Big Changes Ahead in Vapor Recovery

In an excerpt of her speech at PEI's Convex '99, CARB's Laura McKinney discusses how, why and when the California Air Resources Board will implement its new Enhanced Vapor Recovery Program.

CARB revamps its testing & certification

The California Air Resources Board (CARB) is in the throes of making major changes in its Phase II (refueling) vapor recovery program. If you were at PEI Convex '99, you heard Laura McKinney, Manager of Certification and Investigation for CARB, speak about the coming changes. For those who were not in attendance and to reiterate her comments to those who were, this article is an edited version of her address. Changes in CARB's vapor recovery program were necessitated by a number of things. These include concern over pressure-related fugitive emissions, poor performance of systems revealed by field testing of systems, questionable reliability of systems, pressure-related fugitive emissions and compatibility with ORVR-equipped vehicles. In addition, CARB must meet the terms of a settlement of a lawsuit filed by environmental groups over failure to attain the air quality emission improvements in California's South Coast Air Quality Management District. The settlement agreement requires CARB to make improvements in the vapor recovery program to achieve greater reductions in emissions. What happens in California will also affect Stage II vapor recovery programs across the country, because all states except Missouri opted to adopt CARB's requirements as a means of complying with the vapor recovery requirements in the Clean Air Act Amendments of 1990. In fact, CARB's testing and certification requirements are used throughout the world.The more stringent requirements that CARB is proposing will effectively decertify all of the systems that are currently approved for new installations, and will require modification of existing systems at some point. California law provides for a grace period of four years for these already-installed systems to meet the new requirements.

My subject today is Enhanced Vapor Recovery. Yes, we are changing a great many things. There has been a good deal of unhappiness with the performance of the equipment in the field, so we are reexamining and restructuring the vapor recovery program. In addition to the material I am presenting today, there are documents posted on the Internet that go into considerably more detail.*

The Enhanced Vapor Recovery Program (EVR) has three components: ORVR compatibility, in-station diagnostics (ISD) and general program improvements.

ORVR and ISD

The initial component that we were concerned about was ORVR compatibility . That is, compatibility with the vehicles that have on-board refueling vapor recovery systems that are mandated by EPA beginning with model year 1998.

The primary compatibility concern is with vacuum assist Phase II systems which have a positive vacuum source that ingests a specified volume of whatever is available, be it vapor or air, into the underground storage tank.

When a vehicle with an on-board canister fuels, because the canister handles the refueling vapor, there is little vapor available for the vapor recovery system. The system, therefore, ingests air which, in the presence of gasoline in the underground storage tank, reacts and becomes vapor. The concern is that, as the air reacts and becomes vapor and therefore increases in volume, this will cause additional emissions from the system because the capacity of the vapor will exceed the capacity of the underground storage tank. The so-called vapor growth due to fueling ORVR cars was our primary concern with this.

We have also, in response to district concerns about the performance of systems in the field and the discovery of a fairly high rate of noncompliance, begun looking at some additional program improvements that are needed. Something that we call in-station diagnostics (ISD) is needed for monitoring systems that can adequately measure the performance of vapor recovery systems in the station and alert the owners and operators when they’re not performing properly, and, in cases where the emissions are significant to justify it, possibly even prohibit dispensing.

With ORVR compatibility, ISD and general program improvements as the three components of EVR, the ultimate goal, of course, is cleaner air.

Goal of EVR

The ultimate goal of the
Enhanced Vapor Recovery Program
is to have vapor recovery systems that operate
effectively and reliably with a
minimum of maintenance and enforcement.

Proposed Revisions to the Certification Procedure

- More Stringent Standards and Specifications
- Operational Test of at Least 180 Days
- Efficiency Test on 200 Vehicles
- Limits on Emissions from Processors
  (CO, NOx and HAPS)
- Limited Term Certifications

Revised schedule

Concerning the schedule for EVR, many of you are familiar with the fact that we had committed to taking this proposal to our Board in December. A number of people have suggested that schedule is rather aggressive and, in fact, it is. We have decided that in order to do a truly adequate job, we need more time. So the proposal will go to our Board on March 23 of the year 2000. It will not be moved again. We are very clear on that.

