SUBCHAPTER 4.4

HAZARDS AND HAZARDOUS MATERIALS

Introduction

2012 AQMP Control Measures with Potential Hazards and Hazardous Materials Impacts

Significance Criteria

Potential Hazards and Hazardous Materials Impacts and Mitigation Measures

Summary of Hazards and Hazardous Materials Impacts

4.4 HAZARDS AND HAZARDOUS MATERIALS

4.4.1 Introduction

Hazards and hazardous materials 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 for the 2012 AQMP identified the following types of control measures as having potentially significant hazards and hazardous materials impacts: 1) use of reformulated coatings, solvents, and consumer products; 2) increase in the transportation and disposal of reformulated products; 3) the use of ammonia in selective catalytic reduction (SCR) or selective non-catalytic reduction (SNCR) air pollution control technology; 4) use of alternative fuels; and, 5) use of catalysts.

4.4.2 2012 AQMP Control Measures with Potential Hazards and Hazardous Materials Impacts

The 2012 AQMP continues the air quality management strategy of advancing clean technologies and promoting their use. In particular, some control measures in the 2012 AQMP promote greater use of reformulated low VOC consumer products such as coatings, adhesives, solvents and lubricants, potentially resulting in additional hazards associated with their use while other control measures encourage the use of alternative fuels which could increase hazards associated with the use of these fuels. Each control measure proposed in the 2012 AQMP was evaluated and 24 control measures were identified as having potential adverse hazard impacts. Table 4.4-1 contains a summary of the 2012 AQMP control measures (e.g., three PM2.5 control measures and 21 ozone precursor control measures) which may result in the use of compliance options that could generate significant hazard impacts.

TABLE 4.4-1

Control Measures with Hazards and Hazardous Materials Impacts

Control Measure	Control Measure Title (Pollutant)	Control Methodology	Hazard Impact
SHORT-TERM PM2.5 CONTROL MEASURES			
CMB-01	Further NOx Reductions from RECLAIM (NOx)	Cement kilns, glass furnaces, and gas turbines were not subject to reduction in the 2005 RECLAIM rule amendment. These sources will be examined for further reductions in this control measure and potential rule making. SCR, SNCR, low NOx burners, and NOx reducing additives (catalysts).	Potential exposure to toxic air contaminant (ammonia) associated with SCRs and SNCR during storage, transport, use and accidental release. Potential increase in the quantity of hazardous materials (e.g., catalysts) associated with shipping, handling, storage, use, and disposal.

TABLE 4.4-1(Continued)

Control Measures with Hazards and Hazardous Materials Impacts

CONTROL MEASURE	CONTROL MEASURE TITLE (POLLUTANT)	CONTROL METHODOLOGY	HAZARD IMPACT
SHORT-TERM PM2.5 CONTROL MEASURES			
IND-01	Backstop Measure for Indirect Sources of Emissions from Ports and Port-Related Facilities	Environmental lease conditions, port rules, tariffs or incentives.	Use of alternative fuels can result in hazard impacts. Potential exposure to toxic air contaminant (ammonia) associated with SCRs during with storage, transport, use and accidental release.
MCS-01	Application of All Feasible Measures	SCAQMD would adopt and implement new retrofit technology control standards as new BARCT standards become available.	Use of alternative fuels can result in hazard impacts. Potential exposure to toxic air contaminant (ammonia) associated with SCRs during with storage, transport, use and accidental release. Reformulating coatings with more toxic or flammable solvents could cause fire, accidental release, offsite/onsite exposure and worker risk.
OZONE CONTROL MEASURES			
CTS-01	Further VOC Reductions from Architectural Coatings (Rule 1113) (VOC)	Reduce the allowable VOC content in product formulations by using alternative low-VOC products and use application techniques with greater transfer efficiency.	Reformulating coatings with more toxic or flammable solvents could cause fire, accidental release, offsite/onsite exposure and worker risk.
CTS-02	Further Emission Reduction from Miscellaneous Coatings, Adhesives, Solvents and Lubricants (VOC)	Reduce the allowable VOC content in product formulations by using alternative low-VOC products or non-VOC products/equipment.	Reformulating coatings with more toxic or flammable solvents could cause fire, accidental release, offsite/onsite exposure and worker risk.
CTS-03	Further VOC Reductions from Mold Release Products (VOC)	Limitation of VOC content for mold release products.	Reformulating coatings with more toxic or flammable solvents could cause fire, accidental release, offsite/onsite exposure and worker risk.
CTS-04	Further VOC Reductions from Consumer Products (VOC)	Eliminate or revise the exemption for low vapor pressure solvents in consumer products.	Reformulating consumer products with more toxic or flammable solvents could cause fire, accidental release, offsite/onsite exposure, and worker risk.
FUG-01	~~Further~~ VOC Reductions from Vacuum Trucks (VOC)	VOC control devices such as carbon adsorption systems, internal combustion engines, thermal oxidizers, refrigerated condensers, liquid scrubbers and positive displacement (PD) pumps.	Hazardous waste from spent carbon, use of ammonia to operate condensers, hazardous waste from operating scrubbers, hazardous waste of spent catalyst from operating thermal oxidizers.

TABLE 4.4-1 (Continued)

Control Measures with Hazards and Hazardous Materials Impacts

CONTROL MEASURE	CONTROL MEASURE TITLE (POLLUTANT)	CONTROL METHODOLOGY	HAZARD IMPACT
OZONE CONTROL MEASURES			
INC-01	Economic Incentive Programs to Adopt Zero and Near-Zero Technologies (NOx)	Installation of cleaner, more efficient combustion equipment, such as boilers, water heaters and commercial space heating or installation of control technologies including fuel cells, diesel particulate filters (DPF), NOx reducing additives (catalysts), alternative electricity generation, such as wind and solar, battery electric, hybrid electric, and usage of low NOx and alternative fuels such as natural gas.	Use of alternative fuels can result in hazard impacts. Potential increase in the quantity of hazardous materials (e.g., catalysts) associated with shipping, handling, storage, use, and disposal.
MCS-03	Improved Start-up, Shutdown and Turnaround Procedures (All Pollutants)	Diverting or eliminating process streams that are vented to flares, and installing redundant equipment to increase operational reliability	Equipment modifications may pose safety issues.
ONRD-01	Accelerated Penetration of Partial Zero-Emission and Zero Emission Vehicles (NOx)	Incentives to replace older vehicles with electric or hybrid vehicles.	Use of alternative fuels can result in hazard impacts.
ONRD-03	Accelerated Penetration of Partial Zero-Emission and Zero Emission Medium Heavy-Duty Vehicles (NOx)	Incentives to replace older medium-duty vehicles with low-emitting vehicles. Highest priority would be given to zero-emission vehicles and hybrid vehicles with a portion of their operation in an “all electric range” mode.	Use of alternative fuels can result in hazard impacts.
ONRD-04	Accelerated Retirement of Older Heavy-Duty Vehicles (NOx)	Incentives replace heavy-duty vehicles with newer or new vehicles. Priority would be placed on replacing older diesel trucks in Mira Loma.	Use of alternative fuels can result in hazard impacts.
ONRD-05	Further Emission Reductions from Heavy-Duty Vehicles Serving Near-Dock Railyards (NOx, PM)	Incentives to replace up to 1,000 heavy-duty vehicles with low-emitting vehicles or zero-emission container movement systems.	Use of alternative fuels can result in hazard impacts.

TABLE 4.4-1 (Continued)

Control Measures with Hazards and Hazardous Materials Impacts

CONTROL MEASURE	CONTROL MEASURE TITLE (POLLUTANT)	CONTROL METHODOLOGY	HAZARD IMPACT
OZONE CONTROL MEASURES			
OFFRD-01	Extension of the SOON Provision for Construction/Industrial Equipment (NOx)	Accelerate Tier 0 and Tier 1 equipment replacement with Tier 4 equipment, use of air pollution control technologies (e.g., advanced fuel injection, air induction, and after-treatment technologies).	Use of alternative fuels can result in hazard impacts.
OFFRD-02	Further Emission Reductions from Freight Locomotives (NOx)	Replace existing engines (Tier 0 and Tier 2 engines) with Tier 4 engines with control equipment (e.g., SCRs, DPM filters, electric batteries, and alternative fuels).	Use of alternative fuels can result in hazard impacts. Potential exposure to toxic air contaminant (ammonia) associated with SCRs during storage, transport, use and accidental release.
OFFRD-03	Further Emission Reductions from Passenger Locomotives (NOx)	Repower existing Tier 0 and Tier 2 engines with Tier 4 engines with control equipment (e.g., SCRs, DPM filters, electric batteries, and alternative fuels).	Use of alternative fuels can result in hazard impacts. Potential exposure to toxic air contaminant (ammonia) associated with SCRs during storage, transport, use and accidental release.
OFFRD-04	Further Emission Reductions from Ocean-Going Marine Vessels While at Berth (NOx)	Shore power of vessels at berth, use of air pollution control technologies on exhaust gases from auxiliary engines and boilers (e.g., SCRs, DPM filters, electric batteries, and alternative fuels).	Use of alternative fuels can result in hazard impacts. Potential exposure to toxic air contaminant (ammonia) associated with SCRs during storage, transport, use and accidental release.
ADV-01	Proposed Implementation Measures for the Deployment of Zero- and Near-Zero Emission On-Road Heavy-Duty Vehicles (NOx)	Construct "wayside" electric or magnetic infrastructure; construct battery charging and fueling infrastructure. Alternatively, if battery, fuel cell or other zero/near zero emission technologies progress sufficiently, the need for wayside power for rail or trucks may be diminished or eliminated.	Use of alternative fuels can result in hazard impacts.
ADV-02	Proposed Implementation Measures for the Deployment of Zero- and Near-Zero Emission Locomotives (NOx)	Construct "wayside" electric, magnetic, battery-hybrid system, or fuel cell infrastructure, construct battery charging or fueling infrastructure.	Use of alternative fuels can result in hazard impacts.

TABLE 4.4-1 (Concluded)

Control Measures with Hazards and Hazardous Materials Impacts

CONTROL MEASURE	CONTROL MEASURE TITLE (POLLUTANT)	CONTROL METHODOLOGY	HAZARD IMPACT
OZONE CONTROL MEASURES			
ADV-03	Proposed Implementation Measures for the Deployment of Zero- and Near-Zero Emission Cargo Handling Equipment (NOx)	Construct electric gantry cranes, construct battery charging or fueling infrastructure, and use of alternative fuels.	Use of alternative fuels can result in hazard impacts.
ADV-04	Actions for the Deployment of Cleaner Commercial Harborcraft (NOx)	Construct battery charging or fueling infrastructure, use of air pollution control equipment (e.g., SCR, and use of alternative fuels).	Potential exposure to toxic air contaminant (ammonia) associated with SCRs during storage, transport, use and accidental release.
ADV-05	Proposed Implementation Measures for the Deployment of Cleaner Ocean-Going Marine Vessels (NOx)	Employ aftertreatment control technologies such as SCR and sea water scrubbers, and use of alternative fuels.	Potential exposure to toxic air contaminant (ammonia) associated with SCRs during storage, transport, use and accidental release.
ADV-06	Actions for the Deployment of Cleaner Off-Road Equipment (NOx)	Construct battery charging or fueling infrastructure, and increased use of alternative fuels.	Use of alternative fuels can result in hazard impacts.
ADV-07	Actions for the Deployment of Cleaner Aircraft Engines (NOx)	Use alternative fuels, lean combustion burners, high rate turbo bypass, advanced turbo-compressor design, and engine weight reduction.	Use of alternative fuels can result in hazard impacts.

