California Environmental Protection Agency

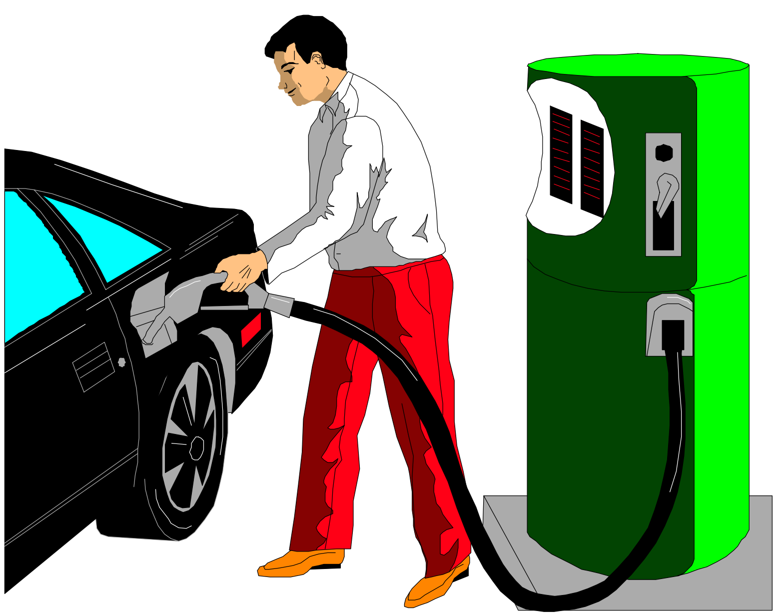
Air Resources Board

HEARING NOTICE AND STAFF REPORT

Enhanced Vapor Recovery

INITIAL STATEMENT OF REASONS FOR PROPOSED AMENDMENTS TO THE VAPOR RECOVERY CERTIFICATION AND TEST PROCEDURES FOR GASOLINE LOADING AND MOTOR VEHICLE GASOLINE REFUELING AT SERVICE STATIONS

February 4, 2000



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VAPOR RECOVERY CERTIFICATION AND TEST PROCEDURES
FOR GASOLINE LOADING AND MOTOR VEHICLE
GASOLINE REFUELING AT SERVICE STATIONS

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2020 L Street
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Air Resources Board
P. O. Box 2815
Sacramento, California 95812

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EXECUTIVE SUMMARY

Changes are proposed to improve the effectiveness of the vapor recovery program at service stations. Gasoline vapor emissions are controlled during two types of gasoline transfer. Phase I vapor recovery collects vapors when a tanker truck fills the service station underground tank. Phase II vapor recovery collects vapors during vehicle refueling. The vapor recovery collection efficiency during both of these transfers is determined through certification of vapor recovery systems.

The Air Resources Board (ARB or Board) and districts share implementation of the vapor recovery program. ARB staff certifies prototype Phase I and Phase II vapor recovery systems installed at operating station test sites. District rules and state law require that only ARB-certified systems be installed. District staff inspects and tests the vapor recovery system upon installation during the permit process and conducts regular inspections to check that systems are operating as certified. Recent joint inspections conducted by ARB and district staff revealed a variety of defects in vapor recovery system operation in currently installed system. ARB staff are working with the district to address these deficiencies, but it was recognized that changes in the certification process could significantly address vapor recovery equipment durability and reliability issues.

ARB staff participates in the California Air Pollution Control Officer's Association (CAPCOA) Vapor Recovery Technical and Enforcement Managers Committees to keep informed of district concerns regarding the vapor recovery program. In addition to the joint inspections mentioned above, ARB and district staff have collaborated on the development of new inspection procedures to allow inspectors to evaluate system operation without elaborate source test equipment. ARB staff plan to incorporate these inspection procedures in future certification executive orders to allow both district inspectors and service station operators to verify that systems are operating as certified. The inspection tools address the need to assess system operation on a regular basis in the near term but, with advent of new technology, staff has proposed application of continuous monitoring of critical vapor recovery system parameters in the Enhanced Vapor Recovery (EVR) proposal. These "in-station diagnostics", similar in concept to on-board diagnostics on vehicles, would signal station operators when failure modes are detected and lead to shut-down of gasoline dispensing when significant defects leading to excess emissions are detected. District staff, including the CAPCOA Committees, have been asked to provide input on how in-station diagnostics should be structured to meet district needs.

The districts have provided valuable suggestions on how to improve vapor recovery systems. These range from identification of new vapor recovery emission sources, such as the liquid retained in nozzles which can evaporate between fuelings, to changes in the certification process, such as limited term certification to allow periodic review of system reliability and durability. The districts are also concerned that Phase II systems fueling vehicles equipped with the Onboard Refueling Vapor Recovery (ORVR) systems do not lead to excess emissions.

The proposed amendments to the vapor recovery program are based on two goals. The first goal is to achieve additional emission reductions from petroleum marketing operations, one of the largest stationary source categories of reactive organic gases (ROG) emissions. The proposed amendments will help meet our SIP commitments and fulfill the obligations of the SIP settlement. The second goal is to make major improvements in the certification process to increase the in-use reliability of vapor recovery systems at gasoline stations. This will address concerns raised by both air pollution control districts and gasoline marketers who purchase vapor recovery equipment.

The Enhanced Vapor Recovery proposal is divided into six modules to allow separate evaluation of the cost/benefit and technological feasibility of each component. The estimated emission reductions for each module are given in the table below. Four of the six modules are not present in existing vapor recovery regulations. Three of the six modules are believed to be technology forcing and warrant a later implementation date as proposed below. A technology review is proposed in 2002 to assess progress towards compliance with the liquid retention, dripless nozzle and in-station diagnostics requirements.

Enhanced Vapor Recovery Module Emission Reductions and Operative Dates

<table>
<tr><th></th><th></th><th></th><th colspan="2">2010 ROG emission reductions</th><th></th></tr>
<tr><th>Module</th><th>Emission Category</th><th>New Category?</th><th>SCAB tons/day</th><th>Statewide tons/day</th><th>Proposed operative date</th></tr>
<tr><td>1</td><td>Phase I Vapor Recovery</td><td>No</td><td>2.1</td><td>5.0</td><td>April 2001</td></tr>
<tr><td>2</td><td>Phase II Vapor Recovery</td><td>Yes</td><td>1.3</td><td>3.1</td><td>April 2001</td></tr>
<tr><td>3</td><td>ORVR Compatibility</td><td>Yes</td><td>2.7</td><td>6.3</td><td>April 2001</td></tr>
<tr><td>4</td><td>Liquid Retention</td><td>Yes</td><td>0.1</td><td>0.2</td><td>April 2001
April 2002
April 2003</td></tr>
<tr><td rowspan="2">5</td><td>Spillage</td><td>No</td><td rowspan="2">1.6</td><td rowspan="2">3.9</td><td>April 2001</td></tr>
<tr><td>And Dripless Nozzle</td><td>Yes</td><td>April 2003</td></tr>
<tr><td>6</td><td>In-Station Diagnostics</td><td>Yes</td><td>2.8</td><td>6.6</td><td>April 2001
April 2004</td></tr>
<tr><td></td><td></td><td>TOTALS:</td><td>10.6</td><td>25.1</td><td></td></tr>
</table>

The estimated emission reductions in the table use the most current inventory information. The SIP settlement required a 5 to 10 tons/day reduction for the South Coast Air Basin (SCAB) in 2010 ROG emissions based on 1994 SIP currency. The 1994 SIP is based on the 1990 inventory. When the Phase I and Spillage EVR emission reductions are translated to SIP currency, and two other vapor recovery SIP reductions are included, staff estimates that 6.5 tons/day in SCAB 2010 emissions can be applied towards the SIP settlement agreement.

The proposed amendments affect a multitude of stakeholders. These include the vapor recovery equipment manufacturers, gasoline marketers who purchase this equipment, contractors who install and maintain vapor recovery systems and air pollution control districts who enforce vapor recovery rules. In addition, California certified systems are required by most other states and many countries.

Although the vapor recovery certification and test procedures have been updated periodically, these proposed amendments are of major significance compared to other revisions since the program was initiated in the 1970s. This is because staff proposes to increase the stringency of the emission standards, which will trigger re-evaluation and likely recertification of most currently certified systems. New systems and installations must comply with the proposed requirements on the scheduled operative dates shown on the previous table. State law provides that systems already installed at service stations may use their existing systems for up to four years after the anticipated April 2001 effective date of the proposed new standards. Vapor recovery systems are likely to require substantial upgrades.

The cost-effectiveness of the proposal is estimated at $1.80/lb of ROG reduced. Costs are expected to be passed on to the consumer, which are estimated to result in an overall increase of about one quarter of a cent per gallon.

The enhanced vapor recovery cost-effectiveness is compared to other recent stationary source regulations reducing ROG emissions in the table below:

Cost-effectiveness Comparison of ROG Regulations

Regulation	**Cost Effectiveness $/lb**
SCAQMD Architectural Coatings Rule (2002 limits)	$2.45
Portable Gasoline containers (9/99)	$2.01
Proposed Enhanced Vapor Recovery	**$1.80**
Consumer Products Mid-term 2 (10/99)	$0.40
Consumer Products Mid-term 1 (7/97)	$0.25

Staff recommends that the Board approve the proposed amendments to the vapor recovery certification and test procedures.

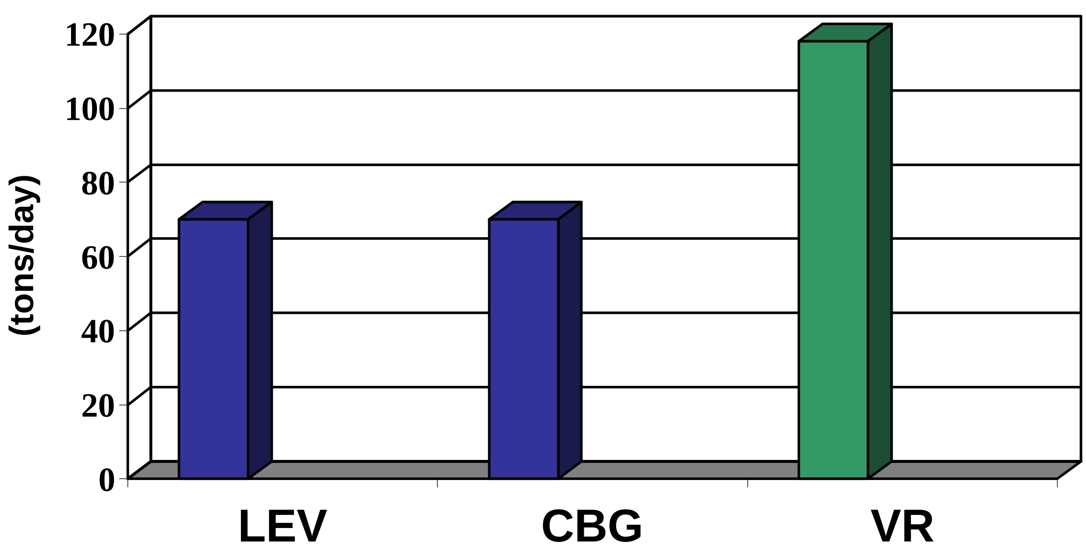
I. INTRODUCTION

Significant strides have been made in improving California's air quality. Nonetheless, regions throughout California continue to exceed health-based state and federal air quality standards. Areas exceeding the State and federal 1-hour ozone standard include the South Coast Air Basin, San Diego County, the San Joaquin Valley, the Southeast Desert, the Broader Sacramento area and Ventura County. As the new federal eight-hour ozone standard is implemented, more areas of the State are likely to be designated as non-attainment for ground-level ozone.

Created by the photochemical reaction of reactive organic gases (ROG) and oxides of nitrogen (NOx), ozone causes harmful respiratory effects including lung damage, chest pain, coughing, and shortness of breath. Ozone is particularly harmful to children, the elderly, athletes, and persons with compromised respiratory systems. Other environmental effects from ozone include substantial damage to crops, buildings, and other structures.

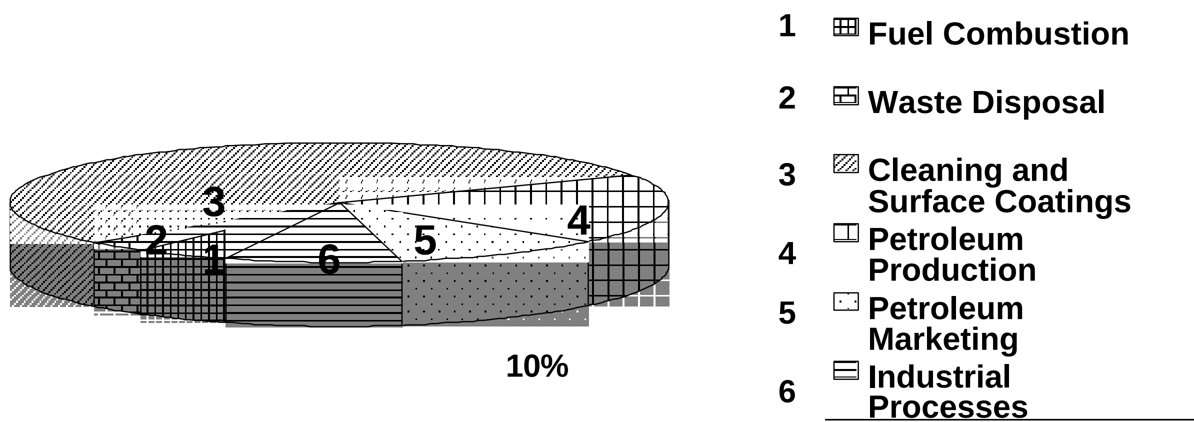
Emission controls have been placed on both mobile and stationary sources of ROG and NOx. One of the earliest and most successful measures for ROG is vapor recovery controls for petroleum marketing operations. The emission reductions attributable to vapor recovery from service stations alone are estimated at 118 tons for the year 2010 in the South Coast Air Basin, more than the reductions for low emission vehicles and cleaner burning gasoline.[2] Additional petroleum marketing emission reductions, such as cargo tank loading, would nearly double the size of the bar in Figure I-1.

Figure I-1. ROG Emission Reductions for Three Major ARB Control Programs (SCAB 2010 Emissions based on 1990 inventory)



Even with current controls, petroleum product transfers result in significant emissions. According to the 1995 inventory, petroleum marketing operations (which include emissions at service stations and cargo tank loading facilities) emit 77 tons/day of ROG statewide. This is about 10% of the total ROG of 740 tons per day from all stationary sources combined. About half of the 77 tons are emitted in the South Coast Air Basin.[3]

Figure I-2. Stationary Source Categories for Statewide ROG Emissions (1995 Inventory)



These emission totals assume that the vapor recovery systems at the 11,250 service stations in the state are operating at a minimum of 90% efficiency. However, field inspections conducted jointly by ARB and district staff in 1999 have shown that for certain systems, equipment failure rates varied from 4.8% to 47.4%, with estimated excess emissions of 6.6 tons/day statewide.[4]

ARB staff has re-examined the vapor recovery program at gasoline dispensing facilities to address both in-use deficiencies and to identify additional technologically feasible, cost-effective emission reductions. The additional emission reductions would cover shortfalls in defined ARB measures and address our commitments as outlined in the SIP settlement. The proposed vapor recovery regulation changes will help achieve and maintain the federal 1-hour ozone standard in regions such as the San Joaquin Valley and the Sacramento area; the federal 8-hour standard in a number of areas; and the State ozone standard throughout California.

This Staff Report is organized to demonstrate the technological feasibility of the staff's proposal, as well as its cost-effectiveness and benefits. Chapter II provides background information as well as a discussion of the current vapor recovery program. Chapter III describes the rulemaking process staff used to develop the proposal, including the staff's public outreach efforts. Chapter IV provides a non-controlling plain English summary and discussion of the proposed amendments to the regulation, as shown in Appendix A. Chapter V discusses the technological feasibility of the proposed standards, while Chapters VI and VII demonstrate the economic and environmental impacts staff expects from the proposal. Chapter VIII compares regulatory alternatives staff evaluated prior to presenting our proposal to the Board. Chapter IX describes how the proposal would be implemented and the anticipated effect on new and existing installations of vapor recovery equipment. Chapter X discusses the main outstanding issues raised during the rulemaking. Chapter XI presents some related activities to improve the program that are not part of this rulemaking. Finally, Chapter XII outlines some of the activities ARB staff plan to undertake in the future, either as a formal part of this proposal or as a follow-up to some of the concerns raised by affected stakeholders.

II. BACKGROUND

1. History of the Vapor Recovery Program

Vapor recovery systems have been used in California to control ROG, and specifically hydrocarbon (HC) emissions, for over twenty years. The feasibility of the first vapor recovery systems was studied at the district level, particularly in the San Diego and Bay Area districts, in the early 1970s. State law enacted in 1975 required the ARB to "adopt procedures for determining the compliance of any system designed for the control of gasoline vapor emissions during gasoline marketing operations, including storage and transfer operations, with performance standards which are reasonable and necessary to achieve or maintain any applicable ambient air quality standard" (Health and Safety Code 41954(a)). State laws pertaining to ARB's role in certifying vapor recovery systems are contained in Appendix C.

Under state law, the ARB is directed to certify vapor recovery systems so that all systems meet minimum standards. To comply with state law, the Board adopted the certification and test procedures found in Title 17, Code of Regulations, Section 94000 et seq. In addition, the vapor recovery test procedures adopted for district use in conducting compliance tests can be found in Title 17, Code of Regulations, Section 94100 et seq.

A. Phase I Vapor Recovery

As each gasoline transfer will lead to displaced vapors, vapor recovery is used throughout the gasoline marketing chain. As illustrated in Figure II-1, Phase I vapor recovery is applied to gasoline transfer operations involving a cargo tank truck. The first transfer occurs when the cargo tank is filled with product at the loading rack of a refinery terminal or a bulk plant. While the cargo tank is filled, gasoline vapor from the cargo tank is recovered and normally condensed back to liquid fuel. The vapor recovery units at the terminal or bulk plant are certified under ARB procedures. There is also an ARB certification procedure for the cargo tanker truck. ARB staff is responsible for the cargo tank certification as part of ARB's mandate to control mobile sources. ARB staff also assist districts in conducting certification tests at terminals and bulk plants.

Phase I vapor recovery also includes the transfer from the cargo tank to the gasoline dispensing facility, or service station. Phase I vapor recovery is required throughout California and in most states.

B. Phase II Vapor Recovery

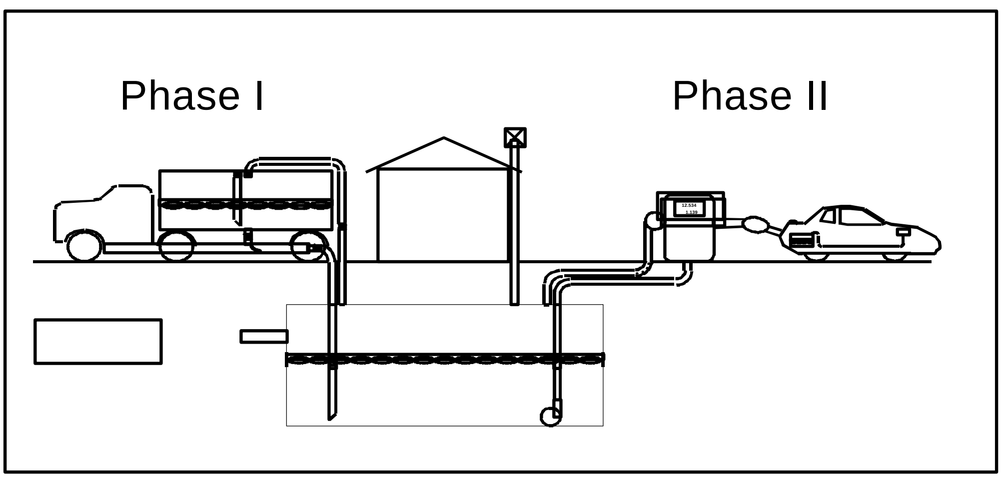
Phase II vapor recovery controls emissions resulting from gasoline transfer at the gasoline dispensing facility to vehicles. This is the vapor recovery equipment that many of us operate routinely when filling up our cars. The two main types of Phase II vapor recovery systems are balance and assist.

The balance systems can be identified by the long bellows or boot on the nozzle. The end of the bellows must make a good seal when the nozzle is dispensing fuel into the vehicle to ensure the vapor pushed out while filling the vehicle tank is routed back through the nozzle to the underground vapor space.

Assist system nozzles, in contrast, are often “bootless”. The vapors are collected through a series of holes in the spout which vacuum up the vapors during a refueling. This requires use of an active vapor pump. Some assist systems also have processors to manage the underground vapor space pressure. Two currently certified systems operate with burners on or near the vent pipe in order to reduce emissions.

The proposed regulatory changes deal only with Phase I and Phase II vapor recovery systems at gasoline dispensing facilities.

Figure II-1: Phase I and Phase II Operations



2. On-Board Refueling Vapor Recovery (ORVR)

The 1990 Clean Air Act (CAA) amendments require the implementation of two distinct vehicle refueling control measures. First, Section 182(b)(3) requires owners or operators of gasoline dispensing facilities to install Stage II vapor recovery systems in ozone non-attainment areas. Second, Section 202(a)(6) requires the United States Environmental Protection Agency (USEPA) to promulgate vehicle-based or onboard refueling vapor recovery (ORVR) standards for control of the same refueling emissions. The USEPA Administrator signed the final rule for ORVR regulations on January 24, 1994.

ORVR works by routing refueling vapors to a carbon canister on the vehicle. The routing of the vapor to the canister requires a few hardware changes to the vehicle. First, the fuel tank vent line must be rerouted from the vehicle fill-pipe to the canister. Second, a seal must be established at the fillpipe to ensure the vapor is not emitted at the fill-pipe outlet. Vehicle manufacturers used different designs to meet these requirements, but there are two basic types of fillpipe seals. The most common is a "liquid" seal, which is formed by the gasoline itself as it enters the fillpipe, which has been reduced in diameter to ensure a good seal. The other type is a "mechanical" seal, which is similar to a gasket which seals closely to the nozzle. Only a few European models are using the mechanical seal, in part because the placement of the fuel tank did not allow a long enough fillneck to form a satisfactory liquid seal.

ARB staff evaluated the merits of seeking a waiver to the federal ORVR requirements since California had already implemented Stage II (or Phase II) vapor recovery controls. At the June 29, 1995 Board meeting, the ARB decided to adopt the federal ORVR regulations, with minor modifications, to promote a consistent vehicle design for all fifty states and reduce the testing burden for vehicle manufacturers.

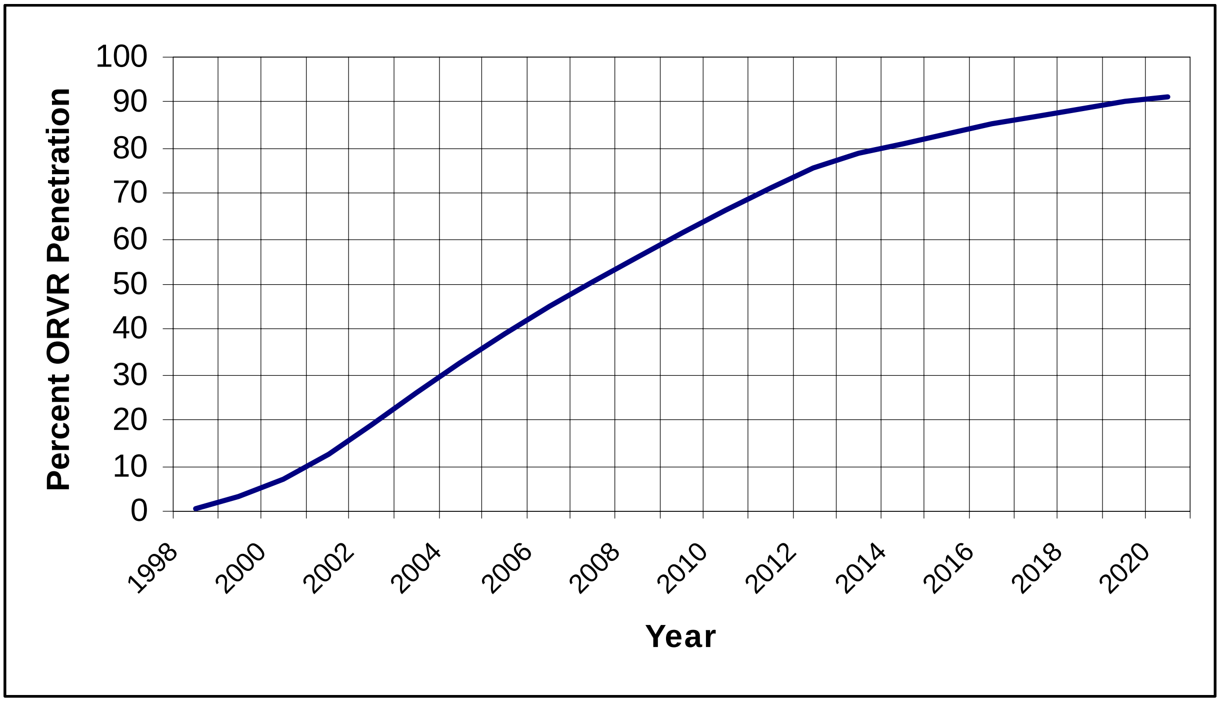
ORVR requirements are phased in as shown in the table below:

Table II-1. ORVR Phase-In Schedule

Vehicle Class	40% Fleet	80% Fleet	100% Fleet
Passenger	1998	1999	2000
Light Duty Trucks & Medium Duty Vehicles (0-6000 lbs GVWR)	2001	2002	2003
Medium Duty Vehicles (6001-8500 lbs GVWR)	2004	2005	2006

The 1990 CAA amendments state that once ORVR standards are promulgated, areas classified as moderate ozone non-attainment areas are exempt from the Stage II requirements of Section 182(b)(3). In addition, once ORVR control systems are in widespread use through the vehicle fleet, the Administrator of the USEPA may exempt areas classified as serious, severe or extreme from Stage II requirements. Since California's vehicle fleet turnover rate is twenty to twenty-five years, it was clear that the two systems would need to operate together for many years. The ORVR penetration curve shows that 66% of the fuel dispensed in 2010 will be to ORVR vehicles.

Figure II-2: ORVR Penetration as Percentage of California Vehicle Fleet



Concerns regarding compatibility of Phase II and ORVR were raised and discussed at a March 15, 1994 workshop. The main concern was that since vapor was not returned to the underground storage tank when fueling an ORVR vehicle, air would be drawn into the underground vapor space as liquid was dispensed. Gasoline evaporation would lead to vapor growth and possible excess emissions. One way to limit air ingestion would be to install a pressure/vacuum (P/V) valve on the service station vent line. Then when fuel was dispensed, the system would maintain a slight negative pressure and slowly equilibrate the vapor space, assuming the underground storage tank was "leak-tight". At that time, 95% of the Phase II systems were balance and it was believed that addition of a P/V valve on the vent line would minimize the air ingestion and the corresponding vapor growth to less than 2 tons/day at full ORVR fleet penetration.

The main concern was and still is the interaction of ORVR with assist systems. In 1994, ARB staff predicted up to 35% efficiency loss could occur based on theoretical calculations. This assumes that the active vapor pump of the assist system would pump air into the underground storage tank, not draw it in due to negative pressure as with the balance system. Excess emissions were estimated at 2.5 tons/day for the assist systems, which at that time were 5% of the Phase II systems. If the assist system installations increased to 20%, then excess emissions of 11 tons/day were predicted.

The current ratio of balance to assist systems for some districts is given below:

Table II-2. Balance/Assist Stations by Air Pollution Control District October 1998 District Survey

District	Number of Balance Stations	Number of Assist Stations
Amador	19	1
Bay Area	1747	600
Butte	1	3
Colusa	9	3
El Dorado	35	17
Feather River	41	14
Mendocino	26	19
Monterey Bay	180	66
North Coast	45	28
San Diego	867	72
San Joaquin	2426	197
San Luis Obispo	73	21
Toulumne	23	5
Ventura	243	93
Yolo-Solano	118	39
TOTALs:	5853	1178

As can be seen, the percentage of assist systems is approaching 20% based on this partial data. More importantly, the throughput associated with assist systems is expected to be higher than for balance systems, as the more expensive assist systems tend to be installed at higher throughput stations.

