✓0.96	✓1.00	✓0.99	✓0.96	✓0.99	✓0.99	✓1.02
06/08/2007	100	100	-3.75	-8.41	-7.21	-3.82	✓0.97	✓0.94	✓0.99	✓0.95	✓0.97	✓0.99	✓0.96	✓0.99
06/09/2007	100	100	-3.15	-8.41	-5.06	-3.37	✓0.95	✓0.93	✓1.02	✓0.94	✓0.93	✓0.92	✓0.91	✓0.97
06/10/2007	100	100	-3.39	-8.39	-6.77	-5.32	✓0.96	✓0.84	✓0.90	✓0.97	✓0.97	✓0.95	✓0.93	✓1.03
06/11/2007	100	100	-3.08	-8.39	-6.26	-5.16	✓0.94	✓0.94	✳0.00	✓0.95	✓0.98	✓0.92	✓0.97	✓1.03
06/12/2007	100	100	-4.43	-8.40	-6.79	-5.28	✓0.95	✓0.94	✓1.01	✓0.93	✓0.96	✓0.96	✓0.97	✓1.00
06/13/2007	100	100	-4.53	-8.39	-6.54	-5.22	✓0.88	✓0.92	✓0.87	✓0.90	✓0.91	✓0.88	✓0.84	✓0.98
06/14/2007	100	100	-3.57	-8.39	-7.68	-5.47	✓0.91	✓0.90	✓0.87	✓0.85	✓0.88	✓0.90	✓0.89	✓0.95

Average V/L per Fueling Point

8. Vapor Recovery Monitoring Monthly Report

Northgate Arco AM/PM
4747 Northgate Blvd
Sacramento CA
ISD Certification Site
with Healy Systems

May 2007

07/11/2007 11:18:49

VRM Monthly Reports

ISD version 1.0.0

Statistics		
Operational Time [%]		**Pass Time [%]**
May 2007		
100		71

Performance Indicators

Monitoring Requirements		
Limits	**LOW**	**HIGH**
Daily Vapor Collection A/L	0.33	1.90
Weekly Vapor Collection A/L	0.81	1.32
Weekly Ullage Pressure Monitoring		1.30
Monthly Ullage Pressure Monitoring		0.30

Monthly Requirements

Operational Requirements	
Vapor Collection Method	Assist
Vapor Collection A/L Low	0.95
Vapor Collection A/L High	1.15

Operational Requirements

Warnings Alarms

Device	Description	Category	Type	Date Occurred	Date Cleared
Fueling Point 6	Weekly Vapor Collection	VRM	Warning	05/20/2007 03:00:04	05/21/2007 00:51:57
Fueling Point 5	Weekly Vapor Collection	VRM	Warning	05/20/2007 03:00:04	05/20/2007 23:23:09

9. Clearing Vapor Recovery Alarms

Alarms must be cleared by a trained technician with *Administrator* rights.

Vapor Collection Alarm - will alarm when average Daily or Weekly V/L is exceeded. If not repaired, a shutdown occurs on single affected dispenser only.

Vapor Containment Alarm - will alarm when weekly or monthly over-pressurization pressure is exceeded, or if weekly leak test pressure exceeds 2 times the limits in TP-201.3. All dispensers will shutdown.

Component Alarm - box or equipment problem. Must repair communication or replace component or module.

Inspecting the VEEDER-ROOT ISD

ARB Executive Order VR-202H, Exhibit 9 - Healy Phase II EVR System Including ISD System, Veeder-Root ISD Operability Test Procedure

ARB Executive Order VR-204-D, Exhibit 13 - VST Phase II EVR System Including Veeder-Root ISD, ISD Vapor Flow Meter Operability Test Procedure

1. Inspection Points - The following components are authorized:

- TLS-350
- ISD Software - Veeder-Root ISD 1.02
- Vapor Flow Meter (1 per Dispenser) - Veeder-Root 331847-XXX
- Vapor Pressure Sensor - (1 per GDF) - Veeder-Root 331946-001
- Dispenser Interface Module (DIM) - Veeder-Root DIM Series
- RS232 Interface Module - Veeder-Root RS232 Interface Module Series

