SUBCHAPTER 4.3

HAZARDS

4.3 HAZARDS

4.3.1 INTRODUCTION

Hazard impacts are related to the risks of explosions or the release of hazardous substances in the event of an accident or upset conditions. The Initial Study identified the following types of control measures as having potentially significant hazards impacts: (1) use of reformulated coatings, solvents, and consumer products; (2) modifications at refineries to produce reformulated fuels; (3) greater use of alternative clean fuels; (4) the use of SCR; and (5) the use of fuel additives.

4.3.2 2003 AQMP CONTROL MEASURES WITH POTENTIAL HAZARD IMPACTS

The 2003 AQMP continues the air quality management strategy of advancing clean technologies and promoting their use. Table 4.3-1 lists the 2003 AQMP control measures which may result in the use of compliance options that could generate significant hazard impacts.

4.3.3 SIGNIFICANCE CRITERIA

Hazard impacts will be considered significant if any of the following criteria are met:

- The project results in a substantial number of people being exposed to a substance causing irritation;
- The project results in one or more people being exposed to a substance causing serious injury or death; or
- The project creates substantial human exposure to a hazardous chemical at levels equal to or greater than the Emergency Response Planning Guide (ERPG)-2 level established for that compound.

4.3.4 POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Reformulated Coatings, Solvents and Consumer Products

PROJECT SPECIFIC IMPACTS: The 2003 AQMP includes control measures that could require reformulation of consumer products including CTS-07, CTS-10, CONS-1, CONS-2 and some of the long-term CARB control measures.

It is expected that future VOC content limits required for coatings and consumer products can be achieved, in part, through the use of coatings and products reformulated with acetone exempt solvents and water based solvents. Acetone is an exempt compound from air quality rules and regulations because of its low reactivity.

TABLE 4.3-1

Control Measures with Potential Hazard Impacts

Control Measures	Control Measure Description (Pollutant)	Control Methodology	Impact
MEASURES TO BE IMPLEMENTED BY THE SCAQMD			
CMB-10	Additional Reductions for NOx RECLAIM	Add on control equipment, process changes, purchase RTCs	SCR to control NOx could result in hazard impacts associated with ammonia.
CTS-07	Further Emission Reductions from Architectural Coating and Cleanup Solvents	Reformulated low-VOC coatings/solvents.	Potential exposure to glycol ethers; flammability of acetone
CTS-10	Miscellaneous Industrial Coatings and Solvent Operations	Reformulation/Alternative Applications, Innovative implementation mechanism	Potential exposure to glycol ethers; flammability of acetone
MSC-08	Further Emission Reductions from Large VOC Sources	Emission Reduction Plan; Controls based on specific source categories	Potential exposure to glycol ethers; flammability of acetone
LTM-ALL	Long-Term Control Measures	Near-zero or zero VOC coating and solvent formulations, add-on controls, inspection & maintenance, process changes	Potential exposure to glycol ethers; flammability of acetone
MEASURES TO BE CONSIDERED BY OTHER AGENCIES			
ON-RD HVY DUTY-3	Pursue Approaches to Clean Up the Existing Truck/Bus Fleet	Reduce emissions from existing heavy-duty diesel vehicles through a mix of strategies.	The use of fuel additives is federally regulated and requires evaluation of health effects prior to approval.
OFF-RD CI-1	Pursue Approaches to Clean Up the Existing Heavy Duty Off-Road Equipment Fleet (Compression Ignition Engines) – Retrofit Controls	Engine modifications, add on control technology, alternative clean fuels	The use of fuel additives is federally regulated and requires evaluation of health effects prior to approval. SCR to control NOx could result in hazard impacts associated with ammonia.
MARINE-1	Pursue Approaches to Clean Up the Existing Harbor Craft Fleet – Retrofit Controls, Cleaner Engines and Fuels	Retrofit crtl. Tech., Add on control devices, Alternative Clean Fuels, Electrification	May promote the use of alternative fuels, particularly compressed natural gas.
MARINE 2	Pursue Approaches to Reduce Land-Based Emissions at Ports – Alternative Fuels, Cleaner Engines, Retrofit Controls, Electrification, Education Programs, Operational Controls	Retrofit control. Tech., Alternative Clean Fuels, electrification of diesel equip., operational changes	May promote the use of alternative fuels, particularly compressed natural gas. Potential fuel additives could be hazardous.

TABLE 4.3-1 (Continued)

Control Measures with Potential Hazard Impacts

Control Measures	Control Measure Description (Pollutant)	Control Methodology	Impact
FUEL-1	Set Additives Standards for Diesel Fuel to Control Engine Deposits.	Deposit control additives	The use of fuel additives is federally regulated and requires evaluation of health effects prior to approval.
CONS-1	Set New Consumer Product Limits for 2006	Reformulation/alternative applications	Potential exposure to glycol ethers, flammability of acetone, potential increase use of non-VOC toxic materials (perchloroethylene, methylene chloride)
CONS-2	Set New Consumer Product Limits for 2008 – 2010	Reformulation/alternative applications	Potential exposure to glycol ethers, flammability of acetone, potential increase use of non-VOC toxic materials (perchloroethylene, methylene chloride)
FVR-2	Recover Fuel Vapors from Gasoline Dispensing at Marinas	Add on control technology.	Potential hazards associated with vapors.
LONG TERM	On-Road Heavy Duty Vehicles - Provide incentives for cleaner trucks and buses, including school buses. On-board diagnostics, in-use testing.	Reduce emissions through a mix of strategies	May promote the use of alternative fuels, particularly natural gas
	Off-Road Class 1 Vehicles - Provide incentives for cleaner off-road equipment. Lower emission standards for new Off-road compression ignition engines.	Engine modifications, add on control technology, alternative clean fuels	May promote the use of alternative fuels, particularly natural gas
	Ports/Marine – Pursue advanced technologies and innovative strategies – alternatives for dockside power and propulsion in/out of port, operational controls. Cleaner fuels, incentives for cleaner ships, smoke limits.	Operational controls, cleaner fuels, cold ironing, retrofit controls, smoke (opacity) limits	May promote the use of alternative fuels, particularly natural gas

TABLE 4.3-1 (Concluded)

Control Measures with Potential Hazard Impacts

Control Measures	Control Measure Description (Pollutant)	Control Methodology	Impact
	Railroad/Locomotives -- Pursue tighter federal emission standards for locomotives, more stringent emission standards for new and remanufactured locomotive engines	Accelerate intro. of new, lower emitting locomotive engines, add on controls, alternative fuels	May promote the use of alternative fuels, particularly natural gas
	Fuels – sulfur/ash content limits for diesel engine lubrication oils; infrastructure for zero-emission vehicles - electric, hydrogen Low-Sulfur Standards for Diesel Fuel for Trucks/Buses and Off-Road Equipment, and Stationary Engines, Incentives to Accelerate Clean Up of Existing Diesel Engines	Sulfur/ash limits, construction of new infrastructure	May promote the use of alternative fuels, particularly natural gas
LONG TERM (cont.)	Consumer Products - Future consumer products regulations	Reformulation/alternative applications	Potential exposure to glycol ethers, flammability of acetone, potential increase use of non-VOC toxic materials (perchloroethylene, methylene chloride)
Conceptual Ideas for Possible Consideration as Long-Term Measures			
Conceptual Control Measures	Control of Emissions from Port Operations	Cold-ironing, electrification, diesel truck retrofit, low sulfur diesel	May promote the use of alternative fuels, particularly natural gas
	Consumer Products	Regulate additional consumer products	Potential exposure to glycol ethers, flammability of acetone, potential increase use of non-VOC toxic materials (perchloroethylene, methylene chloride)

As illustrated in Table 4.3-2, the flammability classifications by the National Fire Protection Association (NFPA) are the same for acetone, t-butyl acetate, toluene, xylene, MEK, isopropanol, butyl acetate, and isobutyl alcohol. Recognizing that as a "worst-case" acetone has the lowest flash point, it still has the highest Lower Explosive Limit, which means that acetone vapors will not cause an explosion unless the vapor concentration exceeds 26,000 ppm.