A. ARB Simulated ORVR Field Tests

ARB staff conducted a series of tests to investigate ORVR and Phase II interactions before the introduction of the first ORVR vehicles in 1998. In November, 1995, tests using an ORVR “stickcar” were conducted at an assist station.[5] A “stickcar” consists of a fillpipe, gasoline tank and charcoal canister assembly on a pallet and can be used to simulate ORVR fuelings. This test showed that the ORVR equipment worked as advertised, with minimal transfer emissions and complete capture of the displaced vapors by the canister. This test also confirmed that air would be returned to the underground storage tank in the vapor return line, showing a drop in hydrocarbon concentration from 46% to 5.5% after the first ORVR fueling.

The ARB and Bay Area Air Quality Management District (BAAQMD) staff conducted further studies at both a balance and assist station in February and March of 1996.[6] During the testing, pressure, HC concentrations and temperature were monitored at the vapor return line, the vent pipe and nozzle/fillpipe interface. Staff measured these parameters for 24 hours at normal operation for the baseline tests. Then the Phase II systems were modified to simulate ORVR fuelings and the same parameters were recorded. The data verified that balance system pressures, which normally operated near atmospheric pressure, became negative during the ORVR simulated fuelings. In contrast, the assist station showed significant increases in underground storage tank pressures, even at the relatively low ORVR simulation rate of 20% penetration. These pressure increases would lead to increased vent and fugitive emissions.

B. Phase II/ORVR Working Group

The Phase II/ORVR Working Group was formed to provide a forum for parties affected by the interaction of Phase II and ORVR systems to share information and work together to find solutions. These included:

Vapor Recovery Equipment Manufacturers
Motor Vehicle Manufacturers
Oil Company Representatives
Service Station Owners and Operators
Air Pollution Control Districts
USEPA
State Fire Marshal
Divisions of Measurement Standards (Weights and Measures)
Division of Occupational Safety and Health

Representatives of the above groups were invited to the first meeting of the workgroup in March 1996 to discuss the incompatibility issues, including the tests described above. Three subcommittees were formed to address (1) safety issues, (2) emissions and (3) ORVR/Phase II (fueling) compatibility. These issues were further discussed in ORVR Working Group meetings held on June 25-27, 1996, October 23, 1996, January 30, 1997, February 21, 1997, January 16, 1998 and July 1, 1998.

Concerns were raised that ORVR fuelings would lead to vapor concentrations in the explosive range (2-8% hydrocarbon) near the nozzle/vehicle interface and pose an increased safety hazard. In summer of 1997, ARB staff conducted testing to measure the hydrocarbon concentrations in the vapor return line of vacuum assist systems while fueling ORVR prototype systems. The results showed that the gasoline vapor did enter the explosive range at some point during a majority of the fuelings.[7] (Note that this study included only ORVR prototypes using the liquid seal technology. Discussion of Phase II interaction with mechanical seal systems is discussed in the next section.) A protocol was developed to test for possible ignition of vapors at the nozzle/vehicle interface and possible propagation of a flame up the vapor return line. Using funds provided by USEPA, a contract was awarded to Southwest Research Institute by the State Fire Marshall to carry out the tests. After reviewing the test results, the Office of the State Fire Marshal determined that the introduction of the ORVR system as tested did not create a greater than normal fire hazard when used in conjunction with existing California certified Phase II vapor recovery systems and components.[8]

An ARB research contract was awarded in 1996 to determine excess emissions from ORVR fuelings with Phase II vapor recovery equipment. However, work was stopped on this contract in mid-1998 due to concerns raised by ARB test observers. A final report containing test results on one of the assist systems tested was completed in August 1999.[9] ARB staff, with assistance from BAAQMD, also conducted tests to quantify excess emissions from ORVR/Phase II fuelings at two assist stations in summer of 1998.[10] The emission factors resulting from the ARB field test are used in estimating the excess emissions due to both ORVR fuelings and pressure-related fugitives for this proposal.

ARB staff, with the cooperation of the vehicle manufacturers, conducted field tests in January and February of 1997 using a combination of ORVR vehicle prototypes and stickcars to find out if currently certified Phase II systems could successfully fuel ORVR vehicles.[11] Two hundred and ninety-seven (297) combinations of seventeen (17) ORVR systems and twenty (20) Phase II nozzles were evaluated in over twelve hundred (1200) dispensing episodes. Only twenty-one (21) refueling difficulties were observed, which consisted of three failures to initiate dispensing associated with a certain nozzle and eighteen (18) nuisance shut-offs associated with various nozzle/vehicle combinations. The study results allowed modifications to be made to Phase II equipment before the introduction of ORVR vehicles. Furthermore, staff have since received no reports of any failures to fuel ORVR vehicles with vapor recovery nozzles.

C. Mechanical Seal

As discussed earlier, the liquid seal and the mechanical seal technologies are both used in ORVR vehicles. One advantage of the mechanical seal is that it allows the Phase II assist system to return vapor, rather than air, to the underground storage tank, thus avoiding vapor growth and the associated excess emissions. In the summer of 1998, ARB staff verified this by conducting field tests comparing the hydrocarbon emissions in the vapor return line for fueling non-ORVR vehicles and one mechanical seal vehicle (the mechanical seal at that time was used only by two German automakers). The results, provided in the table below, show that the vapor concentration in the vapor return line was similar between the mechanical seal ORVR vehicle and the non-ORVR vehicles.

Table II-3. PhaseII/Mechanical Seal Interaction Test Results

Vehicle	ORVR?	Volume to Liquid Ratio (V/L)	Hydrocarbon Concentration (%)
GMC Pick-up	Non-ORVR	0.99	50
Ford Aerostar	Non-ORVR	0.96	57
Audi A6	ORVR Mechanical seal	0.98	53

3. Current Vapor Recovery Program Issues

The implementation of the vapor recovery program is shared between ARB and the districts. The ARB's role is to certify prototype vapor recovery systems which meet the performance standards. The districts then inspect the installed vapor recovery systems to ensure proper installation and continued compliance with the performance criteria set at the time of certification.

One of main goals of Enhanced Vapor Recovery is to improve the in-use effectiveness of installed vapor recovery systems. ARB and the air pollution control districts have been working together to identify and resolve problems identified in recent years. In September 1998, the California Air Pollution Control Officers Association (CAPCOA) submitted a list of "43 CAPCOA Priorities for Correcting Vapor Assist and Balance Vapor Recovery System Problems". In October 1998, ARB staff responded with an action plan to address the 43 requested items. An ARB-district meeting was held in November 1998 to decide which items to address first. It was agreed that the first priority was to conduct field testing of bootless nozzles, followed by balance system tests and parts houses inspections.

Ninety-nine service stations equipped with the two predominant bootless systems were tested from January through April 1999 in six districts. The results are described in the draft April 1999 ARB/CAPCOA Vapor Recovery Test Report. One nozzle was found to have design flaws that did not allow the nozzle to sustain the wear and tear of everyday use for the duration of its actual service life. Other problems were found with dispenser piping configuration, as well as other equipment component defects. The excess emissions estimated from these failures were 6.6 tons/day. A similar test program for balance systems was conducted in fall of 1999 in several districts. The test results have yet to be summarized in a draft report, but the preliminary data suggest that significant failures were observed on balance systems as well. The parts houses inspections began in December 1999.

The field tests used a combination of adopted test procedures and inspection procedures to identify defects. In an April 22, 1999 letter, the CAPCOA Enforcement Managers Committee asked ARB staff to include these simple inspection procedures into the ARB Compliance Assurance Manual. ARB staff initially proposed to adopt some of the inspection procedures as screening methods as part of the June 1999 vapor recovery board item, but some districts protested that if the screening methods were used as non-enforceable diagnostic procedures, then district inspectors would essentially become maintenance staff for the service stations.

In a July 28, 1999 letter to CAPCOA, Mike Kenny discussed three major concerns regarding the vapor recovery program. These were:

a) Vapor recovery equipment is not as durable and reliable as it should be.

b) Those responsible for installing, repairing and inspecting equipment do not have sufficient knowledge to perform these tasks competently, and

b) Tests for making efficient compliance determinations have either not been developed or are not recognized as legitimate compliance tools.

The letter listed ARB staff actions to address these concerns, which included initiation of decertification of the problem nozzle identified in the assist inspections. A provision requiring vapor recovery equipment manufacturers to offer training on installation of their equipment is included in the EVR proposal. It is proposed that the simple compliance tools be referenced as part of certification executive orders.

In a December 1999 letter, CAPCOA agrees that EVR is “a big step in the right direction” for long-term improvements. The letter also states that EVR will provide little resolution of the problems with existing systems. In response, Mike Kenny sent a letter stating that ARB staff will work with CAPCOA to address these issues.

III. RULE DEVELOPMENT PROCESS AND PUBLIC OUTREACH EFFORTS

1. Public Workshops

The Air Resources Board had conducted nine vapor recovery workshops on Enhanced Vapor Recovery. Workshop dates and locations are listed below:

Table III-1. Enhanced Vapor Recovery Public Workshops

Workshop Date	Location
August 11, 1998	Sacramento
November 10, 1998	Sacramento
March 4, 1999	Sacramento
May 6, 1999	Sacramento
July 8, 1999	Sacramento
August 31, 1999	Sacramento
October 1, 1999	El Monte
November 9, 1999	Sacramento
January 19, 2000	Sacramento

On July 1, 1998, the ARB staff introduced the concept of Enhanced Vapor Recovery at a meeting of the Phase II Vapor Recovery/ORVR Working Group.

2. Individual Meetings with Equipment Manufacturers

Staff encouraged individuals and companies interested in various aspects of Enhanced Vapor Recovery to meet with Staff. Staff met with manufacturers of existing certified vapor recovery equipment, manufacturers of developing vapor recovery equipment, and manufacturers of products applicable to In-Station Diagnostics (ISD).

Table III-2. Individual Meetings with Vapor Recovery Equipment and In-Station Diagnostic Manufacturers

Manufacturer	Meeting Dates
ARID Technologies	January 18, 2000
Blackmer	April 8, 1999; May 7, 1999; July 9, 1999
Hirt Combustion Engineers	November 8, 1999
Tokheim	November 8, 1999
Healy	November 9, 1999
Catlow	November 9, 1999
Veeder-Root	September 20, 1999; December 2, 1999; January 6, 2000
Red Jacket	June 25, 1999; December 6, 1999
Franklin-Electric	January 20, 2000
Marconi (formerly Gilbarco)	October 26, 1999, November 9, 1999
OPW/Hasstech	May 7, 1999; November 10, 1999; January 20, 2000
Kavlico Corporation	November 9, 1999; January 18, 2000
Intelligent Controls	May 19, 1999; June 29, 1999; January 18, 2000
Membrane Technology & Research	May 21, 1999
EBW	October 19, 1999
Vapor Systems Technologies	June 14, 1999; November 8, 1999; December 17, 1999; January 20, 2000
Tuthill Corporation	January 19, 2000
Fenner Fluid Power	July 8, 1999
Wayne/Dresser	November 10, 1999
Husky	June 2, 1999; October 27, 1999

3. Meetings with Industry Groups

Staff met with petroleum marketers associations, including representatives from the American Petroleum Institute (API), Western States Petroleum Association (WSPA) and the California Independent Oil Marketers Association (CIOMA). Staff also met with individual oil companies as indicated below.

Table III-3. Meetings with Industry Groups

Industry Group	Meeting Dates
American Petroleum Institute	June 18, 1999; August 18, 1999; August 31, 1999; January 19, 2000
Western States Petroleum Association	June 18, 1999; August 31, 1999
California Independent Oil Marketers Association	August 18, 1999
Tosco	September 1, 1999
Ultramar	September 8, 1999
ARCO Products	December 9, 1999

4. Meetings with Districts and Other Agencies

Staff communicated frequently with air pollution control district staff while preparing these proposals, in part through regular attendance at the CAPCOA Vapor Recovery Technical Committee meetings. Staff met with the Missouri Department of Natural Resources in St. Louis to review and compare our program challenges and harmonize our respective programs. Staff met with Sacramento County staff responsible for the construction and testing of vapor recovery system installations. Staff is also meeting regularly with the State Water Resources Control Board to ensure our proposed regulations are consistent with their regulatory activities, including methods to streamline the programs and reduce overall costs to gasoline marketers.

Table III-4. Meetings with Districts and Other Agency Representatives

Agency Group	Meeting Dates
CAPCOA Vapor Recovery Technical Committee	July 23-24, 1998; October 22-23, 1998; January 21-22, 1999; April 21-23, 1999; July 13-15, 1999; October 21-22, 1999
CAPCOA Enforcement Mangers Committee	July 13-15, 1999; January 4, 2000; January 20, 2000
Missouri Department of Natural Resources	June 2, 1999
Sacramento County	April 2, 1999
State Water Resources Control Board	July 9, 1999; August 25, 1999; December 29, 1999;

5. Conferences, Trade Shows, and Publications

Staff conducted outreach efforts, including presentations at conferences, participation at trade shows, and articles published in trade magazines.

Table III-5. Conferences, Trade Shows, and Publications

Conference	Meeting Dates
PEI Convex	October 5-7, 1999
Pacific Oil Conference	September 24, 1999
Petroleum Equipment & Technology	December 1999

IV. SUMMARY OF PROPOSED AMENDMENTS

Staff proposes new and amended standards and specifications for vapor recovery systems at gasoline dispensing facilities as set forth in the proposed revisions to CP-201, Certification Procedure for Vapor Recovery Systems for Gasoline Dispensing Facilities. A standard is defined in CP-201 as a minimum performance requirement for certification of any system, including system components. A performance specification is an engineering requirement that relates to proper operation of a specific vapor recovery system or component. Any applicant may request certification to a performance specification that is more stringent than the minimum performance standard or specification. The certification standards and specifications are proposed to be required to be met throughout the warranty period.

1. Module 1: Phase I Vapor Recovery

Most of the Phase I equipment in current use was originally certified over 15 years ago and was found to meet the 95% efficiency standard with an open vent pipe on the underground storage tank. Through recent tests, staff has learned that higher efficiencies can be achieved through use of a pressure/vacuum valve on the vent. However, this efficiency can be eroded due to leaks in the Phase I fittings and drop tubes. The drop tubes are metal cylinders which route gasoline to the tank bottom as submerged filling has fewer emissions than “splash filling.” Staff proposes to increase efficiency requirements to gain additional emission reductions as well as require more stringent leak requirements for Phase I components to ensure these efficiencies are achievable at all installations.

The proposed certification requirements for Phase 1 vapor recovery system certification are set forth in CP-201, “Certification Procedure for Vapor Recovery Systems for Gasoline Dispensing Facilities.” Proposed changes to Phase I certification consist of an increase in the efficiency requirement from 95% to 98%, a new specification for Phase I couplers to reduce leaks, new performance specifications for drain valves in spill containment boxes and other improved Phase I equipment specifications.

A. Increase from 95% Efficiency to 98% Efficiency Standard
(CP-201, Section 3.1)

As noted previously, Phase I vapor recovery is applied to the transfer of gasoline from the cargo tanker truck to the gasoline dispensing facility. This is commonly known as a bulk drop. Currently, Phase I systems are certified to be at least 95% efficient in recovering vapors from the underground storage tank vapor space to the cargo tank. Staff proposes an increase in the certification standard to require Phase I systems to be certified at a minimum of 98.0% efficiency. This corresponds to an emission limit of 0.15 lbs/1000 gallons using a summer uncontrolled emission factor of 7.6 lbs/1000 gallons.

B. Phase I Adaptor Specifications
(CP-201, Section 3.2)

Phase I adaptors are the connection points for the cargo tank truck to the service station underground storage tank. The adaptors tend to become loose during the bulk drop as the cargo tank driver connects and disconnects the hoses for the fuel transfer. This is one of the commonly identified causes of leaks from vapor recovery systems, as well as a contributing factor to reduced effectiveness of the Phase I system. Staff has added a requirement for 360 degree rotatable Phase I vapor and product adaptors. Alternatively, this may be accomplished with designs that otherwise prevent the fittings from being over-tightened or loosened. This swivel design will allow rotation of the hoses and help prevent leaks.

Normally there are two Phase I adaptors, a connection for the product hose (gasoline delivered) and one for the vapor hose (vapor recovered). Additional specifications have been added for the vapor adaptor to prevent leaks. The Phase I vapor adaptor must be poppeted and be leaktight as tested by TP-201.2B. The poppet is an automatic seal on the pipe leading to the underground vapor space, so that this pipe is open only when a hose is connected to the adaptor. In addition, pressure vs. flow standards at 300, 400 and 500 gallon/min are to be established during the certification process, to ensure the Phase I fittings do not restrict the return flow of the vapor.

C. Drop tube with Overfill Protection Specification
(CP-201, Section 3.2.2)

A new specification is proposed to reduce leaks in drop tubes with overfill protection devices installed. These devices are installed in the Phase I drop tube and use a valve to shut off liquid flow when the underground storage tank is being filled. The moving parts and the fasteners, which connect the flapper valve to the drop tube, can result in holes that can lead to air ingestion during the bulk drop. All drop tubes with overfill protection will be required to meet a pressure vs. flow specification of $\leq$ 0.17 CFH at 2 inches water column.

D. Pressure/Vacuum Relief Valves (P/V Valves) on Vent Pipes
(CP-201, Section 3.3)

Vent pipes are required for gasoline underground storage tanks to allow venting of vapors if the underground tanks develop significant pressure. Several district rules have required installation of pressure/vacuum valves on the vent pipe to reduce emissions for small pressure changes. The EVR proposal requires P/V valves for all systems. These emission reductions will not be realized if the vent valve leaks. Stations may have a P/V valve on each of their vent pipes (normally 2 or 3) or will manifold them together to one P/V valve. Staff is proposing that the criteria now applicable to one P/V valve be changed to cover all the P/V valves at a station. New P/V valve designs which allow less leakage would allow three P/V valves, but it is expected that most stations would comply by manifolding the vent pipes to one P/V valve.

Staff proposes to tighten the certification leakrate criteria for P/V valves. The current and proposed standards are compared in the table below.

Table IV-1. Comparisons of Current and Proposed P/V Valve Standards

Standard	Current	Proposed
Pressure settings	3.0±0.5 in H_2O positive pressure 8.0±2.0 in H_2O negative pressure	3.0±0.5 in H_2O positive pressure 8.0±2.0 in H_2O negative pressure
Individual P/V valve leakrate limit	≤ 0.38 CFH at +2 in H_2O ≤ 0.50 CFH at -4 in H_2O	≤ 0.17 CFH at +2 in H_2O ≤ 0.21 CFH at -4 in H_2O
Total additive leakrate limit from all P/V valves	No requirement	≤ 0.17 CFH at +2 in H_2O

E. Spill Containment Boxes
(CP-201, Section 3.4)

Spill containment boxes are required by the State Water Resources Control Board (SWRCB) to contain any spills which occur during the bulk drop. Originally, SWRCB regulations required a spring-loaded drain valve to allow return of the product to the underground storage tank. Unfortunately, the drain valves are also a common source of vapor leaks due to build-up of dirt, leaves and other foreign matter which prevent the valve from reseating to form a good seal. ARB and district staff raised this concern to the SWRCB who modified their regulation to allow alternatives to the drain valve, such as a small hand pump to empty the spill box when spills occur. Before this change was effected, however, a number of spring-loaded designs had been certified. Since an alternative to the drain valve is now available, the districts asked ARB staff to consider prohibition of drain valves to eliminate this emission source.

Staff proposed at workshops that the spill containment boxes for both the product and vapor connectors be designed without drain valves and be kept free of gasoline by other means. SWRCB staff has indicated they will oppose removal of drain valves for the product connectors, as their experience shows that the handpump is not being used when spills occur. SWRCB staff believes an improved drain valve design could address the problem of vapor leaks. ARB staff have added product containment box standards which limit the leakrate to ≤ 0.17 CFH at + 2.0 inches H_2O and prohibit any standing fuel in the containment box of product connectors. Drain valves would be prohibited in the spill boxes of vapor connectors under this proposal. In addition, any application for certification of a drain valve that requires unreasonable maintenance shall be deemed unacceptable.

F. Connectors and Fittings
(CP-201, Section 3.5)

Loose connectors and fittings can also lead to leaks in the underground tank vapor space. This equipment has never had a defined allowable leak rate as it is assumed that there should be no leaks. This new specification explicitly states that connectors and fittings shall be leak-free as determined by either leak detection solution or by bagging the fittings and observing inflation of the bag.

G. Fuel Blend Compatibility
(CP-201, Section 3.6)

This is a new requirement that recognizes that changes in fuel formulation can affect durability and performance of materials which come into contact with gasoline. An example could be degradation of an 0-ring or seal when exposed to a fuel component, such as an alcohol. Phase I components must be demonstrated to be compatible with fuel blends approved for use and commonly used in California, including fuels meeting the recently adopted Phase III fuels requirements.

H. Phase I Test Procedures

Staff have proposed revisions to the following test procedures associated with the proposed Phase I standards described above:

TP-201.1 Volumetric Efficiency of Phase I Systems at Dispensing Facilities

TP-201.1 has been updated to reflect the change from 95% to 98% efficiency and make the format consistent with other methods.

TP-201.1A Emission Factor for Phase I Systems at Dispensing Facilities

TP-201.1A has been revised to include more accurate measurement of the vent emissions and other test improvements.

In addition, staff has proposed the following new test procedure to determine compliance with the drop tube overfill protection device leak standard.

TP-201.2O Pressure Integrity of Drop Tube Overfill Protection Devices

TP-201.2O describes the flow vs. pressure measurement procedure for determining compliance with the proposed drop tube leak rate standard.

2. Module 2: Phase II Vapor Recovery

Recent field inspections conducted jointly by ARB and district staff have uncovered many deficiencies in installed Phase II systems. ARB staff is working with the districts and equipment manufacturers to resolve these problems, however, it became clear that many reliability concerns could be addressed during the certification process. Staff has proposed extending the certification tests and expanding on the tests required during certification to thoroughly address durability and reliability issues. Staff has also identified new emission points for gasoline vapor emissions and proposed new standards to control these emissions.

Fugitive leaks from the underground storage tank are a concern with existing systems. Staff has proposed pressure profiles that would limit underground storage tank pressures and assess leaks in the vapor space. Increased use of processors is expected to maintain desired underground storage tank pressures, but concerns have been raised regarding toxics in the exhaust of combustion processors. New limits for selected hazardous air pollutants are included in the proposal.

Another proposal to address system deficiencies is to limit the certification to four years with renewal contingent on successfully addressing any problems that have been documented during the four-year period. Currently, certifications have no expiration date.

The proposed certification requirements for Phase II vapor recovery system certification are set forth in CP-201, "Certification Procedure for Vapor Recovery Systems for Gasoline Dispensing Facilities". Sections A through J describe new standards applicable to all Phase II systems. Sections K through M discuss new standards for balance systems. Sections N through R cover new requirements for assist system, including assist systems with processors. Section S lists amended, new and repealed test procedures for Phase II vapor recovery.

A. Include Pressure-Related Fugitives in Efficiency Standard Calculation (CP-201, Section 4.1.1)

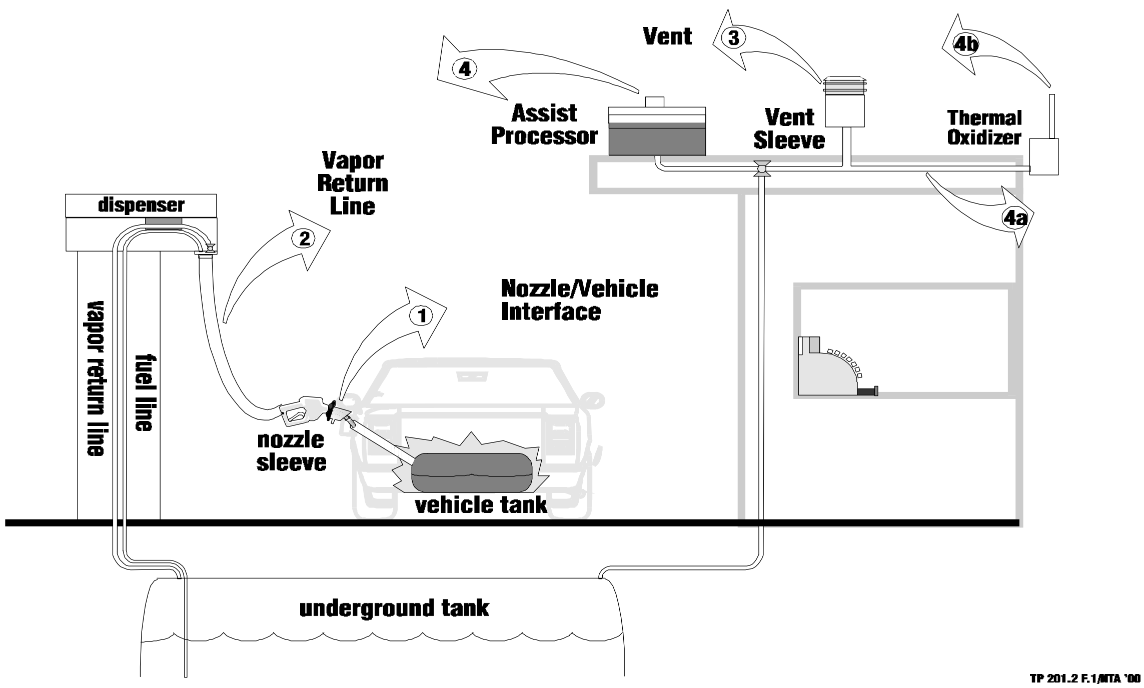
The primary standard for Phase II certification is the demonstration that the vapor recovery system is at least 90% efficient. Most systems are certified to be at least 95% efficient in order to meet district rule requirements. The current test procedure requires that up to four measurement points be included in this calculation. These are:

a) the mass of vapor emitted at the nozzle/vehicle fillpipe (Test Point 1)
b) the mass of vapor returned through the vapor return line (Test Point 2)

c) the mass of vapor emitted through the vent pipe (Test Point 3)
d) the mass of vapor emitted from a processor, if applicable (Test Point 4)

These emission points are monitored while testing 100 cars which are representative of the California fleet at a normal operating station. These measurement locations are shown in the diagram below:

Figure IV-1: Phase II Certification Test Emission Points



The efficiency of the vapor recovery system is calculated by a mass balance per the following equation where the mass of vapor recoverable from the vehicle fueling is the sum of the mass of vapor emitted at the nozzle/vehicle interface and the mass of vapor collected through the vapor return line.

% vapor recovery efficiency =

$$\frac{\text{(mass of vapor from vehicle - mass emitted at nozzle, vent and processor)}}{\text{(mass of vapor from vehicle)}}\text{x100}$$

$$\text{\% vapor recovery efficiency } = \frac{[(m_{(1)} + m_{(2)} - [m_{(1)} + m_{(3)} + m_{(4)}]}{[m_{(2)} + m_{(1)}]} \times 100\%$$

However, this equation does not represent a true mass balance as it does not include fugitive emissions, which may be considerable even if the facility meets existing leak tightness requirements. Therefore, staff proposes to amend the efficiency calculation to include pressure-related fugitive emissions. The fugitive emissions will be calculated by measuring the total station leak rate through a pressure decay test as outlined in the new proposed test procedure, TP-201.2F, Pressure-Related Fugitive Emissions.

B. Replace Efficiency Requirement with Emission Limit
(CP-201, Section 4.1.1)

Although efficiency is a common method of quantifying emission control, it is not the best way to quantify the emissions directly. Staff is proposing to substitute an emission limit of 0.38 lbs/1000 gallons (corresponds to 95% efficiency using an uncontrolled summer emission factor of 7.6 lbs/1000 gallons) for the 95% efficiency requirement. The advantages of the emission limit include:

a) Removes bias for ORVR vehicle refueling

The certification test is conducted on a vehicle matrix that represents the current California fleet. This matrix now includes ORVR vehicles, which were introduced in the 1998 model year. Since most ORVR designs do not allow vapors to be made available to the Phase II system, this would mean that a very low HC measurement at the vapor return line (test point 2). Looking at the efficiency equation, this would result in an artificially high efficiency for ORVR vehicles.

b) Eliminates Need for High Concentration Hydrocarbon Analyzer (NDIR)

Test point (2) requires measurement of typically saturated gasoline vapor in the range of 25-40%. Also, to reduce interference due to the measurement, the method requires that the sample taken at test point 2 be returned to the vapor return line after measurement. These two criteria have necessitated use of a hydrocarbon analyzer with a non-dispersive infrared (NDIR) detector at this test point only. Elimination of this test point reduces the complexity and cost of the test procedure.

C. Compatible with Phase I System
(CP-201, Section 4.5)

As mentioned earlier, most Phase I systems have been certified with open vent pipes, which means the tank operated at atmospheric pressure. Incompatibilities between Phase I and Phase II generally are due to the presence of positive pressure or vacuum in the underground vapor space. For example, if the underground storage tank has a positive pressure when the vapor hose is hooked to the Phase I adaptor (but before the other end of the hose is attached to the truck), the pressure is released to atmosphere, along with gasoline vapors.