2. Connecting a PC to the Console

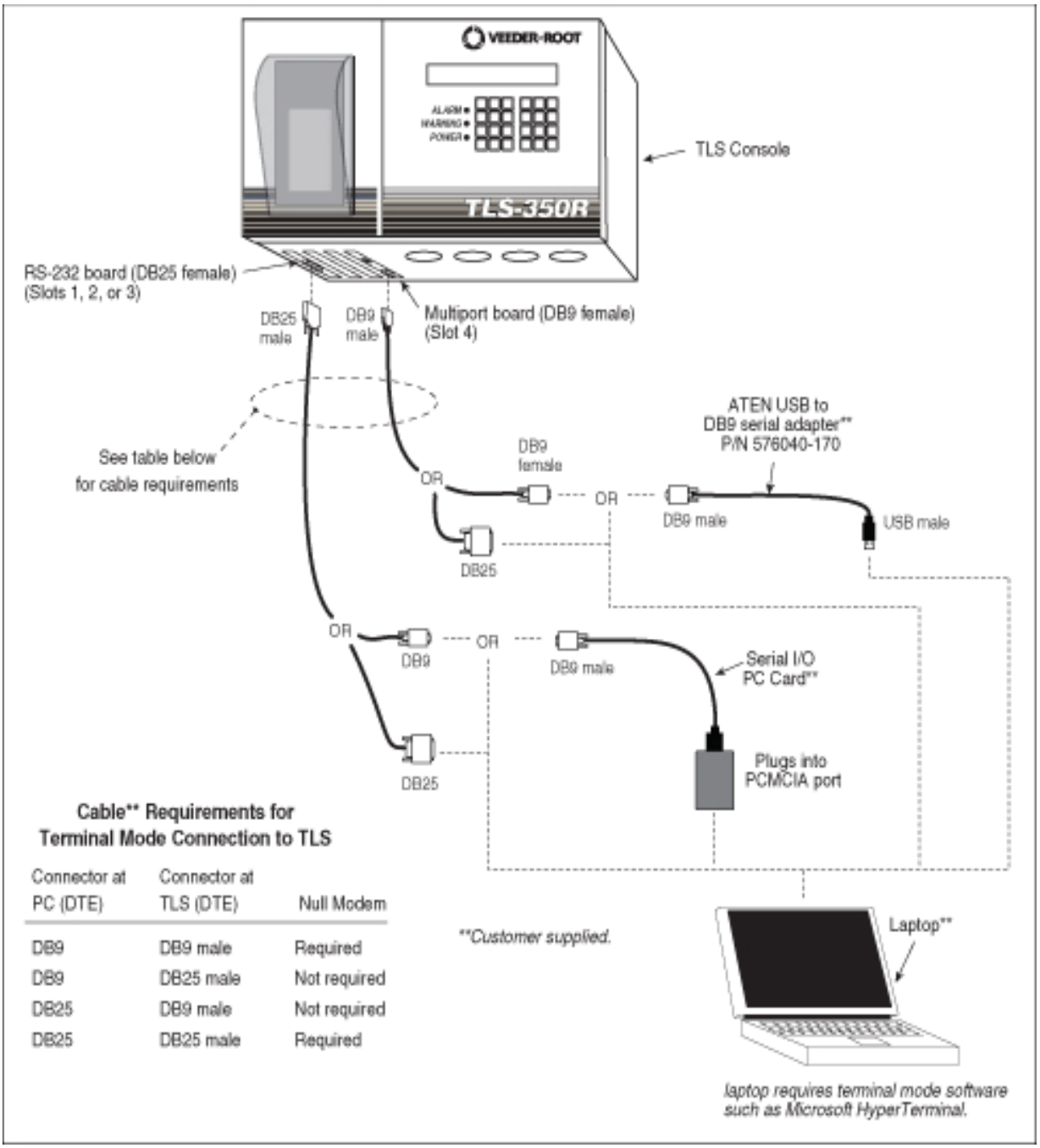
Direct Connection Method (RS-232) connects a single PC to the console. ***Remote Connect*** requires a telephone line with a modem at each end (PC and Console).

