



**Measurement of VOC Emissions from
Pressurized Railcar Loading Arm Fittings**

FINAL REPORT

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Executive Summary

Factors and correlation equations for estimating fugitive emissions during loading and unloading of pressurized railcars (pressure cars) are presented. The factors and correlation equations were derived from measurements made using the U.S. Environmental Protection Agency (EPA) method for screening and bagging fugitive leak sources, as described in the EPA document titled, "*Protocol for Equipment Leak Emission Estimates*" (EPA-453/R-95-017). The measurements were made at railcar loading and unloading terminals in the Houston-Galveston-Brazoria (HGB) area during February-March and July 2006.

Pressure cars are loaded and unloaded from the top. The top of each car is equipped with a pressure head assembly and protective housing that contains valves for loading and unloading liquid product. The pressure head assembly also contains a vapor line that is used during loading to vent the railcar back to a storage tank or flare and during unloading to pressure the product out of the railcar with compressed product vapors or an inert gas (e.g., nitrogen). Other items contained within the pressure head assembly include a sampling valve that is used for sampling liquid from the bottom of the railcar, a safety valve, a thermometer well, and a gauging device.

To load and unload a railcar, a pipe extension is usually inserted into the liquid valve so that the connection to the loading arm can be made outside of the pressure head assembly protective housing. The valve and pipe extension are joined by a threaded connection designed to American National Pipe Tapered Thread (NPT) specifications. The connection from pipe extension to loading arm is usually made with a quick connect dry break coupler that is designed to prevent liquid leaks and spills. Several variations are commercially available. Opposite ends of the quick connect are joined to the pipe extension and loading arm, respectively, using NPT connections.

The average emission factors for threaded pipe connections and quick connect couplers measured during this study were 0.0097 kg/hr/source and 0.0025 kg/hr/source, respectively. These estimates are higher than the SOCFI and refinery average emission factors for connectors reported by EPA¹, which are 0.00183 kg/hr/source and 0.00025 kg/hr/source, respectively.

The measured emission factors were used with previously reported estimates of railcar loading and unloading activity in the HGB to estimate the regional VOC emissions from pressure

¹ EPA, 1995. *Protocol for Equipment Leak Emission Estimates* (EPA-453/R-95-017).

car loading and unloading. For chemicals having boiling points less than 75 °F at one atmosphere pressure, the total fugitive emissions estimate from pressure car loading and unloading is 2.69 tons per year. This estimate is less than one percent of the total railcar loading emissions in the HGB (392 tons per year) that was estimated by ERG (2004)².

Options for reducing fugitive VOC emissions from pressure car loading arm connections were investigated. The substitution of bolted flanged connections in place of the typical threaded connections to liquid and vapor valve assemblies resulted in zero detectable emissions at the four valves where the flanged connections were tested. Hot-welding of threaded connections on the inlet and outlet side of quick connect (dry break) couplers would eliminate other potential emissions sources. Other means for reducing fugitive VOC emissions during pressure car loading and unloading include implementation of leak detection and repair protocols and good piping practices (e.g., routine inspection, care, and maintenance of pipe threads).

² ERG, 2004, *Development of Emission estimates for Railroad Tank Cars for the Houston-Galveston Nonattainment Area*, Draft Report.