SUBCHAPTER 4.3

HAZARDS

Introduction
2007 AQMP Control Measures With Potential Hazard Impacts
Significance Criteria
Potential Environmental Impacts and Mitigation Measures
Summary of Hazard Impacts

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) use of alternative fuels; (4) the use of SCR; and (5) the use of fuel additives.

4.3.2 2007 AQMP CONTROL MEASURES WITH POTENTIAL HAZARD IMPACTS

The 2007 AQMP continues the air quality management strategy of advancing clean technologies and promoting their use. In particular the 2007 AQMP promotes greater use of reformulated fuels, which will likely require modifications at local refineries to produce the reformulated fuels. Refinery modification in turn may increase the use of hazardous materials that could increase hazard impacts in the district. Similarly, the 2007 AQMP is expected to increase the use of natural gas as a combustion fuel in mobile sources, which has the potential to increase explosion and fire risks. Table 4.3-1 lists the 2007 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

<u>Reformulated Coatings, Solvents and Consumer Products</u>

PROJECT SPECIFIC IMPACTS: The 2007 AQMP includes control measures that could require reformulation of consumer products including CTS-01, MCS-01, MCS-07, EGM-01, MOB-03, ARB-CONS-01, and SCTM-03.

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	Hazard Impact
MEASURES TO BE IMPLEMENTED BY THE SCAQMD			
CTS-01	Emissions Reductions from Lubricants	Reduce VOC emissions from industrial lubricants. Low-VOC lubricants.	Potential exposure to toxic air contaminant; flammability of reformulated material.
CTS-04	Emission Reductions from the Reduction of VOC Content of Consumer Products not Regulated by the State Board	Reduce VOC emissions from reformulated, lower VOC content products	Potential exposure to toxic air contaminant; flammability of reformulated material.
MCS-01	Facility Modernization	Equipment retrofitted or replaced with BACT at the end of a pre-determined lifespan and use of super compliant materials/process change.	Potential exposure to toxic air contaminant; flammability of reformulated material. SCR to control NOx could result in ammonia hazard impacts.
EGM-01	Emission Reductions from New or Redevelopment Projects	Mitigate impacts new/redevelop projects. Dust control; alternative fuel; diesel PM filter; low-emitting engines; low VOC coatings; energy conservation; mitigation fee.	Potential exposure to toxic air contaminant; flammability of reformulated material. The use of fuel alternative fuels and additives can result in hazard impacts.
MOB-03	Backstop Measure for Indirect Sources of Emissions from Ports & Port-Related Facilities	Address emissions from stationary and mobile sources at ports and related facilities. PM filter/catalysts; use of non-diesel equipment (i.e., electrical, fuel cells, LNG, CNG, etc); alternate diesel fuel (i.e. low sulfur, emulsified, etc); hoods, shoreside power (SCR); vessel speed reduction.	Potential exposure to toxic air contaminant; flammability of reformulated material. The use of alternative fuels and fuel additives can result in hazard impacts.
MEASURES FOR SOURCES UNDER STATE AND FEDERAL JURISDICTION			
ARB-ONRD-06 SCFUEL-01	CA Phase 3 Reformulation Gasoline Modifications	Adopt enhance reformulated gasoline specifications; limit oxygenates.	Production of reformulated fuels could increase hazards at refineries.
SCONRD-01	Accelerated Penetration of Partial Zero-Emission & Zero-Emission Vehicles	Focus on implementation of technologies capable of achieving partial zero-tailpipe emissions. Alternative fuels; advanced technology (partial zero emitting vehicles); old battery disposal.	The use of alternative fuels and fuel additives can result in hazard impacts. Production of alternative fuels could increase hazards at refineries.

TABLE 4.3-1 (cont.)

Control Measures	Control Measure Description (Pollutant)	Control Methodology	Hazard Impact
SCFUEL-02	Greater use of Diesel Fuel Alternatives and Diesel Fuel Reformulation	Two-phase approach to achieve additional emissions from diesel fuel engines. Fuel reformulation; diesel alternatives (Fischer-Tropsch, biodiesel, emulsified).	Production of reformulated diesel fuels could increase hazards at refineries.
ARB-ONRD-04 SCONRD-03	In-Use Emission Reductions from On-Road Heavy-Duty Vehicles	Accelerate retrofits for vehicles, fleet modernization and enhanced screening and repair, including out-of-state vehicles.	Use of alternative fuels, particularly natural gas can result in hazard impacts. SCR to control NOx could result in ammonia hazard impacts.
ARB-OFFRD-02 SCOFFRD-03	Further Emission Reductions from Locomotives	Operating in the Basin to meet Tier 3 equivalent emissions by 2014. Accelerated replacement; control tech (SCR, PM filters, hybrid battery engines).	SCR to control NOx could result in ammonia hazard impacts.
OFFRD-06 ARB-OFFRD-01	Auxiliary Ship Engine Cold Ironing and Other Clean Technology. Cleaner Main Ship Engines and Fuel.	Reduce emissions from ships at berth cold ironing (electrical power) and other clean technologies. Further reduce emissions from main engines through added retrofits. Accelerate use of cleaner ships and rebuilt engines. Use low sulfur diesel fuel in main engines when operating within 24 nautical miles of shore.	Production of reformulated fuels could increase hazards at refineries. SCR to control NOx could result in ammonia hazard impacts.
ARB-CONS-01 SCLTM-03	Further Emission Reductions from Consumer Products	Achieve the maximum technologically and commercially feasible VOC emission reductions from consumer products. Ultra low VOC products.	Potential exposure to toxic air contaminant; flammability of reformulated material.
LONG TERM (“BLACK BOX”) MEASURES			
SCLTM-02	Further Emission Reductions from Off-Road Mobile Sources	Further Reductions from Off-Road Mobile Sources through 1) accelerated turn-over of existing equipment and vehicles and replacement with new equipment meeting the new engine standards; 2) retrofit of existing vehicles and equipment with add-on controls such as SCR; and 3) develop new engine standards (e.g., aircraft, ships)	SCR to control NOx could result in ammonia hazard impacts.