	Direct Connect		**Remote Connect**		
Console	Connectors		Modem	Connectors	
	@ PC	@Console		@Modem	@ Console
TLS-300	Female DB-9 or DB-25	Male DB-25	External Modem	Female DB-9 or DB-25	Male DB-25
TLS-350	Female DB-9 or DB-25	Male DB-25	External Modem with Internal RS-232 Inerface Module	Female DB-25	Male DB-25
			Console Internal Site-Fax Module		Phone & line RJ-11 jacks
TLS-350R	Female DB-9 or DB-25	Male DB-25	External modem with internal RS-232 Interface Module	Female DB-25	Male DB-25
			Console Internal Site-Fax Module		Phone & Line RJ-11Jacks

Viewing ISD Reports via RS-232 Connection

Connecting LAPTOP to Console:

Connect your laptop to the TLS console's RS-232 or Multiport module using one of the methods shown ***(fold-out schematic)***:



Cable Requirements for Terminal Mode Connection to TLS**

Connector at PC (DTE)	Connector at TLS (DTE)	Null Modem
DB9	DB9 male	Required
DB9	DB25 male	Not required
DB25	DB9 male	Not required
DB25	DB25 male	Required

Once the PC is connected:

- Open the HyperTerminal communication program from: Start/Programs/Accessories/Communications.
- Cancel any modem related dialing request. Enter a connection name such as TSLDIRECT, and choose an icon in the connection description window.
- In the “Connect to” window, select 1 from the drop-down menu: COM1 (if RS-232- port on laptop)
  USB-Serial Controller (if using USB port on laptop), or Serial I/O PC Card (if using PCM-CIA port on laptop)
- Check TLS RS232 Settings:
  Settings on the laptop com-port and the Console com-port must be the same.
  Press MODE=SETUP; Press FUNCTION=COMMUNICATIONS SET UP; STEP=PORT SETTINGS; Then PRINT SETTINGS; Enter SETTINGS into COM1 Properties.

3. Retrieving Reports from the VEEDER-ROOT ISD

REPORT TYPE	SERIAL COMMANDS
ISD Alarm Report	Inquire Format, Display<SOH>**IV0100**
ISD Monthly Status Report	Inquire Format, Display<SOH>**IV0200yyyymm**
ISD Daily Status Report	Inquire Format, Display<SOH>**IV0300yyyymmdd**
ISD Daily Report Details (by month)	Inquire Format, Display < SOH >**IV0400yyyymm**
ISD Daily Report Details (by day(s))	Inquire Format, Display < SOH >**IV0500ddd** 1. ddd=number of days: 000-current day, 001= yesterday & today.
ISD Daily Report Details, 132 columns(by monthy)	Inquire Format, Display < SOH >**IV0600yyyymm**
ISD Daily Report Details (by day(s))	Inquire Format, Display < SOH >**IV0700yyyymm** 1. ddd=number of days: 000-current day, 001= yesterday & today.
ISD Daily Report Details (by month)	Inquire Format,Display<SOH>**IV0800yyyymmCCC** CCC=Number of columns (decimal) valid values=555-999
ISD Daily Report Details, user input columns (by day(s))	Inquire Format,Display<SOH>**IV0900yyyymmCCC**
ISD Daily Overall Status Report	Inquire Format, Display<SOH >**IV0A00yyyymmdd**
ISD Monthly Overall Status Report	Inquire Format, Display < SOH >**IV0B00yyyymm**