Staff proposes a new standard requiring that Phase II vapor recovery systems shall not cause excess emissions from Phase I systems. As Phase I and Phase II systems historically have been certified separately, excess emissions attributed to Phase I were discounted if they occurred during testing of a Phase II system. Emissions caused by a condition that would not be present without the Phase II system will not be discounted in future certifications of Phase II systems.

D. Underground Storage Tank Pressure Limits
(CP-210, Section 4.6)

Current vapor recovery systems can cause a positive pressure in the underground storage tank. This positive pressure causes gasoline vapors to be emitted through leaks in fittings and valves. These are referred to as pressure-related fugitive emissions. Experience indicates it is not possible to permanently eliminate these leak points and that, in general, vapor leakage at a typical service station is greater than during the certification test. By limiting underground storage tank pressure, fugitive emissions will be reduced even in stations with leaks.

Staff propose pressure profiles which must be met by all Phase II system types in order to limit pressure-related fugitive emissions and allow regular checks of underground storage tank pressure integrity by in-station diagnostics. The proposed pressure profile limits will exclude periods where pressure changes are due to Phase I operations, such as the station receiving a tanker truck fuel delivery. For example, this could be 2 hours out of every 24-hour period. The exact exclusion period for Phase I pressure changes will be set during the certification process.

The positive pressures for the non-excluded periods will be averaged for each hour to produce an hourly average. The hourly average with the highest pressure is deemed the daily high pressure. The average of the non-excluded hours in one day will be the daily average pressure.

A rolling 30-day average of the daily average pressure and the daily high pressures each day shall be calculated by averaging the most current daily value with the appropriate values for the previous 29 days. These 30-day rolling averages shall meet the following criteria:

The daily average pressure shall not exceed 0.25 inches H_2O.
The daily high pressure shall not exceed 1.5 inches H_2O.
The non-excluded hours must differ from 0 $\pm$ 0.05 in H_2O

Staff recognizes that there is evidence of a leak in the underground vapor space when the underground storage tank (UST) pressure remains at atmospheric pressure for long periods of time. This demonstrates the necessity of having a pressure monitor to signal when a leak is present. A more detailed discussion is contained in the section on in-station diagnostics.

E. Nozzle/Dispenser Compatibility
(CP-201, Section 4.9)

The first vapor recovery balance nozzles were longer than conventional nozzles, so the dispenser housing was modified in order to allow the nozzle to be properly hung on the dispenser when not in use. Shorter vapor recovery nozzles were later developed, to fit conventional dispenser housings without modification. Today, a variety of nozzles and dispenser housings are available. When the dispenser housing appropriate for the shorter nozzle is used with one of the longer nozzle varieties, the nozzle is jammed into the housing and the vapor check valve of a nozzle may be forced open and remain open when the nozzle is not in use. Staff proposes a new standard for nozzle/dispenser compatibility to verify that the vapor check valve and hold-open latch are closed when the nozzle is properly hung on the dispenser.

F. Unihose MPD Configuration
(CP-201, Section 4.11)

Gasoline dispensers may have three hoses per fueling point, one for each grade of gasoline, or just one hose for all grades, which is known as a unihose configuration. The unihose configuration reduces the number of hoses, nozzles and other hanging hardware by two-thirds. As this equipment has leak sources, such as check valves, the less hanging hardware, the less potential for leaks. Staff proposes that all systems have unihose dispensers to reduce the potential number of leak sources.

G. Liquid Removal
(CP-201, Section 4.10)

The liquid removal standard is not proposed to be changed for this proposal. The liquid removal standard was recently changed from 10 ml/gallon to 5 ml/gallon in the June 1999 vapor recovery Board item. It is mentioned here as the 5 ml/gallon change is proceeding through the regulation adoption process.

H. Vapor Return Piping
(CP-201, Section 4.11)

Restrictions in the vapor return lines have been observed due to fittings which reduce the internal diameter. This reduces the efficiency of vapor collection. Staff proposes new standards for vapor return piping to facilitate the return of vapors to the underground storage tank. The Phase II riser and the connection between the Phase II riser shall have a minimum 1 inch internal diameter (1 in ID). All new vapor recovery piping shall have a minimum 3 in ID from the point of the first manifold to the storage tank.

The vapor return piping is installed so that any condensed liquid gasoline will flow to the underground storage tank and not cause a liquid blockage to the returned vapors. If necessary, liquid condensate traps may be used to keep liquid out of the vapor lines. The recommended minimum slope of the vapor return piping from the dispensers to the tank shall be ¼ inch per foot. A minimum slope of 1/8 inch per foot is allowed only if the ¼ inch per foot is not feasible. A liquid condensate trap would be allowed only if the 1/8 inch slope cannot otherwise be achieved.

Staff is aware of some underground piping configurations where long runs of vapor recovery piping interfered with effective vapor collection. Staff proposes to establish the maximum allowable pipe run lengths during the certification process.

I. Liquid Condensate Traps
(CP-201, Section 4.12)

A new standard is proposed for liquid condensate traps (also known as knockout pots). These traps are used to keep the vapor lines clear when it is not possible to achieve the minimum slopes for the vapor recovery piping as discussed above. The liquid condensate traps are to be used only when there is no feasible alternative. If the liquid condensate traps are used, then the traps must be certified by ARB. The design must ensure that the traps can be maintained vapor tight, be accessible for inspection upon request, be capable of automatic evacuation of liquid and be equipped with an alarm system to indicate evacuation system failure. The condensate trap alarms will be included in the in-station diagnostic systems discussed in module 6.

J. Connections and Fittings
(CP-201, Section 4.13)

Loose connectors and fittings can also lead to leaks in the underground tank vapor space. This equipment has never had a defined allowable leak rate as it is assumed that there should be no leaks. This new specification explicitly states that connectors and fittings shall be leak-free as determined by either leak detection solution or by bagging the fittings and observing inflation or deflation of the bag when the underground storage tank vapor space in under pressure or vacuum.

Sections K through M describe proposed new standards applicable to balance systems:

K. Balance nozzles
(CP-201, Section 5.1)

Currently, each balance nozzle must have a vapor check valve. The purpose of the check valve is to keep vapors from exiting the underground vapor space through the vapor return line when the nozzle is not in operation. Staff propose that the balance nozzle check valve be located in the nozzle to reduce vapor emissions which result if the check valve is present in another location between the nozzle and the underground storage tank. For example, if the check valve was at the dispenser, then vapor in the vapor return hose and nozzle open to atmosphere would be emitted. Recent field inspections of balance systems show that check valves are a common leak source. The vapor check valve limits are proposed to be lowered from $\leq$ 0.038 CFH at +2 in H_2O to $\leq$ 0.07 CFH at +2 in H_2O to improve performance and reliability of this equipment.

A new specification is proposed to determine nozzle bellows insertion force. This will allow a check that the production nozzles are consistent with the nozzle certified as well as provide an evaluation of nozzle bellows durability. Staff is aware that some nozzle bellows materials may degrade due to environmental exposure and thus may not form a tight seal at the vehicle fillneck. One way to track degradation is by measurement of the bellows insertion force.

L. Dynamic Backpressure
(CP-201, Section 5.2)

This existing standard for the balance system is necessary to provide a non-restrictive path for the vapors to be returned to the underground storage tank. Because balance systems do not have an active vapor pump, they rely on the pressure generated by the gasoline filling the vehicle tank to push the vapors back through the boot in the balance nozzle and the rest of the vapor path leading to the underground storage tank. The dynamic backpressure standard is determined by measuring the backpressure at varying flows of nitrogen (to simulate vapor) introduced at the nozzle.

Staff proposes to modify the existing backpressure requirements to remove the limit at 40 CFH. Existing certified systems have experienced trouble meeting the 40 CFH limit, which represents a dispensing rate of 5 gallons/minute. Staff believes that the 60 and 80 CFH limits are sufficient to ensure acceptable backpressure at flowrates normally experienced during fuelings. The current and proposed dynamic backpressure requirements are as follows:

Table IV-2. Comparisons of Current and Proposed Dynamic Backpressure Standards

Nitrogen Flowrate (cubic feet per hour)	Current Dynamic Backpressure (inches water)	Proposed Dynamic Backpressure (inches water)
40	0.16	No requirement
60	0.35	0.35
80	0.62	0.62

M. Component Pressure Drop Limits
(CP-201, Section 5.2)

New standards are proposed for individual balance system components to ensure the overall dynamic backpressure requirements discussed above are met. This is necessary as certified balance system equipment is currently specified in a matrix that allows different combinations of certified balance system components. Staff has learned that some combinations of balance system components are not able to meet the dynamic backpressure limits described above. A pressure drop budget has been suggested to resolve this problem. Staff has developed component pressure drop limits with input from several vapor recovery equipment manufacturers. The proposed individual component pressure drops are listed below.

Table IV-3. Proposed Component Pressure Drop Limits

Component	**Pressure Drop Limit (@ 60 CFH nitrogen) (inches water)**
Nozzle	0.08
Hose	0.09
Breakaway	0.04
Dispenser	0.08
Swivel	0.01
Phase II riser to underground storage tank	0.05
TOTAL:	0.35

Staff has asked the equipment manufacturers to propose test procedures in measuring component pressure drops and will be finalizing a proposed procedure by March 2000.

Sections N through P describe proposed amendments regarding assist systems. Sections Q through R focus on assist system processor requirements.

N. Assist Nozzles
(CP-201, Section 6.1)

Staff propose that all “bootless” assist nozzles be equipped with a vapor guard. This is a small cup or mini-boot at the base of the nozzle that assists in routing the vapor back through the nozzle. Although there are currently certified systems without vapor guards, it is believed that the addition of the vapor guard will improve the vapor collection of these systems as well. The systems without a vapor guard have an A/L greater than 1.0 to achieve the required efficiency. This means that the volume of air-vapor returned to the underground storage tank is larger than the volume of liquid gasoline removed. This added volume leads to positive pressures in the underground storage tank. Requiring a vapor guard should allow a reduction of the A/L (and resulting pressure-related fugitive emissions) without impacting efficiency.

Each assist nozzle must have a vapor check valve. The purpose of the check valve is to keep vapors from exiting the underground vapor space through the vapor return line when the nozzle is not in operation. Some systems have a vapor check valve located at the dispenser, rather than in the nozzle. Vapor and/or liquid in the vapor hose is subject to spillage or evaporation. Requiring that the valve be located in the nozzle will prevent these emissions. The vapor check valve limits are indicated below:

Table IV-4. Comparisons of Current and Proposed Assist Nozzle Check Valve Standards

Current	Proposed
$\leq$ 0.038 CFH at +2 in H_2O	$\leq$ 0.038 CFH at +2 in H_2O
$\leq$ 0.005 CFH at –27.69 in H_2O (-1.00 psi)	$\leq$ 0.10 CFH at -100 in H_2O

Staff also proposes to add a new specification for assist nozzle pressure drop. Although the pressure drop through the nozzle is not as critical for assist systems as for balance systems due to the assist system vapor pump, the limit discourages designs that rely on higher vacuum levels to overcome pressure drop. Such systems have the potential for higher excess emissions if the system develops a leak and ingests air. This pressure specification also provides another parameter which can be checked to ensure future production nozzles match the tested prototype nozzle.

O. Air to Liquid Ratio Limits
(CP-201, Section 6.1.3)

Staff proposes a new limit on air to liquid ratio, or A/L, for assist systems. This is the ratio of the volume of the vapor-air mixture collected at the nozzle to the volume of liquid dispensed. Currently, the A/L is measured during certification so that a range may be set that corresponds to operation of the system while meeting the emission limits. Theoretically, the ideal A/L ratio would be 1.00 in order to return the same volume of vapors as liquid dispensed. However, some certified systems have higher A/L ratios and can still meet existing emission requirements. Staff believes that A/L ratios will decrease if the proposal to include pressure-related fugitive emissions is adopted. However, A/L limits are still necessary because some systems are designed to collect a volume of vapor/air that exceeds the volume of the dispensed fuel. These systems rely on a processor to control the excess vapor. In the event of a processor failure, the resulting emissions may be greater than the emissions from an uncontrolled station. Limiting the A/L will minimize the excess emissions in the event of a processor failure.

Staff proposes to limit the maximum A/L to 1.00 for a system without a processor and 1.30 for a system with a processor.

P. Assist Systems with Common Collection Device
(CP-201, Section 7)

Staff proposes two new specifications for assist systems utilizing a common collection device. This means that there is one vacuum source for the entire station rather than a separate vacuum pump in each dispenser. Staff's experience is that these systems can be problematic if the vacuum is not distributed evenly to each dispenser, or is overwhelmed when many fuelings are occurring at once. For the first specification, the minimum and maximum vacuum levels would define the operating vacuum range for the system. The second specification sets the maximum number of fueling points that can be supported by the vacuum device. Both of these specifications will be determined during the certification process.

These specifications are needed to ensure that individual installations of these assist systems operate do not exceed the parameters at which they were certified to meet emission limits.

Q. Assist Systems with Destructive Processors
(CP-201, Section 8)

Assist systems with destructive processors are estimated to be used at about 5% of service stations. These systems, when working properly, maintain a constant negative pressure in the underground vapor space. However, these systems are receiving new attention as a way to eliminate pressure-related fugitive emissions. Increased use of destructive processors has raised a concern regarding toxic products of combustion. To address these concerns, staff proposes additional requirements for assist systems using destructive processors. A comparison between existing requirements and proposed amendments is provided in Table IV-5:

The new performance standards provide limits on criteria (CO, NOx) and hazardous air pollutant (HAP) emissions for destructive processors. The 1 in a million risk threshold recognizes that gasoline vapor emitted during normal operation of dispensing facilities already can pose some risk[14] and any additional risk associated through use of a processor should be minimized as much as possible.

The proposed requirement for a maximum hydrocarbon rate to the processor is $\leq$ 1.9 lbs/1000 gallons. This limit is to ensure that HC emissions are not excessive during periods of processor failure. A performance specification for typical load on the processor and processor operation time will be established during certification in order to monitor the performance of the processor in the field.

Table IV-5. Comparisons of Current and Proposed Assist System Destructive Processor Requirements

Current	Proposed
Identify critical parameters Identify gauges, detection devices and alarms	Identify critical parameters Identify gauges, detection devices and alarms
Establish sensitivity to : Storage tank ullage Volume and rate of liquid transfer # nozzles used simultaneously nozzle dispensing rates	Establish sensitivity to : Storage tank ullage Volume and rate of liquid transfer # nozzles used simultaneously nozzle dispensing rates
CO emissions Critical parameters	CO < 0.02 lbs/1000 gal NO_x< 0.02 lbs/1000 gal Benzene < 0.01 lbs/1000 gal 1,3-butadiene < 1 in a million risk or 0.04 lbs/yr aldehydes < 1 in a million risk max HC rate < 1.9 lb/1000 gal Typical load on processor Processor operation time

R. Assist Systems with Non-Destructive Processors
(CP-201, Section 8)

Not all processors used in vapor recovery rely on combustion to control emissions. Refrigeration units (condensers or chillers) are commonly used to recovery vapors at truck loading facilities. Carbon bed units have been successfully certified at loading terminals. Membranes which separate the hydrocarbons from the air to reduce emissions have been used in some refinery processes. Several companies are currently investigating the application of membrane technology to service stations. The proposed standards between destructive and non-destructive processors differ because non-destructive processors are not subject to emission limits of products of combustion. This is illustrated in the following table:

Table IV-6. Comparisons of Proposed Assist System Destructive and Non-Destructive Processor Requirements

	Destructive Processors	**Non-Destructive Processors**
Performance Specifications	Typical load on processor Processor operation time	Typical load on processor Processor operation time
Performance Standards	CO < 0.02 lbs/1000 gal NO_x< 0.02 lbs/1000 gal Benzene < 0.01 lbs/1000 gal 1,3-butadiene < 1 in a million risk or 0.04 lbs/yr aldehydes < 1 in a million risk max HC rate < 1.9 lb/1000 gal	Benzene < 0.01 lbs/1000 gal max HC rate < 1.9 lb/1000 gal

S. Phase II Vapor Recovery Test Procedures

Staff has proposed revisions to the following test procedures associated with the proposed Phase II standards described above:

TP-201.2 Emission Factor for Phase II Systems

TP-201.2 has been revised to reflect measurement of an emission factor rather than an efficiency. A more accurate technique to measure vent emissions and other improvements were also included.

TP-201.2A Determination of Vehicle Matrix for Phase II Systems

TP-201.2A has been modified to reflect the change from a 100-car to a 200-car matrix for certification testing.

TP-201.2B Pressure Integrity of Vapor Recovery Equipment

Appendix 1, Pressure and Vacuum Performance of Pressure/Vacuum Vent Valves, has been added to TP-201.2B to determine compliance with the new vent valve requirements.

Staff have proposed the following new test procedures to determine compliance with new Phase II vapor recovery standards:

TP-201.2F Pressure-Related Fugitive Emissions

TP-201.2F estimates the total leak rate from fugitive emission sources using leak decay data. The leak rate is combined with the hydrocarbon concentration in the vapor space to calculate the mass emission rate of pressure-related fugitives.

TP-201.2H Determination of Hazardous Air Pollutants from Phase II Vapor Recovery Combustion Processors.

TP-201.2H describes the sampling and analytical procedure for selected hazardous air pollutants from combustion processors, including benzene, 1,3-butadiene, and carbonyl.

Staff proposes to repeal the five-inch leak test procedure that is no longer used for pressure decay testing.

TP-201.3A Determination of 5 inch WC Static Pressure Performance of Vapor Recovery Systems of Dispensing Facilities

3. Module 3: ORVR Compatibility
(CP-201, Section 4.4)

As previously discussed in Section II, vapor recovery systems may have excess emissions when fueling a significant number of ORVR vehicles. ORVR is required on new cars, beginning in the 1998 model year, so ORVR vehicles will eventually dominate the fleet (See Figure II-2, ORVR penetration curve). Excess emissions from fueling ORVR vehicles are especially likely for assist systems with vapor pumps that will pull air rather than vapor into the underground storage tank when fueling. The air volume will increase as gasoline in the underground storage tank evaporates to form an equilibrated saturated vapor. This vapor volume increase causes pressure which can lead to increased fugitive and vent emissions as was documented in the ARB field tests.

Staff proposes that no excess emissions due to ORVR fuelings be allowed. A new standard will require that refueling vehicles equipped with ORVR systems shall not cause the Phase II vapor recovery system to exceed the emission factor of 0.38 lbs/1000 gallons, and that the pressure-related fugitive emissions shall not exceed 50 percent of the emission factor.

The applicant for Phase II certification must supply a test procedure by which compatibility may be demonstrated, subject to ARB evaluation. ORVR compatibility shall be demonstrated for both typical and worst case situations, up to and including 80% of gasoline dispensing throughput into ORVR vehicles. Actual ORVR vehicles shall be used when feasible, simulations may be proposed for specific demonstrations.

4. Module 4: Liquid Retention and Spitting

(CP-201, Section 4.8)

A previously unregulated source of gasoline vapor emissions has been identified by the BAAQMD which was originally known as “psuedo-spillage” and is now termed liquid retention. These emissions occur when liquid gasoline contained in the hanging hardware (nozzles, hoses, etc.) on the dispenser is allowed to evaporate into the atmosphere between vehicle fuelings while the nozzle is hung on the dispenser. It may also be spilled into the fillpipe well or the dispenser housing or otherwise find its way to atmosphere without being counted as spillage. The liquid product and vapor lines are required to have valves which separate the underground vapor space from atmosphere, however, these emissions occur from the atmospheric side of the valves.

Staff is proposing to phase-in new standards for liquid retention to allow time for the redesign of nozzles to meet the final standard. The first standard of 350 ml/1000 gallons is achievable by some existing certified nozzles. However, staff expects that many nozzles will need to be redesigned to meet the final limit of 100 ml/1000 gallons. The proposed phase-in schedule is given below:

Table IV-7. Phase-In of Liquid Retention Limits

Liquid Retention Limit (ml/1000 gallons)	Operative Date
350	April 2001
200	April 2002
100	April 2003

Another new standard is proposed for “nozzle spitting”. This is defined as the release of liquid when the nozzle trigger is depressed with the dispenser not actuated. This can happen when the nozzle is lifted from the dispenser and the trigger is accidentally depressed before the gasoline pump is activated. The nozzle spitting shall not exceed 1.0 ml/nozzle. The standard for nozzle spitting will minimize accidental liquid gasoline releases which occur while moving the nozzle from the dispenser to the vehicle before fueling.

Staff proposes a new test procedure to determine compliance with the liquid retention and nozzle spitting standards:

TP-201.2E Gasoline Liquid Retention in Nozzles and Hoses

TP-201.2E describes how to measure gasoline retained in nozzles and hoses to determine compliance with the liquid retention standard. The method also contains the test for nozzle spitting.

5. Module 5: Spillage and Dripless Nozzle

(CP-201, Sections 4.3 and 4.7)

Originally, the requirement for spillage when using vapor recovery system nozzles was limited to be no more than from conventional nozzles. As spillage is a significant source of gasoline vapor emissions, staff is seeking additional emission reductions from this category. Staff proposes to reduce the spillage limit from 0.42 lbs/1000 gallons to 0.24 lbs/1000 gallon limit. Staff also proposes to limit the number of drops to one drop per fueling event.

The current 0.42 lbs/1000 gallon emission factor is based on the 1989-1990 spillage survey conducted by ARB staff, which were summarized in a 1992 paper [12]. Table IV-8 shows spill volumes recorded during portions of the fueling event. There were three types of spills recorded:

M = measurable spills on concrete (spills > 1 ml)
V = 1 to 3 ml spills on vehicle (quantified as 2 ml each)
D = Drops (less than 1 ml) which result in stains the size of dimes, quarters or half-dollars

The fueling event was defined as follows:

Pre-fuel: Includes removing nozzle from dispenser and inserting it into vehicle fill-pipe.

Fueling: Includes the dispensing process from start to nozzle shut-off phase.

Shut-off: Includes spills at nozzle shut-off either by automatic or customer controlled shut-off

Post-fuel: Includes spillage occurring from removal of nozzle from the vehicle to hanging the nozzle up on the dispenser.

Also note in the following table that the M and V spills are given in milliliters (ml), but the drops are the number of drops observed. The percentage columns indicate the proportion that a type of spill occurred during a certain portion of the fueling event. In the last column, for example, 6% of the spills on the vehicle occurred during the pre-fuel, 18% during the fueling, 20% during the shut-off and 56% during the post-fueling period.

Table IV-8. Spillage Data Summary

Portion of Fueling Event	Type of Spill	Conventional Nozzle	%	Vapor Recovery Nozzle	%
Pre-fuel	V (ml)	12	3%	12	6%
	M (ml)	65	1%	432	13%
	D (# drops)	173	5%	124	5%
Fueling	V (ml)	38	9%	38	18%
	M (ml)	1662	30%	1121	33%
	D (# drops)	35	1%	3	0%
Shut-off	V (ml)	210	51%	42	20%
	M (ml)	3563	63%	839	25%
	D (# drops)	92	3%	14	1%
Post-Fueling	V (ml)	150	37%	120	56%
	M (ml)	328	6%	981	29%
	D (# drops)	3052	91%	2357	94%
TOTAL	V (ml)	410	100%	212	100%
	M (ml)	5618	100%	3373	100%
	D (# drops)	3352	100%	2498	100%

Only the total V and M spills were used in calculating the 0.42 lbs/1000 gallons emission factor (212 + 3373 = 3585 ml).

If we assume that redesigned nozzles can eliminate all types of spills before and after the fueling, then this would eliminate 63% of the vehicle spills, 42% of the “cement” spills and 99% of the drops.

If we consider only the spills during fueling and shut-off, then this reduces the total number of ml spilled (V + M) to:

(38 + 42) + (1121 + 839) = 2,040

with an adjusted emission limit of:

(0.42 lbs/1000 gal)(2040/3585) = 0.24 lbs/1000 gallons.

Staff has proposed amendments to the spillage procedure to determine compliance with the new spillage limit:

TP-201.2C Spillage from Phase II Systems

TP-201.2C has been updated to improve the spill calibration procedure and to include spill volumes from gasoline drops and vehicle spills.

Staff proposes a new procedure to determine compliance with the new "dripless" nozzle standard:

TP-201.2D Post-Fueling Drips from Nozzle Spouts

TP-201.2D describes the procedure to count post-fueling drops following a vehicle fueling.

6. <u>Module 6: In-Station Diagnostics (ISD)</u>
(CP-201, Section 10)

Although vapor recovery systems are certified at 95% efficiency at a prototype station, the effectiveness of the system at each individual installation may vary depending on a multitude of factors, including whether the vapor recovery equipment is properly installed and whether equipment failure has occurred. Districts may and sometimes do require field tests to check for proper operation upon granting a permit to operate, but follow-up inspections and field tests vary depending on district resources. Some of these field tests, such as the pressure decay test to check for underground storage space leaks, can shut-down service station operation for several hours. Other tests, such as the air-to-liquid (A/L) tests for assist nozzles, are less intrusive to the gasoline dispensing facility, but may require several hours per station for a contractor and/or district inspector to perform. Even if these tests are conducted, they are typically conducted only annually as required in some of the certification orders. As many defects in vapor recovery system operation do not interfere with gasoline dispensing, a component failure may not be detected until the next field test. And historically, the field test procedures did not assess all the potential sources of excess emissions. Thus, a failure may result in excess emissions for weeks or months before corrective action is taken. Recent audits of service station vapor recovery systems indicate that 5 to 40% of the stations are out of compliance, resulting in excess emissions.

The goal of in-station diagnostics is to provide continuous monitoring of important emission-related vapor recovery system parameters and to alert the station operator when a failure mode is detected so that corrective action can be taken. It is similar in concept to the current ARB on-board diagnostics regulations for motor vehicles, where every emission-related component or system must be regularly monitored for proper operation. Many gasoline dispensing facilities already have a similar diagnostic system for detection of liquid gasoline leaks from underground storage tanks (USTs). Staff supports integration of the vapor recovery in-station diagnostics with these UST leak detection systems where possible.

General requirements for ISD systems include:

a) Diagnostics that alert the owner/operator to potential problems
b) Provide audible and visible alarms upon detection of defect
c) Prohibit dispensing if an identified defect is not repaired within a reasonable period of time
d) Monitor critical component performance
e) Provide record of system performance

ISD designs are expected to be specific to vapor recovery system type. However, certain minimum design parameters, such as calibration of monitors, frequency of data collection, type of data storage and accessibility, criteria for determining warning and failure conditions and other parameters shall be proposed by the applicant and will be evaluated and verified during the certification process. Other criteria proposed for ISD systems are discussed below.

UST pressure monitoring will be required for all vapor recovery systems. These monitors will detect leaks in the underground storage space indicated by long periods that the tank remains at atmospheric pressure. Pressure monitors can also indicate if the gasoline delivery was conducted correctly. For example, connecting the product hose, but failing to connect the vapor return hose, would generate a large pressure spike which would lead to escape of the vapors out the vent pipe. Stations which remain at high pressures for significant periods would signal an investigation to correct system operations so that pressure-related fugitive emissions are minimized.

Additional requirements for in-station diagnostics vary depending on the type of vapor recovery system. The three system categories are balance, assist, and assist with processor.

A. Balance Systems

In addition to the pressure monitor, balance systems would be required to check for liquid blockage at each dispensing point. A high pressure drop would indicate a blockage problem. Another approach is to measure the vapor to liquid ratio, or V/L ratio (also referred to as A/L), in each dispenser with a flowmeter. The flowmeter, installed in each dispenser, would measure the amount of vapor flow during every fueling episode without reducing the vapor recovery system's efficiency. A consistent lack of flow, or low flow, would indicate a blockage.

B. Assist Systems

Assist systems would also be required to monitor the vapor to liquid ratio, or V/L ratio in a way that would detect a failure mode at individual dispensers. Recent inspections have discovered that vapor pumps were not operating at some dispensers although gasoline fueling was normal. Staff proposes that when the monitor detects an A/L of zero, which would mean no vapor recovery, that the dispenser be shut down.

C. Assist Systems with a Processor

In addition to monitoring the V/L ratio, vapor recovery systems with processors must have additional ISD sensors to ensure the processors are operating correctly. The hydrocarbon concentration, the flowrate, and other parameters unique to each processor will need to be continuously monitored. This is already required for current systems with thermal processors. For vapor recovery systems certified to operate at a continuous vacuum, a pressure switch is used to detect insufficient vacuum. An alarm signals the station operator when the system fails to achieve the certified vacuum level after a prescribed time interval, indicating insufficient system leak integrity or a system failure.