TABLE 4.3-1 (cont.)

Control Measures	Control Measure Description (Pollutant)	Control Methodology	Hazard Impact
SCLTM-03	Further Emission Reductions from Consumer Products	Implement low-VOC technologies from stationary sources into categories with similar uses in consumer products. Use of lower reactive VOC compounds could achieve equivalent reductions.	Potential exposure to toxic air contaminant; flammability of reformulated material.

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 (LEL), which means that acetone vapors will not cause an explosion unless the vapor concentration exceeds 26,000 ppm.

In contrast, conventional solvents such as toluene vapors can cause an explosion at 13,000 ppm, which poses a much greater risk of explosion. The concentration of xylene vapors, another conventional solvent, 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 2007 AQMP coating categories would be reformulated with acetone to meet the interim and final VOC content limits. It is anticipated that impacts to fire departments would be equal to or less than conventional solvents, and, therefore, less than significant. It is anticipated that most future reformulated products will be formulated using water-based formulations, which generally are not flammable or have a lower NFPA classification compared to conventional solvents.

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 with ventilation.” All of the large coating manufacturers currently offer pure acetone for sale in quart or gallon containers with similar warnings. The Uniform Fire Code (UFC) treats solvents such as acetone, butyl acetate, MEK, and

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)***
Conventional Solvents						
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
Replacement Solvents						
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
Ethyl Methyl Ketone Oxime	87	306	140	0.904	--	--
2-Ethylhexonoic Acid	144	442	244	--	--	--
n-Butanol	74	244	95	6.7	1.4	
Ethyl 3-Thonypropionate	146	376	138	--	--	--
EGPE	104	300	124	--	--	--
Ethyl Alcohol	46	173	54	44	3.3	3
NN-Dimethylethanolamine	89	282	104	3.18	--	--
n-Butyl Acetone	116	259	72	10	1.7	3
Trimethyl 1,3-Pentanediol	216	471	32	--	--	--
Styrene	104	293	90	5	1.1	3
Ethyl Acetate	88	171	25	73	2	3

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

as Class I Flammable Liquids. Further, the UFC considers all of these solvents to present the same relative degree of fire hazard (SCAQMD, 2003).

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.

In addition to fire impacts, health hazards can also be generated due to exposure to chemicals present in reformulated coatings. The health hazard impacts of the replacement solvents are comparable to the conventional solvents so additional health impacts due to exposure are not expected due to reformulated coatings/solvents.

Based upon the above considerations, significant adverse hazard impacts are not expected from low VOC reformulated products. Similarly, any increase in future low VOC compliant coating materials would be expected to result in a concurrent reduction in the number of accidental releases of high VOC coating materials. As a result, the net number of accidental releases would be expected to remain constant, allowing for population growth in southern California. 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. In general, water-based coatings tend to contain less flammable materials. A list of solvents commonly used in coatings and solvents and their related toxicity information are shown in Table 4.3-3.

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 implement certain control measures that would require modified fuels or alternative fuels, including ARB-ONRD-03/SCFUEL-01, SC-ONRD-01, SCFUEL-02, ARB-ONRD-4/SCONRD-03, ARB-OFFRD-1, and SCLTM-02. All of these control measures seek to reduce emissions from mobile sources by modifying the fuel to burn cleaner, e.g., reduce sulfur content in the diesel used as a combustion fuel in ocean-going marine vessels. 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. For most refineries, projects to produce reformulated fuels were determined to generate significant adverse hazard impacts because of the installation of new equipment or the modification of existing equipment that could generate explosion or flammability impacts beyond the refinery boundaries.

TABLE 4.3-3

Toxicity of Currently Available Coating Solvents

Traditional/Conventional Solvents				
Solvents	**TLV (ACGIH) (ppm)**	**PEL (OSHA) (ppm)**	**IDLH (NIOSH) (ppm)**	**Health Hazards**
Conventional Solvents				
Toluene	50	200	2,000	Moderate irritation – eye, nose, throat; narcosis; skin; suspect teratogen; mutagen, nervous system
Xylene	100	100	1,000	Mild irritation – eye, nose, throat; narcosis; skin
MEK	200	200	3,000	Mild irritation – eye, nose, throat; narcosis; skin
Butyl Acetate	150	150	10,000	Moderate irritation – eye, nose, throat; narcosis
Isobutyl Alcohol	50	100	8,000	Mild irritation – eye, nose, throat; suspect carcinogen
Stoddard Solvent	100	500	5,000	Narcosis; mild irritant
Petroleum Distillates (Naptha)	100	500	10,000	Mild irritation; narcosis
EGME	5	25	Not Available	Cumulative CNS; skin; suspect reproductive effects; blood disorders
EGEE	5	200	Not Available	Cumulative blood damage; moderate irritation of eyes, throat, skin
Replacement Solvents				
Propylene Glycol	100	100	Unknown	Mild irritation – slight eye, anesthesia
Ethylene Glycol	Not Available	10	2,500	Mild irritation – respiratory, skin, kidney, reproductive
EGBE	20	50	700	Mild irritation – eye, nose, throat; anemia; skin
Isopropyl Alcohol	400	400	12,000	Mild irritation – eyes, nose, throat; narcosis
TDI	0.005	0.02	10	Mild irritation – respiratory
MDI	0.005	0.02	40	Mild irritation – respiratory
Styrene	20	100	5,000	Mild irritation – eye, respiratory, neurotoxicity

To evaluate the hazard impacts associated with modifications required at refineries to produce reformulated fuels, this analysis uses as an example the project at BP's Carson Refinery. The BP project included a variety of modifications including those to comply with reformulated fuel requirements and to comply with other SCAQMD rules (former AQMP control measures, which have been adopted as rules by SCAQMD). The BP project was comprised of physical changes and additions to multiple process units and operations, as well as, operational and functional improvements within the confines of the existing Refinery (Final Environmental Impact Report for: BP Carson Refinery, Safety, Compliance and Optimization Project, SCH. No. 2005111057, SCAQMD 2006). This project is used as an example of the type of project that could occur in the future as a result of complying with 2007 AQMP measures.