4.4.3 Significance Criteria

Impacts associated with hazards and hazardous materials will be considered significant if any of the following criteria are met:

- Non-compliance with any applicable design code or regulation.
- Non-conformance to National Fire Protection Association standards.
- Non-conformance to regulations or generally accepted industry practices related to operating policy and procedures concerning the design, construction, security, leak detection, spill containment or fire protection.
- Exposure to hazardous chemicals in concentrations equal to or greater than the Emergency Response Planning Guideline (ERPG) 2 levels.

4.4.4 Potential Hazards and Hazardous Materials Impacts and Mitigation Measures

4.4.4.1 Reformulated Coatings, Solvents, and Consumer Products

PROJECT-SPECIFIC IMPACTS: The 2012 AQMP control measures that could require reformulation of coatings, adhesives, solvents, lubricants, mold release agents, and consumer products are MCS-01, CTS-01, CTS-02, CTS-03, and CTS-04. To meet the lowered future VOC content limits, these products are expected to be reformulated. While reformulated products would be expected to have lower VOC contents, the reformulations could have widely varying flammability and health effects, depending on the chemical characteristics of the replacement solvents chosen. While most reformulations are expected to be made with water, which is not flammable and does not have adverse health impacts, other reformulations could be made with an exempt, but extremely flammable solvent, such as acetone. Acetone is an exempt compound from air quality rules and regulations because of its low reactivity. In addition, coatings, solvents and consumer products can also be reformulated with other solvents that are not exempted from the definition of a VOC in SCAQMD's Rule 102, but that also have flammability and health effects issues.

Table 4.4-2 identifies a list of typical conventional solvents and possible replacement solvents that may be used in the manufacture of coatings, adhesives, solvents, lubricants, mold release agents, and consumer products along with their chemical characteristics pertaining to whether each substance is fire hazard.

As illustrated in Table 4.4-2, the flammability classifications by the NFPA are the same for acetone as well as for other conventional solvents that are currently used in existing formulations such as tertiary butyl acetate (T-BAc), toluene, xylene, methyl ethyl ketone (MEK), isopropanol, butyl acetate, and isobutyl alcohol. Because acetone has the lowest flash point of all the chemicals listed, from a flammability perspective, reformulations made with acetone would represent the worst-case. However, it is important to note that acetone also has one of the highest LEL, 2.6 percent by volume, which means that acetone vapors will not cause an explosion unless the vapor concentration exceeds 26,000 ppm.

In contrast, a conventional solvent such as toluene can cause an explosion at 1.3 percent by volume or 13,000 ppm, which poses a much greater risk of explosion when compared to acetone. Similarly, the concentration of xylene, another conventional solvent, that can cause an explosion is even lower than toluene at 1.0 percent by volume or 10,000 ppm. However, facility operators are required to follow operating guidelines when working with flammable chemicals. These guidelines specify well-ventilated areas, as prescribed by the fire department codes, so that it would be difficult to achieve the LEL concentrations when working with flammable chemicals.

TABLE 4.4-2

Chemical Characteristics for Conventional and Potential Replacement Coating Solvents

CAS No.	Chemical Compound	Auto-ignition Temperature (°F)	Boiling Point (@760 mmHg, °F)	Evaporation Rate @ 25 °C (Butyl Acetate = 1)	Flash Point (°F)	LEL/ UEL [a] (% by Vol.)	Vapor Pressure (mmHg @ 20 °C)	NFPA Flammability Rating [b]	Flammability[c]
Conventional Solvents									
67-64-1	Acetone	538	56	6.1	-4	2.6/12.8	180	3	Extremely Flammable
80-05-7	Bisphenol A	N/A	428	N/A	N/A	N/A	N/A	0	N/A
123-86-4	n-Butyl acetate	N/A	257	1	73	1.7/7.6	15	3	Extremely Flammable
111-79-2	2-Butoxyethanol	471.2	340.7	N/A	141.8	1.1/12.7	0.8	2	Combustible
78-92-2	sec-Butyl alcohol	N/A	208	N/A	81	1.7/9.8	11.5	3	Flammable
108-94-1	Cylohexane	788	312.1	N/A	111	1.1/9.4	0.53	2	Combustible
25265-71-8	Diethylene glycol	444	471	N/A	255	1.6/10.8	1	1	Combustible
34590-94-8	Dipropylene glycol methyl ether	278.6	408	N/A	180	1.1/3	0.5	3	Combustible
29911-28-2	Dipropylene glycol monobutyl ether	N/A	441	N/A	205	N/A	0.06	1	Combustible
100-41-4	Ethylbenzene	809.6	276.8	0.84	70	0.8/7	6.75	3	Flammable
103-09-3	2-Ethylhexyl acetate	N/A	390	N/A	185	N/A	N/A	2	Combustible
107-21-1	Ethylene glycol	748	388	0.01	232	3.2/15.3	0.06	1	Combustible
109-59-1	Ethylene glycol isopropyl ether	N/A	109.5	N/A	109	1.6/13	2.6	2	Combustible
50-00-0	Formaldehyde	806	- 2	N/A	147	N/A	N/A	4	Combustible
78-83-1	Isobutyl alcohol	780	226	0.82	82	1.2/10.9	9	3	Flammable
108-21-4	Isopropyl acetate	N/A	109.5	N/A	39	1.8/8	47	3	Flammable
67-63-0	Isopropyl alcohol	399	180	2.3	53	2/12.7	33	3	Extremely Flammable
64742-95-6	Light aromatic hydrocarbons	880	335	0.3	180	0.6/7	11	2	Combustible
110-43-0	Methyl amyl ketone	N/A	301	N/A	106	1.1/7.9	2.14	2	Combustible
78-93-3	Methyl ethyl ketone	474	80	4	16	1.8/11.5	8.7	3	Extremely Flammable
108-10-1	Methyl isobutyl ketone	860	291	0.46	97	1/8.2	5	3	Flammable
107-87-9	Methyl n-propyl ketone	N/A	271.5	N/A	45	1.5/8.2	27	3	Flammable

TABLE 4.4-2 (Continued)

Chemical Characteristics for Conventional and Potential Replacement Coating Solvents

CAS No.	Chemical Compound	Auto-ignition Temperature (^{o}F)	Boiling Point (@760 mmHg, ^{o}F)	Evaporation Rate @ 25 ^{o}C (Butyl Acetate = 1)	Flash Point (^{o}F)	LEL/ UEL [a] (% by Vol.)	Vapor Pressure (mmHg @ 20 ^{o}C)	NFPA Flammability Rating [b]	Flammability[c]
Conventional Solvents									
64741-41-9	Mineral spirits (Stoddard)	232	154-188	0.1	109-113	1.0 / 7	1.1	2	1. Combustible; 2. Special Hazards Labeling per 16 CFR Part 1500.14 (a)(3) & (b)(3)
64742-94-5	Heavy aromatic naphtha	830	719.6	>0.1	145	1.8/11.7	1	2	Combustible
91-20-3	Naphthalene	978.8	424	N/A	176	0.9/5.9	0.03	2	Combustible
8002-05-9	Petroleum distillate (Naphtha)	N/A	86-460	N/A	20 - 100	1.1/5.9	40	3	Extremely Flammable
108-88-3	Toluene	538	111	2	41	1.3/7	22	3	1. Flammable; 2. Special Hazards Labeling per 16 CFR Part 1500.14 (a)(3) & (b)(3)
108-67-8	1,3,5-Trimethylbenzene	550	329	0.01	122	2.6/12.5	2	2	Combustible
95-63-6	1,2,4-Trimethylbenzene	932	337	0.01	112	0.9/6.4	1	2	Combustible
64742-89-8	V.M.&P Naphtha	288	266.9	1.2	53.1	1.2/6	20	3	Flammable
1330-20-7	Xylene	499	139	0.8	81	1.0/6.6	6	3	1. Flammable; 2. Special Hazards Labeling per 16 CFR Part 1500.14 (a)(3) & (b)(3)

TABLE 4.4-2 (Continued)

Chemical Characteristics for Conventional and Potential Replacement Coating Solvents

CAS No.	Chemical Compound	Auto-ignition Temperature (°F)	Boiling Point (@760 mmHg, °F)	Evaporation Rate @ 25 °C (Butyl Acetate = 1)	Flash Point (°F)	LEL/ UEL [a] (% by Vol.)	Vapor Pressure (mmHg @ 20 °C)	NFPA Flammability Rating [b]	Flammability[c]
Potential Replacement Solvents									
67-64-1	Acetone	538	56	6.1	-4	2.6/12.8	180	3	Extremely Flammable
100-51-6	Benzyl alcohol	817	401	0.006	199	1.3/13	0.15	2	Combustible
71-36-3	n-Butanol	N/A	242.5	N/A	95	1.4/11.2	4	3	Flammable
123-86-4	n-Butyl acetate	N/A	257	1	73	1.7/7.6	15	3	Extremely Flammable
85-68-7	Butyl benzyl phthalate	797	698	N/A	390	N/A	8.6E-6	1	Combustible
616-38-6	Dimethyl carbonate	869	194	3.2	64	4.2/12.9	42	3	Flammable
108-01-0	2-Dimethylaminoethanol	455	282	N/A	104	1.6/11.9	3.18	2	Combustible
117-81-7	Dioctyl phthalate	735	446	N/A	405	0.3/	< 0.01	1	Combustible
25265-71-8	Dipropylene glycol	590	449	N/A	250	2.9/12.6	0.03	1	Combustible
763-69-9	Ethyl 3-Ethoxypropionate	N/A	338	N/A	138	N/A	< 1	2	Combustible
141-78-6	Ethyl acetate	800	171	N/A	25	2.2/9	73	3	Extremely Flammable
64-17-5	Ethyl alcohol	685	173	1.4	55	3.3/19	44	3	Extremely Flammable
111-76-2	Ethylene glycol monobutyl ether	460	340	0.07	144	1.1/12.7	0.8	2	Combustible
111-80-5	Ethylene glycol monoethyl ether	455	275	0.41	120	1.7/15.6	4	2	Combustible
109-86-4	Ethylene glycol monomethyl ether	545	256	0.53	100	1.8/19.8	6	2	Combustible
2807-30-9	Ethylene glycol monopropyl ether	455	300	0.22	124	1.3/15.8	1.3	2	Combustible
149-57-5	2-Ethylhexanoic acid	699	442	N/A	244	1/8.6	< 0.01	1	Combustible
822-06-0	Hexamethylene diisocyanate	N/A	415	N/A	284	1/	0.5	1	Combustible
64742-53-6	Hydrotreated light naphthenic distillate	>600	500	N/A	295	N/A	0.04	1	Combustible
79-20-9	Methyl acetate	501	135	5.3	14	3.1/16	173	3	Extremely Flammable
96-29-7	Methyl ethyl ketoxime	N/A	306	N/A	1380	N/A	0.9	2	Combustible
101-68-8	Methylene bisphenyl diisocyanate	464	597	N/A	390	N/A	5E-6	1	Combustible
98-56-6	Parachlorobenzotrifluoride	>500	282	0.9	109	0.9/10.5	5.3	1	Combustible
57-55-6	Propylene glycol	700	370	0.01	210	2.6/12.5	0.08	1	Combustible

TABLE 4.4-2 (Concluded)

Chemical Characteristics for Conventional and Potential Replacement Coating Solvents