4. ISD Sample MONTHLY Report - IV0200

EVR TYPE: VACUUM ASSIST
ISD TYPE: 01.02
VAPOR PROCESSOR TYPE: NO VAPOR PROCESSOR

OVERALL STATUS :WARN EVR VAPOR COLLECTION :WARN
EVR VAPOR CONTAINMENT :WARN
ISD MONITOR UP-TIME :100% STAGE I TRANSFERS: 24 of 24 PASS
EVR/ISD PASS TIME : 42%

CARB EVR CERTIFIED OPERATING REQUIREMENTS

	MIN	MAX
VAPOR COLLECTION ASSIST SYSTEM A/L RANGE	0.95	1.15

ISD MONITORING TEST PASS/FAIL THRESHOLDS

	PERIOD	BELOW	ABOVE
VAPOR COLLECTION ASSIST SYSTEM A/L GROSS FAIL	1DAYS	0.33	1.90
VAPOR COLLECTION ASSIST SYSTEM A/L DEGRADATION FAIL	7DAYS	0.81	1.32
VAPOR CONTAINMENT GROSS FAIL, 95th PERCENTILE	7DAYS	----	1.30”wcg
VAPOR CONTAINMENT DEGRADATION, 75th PERCENTILE	30DAYS	----	0.30”wcg
VAPOR CONTAINMENT LEAK DETECTION FAIL @2”WCG	7DAYS	----	8.50cfh
STAGE I VAPOR TRANSFER FAIL, 50th PERCENTILE	20MINS	----	2.50”wcg

WARNING ALARMS

DATE	TIME	DESCRIPTION	READING	VALUE
08-12-22	00:01:00	CONTAINMENT GROSS OVER PRESSURE WEEKLY	95%	2.74
08-12-18	00:01:31	A/L RATIO DEGRADATION	FP 2 BLEND3	0.81
08-12-15	00:02:17	A/L RATIO GROSS BLOCKAGE	FP 5 BLEND3	BLKD

FAILURE ALARMS

SHUTDOWN & MISCELLANEOUS EVENTS

DATE	TIME	DESCRIPTION	ACTION/NAME
08-12-22	08:30:25	CONTAINMENT GROSS & DEGRD	TEST MANUALLY CLEARED
08-12-22	08:30:07	CONTAINMENT GROSS & DEGRD	TEST MANUALLY CLEARED
08-12-19	12:52:57	COLLECTION TEST HH08 GRADE	TEST MANUALLY CLEARED
08-12-13	14:12:24	CONTAINMENT GROSS & DEGRD	TEST MANUALLY CLEARED
08-12-11	09:56:43	COLLECTION TEST HH05 GRADE	TEST MANUALLY CLEARED
08-12-11	09:56:32	CONTAINMENT GROSS & DEGRD	TEST MANUALLY CLEARED
08-12-09	12:18:50	COLLECTION TEST HH04 GRADE	TEST MANUALLY CLEARED
08-12-09	12:18:38	CONTAINMENT GROSS & DEGRD	TEST MANUALLY CLEARED
08-12-09	12:18:17	CONTAINMENT GROSS & DEGRD	TEST MANUALLY CLEARED
08-12-09	12:17:44	COLLECTION TEST HH05 GRADE	TEST MANUALLY CLEARED

5. ISD Sample DAILY Report - IV0100

EVR TYPE: VACUUM ASSIST ISD TYPE: 01.02
VAPOR PROCESSOR TYPE: NO VAPOR PROCESSOR

OVERALL STATUS: WARN EVR VAPOR COLLECTION :PASS
EVR VAPOR CONTAINMENT: WARN
ISD MONITOR UP-TIME: 100% STAGE I TRANSFERS: 0 of 0 NOTEST
EVR/ISD PASS TIME: 0%

WARNING ALARMS:

DATE	TIME	DESCRIPTION	READING	VALUE
08-12-22	00:01:00	CONTAINMENT GROSS OVER PRESSURE	WEEKLY 95%	2.74
08-12-18	00:01:31	A/L RATIO DEGRADATION	FP 2 BLEND3	0.81
08-12-15	00:02:17	A/L RATIO GROSS BLOCKAGE	FP 5 BLEND3	BLKD