The objectives of the BP project were to:

1. Comply with Rule 1105.1 - PM10 and Ammonia Emissions from Fluid Catalytic Cracking Units (FCCU), Rule 1118 – Control of Emissions from Refinery Flares, and Rule 1173 - Control of Volatile Organic Compound Leaks and Releases from Components at Petroleum Facilities and Chemical Plants;

2. Comply with the settlement agreement between the SCAQMD and BP that required refinery modifications to reduce refinery emissions;

3. Improve the efficiency, availability and performance of vapor recovery systems;

4. Ensure that there is no increase in the annual average concentration of total reduced sulfur in the Refinery by improving the operational efficiency and optimizing operations of the FCCU, Fluid Feed Hydrodesulfurization Unit, Alky Merox Unit, Alkylation Unit, Hydrocracker Unit, and Sulfur Plant; and

5. Produce additional quantities of reformulated fuels and jet fuel without increasing the crude throughput capacity of the BP Carson Refinery.

A hazard analysis was conducted for the proposed new and modified units and is summarized in Table 4.3-4. The hazard analysis evaluated the potential hazards (fires, explosion overpressure, thermal radiation, or release of hydrogen sulfide) from the new or modified units and the results of the modeling for these hazards. Hazard impact results are shown for existing equipment, modified equipment, and new equipment. For each potential release, the distance to the significance threshold level was determined before and after the proposed project modifications (where applicable) For new units, the distance to the threshold level for each release was determined. Most of the proposed modifications do not affect the size or the location of the largest potential release for the specific unit. In other words, most of the potential releases, which would result in the largest hazard zones, already exist for many units.

TABLE 4.3-4

Maximum Hazard Distances for Maximum Credible Event in Each Process Unit/Area*

Process Unit/Release		Status of Potential Hazard	Maximum Distance (feet) from Center of Unit to				
			Flash Fire (LFL)	**Explosion Overpressure (1.0 psig)**	**Pool/Torch Fire Thermal Radiation [1,600 Btu/(hr-ft^3)]**	**H_2S Gas Concentration (30 ppm for 60 min)**	**SO_2 Concentration (3 ppm for 60 min)**
ALKY	Release from liquid line leaving debutanizer overhead accumulator	Existing	780	295	290	--	--
		Modified	795**	295	295***	--	--
	Release from liquid line leaving alkylation contactor feed coalescer	Existing	610	245	350	--	--
		Modified	670***	265***	360***	--	--
FFHDS	Release from cold flash drum	Existing	170	60	190	2,850	--
		Modified	170	60	190	2,750	--
	Release from sour water flash drum	New	30	15	50	755	--
HCU	Release from fractionator overhead line entering absorber	Existing	90	35	100	1,790	--
		Modified	190***	75***	90	1,860**	--
	Release fractionator hot flux condenser	Existing	890	335	670	--	--
		Modified	770	305	540	--	--
SULFUR	Release from combustion gas stream leaving waste boiler (Unit D)	Existing	--	--	--	1,275	3,510
		Modified	--	--	--	1,240	3,490
FCCU	Liquid line leaving extractor	Existing	890	305	530	--	--
		Modified	890	320***	620**	--	--
MEROX	Liquid line leaving extractor	Existing	1,085	405	565	--	--
		Modified	1,370**	510***	415	--	--

* Source: Final EIR BP Carson Refinery, Safety, Compliance and Optimization Project, SCH. No. 2005111057, SCAQMD 2006.

** Considered to be a potentially significant adverse impact

*** Increase does not extend offsite

Four of the existing or modified units have the ability to create a hazard that could extend further off-site including the Hydrocracker Unit, FCCU, Alkylation Unit and Alky Merox Unit. Therefore, the potential hazard impacts associated with the BP project were considered to be significant because there is the potential for some individuals to be exposed to the potential hazards that exceed the significance thresholds. Compliance with existing regulations and implementation of the recommended safety measures would further minimize the potential impacts associated with a release, but are not expected to eliminate the potential hazard impacts. No additional feasible mitigation measures were identified to further reduce significant adverse hazard impacts. Therefore, hazards and hazardous material impacts generated by the BP project are expected to remain significant.

Reformulated Fuel Modifications at Refineries Conclusion: Although the specific modifications to the refineries are currently unknown, changes in fuel specifications that would require modifications to fuel products include refinery modifications that 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. Based on past experience relative to refinery reformulated gasoline projects, significant hazard impacts due to modifications necessary to comply with new fuel specifications could include additional storage of flammable materials (e.g., LPG), additional transport and unloading of hazardous materials (e.g., LPG and isobutane), and hazards related to the potential release of hazardous materials (e.g., hydrogen sulfide).

PROJECT-SPECIFIC MITIGATION: Based on past experience with reformulated fuels projects, the following mitigation measure would likely be required for future 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 or generated. 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.
- Safety 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.

<u>Use of Alternative Fuels</u>

The 2007 AQMP would establish incentive programs and in-use strategies that may require or promote the use of alternative fuels, including control measures EGM-01, MOB-03, MOB-04, SC-ONRD-01, and ARB-ONRD-4/SCONRD-03. Use of alternative fuels in place of conventional fuels may present a potential safety issue due to the increased transport, use and handling of alternative fuels. Most of the alternative fuels are flammable and increased use could result in increased hazards associated with their transport and use, 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. Pure methanol burns with an invisible flame, so gasoline is often added as a safety measure to produce a visible flame in case of fire. M100, consisting of 100 percent methanol, may increasingly be used for low emission methanol powered vehicles, but M85 is the more likely fuel of choice for safety reasons.