Certification and testing

The EVR proposal that we will take to the Board includes a revised Certification Procedure, CP201. There will be a significant revision, basically a complete rewrite. We have put together a special team to work on this. Some of you are familiar with the fact that I'm no longer doing most of my usual job, but work full-time, with the other members of the team, to take this proposal to our Board.

In addition, we will revise the existing test procedures as needed. We will develop and present to the Board the new procedures that are required to carry out some of the goals of this project. We also will present the cost-benefit analysis of the rule-making. Some of the cost-benefit information was presented at the workshop that we held in El Monte on Friday. There was another one in Sacramento on November 9, when we did a thorough cost-analysis presentation.

Proposed revisions to the certification procedure include more stringent standards and specifications. Those have been prepared in the form of eight tables which are posted on the Internet (see page 28).

The operational test of at least 90 days, currently required in the certification procedure, will become an operational test of at least 180 days. The current test tends to be nicknamed the "90-day test." It is not a 90-day test. It is a test of at least 90 days, and will become a test of at least 180 days to check the reliability of the system. The system will be expected to conform to all of the performance standards and specifications throughout the test as well as throughout the warranty period.

The efficiency test has been expanded from the 100 vehicles currently required to 200 vehicles. The reason for this is that the 100-vehicle number was selected back in the mid-'70s when that was felt to adequately represent the number of vehicles on the road and the different types of configurations of fill pipes, etc. We feel this no longer adequately represents that population, so we'll require a 200-car test.

In addition, there will be specified limits on emissions from processors, including carbon monoxide, oxides of nitrogen and hazardous air pollutants that are not already in gasoline, but are products of combustion. There will be limits on all of these elements from processors.

Finally, there will be a change to require limited term certifications. Right now we're talking about a four-year limit on certifications which would simply be pretty much routinely renewed unless we discover some sort of problem. We're still working out the legal ramifications of how to best go about limited term certification. This is something the districts have been requesting for quite some time.

Performance requirements

The Performance Standards and Specifications, as I said, must be complied with during all the certification testing. In the Application for Certification, we will require the applicant to provide evidence of compliance with all the applicable standards and specifications along with the results of tests which indicate that. The system shall demonstrate compliance with these standards and specifications throughout certification testing, and all systems and components shall be required to comply with the standards and specifications throughout the warranty period.

The standards and specifications have been organized into eight tables that will be included in the certification procedure. Table 1 will be a list of all the test procedures. Tables 2 through 8 contain the standards and specifications.

The way the tables are organized, Table 2 contains all the new specifications for the Phase I systems. Tables 3 through 8 contain the specifications applicable to the Phase II systems. Table 3 has specifications and standards that apply to all Phase II systems. The remaining tables contain additional standards and specifications specific to the systems as listed. The way this is organized, more than one table may apply.

For example, for an assist system with a processor, the tables that apply would be Table 2; Table 3; Table 5; either Table 7 or 8, depending on the type of processor; and probably Table 6, depending on the system design.

For Phase I systems, the new standards and specifications are described above. What's on the books currently is a requirement for a system to demonstrate at least 90 percent efficiency to qualify for certification. We have, for probably more than 10 years now, been certifying to a standard of 95 percent. But the number on the books has been 90 percent. We are going to change that and raise it to 98 percent. We believe that, aside from problems with maintaining integrity, the current systems out there are quite capable of 98 percent efficiency when properly installed.

The hydrocarbon emission factor that would apply to a Phase I system in a facility with a processor as part of the Phase I system would be less than or equal to 0.17 lbs./1,000 gallons. That is two percent (98 percent leaves two percent) of our 8.4 lbs./1,000-gallon emission factor.