TABLE 4.3-2

Chemical Characteristics for Common Coating Solvents

Traditional/Conventional Solvents						
Chemical Compounds	**M.W.**	**Boiling Point (F)**	**Flashpoint (F)**	**Vapor Pressure (mmHg @ 68 F)**	**Lower Explosive Limit (% by Vol.)**	**Flammability Classification (NFPA)***
Toluene	92	231	40	22	1.3	3
Xylene	106	292	90	7	1.1	3
MEK	72	175	21	70	2.0	3
Isopropanol	60	180	53	33	2.0	3
Butyl Acetate	116	260	72	10	1.7	3
Isobutyl Alcohol	74	226	82	9	1.2	3
Stoddard Solvent	144	302-324	140	2	0.8	2
Petroleum Distillates (Naptha)	100	314-387	105	40	1.0	4
EGBE	118	340	141	0.6	1.1	2
EGME	76	256	107	6	2.5	2
EGEE	90	275	120	4	1.8	2
Acetone	58	133	1.4	180	2.6	3
Di-Propyl Glycol	134	451	279	30	1	1
Propylene Glycol	76	370	210	0.1	2.6	1
Ethylene Glycol	227	388	232	0.06	3.2	1
Texanol	216	471	248	0.1	0.62	1
Oxsol 100	181	282	109	5	0.90	1
t-Butyl Acetate	113	208	59		1.5	3
Hexamethylene Diisocyanate (HDI)	168	415	284	0.5	1	1
Methylene Bisphenyl Diisocyanate	250	314	385	0.5	1	1
Toluene Diisocyanate (TDI)	174	200	270	0.04	1	1

*National Fire Protection Association
0 = minimal; 1 = slight; 2 = moderate; 3 = serious; 4 = severe

In contrast, toluene vapors can cause an explosion at 13,000 ppm, which poses a much greater risk of explosion. The concentration of xylene vapors that cause an explosion is even lower at 10,000 ppm. Under operating guidelines of working with flammable coatings under well-ventilated areas, as prescribed by the fire department codes, it would be difficult to achieve concentrated streams of such vapors.

Assuming as a "worst-case", although not likely, it is assumed that most affected 2003 AQMP coating categories would be reformulated with acetone to meet the interim and final VOC content limits, it is anticipated that impacts to fire department would still be insignificant.

Chemistry classes at all levels from grade school to universities, as well as industrial laboratories, use acetone for wiping down counter tops and cleaning glassware. Additional uses for acetone include solvent for paint, varnish, laquers, inks, adhesives, floor coatings, and cosmetic products including nail polish and nail polish remover.

Labels and MSDSs accompanying acetone-based products caution the user regarding acetone's flammability and advises the user to "keep the container away from heat, sparks, flame and all other sources of ignition. The vapors may cause flash fire or ignite explosively. Use only for ventilation." All of the large coating manufacturers currently offer pure acetone for sale in quart or gallon containers with similar warnings.

Interviews with four local fire departments during the 1996 amendments to Rule 1113 revealed that all four departments would be equally concerned with any coating or solvent, which has a flashpoint below 65 degrees Fahrenheit. Based on inquiries from the SCAQMD, Captain Michael R. Lee, of the Petroleum-Chemical Unit for the County of Los Angeles Fire Department, submitted a letter to the SCAQMD stating that the Uniform Fire Code (UFC) treats solvents such as acetone, butyl acetate, MEK, and xylene as Class I Flammable Liquids. Further, the UFC considers all of these solvents to present the same relative degree of fire hazard. Captain Lee goes on to state, "In my opinion, acetone presents the highest degree of fire hazard than others. All four should be used with extreme caution, with proper safeguards in place."

The County of Los Angeles, Fire Department, Fire Prevention Guide #9 regulates spray application of flammable or combustible liquids. The guide requires no open flame, spark-producing equipment or exposed surfaces exceeding the ignition temperature of the material being sprayed within the area. For open spraying, as would be the case for the field application of the acetone-based coatings, no spark-producing equipment or open flame shall be within 20 feet horizontally and 10 feet vertically of the spray area. Anyone not complying with the above guidelines would be in violation of the current fire codes. The fire department limits residential storage of flammable liquids to five gallons and recommends storage in a cool place. If the flammable coating container will be exposed to direct sunlight or heat, storage in cool water is recommended. Finally, all metal containers involving the transfer of five gallons or more should be grounded and bonded.

Based upon the above considerations, significant adverse hazard impacts are not expected. Similarly, any increase in future compliant coating materials would be expected to result in a concurrent reduction in the number of accidental releases of coating materials. As a result, the net number of accidental releases would be expected to remain constant, allowing for population growth in the SCAQMD. Furthermore, if manufacturers use solvents such as Texanol, propylene glycol, etc., in future compliant water-borne coatings, significant adverse hazard impacts would not be expected to occur because in general these solvents are less flammable solvents as rated by the NFPA.

PROJECT-SPECIFIC MITIGATION: No significant impacts on hazards associated with reformulated coatings, solvents and consumer products are expected so no mitigation measures are expected.

Hazards Associated with Modifications at Refineries to Produce Reformulated Fuels

Modifications are likely to be required at refineries in the Basin to produce CARB Phase IV gasoline or some other type of alternative fuel. Modifications were required at all refineries in the Basin to produce reformulated gasoline in compliance with CARB Phase 2 and Phase 3 requirements. EIRs were required for most of these modifications. Significant hazard impacts due to the implementation of CARB Phase 2 and Phase 3 requirements were identified for a number of refineries associated with additional storage of flammable materials (e.g., LPG), additional transport of hazardous materials (e.g., LPG and isobutane), and hazards related to the potential release of hazardous materials (e.g., hydrogen sulfide).

Although the specific modifications to the refineries are currently unknown, changes that would require that additional fuels be produced would require refinery modifications which could include the ability to process additional quantities of crude (expanded crude units), crack more intermediate streams (e.g., the fluid catalytic cracking unit), and the ability to produce more alkylate (the main blending component of gasoline). Refineries operate at or near capacity on a continuous basis. Therefore, modifications to existing major processing units or the construction of new major processing units at the refineries would be required. Based on the analysis from previous refinery modifications to produce CARB Phase 2 and Phase 3, it is expected that some of these modifications would result in significant hazard impacts, resulting in an increase in exposure to hazardous materials/flammable materials to the surrounding population.

PROJECT-SPECIFIC MITIGATION: The following mitigation measures are required for refinery modifications:

HZ1: To reduce the likelihood of the occurrence of an upset condition, a pre-start up safety review will be performed for those refinery additions and proposed modifications, where the change is substantial enough to require a change in the process safety information and/or where an acutely hazardous and/or flammable material would be used. The review will be performed by personnel with expertise in process operations and engineering. The review will verify the following:

- Construction and modifications are in accordance with design specifications and applicable codes.

