

# APPENDIX L

Description of CARB Overpressure Field Studies

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## Description of CARB Overpressure Field Studies

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The purpose of this appendix is to provide a brief description of nine field studies conducted by CARB staff to better understand the magnitude of the overpressure problem and to identify primary causes and potential solutions. Studies are listed in chronological order by start date. Each field study prompted the preparation of a technical support document as described below. Study descriptions include the number of gasoline dispensing facilities (GDF) evaluated and report citation. Eight of these nine studies are referenced in the ISOR. A description of the one study not cited in the ISOR, the Balance System at Positive Pressure Study, is provided for completeness. All technical support documents are available on the CARB Vapor Recovery webpage at: <https://www.arb.ca.gov/vapor/op/op.htm>

### 1. PWD EMISSION STUDY

Title: Estimate of Pressure Driven Emissions Occurring at GDF Equipped with the Assist Phase II Enhanced Vapor Recovery System (PWD Emission Study)

Purpose: To determine summer, winter, and year round emissions resulting from a severe form of overpressure known as “pressure increase while dispensing” (PWD) at GDFs equipped with the Healy Phase II Enhanced Vapor Recovery System.

Time Frame: 2009 through 2013

Number of GDFs: Eight (8)

Report Number: VR-OP-A6

Report Citation: CARB. 2017c. Estimate of Pressure Driven Emissions Occurring at GDF Equipped with the Assist Phase II Enhanced Vapor Recovery System, Report Number VR-OP-A6. Overpressure Study Technical Support Document prepared by staff of the Vapor Recovery and Fuel Transfer Branch, Monitoring and Laboratory Division, California Air Resources Board (CARB). December 7, 2017. Available at: <https://www.arb.ca.gov/vapor/op/studies/assist/vropa6.pdf>

Relied upon by this ISOR? Yes [Chapter V and Appendix G]

## **2. GASOLINE REID VAPOR PRESSURE STUDY**

**Title:** Gasoline Sampling and Analysis to Investigate the Effect of Reid Vapor Pressure on Vapor Recovery System Overpressure (Reid Vapor Pressure Study)

**Purpose:** To investigate the influence of winter fuel volatility, CARB staff periodically sampled gasoline from GDFs located in both northern and southern California. Samples were collected and analyzed for Reid Vapor Pressure (RVP) per CARB adopted test procedures. Analysis of RVP data and ISD system overpressure alarm history shows that there is a strong correlation between the volatility of gasoline and the frequency of overpressure alarms triggered by the ISD system.

**Time Frame:** 2009 through 2015

**Number of GDFs:** 16

**Report Number:** VR-OP-G1

**Report Citation:** CARB. 2017f. Gasoline Sampling and Analysis to Investigate the Effect of Reid Vapor Pressure on Vapor Recovery System Overpressure, Report Number VR-09-G1. Overpressure Study Technical Support Document prepared by staff of the Vapor Recovery and Fuel Transfer Branch, Monitoring and Laboratory Division, California Air Resources Board (CARB). December 1, 2017. Available at: <https://www.arb.ca.gov/vapor/op/studies/gdf/vropg1.pdf>

**Relied upon by this ISOR?** Yes [Chapter I]

## **3. EXTENT OF OVERPRESSURE STUDY**

**Title:** 2013/2014 Field Study to Determine the Extent of the Overpressure Issue Occurring at California Gasoline Dispensing Facilities (Extent of Overpressure Study)

**Purpose:** To collect In-Station Diagnostic (ISD) system alarm history data, ISD generated pressure and ullage data, ISD generated individual fueling transaction data, and general operating characteristics from approximately 400 GDFs throughout California to determine the frequency and causes of ISD overpressure alarms and the prevalence of GDFs that exhibit PWD during winter months.