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 five million miles traveled 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 (PAHs) and gasoline contains an array of toxic compounds, including benzene, a known carcinogen. Table 4.3-5 presents a summary of the flammable and toxic hazards of methanol (M100) versus gasoline.

TABLE 4.3-5

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: SCAQMD, 2000a

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.

There was a great deal of interest in the use of methanol as a motor fuel in the 1970's because of the oil crises that occurred at that time. Methanol was generally readily available at low cost. However, problems occurred early in the development of methanol-gasoline blends due to improper blending and handling techniques. These problems led to consumer and media problems, which hindered continued interest in the use of methanol as a vehicle fuel. Although there is still some interest in methanol as a vehicle fuel, there is greater emphasis on research and development of natural gas-based fuels as a replacement for gasoline and diesel. Consequently, it is not expected that methanol use will increase substantially.

PROJECT-SPECIFIC MITIGATION: Based upon the preceding information, hazards associated with methanol are approximately equivalent or less compared to gasoline and diesel. Therefore, slightly 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 United States 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.

PROJECT-SPECIFIC MITIGATION: Based upon the preceding information, hazards associated with CNG are approximately equivalent or less compared to gasoline and diesel. Therefore, increased usage of CNG 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 CNG is not expected to generate significant adverse hazard impacts.

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, liquified 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 have 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 five 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 United States, 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 five 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.

PROJECT-SPECIFIC MITIGATION: Based upon the preceding information, hazards associated with LPG are approximately equivalent or less compared to gasoline and diesel. Therefore, increased usage of LPG 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 LPG is not expected to generate significant adverse hazard impacts.

Hydrogen

Hydrogen-fueled cars are not currently commercially available, but hydrogen can also be used to power mobile sources. In the 1950's the National Aeronautics and Space Administration (NASA) began using hydrogen as a fuel. Hydrogen is the simplest, lightest and most plentiful element in the universe. In its normal gaseous state, hydrogen is a colorless, odorless, tasteless, non-toxic and burns invisible. Most hydrogen is made from natural gas through a process known as reforming. Reforming separates hydrogen from hydrocarbons by adding heat. Hydrogen can also be produced from a variety of sources including water and biomass. About 160 hydrogen vehicles are being used in demonstration programs in California, including vehicles in some specific fleets and buses. Hydrogen would be stored in above ground vessels. Hydrogen holds more energy per unit mass than other fuels. One kilogram of hydrogen contains as much energy (114,000 Btu LHV) as a gallon of gasoline, which weighs 2.7 kilograms (CEC, 2006r).

PROJECT-SPECIFIC IMPACTS: Fuel cells using hydrogen are two to three times more efficient than an internal combustion engine using gasoline or natural gas. Some researchers claim that a fuel economy improvement of a hybrid hydrogen vehicle with a factor of 1.7 over conventional gasoline vehicles should be attributed to hydrogen-fueled vehicles. Others argue that the improvement from a comparable vehicle is only 1.1 over gasoline because hydrogen vehicles would require larger engines and fuel tanks to achieve the same performance and range as gasoline vehicles. A 2.0 improvement for hydrogen fuel cell vehicles has been estimated (CEC, 2006r). Therefore, fewer truck deliveries to supply refueling stations with hydrogen are expected to provide the same available energy as conventional fuels. Since the probability of accidents is related to the miles traveled, fewer accidents are expected using hydrogen 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 five million miles traveled) and the accident rate with chemical releases is even less, so this would not be a significant risk factor.

Hydrogen is not more dangerous than other fuels. Hydrogen's hazards are usually managed easier than hydrocarbon fuels because hydrogen is lighter than air, and it burns upward and disperses. Hydrogen can cause brittleness in some material, including metals, and can generate electrostatic charges and sparks through flow or agitation (CEC, 2007).

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

- Diesel fuel and gasoline are toxic to the skin and lungs and hydrogen is non-toxic and non-reactive, so if released, it does not present a health hazard to humans;

- Diesel fuel gasoline vapors are heavier than air (for specific gravity of air =1, gasoline is 3.4, diesel fuel is 4.0). Hydrogen is 14 times lighter than air. If released it quickly dissipates into the atmosphere.

- Hydrogen has an extremely low ignition energy requirement, about 20 microjoules can ignite hydrogen/air, which is about 10 times less than what is required to ignite a gasoline/air mixture (LLNL, 2007);

- Hydrogen is clear, odorless, and tasteless. It burns with an extremely hot, but nonluminous flame which is difficult to see. The flame of burning hydrogen has few warning properties.

- Hydrogen has an usually large flammability range and can form ignitable mixtures between four and 75 percent by volume in air. Given confinement and good mixing, hydrogen can be detonated over the range of 18 to 59 percent by volume in air.

The use of hydrogen has raised some concerns over the possible accumulation of hydrogen near the ceilings of enclosed spaces. Current indications are that relatively minor mitigation such as hydrogen sensors, assurance of positive ventilation and avoidance of ceiling-area entrapments will be sufficient in enclosed garages and repair facilities. In parking structures, existing ventilation, existing ventilation standards may prove adequate, particularly in structures with open sides. In home garages, a passive above-door vent may suffice (CCFP, 2001).

Local fire officials in locales such as Sacramento, where hydrogen prototype vehicles are being used have begun to address the hydrogen safety issue for emergency response training and operations. The principal concerns associated with compressed hydrogen include flame invisibility, lack of radiant heat, and fire suppression difficulty. These challenges have been handled by familiarizing emergency response personnel with the characteristics of hydrogen. Emergency procedures are expected to evolve into standardized codes before any commercialization begins. Such procedures are expected to cover both vehicle and structure fires involving hydrogen, including fueling sites.

PROJECT-SPECIFIC MITIGATION: Based upon the preceding information, hazards associated with hydrogen are not greater than gasoline and diesel. However, procedures are expected to evolve into standardized codes before commercialization begins. Therefore, increased usage of hydrogen 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 hydrogen is not expected to generate significant adverse hazard impacts.