CAS No.	Chemical Compound	Auto-ignition Temperature (°F)	Boiling Point (@760 mmHg, °F)	Evaporation Rate @ 25 °C (Butyl Acetate = 1)	Flash Point (°F)	LEL/UEL [a] (% by Vol.)	Vapor Pressure (mmHg @ 20 °C)	NFPA Flammability Rating [b]	Flammability[c]
Potential Replacement Solvents									
108-65-6	Propylene glycol monomethyl ether acetate	N/A	294	N/A	109	1.1/13.1	2.53	2	Combustible
770-35-4	Propylene glycol phenyl ether	923	469	0.002	239	0.8/6.0	0.01	3	Flammable
1569-01-3	Propylene glycol propyl ether	N/A	302	N/A	118	N/A	N/A	2	Combustible
100-42-5	Styrene	914	293	0.5	88	1.1/6.1	4.5	3	Flammable
540-88-5	Tertiary butyl acetate	N/A	208	2.8	62	1.5 /N/A	N/A	3	Flammable
25265-77-4	Texanol	730	471	< 0.01	248	0.6/4.2	0.01	1	Combustible
26471-62-5	Toluene diisocyanate	1148	478	N/A	250	0.9/9.5	0.025	1	Combustible
121-44-8	Triethylamine	480	194	5.6	16	1.2/8.0	57.1	3	Extremely Flammable
144-19-4	Trimethyl 1,3-pentanediol	572	450	N/A	235	N/A	N/A	1	Combustible

[a] Lower Explosive Limit / Upper Explosive Limit

[b] NFPA Flammability Rating: 0 = Not Combustible; 1 = Combustible if heated; 2 = Caution: Combustible liquid flash point of 100° to 200°F; 3 = Warning: Flammable liquid flash point below 100°F; 4 = Danger: Flammable gas or extremely flammable liquid

[c] The Consumer Products Safety Commission (CPSC) has Labeling and Banning Requirements for Chemicals and Other Hazardous Substances which are located in 15 U.S.C.§1261 and 16 CFR Part 1500. Specifically, the flammability of a product is defined in 16 CFR Part 1500.3 (c)(6) and is based on flash point. For example, a flammable liquid needs to be labeled as: 1) "Extremely Flammable" if the flash point is below 20 °F; 2) "Flammable" if the flash point is above 20 °F but less than 100°F; or, 3) "Combustible" if the flash point is above 100 °F up to and including 150 °F.

While a “worst-case” flammability scenario could be that all of the affected 2012 AQMP coatings, solvents and consumer products would be reformulated with acetone to meet the interim and final VOC content limits, due to lower costs, most future reformulated products will likely be reformulated using primarily water. Water-based coatings are generally not flammable and typically have a lower NFPA classification, and a lower CPSC classification, when compared to coatings formulated with 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, lacquers, inks, adhesives, floor coatings, and cosmetic products including nail polish and nail polish remover. Further, it is currently used widely in coating and solvent formulations.

Labels and MSDSs accompanying acetone-based products caution the user regarding acetone’s flammability and advise 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 with similar warnings. The Uniform Fire Code (UFC) treats solvents such as acetone, butyl acetate, and MEK as Class I Flammable Liquids. Further, the UFC considers all of these solvents to present the same relative degree of fire hazard (SCAQMD, 2003).

A list of conventional and potential replacement solvents and their related health hazards information are shown in Table 4.4-3. As illustrated in Table 4.4-3, some of the potential replacement solvents have lower or less severe TLVs, PELs, IDLHs than some of the conventional solvents. For example, acetone would be considered to have less health hazards than all of the conventional solvents listed. However, there are some replacement solvents that could have higher, more severe, or unknown toxicological effects. For example, the diisocyanate group of solvents appear to have more severe toxicological effects than the listed traditional solvents.

In addition to the health hazard values summarized in Table 4.4-3, there are several chemicals listed that are toxics, identified as TACs, including but not limited to the following: ethylbenzene, formaldehyde, methyl ethyl ketone (MEK), methyl isobutyl ketone (MIBK), toluene, triethylamine, and xylene. The use of materials that contain toxic compounds is of particular concern, in both existing formulations as well as reformulated products, to the SCAQMD and other agencies such as EPA, CARB, OSHA, and the Office of Environmental Health Hazard Assessment (OEHHA) (which is part of the California Environmental Protection Agency (Cal/EPA)), because some of the TACs used in some coatings are considered carcinogens (cancer-causing) such as formaldehyde while others may have other non-cancer health effects[1].

---

[1] Formaldehyde, toluene, triethylamine, and xylene are classified as having both chronic and acute health effects; ethylbenzene as having chronic health effects and zinc oxide proposed as having chronic health effects; MEK as having acute health effects with future proposed risk value for chronic; and, cobalt compounds as having future proposed risk values. In addition, MIBK is classified by EPA as a HAP, but the toxicology assessment is not finalized.

TABLE 4.4-3

Health Hazards of Conventional and Potential Replacement Solvents

CAS No.	Chemical Compound	NFPA Health Rating [a]	TLV (ACGIH)[b] (ppm)	PEL (OSHA) [c] (ppm)	IDLH (NIOSH)[d] (ppm)	Health Effects
Conventional Solvents						
67-64-1	Acetone	1	500	1,000	2,500	Mild irritation - eye, nose, throat, skin; narcosis
80-05-7	Bisphenol A	2	N/A	N/A	N/A	Mild irritation - eyes and skin
123-86-4	n-Butyl acetate	2	150	150	1,700	Moderate irritation – eye, nose, throat; narcosis
111-79-2	2-Butoxyethanol	1	20	50	5	Mild irritation - eyes, skin and respiratory
78-92-2	sec-Butyl alcohol	2	100	150	2,000	Mild irritation - eye, nose, throat, skin; narcosis
108-94-1	Cyclohexane	2	20	50	700	Moderate irritation- eye, skin, nose and throat
25265-71-8	Diethylene glycol	1	N/A	N/A	N/A	Mild irritation - eyes and skin
34590-94-8	Dipropylene glycol methyl ether	0	100	100	100	Mild irritation – eye, skin, respiratory, digestion
29911-28-2	Dipropylene glycol monobutyl ether	1	N/A	N/A	N/A	Potential severe irritation to eyes, nose and throat; moderate skin and digestion irritation
100-41-4	Ethylbenzene	2	100	100	800	Moderate irritation – eye, skin, nose, throat
103-09-3	2-Ethylhexyl acetate	2	N/A	N/A	N/A	Mild irritation – eye, skin, respiratory, digestion
107-21-1	Ethylene glycol	2	100	50	N/A	Mild irritation – respiratory, skin, kidney, reproductive
109-59-1	Ethylene glycol isopropyl ether	2	25	25	N/A	Mild irritation – eye, skin, respiratory, digestion
50-00-0	Formaldehyde	3	0.30	1	0.016	Irritation - skin, eyes, nose, and throat. High levels of exposure may cause some types of cancers.
78-83-1	Isobutyl alcohol	1	50	100	8,000	Mild irritation – eye, nose, throat; suspect carcinogen
108-21-4	Isopropyl acetate	1	100	250	1,800	Mild irritation – eye, skin, nose, throat
67-63-0	Isopropyl alcohol	1	200	400	2,000	Mild irritation – eyes, nose, throat; narcosis
64742-95-6	Light aromatic hydrocarbons	2	10-100	10-100	25-100	Mild irritation – eye, skin, respiratory, digestion
110-43-0	Methyl amyl ketone	1	50	100	100	Mild irritation - eyes and skin
78-93-3	Methyl ethyl ketone	1	200	200	3,000	Mild irritation – eye, nose, throat; narcosis; skin
108-10-1	Methyl isobutyl ketone	2	50	50	50	Potential serious eye irritation; mild skin and respiratory irritation
107-87-9	Methyl n-propyl ketone	2	150	200	150	Moderate irritation – eye, skin, respiratory

TABLE 4.4-3 (Continued)

Health Hazards of Conventional and Potential Replacement Solvents

CAS No.	Chemical Compound	NFPA Health Rating [a]	TLV (ACGIH)[b] (ppm)	PEL (OSHA) [c] (ppm)	IDLH (NIOSH)[d] (ppm)	Health Effects
Conventional Solvents						
64741-41-9	Mineral spirits (Stoddard)	1	100	500	5,000	Narcosis; mild irritant
64742-94-5	Heavy aromatic naphtha	2	N/A	N/A	N/A	Mild irritation – eye, skin, respiratory, digestion
91-20-3	Naphthalene	4	10	10	10	Moderate irritation - eye, skin; fatal if inhaled
8002-05-9	Petroleum distillate (Naphtha)	1	400	500	1,100	Mild irritation; narcosis
108-88-3	Toluene	2	50	200	500	Moderate irritation – eye, nose, throat; narcosis; skin; suspect teratogen; mutagen, nervous system
108-67-8	1,3,5-Trimethylbenzene	2	25	25	25	Mild irritation - skin, eye; harmful if inhaled
95-63-6	1,2,4-Trimethylbenzene	2	25	25	25	Mild irritation - skin; serious irritation- eye; harmful if inhaled
64742-89-8	V.M.&P Naphtha	1	300	500	N/A	Mild irritation - skin, eye
1330-20-7	Xylene	2	100	100	1,000	Mild irritation – eye, nose, throat; narcosis; skin
Potential Replacement Solvents						
67-64-1	Acetone	1	500	1,000	2,500	Mild irritation - eye, nose, throat, skin; narcosis
100-51-6	Benzyl alcohol	2	N/A	N/A	N/A	Mild irritation - skin, respiratory; severe eye and ingestion irritation
71-36-3	n-Butanol	2	20	100	1,400	Potential severe irritation to eyes, nose and throat; moderate skin, digestion and respiratory irritation
123-86-4	n-Butyl acetate	2	150	150	150	Mild irritation - skin, eye, respiratory, digestion
85-68-7	Butyl benzyl phthalate	1	N/A	N/A	N/A	Mild irritation - eye, nose, throat, skin
108-01-0	2-Dimethylaminoethanol	3	N/A	N/A	N/A	Potential severe irritation to eyes, skin, throat and digestion; high risk to unborn child
616-38-6	Dimethyl carbonate	0	N/A	N/A	N/A	Mild irritation - respiratory, skin, eye, digestive
117-81-7	Dioctyl phthalate	0	N/A	N/A	N/A	Mild irritation - respiratory, skin, eye, digestive
25265-71-8	Dipropylene glycol	1	N/A	N/A	N/A	Mild irritation - respiratory, skin, eye, digestive, nausea, dizziness; may cause liver and kidney damage
763-69-9	Ethyl 3-Ethoxypropionate	1	0.3	N/A	0.01	Mild irritation - respiratory, skin, eye, digestive

TABLE 4.4-3 (Continued)