ARB staff is continuing to work with stakeholders to refine the ISD requirements. Many of these issues involve how the data collected by ISD will be used by the station operator and the district enforcement staff. Topics under discussion include how to handle out-of-service or uncalibrated equipment, ISD system failure notification requirements, legal status of data, reporting requirements and avoiding false-positives detection of defects. The staff will return to the Board with regulatory amendments, if needed to fully implement ISD requirements.

7. Warranty
(CP-201, Section 9.2)

Staff propose additional changes to the warranty provisions of CP-201. The existing warranty provisions were adopted in April 1996. ARB staff presented revised warranty language for Board approval in June 1999, which the Board approved. A summary of the current warranty, the 1999 revisions and the proposed new changes are shown in the table below:

Table IV-9. Comparison of Warranty Revisions

Current	Approved June 1999	Proposed March 2000
Applies to original manufacturers and rebuilders	Applies to original manufacturers and rebuilders	Applies to original manufacturers and rebuilders
Warrant in writing to ultimate purchaser and each subsequent purchaser	Warrant in writing to ultimate purchaser and each subsequent purchaser within the warranty period	Warrant in writing to ultimate purchaser and each subsequent purchaser within the warranty period
Warranty of at least one year	Warranty of at least one year	Warranty of at least one year May request longer warranty
Conform at time of sale with applicable regulations	Conform at time of sale with applicable regulations	Conform at time of sale with applicable regulations
Free from defects in materials and workmanship which cause failure to conform with applicable regulations for at least one year	Free from defects in materials and workmanship which cause failure to conform with applicable regulations for at least the warranty period	Free from defects in materials and workmanship which cause failure to conform with applicable regulations for at least the warranty period
	Warranty tag with: Warranty period Date of manufacture or where date is on equipment Shelf life or sell-by date, if applicable	Warranty tag with: Warranty period Date of manufacture or where date is on equipment Shelf life or sell-by date, if applicable Statement that component was factory tested, with list of certification criteria met
		Comply with certification conditions over the 1 year warranty period Applicant may make warranty contingent on use of trained installers

The current warranty requires that the vapor recovery system conform to the applicable regulations at time of sale. It also requires that the equipment be free from defects in materials and workmanship which cause such vapor recovery system to fail to conform with applicable regulations for at least the warranty period. Staff has found that failures can occur which cannot necessarily be attributed to defects in materials and workmanship but to failure to maintain performance specifications. Staff proposes to modify the warranty requirements to require that the performance standards and specifications contained in CP-201 and/or the executive orders be maintained throughout the warranty period. As the manufacturers have little control over the installation of the systems, but would be required to meet the standard for the warranty period, staff proposes that the equipment manufacturer may make the warranty contingent upon the use of installers trained to install their vapor recovery system.

8. Certification Procedure

The certification procedure has been completely rewritten for clarification and to include new and revised performance standards and specifications. These standards and specifications are summarized in several tables, which progress from general requirements for all vapor recovery systems to specific requirements for certain system types, such as balance systems. Thus, the requirements in Table 3-1 apply to all Phase I and Phase II systems, Table 4-1 applies to all Phase II systems and so on.

A. Installation, Operation and Maintenance Manuals
(CP- 201, Section 9.3)

The purpose of these manuals is to provide guidance on proper vapor recovery system operation to service station operators. Staff proposes revised requirements for these manuals which are evaluated during the certification process. Portions of the existing language which pertain to engineering evaluation of the system for certification purposes has been removed to clarify the manual requirements.

B. Application for Phase II Certification
(CP-201, Section 11)

Staff proposes significant changes to improve the application package that will require much more information to be submitted by the vapor recovery equipment manufacturer in advance of setting up a test site. This is intended to change the current situation where manufacturers have set up test sites and availed themselves of ARB staff time while still conducting research and development on their systems. System applicants will need to submit data showing that their systems can meet the required standards. The certification tests should be a confirmation that the standards are indeed achieved at an operating station. Staff will need more time to review the test data provided by the manufacturer and so have revised and the application process schedule as shown in the table below:

Table IV-10. Comparison of Current and Proposed Application Timelines

Time period	Current	Proposed
Time to review initial application	30 days	60 days
Time to review resubmitted application	15 days	30 days
Time allowed to applicant to respond before closing file	90 days	120 days

As mentioned above, staff has proposed revisions to the materials required to be included in the system application for ARB staff review. These include new requirements for information on compatibility of Phase II components with new fuels, Phase I and ORVR systems; description of the in-station diagnostics, test results demonstrating that applicable performance standards can be met, data indicating the system reliability and a plan for training installers in the proper installation of the system.

C. Engineering Evaluation
(CP-201, Section 12)

All applications for certification of systems and components are subjected to an initial engineering evaluation. The description of this initial evaluation has been clarified in the proposed certification procedure.

D. Certification Testing
(CP-201, Section 13)

The proposed revisions include new requirements for vapor recovery certification testing. These include a requirement that the initial application be complete before certification testing begins. Another provision would terminate the certification process if unauthorized maintenance or falsified information is discovered. The throughput requirements for the test stations have been changed from a minimum of 1000,000 gallons/month to 200,000 gallons/month as this is more typical of a current station throughput. Currently, the test station must be within 100 miles of the CARB offices. However, if a suitable location for testing cannot be located within 100 miles, the Executive Officer may, for good cause, approve a test station elsewhere.

A critical part of the certification process involves assessing the durability and reliability of the vapor recovery system. The current procedure requires an operational test of at least 90 days. The operational test has been increased from a minimum of 90 days to a minimum of 180 days. This is to address equipment reliability concerns identified during recent inspections. No maintenance is allowed other than what is specified in the operation and maintenance manual, except for occurrences beyond control of the applicant and even in those cases, maintenance shall not be performed without Executive Officer approval (except for safety reasons). This is to avoid certifying systems, which would require unreasonable maintenance to maintain compliance.

The 100 car matrix has been increased to 200 cars. Staff believes that 200 cars are now necessary to adequately represent the current vehicle fleet and the different types of fill pipe configurations.

The pressure in the underground storage tank is proposed to be monitored and recorded continuously throughout the operational test. This is already common practice for the current certification test. The pressure monitoring will determine if the system can meet the proposed pressure profile requirements for at least 180 days.

Components requiring bench testing are proposed to be submitted to the Executive Officer prior to commencement of field testing. Performance tests will be conducted periodically throughout the operation test period. If the results of the performance tests indicate a change of more than 3 percent, the operational test maybe extended or terminated.

Failure mode testing is already part of the existing certification process. Staff propose to add failure mode tests for ORVR compatibility and in-station diagnostics.

Data on the Reid vapor pressure (RVP) of the fuel used during the certification test is valuable in defining the certification test conditions. Similarly, test measurements to allow calculation of the uncontrolled emissions from the vehicle fuel tanks will help assess the performance of the system. Staff propose that testing for fuel RVP, uncontrolled emissions or other testing be required if deemed necessary by the Executive Officer.

E. Alternative Test Procedures and Inspection Procedures
(CP-201, Section 14)

Staff has updated the alternative test procedure approval procedures by adding timelines for alternative method evaluation and specifying use of USEPA Method 301 for equivalency testing. A new section has been added to allow for evaluation of inspection procedures to identify defects in vapor recovery equipment.

F. Certification Summary Document
(CP-201, Section 15)

Staff propose that a certification summary be prepared to document the certification process. The document would include problems encountered, any changes made to address the problems, test station location, tests conducted, frequency of monitoring and any other pertinent information about the evaluation process. This document would serve as an information resource to other agencies and the users of the vapor recovery system.

G. Non-transferable Certification
(CP-201, Section 16.2)

The successful implementation of certified Phase II systems depends on the vapor equipment manufacturer commitment to the conditions imposed by the certification Executive Order. Staff propose that if the ownership, control or significant assets of the certification holder are changed as a result of a merger, acquisition or other transfer, the certification shall expire as of the date of transfer. This will prevent installation of equipment that may no longer be supported by the manufacturer.

H. Non-System-Specific Components
(CP-201, Section 17)

The ARB is generally directed by state law to certify vapor recovery systems, not system components. Certification of vapor recovery systems shall include certification of all components present on the system during certification. To provide flexibility in choice of components for system owners, staff proposes that some components which do not directly affect system operation may be certified as alternatives to the components present during the certification tests, provided they meet the following requirements:

a) component can be defined by performance specifications
b) component does not directly affect system performance
c) component meets operational test requirements
d) component is not a nozzle, vacuum source, processor or control board.

CP-201, Table 17-2, provides several examples of non-system-specific components along with their minimum testing requirements.

I. Limited Term Certification
(CP-201, Section 19)

Currently, certifications for vapor recovery equipment have no expiration date. State law provides for decertifying systems if the system no longer meets the required specifications or standards (H&SC 41954(c)), however; this process is infrequently invoked, except in special circumstances, because of the legal consequences of revocation. Thus, there are outdated equipment designs which were certified in the 1970s, which may still be purchased and installed even if there have been problems identified with their operation. Also, systems which are no longer manufactured or supported remain installed and, in some cases, are even being installed from old stockpiles of equipment.

Staff is proposing limited term certifications of four years duration that could be renewed continuously without additional testing unless renewal is denied based on data demonstrating deficiencies. If no evidence of a deficiency exists, ARB staff would process the renewal automatically. If deficiency information is available, ARB staff would work together with the equipment manufacturer to resolve the problems before a new certification is issued. This process allows timely correction of problems while avoiding the negative connotations associated with decertification.

If a certification is modified, a new expiration date would be set provided any significant outstanding problems have been resolved, the modified system passes the operational and efficiency testing required for a new system and no extension to the expiration date for other system-specific components would result. For example, if a certification was modified to add Nozzle B and Nozzle A was not included in the new testing, then the original expiration date for Nozzle A would apply.

Installed systems affected by certification expiration may remain in use for the remainder of the useful life, or four years, whichever is shorter providing the replacement parts or components meet the requirements discussed in the next section.

J. Replacement of Components or Parts
(CP-201, Section 20)

Current law requires that if performance or certification standards are revised or a certification is revoked, a system installed prior to the adoption of the revised standards or revocation may continue to be used for four years. However, all replacement parts or components shall be certified (H&SC 41956.1).

ARB staff propose that replacement and component parts meeting the current performance standards or specifications may be certified for use with a no-longer-certified system for the remainder of the allowable in-use period of the system. This assures that existing systems will not have to be replaced prematurely because of equipment unavailability. However, when replacement parts certified to meet the new standards are commercially available, only those replacement parts shall be installed. For example, nozzles certified to meet the liquid retention standard would be required when available.

K. Innovative Systems
(CP-201, Section 2.3)

Some equipment manufacturers have commented that the proposed standards and specifications unnecessarily restrict vapor recovery system operating parameters. Systems which may not comply with an identified performance standards or specification may qualify for consideration as an innovative system as long as the system meets the primary emission factor and complies with the other applicable certification requirements. For example, a system may be certified to operate at a higher hydrocarbon rate to the processor than currently proposed, if all other certification requirements are met and staff agrees that deviation will not pose an emission concern.

V. TECHNOLOGICAL FEASIBILITY OF PROPOSED STANDARDS

1. Methodology

We began our analysis by defining the systems and technologies likely to be used by manufacturers to meet the proposed new standards. To do this, we held discussions with engineers from the vapor recovery equipment manufacturers and local air districts. (See Chapter III, “Rule Development Process and Public Outreach Efforts.”) We also reviewed the ARB’s certification Executive Orders to establish the current baseline of technologies in vapor recovery systems.

We then conducted literature searches and evaluated what other jurisdictions are requiring to control fueling emissions from gasoline and other motor vehicle fuels. For example, we evaluated the European emission requirements for diesel fueling to determine if any of the technologies involved (e.g., spillage control) can be transferred into the proposed enhanced vapor recovery (EVR) requirements. We also attended several industry trade conferences for exposure to the latest technologies being offered by the manufacturers.

And finally, we relied on ARB’s and the local air districts’ more than 20 years experience with vapor recovery emission controls and our best engineering judgment to ensure that the assumed technologies to be developed would be realistic, reasonable, and robust. From this process, we determined the most likely emission control technologies that would be needed to meet the proposed requirements, recognizing that companies may find even more innovative solutions to meet the staff’s proposal than the technologies discussed in this analysis.

Our analysis of information from the sources noted above shows that the standards proposed in Modules 1 through 3 are technologically feasible now. The current availability of systems or components that are capable of meeting these requirements demonstrates the feasibility of these modules. Our engineering analysis also shows that the technologies needed for meeting the standards proposed in Modules 4 through 6 are technically feasible, but such technologies are either not yet in widespread use or are under development. Thus, we are providing additional lead time for manufacturers to refine and commercialize the systems and components needed to comply with these modules. To track industry’s progress in meeting the staff’s proposal, we are proposing a technology review before the final implementation date of the technology-forcing standards in Modules 4 through 6. This will allow sufficient time for any adjustments of the final requirements that might be needed.

2. Module 1: Phase I Vapor Recovery

A. Increase from 95% to 98% Efficiency Standard

The proposed 95% to 98% efficiency increase is currently achievable. Many Phase I systems were originally certified based on the demonstration that they could meet the 95% requirement with open vent pipes. Closing the vent pipes, by installing a pressure/vacuum relief valve (P/V valve) and maintaining its tightness will achieve control efficiencies of 98% or more. This has been shown by tests conducted by district staff, which indicate that currently-certified equipment achieves 98% efficiency when such equipment is maintained leak-tight and a P/V valve is installed on the tank vent. Many gasoline dispensing facilities are already required to have P/V valves for two reasons: 1) District rule requires P/V valve, and/or 2) Phase II system requires P/V valve. The most recent certification of a Phase I system at a gasoline dispensing facility demonstrated greater than 99% efficiency using the existing test procedure.

B. Phase 1 Adaptor Specifications

Phase I tank connections are simple adaptors that are threaded onto the top of a riser pipe connected to the underground storage tank (UST). However, sometimes the adaptor fitting is rotated during normal fuel delivery operations. This occurs when the delivery truck driver “walks” the hose at the end of the fuel delivery, raising the hose to the height of the delivery elbow to empty the hose of any residual liquid before disconnecting it from the delivery elbow. As the driver approaches the delivery elbow connected to the Phase I tank adaptor, the hose and elbow can act as a “wrench” and cause the adaptor fitting to rotate. The adaptor may be over-tightened, damaging a necessary gasket, or may be loosened. This is one of the common identified causes of leaks from vapor recovery systems, which can also reduce the effectiveness of the Phase I system.

Two Phase I fill adaptors have been certified with a swivel incorporated into the design, to allow rotation without compromising the integrity of the system. The same swivel design has been incorporated for vapor adapters, and these are expected to meet the certification requirements before the effective date of this regulation. The requirement also allows for designs which similarly eliminate over-tightening or loosening of the fittings in other ways, such as by anchoring the adaptors.

Staff is proposing that Phase I vapor adaptors have a poppet to prevent the loss of vapor when the dust cap is removed. This codifies long-standing existing practice. Staff is proposing that the pressure drop at 300, 400 and 500 gallons per minute fuel delivery rates be established during the certification process. Some of the currently certified adaptors can meet these requirements without modification.

C. Drop tube with Overfill Protection Specification

The proposed specification for a minimum leak rate for drop tubes with the overfill protection is new in that no such specification is stated in the current regulation. The currently certified overfill protection devices, however, were required to demonstrate a leakrate that did not exceed 0.38 cubic feet per hour (CFH) at a pressure of 2.0 inches water column (inches H2O). The proposed specification imposes a more stringent specification of 0.17 CFH at a pressure of 2.0 inches H2O. Some of the currently certified designs have been modified to meet the more stringent requirements of local districts. The materials and technology exist to meet this specification.

D. Pressure/Vacuum Relief Valves (P/V Valves) on Vent Pipes

P/V valves have been shown to improve the effectiveness of Phase I systems and enhance the performance of and/or are essential to many Phase II systems. However, not all vapor recovery system certifications require the installation of a P/V valve. Several districts have adopted rules requiring P/V valves on all affected stations. The proposed standard requires that all systems have a P/V valve.

The settings and integrity requirements for P/V valves were developed and adopted into the certification procedure in 1996. Recent testing using new procedures has demonstrated that seepage through P/V valves when there is pressure in the UST can be significant. Based on testing of one currently certified P/V valve that exceeds the required performance standard, a more stringent performance specification for P/V valves is proposed. At least one currently certified P/V valve is capable of meeting these more stringent standards.

P/V Valve Leakrate	Current	Proposed
Maximum Allowable at +2.0 inches H2O	≤ 0.38 CFH	≤ 0.17 CFH
Maximum Allowable at –4.0 inches H2O	≤ 0.50	≤ 0.21 CFH

Service stations typically have three storage tank vent pipes. P/V valves may be installed on each tank vent, or the vents may be manifolded together into one P/V valve. In order to encourage manifolding and minimize the number of leak sources in a facility, a standard is proposed that limits the additive leak rate from all installed P/V to the leak rate allowed for a single valve. Upon request, a manufacturer may request certification to a performance specification that is more stringent than the performance standard. P/V valves certified to the higher performance specification could be used in combination, if desired, as long as the total additive leak rate does not exceed the maximum allowable for the station.

E. Spill Containment Boxes

Spill containment boxes with spring load drain valves were required a number of years ago by the State Water Resources Control Board's regulation. It was brought to the ARB's attention that these drain valves often compromised the leak integrity of the underground storage tank vapor space. ARB staff worked with SWRCB staff, and the regulation was changed to mandate the immediate evacuation of gasoline from spill boxes, and the specific requirement for a spring-loaded drain valve was removed. Before this change was effected, however, a number of spring-loaded designs were certified.

The problems that have been discovered with spring-loaded drain valves are simple. The valves work well when they are kept lubricated and free of dirt and debris. Unfortunately, the spill containment box in a service station is not a clean environment, and most service station operators do not routinely clean their drain valves. The drain valves are a common reason that stations fail leak integrity tests.

Some district staff have requested that drain valves be disallowed. Staff originally proposed that spill containment boxes be designed without drain valves, and be kept free of gasoline by other means, such as pumping any liquid out of the box with a small, gasoline-compatible, hand pump. However, SWRCB staff are uncomfortable with the elimination of drain valves on spill boxes for fill connections. Therefore, staff is proposing that drain valves be prohibited only in spill boxes used exclusively for Phase I vapor connections.

Staff proposes that drain valves for fill connections be required to meet the more stringent pressure integrity standard that is being applied to other Phase I equipment. Any drain valve design will be subjected to an engineering evaluation, as well as operational and performance tests, to ensure that it can meet the pressure integrity standards without unreasonable maintenance. In addition, the performance standard requires that the containment boxes be maintained free of standing liquid gasoline. Service stations with containment boxes that do not have drain valves will be required to maintain a gasoline compatible hand pump on the premises. In addition, all gasoline delivery trucks shall maintain a hand pump. Finally, staff is proposing that any gasoline that is spilled into the containment box, or discovered in the containment box, shall be immediately removed by the station operator or the delivery cargo tank driver.

F. Connectors and Fittings

Connectors and fittings have never had a defined allowable leak rate because it has always been understood that they should be leak-free. This new specification explicitly states this requirement, and specifies two methods for determining the integrity of any connectors and fittings. These are the use of commercial leak detection solution, or by bagging fittings that are accessible (such as Phase I adaptors) and observing inflation of the bag.

G. Fuel Compatibility

Some problems with vapor recovery equipment have been attributed to a lack of compatibility with fuels. In some cases, this was due to a change in the formulation of the fuel itself. The proposed specification will require the equipment manufacturers to provide information about the materials used in their products, and demonstrate that they are compatible with fuels approved for and commonly used in California. This will facilitate the engineering evaluation of the system. For example, many of the available gasoline compatible materials are also compatible with either alcohols or ethers, but not both. Identifying materials that are compatible with all possible components of fuel, and that have other characteristics that are acceptable, may present a challenge to manufacturers. However, in view of the changing composition of fuels, staff believe this specification is necessary.

3. Module 2: Phase II Vapor Recovery

A. Including Pressure-Related Fugitives in the Certification Emission Limit

The emission measurement tests during the certification process are intended to capture emissions at all possible emission points. Currently, system emissions are measured at the nozzle/vehicle interface, the vapor return line, the vent pipe and the processor (if applicable). However, systems that cause the UST to have positive pressure can lose vapor at points that are not monitored. Even a station that passes the static pressure integrity test can have small leaks that, over time, will lose a significant amount of vapor. These emissions are referred to as pressure-related fugitive emissions.

In the early days of Phase II vapor recovery, almost all systems were balance systems. The driving force for returning vapors from the vehicle fuel tank to the UST of a balance system is the vapor that is pushed out as the tank is filled with gasoline. Due to the passivity of the balance system design, and the fact that the systems were certified with open vent pipes, the underground storage tank normally operated at atmospheric pressure. With the addition of a P/V valve on the tank vent pipes, a slight negative pressure in the UST as liquid is withdrawn enhances the effectiveness of the system. However, assist systems are designed such that the vapor pump will collect a fixed volume that contains both air and vapor. Air forced into the underground storage tank will cause evaporation of liquid gasoline. The formation of vapor causes an increase in volume, which in turn causes positive pressure in the UST. The resulting fugitive emissions have not been included in the calculation of the efficiency of these system.

Due to the multitude of equipment connections and normal wear and tear on gasoline dispensing equipment, it is very difficult to maintain a leak-free vapor storage space with the equipment currently available. As a result, the pressure-related fugitive emissions can be significant for assist systems. Staff proposes that pressure-related fugitives be included in the emission limit for all systems during the certification tests.

Staff believes balance systems, based on their design, will achieve the certification standards when coupled with improvements of components, such as better Phase I equipment and improved nozzle vapor check valves. Assist systems which now operate at positive pressures and therefore have excessive pressure-related fugitive emissions, could be modified to reduce these emissions. One way to reduce fugitive emissions would be to remove excess vapor from the storage tank and send it to some kind of processor to eliminate the vapors. This would allow the storage tank to be maintained at lower pressures than would otherwise be possible. Another way would be to modify the vapor pump and/or nozzle vapor inlet, so that sufficient vapor is recovered at the nozzle/vehicle interface to meet the emission factor without drawing excess air into the underground storage tank.

B. Emission Limit of 0.38 pounds/1000 gallons

Currently, systems must achieve the state standard of 90% efficiency, although almost all systems have been certified to 95% efficiency as required by most districts. The 95% efficiency is equivalent to an emission limit of 0.42 lbs/1000 gallons using an uncontrolled emission factor of 8.4 lbs/1000 gallons. The emission factor of 8.4 pounds per 1,000 gallons was developed on the basis of speciation of gasoline vapor collected in 1993. Staff has recalculated the uncontrolled emission factor based on more recent certification tests conducted over the past several years to assess any change in the uncontrolled emission factor due to introduction of cleaner burning gasoline (see Section VII). Based on these calculations, the current summer gasoline uncontrolled emission factor is 7.6 lbs/1000 gallons. An emission limit equivalent to 95% efficiency would then be 0.38 lbs/1000 gallons, which is the limit proposed by staff.

The efficiency tests conducted since the introduction of Cleaner Burning Gasoline demonstrate that the 0.38 limit was achieved excluding fugitives. For systems that currently operate with pressure in the UST, modification or the addition of a processor will achieve this limit.

C. Compatibility with Phase I System

Many vapor recovery systems were originally certified with open vent pipes and atmospheric pressure in the UST. During testing of Phase II systems, emissions from the vent that occurred during refueling of the storage tank were excluded from the emissions attributed to the Phase II system.

This practice continued during testing of Phase II systems that had P/V valves on the vent pipes. However, some of the Phase II systems normally operated at positive or negative pressure. Typical practices of the tanker truck drivers can cause excess emissions from a storage tank that has positive or negative pressure. Two examples of this involve the driver connecting the vapor return hose to the underground storage tank before it is connected to the truck, which opens the vapor poppet on the storage tank.

In the first example, the vapor space in the UST is under positive pressure when the delivery truck arrives. If the driver hooks the vapor hose up to the UST first, before it is connected to the truck, the Phase I poppet is opened and vapors escape to atmosphere through the hose until the pressure is relieved or until it is connected to the truck.

In the second example, the vapor space in the UST is under negative pressure when the delivery truck arrives. In this case, connecting the hose to the UST opens the poppet and allows air to be sucked into the system. This air will immediately begin to react with the liquid gasoline in the storage tank, will increase in volume, and will then cause the storage tank to pressurize. Venting, when the pressure setting of the P/V valve is exceed, and pressure-related fugitive emissions may result. Efforts were made by the system manufacturers to prevent either of these situations from occurring during certification testing, but the end result was the certification of Phase II systems that are not compatible with typical Phase I operations.

The proposed standard requires that Phase II systems demonstrate that they do not create excess Phase I emissions as a result of conditions that would not occur if the Phase II system were not installed. The balance systems, which tends to operate at near-atmospheric pressure, and those assist systems that operate at near-atmospheric pressure, are expected to comply without difficulty with this standard. Other systems may require modification; however, the modification would likely be necessary to meet other standards, such as ORVR compatibility or the fugitive emissions standard.

D. Underground Storage Tank Pressure Limits

Fugitive emissions occur when the pressure in the UST of a service station causes vapor to leak out. Even stations that meet the pressure integrity criteria, and are considered “tight,” have an allowable leak rate. Vapor recovery systems that overcollect at the nozzle will cause the UST to pressurize. Continuous positive pressure will, even at the low allowable leakrate, cause fugitive emissions which can become significant over time. Stations that leak more than the allowable limit will, of course, have higher fugitive emissions.

The balance system is a simple positive displacement system, in which the driving force is the fuel flowing into the vehicle fuel tank, forcing the vapor out where it is captured by the bellows that is affixed tightly to the fillpipe opening. A properly installed balance system has a path of very low resistance back to the UST, in which a slight vacuum is created as fuel is withdrawn. By its design, the balance system does not overcollect at the vehicle. Recent changes in fuel formulation, particularly reduction of the Reid Vapor Pressure of fuel sold in during the warm weather, has reduced the volume of vapor produced by vehicle fueling. In addition, vehicles with fuel injection systems tend to have hotter vapor in the fuel tank; as the fuel encounters the hot vapor, it cools it, causing the volume of the vapor to be reduced (vapor shrinkage). For these reasons, the vapor returned to a balance system is usually slightly less than the volume of fuel dispensed. Data collected at a tight balance system with a P/V valve, before the introduction of ORVR-equipped vehicles, shows that the UST pressure ran slightly negative over ninety percent of the time. The introduction of vehicles equipped with ORVR systems will increase this tendency, because those vehicles will return even less vapor. Staff believe that the lack of pressure in the UST of tight balance systems ensures that significant fugitive emissions do not occur. Staff have been and continue to collect data from tight balance systems, with and without large ORVR populations, to verify this.

As noted in the preceding discussions, some of the system components have been found to perform poorly with regard to maintaining stations leak tight. Staff first considered proposing that pressure in the underground storage tank be maintained continuously negative. This concept is appealing in its apparent simplicity. First, a negative pressure is simple to monitor, and any failure to maintain negative pressure would be considered evidence of a leak. Second, leaks in the UST vapor space would cause air to leak into the system, rather than vapor leaking out. The only systems currently designed to operate at continuously negative pressure are assist systems with destructive processors. These represent less than 5% of existing installed systems. Staff believes that requiring continuously negative UST pressure would require the installation of processors on all service stations.

Because the balance system operates at atmospheric pressure most of the time, the addition of a processor and processor monitor was considered to be unnecessary. Therefore, an UST pressure profile for the balance system was proposed, while the assist systems would be required to maintain negative pressure. This was discussed at several workshops. Through workshop discussions and meetings with various stakeholders, staff became aware of the following potential problems with this approach:

- The profile for the balance system required atmospheric or negative pressure most of the time, but provided for no remedy if occurrences unrelated to the vapor recovery equipment, such as a change in the RVP of the fuel or a barometric shift, caused occasional positive pressures in excess of the defined allowable.

- Processors currently in use have burners that can be overwhelmed by air leaking into the system, resulting in unprocessed vapor being emitted directly through the burner and/or as a result of fugitive emissions.

- Processors with burners are unlikely to meet the HAPs limits without significant redesign, and may not be economically feasible.

- Membrane systems are currently being developed, but none have yet demonstrated that they can meet the requirements.

- SWRCB staff expressed concern that significantly negative UST pressures could impact the operation of liquid leak monitoring systems currently required by the SWRCB.

- Pressures in the UST significantly above or below atmospheric cause compatibility problems with Phase I systems.

