Barnard McEntire - Father of the Vapor Recovery Nozzle

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Today, Barney is a distinguished senior air pollution control engineer for the San Diego Air Pollution Control District. Perhaps not so well-known is what Barney does on the side: He reviews and writes screenplays. This article tells more about this intriguing sideline, along with Barney's notable career in the air pollution control business.

The first generation balance system nozzle

Where you were educated?
I studied chemical engineering and chemistry at California State Polytechnic University in California. I graduated in 1968 and did some post-graduate study in chemical engineering at the University of Southern California. I left graduate school in 1970.

What was your first job?
I worked as a chemical engineer for Firestone Tire and Rubber Company in Southgate, California while attending USC. In 1970 Honeywell persuade me to join them in San Diego. I was placed in charge of a materials testing laboratory. When they decided to close down their West Coast operations, they offered me a position in Oklahoma City, Oklahoma. But my family was in California, so I went to work for the San Diego Air Pollution Control District in September 1971. I've been with them ever since.

What is your present job?
My formal title is Senior Air Pollution Control Engineer for the San Diego Air Pollution Control District. I once managed the Vapor Recovery and Emissions Inventory Sections. Now I manage only Emissions Inventory and serve as a consultant to the vapor recovery program. The Emissions Inventory section estimates and records emissions from sources within our jurisdiction. The State provides the factors that are used to determine emissions from mobile (motor vehicles) and many area sources. We calculate the emissions for all stationary facilities using field test, process and throughput data. The

sources are given the opportunity to review the calculations and methodology. Because we have an efficient computer system, we are able to save industry the cost of doing its own inventories. At the same time we have contained our costs.

What is done with the emissions inventory data that your section compiles?

Industry has used the emission profiles we provide to voluntarily reduce their emissions. This in turn has allowed them room to expand production. The data is also used in air modeling to estimate toxic and acute health impacts, to demonstrate progress in achieving compliance with the California and federal clean air acts, to predict emission trends, to develop strategies for further reductions, to determine off-sets and for urban and industrial planning.

Barney (left) and two contractors testing a balance system nozzle for leaks from the back-end

With all of the regulatory emphasis in recent years on controlling the amount of air pollution, does the emissions data you collect show any changes in the levels of emissions? Is the air actually getting cleaned up?

In 1978, we exceeded the federal 1-hour standard for ozone on 90 different days. In 1999 and 2000, there were no days over the standard. Violations of the more stringent state standard went from 168 days down to 27 days in the last 20 years. Photochemical smog has been reduced 84 percent during that time. We have gone from a classification of "severe" to where we will be petitioning for a classification of "attainment" for ozone. Also, toxic emissions were reduced by over 80 percent in just the last ten years.

We have had considerable success except for one program-vapor recovery at gasoline service stations. We have had an increase in hydrocarbon and toxic emissions from gasoline dispensing despite a reduction in gasoline volatility.

Do you inspect pollution sources?

Occasionally, I do field inspections when there is an engineering problem. Most routine stationary source inspections are conducted by our engineering sections that process permits and by our compliance division. Vehicle inspections are done at stations that do smog testing. Source testing is conducted or witnessed at the larger facilities at least once a year by our laboratory division with assistance from engineering.

California is separated into districts. Do all districts do the same work?

Well, there are some differences from one district to the next depending on the pollutants within their air basins. For example, you may have more pollution from agricultural operations in a district that is in a rural part of the state, whereas a district with a great deal of industry will have a different emphasis. Unlike Northern California districts, we do not inspect wood waste incinerators since we have no commercial forestry. However, where possible, the California Air Pollution Control Officers Association (CAPCOA) and the California Air Resources Board (CARB) strive for uniformity.

What kind of pollutants does San Diego deal with?

We deal with "criteria" and "toxic" pollutants. Criteria pollutants include hydrocarbons, carbon monoxide, oxides of nitrogen, sulfur oxides, and particulate matter (PM) in two size categories (diameters of 10 microns or less and 2.5 microns or less). Lead is also a criteria pollutant, but emissions are now rare. We also keep track of 324 toxic compounds.

I can imagine that you, as a regulator, might have some strained relationships with people in industry.

Of course, our friends in industry represent the interests of their companies, which is what they are paid to do. Some in the power industry see the current energy crisis as an opportunity to push for the relaxation of emission rules. We have to protect public health. However, our relationships with the vast majority of industry people are quite good. We attribute this to the District's emphasis on the concept of "customer service." We always pay close attention to the needs of industry, especially with regard to turn-around time on permit applications. Our objective is pollution reductions at the lowest possible cost to both industry and to our agency. We have often met in joint committees to achieve this goal.

Have there been any issues on which both sides were so adamant that you couldn't come to an agreement?

Sometimes we have to go to court. There are always a few defiant companies or individuals. But they are the exceptions. We occasionally are sued by environmental groups that claim we are too lax, even through we have an unmatched record in the percentages of emission reductions. How do you view the new EVR requirements? There are some very serious issues that still have to be resolved with EVR. There are divisions within CARB over those issues and there are divisions between CARB and the districts. So, although we believe some aspects of the program will bring improvements, we are not so sure about others.