Health Hazards of Conventional and Potential Replacement Solvents

CAS No.	Chemical Compound	NFPA Health Rating [a]	TLV (ACGIH)[b] (ppm)	PEL (OSHA) [c] (ppm)	IDLH (NIOSH)[d] (ppm)	Health Effects
Potential Replacement Solvents						
141-78-6	Ethyl acetate	1	400	400	400	Mild irritation - respiratory, skin, eye, digestive; may cause acute inhalation
64-17-5	Ethyl alcohol	2	1,000	1,000	1,000	Mild irritation - respiratory, skin, eye, digestive
111-76-2	Ethylene glycol monobutyl ether	2	20	50	700	Mild irritation – eye, nose, throat; anemia; skin
111-80-5	Ethylene glycol monoethyl ether	2	5	200	500	Cumulative blood damage; moderate irritation of eyes, throat, skin
109-86-4	Ethylene glycol monomethyl ether	2	5	25	N/A	Cumulative CNS; skin; suspect reproductive effects; blood disorders
2807-30-9	Ethylene glycol monopropyl ether	2	N/A	N/A	N/A	Mild irritation - eye, nose, skin, respiratory, digestive
149-57-5	2-Ethylhexanoic acid	2	N/A	N/A	N/A	Mild irritation - eye, nose, skin, respiratory, digestive
822-06-0	Hexamethylene diisocyanate	4	0.005	N/A	0.005	Potential fatality if inhaled; moderate skin, eye irritation; toxic if swallowed
64742-53-6	Hydrotreated light naphthenic distillate	1	N/A	N/A	N/A	Mild irritation - eye, skin, respiratory, digestive
79-20-9	Methyl acetate	2	200	200	200	Mild irritation - eye, nose, skin, respiratory, digestive
96-29-7	Methyl ethyl ketoxime	2	N/A	N/A	N/A	Mild irritation - eye, nose, skin, respiratory, digestive
101-68-8	Methylene bisphenyl diisocyanate	3	0.01	0.02	40	Mild irritation – respiratory
98-56-6	Parachlorobenzotrifluoride	2	N/A	N/A	N/A	Mild irritation - eye, nose, respiratory, digestive
57-55-6	Propylene glycol	0	100	100	N/A	Mild irritation – slight eye, anesthesia
108-65-6	Propylene glycol monomethyl ether acetate	1	N/A	N/A	N/A	Mild irritation - eye, nose, skin, respiratory, digestive
770-35-4	Propylene glycol phenyl ether	2	N/A	N/A	N/A	Mild irritation - eye, nose, skin, respiratory, digestive
1569-01-3	Propylene glycol propyl ether	2	N/A	N/A	N/A	Mild irritation - eye, nose, skin, respiratory, digestive
100-42-5	Styrene	2	20	100	5,000	Mild irritation – eye, respiratory, neurotoxicity

TABLE 4.4-3 (Concluded)

Health Hazards of Conventional and Potential Replacement Solvents

CAS No.	Chemical Compound	NFPA Health Rating [a]	TLV (ACGIH)[b] (ppm)	PEL (OSHA) [c] (ppm)	IDLH (NIOSH)[d] (ppm)	Health Effects
Potential Replacement Solvents						
540-88-5	Tertiary butyl acetate	2	200	200	200	Mild irritation - eye, nose, skin, respiratory, digestive; prolonged exposure may cause dermatitis, blood effects, central nervous system and kidney problems
25265-77-4	Texanol	1	N/A	N/A	N/A	Mild irritation - eye, nose, skin, respiratory, digestive
26471-62-5	Toluene diisocyanate	3	0.005	0.02	10	Mild irritation – respiratory
121-44-8	Triethylamine	3	1	25	200	Mild irritation - eye; Cumulative eye, respiratory, and hematological effects.
144-19-4	Trimethyl 1,3-pentanediol	0	N/A	N/A	N/A	Mild irritation - eye, nose, skin, respiratory, digestive

[a] NFPA Health Rating: 0 = No unusual hazard; 1 = Caution: May be irritating; 2 = Warning: May be harmful if inhaled or absorbed; 3 = Warning: Corrosive or toxic. Avoid skin contact or inhalation; 4 = Danger: May be fatal on short exposure. S pecialized protective equipment required.

[b] TLV = Threshold Limit Value, a recommended guideline established by the American Conference of Governmental Industrial Hygiene (ACGIH)

[c] PEL = Permissable Expo~~ru~~sure Limit, established by OSHA

[d] IDLH = Immediately Dangerous to Life and Health, established by NIOSH

For these reasons, there are two local rules that regulate TAC emissions in coatings: SCAQMD Rule 1401 – New Source Review of Toxic Air Contaminants, and SCAQMD Rule 1402 – Control of Toxic Air Contaminants From Existing Sources. Rule 1401 applies to new and modified facilities, including coating facilities, and Rule 1402 applies to facility-wide risk at existing facilities. Since the majority of coating facilities located within SCAQMD's jurisdiction are existing sources, the requirements in Rule 1402 are the main drivers for reducing overall risk and, therefore, TAC emissions from this industry.

For reasons of cost and to provide flexibility with stringent coating VOC content requirements the SCAQMD has received requests to exempt two chemicals from the definition of a VOC in SCAQMD's Rule 102: tertiary butyl acetate (T-Bac) and dimethyl carbonate (DMC). T-BAc is not currently identified in any of SCAQMD's rules as a TAC. T-BAc has been delisted as a VOC by the U.S. EPA[2], but it has not been delisted as a VOC by CARB or the SCAQMD. When delisting a compound from the definition of VOC, EPA only considers reactivity and does not address whether the compound is toxic or has global warming of stratospheric ozone depleting potential. T-BAc is not currently classified as a hazardous air pollutant under the federal Clean Air Act. T-BAc possesses a low photochemical reactivity as well as some other physical and chemical properties that are considered desirable by its manufacturer's representatives. However, T-BAc may be unsuitable for consideration as a potential replacement for all conventional solvents because of T-BAc's potential toxicity. Specifically, T-BAc has the potential to form a metabolite called tert-butyl alcohol (TBA) which has cancer potency and acute noncarcinogenic values established by OEHHA. According to Acute Toxicity and Cancer Risk Assessment Values for TBA, (Budroe, et al., 2004), "TBAc should be considered to pose a potential cancer risk to humans because of the metabolic conversion to TBA."

Under limited and prescribed circumstances, the SCAQMD incorporated limited use exemptions for T-BAc into SCAQMD Rules 1113 - Architectural Coatings, and 1151 - Motor Vehicle and Mobile Equipment Non-Assembly Line Coating Operations) to provide potential compliance flexibility while limiting use of T-BAc because of the potential toxics concerns.

DMC is also not currently identified in any of SCAQMD's rules as a TAC. EPA revised the federal VOC definition to exclude DMC based on its negligible photochemical reactivity[3]. DMC is also currently not identified as a HAP under the federal Clean Air Act nor is it classified as an ozone depleting substance. No exposure guidelines have been established for DMC by the American Conference of Governmental Industrial Hygienists (ACGIH), or by the National Institute for Occupational Safety and Health (NIOSH). DMC is of concern because it forms a metabolite (an intermediate product of metabolism) consisting of methanol, which is a carcinogen.

---

[2] U.S. EPA. 2004. Revision to Definition of Volatile Organic Compounds – Exclusion of t-Butyl Acetate, 40 CFR Part 51, Federal Register 69298, November 29, 2004. (http://www.gpo.gov/fdsys/pkg/FR-2004-11-29/pdf/04-26069.pdf)

[3] U.S. EPA. 2009. Air Quality: Revision to Definition of Volatile Organic Compounds- Exclusion of Propylene Carbonate and Dimethyl Carbonate, 40 CFR Part 51, Federal Register 3437, January 21, 2009. (http://www.gpo.gov/fdsys/pkg/FR-2009-01-21/pdf/E9-1150.pdf

Thus, when coatings and other products are reformulated as part of implementing the various control measures proposed in the 2012 AQMP, manufacturers could potentially use replacement chemicals that could pose new or different health risks, but SCAQMD Rule 1401 and 1402 would limit potential exposures to nearby receptors. Further, as was the case with the limited use exemption of T-Bac in Rules 1113 and 1151, future SCAQMD rulemaking would require individual evaluation of replacement chemicals that could pose health risks.

When comparing the conventional solvents listed in Table 4.4-3, some of the replacement solvents (e.g., triethylamine) are likely to be present in trace amounts and accidental releases would be considered a one-time event that would be neutralized and cleaned up before all the solvent has evaporated, so no new chronic health risk is expected. As shown in Table 4.4-3, the toxicity of replacement materials is generally less or no worse than conventional solvents overall but if a facility changes from using water-based products to using products that are reformulated with chemicals that may have new or different health hazards, significant adverse health hazard impacts could occur from using some low VOC reformulated products. However, as with the use of all chemicals, facilities and their workers would be required to continue to comply with existing health protective procedures when handling both flammable and toxic materials. In addition, any increase in the future use of low VOC compliant coating materials that are reformulated with water 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.

Regarding fire hazards, 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 either equivalent or less flammable solvent per the NFPA ratings. However, if manufacturers reformulate with acetone, then more acetone-based (and extremely flammable) products would be on the market. Similarly, if manufacturers reformulate with products that have increased flammability than products manufactured with conventional solvents, consumers who may be used to a higher VOC product with lower flammability, may be unaware that the reformulated products may have chemicals with increased flammability and an increased risk when used.

Lastly, in general, water-based coatings and products tend to contain less flammable and less toxic materials than solvent-based coatings and products. While the continued and potentially increased use of waterborne coatings and products would generally be expected to reduce the overall hazard impacts associated with solvent-based products, a switch from currently using water-based products to reformulated solvent-based products could offset any reduction realized. Without knowing how many facilities currently using water-based products would switch to using reformulated solvent-based products as a result of implementing the 2012 AQMP control measures, significant impacts on fire hazards associated with reformulated coatings, solvents and consumer products could occur. Therefore, hazards and hazardous materials impacts associated with increased flammability of potential replacement solvents are concluded to be significant.

PROJECT-SPECIFIC MITIGATION: Since hazards and hazardous materials impacts associated with increased flammability of potential replacement solvents, reformulated coatings and consumer products were identified, the following mitigation measures are necessary and required as part of future rule development pertaining to reformulated products:

HZ-1: Add consumer warning requirements for all flammable and extremely flammable products; and,

HZ-2: Add requirements to conduct a public education and outreach program in joint cooperation with local fire departments regarding flammable and extremely flammable products that may be included in consumer paint thinners and multi-purpose solvents.

REMAINING IMPACTS: The fire hazard impacts are expected to be significant prior to mitigation. While the SCAQMD cannot predict which coatings, solvents and consumer products each affected facility might choose to use in the future as reformulations become available, the mitigation measure is expected to be effective at informing consumers about the potential fire hazards associated with reformulated products. Thus, after mitigation, no remaining significant impacts on fire hazards are expected.

4.4.4.2 Use of Alternative Fuels

The 2012 AQMP would establish in-use strategies that may require or promote the use of alternative fuels including Control Measures IND-01, INC-01, ONRD-01, ONRD-03, ONRD-04, ONRD-05, OFFRD-01, OFFRD-02, OFFRD-03, OFFRD-04, ADV-01, ADV-02, ADV-03, ADV-04, ADV-05, ADV-06, and ADV-07. Control Measure IND-01 is the only control measure developed for PM2.5 emission reductions and the rest of the control measures were developed for ozone precursor reductions. 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. All fuels are flammable; therefore, their use could result in increased hazards associated with their transport and use.

4.4.4.2.1 Methanol/Methanol Blends

Methanol or methyl alcohol is a clear colorless liquid which is commercially manufactured from natural gas in the U.S. At its peak, nearly six million gasoline gallon equivalents of methanol blends were used annually in alternative fuel vehicles in the U.S. Methanol use in vehicles has declined dramatically since the early 1990s, and automakers no longer manufacture methanol vehicles (DOE, 2012).

Methanol is often designated at M100, which is 100 percent methanol, or M85, which are 85 percent methanol and 15 percent gasoline. Pure methanol has low flame luminosity, making it difficult to see fires, particularly in daylight. However, the addition of gasoline to M85 increases both the luminosity and the fuel volatility. The increased luminosity produces a visible flame, and the latter effect generally makes the vapors present in the fuel tank too rich to be flammable.