We are requiring both product and vapor adapters to be "rotatable," or equivalent, by which we mean that the typical driver behavior of walking the hose at the end of a delivery will not tighten or loosen those fittings, which is one of the problems we're aware of in the field now. Often, as the driver walks the hose, he rotates the tank fitting because the hose and elbow act much like a four-inch torque wrench. As a result, the fittings are either tightened, causing the gaskets to be damaged, or they are loosened. A rotatable swivel adapter would eliminate this problem. Another way would be to lock the fitting to the spill bucket—whatever works.

A drop-tube with over-fill protection will have a maximum allowable leak rate, not to exceed 0.17 cubic feet per hour (CFH) at a pressure of two inches water column. The vapor adapter poppet will

have the same standard, and all vapor adaptors must be poppeted.

We also, in the table of the Performance Standards and Specifications, include the criteria for pressure-vacuum valves. They are similar to the ones that we have now with a cracking pressure at 3 ± H inches and vacuum 8 ± 2 inches water column. The leak criteria we have previously applied (0.38 CFH at two inches water column) will be changed to 0.17 CFH at two inches water column. We're tightening up all the integrity criteria. These P/V-valve criteria are listed in the Tables of Performance Standards and Specifications for Phase I systems, and will apply to all Phase II systems as well.

For all Phase II systems, rather than the 95 percent efficiency previously required, we're going to use an emission factor to measure the effectiveness. The emission factor will be 0.42 lbs./1,000 gallons, which is five percent of the 8.4 pounds per 1.000 gallons that we're currently using as our emission factor.

All Phase I Systems

- Phase I Efficiency 98 percent
- Emission Factor HC < 0.17 lbs./1,000 gals
- Product Adapter Rotatable 360 degrees or equiv.
- Drop tube with Overfill Protection < 0.17 CFH at 2.0 inches wc
- Vapor Adapter < 0.17 CFH at 2.0 inches wc Rotatable 360 degrees or equiv Poppeted
- Criteria for Pressure/ Vacuum Vent Valves

All Phase II Systems

- Emission Factor HC < 0.42 lbs./1,000 gals
- "Dripless" Nozzles 1 drop per fueling
- Spillage (including drips from spout) 0.42 lbs./1,000 gals
- Liquid Retention 100 ml/1,000 gals
- More Stringent Component Integrity
- Compatible with ORVR-equipped vehicles
- Compatible with Phase I systems

Drips and spills

We're doing some additional testing on a number of things, including looking at the emission factor. We are requiring that nozzles be "dripless," by which we mean no more than one drop per fueling per nozzle. There's a lot of concern that even when people fuel very carefully and remove the nozzle, they still get several drips on the way to hanging it up, so this is to address that.

Spillage is currently limited to 0.42 lbs./1,000 gallons. That will not change, except that the drop from the spout, the allowed one drop per fueling from the spout, will be part of the 0.42 lbs./1,000 gallons.

We also have some concerns about what we call liquid retention. That's liquid found in the nozzle when it's hanging up. You pick the nozzle up, drain it into a graduated cylinder and get a number of milliliters from a variety of places: from the inside of the spout, from the aspirator, from the vapor-return holes. We're concerned about this liquid because it tends to either be spilled onto the ground, into the fill well of the vehicle, or into the dispenser housing, or it may simply sit there and evaporate into the atmosphere. We're calling it liquid retention, and have also referred to it as pseudo spillage. The limit will be 100 milliliters/1,000 gallons. This is separate from post-fueling drips from the spout.

We are increasing the stringency of the required reliability of components, and those criteria are listed in the specific tables. We are also requiring compatibility of Phase II systems with ORVR-equipped vehicles.

Performance Standards and Performance Specifications

• Evidence of compliance with the standards and specifications shall be provided in the application for certification, along with the results of tests demonstrating compliance.

• The system shall demonstrate ongoing compliance with all applicable standards and specifications throughout certification testing.

• Systems and components shall comply with all performance standards and specifications throughout the warranty period.