Staff developed a new pressure profile for all systems that requires that the vapor recovery system be designed to operate at very low positive or negative pressures. Excluding the pressure changes due to Phase I operations, the integrity of the system is presumed to be compromised if no pressure changes are observed during a (24-hour) day. The daily high and daily average pressures are averaged over a 30-day period to normalize any temporary anomalies. The daily average pressure shall not exceed ¼ inch H_2O. Balance systems, and assist systems that achieve compatibility with ORVR by limiting collection, are expected to meet the pressure profile without processors. Development continues on the membrane processors, and these show promise as a viable alternative way of managing UST pressure and achieving ORVR compatibility. Staff is continuing to collect data at operating service stations and may adjust the pressure profile based on the data collected if necessary.

Pressure data would be collected over the certification operational test (minimum of six months in a leak tight station) to ensure the system design complies with the pressure profile. Once the in-station diagnostic (ISD) requirements are implemented, pressure profiles would be monitored at existing installations by the ISD.

E. Nozzle/Dispenser Compatibility

Balance vapor recovery nozzles were originally longer than conventional nozzles, and some certified nozzles are still manufactured in this length. These nozzles are compatible with dispenser housings designed or modified to accommodate these longer-than-conventional nozzles. Shorter balance nozzles, designed to fit into conventional dispenser housings without modification were later developed. If the longer type of nozzle is used with the shorter housing, the vapor check valve in the nozzle may be forced open while the nozzle hangs on the dispenser. Staff proposes to require that the dispenser housing and nozzle be selected to be compatible. This requires no change in the currently available equipment, merely some discretion in the selection of equipment.

F. Unihose MPD Configuration

Multi-product dispenser (MPD) configurations include two types, multihose and unihose. The multihose configuration typically has three hoses per side, with one hose and nozzle for each product. The unihose configuration has only one hose and nozzle per side, with product selection options. Both options are currently available, as are conversion kits for most dispensers. In order to reduce potential leak sources in stations, staff proposes that only unihose configurations be installed in new stations, and that existing configurations be modified by the end of the four-year clock period.

G. Liquid Removal

As mentioned previously, the liquid removal standard was updated in June 1999. There is no change associated with this proposal.

H. Vapor Return Piping

The minimum standards for vapor recovery piping are to be applied only to new and modified installations. These piping sizes are currently required by many of the more recently issued certification orders and or by district permit conditions. This proposal codifies what is current practice.

I. Liquid Condensate Traps

Liquid condensate traps (also known as knockout pots and thief ports) are used to keep the vapor return piping clear of liquid when it is not possible to achieve the necessary slope from the dispenser to the underground storage tank. An Eductor System designed by Red Jacket was certified in the early 1980's. Since that time, condensate trap systems have not been certified; instead, ARB's position has been to recommend that they meet certain design requirements including approval by the local district. Staff is proposing certification requirements for liquid condensate traps to assure uniformity of design review and testing and codify existing practice.

J. Connections and Fittings

Connectors and fittings have never had an allowable leak rate. This new standard codifies existing practice.

K. Balance Nozzles

All certified balance nozzles have an insertion interlock. This codifies existing practice.

The proposed requirement for a vapor check valve in the nozzle will disallow a design that allows a significant amount of vapor to remain on the atmospheric side of the vapor check valve at the end of the fueling. With only one exception, all currently certified nozzles have vapor check valves. Testing conducted by local districts has demonstrated that the proposed pressure leakrate limit for the check valve of 0.07 CFH at 2.0 inches H_2O can be met by at least some of the available nozzles. One nozzle in particular has a vapor check valve design that differs from the common design and has demonstrated superior in-use performance.

L. Dynamic Backpressure

Because the driving force for the balance system is the fuel forcing vapors out of the vehicle tank, it is crucial that the vapor path to the storage tank be the path of least resistance. For this reason, limits on the dynamic backpressure at 20, 60 and 100 CFH of Nitrogen have been imposed since the early years of the program. The backpressure limits were first developed for "dual hose" balance systems. The development of coaxial hoses reduced the backpressure through the vapor hose. For this reason, more stringent limits for new installations were adopted in 1996 at flowrates of 40, 60 and 80 CFH. However, testing by local districts and ARB staff revealed that some combinations of balance system components that meet the backpressure limits at 60 and 80 CFH fail to meet the limit at 40 CFH. Because 40 CFH is equivalent to a dispensing rate lower than that typically found in service stations, staff is proposing to eliminate this requirement. The flowrates, approximately equivalent dispensing rates, and the backpressure limits are summarized in the table below. Most of the certified systems can meet the proposed limits.

Nitrogen flowrate (CFH)	20	40	60	80	100
Equivalent Dispensing Rate (gpm)	2.5	5	7.5	10	12.5
Backpressure Limits (Inches H_2O)	0.15	N/A	0.45	N/A	0.95
1996 New Limits (Inches H_2O)	N/A	0.16	0.35	0.62	N/A
Proposed Backpressure Limits	N/A	N/A	0.35	0.62	N/A

M. Component Backpressure Limits

The backpressure requirements for balance systems previously applied to the entire system, and the portion available to any component has never been identified. Staff is proposing identified limits for each component in the system. There are certified components in each category capable of meeting the component limits, as well as combinations of components that are capable of meeting the system limits. However, if a person were to combine some of the components with higher back pressure, the system total may exceed the system limits. The proposed limits will improve the program by eliminating the possibility of choosing combinations of components that fail to meet the limits for the system.

N. Vacuum Assist Nozzle

Staff proposes that each assist nozzle possess a vapor guard. This is a short "mini-boot" that fits over the spout of the "bootless" nozzles. Currently, the only two systems certified with nozzles lacking a vapor guard are the Gilbarco and the Hasstech. In order to achieve the desired efficiency, these systems have a higher air to liquid (A/L) ratio than do systems certified with nozzles featuring a vapor guard, which means that they suck more air into the system. The addition of a vapor guard will allow these systems to achieve the necessary collection effectiveness with a lower A/L and less air ingestion. The vapor guard will also minimize the customer's exposure to gasoline in the event that a spitback occurs during fueling, because the cup-like shape of the vapor guard contains spitbacks better than the conventional splashguard. The proposed requirement for an integral vapor valve will further reduce emissions by ensuring that liquid trapped in the vapor hose does not evaporate or spill. Many of the certified nozzles are available either with or without the vapor guard and the vapor valve.

The current limit on the maximum allowable leakrate for bootless nozzle system vapor valves is ≤ 0.005 CFH at a vacuum of –27 inches H_2O. This vacuum level was selected because it represents the typical operating vacuum level of many systems. However, the deadhead vacuum can be as high as –100 inches H_2O when the system is clearing a liquid blockage, causing other nozzle vapor valves associated with the same vapor pump could be sucked open and ingest air if the vapor valve does not hold against this vacuum. One nozzle manufacturer informed staff that new proposed limit of ≤ 0.10 CFH at a vacuum of –100 inches H_2O is achievable. The maximum allowable leakrate at 2.0 inches of pressure is unchanged.

O. Air-to Liquid (A/L) Ratio Limits

Staff is proposing to limit the maximum A/L ratio to 1.0 for systems without a processor and 1.3 for systems with a processor. The Gilbarco VaporVac system is currently certified with an A/L range of 1.0 to 1.2. Significant positive pressures are commonly observed in the UST vapor space of these systems. This is not unexpected, because the average volume of the vapor returned to the UST is larger than the volume of the fuel withdrawn from it. The addition of a vapor guard to the nozzle for this system is expected to make it possible for it to operate effectively within a lower A/L range. The limit on the A/L for processor systems was proposed in response to concerns about the magnitude of emissions that occur when the processor fails. The simple addition of a vapor guard on a Hasstech system nozzle, for example, may enhance the performance so that an A/L range could be lowered from the 1.4 to 2.4 range within which it is currently certified. Because this system has a single collection unit that creates a constant vacuum, regardless of the number of nozzles in use, however, it is likely that the range would still be too broad without other design improvements.

P. Assist System with Common Collection Device

Systems that, by design, rely on a single vapor collection device are subject to significant excess emissions in the event of collection unit failure. In order to adequately characterize the performance of these systems, specifications are proposed to require the identification of the number of fueling points that can be supported, and the maximum and minimum vacuum levels at which the system can be operated effectively. These specifications have already been established for some recently certified systems.

Q. Assist System with Destructive Processors

Tests of currently certified assist systems with destructive processors demonstrate that the proposed standards for CO and NOx can be met. Staff has collected test data and has determined that the hazardous air pollutant (HAP) 1,3-butadiene is detectable in the exhaust from destructive processors. Staff is continuing to test to evaluate the potential increase in the toxic risk factor. The proposed limit requires destructive processors to operate such that the toxic risk factor for 1,3-butadiene is not increased by more than one in one million over the risk factor established for a service station without a processor. The processors currently used in service stations are cold-start burners that typically, by design, cycle on and off frequently. There are destructive processors for gasoline vapor in use in other applications; however these typically involve preheating the combustion chamber and may not be economically feasible for use in service stations.

The proposed standard for hydrocarbon feedrate to the processor is ≤1.9 pounds per 1,000 gallons dispensed. This is to ensure that the system is not designed to destroy more than 25% of the vapor that is displaced by refueling vehicles (25% of the emission factor 7.6 pounds per 1,000 gallons). One reason for this limit is that destructive processors convert fossil fuel into greenhouse gasses. Another reason is that, if the processor should fail, the emissions that result are minimized. The two currently certified systems with destructive processors will not comply with this limit without modification. This is because they both have central vacuum units. That is, a single vacuum-producing device generates the vacuum regardless of how many fueling points are in operation at any given time, and regardless of the dispensing rate. The Hasstech system collection unit acts directly on the nozzles. In order to generate enough vacuum to support multiple fueling points simultaneously, the vacuum level is high enough to causes the A.L to be as high as 2.4, meaning that the system ingests 1.4 cubic feet of air to capture 1 cubic foot of vapor. This air causes evaporation in the storage tank, creating more vapor that must be incinerated. The Hirt system design differs somewhat, in that the vacuum unit acts on the underground storage tank to maintain enough vacuum to draw the vapors from the vehicle tank back to the UST. The vacuum generated by both the Hirt and Hasstech system is constant regardless of the dispensing rate, so lower dispensing rates result in higher A/L ratios, requiring the destruction of more vapor. There are other certified systems, such as the dispenser-based systems, that use the dispensing rate to adjust the collection rate, and operate with A/L ratios close to 1.0.

R. Assist System with Non-destructive Processors

ARB has not certified any systems with non-destructive processors, although staff are working with the manufacturers of several membrane technologies under development. The proposed benzene emission limit and the maximum hydrocarbon rate to the processor represent design requirements that are yet to be demonstrated.

4. Module 3: ORVR Compatibility

There are two certified systems that already achieve ORVR compatibility. These are the balance system and the Healy system. These systems do not ingest "excess air" when fueling ORVR vehicles and thus do not cause excess emissions. No modifications are necessary for the balance system to achieve ORVR compatibility, as the passive system design only collects vapor actually displaced by fueling of the vehicle. Since the ORVR vehicles collect the vapor in the canister, the dispensing facility with a balance system will dispense fuel without replacing it with vapor, thus leading to negative pressure in the underground storage tank. Even if the balance system station has some leaks, field data shows the underground storage tank tends to maintain negative UST pressure. This was demonstrated during an ARB field test of a balance system at which 32% of the fuel was dispensed in ORVR simulation.[6] The underground storage tank pressure was less than 0.10 inches H_2O for 99% of the test, including the bulk delivery periods.

The Healy assist-type vapor recovery system recognizes ORVR vehicle fuelings by means of a pressure-sensing diaphragm in the nozzle that prevents the ingestion of air when fueling an ORVR vehicle. Other system manufacturers are exploring hydrocarbon sensing technology. Both of these systems illustrate how differences in the vapor return line can be monitored to detect ORVR vehicles and adjust the vapor collection of the system.

Assist systems with processors may be compatible with ORVR, but have not yet been tested to confirm that the existing processors can handle the excess air from fueling a significant percentage of ORVR vehicles.

5. Module 4: Liquid Retention and Nozzle Spitting

Ensuring that vapor recovery systems do not cause excessive spillage has been a requirement since the early years of the vapor recovery program (see the discussion in Module 5).

There are fire safety requirements that nozzles must meet to prevent inadvertent dispensing. A hold-open latch allows a customer to latch the nozzle trigger in the open position and refuel without holding the nozzle trigger. When the vehicle tank is full, the shutoff mechanism unlatches the hold open latch. The insertion interlock mechanism ensures that the nozzle will shut off if it falls out of the vehicle while dispensing. If the nozzle is used in pre-pay mode, where dispensing may be terminated by the dispenser before the shutoff mechanism senses a full tank, a customer may inadvertently hang up the nozzle with the hold open latch engaged. If the next pre-pay customer picks up the nozzle without disengaging the hold open latch, and activates the dispenser before the nozzle is in the vehicle tank, the nozzle becomes a “gas gun,” spraying gasoline and creating a safety hazard. Therefore, nozzles are required to have a mechanism that prevents this from occurring.

Balance nozzles have an insertion interlock, or “no-latch-no-flow,” mechanism. This prohibits or immediately terminates dispensing unless the bellows is compressed. This ensures that the gas is not dispensed until the nozzle is securely fastened in the fillpipe of a vehicle unless the bellows is deliberately pulled back. The balance nozzle insertion interlock is listed in the National Fire Protection Association NFPA 30A, as meeting the safety requirement.

The bootless nozzles, which do not have a bellows and therefore do not have an insertion interlock, have a feature that senses a loss of pressure in the hose and nozzle, and closes the main poppet in the nozzle at the end of the pre-pay fueling. The design of this mechanism, however, allows gasoline to seep past the spout poppet and accumulate in the spout after the fueling is completed, especially if the gasoline in the nozzle gets warm and expands. This has created a new source of emissions because this gasoline is subject to being spilled. Even if no spillage occurs, this gasoline evaporates and creates emissions. This was originally called “pseudo-spillage” and is now referred to as liquid retention. In addition to gasoline in the spout, this includes gasoline trapped in the vapor path, as well as gasoline that dribbles out of the shutoff port. The emissions from this category are considerable, and it is, therefore, crucial that it be addressed as soon as possible. However, redesign will probably be necessary for most nozzles to meet the 100 ml/1,000 gallon limit proposed by staff.

Because some nozzles retain more liquid than others, and because the industry standard for the useful life of a nozzle is one year, there is concern that the nozzles with the higher liquid retention may be installed in stations that are operating under the 4-year period provided by state law. Therefore, staff proposes to phase-in three emission limit levels. The first level, which will be effective when the regulation becomes law, sets the maximum allowable liquid retention at 350 ml/1,000 gallons. This would have the effect of prohibiting the installation of nozzles that are identified by the ARB as having liquid retention above this level, but would allow nozzles determined by the ARB as meeting this criteria to be used as replacement parts on the decertified systems operating under the 4-year grace period. The second level would become effective a year later, and the ultimate standard would be operative by the third year.

Preliminary field data collected by ARB staff indicates that some assist nozzles meet the proposed standards of 100 ml/1000 gallons. A summary of the field data is provided below: However, because this data was collected in test stations, which are typically better maintained than the average station, staff believes that liquid retention may be greater than this data indicates. In addition, it is necessary to get more data to identify the liquid retention of each type of nozzle. Station D in this table had a mix of the two most common bootless nozzles and is probably the most representative of the in-use nozzle population. Stations B and E had nozzles that were undergoing certification testing when the data was collected. Staff is continuing to collect data.

Table V-1. Preliminary Liquid Retention Data

VR System Info	Gallons Pumped	Liquid Retained (ml/1000 gal)
Station A	54.637	256
Station B	66.940	122
Station C	125.691	65.2
Station D	189.450	100
Station E	87.019	48.3
AVERAGES	104.747	118

Staff proposes to limit nozzle “spitting,” which is the release of liquid when the dispenser is off and the nozzle trigger is pulled. Customers grabbing the nozzle sometimes squeeze the trigger, spitting gasoline into the dispenser housing. Eliminating spitting will, for some nozzles, require design changes.

6. Module 5: Spillage and Dripless Nozzles

The concern that vapor recovery systems may cause more spillage during vehicle refueling was raised early in the implementation of the program. State law requires that systems for the control of gasoline vapors resulting from motor vehicle fueling operations do not cause excessive gasoline liquid spillage when used in a proper manner.

Spillage is evaluated during the certification process. However, with the recent trend toward pre-paid fueling, there have been more and more refuelings terminated before the primary shut-off mechanism in the nozzle triggers. In addition, refuelings stopped at a specified amount prior to shut-off typically slow down the dispensing for last part of the fueling event. In ensure that both types of refuelings are properly evaluated, staff proposes a minimum number of fuelings, as well as a minimum number of fill-ups, during the spillage evaluation.

Staff proposes that the post-fueling drips from nozzles be limited to one drop per fueling. No-spill nozzles have been recently mandated by ARB for portable gasoline containers. However, the no-spill design of the gas cans may not be applicable or robust enough for use on nozzles. There are also diesel nozzles designed for use in Europe that have a valve in the spout tip to minimize drips. Nozzle manufacturers have expressed concerns about the applicability and effectiveness of this design for the smaller-diameter bootless nozzle spouts. They also pointed out that this would result in a nozzle spout full of liquid at the end of the fueling, so any seepage due to expansion would be closer to the tip of the spout, and more subject to spillage or evaporation. In confidential meetings with manufacturers, another method of meeting this standard has been discussed. No matter how the manufacturers decide to approach this, however, it will require redesign of at least the nozzle spout, and possibly of the nozzle itself.

Beginning in vehicle model year 1996, EPA has mandated a limit of 1 gram per fueling with a conventional nozzle, with a fueling being 9 to 12 gallons.[13] This corresponds to an emission factor of 0.23 lbs/gallon for a 12-gallon fueling. Thus, lower spillage values should be achievable as the pre-1996 vehicle population decreases.

Staff understands that the spillage numbers may be difficult to meet as spillage is highly dependent on customer handling of the vapor recovery nozzles. However, a combination of the design improvements implemented to reduce liquid retention and spout drips, and the reduced spillage from the 1996 and later vehicle fillpipe designs, are expected to achieve this standard.

7. Module 6: In-Station Diagnostics (ISD)

The objective of in-station diagnostics is to provide real-time monitoring of critical vapor recovery system components and signal the station operator when failure modes are detected. Stations are already equipped with dataloggers which monitor for liquid leaks so this concept is not new. Staff continues to work with the districts to ensure data provided by ISD will meet district compliance needs.

Staff believe that many of the functions of an ISD system are already present in some of the UST leak detection monitoring systems currently installed to comply with SWRCB regulations. Leak detection systems consist of sensors to detect the amount of fuel in the UST, sensors to detect leaks in the fuel piping, sensors to measure the UST fuel temperature, and an electronic console to manage the data from the sensors. The fuel temperature is measured to compensate for the thermal expansion and contraction of the fuel. The console compares the amount of fuel in the tank against the amount of fuel dispensed on a continuous basis. If a leak is detected, the console takes appropriate action, including disallowing fuel dispensing, until the leak is corrected.

ISD functions for vapor recovery can be added to existing electronic consoles on many models. Most installed consoles have extra ports for additional sensors, and the console's software can be modified on-site by the owner or remotely by the manufacturer. Gasoline dispensing facilities with no console or an older model console will have to purchase a new console or upgrade their existing console to implement ISD requirements.

Vapor recovery ISD will measure and record the performance and the failure of key vapor recovery components and systems. The objective of ISD is to continuously monitor the vapor recovery system's performance to alert the service station operator of equipment degradation and malfunction in real time. The malfunctions that the ISD system identifies can then be fixed in a timely manner. Currently, certain vapor recovery system failures may go undetected for months or even years between vapor recovery equipment inspections, resulting in excessive hydrocarbon emissions. For example, we have found existing vapor assist systems in which the vapor pump is nonoperative, resulting in total loss of refueling vapor recovery control. The station was able to operate without an indication of this major system failure. Staff propose that electronic and hard copy record of failures will be recorded in a manner similar to the State Water Resources Control Board's Leaking Underground Tank Program.

Staff propose that UST pressure monitoring will be required in all vapor recovery systems. Pressure monitors are commercially available. Pressure monitoring is already routinely conducted during certification testing at Sacramento test sites. A pressure monitoring system known as the EnviroSentry is required in Mexico City. The EnviroSentry continuously monitors the UST pressure, and disallows fuel dispensing if the UST pressure dwells in one of three pressure zones for preset time intervals, indicating a chronic vapor recovery system failure. Additional requirements for in-station diagnostics vary depending on the type of vapor recovery system. The three system categories are balance, assist, and assist with processor.

A. Balance Systems

In addition to the pressure monitor, balance systems would be required to check for liquid blockage at each dispensing point. Although there is not currently a sensor marketed for this purpose, staff believes that existing pressure sensor technology can be used to measure pressure drop across the vapor recovery hanging hardware (hose, nozzle, etc.). A high pressure drop would indicate a blockage problem.

An additional approach is to measure the vapor to liquid ratio, or V/L ratio (also referred to as A/L), in each dispenser with a flowmeter. Flow Technology developed a flowmeter with virtually zero pressure loss for the US EPA to measure tailpipe emissions in automobiles. The flowmeter, installed in each dispenser, would measure the amount of vapor flow during every fueling episode without reducing the vapor recovery system's efficiency. A consistent lack of flow, or low flow, would indicate a blockage.

B. Assist Systems

Assist systems would also be required to monitor the vapor to liquid ratio, or V/L ratio in a way that would detect a failure mode at individual dispensers. Fenner Fluid Power has developed a sensor that measures the volume of the vapor returned to the UST at each dispenser. The volume of vapor is compared to the volume of liquid gasoline dispensed to the vehicle. If the ratio is out of limits, a flow device adjusts the vapor pump flow to control the V/L for each fueling. Staff believes the Fenner system already has the capability to act as an V/L monitor, and that other devices to monitor V/L could be developed by dispenser manufacturers.

C. Assist Systems with a Processor

In addition to monitoring the V/L ratio, vapor recovery systems with processors must have additional ISD sensors to ensure the processors are operating correctly. The hydrocarbon concentration, the flowrate, and other parameters unique to each processor will need to be continuously monitored.

Processors can be added to new and existing vapor recovery systems to reduce excess UST pressure or to continuously maintain a negative UST pressure. Some vapor recovery systems depend on the processor to manage their excess emissions, since the vapor recovery system is designed to recovery a higher volume of vapor than the volume of liquid dispensed. Other systems depend on the processor to maintain a high level of vacuum in the UST to draw the vapors from the vehicle.

Staff is aware of two processor technologies, thermal processors and membrane processors. Thermal processors, or burners, are currently certified and have operated for years. Membrane processors are currently under development, but staff expects that certification tests for these processors will begin soon.

Thermal processors draw vapors either directly from the dispensers or from the UST. The vapors are burned until dispensing ceases or until the UST pressure reaches its preset limit. Thermal processors currently monitor the combustion process with a flame detector, which determines if the burner has achieved combustion. For vapor recovery systems certified to operate at a continuous vacuum, a pressure switch is used to detect insufficient vacuum. An alarm signals the station operator when the system fails to achieve the certified vacuum level after a prescribed time interval, indicating insufficient system leak integrity or a system failure.

Membrane processors also draw vapors either directly from the dispensers or from the UST. The membrane separates the air component of the UST vapor from the hydrocarbon component. The air component is released into the atmosphere, and the hydrocarbon component is returned to the UST. Membrane processors would monitor the hydrocarbon concentration of the air released into the atmosphere using a hydrocarbon sensor, monitor the volume of the air released to the atmosphere using a flowmeter, and detect insufficient vacuum with a pressure switch or a pressure transducer. In addition, the system would record the percent run time. An excessive run time indicates deteriorating system leak integrity. For those vapor recovery systems certified to operate at a continuous vacuum, an alarm will signal the station operator when the system fails to achieve the certified vacuum level after a prescribed time interval, indicating insufficient system leak integrity or a system failure.

8. Warranty

Vapor recovery systems and components are currently required to be free from defects in materials and workmanship for at least one year. Some of the systems tested recently were found to be performing poorly. Some districts felt this was an indication that the equipment was manufactured to pass an operational test, rather than to perform adequately in actual use, and asked for the warranty requirement to be expanded. The industry-accepted "useful life" for most of the hanging hardware (nozzles, breakaways and hoses) is generally accepted to be one year. Staff proposed a three-year warranty for systems; this was discussed extensively at workshops. The warranty requirement is problematic for vapor recovery systems, because they are composed of components generally manufactured by more than one company. Is the system certification holder responsible for three years for the performance of a system whose component parts have a warranty of one year? After considerable discussion, staff concluded that the better approach would be to require a more meaningful warranty of one year for both systems and components.

The proposed changes to the warranty are:

a) the component warranty tag shall include at least the following information:

   Notice of warranty period;
   Date of manufacture, or where date is located on component;
   Shelf life of equipment or sell-by date, if applicable; and
   A statement that the component was factory tested, with a listing of the performance standards and/or specifications to which it was certified.

b) the system and components must comply with the performance standards and specifications throughout the warranty period.

Recent testing of vapor recovery systems and components reveals that some of the currently certified equipment does not meet the standards when new, let alone throughout the entire the warranty period. Other equipment performs adequately well beyond the first year of use. Some modifications will be needed to make the equipment more robust. There are, in each equipment category, examples of some components or parts of components that are superior to the others. Therefore, the technology exists and improving the performance of the equipment is often a matter of economics.

9. Innovative Technology

The performance standards and specifications, whether currently adopted, modified or new, address specific concerns about the vapor recovery systems. However, staff are aware that someone may design an innovative vapor recovery system that, while it may not comply with a performance standard or specification, is a better design. In order to allow flexibility in the future, the innovative technology provision is proposed. The applicant for certification would identify, in the preliminary application, the standard(s) or specification(s) with which the system does not comply, and demonstrate that the proposed system meets the primary performance standard of 0.38 lbs/1000 gallons. Supporting test procedures, if necessary and results of tests performed by, or at the expense of, the applicant will be required. The system will then be subjected to an engineering analysis. The system will, within the time frames for reviewing the application, either be returned to the applicant with identification of the deficiencies, or will be approved for testing.

VI. ECONOMIC IMPACTS OF PROPOSED STANDARDS

1. Introduction

This chapter discusses the estimated economic impacts we anticipate from implementation of the six proposed modules and other requirements. In general, economic impact analyses are inherently imprecise by nature, especially given the unpredictable behavior of companies in a highly competitive market such as gasoline marketing and distribution. While we quantified the economic impacts to the extent feasible, some projections are necessarily qualitative and based on general observations and facts known about the gasoline marketing and distribution industry. This impacts analysis, therefore, serves to provide a general picture of the economic impacts typical businesses subject to the staff's proposal might encounter; we recognize that individual companies may experience different impacts than projected in this analysis.

The overall impacts are first summarized, followed by a more detailed discussion of specific aspects of the economic impacts analysis in the sections listed below:

- Economic Impacts Analysis on California Businesses as Required by the California Administrative Procedure Act (APA);
- Potential Impacts to California State and Local Agencies; and
- Cost-Effectiveness of the Proposed Standards.

It is important to note that we conducted the economic impacts analysis shown in this report to meet the current legal requirements under the APA. The analysis we used in this report conforms to standardized practices at the ARB and the California Environmental Protection Agency (Cal/EPA). Moreover, the analysis we used goes beyond recent ARB rulemaking cost analyses in that we evaluated the cost-effectiveness of the six individual proposed modules on five different sizes (i.e., throughput) of gasoline dispensing facilities (GDFs). Thus, the analysis not only provides an overall picture of cost-effectiveness, but it also discusses the cost-effectiveness of the modules as applied to different sizes of GDFs.

2. Economic Impacts Analysis on California Businesses as Required by the California Administrative Procedure Act (APA)

A. Summary of Economic Impact

Overall, we do not expect the proposed amendments to impose an unreasonable cost burden on gasoline dispensing equipment manufacturers, component suppliers, or gasoline dispensing facilities. Most of the major manufacturers are located outside of California although some may have small operations in California. GDFs are local business by nature, and all affected GDFs are

California-based.

We estimate the average annual costs of the proposed amendments to be around $33 million per year upon full implementation in 2004. These costs are most likely to be passed on fully to motorists, resulting in an increase of about 0.24 cent per gallon in the average price of gasoline. A price increase of this magnitude is not expected to dampen the demand for gasoline significantly. Neither do we expect a noticeable change in the profitability of GDFs if they are unable to pass on the cost increase to motorists. In 1998, the average nationwide profit margin for a gallon of gasoline was 12.6 cents. Thus, the estimated 0.24 cent increase in the price of gasoline would change this margin by less than 2 percent. As a result, staff expects the proposed regulation to impose no noticeable adverse impact on California competitiveness, employment, and business status.