Barney reading a water manometer to determine flow coeficients for leaks typically found in the field

Could you be more specific about the EVR issues that need to be resolved?

As you know, I am writing an article to be published in a future issue of PE&T. That article will deal with some of these specific issues.

In your opinion, who should be in charge of vapor recovery equipment testing and certification-private industry or the government?

I've heard that various business organizations think that somebody other than the current CARB staff-Underwriters Laboratories, for example-should be doing the testing and certifications. But I don't know how much support there is for such a change. There is considerable frustration with the program as it is right now. The high failure rate in field testing of the equipment has been unacceptable, which has caused the cost-both to the districts and industry-to accelerate.

Could you elaborate?

Again, the article I'm going to send you in the near future will be more specific.

What is your opinion on the effectiveness of ORVR equipment?

We don't know to what level ORVR is controlling emissions. It is a serious problem. We are not aware of any tests on vehicles that have been on the road for three or more years. We are especially concerned with emissions during hot summer months when carbon canisters may not be as effective. Some districts in the State of California were not entirely satisfied with the type of testing that was done to determine emissions from ORVR vehicles back in 1994 when ORVR was first approved.

A test kit attached to a drop tube

What kind of testing was it?

They conditioned virgin carbon canisters with butane and then drove the vehicles on a track. After a given time, the vehicles were refueled and emissions from the canisters measured. US EPA was criticized for using dispensed liquid that was too low in temperature. The American Petroleum Institute stated, and we supported them, that the ORVR systems should be tested under worse case conditions, which usually means summertime gasoline temperatures. We suffer the most from photochemical smog during the summer. Also, the testing was done on fairly new systems-prototype systems-and we do not know how well the systems hold up over time.

Why isn't there any mandated testing of ORVR vehicles in use after several years?

We don't know. The districts have been asking the same question.

Do you think that ORVR will ever replace Stage II vapor recovery?

Well, the districts and the states cannot relax the Stage II rules unless they can show there is no emission increase as a result of that action. We can't make that determination until we know what ORVR is doing.

So you think the State of California will actually test ORVR vehicles' effectiveness, rather than just count the number of ORVR-equipped vehicles on the road compared to non-ORVR vehicles?

I suspect, at some point, pressure from the districts and the service station industry will result in CARB testing the actual effectiveness of ORVR. But apparently there are not enough ORVR vehicles on the road as yet to force the issue. When it will happen, I don't know.

Barney with a test kit used to leak-test bulk delivery drop tubes, vacuum assist and balance system nozzles, dispenser piping and vapor return hoses

What was your role in the San Diego Air Pollution Control District's vapor recover rules in 1972?

In January 1972, the San Diego Air Pollution Control District became the first agency in the nation to pass vapor recovery rules for gasoline service stations. The control technology was not yet on the

market. I was assigned in November 1971 to work with companies willing to develop vapor recovery equipment for bulk fuel deliveries (Phase I) and vehicle fueling (Phase II). I designed and directed the first test of a vapor recovery system at a commercial service station in August 1972. It was a balance system and it failed miserably, as several oil companies predicted.

We felt that a vacuum assist system with a processor might overcome the balance system problems. One was designed and tested at a county-owned service station. It did the job using the first generation balance system nozzles. But because of opposition to the program, nozzle manufacturers stopped supplying vapor recovery nozzles. I responded with the concept of a kit that would convert conventional nozzles into bootless vacuum assist nozzles. But first we had to determine if they would work. A public demonstration was conducted in July 1973. Using a gas-tight system with a processor, the nozzles proved to be a success. A few days later, the State Attorney General met with the major oil companies for a chat. The following week, the nozzle manufacturers were again supplying us with nozzles.

Is there a patent on the nozzle?
No, people here frown on government making money off it's own regulations. Also, even though we designed and developed the nozzle, we discovered later that a similar design had been patented in 1959. Our nozzle may have been unique enough, but the District's attorney didn't think applying for a patent was good idea. My job was to simply keep the program moving.

PE&T has a report written by you several months ago on what you found during your field inspections of balance systems. Could you describe what those findings were?
We found that liquid blockage, which is a serious problem, was occurring solely because of defects in the equipment. Spitback puts liquid into the folds of the bellows of balance system nozzles. The balance nozzle check valve surrounds the spout. If the check valve leaks, liquid trapped in the bellows will trickle down the bellows, through the valve and into the hose when the nozzle is hung up. We also found the shear grooves on the spouts split. When this happens, liquid is sprayed into the check valve assembly and kicked back into the hose. Defective gaskets at the rear of the nozzles and at hose and dispenser fittings also resulted in liquid flow from the liquid side into the vapor paths. Some liquid lines within the hoses leaked.

None of the liquid found in the hoses came directly from spitbacks and overfills. In fact, we could not get liquid into the hoses from overfills and spitback when we tried.