Dealing with the pressure

We are requiring that Phase II systems be compatible with Phase I systems. By this we mean that the Phase II system shouldn't impose a condition on the underground storage tank that causes it to be incompatible with Phase I, so that when Phase I delivery is made in the standard, typical manner, emissions result. We've had sort of a disconnect between Phase I and Phase II where the Phase II manufacturer says, "Oh, that's Phase I," and wants it to be discounted. The Phase I system may work fine unless this particular condition is imposed by the Phase II system. We're requiring that they play well together, basically.

Underground storage tank pressure is controversial. We've defined a profile that we believe is typical of balance systems and that a normally operating balance system can meet. This is: pressure not to exceed atmospheric for 16 hours a day, a 24-hour average of positive pressures not to exceed a 1/4-inch water column and a maximum pressure, not to exceed 1-1/2 inches, for not more than one hour a day. We believe that this will cause very few pressure-related fugitive emissions and that the typical balance system can operate within this. As part of the in-station diagnostics, we'll be putting on some monitoring, to see how we structure what constitutes a failure when the ISD system detects a certain condition. There will be occasions when a balance system, for some reason (a fast-moving storm-front has been mentioned), may exceed these criteria, so we'll have to be really careful how we structure the ISD requirements to allow certain excursions that are normal but still have a pattern that indicates

that the balance system is operating properly and maintaining good integrity.

We've had monitors on a balance system at a rental car place with a lot of ORVR vehicles. Until that system got tightened up, we saw a negative pressure spike every time a vehicle fueled, but it went immediately back to atmospheric as soon as the fueling ended. Obviously, that's a good indication pattern that the station doesn't have integrity. When we tighten it up, it will be able to maintain that vacuum.

For vacuum-assist systems, the requirement is for measurably negative pressure continuously. There is one exception to that and that is for innovative systems.

Innovative systems

Applicants must identify performance standards and specifications that are applicable to the innovative system. That is, they can meet the intent of these criteria in some other way without actually meeting that particular criteria. They shall provide test procedures for demonstrating equivalency and provide the results of such tests that they have conducted. We will then subject the system to those tests as well.

One example of an innovative system comes back to the continuous negative pressure requirement that I mentioned, a system not subject to negative pressure in the underground storage tank. This system ensures that low pressures due to leaks are not mistaken for compliance and it meets the UST pressure for the balance system. One of the reasons for the 1/4-inch positive pressure being allowed is that at very, very low positive pressures, because of the size of the molecules and frictional drag, there really are effectively no fugitive emissions.

Now, this type of a system would be subject to quantifying pressure-related fugitive emissions, and that would be considered part of the .42 lbs./1,000 gallons. But if it can do all this, assure that there are no leaks that could be mistaken for compliance and that the pressure-related fugitives do not put the total overall emission factor over 0.42 lbs./1,000 gallons, then we would consider certifying it as an innovative system.

Alarms and records

The in-station diagnostics shall be capable of activating visible and audible alarms and/or prohibit dispensing in cases where the emissions are significant, in response to certain failures or a failure that continues for a period of time. They shall also be capable of monitoring and creating a record of the system performance for the last 12 months. Parameters to be monitored include: underground storage tank pressure; for the balance system, assurance of no blockage in the vapor return line; for the assist system, the air-to-liquid ratio or an equivalent measure of system performance; and monitoring of the processor function, be that hydrocarbon concentration of the exhaust stream from a membrane or temperature in the burner or whatever.

Finally, the goal of the Enhanced Vapor Recovery Program is to have vapor recovery systems that operate effectively and reliably with a minimum of maintenance and enforcement. That's our goal.

Our Executive Officers are very involved in the vehicle programs, which require that the vehicle must now have on-board diagnostic systems that alert the owner/operator when there is a problem. The goal is to have vapor recovery systems that are similarly reliable and to signal when they are not.

Laura McKinney was the Manager of Certification and Investigation for CARB. She is deceased.

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