B. Legal Requirement

Section 11346.3 of the Government Code requires State agencies to assess the potential for adverse economic impacts on California business enterprises and individuals when proposing to adopt or amend any administrative regulation. The assessment shall include a consideration of the impact of the proposed regulation on California jobs, business expansion, elimination or creation, and the ability of California business to compete.

Also, section 11346.5 of the Government Code requires State agencies to estimate the cost or savings to any state, local agency and school district in accordance with instructions adopted by the Department of Finance. The estimate shall include any non-discretionary cost or savings to local agencies and the cost or savings in federal funding to the state.

Health and Safety Code section 57005 requires the ARB to perform an economic impact analysis of submitted alternatives to a proposed regulation before adopting any major regulation. A major regulation is defined as a regulation that will have a potential cost to California business enterprises in an amount exceeding ten million dollars in any single year.

C. Businesses Affected

Any business involved in manufacturing or use of vapor recovery equipment would potentially be affected by the proposed amendments. Also potentially affected are businesses which supply parts, sell, install and maintain vapor recovery systems. These businesses fall into the following industry classifications.

Table VI-1. Industries with Affected Businesses

SIC*	NAICS**	Industry
1542	233310	Vapor Recovery Equipment Contractors
3586	333913	Vapor Recovery Equipment Manufacturers
5084	421830	Vapor Recovery Distributors
5541	447110 & 447190	Gasoline Dispensing Facility Owners and Operators

* Standard Industrial Classification
** North American Industry Classification System

According to the U.S. Census Bureau, there were 71 establishments which manufactured measuring and dispensing equipment in the U.S. in 1997, of which twelve were in California. (U.S. Census Bureau, 1999) These manufacturers shipped products valued at $1.3 billion in 1997, of which California firms accounted for $55 million or 4.2 percent of the total national value of shipments.

D. Potential Impacts on California Businesses

Equipment Manufacturers

The proposed amendments would potentially impose additional costs on manufacturers of vapor recovery equipment. A detailed analysis of these costs is provided in the cost-effectiveness section of this report. The cost analysis shows that the proposed amendments will increase average annual costs of manufacturing enhanced vapor recovery (EVR) equipment by about $33 million per year upon full implementation in 2004. In the short run, competitive market forces may prevent these manufacturers from passing the cost increase to gasoline dispensing facilities (GDFs) through distributors. Thus, we do not expect a significant change in the price of equipment. In the long run, however, if manufacturers are unable to lower their costs of doing business they will pass the cost increase to GDFs. As a result, we do not expect the proposed amendments to cause a noticeable adverse impact on the affected manufacturers.

Equipment Distributors and Contractors

The proposed amendments may have some adverse impacts on distributors of vapor recovery equipment if the increased costs of equipment dampen demand for such equipment. Distributors would then have to lower their prices to improve demand, thus reducing their profit margin. This scenario may occur in the short run. In the long run, however, we expect distributors will be able to maintain their profit margin by passing along any cost increase to the GDFs.

Contractors, on the other hand, will potentially benefit from the staff's proposal.

Contractors will experience an increased demand for their expertise, as manufacturers require certification testing and GDFs start complying with the new standards.

Gasoline Dispensing Facilities

Gasoline dispensing facilities are the main focus of the proposed amendments. These facilities are required to install and maintain EVR equipment. Currently, there are about 11,250 GDFs in California. 7,077 are identified as service stations, while the others include private dispensing facilities, convenience stores with gasoline dispensing and other dispensing facilities. The new requirements are expected to impose additional costs on these facilities. These costs are estimated to range from about $2,700 per year for a small facility with 2 dispensers and an average monthly fuel sale of 13,233 gallons to $3,100 per year for a large facility with 12 dispensers and an average monthly fuel sale of 300,000 gallons. Over three-quarters of California GDFs, however, sell about 75,000 to 150,000 gallons of gasoline per month. The costs of the proposed amendments when it is fully implemented in 2004 are estimated to range from $2,950 to $3,100 per year for each of these facilities.

GDFs are most likely to pass on the bulk of the cost increase to consumers. Staff estimate an average increase in the price of gasoline of about 0.24 cent per gallon. A price increase of this magnitude is not expected to dampen the demand for gasoline significantly. As a result, the proposed regulation is not expected to have a significant impact on GDFs.

E. Potential Impact on Consumers

The potential impact of the proposed amendments on retail prices of gasoline depends on the ability of GDFs to pass on the cost increase to consumers. Since most California GDFs are not subject to competition from GDFs in other states, they are able to pass on the entire costs of compliance to consumers. Assuming that they are able to do so, staff estimates that the average price of gasoline would increase by about 0.24 cent per gallon (i.e., about 1/4 of a penny) upon full implementation of the proposed amendments in 2004. This represents an increase of less than 0.2 percent in the price of a gallon of gasoline, considering an average price of $1.50 for a gallon of gasoline. Thus, a motorist who buys 1000 gallons of gasoline a year would pay an additional $2.40 annually. A price increase of this magnitude is not expected to have a significant impact on the demand for gasoline in California.

F. Potential Impact on Business Competitiveness

The proposed amendments would have no significant impact on the ability of California manufacturers to compete with manufacturers of similar products in other states. This is because all EVR equipment manufactured for sale in California are subject to the proposed amendments regardless of where they are manufactured. Most EVR manufacturers are located outside of California although some may have some facilities in California. Of a total of 71 establishments involved in manufacturing of measuring and dispensing equipment, only twelve were located in California in 1997 according to the U.S. Census Bureau. (Id.)

The amendments would have no impact on the competitiveness of most California GDFs. Except for a small number of GDFs operating in the border areas between California and other states, most California GDFs compete for local motorists within California border. This fact, coupled with the small average increase in the price of gasoline that we estimated, is unlikely to encourage cross-border driving to purchase gasoline in neighboring border states.

G. Potential Impact on Employment

California accounts only for a small share of manufacturing employment for EVR equipment. According to the U.S. Census Bureau, California employment in the industry (SIC 3586, which includes establishments primarily involved in manufacturing measuring and dispensing pumps, such as gasoline pumps and lubricating oil measuring and dispensing pumps) was 366 in 1997, or about 5.4 percent of the national employment in the industry. (Id.) This also represents only 0.02 percent of the total manufacturing jobs in California. These employees working in 12 establishments generated approximately $13 million in payroll. Six establishments had more 20 employees; the rest had less than 20 employees. The proposed amendments are unlikely to cause a noticeable change in employment for EVR manufacturers because they are likely to pass on the bulk of the cost increase to GDFs.

Most California GDFs, in turn, are able to pass along the cost increase to consumers because they compete in a local market, rather than a national one. According to California Trade and Commerce Agency, there were 7,077 gasoline service stations in California in 1997, employing 56,345 people with an estimated $837 million in payroll. (CA Trade & Commerce, 1999) These employees are not expected to be affected adversely because a small price increase is unlikely to dampen demand for gasoline in California.

Contractors that install and maintain vapor recovery systems may actually benefit from the staff's proposal. The amendments would potentially increase demand for these contractors' services, resulting in an employment increase for that sector.

H. Potential Impact on Business Creation, Elimination, or Expansion

The proposed amendments are not expected to have a noticeable impact on the status of California businesses. As stated above, most manufacturers are likely to pass on the bulk of the cost increase to GDFs, which they will in turn pass on to consumers. Thus, we expect most EVR manufacturers and GDFs will be able to maintain their profit margin in the long run. In 1998, the nationwide average margin for a gallon of gasoline was 12.6 cents. (NACS, 1999) An estimated 0.24 cent increase in the price of gasoline would change this margin by 1.9 percent. A change of this magnitude is unlikely to alter the status of GDFs in California.

Nonetheless, some small GDFs with little or no profit margin may lack the financial resources to install EVR equipment on a timely basis. Should the proposed amendments impose significant hardship on these GDFs, temporary relief in the form of a compliance date extension under a local district variance provision may be warranted.

The proposed amendments may actually result in the creation of some business opportunities in California. The amendments would potentially increase demand for services of the contractors who install and maintain vapor recovery equipment. As a result, some existing businesses may expand, and some new businesses may be created to meet the increased demand for installation and maintenance of EVR equipment.

I. Potential Impacts to California State and Local Agencies

For Modules 1 through 5 (i.e., all modules except for In-Station Diagnostics), we do not expect any significant adverse impacts on the local air pollution control districts. This is because the ARB will continue to conduct the certification testing of enhanced vapor recovery (EVR) equipment, and the districts' role of inspecting the in-field applications of EVR equipment will not change. In general, the EVR proposal will mainly require a replacement or modification of existing equipment with EVR-compliant components and systems. Because the basic configuration of gasoline dispensing facilities will not change, there should be no drastic changes in the local district inspectors' role.

For Module 6 (In-Station Diagnostics (ISD)), there are three possible scenarios for the frequency of inspections that will be needed: more frequent, less frequent, and no change. The ISD proposal may result in more inspections, at least in the initial stages of rule implementation, when both industry (EVR equipment suppliers and GDFs) and the regulators (ARB and districts) are on the "learning curve" with this relatively new application of existing technology. This is because it will take time for the operators and regulators to become familiar with each ISD system and the system's particular unique characteristics.

However, in the long term, we expect the severity and frequency of problems found to decrease, and the frequency of inspections to either decrease or remain at current levels. The ISD requirements are, by definition, designed to alert the operators and inspectors to potential problems before they occur. For example, an

ISD system will alert a facility owner to a system leak, prompting the owner to find the root cause of the problem before an even more significant problem occurs, like a mandatory shutdown. Thus, when coupled with the robust EVR requirements in the other modules, the ISD provision should reduce the districts' field inspection burden to the extent that ISD increases owner self-inspection and correction.

3. Cost-Effectiveness of the Proposed Standards

A. Methodology

We began our analysis by defining the systems and technologies likely to be used by manufacturers to meet the proposed new standards. To do this, we held discussions with engineers from the vapor recovery equipment manufacturers. (See Chapter III, "Rule Development Process and Public Outreach Efforts.") We also reviewed the ARB's certification Executive Orders to determine what technologies are in place in current vapor recovery systems.

We based the portion of our analysis that looked at equipment purchase costs on a similar 1991 analysis conducted by the U.S. EPA for its national Phase II vapor recovery program. (U.S. EPA, "Technical Guidance – Stage II Vapor Recovery Systems for Control of Vehicle Refueling Emissions at Gasoline Dispensing Facilities, EPA-450-391-022a and 022b, November 1991). We adjusted the U.S. EPA's analysis to reflect the proposed modules and the current market conditions in California.

In addition, we used current retail price lists for specific equipment in our equipment purchase costs analysis whenever we could obtain them; in the absence of a list price, we used as-applied prices found in the field or the prices in the 1991 U.S. EPA analysis (adjusted to 1999 dollars) as default prices.

And finally, we relied on ARB's more than 20 years experience with vapor recovery emission controls and our best engineering judgment to ensure that the assumed technologies and cost figures are realistic and reasonable. From this process, we determined the most likely emission control technologies that would be needed to meet the proposed requirements, recognizing that individual companies may experience costs that are different than those we project in this analysis.

We should note that some manufacturers do not entirely agree with the technologies or combination of technologies we determined will help meet the proposed requirements. However, our experience with regulated industries generally shows that industry tends to overestimate the level of technology and amount of hardware needed to meet standards proposed by the ARB in the past (see ARB, 1998; ARB, 1999). For example, at the January 2000 workshop, it was suggested that the proposed regulation would require not only changes in the emissions-related hardware (nozzles, fittings, breakaways, etc.) but also in the nonemissions related hardware, such as the credit card reader, liquid crystal display, and other point-of-sale equipment. In other words, the commenter seemed to be suggesting that the entire dispenser would need replacement upon implementation of the staff's proposal. This assertion was immediately refuted by one of the major nozzle manufacturers, who stated that his EVR systems (and presumably others) would be designed as generic retrofits or original equipment manufacture (OEM) so that only the pieces directly affecting emissions would need to be replaced.

In general, the cost to manufacturers for the individual components and systems that are needed to comply with the proposed requirements are fairly quantifiable. This is because most of the requirements in the modules (Phase I, Phase II, ORVR compatibility, and ISD) could be met by refinements to off-the-shelf equipment already available in the market. (See Chapter V, "Technological Feasibility of Proposed Standards.")

Once we defined and determined the typical pieces of equipment that would need to be refined and their costs, our assessment of non-hardware costs (e.g., research and development (R&D), certification costs) to manufacturers becomes less clear because these costs are closely guarded by individual manufacturers. Such costs may vary significantly within the industry, not only by company but also by the type of equipment being redesigned. Nevertheless, we included our estimates of all identifiable costs in the analysis, based on the best available information, confidential discussions or correspondence from manufacturers, and our most conservative engineering judgment of costs.

B. Assumptions

To ensure that our analysis covers the most likely cost impacts, we built into our analysis a series of conservative assumptions that significantly increased our cost estimates. The most influential assumptions are described in more detail as follows.

<u>Assumption 1</u>: All major emissions-related equipment would need replacement

We assumed that upon full implementation, every gasoline dispensing facility (11,250 in California) would need to install new or replace all existing nozzles, hanging hardware, vacuum pumps, breakaways, Phase I drop tubes, pressure/vacuum (P/V) valves, processors, and other pieces of emissions-related equipment. In other words, we assumed a near-complete overhaul of all California gas stations' aboveground dispensing systems, even though this would clearly not be the case in reality. For instance, this assumption means that all GDFs either have to replace or install (if there were none before) a vapor "processor" (thermal oxidizer/incinerator, membrane separator), the single highest-cost equipment in our analysis at $7500 to $9000 per GDF. However, this is not going to be the case for all GDFs, because some of the new certified systems may be able to meet the requirements without a processor, and some of the existing certified processors could meet the requirements with few or no modifications. (See Chapter V, "Technological Feasibility of Proposed Standards: Module 2 Phase II Vapor Recovery.")

Because the staff's proposal primarily affects aboveground systems, gas station owners will not be required to dig up and replace underground storage tanks (USTs). Thus, no assumptions involving the removal or replacement of USTs were used in this analysis.

Assumption 2: "Retail list" prices represent actual equipment purchase costs

For the equipment purchase cost portion of the analysis, we used retail list prices for nozzles, breakaways, drop tubes, spill containers, P/V valves, and other Phase I and Phase II vapor recovery equipment that are published on the Internet by EZ-Flo (EZ-Flo Internet site, op cit.), Emco-Wheaton (http://www.emcoretail.com/pnozzles.html), and EBW (http://www.ebw.com/pricelst). For other equipment such as vapor processors, we used actual as-applied costs that we obtained from GDFs in California. Finally, we used the U.S. EPA's 1991 Phase II Technical Guidance [26] cost figures (updated to 1999 dollars) and our best engineering judgment to establish default component costs when no other data were available.

In addition to using the retail price lists, we did not factor in any potential discounting for trade-ins of used equipment (i.e., discount for the "core") or high-volume purchases of new equipment. The U.S. EPA cited discounts of up to 30% in their 1991 Phase II Technical Guidance. (U.S. EPA, op cit., Volume II: Appendices) Several of the equipment manufacturers currently provide such "core" trade-in discounts, and at least one nozzle manufacturer provides a separate price list for refinery-owned GDFs (for example, compare EZ-Flo's Retail Price List at http://www.ez-flo.com/pn/pn.html with the Chevron Price List at http://www.ez-flo.com/prices/prices.html). We expect such practices would continue since the refurbished equipment obtained through this process can be sold elsewhere in the nation where Phase I and II requirements are in effect, and the number of refinery-owned GDFs and other high-volume purchasers is generally increasing. These practices would effectively reduce the actual costs relative to the staff's estimates.

The use of retail list prices is conservative because, as noted earlier, some end-users can enter into contracts to purchase equipment at lower prices than indicated by the retail price list. This is particularly true for high-volume equipment purchasers, such as the petroleum refiners, which own the majority of GDFs in California.

Assumption 3: ORVR, Liquid Retention, and Spillage modules add a 75% premium over the cost of conventional Phase II nozzles.

We expect the ORVR compatibility, liquid retention, and spillage requirements (Modules 3, 4, and 5) to be addressable by overlapping design changes, at least to some degree. Most of these design changes will be incorporated into the nozzle. With foreknowledge of the staff's proposal, nozzle manufacturers will likely keep all three of these modules in mind when designing new EVR nozzles.

We assumed that these three modules would each increase the price of an EVR nozzle by 25%, or 75% in combination. A percentage increase assumption is necessary because the liquid retention and spillage requirements are considered technology-forcing, and the exact design changes needed to meet these standards are not well defined at this point. Because equipment suppliers compete heavily in this market, the amount of price increase should be limited by competition between the nozzle manufacturers and the demand for lower prices from end-user GDFs. Thus, a 25% increase per module or 75% increase for all three modules seems to be a reasonable assumption.

It is likely to be a conservative assumption because there will probably be designs that can address two or all three modules with the same equipment changes, rather than incrementally increasing the number of components within the nozzle or dispenser. This assumption is significant because the cost of nozzle replacement represents approximately 20% of the entire equipment purchase costs. At an average "retail list" price of $216 per nozzle, this assumption represents a $162 increase. Note, however, that actual purchase prices for a nozzle, and thus the actual increases from these three modules, may be significantly lower. CIOMA reports $50 to $125 per nozzle as the cost of replacing a dozen or so nozzles in "mom-and-pop" facilities (CIOMA, 1998[19]).

Assumption 4: All existing certifications will be renewed

There are currently 64 Phase II and 14 Phase I certifications listed on ARB's EVR Internet site; we assumed each of these 78 certifications would be recertified under the staff's proposal. In addition, we assumed that there will be one certified ISD system for every 4 certified Phase II systems (i.e., 16 new ISD certified systems). However, we believe only a portion of the existing Phase I and II certifications will actually be recertified, as manufacturers drop currently certified systems and components that are less promising for meeting the new requirements than other certified equipment. In addition, some of the existing certifications represent systems or components that are no longer manufactured. Finally, because ISD systems are essentially data-gathering tools with some possible feedback control, it is likely that only a mere handful of ISD systems will actually need to be developed to address the basic nozzle/dispenser configurations (e.g., balance, assist with destructive processor, assist with non-destructive processor).

This is a significant assumption because the number of Phase I and II certifications that are assumed to be recertified under the staff's proposal heavily influences the annualized R&D and certification costs. Indeed, the assumption that there will be 94 overall new or renewed certifications under the staff's proposal represents about 64% of the total annual costs, or about $21 million out of the total $33 million annual costs. Any change in this assumption will significantly affect the estimated costs for this regulation. By assuming all 80 existing certifications (plus 14 new ISD certifications) will be recertified, we may be significantly overestimating the total costs.

C. Analysis

The analysis consisted of two main parts: the cost-effectiveness analysis and the projection of cost impacts on the consumer. The cost-effectiveness analysis is well established and is essentially the same type of analysis used in past ARB rulemakings (e.g., see ARB, 1998[16]; ARB, 1999[15]). The methodology is fairly straightforward and involves quantifying the nonrecurring costs, converting these costs to annualized costs through the use of an appropriate cost recovery factor (CRF), adding or subtracting the annual recurring costs, then dividing the entire annual costs by the annual emission reductions. The resulting value is the cost-effectiveness of the proposed regulation and is expressed in terms of "dollars to be spent per pound of pollutant reduced." The projection of cost impacts on the consumer is a macroeconomic projection of the total annual costs (from the cost-effectiveness analysis) onto the entire amount of gasoline affected by the proposed regulation. This projection assumes that the entire cost of the regulation can and is passed on to the consumer in the form of higher gasoline prices.

In addition to the standard overall cost-effectiveness that we normally report for proposed regulations, we also report the cost-effectiveness of each individual module and for each of five different size classes of GDFs (by throughput). This represents an expansion over previous ARB cost-effectiveness analyses, in which only the overall cost-effectiveness and per-module (or per-standard) cost-effectiveness were reported. (see ARB, 1999, op cit.; ARB, 1998, op cit.)

Because it is our goal to report the cost-effectiveness by GDF size, the first step in the analysis was to establish a GDF population distribution by throughput. To do this, we modified the U.S. EPA's approach of developing costs for different GDF classes (what U.S. EPA calls "Model Plants") to incorporate the staff's six proposed modules and five Model GDF classes. We then updated the U.S. EPA's reported population distribution for their Model Plants to reflect current California market conditions. The five Model GDFs we used in our approach range in throughput from 13,233 gallons per month for Model GDF 1 to 300,000 gallons per month for Model GDF 5. The population distribution we used are shown in Table VI-2 below along with the corresponding population distribution from the 1991 U.S. EPA Phase II Technical Guidance, (op cit.).

Table VI-2. Comparison of 1991 National vs. 1998 Assumed CA GDF Distribution

National GDF Distribution in 1991			Est. California Distribution in 1998		
Gal/mo		Percent of GDFs	Gal/mo		Percent of GDFs
3,000		3.80%	3,000		0.76%
8,000		4.80%	8,000		0.96%
17,500		15.00%	17,500		3.00%
37,500		23.50%	37,500		14.10%
75,000		32.30%	75,000		45.65%
150,000		18.20%	150,000		31.30%
300,000		2.40%	300,000		4.22%
PWA (1991) =	70,661	gal/mo	PWA (1998) =	99,779	gal/mo
PWA = population-wtd average					

Because there are no readily available data on the distribution of GDFs by throughput, we adapted the U.S. EPA's reported distribution to reflect current California conditions. We chose the estimated California distribution shown in Table VI-2 because it results in a population-weighted average (PWA) throughput that reflects the current 99,865 gallons per month per GDF in California (13.5 billion gallons in 1997 divided by 11,250 GDFs). The current population-weighted average throughput in California (99,865 gallons/month) is consistent with the slightly lower estimated national average throughput for convenience stores. (NACS, 1999[24]) The chosen distribution also reflects the general trend of increasing numbers of higher-throughput GDFs and decreasing numbers of smaller, "mom-and-pop" operations.

Once we established an assumed GDF population distribution, we simply apportioned the total number of GDFs (11,250) and total gasoline throughput into each Model GDF class. Because we had no data to show otherwise, we assumed the distribution of nozzles, dispensers, and processors remain unchanged from the values reported by the U.S. EPA. These values, along with other important input values we used in our calculations, are shown in Table VI-3 below.

Table VI-3. Selected Input Values for Each Model GDF Class

	Input value for each Model GDF				
Input Variable used in Cost Analysis	1	2	3	4	5
Nominal Monthly Average Sales per GDF	13,233	37,500	75,000	150,000	300,000
Population Distribution	4.7%	14.1%	45.7%	31.3%	4.2%
Estimated Number of GDFs	531	1,586	5,136	3,522	475
Total Annual Sales, million gals/yr	84	714	4,626	6,344	1,712
Number of Processors per GDF	1	1	1	1	1
Number of Drop Tubes & Spill Buckets per GI	2.5	2.5	2.5	2.5	2.5
Wtd-Avg Number of Nozzles per GDF	2.5	3.25	6.5	9.75	16.25
Number of Dispensers per GDF	2	3	6	9	12
Population-wtd avg gal/mo using population al	99,779	Total 1997 CA gasoline sales =		13,481,725,000	gals
Actual population-wtd average gallons per mo	99,865	Total GDFs in CA in 1998 =		11,250	

The next step was to use the assumed GDF population distribution to apportion the amount of projected emission reductions for each module into the five different Model GDF classes we used in the analysis. This is shown in Table VI-4 below.

Table VI-4. Projected Emission Benefits by Proposed Module and Model GDF

Module	Description	2010 ROG Reductions Statewide, tons/day	Emission Reductions by Model GDF and Module, tons/day				
			1	2	3	4	5
1	Phase I	5.0	0.03	0.26	1.72	2.35	0.64
2	Phase II	3.1	0.02	0.16	1.06	1.46	0.39
3	ORVR Compatibility	6.3	0.04	0.33	2.16	2.96	0.80
4	Liquid Retention	0.2	0.00	0.01	0.07	0.09	0.03
5	Spillage/Dripless Nozzle	3.9	0.02	0.21	1.34	1.84	0.50
6	In-Station Diagnostics	6.6	0.04	0.35	2.26	3.11	0.84
	Total	25.1	0.16	1.33	8.61	11.81	3.19

With the projected emission reductions by proposed module and Model GDF class, our next step was to quantify and annualize the non-recurring costs, quantify the annual recurring costs, and subtract from these the annual gasoline recovery credits. The resulting total annual costs would then be divided by the annual emission reductions for each module and GDF class to estimate the various cost-effectiveness values.

The non-recurring costs are annualized into discounted, equal annual payments when multiplied with an appropriate cost recovery factor (CRF), a standardized method recommended by the Cal/EPA for annualizing costs. (Cal/EPA, 1996[18]) The CRF method has been used for years by the ARB, Cal/EPA, the U.S. EPA, and the local air quality districts in California.

The CRF is calculated as follows:

$$CRF = \frac{i(1+i)^n}{(1+i)^n - 1}$$

where,

CRF = cost recovery factor
i = discount rate (10% default value)
n = project horizon or useful life of equipment
= 3 years for nozzles
= 7 years for dispensers and dispenser-mounted hardware (Koch, 1999)
= 5 years for R&D costs
= 4 years for certification costs
= 10 years for all other costs (Cal/EPA, 1996, op cit.).

Unit costs from the 1991 U.S. EPA Phase II Technical Guidance[26], to the extent they were used in our analysis, were adjusted to 1999 dollars using the well-established Marshall & Swift Equipment Cost Indices as follows:

$$1999\,Costs = 1991\,Costs \times \frac{1999\,MSECI}{1991\,MSECI}$$

where,

1991 Costs = Unit costs reported in 1991 U.S.EPA Ph. II Technical Guidance
1999 MSECI = 1999 Marshall & Swift Equipment Cost Index[28] = 1,068.3

1991 MSECI = 1991 Marshall & Swift Equipment Cost Index[29]= 930.6

D. Non-Recurring Costs

The non-recurring costs include the cost of new equipment to be purchased by the GDFs, the research and development (R&D) costs to the manufacturers, and the certification costs to legally sell the equipment in California.

Cost of New Equipment and Parts

As noted earlier, we estimated the cost of new equipment and parts using retail price lists, as-applied costs found in actual GDFs, the 1991 U.S. EPA Phase II Technical Guidance, and our best engineering judgment. We used the 1991 U.S. EPA Phase II Technical Guidance to provide the number of components that could be replaced within each Model GDF. We then multiplied the unit cost by the number of units of each component within each Model GDF to calculate the overall equipment purchase costs. Because GDFs will have 4 years to replace equipment that has been decertified under the staff's proposal, we assumed that there would be a 25% per year turnover for purchasing new equipment. The estimated equipment costs for each Model GDF class are summarized in Table VI-5 below and are shown in detail for Model GDF classes 1-5 in Appendix E.

Table VI-5. Summary of Annualized Equipment Costs

		Annualized Equipment Costs per Model GDF, $/yr				
Module	Description	1	2	3	4	5
1	Phase I	$76,963	$229,910	$744,386	$510,433	$68,875
2	Phase II	$274,395	$886,260	$3,803,379	$3,248,401	$611,144
3	ORVR Compatibility	$23,214	$97,188	$629,338	$647,314	$129,763
4	Liquid Retention	$7,214	$28,014	$181,402	$186,583	$41,961
5	Spillage/Dripless Nozz	$7,214	$28,014	$181,402	$186,583	$41,961
6	In-Station Diagnostics	$74,436	$279,480	$1,459,666	$1,381,328	$237,721
	Total	$463,435	$1,548,865	$6,999,572	$6,160,643	$1,131,425

Research and Development Costs

We assumed that Phase II and ISD vapor recovery equipment would require more research and development (R&D) effort to redesign than Phase I equipment. We therefore assumed that 2 full-time engineers at $100,000 per year plus 1 support staff at $50,000 per year would be needed to redesign each of the 80 Phase II+ISD certifications (see “Assumption 4”). We also assumed that 1 full-time engineer plus 0.5 support staff would be required to redesign each of the 14 Phase I certifications. To cover the cost of fabricating prototypes, using computer-aided design (CAD), bench-testing of pre-production models, and similar activities, we assumed these component and system development costs (CDSC) would be 10% of the engineering design costs for each recertification. Finally, to cover miscellaneous marketing costs such as modifying print and Internet advertisements and training salespersons, we assumed miscellaneous marketing costs would be about 25% of the CDSC. We annualized these costs using a 10% discount rate and 5 year project horizon.

To apportion these R&D costs to each module, we assumed that the standards for Phase II (Module 2), ISD (Module 6), and ORVR/Liquid Retention/Spillage (Modules 3-5) would require the most R&D resources. Thus, we assumed the following percentages of the total R&D expenditures for each of the proposed modules: Module 1 (5%), Module 2 (50%), Module 3 (10%), Module 4 (5%), Module 5 (5%), and Module 6 (25%). To apportion the resulting per-module annualized costs to each Model GDF class, we simply weighted each per-module annualized cost by the number of GDFs within each Model GDF class (see Table VI-3).