The bulk transfer of methanol is usually done in standard petroleum tanker trucks. There is no reason to expect that methanol transport will be more dangerous than gasoline or diesel transport. There are, however, certain physical properties of methanol that must be addressed during transport and storage when compared to gasoline or diesel. First, methanol (M100 and M85) is incompatible with several types of materials typically used in petroleum storage and transfer systems. Therefore, it is necessary to take special precautions in selecting material for these purposes. Second, pure methanol (M100) vapor/air mixtures at ambient temperatures and pressures can create a flammable mixture in the ullage space of a storage tank. Therefore, it is important to ensure that there are strong safeguards against any ignition sources inside tanks and that vent lines or other openings have flame arrestors. Furthermore, any fill lines must extend below the liquid methanol level to provide a seal between an external ignition source and the vapor/air mixture in the tank. M85 vapors are primarily composed of gasoline, and should not change the fire hazard of transfer and storage relative to gasoline (DOT, 1995).

Methanol has been used for car racing in the U.S. The main reason for this choice was its safety compared to gasoline. Methanol is harder to ignite, creates less radiant heat, can be controlled/extinguished with water, and burns without producing black smoke, facilitating rescue. For regular driving, methanol offers a substantial decrease in the risks of fuel fire deaths compared to gasoline for the same reasons as in racing. For M100 a 90 percent reduction in fuel related automotive fires is projected, while a smaller reduction of 40 percent is projected for M85 (MIT, 2010).

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

- 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;

- 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.

In 2005 California stopped the use of methanol after 25 years and 200,000,000 miles of operation. There are currently no fueling stations in the state. Although there is still some interest in methanol as a vehicle fuel, there is great emphasis on research and development of other alternative fuels. Consequently, it is not expected that methanol use will increase substantially.

PROJECT-SPECIFIC MITIGATION - METHANOL: Less than significant impacts on hazards associated with the use of methanol as an alternative fuel are expected so no mitigation measures are necessary or required.

REMAINING IMPACTS - METHANOL: The hazard impacts associated with using methanol as an alternative fuel are expected to be less than significant. Thus, no remaining hazard impacts associated with methanol use are expected.

4.4.4.2.2 Ethanol/Ethanol Blends

Like methanol, ethanol is a clear colorless organic liquid with physical and chemical properties which do not change from source to source like conventional fuels. In the U.S., ethanol is typically produced from corn or other grain products, while some imported ethanol is produced from sugar cane. For commercial or industrial use, pure ethanol (E100) is usually denatured with a small amount of gasoline or similar substance to avoid federal alcoholic beverage tax and intentional ingestion. Heavy duty vehicles use E95 (95 percent ethanol and five percent gasoline) or E93 (93 percent ethanol, five percent methanol, and two percent kerosene). Light and medium duty vehicles use E85 (85 percent ethanol and 15 percent gasoline). Vapors from ethanol blended fuels will exhibit similar flammability characteristics as gasoline. There are currently 48 E85 fueling stations that are open to the public in California (U.S. DOE, 2012).

The bulk transfer of ethanol is usually done in standard petroleum tanker trucks. Since the NFPA classification of ethanol is the same as gasoline or diesel (Class IB flammable liquid), there is no reason to expect that ethanol transport will be more dangerous than gasoline or diesel transport. There are, however, certain physical properties of ethanol that must be addressed during transport and storage when compared to gasoline or diesel. First, ethanol is incompatible with some types of materials used in petroleum storage and transfer systems; therefore, it is necessary to take some precaution to assure ethanol capable materials are used. Second, like M100, E100 vapor/air mixtures at ambient temperatures and pressures can create a flammable mixture in the ullage space of a storage tank. Therefore, it is important to ensure that there are strong safeguards against any ignition sources inside tanks and that vent lines or other openings have flame arrestors. Furthermore, any fill lines must extend below the liquid ethanol level to provide a seal between an external ignition source and the vapor/air mixture in the tank. Ethanol blended fuel vapors are primarily composed of gasoline, and should not change the fire hazard of transfer and storage relative to gasoline (DOT, 1995).

PROJECT-SPECIFIC IMPACTS – ETHANOL/ETHANOL BLENDS: Compared with diesel fuel and gasoline the following can be stated with respect to ethanol:

- Diesel fuel and gasoline contain components that are considerably more hazardous than ethanol. For example, diesel fuel contains highly toxic polynuclear aromatic hydrocarbons (PAHs) and gasoline contains an array of toxic compounds, including benzene, a known carcinogen;

- 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). Ethanol is heavier than air but lighter (specific gravity is 1.6) than gasoline and diesel fuel and disperses more readily in air than gasoline or diesel fuel;

- Ethanol has a higher auto ignition temperature (684 degrees Fahrenheit [^{o}F]) than diesel fuel (500 ^{o}F) or gasoline (500 ^{o}F);

- Ethanol is more difficult to ignite since it has a “lower flammability limit” that is higher (3.3 percent) than gasoline (approximately one percent) or diesel fuel (0.5 percent);

- Unlike gasoline, ethanol 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, ethanol can be extinguished with water while water on gasoline or diesel fuel spreads the fire.

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

PROJECT-SPECIFIC MITIGATION – ETHANOL/ETHANOL BLENDS: Less than significant impacts on hazards associated with the use of ethanol or ethanol blends as an alternative fuel are expected so no mitigation measures are necessary or required.

REMAINING IMPACTS – ETHANOL/ETHANOL BLENDS: The hazard impacts associated with using ethanol and ethanol blends as an alternative fuel are expected to be less than significant. Thus, no remaining hazard impacts associated with ethanol and ethanol blend use are expected.

4.4.4.2.3 Compressed Natural Gas (CNG)

Natural gas is a mixture of hydrocarbons, mainly methane, that are in gaseous form at ambient temperature and pressure. It is also odorless and tasteless; therefore, an odorant is added so personnel in the vicinity of a leak can detect the presence of natural gas before it has reached the flammability limit in the area. Unlike other alternative fuels, natural gas already has an extensive distribution system and supply network. The issues of bulk transfer and storage are very different from other fuels, which are usually transported via tanker truck. CNG is generally produced onsite using compressors fed from a nearby natural gas pipeline. The typical range of methane in pipeline quality natural gas is approximately 80 to 95 percent. However, CARB has specified that the methane content to be greater than 88 percent for vehicular grade CNG. Typical on-board pressures for CNG range from 3,000 to 3,600 pounds per square inch gauge (psig) (DOT, 1995). There are currently 140 CNG refueling stations that are open to the public in California, and a few manufactures offer home refueling options (U.S. DOE, 2012).

The SCAQMD has had a history of promoting the use of CNG in the past and few issues have arisen from the transport of CNG, as most refueling applications have relied on the existing natural gas pipeline infrastructure. Furthermore, CNG compositions and storage cylinders in vehicles follow NFPA 52 (CNG Vehicular Fuel Systems) and Society of Automotive Engineers (SAE) J1616 (Recommended Practice for CNG Fuel) specifications. These specifications limit the potential hazards related to CNG leaks related to fuel storage and use in vehicles. Furthermore, natural gas has a higher flammability limit (five percent) than gasoline (one percent) or diesel (0.5 percent). Natural gas also has a lower ignition temperature (1,200 ^{o}F) than gasoline or diesel (500 ^{o}F). Other hazards associated with compressed fuels are projectiles from openings and freeze burns from rapid vaporization.

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 (DOT, 1995).

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

- Diesel fuel and gasoline are toxic to the skin and lungs while 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.

- Based upon the preceding information, hazards associated with CNG are approximately equivalent or less compared to conventional fuels. Therefore, increased usage of CNG with a concurrent decline in usage of conventional fuels 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.

PROJECT-SPECIFIC MITIGATION – CNG: Less than significant impacts on hazards associated with the use of CNG as an alternative fuel are expected so no mitigation measures are necessary or required.

REMAINING IMPACTS – CNG: The hazard impacts associated with using CNG as an alternative fuel are expected to be less than significant. Thus, no remaining hazard impacts associated with CNG use are expected.

4.4.4.2.4 Liquefied Natural Gas (LNG)

Natural gas can be liquefied by refrigerating it below -160 degrees Celsius or -260 degrees Fahrenheit at relatively low pressure (20 to 150 psig). Like CNG, there are NFPA standards (NFPA 59A – Standards for Production, Storage, and Handling of LNG and NFPA 57 – Standard for LNG Vehicular Fuel Systems) for the handling, storage, production, and use of LNG, especially in vehicles. However, unlike CNG, most LNG is not generated on-site. Instead, LNG is typically delivered via insulated double walled tanker trucks to distribution facilities. The double walled construction of the LNG tanker trucks are more robust than standard petroleum tanker trucks, therefore, the transport of LNG is safer from spills and tank ruptures during accidents than conventional fuel tanker trucks.

PROJECT-SPECIFIC IMPACTS – LNG HEALTH IMPACTS: The safety issues associated with LNG are similar to CNG, with the added hazards of handling a cryogenic liquid and the vaporization of the liquid. The cryogenic liquids have the potential to burn workers who come into contact with the liquid or uninsulated surfaces. This hazard can be mitigated by proper personal protective equipment and training. The vaporization of LNG in storage tanks can potentially cause a boiling liquid expanding vapor explosion (BLEVE). For a BLEVE to occur there would need to be a catastrophic failure of all safety measures, including safety relief valves and burst discs, built into the vessel the design code.

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 (DOT, 1995).

Hazards associated with LNG are that, under certain conditions, it may explode or catch on fire. LNG is not explosive or flammable in unconfined areas[4]. However, as it warms and expands to a gas it becomes flammable at a concentration between five and 15 percent.

LNG is comprised mostly of methane, but may contain ethane, propane and other heavier gaseous hydrocarbons. The main acute health effect associated with ammonia vapor is asphyxia. Asphyxia is the condition of severely depleting the oxygen supply to the body. Methane causes asphyxia by displacing oxygen in air. Asphyxiation can occur when oxygen concentrations drop below 18 percent. Oxygen is displaced to 18 percent at a concentration of 14 percent methane. Unconsciousness from central nervous system depression occurs at 30 percent methane[5]. The potential adverse health effects of oxygen deficiency are summarized in Table 4.4-4.

TABLE 4.4-4

Effects of Oxygen Deficiency

Amount of Oxygen Deficiency	Effects of Oxygen Deficiency
12-16 percent	Breathing and pulse rate are increased, with slight muscular incoordination
10-14 percent	Emotional upsets, abnormal fatigue from exertion, disturbed respiration
6-10 percent	Nausea and vomiting, inability to move freely, collapse, possible lack of consciousness
Below 6 percent	Convulsive movements, gasping, possible respiratory collapse and death

It is unlikely that off-site receptors would be exposed to LNG concentrations that would generate adverse health effects, because the lower explosive limit (LEL) for methane is five percent (50,000 ppm). The LEL is the concentration at which there is enough of the given gas to ignite or explode.

The methodology used for estimating the potential risk from a vapor explosion is that developed for off-site consequence analysis for the Risk Management Program (RMP) under 40 CFR 68 (EPA, 1999). For an RMP off-site consequence analysis, a gaseous release is assumed to produce a vapor explosion that results in a blast impact. For a vapor explosion, the significance level is a pressure wave (blast) of one pound per square inch (psi) and the metric examined is the modeled distance to the significant overpressure level.