FAILURE ALARMS:
SHUTDOWN & MISCELLANEOUS EVENTS

DATE	TIME	DESCRIPTION	ACTION/NAME
08-12-22	08:30:25	CONTAINMENT GROSS & DEGRD	TEST MANUALLY CLEARED
08-12-22	08:30:07	CONTAINMENT GROSS & DEGRD	TEST MANUALLY CLEARED
08-12-19	12:52:57	COLLECTION TEST HH08 GRADE	TEST MANUALLY CLEARED

6. Types of Warnings, Failures, and Shutdown

(W) Warning - Warnings indicate when equipment has a probability of malfunctioning and can be used by GDF operators to identify trends.

(F) Fail - When equipment has a high certainty of non-compliance with specific requirements, ISD systems will post a failure and shut down dispensing.

(D) Degradation Collection Failure - Two consecutive degredation test warnings over a 14-day period will result in a degradation collection alarm, failure event recorded, and will shut down dispensing.

(G) Gross Collect Failure - Two consecutive 1-day periods of gross test failures will result in a gross failure alarm, failure event recording, and will shut down dispensing at all fueling points.

(ISD-W) ISD Warning - Vapor Recovery Monitoring Alarms occur when the ISD system detects a problem with one of its own components (pressure sensor out, missing flow meter, dispenser interface module connection down, ATG connection down, etc.)

(ISD-F) ISD Failure - If the ISD system continues to detect problems with its own components, the system will go into ISD system failure.

(N) No Test - When ISD does not receive enough data to perform an assesment, the system will yield a No Test.

7. Alarm Table

WARNING ALARM	BALANCE ISD	ASSIST ISD	DAYS TO ALARM	DESCRIPTION
ISD DEGRD PRESSURE	X	X	30	Vapor Overpressure problem
ISD GROSS PRESSURE	X	X	7	Vapor Overpressure problem
ISD VAPOR LEAKAGE	X	X	7	Vapor Leakage Problem
ISD SENSOR OUT	X	X	7	Optional Sensor Problem
ISD SETUP	X	X	7	Optional Setup Problem
DEGRD COLLECT		X	7	Hose A/L Problem
GROSS COLLECT		X	1	Hose Blockage or A/L Problem
FLOW COLLECT	X		1	Hose Blockage Problem
ISD VP STATUS	X		1	Vapor Processor Problem
ISD VP PRESSURE	X		1	Vapor Processor Problem

Remember...

- *An alarm can only be cleared by a certified maintenance technician.*
- *There must be an entry in the maintenance log documenting the repair or reason for each cleared alarm event.*
- *For additional ISD operator action guidance, see: http://www.arb.ca.gov/vapor/isdresponse072208a.pdf*

Clearing an alarm is subject to your District permit conditions.

The Training & Compliance Assistance Branch, State of California, Air Resources Board (ARB), Enforcement Division, has developed this booklet for use by California Air District Inspectors and gasoline dispensing facilities operators to help clarify rules and assist in compliance with Vapor Recovery ISD requirements. It provides general ISD information and tools. Specific rules, regulations, and permitting and inspection requirements are handled by your local Air District.

To view all available publications, please visit www.arb.ca.gov/cap/cap/htm. If you would like to order more publications, please call (916) 327-7211, or email cap_pubs@arb.ca.gov.

Vapor Recovery and ISD training is also available. To view all classes and to enroll, visit www.arb.ca.gov/training/training.htm.

For more information:

ARB Vapor Recovery:
http://www.arb.ca.gov/vapor/vapor.htm

EVR Compliance Information:
http://www.evrhome.org

Franklin Fueling Systems, Inc.
http://www.franklinfueling.com/

Veeder-Root
http://www.veeder.com

CAP 05/2009