- Safety, operating, maintenance, and emergency procedures are in place and are adequate.

- Process hazard analysis recommendations have been addressed and actions necessary for start-up have been completed.

- Training of each operating employee and maintenance worker has been completed.

- Written process safety information is available for the employer and employees to identify and understand the hazards posed by the process.

Compliance with existing regulations and implementation of the safety review measures would further minimize the potential impacts associated with a release but are not expected to eliminate the potential hazard impacts. Therefore, the impacts on hazards due to refinery modifications are expected to remain significant.

Use of Alternative Fuels

The AQMP would establish incentive programs and in-use strategies that may require or promote the use of alternative fuels, particularly compressed natural gas, including some of the long term and conceptual long-term control measures. This presents a potential safety issue due to the increased transport, use and handling of gaseous fuels. Compressed natural gas is a flammable material and increased use of natural gas could result in increased hazards associated with the transport and use of natural gas, particularly in mobile sources.

Methanol

Methanol or methyl alcohol can be produced from natural gas, coal or biomass. Methanol is mainly produced from natural gas. The methanol fuel that is most widely used currently is M85, a mixture of 85 percent methanol and 15 percent unleaded gasoline. M100, consisting of 100 percent methanol, may increasingly be used for low emission methanol powered vehicles as a result of the implementation of the SCAQMD fleet vehicle rules.

PROJECT-SPECIFIC IMPACTS: The energy content of methanol is lower than gasoline or diesel fuel. Based on energy, about 1.68 gallons of M85 methanol is equal to one gallon of gasoline. Compared to one gallon of diesel the fuel equivalent for M85 is 2.3. This requires larger fuel tanks in a methanol vehicle to achieve the same range as a gasoline- or diesel-powered vehicle. It would also require about 68 (gasoline) to 130 (diesel) percent more tanker deliveries to supply refueling stations with the same available energy as conventional fuels. Since the probability of accidents is related to the miles traveled, about 68 to 130 percent more delivery accidents can be expected with methanol than conventional fuels (assuming that they are delivered from similar source locations in similar sized tankers). However, the truck accident rate is small, on the order of one accident per ten million miles traveled (ENSR 1994) and the accident rate with chemical releases is even less, so this would not be a significant risk factor.

Methanol is more corrosive to rubber and plastic parts than gasoline and diesel fuel, which requires that parts more tolerant to such corrosion be incorporated into vehicles and refueling stations. Methanol-fueled vehicles also require a special (more expensive) lubricant with additives that enhance acid neutralization.

Compared with diesel fuel and gasoline the following can be stated:

- Diesel fuel and gasoline contain components that are considerably more hazardous than methanol. For example, diesel fuel contains highly toxic polynuclear aromatic hydrocarbons (PAH)s and gasoline contains an array of toxic compounds, including benzene, a known carcinogen. Table 4.3-3 presents a summary of the flammable and toxic hazards of methanol (M100) versus gasoline.

TABLE 4.3-3

Hazard Summary of Methanol Compared to Gasoline[1]

Toxicity	M100	Gasoline
Inhalation – Low Concentration		
Toxicity	3	10
Ease of Occurrence	10	10
Inhalation – High Concentration		
Toxicity	10	10
Ease of Occurrence	3	4
Skin Contact		
Toxicity	9	8
Ease of Occurrence	3	3
Ingestion		
Toxicity	10	10
Ease of Occurrence	8(2)[2]	3

Source: Table adapted from Machiel, 1998

1 1- No concern. 2 to 3 – Low Level concern. 4 to 6 – moderate concern. 7 to 8 – high-level concern. 9 to 10 – extreme hazard.

2 Number in parenthesis incorporates the lowered likelihood of ingestion due to the presence of additives.

- Diesel fuel and gasoline vapors are heavier than air (for a specific gravity of air =1, gasoline is 3.4 and diesel is greater than 4). Methanol is heavier than air but lighter (specific gravity is 1.11) than gasoline and diesel fuel and disperses more readily in air than gasoline or diesel fuel;

- Methanol has a higher auto ignition temperature (793 degrees Fahrenheit [^{o}F]) than diesel fuel (500 ^{o}F) or gasoline (500 ^{o}F);

- Methanol is more difficult to ignite since it has a "lower flammability limit" that is higher (5.5 percent) than gasoline (approximately one percent) or diesel fuel (0.5 percent);

- Unlike gasoline, methanol can ignite in enclosed spaces such as fuel tanks since its upper flammability limit is 15 percent and it is slightly heavier than air. For gasoline in a confined space, the vapor concentration exceeds the higher flammability limit (7.6 percent) and is therefore too high to ignite in the tank. Modifications such as materials inside the fuel tank that can arrest and quench flame propagation and modifications to isolate the tank from sparks and ignition sources are required to avoid ignition in the fuel tanks; and,

- In case of fire, methanol can be extinguished with water while water on gasoline or diesel fuel spreads the fire.

Methanol is generally stored in underground storage tanks. Because the fuel is corrosive to rubber, some metals and certain plastics, special methanol-compatible storage facilities, tanks, hoses pumps and parts are needed.

Based upon the preceding information, hazards associated with methanol are approximately equivalent or less compared to gasoline and diesel. Therefore, increased usage of methanol with a concurrent decline in usage of gasoline and diesel will not significantly alter existing hazards associated with mobile source fuels. Consequently, increased usage of methanol is not expected to generate significant adverse hazard impacts.

Compressed Natural Gas

Natural gas is a mixture of hydrocarbons, mainly methane, that are in gaseous form at ambient temperature and pressure. Natural gas can be compressed to increase its density, and in compressed form it contains a high enough fuel value that it can be used as a fuel for motor vehicles. Typical on-board pressures for CNG range from 3,000 to 3,600 pounds per square inch gauge (psig).

PROJECT-SPECIFIC IMPACTS: Compared with diesel fuel and gasoline the following can be stated:

- Diesel fuel and gasoline are toxic to the skin and lungs and CNG is not;

- Diesel fuel and gasoline vapors are heavier than air (for specific gravity of air =1, gasoline is 3.4 and diesel fuel is >4). CNG is lighter than air (specific gravity is 0.55) and disperses more readily in air;

- CNG has a higher auto ignition temperature (1,200 ^{o}F) than diesel fuel (500 ^{o}F) or gasoline (500 ^{o}F);

- CNG is more difficult to ignite since it has a "lower flammability limit" that is higher (5.3 percent) than gasoline (one percent) or diesel fuel (0.5 percent); and,

- Natural gas can be directly shipped via pipelines to the compressor station, rather than by on-road delivery trucks, and has less delivery accident risk than vehicle shipments.

The compressed natural gas cylinders in vehicles are built to rigorous quality standards (Standards for CNG Vehicular Fuel Systems are specified in NFPA 52). CNG fuel tanks are made of one-half to three-quarter inch aluminum or steel and have been shown to be safer than conventional gasoline tanks in accidents. For the 85,000 vehicles operating in the US over the approximate two year (1998 to 1999) time period, there had not been a fuel tank rupture in over two years (GRI, 1999b).

In collisions, gasoline-fueled vehicles have a much higher rate of fuel leakage and fires than CNG-fueled vehicles (SAE, 1995). If a sudden release of CNG were to occur, the gas disperses rather than pooling or forming a vapor cloud like gasoline. Due to the high ignition temperature of CNG, the risk of fire is lower than gasoline and comparable to diesel fuel.