Electric and Hybrid Vehicles 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 Engineers (SAE) 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, significant hazards risks are not expected from using this technology.

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 potentially significant hazard is a release of propane gas during vehicle maintenance.

Hydrogen – The main additional hazard associated with the use of hydrogen versus conventional fuels is the difficulty in seeing hydrogen fires and potentiality of a large fire stemming from a release in the case of an accident (e.g., a tanker truck accident). Another potentially significant hazard is a release of hydrogen in an enclosed space, e.g., garage or vehicle maintenance facility.

EV and Hybrid Vehicles- Specific safety issues involving EV technology revealed no potentially 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 fuel powered ICEs currently in use.

There are various existing regulations and recommended safety procedures that, when employed, will reduce any slightly higher insignificant hazards associated with use of alternative clean fuels to the same or lower level as conventional fuels. Table 4.3-6 summarizes some of the regulations and safety procedures associated with use of alternative clean fuels.

Therefore, when affected vehicle owners and maintenance personnel 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.

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. Further, as use of alternative fuels increases in the district, use of conventional fuels such as gasoline and diesel will decline. As a result, explosion and flammability hazards associated with conventional fuels will also decline. In addition, hazards and hazardous clean-up associated with accidental releases of conventional fuels, especially diesel, are essentially eliminated with increasing use of alternative fuels.

TABLE 4.3-6

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).
	Releasing gas in a maintenance shop can potentially create 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 CFC 2903.1). 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 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 4.3-6 (concluded)

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

Fuel Type	Hazard	Regulation/Procedure
LNG (cont.)	Releasing LNG in an enclosed area where there are potential ignition sources such as a maintenance shop my pose an explosive hazard. (A flammable concentration within an enclosed space in the presence of an ignition source can explode).	Installation of flammable gas detection systems in a maintenance 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 are defueled prior to maintenance.
Hydrogen	Releasing gas in enclosed spaces with its related explosive hazards may pose an explosive hazard. (A flammable concentration within an enclosed space in the presence of an ignition source can explode).	Installation of combustible gas detection systems can provide early detection of leaks. 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 maintenance are defueled prior to maintenance.
EV and Hybrid Vehicles	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

PROJECT-SPECIFIC MITIGATION: 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, hazards impacts from the increased use of alternative fuels are expected to be similar to or less than hazards associated with conventional fuels. Therefore, significant hazard impacts are not expected from the increased use of alternative fuels.

Ammonia Use in SCRs

Implementation of some control measures proposed in the 2007 AQMP could result in the use of SCR to reduce NOx emissions including MCS-01, MCS-07, ARB-ONRD-4/SCONRD-03, and ARB-OFFRD-02/SCOFFRD-03. Greater use of SCRs may occur on industrial combustion sources such as boilers and heaters, as well as large diesel engines on mobile sources to reduce NOx, including off-road diesel engines (e.g., locomotive engines and marine vessel engines). Ammonia or urea is used to react with the NOx, in the presence of a catalyst, to form nitrogen gas and water. Anhydrous ammonia (100 percent ammonia) can be diluted with water (aqueous ammonia), which is the recommended formulation for use in the SCR. 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 the formation of ambient PM10 and PM2.5 emissions under some circumstances. Since ammonia is not typically considered to be a flammable compound, other types of hazard impacts such as fires and explosions are not expected to occur and, therefore, will not be evaluated as part of this hazards analysis. To further evaluate the potential for significant adverse environmental impacts due to an accidental release of ammonia, various scenarios were evaluated that could occur during the onsite storage, transportation, and transfer of ammonia. These scenarios and their consequences are discussed in detail below.

Impacts on Water Quality: A spill of any of the hazardous materials (including ammonia) used and stored at any of the affected facilities could occur under upset conditions such as an earthquake, tank rupture, or tank overflow. Spills could also occur from corrosion of containers, piping and process equipment; and leaks from seals or gaskets at pumps and flanges. A major earthquake would be a potential cause of a large spill. Other causes could include human or mechanical error. Construction of the vessels, and foundations in accordance with the Uniform Building Code Zone 4 requirements helps structures to resist major earthquakes without collapse, but may result in some structural and non-structural damage following a major earthquake. As required by U.S. EPA's spill prevention control and countermeasure regulations, all of the affected facilities are currently required to have emergency spill containment equipment and would implement spill control measures in the event of an earthquake. Storage tanks typically have secondary containment such as a berm, which would be capable of containing 110 percent of the contents of the storage tanks. Therefore, should a rupture occur, the contents of the tank would be collected within the containment system and pumped to an appropriate storage tank.

Spills at affected industrial or commercial facilities would be collected within containment structures. Large spills outside of containment areas at affected facilities that could occur when transferring the material from a transport truck to a storage tank are expected to be captured by the process water system where they could be collected and controlled. Spilled material would be collected and pumped to an appropriate tank or sent off-site if the materials cannot be used on-site.

PROJECT-SPECIFIC MITIGATION: Because of the containment system design, spills are not expected to migrate from the facility and as such, potential adverse water quality hazard impacts are considered to be less than significant.

Transportation Release: It is expected that affected facilities will receive ammonia from a local ammonia supplier located in the greater Los Angeles area. Deliveries of aqueous ammonia would be made to the other affected facilities by tanker truck via public roads. The maximum capacity of an ammonia tanker truck is approximately 7,000 gallons.

Transportation Release Scenario 1: This aqueous ammonia truck transport release scenario is taken from the Final Environmental Impact Report for Los Angeles Department Of Water And Power’s (LADWP) Installation Of Five Combustion Turbines At The Harbor Generating Station (HGS), Installation Of Three Selective Catalytic Reduction Systems At The Scattergood Generating Station, And The Installation Of One Combustion Turbine At The Valley Generating Station (SCH. No. 2000101008; SCAQMD, 2001). This LADWP project included a number of modifications including installation of SCRs on new gas turbines and construction of new ammonia storage tanks.