---

[4] Federal Energy Regulatory Commission, http://www.ferc.gov/o12faqpro/default.asp?Action=Q&ID=470

[5] Canadian Centre for Occupational Health and Safety, http://www.ccohs.ca/oshanswers/chemicals/chem_profiles/methane/health_met.html

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 LNG 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). LNG is lighter than air (specific gravity is 0.55) and disperses more readily in air;
- LNG has a higher auto ignition temperature (1,200 ^{o}F) than diesel (500 ^{o}F) or gasoline (500 ^{o}F). LNG 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 such as LNG 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.

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

PROJECT-SPECIFIC MITIGATION – LNG HEALTH IMPACTS: Less than significant impacts on health hazards associated with the use of LNG as an alternative fuel are expected so no mitigation measures are necessary or required.

REMAINING IMPACTS – LNG HEALTH IMPACTS: The health hazard impacts associated with using LPG as an alternative fuel are expected to be less than significant. Thus, no remaining health hazard impacts associated with LPG use are expected.

PROJECT-SPECIFIC IMPACTS – LNG TRANSPORTATION RELEASE: LNG is non-toxic, disperses more readily in air than conventional fuels, and has more rigorous standards for transportation. It is expected that affected facilities will receive LNG from a local supplier located in the district. Deliveries of LNG would be made to the other affected facilities by tanker truck via public roads. The transport of LNG is regulated by the U.S. DOT. LNG trucks are double-walled aluminum and are designed to withstand accidents during the transport of LNG. LNG is loaded into delivery tanks at atmospheric pressure, which would be at its boiling point of -260ºF (-162ºC). The LNG is maintained at this temperature by evaporation of the boiling LNG and venting of the evaporated LNG. Because the vent is closed during shipment, the pressure in the tank builds and the temperature of the LNG increases. The FMCSA analyzed releases from delivery tanks with an average pressure of 30 psig, which would be -230ºF (-146ºC). At 30 psig, approximately 30 percent of the LNG will flash into vapor when released.

Transportation Release Scenarios: These LNG transport release scenarios were analyzed in the December 2007 Final EA for Proposed Amended Rule 1110.2 – Emissions from Gaseous- and Liquid-Fueled Internal Combustion Engines (ICEs) (SCAQMD No. 280307JK). The following description of LNG transportation and consequences is taken from the Federal Motor Carrier Safety Administration (FMCSA)[6].

Four scenarios were identified as having major consequences:

1. Release of LNG into a pool that evaporates and disperses without ignition. Approximately 40 percent of the liquefied LNG immediately flashes into vapor. The temperature of the liquid pool would be -44 ºF (-42ºC) and would therefore damage exposed vegetation and people.
2. A flammable cloud is formed that contacts an ignition source. The flame front can flash back and set the liquid pool on fire. Quantities of LNG shipped by truck would not typically cause vapor cloud explosions.
3. A boiling liquid expanding vapor explosion (BLEVE) occurs. BLEVEs would occur when an LNG tank is exposed to fire and the increase in pressure within the tank exceeds the capacity of the relief valve.
4. The tank ruptures, rockets away and ignites.

RMPComp was used for the consequence analysis for these four scenarios. The adverse impacts from the four scenarios were determined to be:

1. The area of the pool was estimated by assuming a depth of one centimeter as described in Example 29 in the EPA's Risk Management Program Guidance for Offsite Consequence Analysis[7]. A 6,000 gallon LNG pool would be 24,448 square feet. This distance would be a "worst-case" since as the LNG pool expands from the tank it will warm and evaporate.
2. A pool fire of 6,000 gallons that is released in one minute would result in a heat radiation endpoint (five kilowatts/square meter) of 0.2 mile. If a vapor cloud fire occurs, the estimated distance to the lower flammability limit would be 0.3 mile.

---

[6] Federal Motor Carrier Safety Administration, Comparative Risks of Hazardous Materials and Non-Hazardous Materials Truck Shipment Accidents/Incidents, Final Report, March 2001, www.fmcsa.dot.gov/documents/hazmatriskfinalreport.pdf.

[7] U.S. EPA, Risk Management Program Guidance for Offsite Consequence Analysis, EPA 550-B-99-009, April 1989.

3. Based on 10,000 gallons the BLEVE would result in a fireball that may cause second-degree burns out to 0.3 mile.

4. The "worst-case" release estimate for 10,000 gallons in RMP*Comp is 0.3 mile from the vapor cloud explosion. Since, it is unclear as to how far away the tank would travel, it was assumed that the adverse impact would be 0.3 mile from where the tank lands. Damage to property and persons may occur from physical impact from the rocketing tank.

During transportation of LNG, it was estimated that the adverse impacts from various releases would extend 0.3 mile. Because sensitive receptors may be within the endpoints above, the accidental release of LNG during transport could cause significant adverse hazards.

Based upon the preceding information, increased transport of LNG may substantially alter existing transportation hazards associated with mobile source fuels. Consequently, increased usage of LNG is expected to generate significant adverse hazard impacts during transport.

PROJECT-SPECIFIC MITIGATION – LNG TRANSPORTATION RELEASE: Potentially significant impacts on hazards impacts associated with the transportation of LNG as an alternative fuel are expected, so mitigation measures are necessary and required. Recommend mitigation would be to implement the following design measures that are typically required by local fire departments:

HZ-3: Install secondary containment (e.g., berms).

HZ-4: Install valves that fail shut.

HZ-5: Install emergency release values and barriers around LNG storage tanks to prevent the physical damage to storage tanks or limit the release of LNG from storage tanks.

HZ-6: Perform integrity testing of LNG storage tanks to assist in preventing failure from structural problems. Construct a containment system to be used for deliveries during off-loading operations.

REMAINING IMPACTS – LNG TRANSPORTATION RELEASE: No additional mitigation measures were identified that would reduce the hazard and hazardous material impacts from a transportation release of LNG to less than significant. Therefore, the remaining hazardous and hazardous material impacts from exposure to the one psi overpressure from the cataclysmic destruction of the LNG storage tank are considered to be significant.

4.4.4.2.5 Liquefied Petroleum Gas (LPG)

LPG, which is also known as propane, is a mixture of natural gases which are liquefied at ambient temperatures by compressing the gases to pressures above 120 psig. Propane is the major component of LPG, with the minor components being propylene, butane, and butene.

In the U.S., almost all of the propane supply comes from stripping wellhead natural gas or as a by-product of petroleum refining. LPG for vehicle use is at least 95 percent propane and no more than 2.5 percent butane and heavier hydrocarbons. LPG has been used in fleet vehicles since the 1940s, so there is a substantial base of experience with LPG as an automotive fuel.

For a variety of reasons, however, LPG is not considered the alternative fuel of the future. Its place has been taken by natural gas. Consequently, there has been little development in dedicated LPG engine technology. On the other hand, other technologies and their emissions improved tremendously over the last decade. As a result of that development, some of the previous emission reduction advantages of LPG fuel, especially the low CO emissions, are now less pronounced[8]. Consequently, it is not likely that LPG would be used to any great extent providing the fuel for near zero- or zero-emission technologies.

PROJECT-SPECIFIC IMPACTS - LPG: Since LPG is a compressed fuel, it shares many of the physical hazards (projectiles, freeze burns, BLEVE, etc.) of CNG and LNG and storage regulations. However, since LPG is under less pressure and is stored at ambient temperatures, the physical hazards are not as high for storage and transport compared to CNG or LNG. Furthermore, the flammability limit range for LPG is similar to gasoline, but the ignition temperature (920 degrees Fahrenheit) is lower than gasoline or diesel (500 degrees Fahrenheit). Therefore, the hazard from transport and storage of LPG should not be significantly different from the transport and storage of gasoline or diesel (DOT, 1995).

The main additional hazard associated with the use of LPG versus conventional fuels is the potential 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 LPG during vehicle maintenance.

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

- Diesel fuel and gasoline are toxic to the skin and lungs and LPG is not;
- Diesel fuel and 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).

Based upon the preceding information, hazards associated with LPG are approximately equivalent or less as compared to conventional fuels. Therefore, increased usage of LPG with a concurrent decline in usage of conventional fuels will not significantly alter existing

---

[8] Net Technologies, Inc. How Clean Are LPG Engines. http://www.nett.ca/faq/lpg-3.html.

hazards associated with mobile source fuels. Consequently, increased usage of LPG is not expected to generate significant adverse hazard impacts.

PROJECT-SPECIFIC MITIGATION – LPG: Less than significant impacts on hazards associated with the use of LPG as an alternative fuel are expected so no mitigation measures are necessary or required.

REMAINING IMPACTS – LPG: The hazard impacts associated with using LPG as an alternative fuel are expected to be less than significant. Thus, no remaining hazard impacts associated with LPG use are expected.

4.4.4.2.6 Biodiesel

Biodiesel is a fuel derived from biological sources such as vegetable oils or animal fats. The process for creating biodiesel involves mixing the oil with alcohol (e.g., methanol or ethanol) in the presence of a chemical such as sodium hydroxide. This process produces a methyl ester if methanol is used or an ethyl ester if ethanol is used. Methyl ester from soy beans is more economical to produce, and, therefore, is more common in the U.S. Biodiesel can be used pure (B100) or blended with conventional diesel. The most common blended biodiesel is B20, which is 20 percent biodiesel and 80 percent conventional diesel.

PROJECT-SPECIFIC IMPACTS – BIODIESEL: Biodiesel fuels are derived from vegetable oils and/or animal fats, the transport of which do not pose any significant hazards, as compared to conventional fuels which are derived from crude oil. Biodiesel and biodiesel blends have a higher flash point and lower vapor pressure than conventional diesel. This makes biodiesel safer to store and transport than conventional diesel. Furthermore, biodiesel is less toxic and more biodegradable than conventional diesel, so the environmental impacts from a spill would be less than for a spill of conventional diesel fuel. However, biodiesel has some compatibility issues with certain rubbers and plastics when compared to conventional diesel. Those leak hazards can be mitigated by using the proper material for seals, fittings, and hoses used for storage and transport. Therefore, the hazard from transport and storage of biodiesel and biodiesel blends should not be significantly different from the transport and storage of conventional diesel (DOT, 1995).

Biodiesels are considered safer than conventional diesels; therefore, increased usage of biodiesel with a concurrent decline in usage of conventional diesel will not significantly alter existing hazards associated with mobile source fuels. Consequently, increased usage of biodiesel is not expected to generate significant adverse hazard impacts.

PROJECT-SPECIFIC MITIGATION – BIODIESEL: Less than significant impacts on hazards associated with the use of biodiesel as an alternative fuel are expected so no mitigation measures are necessary or required.

REMAINING IMPACTS – BIODIESEL: The hazard impacts associated with using biodiesel as an alternative fuel are expected to be less than significant. Thus, no remaining hazard impacts associated with biodiesel use are expected.

4.4.4.2.7 Hydrogen

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 steam reforming. Reforming separates hydrogen from hydrocarbons by adding heat. Hydrogen can also be produced from a variety of sources including water and biomass. Hydrogen can be used as a combustion fuel or in fuel cell vehicles to produce electricity to power electric motors. There is currently one commercially available fuel cell vehicle sold in the U.S., the Honda Clarity. Honda planned to have about 200 Clarities available for lease by 2010, but the actual number of Clarities on the road is estimated at 50 (AP, 2010). The majority of hydrogen powered vehicles on the road at this time are used for research and development or fleet use.