A summary of the R&D and other developments costs we used in our analysis are shown in Table VI-6 below, with the detailed per-certification R&D cost analysis shown in Appendix E.

Table VI-6. Summary of Annualized Research & Development Costs

		Dollars per Year per Model GDF Class				
Module	Description	1	2	3	4	5
1	Phase I Annualized R&D Costs	$29,650	$88,572	$286,771	$196,642	$26,534
2	Phase II Annualized R&D Costs	$296,495	$885,717	$2,867,711	$1,966,416	$265,338
3	ORVR Compat. Annualized R&D Costs	$59,299	$177,143	$573,542	$393,283	$53,068
4	Liquid Retention Annualized R&D Costs	$29,650	$88,572	$286,771	$196,642	$26,534
5	Spillage Annualized R&D Costs	$29,650	$88,572	$286,771	$196,642	$26,534
6	ISD Annualized R&D Costs	$148,248	$442,858	$1,433,856	$983,208	$132,669
	Total Annualized R&D Costs	$592,990	$1,771,433	$5,735,423	$3,932,833	$530,676

Certification Costs

As with the R&D costs, we assumed that Phase II and ISD systems would incur more certification costs than Phase I systems and components. Certification costs are comprised of ARB fees and manufacturer costs.

The ARB charges a reasonable fee to conduct an engineering evaluation, perform bench and as-applied testing of vapor recovery equipment, and prepare the Executive Orders which certify equipment. We assumed the ARB's fees (currently about $10,000 per Phase II certification and $2,000 per Phase I certification) would increase due to the increase in required component tightness, testing period (90 days to 180 days), and test-car matrices (100 cars to 200 cars). While the actual increase would likely be double or triple current ARB costs, we conservatively assumed for this analysis that ARB fees would be five times current levels.

Based on confidential discussions with industry representatives, we used a figure of $170,000 for current certification costs for each of the 80 assumed Phase II and ISD certifications. This amount includes $70,000 for in-field site preparation, setup, and testing by the manufacturer or third-party consultant; $70,000 for in-house bench testing and design refinements; and $20,000 for pressure monitoring. We then doubled this amount (to account for the doubling of the testing period and test-car matrix) to $340,000 for future recertifying each of the 80 assumed Phase II and ISD certifications under the staff's proposal. Consistent with the current ARB fees, we assumed that a Phase I recertification currently costs about 20% of a Phase II/ISD recertification (i.e., $34,000 per Phase I recertification). For this analysis, we assumed future Phase I recertifications would also double to $68,000 per recertification.

The total annualized certification costs (using 4 years project horizon, 10% discount rate for the CRF) are shown in Table VI-7. They are apportioned to each module and each Model GDF class in the same way the annualized R&D costs were apportioned.

Table VI-7. Summary of Annualized Certification Costs

		Dollars per Year per Model GDF Class				
Module	Description	1	2	3	4	5
1	Phase I Annualized Cert. Costs	$20,104	$60,056	$194,444	$133,332	$17,991
2	Phase II Annualized Cert. Costs	$201,038	$600,558	$1,944,444	$1,333,323	$179,912
3	ORVR Annualized Cert. R&D Costs	$40,208	$120,112	$388,889	$266,665	$35,982
4	Liquid Retention Annualized Cert. Costs	$20,104	$60,056	$194,444	$133,332	$17,991
5	Spillage Annualized Cert. Costs	$20,104	$60,056	$194,444	$133,332	$17,991
6	ISD Annualized Cert. Costs	$100,519	$300,279	$972,222	$666,662	$89,956
	Total Annualized Cert. Costs	$402,077	$1,201,117	$3,888,887	$2,666,646	$359,823

E. Recurring Costs

Because we are evaluating incremental cost increases with the staff's proposal, we believe that any increase in recurring costs associated with this proposal would be negligible relative to existing recurring costs. This is because the staff's proposal primarily requires more robust equipment that emit less ROG and are more durable than previously certified equipment; however, the basic configuration of GDFs would not change. Thus, for example, an existing GDF with 6 dispensers and 12 nozzles will continue to have that same basic configuration after the proposed regulation is implemented. Because of this, the amount of maintenance and other recurring costs associated with the staff's proposal should not change significantly from current levels.

F. Gasoline Recovery Credit

The amount of usable gasoline that is prevented from being emitted because of the proposed requirements represents a cost saving that must be factored into our analysis. To estimate such savings, we apportioned the 25.1 tons per day total ROG emission reductions to each proposed module and Model GDF class as noted earlier. We then converted these amounts into dollars saved using an average gasoline retail price of $1.50 per gallon, as shown in Table VI-8 below.

Table VI-8. Summary of Annual Gasoline Recovery Credit

		Dollars per Year per Model GDF Class				
Module	Description	1	2	3	4	5
1	Phase I	-$5,435	-$46,053	-$298,214	-$408,976	-$110,370
2	Phase II	-$3,370	-$28,553	-$184,892	-$253,565	-$68,429
3	ORVR Compat.	-$6,849	-$58,027	-$375,749	-$515,309	-$139,066
4	Liquid Retention	-$217	-$1,842	-$11,929	-$16,359	-$4,415
5	Spillage	-$4,240	-$35,921	-$232,607	-$319,001	-$86,089
6	ISD	-$7,175	-$60,790	-$393,642	-$539,848	-$145,689
	Total Annual Gas Credit	-$27,286	-$231,185	-$1,497,032	-$2,053,058	-$554,058

4. Overall, Per-Module and Per-Model GDF Class Cost-Effectiveness

Based on the previous calculations, we estimate the overall cost of the regulation upon full implementation in 2004 to be about $33 million per year. With a projected 25.1 tons per day of ROG reductions, this annual cost translates to an overall cost-effectiveness of about $1.80 per pound of ROG reduced. The remainder of this section discusses ways to evaluate the various contributions to the overall cost-effectiveness, on both a per-module and per-Model GDF basis.

A. Non-Weighted Individual Cost-Effectiveness Per Model GDF Class

The non-weighted cost-effectiveness shows the cost-effectiveness of each module on each Model GDF, independent of the other modules and Model GDFs. These values are useful if an agency decides to implement, for example, only module 2 (Phase II) and only for gas stations within Model GDF 4. We estimate that the non-weighted cost-effectiveness for each module on each Model GDF class ranges from a low of essentially $0.00 (Spillage and Phase I modules on the Model GDF 5 class) to a high of $6.71 (Phase II module on the Model GDF 1 class) per pound of ROG reduced. When all the non-weighted, per-module impacts are added for each Model GDF class (i.e., down the column), we find that the Model GDF 1 class would have the highest non-weighted cost-effectiveness at over $12 per pound of ROG reduced. At the other end of the spectrum, facilities in the Model GDF 5 class would have the lowest non-weighted cost-effectiveness at just over $0.60 per pound of ROG reduced. These results are presented in the non-shaded cells in Table VI-9 below.

B. Emission Reductions (E.R.)-Weighted Cost-Effectiveness Per Model GDF Class

The E.R.-weighted cost-effectiveness shows how the cost-effectiveness of each Model GDF class contributes to the overall cost-effectiveness of $1.80 per pound of ROG reduced. We estimate that the E.R.-weighted cost-effectiveness for each Model GDF class ranges from a low of essentially $0.08 (Model GDF classes 1 and 5) to a high of $0.83 (Model GDF 3 class) per pound of ROG reduced. Because most of the gas stations fit within Model GDF classes 3 and 4, we find that these two Model GDF classes represent the largest portions of the overall cost-effectiveness for the staff's proposal. These results are presented in the shaded cells in Table VI-9 below.

Table VI-9. Summary of Cost-Effectiveness per Model GDF Class

		Non-Wtd Cost-Effectiveness by Model GDF Class 1999 Dollars per Pound ROG Reduced					
Module	Description	1	2	3	4	5	
1	Phase I	$1.06	$0.34	$0.15	$0.05	$0.00	
2	Phase II	$6.71	$2.41	$1.34	$0.73	$0.42	
3	ORVR Compatibility	$1.01	$0.35	$0.19	$0.09	$0.04	
4	Liquid Retention	$0.50	$0.18	$0.10	$0.06	$0.04	
5	Spillage	$0.46	$0.14	$0.07	$0.02	($0.00)	
6	ISD	$2.76	$0.99	$0.55	$0.29	$0.13	
	Non-wtd C.E. per Model GDF Class	$12.49	$4.42	$2.41	$1.24	$0.63	
	E.R. per Model GDF*, tons/day	0.16	1.33	8.61	11.81	3.19	
	E.R.-wtd Cost-Effectiveness (C.E.)**	**$0.08**	**$0.23**	**$0.83**	**$0.58**	**$0.08**	**$1.80**
							Overall C.E.

*E.R. = emission reductions from Table VI-3

**E.R.-wtd C.E. = (E.R. per Model GDF x Non-Wtd C.E. per Model GDF Class) / (25.1 tons/day)

We should emphasize that the results shown in Table VI-9 are for information purposes only and are of limited utility at this time. This is because the cost-effectiveness of previously-proposed regulations have not been reported for distinct classes of different-sized facilities. Thus, it is not possible to compare the cost-effectiveness of the staff's proposal for small businesses (i.e., low-throughput GDFs) with, for example, the cost-effectiveness of the ARB's consumer products regulation on similarly-situated small businesses. The main use for the cost-effectiveness numbers presented in Table VI-9 is for intra-rulemaking comparisons (i.e., comparing this rule's impacts on different Model GDF classes).

C. Non-Weighted Individual Cost-Effectiveness Per Module

Another way to present the cost-effectiveness results is by comparing the cost-effectiveness of each module independent of the other modules. These non-weighted cost-effectiveness values for each module are useful if an agency decides to implement, for example, only module 2 (Phase II) on all gas stations regardless of throughput. We estimate that the non-weighted cost-effectiveness for each module across all Model GDF classes ranges from a low of $0.29 (Spillage module) to a high of $10 (Liquid retention module) per pound of ROG reduced. These results are presented in the non-shaded column in Table VI-10 below.

D. Emission Reductions (E.R.)-Weighted Cost-Effectiveness Per Module

Similar to earlier discussions, we can also present the E.R.-weighted cost-effectiveness for each module to show how each module contributes to the overall cost-effectiveness of $1.80 per pound ROG reduced. We estimate that the E.R.-weighted cost-effectiveness for each module ranges from a low (Spillage) of about $0.05 to a high (Phase II) of $1.03 per pound of ROG reduced. These results are presented in the shaded cells in Table VI-10 below.

Table VI-10. Summary of Cost-Effectiveness per Proposed Module

Module	Description	Non-Wtd Cost-Effectiveness by Module, $/Lb (A)	Emission Reductions (E.R.) by Module, tons/day (B)	E.R.-Wtd Cost-Effectiveness by Module, $/Lb (A)*(B)/25.1
1	Phase I	$0.50	5.0	**$0.10**
2	Phase II	$8.32	3.1	**$1.03**
3	ORVR Compat.	$0.55	6.3	**$0.14**
4	Liquid Retent.	$10.03	0.2	**$0.08**
5	Spillage	$0.29	3.9	**$0.05**
6	ISD	$1.57	6.6	**$0.41**
			Overall E.R.-Wtd C.E.	**$1.80**

To put these figures into context, Table VI-11 compares the overall and per-module cost-effectiveness range for this rulemaking with other recent ARB rulemakings.

Table VI-11. Cost-Effectiveness of Recently-Adopted ARB Regulations

ARB Regulation	Cost-Effectiveness $/Lb pollutant reduced	
	Range (Min to Max)	Overall (Reductions-Wtd)
Proposed EVR (as of 1/2000; ROG only)	$0.29 to $10	$1.80
Consumer Products Mid-Term 2 (10/99; ROG only)	$0.00 to $6.30	$0.40
Consumer Products Mid-Term 1 (7/97; ROG only)	$0.00 to $7.10	$0.25
Portable Gasoline Containers (9/99; ROG only)	---	$2.01
On-Road Motorcycles (12/98; ROG+NOx)	---	$5.60
Small Off-Road Engines (3/98; ROG+NOx)	---	$9.63
Marine Engines and Pers. Watercraft (12/98; ROG+NOx)	---	$3.57

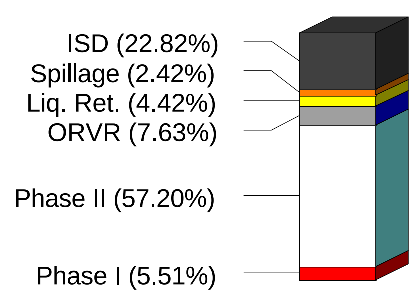
As Table VI-11 shows, the cost-effectiveness of the staff's proposed EVR requirements compares favorably to other, recent ARB rulemakings.

5. Cost to Consumers

If the total costs of the staff's proposal were passed on to the consumer, we would expect an overall increase of slightly less than ¼ of a penny per gallon ($0.0024 per gallon). This is simply the $33 million per year annual costs divided by the approximately 13.5 billion gallons of gasoline sold in California each year.

Fig. VI-1.

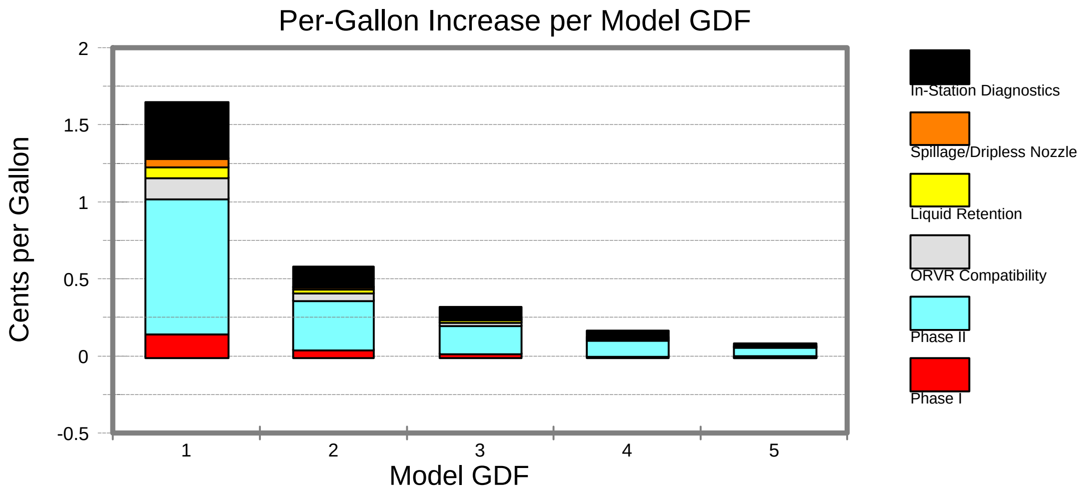
Modules Add 1/4 Penny to 1 Gallon



Of this 0.24 cent per gallon overall increase, the Phase II, ORVR compatibility, and ISD modules represent the largest fractions, as shown in Figure VI-1.

Because of the different apportionment of overall costs and gasoline throughput between the five Model GDF classes in our analysis, we would expect a gas station within Model GDF 1 to experience a different impact than a gas station in the Model GDF 5 class. Indeed, we find that the largest potential per-gallon increases are greatest with those facilities that have the least throughput of gasoline over which to spread the cost increases (e.g., Model GDFs 1 and 2), while the smallest increases are with those facilities at the opposite extreme of throughput (Model GDFs 4 and 5). We estimate the potential per-gallon increase ranges from a low of less than one-tenth of a penny per gallon for facilities within the Model GDF 5 class, up to a high of about 1.7 cents per gallon for the smaller gas stations within Model GDF 1. These results are shown Figure VI-2.

Fig. VI-2



Since most of the gasoline sold in California is sold at facilities within the Model GDF 3, 4 and 5 classes, most consumers will probably not notice the projected 0.24 cent per gallon overall increase from the staff's proposal.

VII. ENVIRONMENTAL IMPACTS OF PROPOSED AMENDMENTS

1. Enhanced Vapor Recovery Emission Reductions

A summary of the estimated ROG emission reductions is provided in the table below for both 2005 and 2010. The calculations that generated these emissions estimates are contained in Appendix D. These calculations are based on the most current available emission data, and include new emission categories such as liquid retention. Section 3 describes the EVR emission reductions in terms of the 1994 SIP, which is based on the older 1990 inventory used in the SIP.

Table VII-1. Estimated Enhanced Vapor Recovery Emission Reductions

		2005 ROG emission reductions (7.6 lbs/1000 gallons uncontrolled)		2010 ROG emission reductions (7.6 lbs/1000 gallons uncontrolled)	
Module	Emission Category	SCAB tons/day	Statewide tons/day	SCAB tons/day	Statewide tons/day
1	Phase I Vapor Recovery:	2.0	4.7	2.1	5.0
2	Phase II Vapor Recovery	1.2	2.9	1.3	3.1
3	ORVR Compatibility	1.4	3.4	2.7	6.3
4	Liquid Retention and Nozzle Spitting	0.1	0.1	0.1	0.2
5	Spillage including Dripless Nozzle	1.5	3.6	1.6	3.9
6	In-Station Diagnostics	2.6	6.2	2.8	6.6
	TOTALS:	**8.8**	**20.9**	**10.6**	**25.1**

Uncontrolled Emission Factor

As noted in the table above, these values assume a summer uncontrolled emission factor of 7.6 lbs/1000 gallons. This value is derived from the 1990 value of 10.0 lbs/1000 gallons adjusted for lower volatility gasoline as discussed below.

Before California Clean Burning Gasoline was introduced in 1992, the uncontrolled *Vehicle Refueling – Vapor Displacement* emission factor for California gasoline was 10.0 pounds per 1000 gallons throughput as derived from USEPA report, Compilation of Air Pollutant Emission Factors AP-42 [30]. Gasoline sold prior to 1992 had a Reid Vapor Pressure (RVP) of 9.0 pounds per square inch (psi) during the summer season as defined by RVP regulations, Title 13, California Code of Regulations, Section 2262.1.

As a result of the introduction of Phase I reformulated gasoline in 1992, the emission factor for California gasoline was reduced to 8.4 pounds per 1000 gallons, based on Phase I speciation data and the Phase I reformulated gasoline's lower Reid Vapor Pressure of 7.8 psi. This value was used in the 1996 vapor recovery regulation amendments.

Phase II reformulated gasoline was introduced in April of 1996. Staff proposes a revised emission factor for California gasoline of 7.6 pounds per 1000 gallons, based on Phase II reformulated gasoline's lower Reid Vapor Pressure (7.0 psi) and testing conducted since the introduction of Phase II reformulated gasoline. Since April of 1996, ARB has conducted certification tests during the summer RVP season at seven gasoline dispensing facilities (see Table VII-2). The average measured emission factor from these studies was 7.6 pounds per 1000 gallons.

ARB staff recognize that wintertime uncontrolled emissions are likely higher due to the higher RVP allowed during the winter months. Further work is planned to develop an uncontrolled emission factor for winter fuels.

Table VII-2. Calculation of Uncontrolled Emissions Using Phase II Reformulated Gasoline based on Summer 100-Car Test Results

100 Car Test	Fuel Dispensed (Gallons)	Reid Vapor Pressure (psi) Limit for Summer Fuel	Mass of Hydrocarbon in Vapor Returned to UST (Pounds)	Mass of Hydrocarbon Emitted at the Nozzle/Vehicle Interface (Pounds)	Uncontrolled Mass of Hydrocarbon (Pounds/1000 Gallons)
July 1999 OPW	1012	7.0	8.53	0.306	8.73
April 1999 Saber Technologies	981	7.0	6.37	0.095	6.59
June 1998 Healy	886	7.0	5.42	0.292	6.45
August 1997 Hasstech	1012	7.0	9.35	0.159	9.39
September 1996 Healy	939	7.0	6.69	0.224	7.37
September 1996 Catlow/Blackmer	842	7.0	6.60	0.132	7.99
April 1996 Hirt	679	7.0	4.39	0.145	6.68
Average	851	na	6.57	0.164	**7.60**

2. Basis for EVR Module Emission Reductions

The emission calculations are given in Appendix D. A summary of the basis for the emission reductions for each module is provided below.

Module 1 Phase I Vapor Recovery

Emission reductions are based on the change from 95% to 98% efficiency.

Module 2 Phase II Vapor Recovery

Emission reductions based on inclusion of pressure-related fugitives in the overall efficiency calculation. The emission factors for pressure-related fugitives are taken from baseline tests to determine emissions related to ORVR fuelings that were conducted by ARB in summer of 1998.[10] Due to the numerous improvements proposed to the certification of Phase II systems, staff believes the emission reductions will likely be higher than estimated here.

Module 3 ORVR Compatibility

The emission reductions are based on the elimination of any excess emissions due to ORVR fueling. The emission factors for ORVR fueling were taken from the ARB 1998 ORVR field tests.[10]

Module 4 Liquid Retention and Nozzle Spitting

These emission reductions are based on a very small number of fuelings observed at five Sacramento test site stations, which probably have the best nozzles in the State. The estimated emission reductions are expected to increase once more data is collected.

Module 5 Spillage

The spillage emission reductions assume elimination of pre-fueling and post-fueling spillage as was described in Section IV. This changes the emission factor from 0.42 to 0.24 lbs/1000 gallons.

Module 6 In-Station Diagnostics

The ISD emission reductions are based on the assist system A/L failure data collected in the 1999 ARB/CAPCOA field tests.[4] As ISD is expected to detect several other failure modes, these emission estimates are probably low. The goal of ISD is to bring the in-use efficiency to the 90% efficiency currently assumed in the inventory. Thus, emissions for this category could also be estimated assuming an existing in-use efficiency, which most stakeholders agree is well below 90%, and calculating the emission difference between the current in-use efficiency and 90%.

3. Impacts on the 1994 Ozone SIP and Inventory

The 1994 State Implementation Plan (SIP)[31] for Ozone is California's master plan for achieving the federal ozone standard in all areas of the state by 2010. The 1994 SIP includes state measures to control emissions from motor vehicles and pesticide usage, local measures for stationary and area sources, and federal measures for sources under exclusive or practical federal control. U.S. EPA approved the 1994 SIP in September 1996 (62 Federal Register 1150-1201 (January 8, 1997)). Although U.S. EPA has not yet approved subsequent plan revisions for ozone, carbon monoxide, and particulate matter, these plans also rely on measures in the 1994 SIP.

A. SIP Lawsuit Settlement

In 1997, a lawsuit was filed against South Coast AQMD, ARB, and U.S. EPA (Coalition for Clean Air v. South Coast Air Quality Management District) by three Los Angeles based environmental groups for failure to implement specific measures contained in the 1994 SIP. In January 1999, the Board approved a settlement regarding ARB's portion of the SIP litigation.[1]

ARB's ongoing evaluation has demonstrated that some regulatory strategies in the 1994 SIP are infeasible or would be ineffective in reducing emissions. As ARB has implemented the SIP over the last five years, some measures have delivered more reductions than anticipated, while other measures have delivered fewer reductions due to technical or economic concerns. ARB has not implemented several measures, and as a result, the emission reductions from those measures need to be replaced to achieve attainment.

The lawsuit settlement addresses near-term emission reduction shortfalls of 42 tons per day of ROG and 2 tons per day of NOx (emission reduction numbers are for South Coast Air Basin in 2010). Under the terms of the settlement, ARB is obligated to achieve the following amounts of emission reductions:

12 tons per day of ROG from measures adopted in 1999;
14 tons per day of ROG from measures adopted in 2000;
16 tons per day of ROG from measures adopted in 2001; and
2 tons per day of NOx from measures adopted in 2000

In 2000, ARB staff will present a number of control measures to the Board for consideration, including: enhanced vapor recovery; emission standards for medium and heavy-duty gas trucks; a lower NOx standard for bus engines; and a suggested control measure for architectural coatings. If the proposed new measures are adopted, the emission reductions will be applied to the 14 tons per day of ROG emission reductions and 2 tons per day of NOx reductions needed from measures adopted in 2000.

B. Review of SIP Baseline Measure: Vapor Recovery Program

Because the vapor recovery regulations were already adopted at the time the 1994 Ozone SIP was developed, emission reductions from those regulations were incorporated into the SIP baseline. Regulations in the baseline for the 1994 SIP were carried over into subsequent plans for particulate matter and carbon monoxide, and were also included in the South Coast Air Quality Management District's 1997 and 1999 ozone plan updates.

In the 1994 SIP, Phase I vapor recovery systems are assumed to have a control efficiency of 95 percent and Phase II systems have a control efficiency of 90 percent (a 95 percent certification level with a five percent defect rate). There are a number of stations that are exempt from vapor recovery controls, either due to low gasoline throughput or because of the nature of the fuel dispensing (i.e., dispensers at boating ramps). Table VII-3 contains the South Coast Air Basin's (SCAB) uncontrolled emissions in 2010 (after adjusting for California's cleaner burning gasoline) for gasoline dispensing facilities, including exempt stations, which were used in the 1994 SIP. The table also shows projected emission reductions due to the vapor recovery program for the four main categories of emissions from gasoline dispensing facilities.

Table VII-3. Vapor Recovery Control Baseline Measure Using 1994 SIP Emissions Inventory SCAB in 2010 (in tons per day)

1994 SIP Category	Uncontrolled Emissions	1994 SIP Controlled Inventory	Reductions from Vapor Recovery Control Assumed in 1994 SIP
	ROG	ROG	ROG
Phase I	61.7	5.7	56
Phase II	65.1	9.1	56
Breathing Losses	6.7	1.0	5.7
Spillage	4.6	4.6	0
Total	138.1	20.4	117.7

C. Current Vapor Recovery Program

Unfortunately, in many cases, vapor recovery systems are not working in the field to control emissions at the level assumed in the 1994 SIP. As a result, significant emission reductions are being forgone. Table VII-4 shows staff's estimate of the current emission reductions being achieved by vapor recovery systems at gasoline dispensing facilities using the 1994 SIP emissions inventory. Compared with the 1994 SIP which assumed that Phase II vapor recovery systems have a control efficiency of 90 percent, ARB staff estimate the actual in-use efficiency is about 76 percent due to low air to liquid test ratios, pressure-related fugitives, and ORVR compatibility issues. Some of these excess emissions are offset by the fact that spillage emissions are being controlled to a greater extent than the 1994 SIP assumed. However, due to Phase II vapor recovery system inefficiencies, there is a projected shortfall of about 6.7 tons per day of ROG emission reductions in the South Coast Air Basin in 2010. This estimate is conservative in that it does not account for the projected loss of emission benefits from current Phase I vapor recovery systems due to decreased in-use efficiency and other system defects which have not been quantified. The Phase I vapor recovery deficiencies will be addressed by the proposed EVR regulation.

Table VII-4. Current Vapor Recovery Control Using 1994 SIP Emissions Inventory SCAB in 2010 (in tons per day)

1994 SIP Category	Uncontrolled Emissions	Estimated Controlled Inventory with Current Vapor Recovery Program	Reductions due to Current Vapor Recovery Controls	Emission Reduction Shortfall/Surplus from 1994 SIP Target
	ROG	ROG	ROG	ROG
Phase I	61.7	5.7[1]	56	Not quantified
Phase II	65.1	17.6[2]	47.5	(8.5)
Breathing Losses	6.7	1.0	5.7	0
Spillage	4.6	2.8[3]	1.8	+ 1.8
Total	138.1	27.1	111.0	(6.7)

[1] This number assumes full emission benefits of Phase I vapor recovery systems. ARB staff believes that actual in-use emissions are higher due to Phase II vapor recovery equipment connection problems and other system defects. However, at this time, insufficient studies have been conducted to accurately quantify the increased in-use emissions.

[2] This number includes additional emissions from gasoline dispensing facilities that are a result of the control equipment used to meet the emission target in the 1994 SIP. These excess emissions -- which result from added pressure to the system or liquid retention in the nozzles -- are roughly 4 TPD of the 8.5 TPD shortfall.

[3] These reductions result from a requirement that took effect in 1996 that limits gasoline spillage to 0.42 lb/1000 gallon. The 1994 SIP baseline used a gasoline spillage factor of 0.7 lb/1000 gallons.

D. Statewide Benefits of Proposed Enhanced Vapor Recovery Regulation

To remedy the problem areas with today's vapor recovery program and to control the excess emissions identified, the following areas are being addressed by staff's proposed EVR regulations: ORVR compatibility; in-station diagnostics; and other program improvements. These programmatic changes, coupled with increased enforcement efforts by the local districts, will result in emission reductions which exceed the projected 1994 SIP emission reduction target. As shown in Table VII-5, the vapor recovery program with EVR regulatory enhancements will remedy the projected 6.7 tons per day ROG shortfall and provide 6.5 tons per day of extra emission reductions beyond what was anticipated in the 1994 SIP in the South

Coast Air Basin in 2010.