The modeling was based on U.S. EPA's RMP Guidance for toxic releases and explosions. The RMP*Comp model was used to calculate size of the impact zones for explosions and toxic releases. Note that the concentration of aqueous ammonia used at the project sites was expected to be 29.5 percent. To calculate ammonia emissions for modeling purposes, U.S. EPA’s data for aqueous ammonia with a 30 percent concentration was used since 29.5 percent concentration data were not available. Appendix D of the Final EIR for the LADWP project provides a more detailed discussion of the modeling approach and shows the results of the RMP*Comp model and the Screen3 model. For all toxic releases, the surrounding terrain was assumed to be “rural,” consistent with SCAQMD guidance. This reduced the dispersion of the modeled compound with distance and is a more conservative assumption than assuming “urban” dispersion.

The hazard analysis for the HGS also evaluated the probability or frequency of an accidental release. The expected accident frequency of n accidental ammonia release was expected to increase because there would be one extra ammonia truck delivery per week. However, the truck accident rate is approximately one per 8.7 million miles traveled and a major release in an accident is about one in forty. One additional delivery per week of about 21 miles estimated distance would not introduce a significant incremental risk over the current situation. The frequency would change from about one per 300,000 years for a major 5,000-gallon release to one per 150,000 years. Because the HGS was already receiving 39.5 percent aqueous ammonia by truck, this result did not exceed the existing risks from an accidental release of ammonia and for this project, was concluded to be less than significant. Had this risk scenario represented a new hazard risk, the conclusion would most likely have been that hazard risks from the accidental release would have been considered significant.

The hazard analysis included an estimate for the HGS site of the impact of the unconfined release of 5,000 gallons of aqueous ammonia in a tanker truck accident in an open area (minimum dispersion with distance). The 5,000 gallons spreads in all directions in an unconfined manner to a depth of one centimeter on an impervious surface (U.S. EPA "worst-case" assumptions). Based on these extremely conservative assumptions, the toxic impact distance from the spill was estimated to be 2,300 meters.

The analysis of hazard impacts for the LADWP project also included an estimate for the an accidental release of ammonia transported to the Valley Generating Station (VGS) site. The results were based on the impact of an unconfined release of 5,000 gallons of aqueous ammonia in a tanker truck accident in an open area (minimum dispersion with distance). The 5,000 gallons spread in all directions in an unconfined manner to a depth of one centimeter on an impervious surface (U.S. EPA "worst-case" assumptions). Based on these extremely conservative assumptions and using the endpoint of an ammonia concentration of 200 ppm, the toxic impact distance from the spill was estimated to be 2,300 meters. Similar to the result for the HGS, this result represents an existing accidental release of ammonia consequence and, therefore, was concluded to be less than significant. Had this been the result for a new project the conclusion would likely have been significant. The expected accident frequency will be based on one delivery per month. The truck accident rate is approximately one per 8.7 million miles traveled and a major release in an accident is about one in 40. One delivery per month of about 36 miles distance would not introduce a significant risk. The expected frequency of a release is about one per 800,000 years.

Transportation Release Scenario 2: To evaluate the hazard impacts from an accidental release of ammonia during ammonia transport, this analysis uses as a surrogate the project at the ConocoPhillips' Carson Refinery in which a SCR was installed on boiler #10 and an associated 10,000 gallon aqueous ammonia storage tank (19 percent ammonia) was constructed (Final Negative Declaration for: ConocoPhillips Los Angeles Refinery Carson Plant SCR Unit Project, SCH. No. 2004011066, SCAQMD 2004). This project is used as an example of the type of project that could occur in the future as a result of complying with 2007 AQMP measures. This project required approximately six additional aqueous ammonia truck transport trips per month. Although truck transport of aqueous ammonia and other hazardous materials is regulated for safety by the U.S. Department of Transportation, there is a possibility that a tanker truck could be involved in an accident that would cause its contents to spill. 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, driver training, and weather. 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 and as a result are not always reported.

Every time hazardous materials are moved from the site of generation, opportunities are provided for an accidental (unintentional) release. A study conducted by the U.S. EPA indicates that the expected number of hazardous materials spills per mile shipped ranges from one in 100 million to one in one million, depending on the type of road and transport vehicle used. The U.S. EPA analyzed accident and traffic volume data from New Jersey, California, and Texas, using the Resource Conservation and Recovery Act Risk/Cost Analysis Model and calculated the accident involvement rates presented in Table 4.3-7. This information was summarized from the Los Angeles County Hazardous Waste Management Plan (Los Angeles County, 1988).

TABLE 4.3-7

Truck Accident Rates for Cargo on Highways

Highway Type	Accidents Per 1,000,000 miles
Interstate	0.13
U.S. and State Highways	0.45
Urban Roadways	0.73
Composite*	0.28

Source: Environmental Protection Agency, 1984.

* Average number for transport on interstates, highways, and urban roadways.

In the study completed by U.S. EPA, cylinders, cans, glass, plastic, fiber boxes, tanks, metal drum/parts, and open metal containers were identified as usual container types. For each container type, the expected fractional release en route was calculated. The study concluded that the release rate for tank trucks is much lower than for any other container type (Los Angeles County, 1988).

The accident rates developed based on transportation in California were used to predict the accident rate associated with trucks transporting aqueous ammonia to the facility. Assuming an average truck accident rate of 0.28 accident per million miles traveled (Los Angeles County, 1988), the estimated accident rate associated with transporting aqueous ammonia for the ConocoPhillips project is 0.00101, or about one accident every 992 years.

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 California Accidental Release Prevention Program requirements) hazardous materials, including aqueous 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 7,000 gallons 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 evaporative emissions. Additionally, the roadside surfaces may not be paved and may absorb some of the spill. In a typical release scenario, because of the characteristics of most roadways, the pooling effect on an impervious surface would not typically occur. As a result, the spilled ammonia would not be expected to form pools that could evaporate into a toxic cloud at concentrations that could significantly adversely affect residences or other sensitive receptors in the area of the spill.

