MEMORANDUM

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TO: Prentiss Searles, American Petroleum Institute STI Ref. No. 904092

FROM: Todd Tamura

SUBJECT: Review of technical issues in EPA's Stage II vapor recovery systems issues paper

This memorandum summarizes my technical comments regarding the U.S. Environmental Protection Agency's (EPA's) Stage II vapor recovery systems issues paper,[1] which was distributed electronically on August 12, 2004 for purposes of (1) providing background information regarding available data, (2) discussing EPA's ideas regarding the definition of "widespread use" (as used in Section 202(a)(6) of the Clean Air Act), and (3) soliciting comments from stakeholders. EPA states that they are "considering selecting [an emissions-based definition] to determine when widespread use occurs" (p. ii), and my primary comments (shown below) are with respect to issues of clearly defining the terms "ORVR compatibility" and "excess emissions," and quantification of emissions.

Defining "ORVR Compatibility" and "Excess Emissions"

As indicated at various points in the issues paper, it is generally understood that emissions at the fillpipe/nozzle interface (emissions point #1 in Figures 1-4 of the issue paper) will be lower for ORVR-equipped vehicles than for vehicles without ORVR. However, for certain types of Stage II vapor recovery systems (VRSs), ORVR-equipped vehicles cause more pressurization of the underground storage tank (UST), which results in more fugitive emissions (emissions point #4) and/or UST vent emissions (emissions point #3).

If the magnitude of the emissions decrease at the fillpipe is greater than the magnitude of the increase in emissions due to pressurization, the net effect of ORVR systems is beneficial, i.e., they are reducing total refueling emissions. However, it appears that EPA's issue paper (p. 10) defines the terms "excess emissions" and "incompatibility excess emissions" based solely on the change in pressurization-related emissions. This definition can easily be misconstrued, since the

[1] U.S. Environmental Protection Agency (2004) Stage II vapor recovery systems issues paper. U.S. EPA Office of Air Quality Planning and Standards, Emissions Monitoring and Analysis Division, Emissions Factors and Policy Applications Group (D243-02), August 12.

terms "excess emissions" and "incompatibility" often result in a perception that emissions from a VRS are increased by ORVR.

As an example, the California Air Resources Board (CARB) estimated that for Wayne VRSs, ORVR vehicles cause an increase in emissions of 0.063 pounds per thousand gallons dispensed (lb/1000 gal) relative to non-ORVR vehicles;[2] under the current definitions, these would be classified as "excess emissions". However, an American Petroleum Institute (API)-sponsored study[3] found that ORVR systems reduced emissions at the fillpipe (from a different VRS system) by approximately 0.31 lb/1000 gal. If that value were applicable to the Wayne VRS, ORVR would have the net effect of reducing refueling emissions from the Wayne VRS by 0.25 lb/1000 gal, despite being labeled as "incompatible". I suggest that the terms "excess emissions," "incompatibility emissions," etc. be defined so that they incorporate the total emissions due to refueling.

It appears that ORVR may also reduce emissions from the initial "puff" that is emitted when a vehicle's gas cap is removed for refueling. The API-sponsored study found that in seven out of eight tests conducted at vehicle tank temperatures of 90-105^{o}F, "puff" emissions from two different ORVR vehicles were lower than those from a non-ORVR vehicle by 3-5 grams per refueling event (0.5-0.8 lb/1000 gal).[4] (At tank temperatures of 70^{o}F, the effect of ORVR was not clear.) It seems unlikely that these emissions would be affected by the VRS with which the vehicles were last fueled, and therefore these emissions do not affect the status of a VRS' classification as "compatible" or "incompatible". However, "puff" emissions are typically not included in SIP emission inventories (they are excluded by both CARB's VRS testing procedures and EPA's ORVR testing procedures), and to the extent that agencies are considering whether they need to adjust those inventories due to the ORVR incompatibility of VRSs, the effects of ORVR on "puff" emissions should be considered.