CNG bottles are typically stored above ground as opposed to below ground for gasoline or diesel fuel tanks. As such, there is a risk of vehicles colliding with the bottles causing a gas release. This can generally be mitigated by installation of curbing and bollards to protect the tanks from vehicle operations.

Liquefied Natural Gas

Natural gas can be liquefied by refrigerating it to below -161.5 degrees Celsius or -259 ^{o}F at atmospheric pressure. Once liquefied, liquid natural gas (LNG) is much more compact, occupying only 1/600th of its gaseous volume (U.S. DOE, 1998). This makes it more economical to ship over long distances and to use in heavy-duty vehicles. LNG is usually shipped in refrigerated trucks to user locations. LNG fueling stations consist of an above-ground storage tank and insulation systems. Typical storage tanks are 30,000 to 70,000 gallons in capacity. Suppliers usually refill them in 10,000-gallon increments. The inner tank is stainless steel and is surrounded by an outer carbon steel tank that forms about a four-inch annulus around the tank. The annulus is evacuated and filled with pearlite insulation. Two pressure safety valves (PSVs) set at 80 psig and 100 psig to protect the inner tank. The outer jacket is also protected in case of an inner jacket leak.

PROJECT-SPECIFIC IMPACTS: The energy content of a gallon of LNG is lower than a gallon of diesel fuel (2.1 gallons of LNG has the same fuel value as a gallon of diesel fuel). This requires larger fuel tanks in an LNG-fueled vehicle to achieve the same driving range as a diesel powered vehicle. It would also require about 110 percent more tanker deliveries to supply refueling stations with the same available energy as diesel fuel. Since the probability of accidents is related to the miles traveled, about 110 percent more delivery accidents can be expected with LNG than with diesel fuel (assuming that they are delivered from similar source locations in similar sized tankers), the miles traveled are probably much greater than for diesel fuel deliveries. However, the national truck accident rate is small (on the order of one accident per ten million miles traveled) and the accident rate with chemical releases is even less, so this would not be a controlling risk factor.

Other safety issues associated with LNG are similar to those discussed previously for CNG, with the added hazards associated with handling a cryogenic liquid. The hazards posed by the use of LNG versus gasoline and diesel fuel are:

- Diesel fuel and gasoline are toxic to the skin and lungs and natural gas is not;

- Diesel fuel and gasoline vapors are heavier than air (for specific gravity of air =1, gasoline is 3.4, diesel is greater than 4). Natural gas is lighter than air (specific gravity is 0.55) and disperses more readily in air;

- Natural gas has a higher auto ignition temperature (1,200 ^{o}F) than diesel (500 ^{o}F) or gasoline (500 ^{o}F). Natural gas is more difficult to ignite since it has a "lower flammability limit" that is higher (5.3 percent) than gasoline (one percent) or diesel fuel (0.5 percent);

- Cryogenic liquids have the potential risk to workers of burns (frost-bite) that can be suffered if workers come in contact with the liquid or with surfaces that are not insulated. Proper safety equipment and training can minimize these hazards; and,

- Since LNG is a cryogenic liquid, in the event of a release from an aboveground storage tank or tanker truck, a fraction of the liquid immediately flashes off to gas while the remainder will pool and boil violently emitting dense vapor. The liquid transitions to dense vapor and the dense vapor transitions to gas as the liquid and vapor draw heat from the surroundings. If a source of ignition is present, the boiling liquid, vapor cloud and gas could explode and burn, threatening surrounding facilities and other storage vessels.

The safety record of LNG-fueled vehicles is not as well established as that of CNG-fueled vehicles, due to the much smaller number of LNG-fueled vehicles in use. If spilled, however, the vapor cloud above the LNG pool is very difficult to ignite, due to the narrow range of flammability of natural gas vapor.

One of the major concerns with the use of LNG-fueled vehicles is the possibility that excess vapor pressure might be vented in an enclosed area, such as a parking garage, possibly causing an explosion. Fuel tanks of inactive vehicles can store LNG up to eight to ten days without pressure relief valves being activated. Inactive vehicles left enclosed for long periods of time could pose problems.

Liquefied Petroleum Gas

LPG consists mainly of propane, propylene, butane, and butylene in various mixtures. For LPG fuels in the US, the mixture is mainly propane. It is produced as a by-product of natural gas processing and petroleum refining. Propane is a liquid at -42.1 ^{o}F and atmospheric pressure. At about 80 ^{o}F and a pressure of about 150 psig, propane can be stored as a liquid.

LPG is stored in tanks that typically range from 12,000 gallons to 120,000 gallons. Transports carry 8,000 to 11,000 gallons and rail cars range from 11,000 to 34,500 gallons. Over 350,000 vehicles currently operate in the U.S. on LPG fuel (U.S. DOE, 1999).

PROJECT-SPECIFIC IMPACTS: The energy content of a gallon of LPG is lower than a gallon of gasoline (based on energy content, about 1.36 gallons of LPG are equal to a gallon of gasoline). Compared to one gallon of diesel the fuel equivalent for LPG is 1.86. This requires larger fuel tanks in a methanol vehicle to achieve the same range as a gasoline- or diesel-powered vehicle. It would also require about 36 (gasoline) to 86 (diesel) percent more tanker deliveries to supply refueling stations with the same available energy as conventional fuels. Since the probability of accidents is related to the miles traveled, about 36 to 86 percent more delivery accidents can be expected with methanol than conventional fuels (assuming that they are delivered from similar source locations in similar sized tankers). However, the national truck accident rate is small (on the order of one accident per ten million miles traveled) and the accident rate with chemical releases is even less, so this would not be a significant risk factor.

Compared with diesel fuel and gasoline the following can be stated:

- Diesel fuel and gasoline are toxic to the skin and lungs and propane is not;

- Diesel fuel gasoline vapors are heavier than air (for specific gravity of air =1, gasoline is 3.4, diesel fuel is 4.0). LPG is lighter than gasoline and diesel fuel but heavier than air (specific gravity is 1.52). It disperses more readily in air than gasoline or diesel fuel;

- LPG has a higher auto ignition temperature (920 ^{o}F) than diesel fuel (500 ^{o}F) or gasoline (500 ^{o}F);

- LPG is more difficult to ignite since it has a “lower flammability limit” that is higher (2.0 percent) than gasoline (one percent) or diesel fuel (0.5 percent).

LPG is generally stored in above ground tanks. In case of a rupture, there is the potential for the gas to pool and boil off. This presents the possibility of a boiling liquid, vapor cloud explosion and fire with potential consequences to nearby structures and other storage tanks. NFPA 58 Code specifies the separation distances required between various sized LPG tanks.

LPG poses a somewhat greater safety risk than CNG, but lower than gasoline. Unlike natural gas, LPG vapors are heavier than air, so that leaks from the fuel system tend to pool at ground level rather than disperse. The flammability limits of LPG vapor in air are also broader than those for natural gas.

Electric Powered Vehicles

Electricity used to power vehicles is commonly provided by batteries, but fuel cells are also an emerging competitor. Batteries are energy storage devices and fuel cells convert chemical energy to electricity. Commercially available electric vehicles (EVs) are mostly battery-powered at the current time. The following discussion concentrates therefore on battery powered EVs.