**Time Frame:** October 2013 through May 2014

Number of GDFs: ~400

Report Number: VR-OP-G2

Report Citation: CARB. 2017d. 2013/2014 Field Study to Determine the Extent of the Overpressure Issue Occurring at California Gasoline Dispensing Facilities, Report Number VR-OP-G2. Overpressure Study Technical Support Document prepared by staff of the Vapor Recovery and Fuel Transfer Branch, Monitoring and Laboratory Division, California Air Resources Board (CARB). December 7, 2017. Available at: <https://www.arb.ca.gov/vapor/op/studies/gdf/vropg2.pdf>

Relied upon by this ISOR? Yes [Chapter II and Appendices G and I]

#### **4. VAPOR RECOVERY SYSTEM PERFORMANCE TESTING STUDY**

Title: Results of Vapor Recovery System Performance Testing Conducted at Gasoline Dispensing Facilities Equipped with the Assist Phase II Enhanced Vapor Recovery System which Experience Pressure Increase While Dispensing (Vapor Recovery System Performance Testing Study)

Purpose: To determine if readily identifiable vapor recovery component failures can be attributed to PWD at GDFs equipped with the vacuum assist Phase II EVR System. A series of vapor recovery system performance tests was conducted on nine GDFs with differing operating characteristics in different regions of the state.

Time Frame: January 2014 through March 2014

Number of GDFs: Nine (9)

Report Number: VR-OP-A1

Report Citation: CARB. 2017g. Results of Vapor Recovery System Performance Testing Conducted at Gasoline Dispensing Facilities Equipped with the Assist Phase II Enhanced Vapor Recovery System which Experience Pressure Increase While Dispensing, Report Number VR-OP-A1. Overpressure Study Technical Support Document prepared by staff of the Vapor Recovery and Fuel Transfer Branch, Monitoring and Laboratory Division, California Air Resources Board (CARB). December 6, 2017. Available at: <https://www.arb.ca.gov/vapor/op/studies/assist/vropa1.pdf>

Relied upon by this ISOR? Yes [Chapter I]

## 5. NOZZLE REPLACEMENT STUDY

Title: Nozzle Replacement Study at Gasoline Dispensing Facility Equipped with Assist Phase II Enhanced Vapor Recovery System Exhibiting Pressure Increase While Dispensing (Nozzle Replacement Study)

Purpose: To determine whether or not replacement of existing, presumably worn/fatigued “in-use” nozzles with new, presumably optimized nozzles would help reduce the frequency of ISD overpressure alarms. The GDF selected for this study routinely exhibited PWD throughout the winter period, when gasoline sold is not subject to CARB regulations that limit Reid vapor pressure. Prior to installing new nozzles, CARB staff conducted performance tests at the GDF to verify the vapor recovery system was operating in compliance with applicable regulatory performance standards and specifications.

Time Frame: November 2014

Number of GDFs: One (1)

Report Number: VR-OP-A2

Report Citation: CARB. 2016c. Nozzle Replacement Study at Gasoline Dispensing Facility Equipped with Assist Phase II Enhanced Vapor Recovery System Exhibiting Pressure Increase While Dispensing, Report Number VR-OP-A2. Overpressure Study Technical Support Document prepared by staff of the Vapor Recovery and Fuel Transfer Branch, Monitoring and Laboratory Division, California Air Resources Board (CARB). December 6, 2016. Available at: <https://www.arb.ca.gov/vapor/op/studies/assist/vropa2.pdf>

Relied upon by this ISOR? Yes [Chapter I]

## 6. ORVR RECOGNITION STUDY

Title: Healy Model 900 Assist Vapor Recovery Nozzle ORVR Vehicle Recognition Study (ORVR Recognition Study)

Purpose: To determine if the ORVR vapor-to-liquid (V/L) ratio and ORVR mis-identification rate of the Healy nozzle have changed since 2007, and to determine if key correlations, similarities, and differences exist between GDFs that exhibit PWD and those that do not.