Based of the low probability of an ammonia tanker truck accident with a major release and the potential for exposure to low concentrations, if any, the conclusion of this analysis was that potential impacts due to accidental release of ammonia during transportation are less than significant.

Transportation Release Scenario 3: This transportation release scenario uses as a surrogate analysis a project at the BP Carson refinery in which SCR was retrofitted onto an existing FCCU and an associated 12,660 gallon aqueous ammonia storage tank (19 percent NH_3) was constructed (Final Negative Declaration for: BP Carson Refinery Fluid Catalytic Cracking Unit NOx Reduction Project: SCH. No. 2002021068; SCAQMD, 2002). The following summarizes the ammonia transport analysis for the BP FCCU project.

The proposed project was estimated to require approximately 35 tanker truck deliveries of aqueous ammonia during the first year of operation (two deliveries after construction to fill the tank plus one delivery every 11 days to replenish the tank during operations). Truck accident rates are approximately one in 8.7-million miles (SCAQMD, 2002). Based upon the projected 35 ammonia deliveries the first year, and a distance of 30 miles from the supplier to the facility, the number of truck-miles associated with the transport of aqueous ammonia is 1,050 truck-miles per year. The expected number of truck accidents associated with the proposed BP Carson project is therefore approximately once every 8,300 years. The likelihood of any release in a transportation accident is one in 10, and that of a large release in a transportation accident is one in 40 (SCAQMD, 2002). The likelihood of a major transportation release after the project is constructed is therefore approximately once per 330,000 years (8,300 times 40). The probability of a transportation accident that would pose a significant risk to the public is therefore insignificant.

In the unlikely event that a major release occurred during a tanker truck accident, 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. 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. Therefore, potential impacts due to accidental release of ammonia during transportation are less than significant.

PROJECT-SPECIFIC MITIGATION: The transportation release scenarios in this subsection do not include transport of anhydrous ammonia because SCAQMD policy does not allow permit application projects for new projects requiring SCR equipment using anhydrous ammonia to be approved. This policy is based on the fact that CEQA documents for past anhydrous ammonia projects were always concluded to have significant adverse hazards impacts. Anhydrous ammonia impacts can be substantially mitigated through use of aqueous ammonia, which is considered to be feasible mitigation. Similarly, accidental releases of ammonia during transport that may occur in connection with the proposed control measures impacts are considered to be less than significant because the concentration of ammonia transported will be less, at 19 percent by volume as compared to 29.5 percent by volume; consequences of an accidental release during transport would be less than for the LADWP project; although probability would increase, the probability of an accidental release remains relatively remote. SCAQMD Staff recommends that permit applicants use aqueous ammonia at 19 percent or less by volume for any new SCR systems.

Ammonia Tank Rupture On-site

Storage Tank Rupture Scenario 1: To evaluate the hazard impacts from an accidental release of ammonia from a 10,000 gallon storage tank constructed for an SCR project, this analysis uses as a surrogate the project at the ConocoPhillips Carson Refinery in which SCR was installed on boiler #10 and an associated 10,000 gallon aqueous ammonia storage tank was constructed (Final Negative Declaration for: ConocoPhillips Los Angeles Refinery Carson Plant SCR Unit Project, SCAQMD 2004). For this project, an ammonia storage tank release scenario, impacts were calculated for an accidental release of 19 percent aqueous ammonia into a containment dike (see Appendix B of the Final Negative Declaration for the detailed hazards analysis). A series of release and dispersion calculations were completed to quantify the dispersion of ammonia gas evaporating from a pool of aqueous ammonia following a release from a storage tank on the premises of the ConocoPhillips Carson Plant. The dispersion calculations were performed until specific ammonia concentrations were reached in the downwind direction. Two ammonia concentrations were chosen for evaluation:

- **Emergency Response Planning Guide Level 2 (ERPG-2) (200 ppm):** The maximum airborne concentration below which it is believed nearly all individuals could be exposed for up to one hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their ability to take protective action.

- **Emergency Response Planning Guide Level 3 (ERPG-3) (1,000 ppm):** The maximum airborne concentration below which it is believed nearly all individuals could be exposed for up to one hour without experiencing or developing life-threatening health effects.

The hazard zones resulting from liquid releases into the storage containment areas were identified and evaluated to determine the extent and location of the gas cloud containing ammonia. Note that the storage containment area is also referred to in Appendix B of the Final Negative Declaration as the bund. Details on the accidental release modeling assumptions are included in Appendix B of the Final Negative Declaration. The dispersion analysis was completed for a range of impoundment sizes ranging from 100 to 1,000 feet. The following conclusions were drawn from this analysis:

1. Under “worst-case” atmospheric conditions (e.g., low winds and stable air), the lowest ammonia concentration of interest (ERPG-2 level of 200 ppm), does not reach the closest property line. The liquid impounding area would have to be much larger than 1,000 square feet (ft^2) to exceed the ERPG-2 level.

2. Under all other atmospheric conditions (e.g., high winds, less stable atmospheres), the distances to the 200 ppm ammonia concentration level would be shorter.

3. Under no condition does the 1,000 ppm ammonia concentration level extend further than 45 feet from the tank. This distance is always well within the Carson Plant property boundaries.

Based on the above, as long as the containment area is no larger than 1,000 ft^2 a release of ammonia from the tank would remain within about 45 feet from the tank, which is well within the boundaries of the Carson Plant. ConocoPhillips is proposing a concrete spill containment of 18 feet by 18 feet, for a total of 324 square feet. Therefore, the containment area is less than 1,000 ft^2 and a release from the ammonia tank is not expected to result in a significant adverse hazard impact.

The modeling analysis completed above for the ammonia tank release would also apply to a release of ammonia when the tank truck is unloaded and transferred to the storage tank. Containment facilities are provided at the truck loading rack to contain ammonia in the event of a spill during transfer activities. The ammonia concentration will be less than the ERPG 2 level of 200 ppm at the facility boundaries, as long as the containment area is limited to 1,000 ft^2.