PROJECT-SPECIFIC IMPACTS: In 1996, the International Center for Technology Assessment (ICTA) conducted a comprehensive review of the safety concerns associated with the use of EVs. ICTA evaluated what it considered to be the four most pressing safety considerations associated with the use of EVs, which include hydrogen offgassing, electrolyte spillage, electric shock, and exposure to toxic fumes. First, the ICTA found that hydrogen offgassing risks are not present in the three types of batteries likely to be used in EVs. In fact, in these three battery technologies hydrogen gas is not released as part of the chemical processes, which take place during normal operation. Additionally, the risk of hydrogen emissions during stressful conditions has been virtually eliminated by the use of seals and proper valve regulation. Finally, the National Electric Code's (NEC's) and the Society of Automotive Engineer's (SAE's) recommended safety practices and guidelines for the operation and maintenance of EVs, which is expected under the proposed project, eliminates any hydrogen gas risk during EV battery recharging (ICTA, 1996).

Second, the ICTA found that EV batteries do not present a serious risk of burns from electrolyte spillage. While electrolyte leakage presents a risk in today's ICE vehicles because of their use of flooded lead acid batteries, most EVs use batteries that are sealed, maintenance-free, and use either starved or gelled electrolyte. Moreover, the SAE, in conjunction with existing federal safety standards, has established standards that regulate the amount of electrolyte allowed to escape during an EV accident. As a result of these battery technologies and the SAE efforts, the amount of electrolyte that can escape during a battery broken by accident has been minimized to the point of providing EV users extreme safety (ICTA, 1996).

Third, the ICTA found that the risk of electric shock from EV use and charging has been thoroughly addressed and poses minimal safety risk. In fact, the entire design of EVs has been premised around minimizing electrical hazards. The high voltage circuits in current EV designs are self-contained and entirely isolated from the passenger compartment, other electric conductors on board the vehicle, and from the vehicle chassis itself (unlike the battery in a conventional ICE vehicle, which uses the frame as grounding). EVs further isolate sources of electricity by using automatic disconnection devices in the event of a malfunction to disconnect the main propulsion battery from all electrical components in the vehicle. Finally, the SAE and manufacturers have worked closely to ensure that the NEC provides for the safe use of both conductive and inductive EV charging systems (ICTA, 1996).

Fourth, the ICTA found that the configuration of modern EV batteries virtually eliminates the risk of exposure to toxic and hazardous materials during normal operating conditions. By isolating batteries and battery packs from the rest of a vehicle operating system, designers have limited the chance of fire causing batteries to release toxic fumes. Moreover, crash tests and direct combustion attempts have indicated that batteries themselves are virtually non-flammable. In addition, U.S. OSHA has set strict standards to ensure that battery manufacturers do not expose workers to harmful doses of toxic or carcinogenic materials during manufacture (ICTA, 1996).

Overall, the ICTA's findings support the view that the widespread adoption of EVs will result in a significantly safer fleet of vehicles than the gasoline- or diesel-fueled ICEs currently in use (ICTA, 1996). Given the ICTA’s findings on EV safety and the total number of EVs that are expected to be used due to the implementation of the proposed fleet vehicle rules are only 750 with a yearly maximum of 100, significant hazards risks are not expected from using this technology.

Conclusions: Conventional fuels, such as gasoline and diesel fuel, have been used since the introduction of the internal combustion engine, and their associated hazards are well known. The alternative clean-fuels discussed in this section pose different hazards during storage, handling, transport, and use than conventional fuels. In general, the hazards posed by the conversion to alternative clean fuels appear no greater than those posed by conventional fuels, particularly when compared to gasoline. Hazards due to fuel leakage are lower due to the lower vapor densities, higher auto ignition temperatures, and the higher “Lower Flammability Limits” of the clean fuels compared to gasoline. The hazards posed by the use of alternative clean fuels that may be slightly higher than those posed by the conventional fuels are in the following areas:

Methanol - Unlike gasoline or diesel, methanol can ignite in confined spaces due to its high upper flammability limit, which exceeds its saturated vapor concentration.

CNG - The main additional hazard associated with the use of CNG versus conventional fuels is the exposure to high pressures employed during storage, dispensing and operations. Due to these high pressures a large amount of gas could escape in a short amount of time and, if present under flammable conditions, could explode in the presence of an ignition source. Another potentially significant hazard is a release of natural gas during vehicle maintenance.

LNG - The main additional hazard associated with the use of LNG versus conventional fuels are personal injuries from contact with a cryogenic liquid and the potential for a large fire stemming from release in the case of an accident (e.g. a tanker truck accident or storage tank failure). Another potentially significant hazard is a release of natural gas during vehicle maintenance.

LPG - The main additional hazard associated with the use of LPG versus conventional fuels is the potentiality of a large fire stemming from a release in the case of an accident (e.g. a tanker truck accident). Another significant hazard is a release of propane gas during vehicle maintenance.

EV - Specific safety issues involving EV technology revealed no significant risks in utilizing this technology. Overall, the widespread adoption of EVs will result in a significantly safer fleet of vehicles than the gasoline- and diesel fueled powered ICEs currently in use.

There are various existing regulations and recommended safety procedures that, when employed by fleet operators, will reduce any slightly higher insignificant hazards associated with use of alternative clean fuels to the same or lower level as conventional fuels. Table 4.3-4 summarizes some of the regulations and safety procedures associated with use of alternative clean fuels

Therefore, when affected fleet operators comply with existing regulations and recommended safety procedures, hazards impacts associated with the use of alternative clean-fuels will be the same or less than those of conventional fuels. Accordingly, significant hazards impacts are not expected from the implementation of the proposed fleet vehicle rules and related amendments.

TABLE 4.3-4

Summary of Hazards and Existing Safety Regulations/Procedures Associated with Alternative Clean-Fuels

Fuel Type	Hazard	Regulation/Procedure
Methanol	Methanol can ignite in enclosed spaces such as fuel tanks since its upper flammability limit is 15 percent and it is slightly heavier than air.	Modifications such as materials inside the fuel tank that can arrest and quench flame propagation and modifications to isolate the tank from sparks and ignition sources are required to avoid ignition in the fuel tanks.
CNG	CNG bottles are typically stored outside and are required to be above ground (NFPA 52) as opposed to below ground for gasoline or diesel tanks. There is a risk of vehicles colliding with the bottles causing a gas release.	Collisions can be mitigated by installation of curbing and bollards to protect the tanks from vehicle operations (LAFC57.42.16).

Table 4.3-4(Continued)

Summary of Hazards and Existing Safety Regulations/Procedures Associated with Alternative Clean-Fuels

Fuel Type	Hazard	Regulation/Procedure
	There is a danger of releasing gas in the maintenance shop potentially creating explosive hazards.	Installation of methane detection systems in the shop can provide early detection of leaks and alert the maintenance personnel. (If integrated with vent systems, vents are not required to operate continuously - CFC 2903.2.5). Ignition sources can be reduced/eliminated by ensuring that all electrical systems in the shop are explosion proof (smoking and open flames are prohibited under CFC 2901.7). Providing adequate ventilation can prevent the occurrence of explosive conditions (required under CFC2903.1). Procedures can be established to ensure that all vehicles requiring maintenance are defueled and depressurized before admission to the maintenance depot.
LNG	LNG is a cryogenic liquid and has the potential risk to workers of burns (frostbite) that can be suffered if workers come in contact with the liquid or with surfaces that are not insulated.	Proper safety equipment and training can mitigate these hazards.
LNG (cont.)	LNG is generally stored above ground. Since it is a cryogenic liquid, in the event of a release, a fraction of the liquid immediately flashes off to gas while the majority of the remainder will pool and boil violently emitting dense vapor. If a source of ignition is present, the boiling liquid, dense vapor and gas could explode and burn threatening surrounding facilities and other storage vessels.	Tanks can be protected by containment dikes (required if neighboring tanks can be affected LAFC57.42.11) and physically separated LAFC57.42.10) so that they do not interact in case of a fire or explosion. Deluge systems can be installed to cool neighboring tanks in case of a fire.