Emissions Quantification

It is not appropriate to characterize the issue of fugitive emissions quantification as "ancillary," as is currently the case in the issues paper. In addition, the statement (p. 27) that "few studies of potential fugitive emissions from GDF have been conducted and as such, it is not clear whether these emissions are significant" is misleading. As I explained to EPA in my presentation on July 28, 2004,[5] the overwhelming majority of the incompatibility excess emission factors identified in Table 1 are based on fugitive emissions calculations, which are in turn based on UST pressure data.

[2] Loscutoff W.V. (2002) Letter to Mr. Prentiss Searles, American Petroleum Institute. August 5.
[3] Tech Environmental, Inc. (2004) ORVR compatibility study for the Gilbarco VaporVac VRS. Report prepared for the American Petroleum Institute, Washington, DC, by Tech Environmental, Inc., Waltham, MA, February.
[4] This is based on a refueling volume of 14 gallons, which was the amount of fuel needed to fill the tank of the non-ORVR vehicle. These factors would be higher if less gasoline were pumped into the vehicle (i.e., if the tank was not filled).
[5] Tamura T. (2004) Current issues regarding vapor recovery from vehicle refueling. Presented to U.S. Environmental Protection Agency, Research Triangle Park, NC, July 28.

Because of their significance, fugitive emissions calculation procedures have received a significant amount of attention. In CARB's 1999 test report[6] that was used to determine excess emission factors for CARB's Enhanced Vapor Recovery (EVR) regulations, CARB based their calculations on Boyle's Law. I pointed out deficiencies in this methodology,[7] and CARB subsequently developed Test Procedure TP-201.2F for calculating fugitive emissions, which was based on an empirical calculation methodology developed by the Bay Area Air Quality Management District (BAAQMD). This methodology resulted in very different estimates of fugitive emissions.[8] API-sponsored testing indicated that the TP-201.2F calculation methodology may be biased high, and this methodology was also critiqued separately.[9] In October 2003, CARB prepared an extensive compilation of issues surrounding fugitive emissions quantification, described experiments that had been conducted, and described a new methodology for estimating fugitive emissions for purposes of certification testing (i.e., the latest revision of TP-201.2F).[10] As described in a second memorandum which was submitted to the EPA on August 16, 2004,[11] this methodology effectively penalizes VRSs that are more vapor-tight, and this issue has been discussed with CARB. (CARB and the Western States Petroleum Association have drafted a testing protocol to help resolve this issue but the protocol has not yet been finalized, and it appears that it will not be possible to schedule testing during the 2004 ozone season.)

[6] California Air Resources Board (1999) Test report: total hydrocarbon emissions from two Phase II vacuum assist vapor recovery systems during baseline operation and simulated refueling of onboard refueling vapor recovery (ORVR) equipped vehicles. Preliminary draft prepared by California Air Resources Board, Compliance Division, Project Number ST-98-XX, June.

[7] Tamura T. (2002) Errors in estimates of Enhanced Vapor Recovery (EVR) emission reductions. Memorandum to Prentiss Searles, American Petroleum Institute, June 14.

[8] Tamura T. (2002) Comments on ARB's August 30, 2002 proposed revision to TP201.2F and other issues related to EVR emissions calculations for underground storage tanks (USTs). Memorandum to Prentiss Searles, American Petroleum Institute, September 13.

[9] Guldberg P. (2002) Comments on proposed changes to EVR test and certification procedures. Memorandum to Prentiss Searles, American Petroleum Institute, December.

[10] Castronovo C. (2003) Modifications to TP-201.2F, pressure related fugitive emissions. Memorandum to George Lew, Chief, Engineering and Certification Branch, California Air Resources Board, October 3.

[11] Tamura T. (2004) Summary of issues being discussed in California regarding emissions from vacuum-assisted Stage II vapor recovery systems. Memorandum to Prentiss Searles, American Petroleum Institute, August 16.

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