Rupture Scenario 2: This tank rupture scenario uses as a surrogate analysis a project at the BP Carson refinery in which SCR was retrofitted onto an existing FCCU and an associated 12,660 gallon aqueous ammonia storage tank was constructed (Final Negative Declaration for: BP Carson Refinery Fluid Catalytic Cracking Unit NOx Reduction Project: SCH. No. 2002021068; SCAQMD, 2002). The following two off-site consequences analyses (OCA) were performed:

1. Complete release of the aqueous ammonia storage tank (10,413-gallon working volume) into a 1,000-square foot diked containment area (25 feet x 40 feet). The bermed area was assumed to empty quickly into a catch basin with sufficient capacity to contain the entire contents of the ammonia tank with freeboard for precipitation and 12,000 gallons of firewater.

2. Complete release of an aqueous ammonia tanker truck (7,000 gallons) into the bermed unloading area. The ammonia then immediately drains into the tank pad containment structure.

RMP guidelines require assessment of the catastrophic failure of the largest storage vessel in a process as part of a RMP analysis. An OCA was therefore performed for a catastrophic rupture of the ammonia tank as a “worst-case” release scenario. The “worst-case” meteorological conditions of “F” stability (very stable dispersion conditions) and a wind speed of 1.5 meters per second (m/s) are defined by U.S. EPA to exist during a “worst-case” release (SCAQMD, 2002).

An unloading spill was evaluated as an alternative release scenario. The maximum potential surface area during an unloading spill is identical with that for the tank rupture scenario (1,000 square feet) since the unloading area drains to the storage tank containment structure. The meteorological conditions for an alternative release scenario are less restrictive than the “worst-case” conditions and are defined by U.S. EPA as “D” stability (neutral dispersion conditions) and a wind speed of 3.0 m/s (SCAQMD, 2002). The emission rate during the alternative release scenario is larger than during the “worst-case” release scenario because the wind speed is higher (3.0 m/s versus 1.5 m/s).

The U.S. EPA RMP*Comp (Version 1.06) program was used to perform the OCA hazard assessment for the BP FCCU project. The RMP*Comp model estimates the distance at which the downwind concentration of the spilled material falls below the Emergency Response Planning Guideline Level 2 (ERPG-2) concentration level of 0.14 mg/l (200 ppm). The minimum distance to the toxic threshold concentration allowed by RMP*Comp is 0.1 mile (approximately 200 m).

For the “worst-case” release scenario involving the rupture of the entire storage vessel, the estimated distance to the 200 ppm significance threshold concentration was 0.1 mile. As the tank is located approximately 685 feet (0.13 mile) from the nearest property boundary, the “worst-case” release scenario is not projected to have an off-site impact. Therefore, because the toxic threshold concentration does not extend off-site, the “worst-case” impact is not significant.

The Negative Declaration for the BP FCCU project noted further that the American Institute of Chemical Engineers (AIChE) Center for Chemical Process Safety (AIChE, 1989) has determined that the mean time to catastrophic failure for a metallic storage vessel at atmospheric pressure is 0.985 per million hours (approximately once per 112 years). For aqueous ammonia tanks used at power plants, the California Energy Commission concluded that the catastrophic failure of an aqueous ammonia storage tank is an extremely unlikely event because the probability of a complete tank failure is insignificant, and the risk of failure due to other causes such as external events and human error also is insignificant. In addition, there is no record of any aqueous ammonia storage tank having had a catastrophic failure in recent history. Therefore, the likelihood of a rupture of the aqueous ammonia storage tank occurring is extremely low (SCAQMD, 2002).

For the alternative release scenario involving a tanker-truck unloading accident, the surface area of the release is identical with that for the “worst-case” scenario, but the release rate is greater because of the higher wind speed assumed. However, because the meteorological conditions for an alternative release scenario are less restrictive than that for the “worst-case” scenario, the estimated distance to the toxic threshold concentration (less than 0.1 mile) is less than that for the “worst-case” scenario. This impact was not considered significant because there were no offsite exposure concentrations that exceeded the ERPG-2 level of 200 ppm.

The release of the entire truckload of 7,000 gallons of ammonia in an unloading accident is also a highly unlikely scenario. Leaks of ammonia from a bad connection or damaged hose would be very noticeable and quickly corrected. Should the connection suddenly break, the operator would be able to hit the emergency shut-off valve, hence substantially limiting the amount of spillage. Therefore, should an accident occur, it is likely that less than the entire load would be spilled before the release is controlled. The analysis concluded that both off-site release scenarios would be less than significant. It is expected that these results would be similar for any future SCR projects at large industrial or commercial facilities.

PROJECT-SPECIFIC MITIGATION: No significant impacts on hazards associated with the use of ammonia in SCR units is expected, assuming that aqueous ammonia is used as the catalyst, rather than anhydrous ammonia. Therefore, so no mitigation measures are required.

Fuel Additives

Some control measures in the 2007 AQMP would provide incentives to use fuel additives to provide emission reductions including MOB-03, and SC-ONRD-01. 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.

4.3.5 SUMMARY OF HAZARD IMPACTS

The following is the summary of the conclusions of the analysis of hazard impacts associated with implementation of the 2007 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 reformulated materials would be expected to result in a concurrent reduction in the amount of materials formulated with conventional solvents. Further, the net number of accidental releases would be expected to remain constant, regardless of formulations being used, 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 2007 AQMP 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 2007 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 2007 AQMP control measures were determined to be less than significant when users of alternative fuels comply with existing regulations and recommended safety procedures. Further, any increase in the use of alternative fuels will result in a concurrent decrease in the amount of conventional fuels used in the district.

- Ammonia Use in SCRs: The use of ammonia in SCRs could be potentially significant due to implementation of the control measures. However, the use of aqueous ammonia at concentrations less than 20 percent by volume is 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.