Table 4.3-4(Continued)

Summary of Hazards and Existing Safety Regulations/Procedures Associated with Alternative Clean-Fuels

Fuel Type	Hazard	Regulation/Procedure
	There is a danger of releasing gas in the maintenance shop with its related explosive hazards (A flammable concentration within an enclosed space in the presence of an ignition source can explode).	Installation of flammable gas detection systems in the shop can provide early detection of leaks and alert the maintenance personnel. (Required for LNG under CFC2903.3). Ignition sources can be reduced/eliminated by ensuring that all electrical systems in the shop are explosion proof (smoking and open flames are prohibited under CFC 2901.7). Providing adequate ventilation can prevent the occurrence of explosive conditions (required under CFC2903.1). Vehicle fuel shut-off valves shall be closed prior to repairing any portion of the vehicle fuel system (CFC2903.4.1). Vehicles fueled by LNG, which may have sustained damage to the fuel system, shall be inspected for integrity with a gas detector before being brought into the garage (CFC2903.4.2). Procedures can be established to ensure that all vehicles requiring maintenance are defueled and depressurized before admission to the maintenance depot.
LPG	There is a danger of releasing gas in the maintenance shop with its related explosive hazards (A flammable concentration within an enclosed space in the presence of an ignition source can explode).	Installation of combustible gas detection systems in the shop can provide early detection of leaks and alert the maintenance personnel. Ignition sources can be reduced/eliminated by ensuring that all electrical systems in the shop are explosion proof. Providing adequate ventilation can prevent the occurrence of explosive conditions. Procedures can be established to ensure that all vehicles requiring maintenance are defueled and depressurized before admission to the maintenance depot. NFPA 58, 8-6 requires that the cylinder shut-off valve be closed when vehicles or engines are under repair except when the engine is operated. Also, the vehicle cannot be parked near sources of heat, open flames, or similar sources of ignition or near inadequately ventilated pits.

Table 4.3-4 (Concluded)

Summary of Hazards and Existing Safety Regulations/Procedures Associated with Alternative Clean-Fuels

Fuel Type	Hazard	Regulation/Procedure
EV	Certain types of batteries that are used in commercially available electric vehicles emit hydrogen during the charging process. Emission of hydrogen gas in an enclosed setting such as a garage presents the potential for the accumulation of flammable concentrations.	Forced ventilation can prevent build-up but if ventilation fails, a hazardous condition can occur. NEC and SAE recommended practices provide strict guidance for eliminating hydrogen gas risk.

CWC = California Fire Code
LAFC = City of Los Angeles Fire Code. It is expected that cities in Orange, Riverside, and San Bernardino Counties have in place similar regulations.
NFPA = National Fire Protection Association
NEC = National Electric Code
SAE = Society of Automotive Engineers

Use of alternative fuels will require additional knowledge and training of owners/operators of fueling stations regarding maintaining and operating alternative fuel refueling stations and emergency responders.

Therefore, when users of alternative fuels comply with existing regulations and recommended safety procedures, hazards impacts associated with the use of alternative clean-fuels will be the same or less than those of conventional fuels. Accordingly, significant hazards impacts are not expected from the increased use of alternative fuels.

Ammonia Use in SCRs

Some of the control measures proposed in the 2003 AQMP would require or encourage the use of SCR including CMB-10, and OFF-RD CI-2. SCR may be used on industrial boilers and heaters as well as large diesel engines to reduce NOx, including off-road diesel engines. Ammonia or urea is used to react with the NOx, in the presence of a catalyst, to form nitrogen gas and water. In some SCR installations, anhydrous ammonia is used. Safety hazards related to the transport, storage and handling of ammonia exist. Ammonia has acute and chronic non-cancer health effects and also contributes to ambient PM10 emissions under some circumstances.

On-Site Release Scenario: The use of anhydrous ammonia involves greater risk than aqueous ammonia because it is stored and transported under pressure. In the event of a leak or rupture of a tank, anhydrous ammonia is released and vaporizes into the gaseous form, which is its normal state at atmospheric pressure and produces a toxic cloud. Aqueous ammonia is a liquid at ambient temperatures and gas is only produced when a liquid pool from a spill evaporates. Under current OES regulations implementing the

CalARP requirements, aqueous ammonia is regulated under California Health and Safety Code Section 2770.1.

Some of the control measures would require the increased use and storage of ammonia. Facilities that would likely use SCRs would be industrial and commercial facilities and located in industrial/commercial zones. However, the use and storage of anhydrous ammonia would be expected to result in significant hazard impacts as there is the potential for anhydrous ammonia to migrate off-site and expose individuals to concentrations of ammonia that could lead to health impacts. Anhydrous ammonia would be expected to form a vapor cloud (since anhydrous ammonia is a gas at standard temperature and pressures) and migrate from the point of release. The number of people exposed and the distance that the cloud would travel would depend on the meteorological conditions present. Depending on the location of the spill, a number of individuals could be exposed to high concentrations of ammonia resulting in potentially significant impacts.

In the event of an aqueous ammonia release, the ammonia solution would have to pool and spread out over a flat surface in order to create sufficient evaporation to produce a significant vapor cloud. For a release from on-site vessels or storage tanks, spills would be released into a containment area, which would limit the surface area of the spill and the subsequent toxic emissions. The containment area would limit the potential pool size, minimizing the amount of spilled material that would evaporate, form a vapor cloud, and impact residences or other sensitive receptors in the area of the spill. Significant hazard impacts associated with a release of aqueous ammonia would not be expected.

Transportation Release Scenario: Use and transport of anhydrous ammonia involves greater risk than aqueous ammonia because it is stored and transported under pressure. In the event of a leak or rupture of a tank, anhydrous ammonia is released and vaporizes into the gaseous form, which is its normal state at atmospheric temperature and pressure, produces a toxic cloud. Aqueous ammonia is a liquid at ambient temperatures and pressure, and gas is only produced when a liquid pool from a spill evaporates. Deliveries of ammonia would be made to each facility by tanker truck via public roads. The maximum capacity of a tanker truck is 150 barrels. Regulations for the transport of hazardous materials by public highway are described in 49 CFR 173 and 177. Nineteen percent aqueous ammonia is considered a hazardous material under 49 CFR 172.

Although trucking of ammonia and other hazardous materials is regulated for safety by the U.S. DOT, there is a possibility that a tanker truck could be involved in an accident spilling its contents. The factors that enter into accident statistics include distance traveled and type of vehicle or transportation system. Factors affecting automobiles and truck transportation accidents include the type of roadway, presence of road hazards, vehicle type, maintenance and physical condition, and driver training. A common reference frequently used in measuring risk of an accident is the number of accidents per million miles traveled. Complicating the assessment of risk is the fact that some accidents can cause significant damage without injury or fatality.