Time Frame: November 2014 through January 2015

Number of GDFs: Six (6)

Report Number: VR-OP-A3

Report Citation: CARB. 2017a. Healy Model 900 Assist Vapor Recovery Nozzle ORVR Vehicle Recognition Study, Report Number VROP-A3. Overpressure Study Technical Support Document prepared by staff of the Vapor Recovery and Fuel Transfer Branch, Monitoring and Laboratory Division, California Air Resources Board (CARB). November 29, 2017. (ORVR Recognition Study.) Available at: <https://www.arb.ca.gov/vapor/op/studies/assist/vropa3.pdf>

Relied upon by this ISOR? Yes [Chapter 2 and Appendix G]

## 7. ASSIST NOZZLE CONTROLLED STUDY

Title: Evaluation of Assist Vapor Recovery Nozzle ORVR Vehicle Recognition Performance under Controlled Fueling Conditions (Assist Nozzle Controlled Study)

Purpose: To determine the reason for wide variation in assist nozzle ORVR recognition performance with certain makes and models of vehicles. Once the common characteristic is identified, appropriate mitigation measures can be pursued to improve ORVR recognition performance which in turn will reduce the volume of excess air ingestion and help mitigate the occurrence of overpressure conditions.

Time Frame May 2015 through September 2015

Number of GDFs: One (1)

Report Number: VR-OP-A4

Report Citation: CARB. 2017b. Evaluation of Assist Vapor Recovery Nozzle ORVR Vehicle Recognition Performance under Controlled Fueling Conditions, Report Number VROP-A4. Overpressure Study Technical Support Document prepared by staff of the Vapor Recovery and Fuel Transfer Branch, Monitoring and Laboratory Division, California Air Resources Board (CARB). December 6, 2017. Available at: <https://www.arb.ca.gov/vapor/op/studies/assist/vropa4.pdf>

Relied upon by this ISOR? Yes [Chapter II]

## 8. BALANCE SYSTEM AT POSITIVE PRESSURE STUDY

Title: Performance of Balance Type Phase II Vapor Recovery Systems Operating at Slightly Positive Underground Storage Tank Ullage Pressure (Balance System at Positive Pressure Study)

Purpose: To determine vehicle refueling emission factors for balance systems when vehicle fueling is conducted while the underground storage tank ullage space pressure was controlled at a slight positive pressure.

Time Frame: May 2015 through July 2015

Number of GDFs: One (1)

Report Number: VR-OP-B1

Report Citation: CARB. 2017h. Performance of Balance Type Phase II Vapor Recovery Systems Operating at Slightly Positive Underground Storage Tank Ullage Pressure, Report Number VR-OP-B1. Overpressure Study Technical Support Document prepared by staff of the Vapor Recovery and Fuel Transfer Branch, Monitoring and Laboratory Division, California Air Resources Board (CARB). December 6, 2017. Available at: <https://www.arb.ca.gov/vapor/op/studies/balance/vropb1.pdf>

Relied upon by this ISOR? No

## 9. EOR NOZZLE STUDY

Title: Evaluation of Healy Model 900 Assist Vapor Recovery Nozzle with Enhanced On-Board Refueling Vapor Recovery (ORVR) Vehicle Recognition Feature during the Winter of 2016/2017 (EOR Nozzle Study)

Purpose: To determine the effectiveness of the EOR spout assembly with regard to improved ORVR vehicle recognition and mitigation of overpressure conditions including PWD within the underground storage tanks over the course of a full winter at seven retail GDFs, each with differing operating conditions and in different regions of California.

Time Frame: October 2016 through March 2017

Number of GDFs Seven (7)



Report Number: VR-OP-A7

Report Citation: CARB. 2018b. Evaluation of Healy Model 900 Assist Vapor Recovery Nozzle with Enhanced On-Board Refueling Vapor Recovery (ORVR) Vehicle Recognition Feature during the Winter of 2016/2017, Report Number VR-OP-A7. Overpressure Study Technical Support Document prepared by staff of the Vapor Recovery and Fuel Transfer Branch, Monitoring and Laboratory Division, California Air Resources Board (CARB). June 10, 2018. Available at:  
<https://ww2.arb.ca.gov/resources/documents/overpressure-studies-and-technical-support-documents>

Relied upon by this ISOR? Yes [Chapters II and V and Appendices G and J]