Table VII-5. Vapor Recovery Control with Proposed EVR Regulations Using 1994 SIP Emissions Inventory SCAB in 2010 (in tons per day)

1994 SIP Category	Uncontrolled Emissions	1994 SIP Controlled Inventory After Proposed EVR Regulation	Reductions due to Vapor Recovery Control and Proposed EVR Regulation
	ROG	ROG	ROG
Phase I	61.7	3.9	57.8
Phase II	65.1	7.3	57.8
Breathing Losses	6.7	1.0	5.7
Spillage	4.6	1.7	2.9
Total	138.1	13.9	124.2

The preceding analysis focused on the South Coast Air Basin and its federal attainment year of 2010, however, the vapor recovery program provides substantial emission reductions statewide toward meeting the state and federal ozone standards. Federal ozone non-attainment areas that have earlier attainment dates, such as the San Joaquin Valley and Sacramento Metropolitan Region, also rely on emission reductions from the vapor recovery program. The Clean Air Act requires all non-attainment areas to demonstrate continuous progress toward attainment -- a steady three percent reduction per year in volatile organic compounds. ARB and the local districts will submit a rate-of-progress demonstration for the period 1996 through 1999. In this demonstration, we will acknowledge the current deficiencies with the vapor recovery program. As the proposed EVR regulation is phased-in over the next few years we expect the vapor recovery program to provide the emission reductions assumed in the 1994 SIP by 2005 at the latest.

E. Summary of 1994 SIP Analysis of Proposed EVR Regulations

Using 1994 SIP currency, the staff's proposal will meet the 1994 SIP baseline emission reductions target and provide an additional 6.5 tons per day of ROG emission reductions in the South Coast Air Basin in 2010. The emission reductions will be used in meeting the terms of the SIP lawsuit settlement agreement. As the proposed EVR regulation is phased-in over the next few years we expect the vapor recovery program to provide the emission reductions assumed in the 1994 SIP by

2005 at the latest.

F. Future Planning Efforts

ARB is scheduled to revise our statewide control strategy for ozone in the 2000 - 2001 timeframe. In future years, ARB will also develop plans for meeting fine particulate matter ambient air quality standards and regional haze requirements. Due to increases in both the on- and off-road emission inventories, staff will be looking at all feasible cost effective emission reductions, including re-examining the regulations currently in place for a broad range of mobile sources and consumer products under the jurisdiction of the ARB. Due to the large magnitude of emission reductions from vapor recovery systems, ARB will be closely examining the progress made toward reducing emissions from these systems.

VIII. ANALYSIS OF REGULATORY ALTERNATIVES

Health and Safety Code section 57005 (HSC 57005) requires the ARB to perform a cost analysis of alternatives to the proposed regulation under specified circumstances. The analysis is required when the proposed regulation is a major regulation, defined as potentially costing California business more than ten million dollars in any single year. As discussed in Chapter VI, we determined that the annual cost of the staff's proposal will be approximately $33 million upon full implementation in 2004. Thus, the staff's proposal is a major regulation under HSC 57005. As required under State law, we considered the following regulatory alternatives to the proposed amendments. Compared to these alternatives, our current proposal represents a fair and workable approach to achieving significant emission reductions with reasonable costs to industry and consumers.

1. Adopt No New Standards

As discussed previously in this report, essentially all possible control measures which the ARB determines are technologically and commercially feasible must be implemented to meet the State Implementation Plan (SIP) requirements. A commitment to amend the current vapor recovery regulation was not a formal part of the SIP when it was adopted in 1994, primarily because the ARB believed at that time that sufficient reductions could be achieved from the commitments already in the SIP. However, we have subsequently determined that additional control measures need to be implemented in order to meet the SIP commitments and contribute to achieving other air quality standards.

Without the 25.1 tons per day emission reductions to be achieved with the proposed standards, the SIP requirements will either not be met or will need to be made up at the expense of other stationary source categories. Local air districts already regulate most stationary sources, and the cost-effectiveness of additional regulations can be very significant. For example, the South Coast Air Quality Management District (SCAQMD) recently amended its Rule 1130 (Graphic Arts) to reduce ROG emissions by 0.56 tons per day in the district at a cost-effectiveness of $4.30 per pound of ROG reduced.[27] The adoption of similar stationary source regulations in sufficient numbers to achieve the same reductions as the staff's proposal may impose a significantly greater burden on California businesses and consumers than the staff's proposal.

2. Adopt Less Stringent Standards

The staff's current proposal is designed to be evaluated on a modular basis. As discussed in Chapter VI (Economic Impacts of the Proposed Standards), we have already evaluated the cost impacts of different combinations of the proposed six modules on different classes of gasoline dispensing facilities (GDFs). Any combination of the six modules other than that proposed by the staff (i.e., all six modules applicable to all GDFs) will result in less cost. However, only the combination of the six modules applied to all GDFs, as proposed by staff, will yield the desired 25.1 tons per day of ROG reductions. Thus, any proposal which applies less than all six modules or applies them on only certain GDFs will result in fewer reductions at possibly higher cost-effectiveness. As mentioned earlier, any difference in emission reduction would have to be made up with further emission reductions from other sources.

3. Adopt More Stringent Standards

The primary alternative which we considered that was more stringent than our current proposal was the requirement for continuous negative pressure. This proposal would have required all systems, including existing balance systems and some assist systems, to continuously draw air-vapor mixtures to a processor without pressurizing the underground storage tank. This proposal was elegant in its simplicity and potential increase in reductions. However, as discussed in detail in the Chapters 4 and 5 ("Summary of Proposed Amendments" and "Technological Feasibility of the Proposed Standards"), this proposal had significant potential problems that precluded its widespread application. Thus, the staff concluded that a more stringent proposal was not feasible at this time.

4. Conclusions

We evaluated a variety of regulatory alternatives and found that the current proposal represents a reasonable balance of potential emission benefits, use of demonstrated and emerging technologies, and reduced economic impacts.

IX. ENHANCED VAPOR RECOVERY IMPLEMENTATION

This section discusses the timetable for EVR implementation and the effect of the new standards on existing and future service station installations.

1. State Law Requirements and 4-year Clock

The EVR proposal significantly modifies existing standards for Phase I and Phase II vapor recovery systems. This means that existing vapor recovery system certifications would expire on the EVR effective date or the operative date of the new requirements and would need to be recertified to the new standards.

State law provides that vapor recovery systems certified under procedures in effect prior to adoption of revised standards and installed prior to the effective date of the revised standards may continue to be used for a period of four years after the effective date of the revised standards. This is commonly referred to as the "4-year clock." Thus, station owners who purchase and install a new vapor recovery system before the proposed effective date of April 2001, would have until April 2005 before their system would need to be upgraded to meet the EVR requirements. State law requires that replacement parts and components must be certified.

This same protection does not apply to new installations of vapor recovery systems. This means a service station constructed in April 2001 would need to install a certified vapor recovery system which meets the EVR requirements. Thus, state law does not provide an interim period to allow time to certify systems to the new standards for use in new installations.

Staff had addressed this gap in the existing certification procedure by allowing systems certified as of the effective date of the revised standards to remain certified for a period of six months from such date, or until the Executive Officer has determined whether the system conforms to the new standards, whichever occurs first. However, this six month grace period has been eliminated in the proposed certification procedure as it would in essence delay the EVR effective date and conflict with the SIP settlement agreement as discussed below.

2. State Implementation Plan (SIP) Settlement Commitment

The SIP settlement agreement resulted from the legal action taken by several environmental groups to address emission reduction shortfalls in the 1994 California State Implementation Plan for Ozone[31]. As per this agreement, ARB agreed to develop a proposal to achieve 5 to 10 tons/day of ROG emission reductions relating to vapor recovery operations in the South Coast Air Basin. The schedule in the agreement calls for an implementation date of 2004 as it was recognized that the four-year clock would delay achieving the emission reductions until four years after the effective date. Staff's proposal exceeds the settlement schedule by four months, with a proposed effective date of April 2001, with full implementation by April 2005.

3. Operative Dates

Staff has proposed a phase-in of EVR requirements, as modules 4, 5 and 6 are technology forcing. The proposed effective date is April 2001. This would start the four-year clock for all of the EVR modules such that all certified systems will need to meet all EVR requirements by April of 2005. The term operative date is used to describe requirements applicable to certification applications. Thus, a manufacturer seeking to certify a system in June 2001 must demonstrate compliance with Module 1 (Phase I), Module 2 (Phase II), Module 3 (ORVR Compatibility) and Module 4 (first Liquid retention requirements), but not the other module requirements. However, ARB will certify systems to meet module requirements before their operative date to encourage early use of systems with these module benefits.

Table IX-1. EVR Proposed Operative Dates

Module	Emission Category	Proposed operative date
1	Phase I Vapor Recovery 95% to 98 % efficiency	April 2001
2	Phase II Vapor Recovery Pressure related fugitives	April 2001
3	ORVR Compatibility	April 2001
4	Liquid Retention 350 ml/1000 gal 200 ml/1000 gal 100 ml/1000 gal	 April 2001 April 2002 April 2003
5	Spillage	April 2001
	And Dripless Nozzle	April 2003
6	In-Station Diagnostics	April 2001 April 2004

4. Replacement Parts

As discussed above, the four-year clock provided that existing systems may be used for four years after the effective date of new standards. However, many vapor recovery equipment components, such as nozzles and hoses, are expected to need replacement over this four-year period. State law requires that all necessary repair or replacement parts or components used during the four-year period be certified. Staff has proposed a new limited-term certification process to address certification of replacement components so that installed systems can continue operation with the best replacement parts available. The certification for these replacement parts will expire at the end of the four-year clock if the parts do not all of the new standards. However, when replacement parts certified to meet the new standard are commercially available, only those replacement parts shall be installed.

5. Effect of EVR Requirements on New Service Stations

As stated above, new installations must meet the EVR requirements in effect at the time of installation. Because of the phase-in of the requirements, a new station installed in summer of 2001 is likely to have a vapor recovery system that meets only the first three modules (including the first liquid retention standard) and would need to upgrade the system by April 2005 to meet the remainder of the EVR requirements. The upgrades for modules 4 and 5 deal with nozzle requirements and thus may require replacement of all nozzles. However, staff understands that nozzles are normally repaired or replaced about every two years for existing systems. So replacement of the nozzles meeting the final EVR standards could be folded into the normal nozzle replacement schedule.

Staff has proposed to place information on the EVR standards met by certified systems on the web to allow for informed vapor recovery equipment purchasing decisions. Thus, if a system has been certified for modules 1 through 5, but another has been certified for modules 1 through 3, the choice can be made as to whether to buy a system compliant with the minimum standards and upgrade later, or to purchase a system that also meets future EVR requirements.

The in-station diagnostics module, which will be required for all systems certified as of April 2004, will be required at all stations in April 2005. The installation of ISD sensors and connection of the sensors to the dataloggers might necessitate “breaking concrete” to provide trenches for the data lines. Ideally, conduits for future ISD data lines could be put in place when a new station is constructed.

6. Effect of EVR Requirements on Existing Service Stations

As described above, existing stations may continue to use their current vapor recovery systems for four years and maintain these systems with certified replacement parts. These stations would need to upgrade or replace the vapor recovery system to meet all of the proposed EVR requirements by April 2005. This could result in significant costs as discussed in Section VI and Appendix E.

The WRCB is also proposing regulations, scheduled for consideration in spring of 2000, that would require major modifications to service stations, including “breaking concrete” to install new dispenser pans. The first phase of dispenser pan replacement is proposed for July, 2001. There could be considerable cost savings if the EVR upgrades, such as the ISD conduit or sensor placement, could be included with the WRCB upgrades.

X. OUTSTANDING ISSUES

Staff presented the essential elements of the proposed amendments through nine public workshops and numerous individual meetings with stakeholders. Several issues were raised which were not completely resolved in the staff proposal to the satisfaction of all stakeholders. Key issues are discussed below:

1. Decertification of Vapor Recovery Systems

State law mandates decertification of existing systems when new performance standards are adopted. Since the EVR proposal contains new performance standards and specifications for virtually all aspects of Phase I and Phase II systems, all existing certified systems will be decertified and need to be recertified. The gasoline marketers and vapor recovery equipment manufacturers are concerned that with the more stringent application and testing requirements imposed by EVR, there may be a period where no certified systems are available for new installations. A related concern is the expense in modifying installed dispensing equipment, at the end of the four-year grandfather period, which still has a significant useful life.

Staff has carefully examined the proposed standards, identified those which are technology forcing and added lead time for those standards as needed. Staff believe the standards to be met by the April 2001 effective date are achievable and will make every effort to ensure certified systems are available for new installations. Staff's analysis, which assumes complete equipment replacement to meet the new standards, shows that the costs associated with upgrading the systems to meet the EVR requirements are reasonable and the emission reductions are cost-effective. According to equipment manufacturers, complete equipment replacement is not expected, as retrofit of existing equipment will be acceptable to meet many of the new standards.

Decertification affects other states that rely on California certification. These states may not have a four-year grandfather exemption (Section 41956.1(a), California Health and Safety Code) to allow installed systems to remain in place, so that the states would have non-certified equipment at all installations upon the EVR effective date. The American Petroleum Institute (API) is concerned that this immediate effect of EVR in other states will lead to unnecessary expense and disruption of operations if existing systems are required to all meet the new standards at once. Staff will work with API and other states to minimize any negative impacts of EVR implementation.

2. In-Station Diagnostics

Stakeholders have concerns about the in-station diagnostic (ISD) proposal. A commonly held view is that ISD is a good idea, but other vapor recovery issues should be addressed first, namely problems in quality and reliability of current vapor recovery equipment. Some are skeptical that the ISD system will work properly and provide useful information. Staff believes that reliability and ISD go hand-in-hand and that continuous monitoring of key parameters will show where equipment failures occur and thus promote the improvement of vapor recovery systems.

ISD systems based on pressure limits for gasoline vapor recovery systems are already required and used in Mexico City. As the staff ISD proposal is more comprehensive, a lead time of three years has been provided in order to develop new sensors, such as for vapor flow, and conduct field demonstrations of ISD technology. Staff has asked for input from the air pollution control districts, both technical and enforcement staff, to develop the ISD system criteria and ensure data generated and recorded helps keep the station in compliance. The cost-effectiveness of the ISD module was found to be $1.52/lb ROG emission reductions (compared to overall EVR cost-effectiveness of $1.80/lb) and assumed purchase of new monitoring equipment and dataloggers. Many stations already have sophisticated dataloggers at stations to meet the requirements of the underground storage tank leak detection regulations (Title 23, California Code of Regulations, Section 2633 and 2634). These can be upgraded to allow ISD for vapor recovery systems which would provide additional cost savings.

3. Underground Storage Tank (UST) Pressure Requirements

The EVR proposal seeks to minimize pressure-related fugitives and leaks from the underground storage tank by establishing pressure profiles which require the UST to stay at negative pressure most of the time. An alternative proposal is to require the UST to stay at negative pressure all of the time.

The negative pressure requirement is attractive for two reasons. First, any leaks in the UST vapor space would involve air leaking in, not vapors leaking out. Second, a negative pressure is simple to monitor and easy to detect a failure.

The concern regarding negative pressure is that the vapor recovery system would likely require a vapor processor to maintain the negative pressure and somehow handle the excess vapors that would occur when air is ingested into the UST. Currently, only assist systems with processors operate at continuous negative pressures. These represent less than 5% of existing installed systems. It is believed that a negative pressure requirement will result in all certified systems having processors. Destructive processors, or burners, will need to meet emissions limits for criteria and toxic products of combustion. Other processors, such as membranes, are possible options, but are still under development. The oil marketing industries are opposed to a requirement that would require the installation of a burner at every service station.

The staff's proposal seeks to minimize fugitive emissions and UST vapor space leaks with pressure profiles that allow the UST to occasionally operate at positive gauge pressures. However, the UST must operate at negative pressure most of the time. Staff believe that in this way emissions can be minimized successfully without requiring a processor. If the UST pressure remains at atmospheric pressure for long periods of time, this would signal a leak is present. The pressure could be continuously monitored using an ISD pressure sensor and thus provides the mechanism for prompt corrective action.

4. Limited Term Certification

There is currently no expiration date on the certification of a system. Staff propose to limit certifications to four years with opportunity for renewal at the expiration date. If deficiencies are documented during the four-year period, then the certification holder must fix the problems before renewal of the certification will be considered. Many of the equipment manufacturers disagree with the proposed limited term certification. They argue that a mechanism to remove a problem system already exists in the decertification process. The gasoline dispensing industry argues that such a limit will cause expensive removal and replacement of serviceable equipment and that purchasers of equipment may not be aware that the systems will be up for renewal within a short period of time. Staff believe that a regular review of certified systems is critical to ensuring system deficiencies are addressed. Staff believes that well-functioning systems will not have problems in renewing their certification. The limited term certification would resolve the current situation of some certified systems which continue to be installed long after these systems are no longer marketed or supported by the manufacturer. The CAPCOA vapor recovery committee supports limited term certification to provide an additional mechanism for addressing system problems. Staff would make information on vapor recovery system certification status available on the web so that purchasers of vapor recovery equipment can make informed decisions.

5. Vapor Recovery Equipment Recall

The gasoline marketers have proposed that a recall program be used to address equipment deficiencies, rather than decertification. The advantage would be that no recertification would be required. Staff believe that the existing decertification process coupled with the limited term certification proposed in EVR provides for ample notification and problem resolution without necessarily leading to decertification.

6. EVR Not Necessary if System Maintenance Improved

The gasoline marketers suggest that opportunities exist now, such as improved system maintenance at service stations, that would yield immediate emission benefits nearly equivalent to EVR at much lower costs. They suggest we work with industry to implement a current system improvement program immediately. The gasoline marketers also proposed establishment of a service station performance reporting system to develop information useful for ISD. This would allow ARB staff time to further develop the EVR proposal.

Staff believes that the delay to the significant improvements in certification performance criteria is not justified.   Districts need emission reductions now to meet their attainment goals. EVR will provide emission reductions by improving operation of in-use systems in several categories, such as spillage, pressure-related fugitives and ORVR compatibility. In-station diagnostics will assure system defects are corrected upon detection and help keep systems operating in compliance. Staff note that relying on industry oversight of vapor recovery systems was not successful when attempted in the SCAQMD as demonstrated by recent district audits.

7. Certification of “Sub-Systems”

Several stakeholders desire a “sub-system” certification option. For example, certification of a processor or ISD system would occur independent of other system components. Costs for certification testing would be greatly reduced if these types of “sub-systems” could be certified and then combined with other vapor recovery system components. Staff interprets State law as specifying certification of complete systems. Furthermore, in some cases, inadequate field performance of systems is a direct result of allowing certification of certain components without adequate testing of complete systems.

8. Warranty Changes

Staff proposes to require that vapor recovery equipment certification requirements continue to be met throughout the warranty period. This will require that significant improvements occur in the reliability and durability of system components. Manufacturers contend that it is unfair to apply a certification standard throughout the warranty period and have suggested that less stringent in-use equipment standards be applied instead. Staff argues that the requirements must be met throughout the certification operational test, which is proposed to be increased from a minimum of 90 days to a minimum of 180 days, or 6 months. The requirements should still be able to be achievable over the 1 year warranty period.

Districts have requested that the warranty periods be lengthened to promote equipment durability. Staff considered this change, but decided that the proposed limited certification, an improved certification process, better identification of maintenance procedures, in-station diagnostics and increased enforcement efforts by ARB will result in improved equipment durability without increasing warranty length. Staff may propose changing the warranty length in the future if needed.

9. ORVR fix on Vehicle instead of Phase II

The petroleum marketers have suggested that ARB staff investigate that vehicles be modified instead of Phase II systems to achieve ORVR compatibility. If all ORVR vehicles were equipped with mechanical seals, rather than liquid seals, then ORVR vehicles would be compatible with Phase II assist systems as vapor, rather than air, would be returned to the underground storage tank. Staff found that mechanical seal is rarely used for ORVR vehicles due to cost considerations. The cost-effectiveness requiring all ORVR vehicles to have mechanical seals is roughly $31/lb ROG reduced. In contrast, the proposed Phase II ORVR compatibility module has a cost-effectiveness of 53 cents/lb ROG reduced (the overall EVR cost effectiveness is $1.80/lb.)

10. Emission Factors

One district has expressed concern that the uncontrolled emission factor of 7.6 lbs per 1000 gallons is not representative. The emission factor for winter-time gasoline can go above 7.6 lbs per gallon as winter-time Reid vapor pressure is not regulated by the State. This was confirmed by recent ARB staff field tests. Staff believes that using the emission factor of 7.6 is appropriate because the vapor recovery program is primarily an ozone control measure and use of the “7.6” value will accurately predict the emission reductions during the summer ozone season. Staff is aware of the need to use accurate emission factors and will work with interested stakeholders to continue to refine the emission factor.

XI. RELATED VAPOR RECOVERY ACTIVITIES

As discussed in Section II, staff is working on other aspects of the vapor recovery program in addition to the proposed Enhanced Vapor Recovery. The topics below relate to current activities underway to increase emission reductions from the current vapor recovery program.

1. Improving Operation of Existing Vapor Recovery Equipment

Over the past year, extensive field work has been conducted to collect performance data for in-use vapor recovery components and systems. ARB and the districts collectively identified the areas which warranted immediate attention and developed protocols for obtaining comprehensive data. Approximately 1600 vacuum assist (bootless) type and 1000 balance type nozzles, and 280 drop tubes have been surveyed at 150 service stations. This information was gathered in cooperation with the following six districts: Sacramento Metropolitan AQMD, San Joaquin Valley Unified APCD, San Diego County APCD, Bay Area AQMD, South Coast AQMD and Monterey Bay Unified APCD. Furthermore, parts house testing has commenced for evaluating the integrity of new vapor recovery equipment being offered for sale.

These efforts have already delivered results. OPW no longer supplies the 11VAI aluminum spout assembly – it's off the market. In use, nearly half of these spouts exceeded the dimensional requirements listed in the Federal Register. Similarly, problems with sticking check valves in VST hoses have been addressed; the problem has been corrected in new hoses and older hoses in the field have been replaced. Additionally, concerns with leaking vapor paths in the 11VAI nozzle and pinched hoses due to the curley-Q arrangement have been resolved. The data also confirmed that the field modifications had been completed for the vapor piping configuration in Dresser/Wayne dispensers which originally contained liquid traps or allowed liquid to transfer from one hose to another. This condition had been revealed from an earlier study in one district. As a result of the parts house testing to date, a letter has been sent to a manufacturer regarding possible decertification of their pressure/vacuum (P/V) valve. ARB will take additional steps to assure that all the problems found are corrected.

A draft advisory pertaining to the use of inspection procedures to improve the in use effectiveness of the vapor recovery systems has been issued. These include the ring, bag and squeeze bulb (15" vacuum) tests. The ring test uses an industry standard round gauge to check the roundness of the spout. The bag test provides a method to detect leaking nozzles by sealing them with a plastic bag. The squeeze bulb test provides a method to determine if bootless nozzles or remote check valves allow air ingestion.

This advisory will be expanded to provide guidance for the increase on the frequency of testing for vapor recovery equipment. The proposed guideline is as follows:

- Monthly performance testing of all installations.
- After three consecutive monthly passes, quarterly testing.
- After two consecutive quarterly passes, semi-annual testing.
- Semi-annual testing will be the minimum requirement.
- Any single failure will trigger monthly testing.

<u>2. Contractor Training</u>

Most stakeholders agree that many deficiencies in vapor recovery system operation can be traced to improper installation or maintenance by contractors. Problems with contractors have also been identified by other agencies which regulate service stations, including Weights and Measures and the State Water Resources Control Board (SWRCB). Although Weights and Measures does require licensing of contractors who work on gasoline dispensers, more is needed to improve the current situation. The SWRCB is working with the Department of Consumer Affairs to upgrade the requirements for service station contractors. This was mandated as part of Senate Bill 989 (Chapter 812, Statutes of 1999) to improve the performance of UST leak detection systems. The SWRCB will require that maintenance contractors for these systems be licensed through training by the system manufacturers and a written test and must recertify every three years. Staff will continue to work with SWRCB , the districts, and other parties interested in ensuring only competent contractors work on vapor recovery systems.

<u>3. Inspection Procedures</u>

As discussed in item 1 above, ARB and district staff have developed simple inspection tools that could be used by service station operators and district inspectors to assure systems are operating properly. Examples of such procedures are the drop tube test, the bag test and the nozzle check valve test. Staff have agreed to include these procedures, where applicable, in the Executive Orders for future certifications.

<u>4. District Executive Order Review</u>

The districts have requested an opportunity to review the draft Executive Order before it is finalized by ARB staff. Currently, staff provide draft Executive Orders to the chair of the CAPCOA Vapor Recovery Committee for comment. Staff will continue to work with districts to define an appropriate expanded review process.

Staff’s intent is to establish a process in cooperation with CAPCOA which would allow identified district engineering, enforcement and permit specialists to review certain portions of the certification applications and review the draft Executive

Orders. Review of critical sections of certification applications by district representatives should facilitate identification of pertinent challenge and failure mode tests to be conducted during the certification process. Similarly, review of draft Executive Orders by district staff should enhance identification of any implementation, installation, inspection, and maintenance problems. Issues that must be addressed by CAPCOA and ARB include timeliness of review and confidentiality of manufacturers information.

XII. FUTURE ACTIVITIES

1. 2002 Technology Progress Review

Our discussions with equipment manufacturers indicate that manufacturers will be able to comply with the liquid retention, spillage, dripless nozzle and in-station diagnostics standards in the time provided. To ensure that manufacturers are adequately progressing in their efforts to comply, we will be conducting a mid-course status review. We are therefore proposing a progress review in 2002 to evaluate the success, cost, and certification status of liquid retention, spillage, dripless nozzle and in-station diagnostics standards. We believe a 2002 progress review will provide sufficient time for mid-course corrections if needed to address unforeseen circumstances.

The technology review will include at least the following:

- A review of the technology availability and associated costs to implement the technology, and

- A review of the phase-in schedule for the technology.

Although the assessments regarding the technology will be based on issues directly relevant to California, the staff is cognizant that all vapor recovery regulatory actions are likely to have an impact outside the State. When reasonable, staff will endeavor to minimize negative impacts on areas outside of California.

2. Further Refinement of the Emissions Inventory

As with virtually all other sources of air pollution, the vapor recovery emissions inventory will undergo refinements in the future as we gain a better understanding of the factors that influence emissions from this category. This continual improvement in emissions data is a natural result of better surveys, testing, enforcement, and other means of information gathering. The ARB staff are committed to refining the inventory for all sources of emissions as more accurate information becomes available. It should be emphasized, however, that this refinement is an on-going process which should not preclude the adoption of control measures based on the best data currently available to staff. The staff's proposal, its commercial and economic impacts, and its benefits were all evaluated based on the best available data. Therefore, the staff's proposal represents the most reasonable set of standards given our current understanding of the operation of vapor recovery systems, the technologies needed to reduce emissions, and consumer behavior patterns that affect emissions.

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APPENDIX A: PROPOSED AMENDMENTS TO
THE CALIFORNIA CODE OF REGULATIONS

APPENDIX B: PROPOSED AMENDMENTS OF THE VAPOR RECOVERY CERTIFICATION AND TEST PROCEDURES

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TP-201.2D	Adopt	Post-Fueling Drips from Nozzle Spouts
TP-201.2E	Adopt	Gasoline Liquid Retention in Nozzles and Hoses
TP-201.2F	Adopt	Pressure-Related Fugitive Emissions
TP-201.2H	Adopt	Determination of Hazardous Air Pollutants from Phase Vapor Recovery Combustion Processors
TP-201.2O	Adopt	Pressure Integrity of Drop Tube Overfill Protection Devices
TP-201.3A	Repeal	Determination of 5 Inch WC Static Pressure Performance of Vapor Recovery Systems of Dispensing Facilities
TP-201.5	Amend - shown as proposed	Determination (by Volume Meter) of Air to Liquid Volume Ratio of Vapor Recovery Systems
TP-201.5	Current - shown as repeal	Determination (by Volume Meter) of Air to Liquid Volume Ratio of Vapor Recovery Systems of Dispensing Facilities

APPENDIX C: VAPOR RECOVERY HEALTH AND SAFETY CODE STATUTES

APPENDIX D: ENHANCED VAPOR RECOVERY EMISSION REDUCTIONS CALCULATIONS

APPENDIX E: SPREADSHEETS FOR COST-EFFECTIVENESS ANALYSIS