The actual occurrence of an accidental release of a hazardous material cannot be predicted. The location of an accident or whether sensitive populations would be present in the immediate vicinity also cannot be identified. In general, the shortest and most direct route that takes the least amount of time would have the least risk of an accident. Hazardous material transporters do not routinely avoid populated areas along their routes, although they generally use approved truck routes that take population densities and sensitive populations into account.

The hazards associated with the transport of regulated (CCR Title 19, Division 2, Chapter 4.5 or the CalARP requirements) hazardous materials, including ammonia, would include the potential exposure of numerous individuals in the event of an accident that would lead to a spill. Factors such as amount transported, wind speed, ambient temperatures, route traveled, distance to sensitive receptors are considered when determining the consequence of a hazardous material spill.

In the unlikely event that the tanker truck would rupture and release the entire 150 barrels of aqueous ammonia, the ammonia solution would have to pool and spread out over a flat surface in order to create sufficient evaporation to produce a significant vapor cloud. For a road accident, the roads are usually graded and channeled to prevent water accumulation and a spill would be channeled to a low spot or drainage system, which would limit the surface area of the spill and the subsequent toxic emissions. Additionally, the roadside surfaces may not be paved and may absorb some of the spill. Without this pooling effect on an impervious surface, the spilled ammonia would not evaporate into a toxic cloud and impact residences or other sensitive receptors in the area of the spill. Aqueous ammonia is, therefore, not expected to have significant impacts.

In the unlikely event that a tanker truck would rupture and release the entire contents of anhydrous ammonia, the ammonia would be expected to form a vapor cloud (since anhydrous ammonia is a gas at standard temperature and pressures) and migrate from the point of release. The number of people exposed and the distance that the cloud would travel would depend on the meteorological conditions present. Depending on the location of the spill, a number of individuals could be exposed to high concentrations of ammonia resulting in potentially significant impacts.

PROJECT SPECIFIC MITIGATION: The impacts associated with the use of anhydrous ammonia are potentially significant. Aqueous ammonia is an appropriate alternative and its use is not expected to result in significant hazard impacts. Therefore, the following mitigation measures are required:

HZ2: Rules encouraging the use of SCRs or permits for SCRs shall limit the catalyst to aqueous ammonia or its equivalent. Current SCAQMD policy already requires using aqueous ammonia.

HZ3: Require the use of transportation routes for ammonia shipments to facilities that ensures minimum exposure to sensitive population and further minimize risks by shipping ammonia during off-peak times. This will be accomplished by implementing the following mitigation measures:

1. Prior to the first delivery of aqueous ammonia to a site, truck haul routes shall be submitted to the SCAQMD for review and approval.

2. The haul routes shall minimize rail crossings and crossings of busy intersections.

3. When travelling on surface streets, the haul routes shall not come within one-quarter mile of an existing or proposed school, where feasible.

4. Deliveries shall not be en route during peak traffic hours, which generally occur between 7:00 AM and 9:00 AM or between 4:00 PM and 6:00 PM weekdays.

5. The haul routes shall be resubmitted if suppliers are changed.

HZ4: Require construction of containment dikes to be used during off-loading operations.

HZ5: Require construction of containment dikes around ammonia storage tanks to contain the volume of the tank.

Use of aqueous ammonia at concentrations less than 20 percent by volume in conjunction with the above mitigation measures can reduce hazard impacts associated with ammonia use to less than significant.

Fuel Additives

Some control measures in the 2003A QMP would provide incentives to use fuel additives to provide emission reductions including ON-RD HVY DUTY-3, OFF-RD CI-1 , FUEL-1, and some of the long-term and conceptual long-term measures. In the past, the introduction of fuel additives into gasoline has resulted in environmental impacts, e.g., lead and MTBE. Before proposing rules requiring fuel additives, federal regulations require that the additives be evaluated for their toxic effects. The additives need to be evaluated for their potential health impacts associated with exposure, secondary air impacts (including generation of toxic air contaminants), hazard impacts, impacts on water quality, and any other potential environmental impacts that could occur. These studies are required prior to approving the additives to be used in any fuel and require that the benefits of the additive (e.g., emission reductions) outweigh any of the negative impacts associated with the additive. Because of these requirements, the potential impacts of fuel additives are less than significant because negative impacts would be identified and mitigated, as necessary, prior to their use.

PROJECT-SPECIFIC MITIGATION: No significant impacts on hazards associated with the use of fuel additives were identified so no mitigation measures are required.

Vapor Recovery

Several control measures may require add-on vapor recovery controls. Unlike vehicle service station fueling, gasoline vapors recovered during fueling operations at marinas are not easily transferred back to the gasoline storage tank. At vehicle service stations, the storage tank is in close proximity to the dispenser, while at marinas, the storage tank may be several hundred feet away at a higher elevation.

The marine vapor recovery control measure may involve collection of emissions at the dispenser and installation of add-on control equipment, e.g., carbon adsorption systems. Cargo tank truck vapor recovery control measures would control gasoline vapors from cargo tanks and delivery hoses. As with all gasoline vapor recovery systems, there is a potential to form an explosive gas mixture when the vapors mix with air. This is a hazard concern with boats since the boat hull can collect leaking heavy gasoline vapors. The State Fire Marshal reviews all vapor recovery equipment designs and procedures to assure that they can comply with the appropriate fire codes and will not cause any undue risk. The USCG would probably also have to approve vapor recovery systems at marinas. The details of the equipment design will be developed when the rules are formally developed and proposed.

PROJECT SPECIFIC MITIGATION: The impacts associated with vapor control measures could result in significant impacts so the following mitigation measure is required:

HZ6: Rules implementing the vapor recovery control measures at marinas shall ensure that vapor recovery systems are submitted to the State Fire Marshal, if applicable, for review and comment prior to implementation.

Implementation of the above mitigation measure is expected to minimize the hazard impacts associated with vapor recovery to less than significant.

Hazard Impacts Associated with Long-Term Strategies

Additional control measures and hazard impacts associated with the long-term strategy or long-term measures may also be expected. The long-term control measures are expected to include aggressive development and commercialization of advanced mobile source control technologies. The potential long-term control options that could result in hazard impacts are expected to be limited the potential use of NOx catalysts, SCR, and alternative fuels for existing federal emission sources (e.g., planes, trains, ships, trucks, farm equipment and construction equipment).

Federal sources such as planes, trains, ships, 49-state vehicles, and farm and construction equipment less than 175 horsepower will also be required to achieve significant reductions under the long-term control strategy. The emission reductions from these sources will be based on more stringent emission standards for new engines as well retrofit controls (e.g., NOx catalyst, SCR, alternative fuels) for existing engines. Therefore, it is expected that long-term measures will place greater reliance on the use of alternative fuels, especially natural gas and hydrogen.

Implementation of the long-term control measures would be expected to result in additional hazard impacts. The specific details of the long-term control measures have not yet been developed and will need to be developed as part of the rulemaking process. Therefore, the impacts related to the long-term control measures are discussed qualitatively since detailed information for a quantitative analysis is not available. The potential hazard impacts from the long-term measures for each of the resources discussed in this subchapter are evaluated below.

- Reformulated Coatings, Solvents and Consumer Products: The analysis for the short-term control measures indicated that the hazard impacts associated with reformulated coatings, solvents and consumer products are expected to be less than significant. The long-term control measures could result in additional controls and reformulation of consumer products. An increase of future compliant materials would be expected to result in a concurrent reduction in the number of accidental releases. As a result, the net number of accidental releases would be expected to remain constant, allowing for population growth in the district. Furthermore, if manufacturers use solvents such as Texanol, propylene glycol, etc., in future compliant water-borne coatings, significant adverse hazard impacts would not be expected to occur because in general these solvents are less flammable solvents as rated by the NFPA.