PROJECT-SPECIFIC IMPACTS - HYDROGEN: The generation and distribution of hydrogen as a consumer product is also still in developmental stages. Currently there are 23 hydrogen refueling stations, nine of which have public access (U.S. DOE, 2012). Most of the refueling stations depend on bulk liquid hydrogen delivery; however, a few hydrogen gas pipeline stations and on-site steam reformer stations exist. The physical hazards associated with bulk liquid transport and storage are similar to LNG, as they are both cryogenic liquids. The physical hazards associated with pipeline and steam reformer stations are similar to CNG, as they are both compressed gases. In general, the fire hazards associated with hydrogen spills or leaks is higher than conventional fuels. This is due to the wide flammability range and low ignition energy of hydrogen. However, hydrogen tanks are built to more rigorous standards than conventional fuel tanks, which reduces the likelihood of spills or leaks.

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).

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

- 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) while hydrogen is 14 times lighter than air. If released, hydrogen will quickly dissipate 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 unusually 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.

Hydrogen is non-toxic and disperses more readily in air than gasoline or diesel. Based upon the preceding information, hazards associated with hydrogen are approximately equivalent or less when compared to conventional fuels. Furthermore, hydrogen is limited in its use as a transportation fuel. In 2007, there were 6,675,888 automobiles, commercial vehicles, and motorcycles registered in the County of Los Angeles alone (LADOT, 2009). The 2012 AQMP projects that the population of zero or near-zero vehicles will increase by about 37,000 vehicles, which means hydrogen is expected to make up a very small portion of transportation fuel (e.g., less than 0.1 percent). While hydrogen fuel cell technology is promising, its use in the future is dependent on many things (cost-effectiveness of the technology, availability of hydrogen, etc.), so that the extent to which it may be used in the future to replace petroleum fuels is currently unknown and, therefore, speculative. For these reasons, the use of hydrogen fuel is not expected to generate significant adverse hazard impacts.

PROJECT-SPECIFIC MITIGATION – HYDROGEN: Less than significant impacts on hazards associated with the use of hydrogen as an alternative fuel are expected so no mitigation measures are necessary or required.

REMAINING IMPACTS – HYDROGEN: The hazard impacts associated with using hydrogen as an alternative fuel are expected to be less than significant. Thus, no remaining hazard impacts associated with hydrogen use are expected.

4.4.4.2.8 Electric/Hybrid

Electric (EVs) and hybrid vehicles (hybrids) both use electricity as part of their fuel system. EVs rely purely on electric power stored in batteries. Hybrids also use batteries as part of their fuel supply; however, hybrids supplement their electric demand by using gasoline engines to generate either mechanical or electric power on demand. Since gasoline is a conventional fuel, any difference in hazards associated with hybrid vehicles would be from the batteries. The most common battery technologies used in modern EVs and hybrids are nickel-metal hydride (NiMH) and lithium ion (Li-ion) (Hybrid, 2008).

PROJECT-SPECIFIC IMPACTS – ELECTRIC/HYBRID: NiMH batteries can generate hydrogen gas if overcharged, which can lead to explosions without proper venting. In 1996, the International Center for Technology Assessment (ICTA) conducted a comprehensive review of the safety concerns associated with the use of EVs. The ICTA found risk of hydrogen emissions during stressful conditions has been virtually eliminated by the use of seals and proper valve regulation. By following the National Electric Codes (NECs) and the Society of Automotive Engineers (SAE) recommended safety practices and guidelines for the operation and maintenance of EVs and hybrids, any hydrogen gas risk during battery recharging would be eliminated (ICTA, 1996).

Li-ion batteries can be fire hazards. There are a few reported cases of fires caused by Li-ion batteries in EVs. In response to these fires, the National Highway Traffic Safety Administration (NHTSA) performed an investigation on the fire hazards associated with Li-ion batteries in EVs. The NHTSA concluded that EVs do not pose a greater risk of fire than gasoline-powered vehicles. The NHTSA also developed an interim guidance, with the assistance of the NFPA, Department of Energy, and others, to increase and identify the appropriate safety measures for handling an EV or hybrid automobile accident (NHTSA, 2012).

Furthermore, all electrical propulsion vehicles must comply with Federal Motor Vehicle Safety Standard (FMVSS) 305. FMVSS 305 specifies performance requirements for limitation of electrolyte spillage, retention of propulsion batteries, and electrical isolation of the chassis from the high-voltage system during a crash event. FMVSS assures that accidents involving EVs and hybrids cause no more electrical hazard than a gasoline- or diesel-powered vehicle.

Electric propelled vehicles are considered less hazardous than conventional fuel vehicles. The 2012 AQMP expects to replace 37,000 conventional fuel vehicles with alternative-fueled vehicles by 2025, which would generally result in a reduction in hazards associated with conventional fueled vehicles.

PROJECT-SPECIFIC MITIGATION – ELECTRIC/HYBRID: Less than significant impacts on hazards associated with the use of batteries in electric/hybrid vehicles are expected so no mitigation measures are necessary or required.

REMAINING IMPACTS – ELECTRIC/HYBRID: The hazard impacts associated with using batteries in electric/hybrid vehicles are expected to be less than significant. Thus, no remaining hazard impacts associated with using batteries for these types of vehicles are expected.

4.4.4.2.9 Summary of Hazards from Alternative Fuels

PROJECT-SPECIFIC IMPACTS – ALTERNATIVE FUELS SUMMARY: As shown in Table 4.4-5, the energy content of alternative fuels is lower than conventional fuels which means that more fuel is needed in an alternative fuel-powered vehicle to achieve the same range as a conventional fuel-powered vehicle. Thus, more tanker deliveries to supply refueling stations would be required to provide the same available energy as conventional fuels. Since the probability of accidents is related to the amount of miles traveled, proportionally more delivery accidents can be expected with alternative fuels 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. Furthermore, any increase in alternative fuels use would decrease the use of conventional fuels, so hazards associated with transportation and storage of all of the alternative fuels, except LNG would not be a significant risk factor. During transportation of LNG, it was estimated that the adverse impacts from various releases would extend 0.3 mile. Because sensitive receptors may be within the endpoints above, the accidental release of LNG during transport could cause significant adverse hazards.

TABLE 4.4-5

Equivalent Fleet Miles
Associated with Alternative Clean-Fuels

FUEL TYPE	BY MASS	BY VOLUME
Diesel	1.00	1.0
CNG/LNG	1.15	1.9
LPG	1.15	2.1
Ethanol	1.90	2.3
Methanol	2.50	2.7

Source: Clean Air Program: Summary of Assessment of the Safety, Health, Environmental and System Risks of Alternative Fuels. (DOT, 1995)

There are various existing regulations and recommended safety procedures that, when employed, will reduce any slightly higher hazards impacts associated with use of alternative clean fuels to the same or lower level as for conventional fuels. Table 4.4-6 summarizes some of the regulations and safety procedures associated with use of alternative fuels. When affected vehicle owners and maintenance personnel comply with existing regulations and recommended safety procedures, hazards impacts associated with the use of alternative fuels will be the same or less than those of conventional fuels. Accordingly, significant hazards impacts are not expected from the implementation of the 2012 AQMP control measures that encourage the use of alternative fuels.

TABLE 4.4-6

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.
Ethanol	Pure ethanol can ignite in enclosed spaces such as fuel tanks since its upper flammability limit is 19 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.

TABLE 4.4-6 (Continued)

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

FUEL TYPE	HAZARD	REGULATION/PROCEDURE
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 the 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.
	Releasing LNG in an enclosed area where there are potential ignition sources such as a maintenance shop may 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 (which is 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.

TABLE 4.4-6 (Concluded)

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

FUEL TYPE	HAZARD	REGULATION/PROCEDURE
LNG	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.
Biodiesel	Certain materials used in conventional petroleum storage are not compatible with pure biodiesel.	Use biodiesel compatible plastic and rubber for fittings.
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 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.
	Li-ion batteries that are used in some commercially available electric vehicles can combust spontaneously.	Reinforced casing and battery cooling systems can prevent the combustion of Li-ion batteries. FMVSS 305 and SAE recommendations provide guidance for eliminating combustion risk.

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

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 reduced with increasing use of alternative fuels.

PROJECT-SPECIFIC MITIGATION - ALTERNATIVE FUELS SUMMARY: When users of alternative fuels comply with existing regulations and recommended safety procedures, hazards impacts associated with the use of alternative clean-fuels are expected to 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 and no mitigation measures are required.

The transportation analysis demonstrated that, of all the alternative fuels analyzed, only LNG was estimated to have significant adverse hazards impacts during various transportation release scenarios. Because significant hazard impacts during transportation of LNG are expected, mitigation measures are required to be identified.

Lastly, the hazard impacts associated with using batteries in electric/hybrid vehicles were concluded to be less than significant. Because no significant hazard impacts were identified that pertain to using batteries in electric/hybrid vehicles, no mitigation measures are required.

REMAINING IMPACTS – ALTERNATIVE FUELS SUMMARY: The hazard impacts associated with alternative fuels and using batteries in electric/hybrid vehicles are expected to be less than significant, except for LNG transportation which was shown to have significant hazards impacts requiring mitigation. However, no additional mitigation measures were identified that would reduce the hazard and hazardous material impacts from a transportation release of LNG to less than significant. Therefore, the remaining hazardous and hazardous material impacts from exposure to the one psi overpressure from the cataclysmic destruction of the LNG storage tank are considered to be significant.

For all other alternative fuels (e.g., other than LNG) and batteries for electric/hybrid vehicles, no remaining hazard impacts are expected.

4.4.4.3 Ammonia Use in SCRs and SNCRs

Implementation of some control measures proposed in the 2012 AQMP could result in the use of SCR or SNCR technology to reduce NOx emissions including CMB-01, IND-01, MSC-01, OFFRD-02, OFFRD-03, OFFRD-04, ADV-01, ADV-02, ADV-04, and ADV-05. Greater use of SCRs and SNCRs 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).

SCR is post-combustion control equipment for NOx control of existing combustion sources like boilers, steam generators and process heaters that is capable of reducing NOx emissions by as much as 90 percent or higher. A typical SCR system design can consist of an ammonia storage tank, ammonia vaporization and injection equipment, an SCR reactor with catalyst, ancillary electronic instrumentation and operations control equipment. In some situations, an SCR system may also utilize a booster fan for the flue gas exhaust and an exhaust stack. The way an SCR system reduces NOx is through a matrix of nozzles injecting a mixture of ammonia and air directly into the flue gas exhaust stream from the combustion equipment. As this mixture flows into the SCR reactor that is replete with catalyst, ammonia and oxygen (from the air), the flue gas exhaust reacts primarily (i.e., selectively) with NO and NO2 to form nitrogen and water in the presence of a catalyst. The amount of ammonia introduced into the SCR system is approximately a 1.0-to-1.05 molar ratio of ammonia to NOx for optimum control efficiency, though the ratio may vary based on equipment-specific NOx reduction requirements. The ammonia injection rate is also regulated by the fuel flow rate to the unit.

SNCR is another post-combustion control technique typically used to reduce the quantity of NOx produced in the hot flue gas, by injecting ammonia. The main differences between SNCR and SCR is that the SNCR reaction between ammonia and NOx in the hot flue gas occurs without the need for a catalyst, but at much higher temperatures (i.e., between 1200 ^{o}F to 2000 ^{o}F). With a control efficiency ranging between 80 and 85 percent, SNCR does not achieve as great of NOx emission reductions as SCR. The need for the exhaust temperature to be high also limits the applicability of SNCR. SNCR would not be considered equivalent to BARCT alone, but it could be used if combined with other technologies.