Another problem was the lack of gas-tightness that is essential to maximizing the efficiency of balance systems. It is difficult to keep the systems gas-tight primarily because of nozzle check-valve leaks. Also, gaps at the vehicle-nozzle interface tended to increase as nozzle faceplates stiffened with age or were deformed. Where the systems are gas-tight, vacuums created in the underground tanks help overcome gaps at the vehicle-nozzle interface, but gas-tightness is rare. The lack of durability is a major concern of station owners and the districts. Some dealers change nozzle front ends monthly to stay in compliance.

How did this report come about?

The California Air Pollution Control Officers Associations (CAPCOA) Vapor Recovery Committee had arranged to do joint field tests with CARB to evaluate vapor recovery equipment. The first major test series involved vacuum assist systems and the second involved balance systems. My assignment was to find out why equipment failed and report the findings.

Flow control and measuring apparatus used for researching leak behavior

Can you tell us the extent to which the balance and assist systems at the sites you inspected were meeting the required efficiency standards?

We estimated that balance systems were averaging about 70 percent collection efficiency. Vacuum assist systems were probably averaging between 80 and 85 percent. In other words, the systems together were believed to be averaging about 75 percent collection efficiency, the same figure that Dr. Harold Falckenberg reported in a July, 1998 PE&T article.

That was well below the reported certification efficiencies of 95 percent. Since the initial field surveys, districts have required increased testing and maintenance programs. One vacuum assist nozzle was removed from the field. Some gas-tight vacuum assist systems with processors are currently achieving efficiencies better than 95 percent.

It is believed these efforts may have increased over all collection efficiencies another 5 to 10 percent to 80 to 85 percent, which is a significant improvement, but still 10 to 15 percentage points below the objective of 95 percent Stage II control. Balance systems still present the most serious problems due to system leaks, gaps at the vehicle-nozzle interfaces and leaks due to liquid blockages.

Do you think the failures of the equipment were because of its design or because the equipment wasn't installed, operated and maintained properly?

The failures are due primarily to a lack of structural integrity attributed to both poor design and improper installation. Two examples are balance system check valves and vapor recovery piping in general. Balance system nozzle check valves should be relocated to within the nozzle body from their current location surrounding the fill spouts.

All piping should be installed in accordance with the piping manufacturers or PEI's installation instructions as opposed to piping installed to meet CARB's 2-inch water column gauge test standard. A more detailed explanation of structural integrity is needed beyond the limits of this interview to fully understand the problem. But in addition to improving structural integrity, maintenance programs need to be followed because all equipment wears out eventually.

Have any of the things you learned from the inspections carried forward to the vapor recovery equipment being designed under the new EVR requirements?

You hit upon one of the primary sources of conflict between the districts and the people responsible for EVR at CARB. Throughout the state, district field inspectors who witness compliance testing daily have a different viewpoint than the CARB people responsible for the EVR program. Many feel the

things we have learned are not being carried forward under the new EVR requirements.

Do you have any hobbies?
I review and modify screenplays and I am writing a screenplay. It's a comedy.

This sounds like a unique and interesting hobby. Can you tell us all about it?
I review screenplays for Rene Sheridan, a Hollywood producer. There are approximately 45,000 screenplays and treatments produced each year, of which only about 500 are filmed. A treatment is a story summary. Of the 500 films, only 115 to 120 become major motion pictures.

The film industry hires readers to review proposed screenplays. It is like prospecting for gold. The reader does a "cover" or summary either rejecting or recommending the screenplay for further consideration. Would-be screenwriters pay dues as readers in the beginning. Reading bad screenplays is part of the learning process and the vast majority is very bad. It is hard work for very little pay. But the reader eventually makes contacts and, if talented, is invited to participate in revising screenplays that show promise. I've been doing this for about four years. They tell me I am a good writer, but I suspect they say that to all the cheap labor.

I got started when my brother encouraged me to take a screenwriting course. He's in the "business." He is currently working on the stage production of a musical, "Jailhouse Rock." I have yet to work on a notable screenplay, other than my own of course.

Barney and his wife Judy

Barney with his daughter Susan (in white), daughter Catherine, son-in-law Ted Saulino and twin grandkids, Shea and Maya

What are your plans?
I plan to keep my day job for another two years, unless I receive some serious money for my writing. Working with other writers in a creative process is often fun and stimulating. I enjoy the company of people who have never been accused of sanity. I plan to continue these activities full time after I retire.

Please tell us about your family?
I have been married for 34 years to my wife, Judy. We have two grown daughters, Catherine and Susan. We are very proud of them. Catherine (Saulino) is working on her Ph.D. She is the mother of twins-a boy and a girl. Susan is currently a district manager for a state senator and a prominent political strategist for the Democratic Party.

Do you have any parting words?
I have had a very exciting and rewarding career. Developing vapor recovery technology in the early days involved original research, which was quite interesting. It is gratifying to see that much of that original work has found its way around the world, not just with regard to gasoline service stations. We also did research on floating roof rim seals found in large bulk storage tanks. We are very proud of the

work we pioneered.

I would just like to remind everyone about the vitally important mission of air pollution control programs: to protect the public from the harmful effects of air pollution. This requires setting, achieving and maintaining air quality standards. It also requires fostering community involvement in the development and implementation of cost-effective programs that meet state and federal mandates while considering both environmental and economic impacts.

Managing Editor of PE&T