- Hazards Associated with Modifications at Refineries to Produce Reformulated Fuels: Although the specific modifications to the refineries associated with the short-term control measures are currently unknown, the hazard impacts are considered to be potentially significant. Modifications to existing major processing units or the construction of new major processing units at the refineries would be required. Based on the analysis from previous refinery modifications, it is expected that some of these modifications would result in significant hazard impacts, resulting in an increase in exposure to hazardous materials/flammable materials to the surrounding population. The short-term control measures could result in significant hazard impacts at refineries. The long-term control measures are expected to rely more on alternative fuels than petroleum fuels and are not expected to require additional modifications at refineries. Therefore, the long-term control measures are not expected to result in any additional hazard impact due to refinery modifications than those addressed in the short-term measures.

- Use of Alternative Fuels: The hazard impacts associated with the use of alternative fuels due to implementation of the short-term control measures were determined to be less than significant when users of alternative fuels comply with existing regulations and recommended safety procedures. Implementation of the long-term control measures could result in additional use of alternative fuels, generally displacing additional quantities of petroleum fuels. As with the short-term control measures, the implementation of the long-term control measures that encourage the use of alternative fuels will result in hazard impacts the same or less than those of conventional fuels. Accordingly, significant hazards impacts are not expected from the increased use of alternative fuels.

- Ammonia Use in SCRs: The use of ammonia in SCRs is considered to be potentially significant due to implementation of the short-term control measures. However, the use of aqueous ammonia at concentrations less than 20 percent by volume in conjunction with additional mitigation measures were expected to reduce hazard impacts associated with ammonia use to less than significant. Implementation of the long-term control measures could result in additional use of SCRs and ammonia, As with the short-term control measures, the implementation of the long-term control measures that encourage the use of SCRs will result in hazard impacts the same or less than those of conventional fuels. Further, SCRs in mobile sources are likely to use urea rather than ammonia. Accordingly, significant hazard impacts are not expected from the increased use of ammonia in SCRs.

- Fuel Additives: The analysis for the short-term control measures indicated that the hazard impacts associated with fuel additives are expected to be less than significant. The long-term control measures could result in additional use of fuel additives. As with the short-term control measures, the implementation of the fuel additives would require evaluation for their potential health impacts associated with exposure, secondary air impacts, hazard impacts, water quality impacts, etc., prior to approval. Because of these requirements, significant hazard impacts associated with the use of fuel additives are not expected.

- Vapor Recovery: The analysis for short-term control measures indicated that the hazards associated with vapor recovery were potentially significant at marinas and a mitigation measure was imposed. Since one of the short-term control measures would include vapor recovery at marinas, no additional long-term control measure is needed to control emissions from this source. The long-term control measures may result in additional vapor recovery, which are not expected to involve marinas. Vapor recovery at other facilities is expected to be standard vapor recovery facilities without the complication of the storage tank being located several hundred feet away from the dispensing. Therefore, long-term control measures would not be expected to generated additional hazard impacts related to vapor recovery above those evaluated for the short-term control measures.

PROJECT-SPECIFIC MITIGATION: No significant impacts on hazards associated with implementation of the long-term control measures (other than discussed above) were identified so no additional mitigation measures are required.

4.3.5 CUMULTIVE HAZARD IMPACTS

The 2003 AQMP contains several control measures that could generate hazard/human health impacts through increased usage of consumer products reformulate with acetone or other hazardous formulations. It is expected that the increased use of certain hazardous exemption compounds (e.g., acetone) would generally be balanced by a decreased use of other hazardous and flammable materials (e.g., methyl ethyl ketone, toluene, and xylenes). Therefore, no significant cumulative impacts are identified.

The potential adverse hazard impacts associated with the 2003 AQMP include the additional production of reformulated fuels at refineries, additional use of ammonia in SCRs, and increased use of vapor recovery. These project-specific impacts would be expected to be minimized by the impact specific mitigation measures identified so that no additional cumulative impacts were identified and no cumulative mitigation measures are required.

CUMULATIVE HAZARD IMPACT MITIGATION: No additional significant adverse cumulative hazard impacts were identified so no cumulative mitigation measures are required.

4.3.6 SUMMARY OF HAZARD IMPACTS

The following is the summary of the conclusions of the analysis of hazard impacts associated with implementation of the 2003 AQMP.

- Reformulated Coatings, Solvents and Consumer Products: The analysis indicates that the hazard impacts associated with reformulated coatings, solvents and consumer products are expected to be less than significant. An increase of future compliant materials would be expected to result in a concurrent reduction in the number of accidental releases. As a result, the net number of accidental releases would be expected to remain constant, allowing for population growth in the district. Furthermore, if manufacturers use solvents such as Texanol, propylene glycol, etc., in future compliant water-borne coatings, significant adverse hazard impacts would not be expected to occur because in general these solvents are less flammable solvents as rated by the NFPA.

- Hazards Associated with Modifications at Refineries to Produce Reformulated Fuels: Although the specific modifications to the refineries associated with the short-term control measures are currently unknown, the hazard impacts are considered to be potentially significant. Modifications to existing major processing units or the construction of new major processing units at the refineries would be required. Based on the analysis from previous refinery modifications, it is expected that some of these modifications would result in significant hazard impacts, resulting in an increase in exposure to hazardous materials/flammable materials to the surrounding population. The 2003 AQMP could result in significant hazard impacts at refineries.

- Use of Alternative Fuels: The hazard impacts associated with the use of alternative fuels due to implementation of the 2003 AQMP control measures were determined to be less than significant when users of alternative fuels comply with existing regulations and recommended safety procedures.

- Ammonia Use in SCRs: The use of ammonia in SCRs is considered to be potentially significant due to implementation of the control measures. However, the use of aqueous ammonia at concentrations less than 20 percent by volume in conjunction with additional mitigation measures were expected to reduce hazard impacts associated with ammonia use to less than significant. Accordingly, significant hazard impacts are not expected from the increased use of ammonia in SCRs.

- Fuel Additives: The analysis indicates that the hazard impacts associated with fuel additives are expected to be less than significant. The use of fuel additives would require evaluation for their potential health impacts associated with exposure, secondary air impacts, hazard impacts, water quality impacts, etc., prior to approval. Because of these requirements, significant hazard impacts associated with the use of fuel additives are not expected.

- Vapor Recovery: The analysis indicates that the hazards associated with vapor recovery were potentially significant at marinas and a mitigation measure was imposed which is expected to minimize the potential impacts to less than significant.

- Hazards Associated with Long-Term Control Strategies: Additional hazard impacts are possible due to implementation of the long-term control measures (over and above those discussed in other portions of the EIR). The increase in hazard impacts is expected to be controlled with the mitigation measures above. No additional significant hazard impacts (over and above those discussed above) are expected.

- Cumulative Hazard Impacts: The potential adverse hazard impacts associated with the 2003AQMP include the additional production of reformulated fuels at refineries, additional use of ammonia in SCRs, and increased use of vapor recovery. These project-specific impacts would be expected to be minimized by the impact specific mitigation measures identified so that no additional cumulative impacts were identified and no cumulative mitigation measures are required.