In SCR and SNCR technology, ammonia or urea is used to react with the NOx, either in the presence of a catalyst or without a catalyst, respectively, to form nitrogen gas and water. Ammonia is the primary hazardous chemical identified with the use of air pollution control equipment (e.g., SCR and SNCR systems). Ammonia, though not a carcinogen, can have chronic and acute health impacts. Therefore, a potential increase in the use of ammonia may increase the current existing risk setting associated with deliveries (i.e., truck and road accidents) and onsite or offsite spills for each facility that currently uses or will begin to use ammonia. Exposure to a toxic gas cloud is the potential hazard associated with this type of control equipment. A toxic gas cloud is the release of a volatile chemical such as anhydrous ammonia that could form a cloud that migrates off-site, thus exposing individuals. Anhydrous ammonia is heavier than air such that when released into the atmosphere, would form a cloud at ground level rather than be dispersed "Worst-case" conditions tend to arise when very low wind speeds coincide with the accidental release, which can allow the chemicals to accumulate rather than disperse. Though there are facilities that may be affected by the proposed 2012 AQMP control measures that are currently permitted to use anhydrous ammonia, for new construction, however, current SCAQMD policy no longer allows the use of anhydrous ammonia. Instead, to minimize the hazards associated with ammonia used in the SCR or SNCR process, aqueous ammonia (100 percent anhydrous ammonia diluted with water to 19 percent by volume), is typically required as a permit condition associated with the installation of SCR or SNCR equipment for the following reasons: 1) 19 percent aqueous ammonia does not travel as a dense gas like anhydrous ammonia; and, 2) 19 percent aqueous ammonia is not on any acutely hazardous material lists unlike anhydrous ammonia or aqueous ammonia at higher percentages. For these safety reasons, aqueous ammonia is recommended for use in these technologies.

In addition, 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.

PROJECT-SPECIFIC IMPACTS – 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 California Building Code 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 – WATER QUALITY: 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. Since hazard impacts that would affect water quality are expected to be less than significant, no mitigation measures are necessary or required.

REMAINING IMPACTS – WATER QUALITY: The hazard impacts associated with ammonia use potentially impacting water are expected to be less than significant. Thus, no remaining hazard impacts are expected.

PROJECT-SPECIFIC IMPACTS – 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 modeling[9] 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 an 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 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

---

[9] This analysis uses the *Final Environmental Impact Report for the Scattergood Generating Station, And The Installation Of One Combustion Turbine At The Valley Generating Station* (SCH. No. 2000101008; SCAQMD, 2001), as a surrogate for transport release scenario 1.

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. This scenario[10] 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 4.4-7. This information was summarized from the Los Angeles County Hazardous Waste Management Plan (Los Angeles County, 1988).

---

[10] This scenario uses the *Final Negative Declaration for: ConocoPhillips Los Angeles Refinery Carson Plant SCR Unit Project*, SCH. No. 2004011066, SCAQMD 2004, as a surrogate for transport release scenario 2.

TABLE 4.4-7

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 [a]	0.28

Source: Environmental Protection Agency, 1984.

[a] 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 on 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. The following summarizes the ammonia transport analysis for the BP FCCU project.

This scenario[11] consists of an SCR retrofitted onto an existing FCCU and construction of an associated 12,660 gallon aqueous ammonia storage tank (19 percent NH_3). It 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 – TRANSPORTATION RELEASE: The transportation release scenarios in this subsection do not include transport of anhydrous ammonia because SCAQMD has historically found the CEQA analysis of permit

---

[11] This scenario uses the *Final Negative Declaration for: BP Carson Refinery Fluid Catalytic Cracking Unit NOx Reduction Project*: SCH. No. 2002021068; SCAQMD, 2002, as a surrogate for transport release scenario 2.

applications for new projects requiring SCR equipment using anhydrous ammonia 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.

REMAINING IMPACTS – TRANSPORTATION RELEASE: The hazard impacts associated with a transportation release are expected to be significant prior to mitigation. Requiring the use of aqueous ammonia, in lieu of anhydrous ammonia, is considered to be feasible mitigation. Thus, after mitigation, no remaining significant impacts on transportation release hazards are expected.

PROJECT-SPECIFIC IMPACTS – AMMONIA TANK RUPTURE ON-SITE:

Storage Tank Rupture Scenario 1: For this project[12], a 10,000 gallon storage tank constructed for 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. . Details on the accidental release modeling assumptions are included in Appendix B of the Final Negative Declaration. The dispersion analysis was completed for a

---

[12] This scenario uses the *Final Negative Declaration for: ConocoPhillips Los Angeles Refinery Carson Plant SCR Unit Project*, SCAQMD 2004, as a surrogate for a tank rupture scenario.

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 square feet, 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 proposed 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 square feet 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.

Storage Tank Rupture Scenario 2: This tank rupture scenario[13] is based on retrofitting an existing FCCU with SCR and constructing an associated 12,660 gallon aqueous ammonia storage tank. 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"

---

[13] This scenario uses the *Final Negative Declaration for: BP Carson Refinery Fluid Catalytic Cracking Unit NOx Reduction Project*: SCH. No. 2002021068; SCAQMD, 2002, as a surrogate for a tank rupture scenario.

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 (or SNCR) projects at large industrial or commercial facilities.

Storage Tank Rupture Scenario 3: This scenario[14] describes hazard impacts from an accidental release of ammonia from a 5,000 gallon storage tank constructed for an SCR project for a biogas facility. The retrofit of existing ICEs with SCR or NOxTech systems were determined to likely need to install ammonia storage tanks. Based on considerations like available area, amount of ammonia needed per year, etc., SCAQMD staff assumed that the largest ammonia tank installed would be 5,000 gallons. Due to local fire department safety regulations, storage tanks constructed at affected facilities would be surrounded by secondary containment designs (e.g., dykes, berms, etc.). These same containment facilities would be provided at truck loading racks to contain ammonia in the event of a spill during transfer of ammonia from the truck to the storage tank.

The worst-case release scenario would be a catastrophic storage tank failure. The rupture of an ammonia storage tank would release the ammonia into the secondary containment area. Ammonia would then form a liquid pool in the secondary containment area and evaporate. A modeling analysis was performed based on EPA's RMP Guidance for worst-case estimates for toxic releases and explosions. The RMPComp model was used to calculate the size of the impact zones. The EPA endpoint for ammonia exposure is the distance from the spill that is required to reduce the concentration to 0.14 micrograms per liter, the ERPG 2 endpoint for ammonia. The RMPComp program estimates were based on 20 percent aqueous ammonia, which is slightly higher concentration than the 19 percent ammonia proposed for this project. The 20 percent concentration is built into RMPComp and was the closest concentration available for use by the model.

To provide a “worst-case” case analysis for all ammonia tank release scenarios, the following assumptions were made:

- Ammonia tank dimensions were assumed to be twice as wide as they were high;
- The ammonia tank volume was assumed to be 10 percent larger than the nominal containment volume. (For a tank with 5,000-gallon contents, the tank volume was assumed to be 5,500 gallons);
- All dike areas were assumed to have excess capacity of 20 percent more than the tank contents. (The dike capacity for 5,000-gallon contents was assumed to be 6,000 gallons);

---

[14] This scenario uses the December 2007 Final EA for Proposed Amended Rule 1110.2 – Emissions from Gaseous- and Liquid-Fueled Internal Combustion Engines (ICEs) (SCAQMD No. 280307JK, as a surrogate for a tank rupture scenario.

- All dike walls were assumed to be three feet high;
- For unconfined ammonia spills, the liquid was assumed to spread to a thickness of one centimeter in all directions on a flat impervious surface;
- Rural conditions were conservatively assumed to reduce dispersion.

Based on these assumptions, RMPComp estimated that the toxic endpoint would be 0.1 mile (528 feet) from the ammonia tank. Since biogas engines typically have back-up flare systems, it was assumed that the ICEs would not be sited near the property boundaries. However, based on a survey of biogas facilities, several facilities were found to have biogas engines within 0.1 mile of the property line. Therefore, in the event of an accidental release of ammonia from an ammonia storage tank at affected biogas facilities, offsite receptors could be exposed to ammonia concentrations exceed the ERPG 2 for ammonia, 150 ppm.

According to the American Institute of Chemical Engineers (AIChE) Center for Chemical Process Safety[15], 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, SCAQMD staff is not aware of any aqueous ammonia storage tank that has had a catastrophic failure in recent history. As a result, the likelihood of a rupture of the aqueous ammonia storage tank occurring is extremely low. In spite of this, however, hazard impacts from exposure to ERPG 2 concentrations of ammonia are considered to be significant.

PROJECT-SPECIFIC MITIGATION - AMMONIA TANK RUPTURE ON-SITE: In the event of an accidental release of ammonia from on-site ammonia storage units, potentially significant adverse hazard impacts from exposure to could occur, even if aqueous ammonia is used rather than anhydrous ammonia. Therefore, since hazard impacts pertaining to on-site ammonia tank rupture are expected to be significant, mitigation measures are required. To mitigate potential adverse hazardous impacts from exposure to an accidental release of ammonia, mitigation for the storage of aqueous ammonia would be to require the construction of a combined delivery and storage aqueous ammonia system equipped with the following.

HZ-7: Install safety devices, including but not limited to: continuous tank level monitors (e.g., high and low level), temperature and pressure monitors, leak monitoring and detection system, alarms, check valves, and emergency block valves.

HZ-8: Install secondary containment to capture 110 percent of the storage tank volume in the event of a spill:

---

[15] AIChE, Guidelines for Process Equipment Reliability Data with Data Tables, Center for Chemical Process Safety 1989.

HZ-9: Install a grating-covered trench around the perimeter of the delivery bay to passively contain potential spills from the tanker truck during the transfer of aqueous ammonia from the delivery truck to the storage facility.

HZ-10: The truck loading/unloading area was designed to be equipped with an underground gravity drain that flows to a large on-site retention basin to provide sufficient ammonia dilution to the extent that no hazards impact is possible in the event of an accidental release during transfer of aqueous ammonia.

REMAINING IMPACTS – AMMONIA TANK RUPTURE ON-SITE: The hazard impacts associated with the potential for an ammonia tank rupturing on-site and causing a release are expected to be significant prior to mitigation. However, requiring the construction of a combined delivery and storage aqueous ammonia system with specific design features to capture any release of aqueous ammonia is considered to be feasible mitigation. Thus, after mitigation, no remaining significant impacts pertaining to on-site ammonia tank rupture hazards are expected.

4.4.4.4 Use of Catalysts

PROJECT-SPECIFIC IMPACTS – USE OF CATALYSTS: Implementing various control measures proposed in the 2012 AQMP could result in the increased use of catalysts as well an increase in the quantity of catalyst disposed of hazardous materials: 1) in SCRs per Control Measure CMB-01; 2) in NOx reducing additives (which are made of catalysts) per Control Measures CMB-01 and INC-01; and 3) in thermal oxidizers per Control Measures CMB-01, OFFRD-03, OFFRD-04, ADV-04, ADV-05, and FUG-01.

<u>Catalysts Used in SCRs:</u> There are two main types of catalysts used in SCRs: one in which the catalyst is coated onto a metal structure and a ceramic-based catalyst onto which the catalyst components are calcified. Commercial catalysts used in SCRs are available in two types of solid, block configurations or modules, plate or honeycomb type, and are comprised of a base material of titanium dioxide (TiO2) that is coated with either tungsten trioxide (WO3), molybdic anhydride (MoO3), vanadium pentoxide (V2O5), or iron oxide (Fe2O3). These catalysts are used for SCRs because of their high activity, insensitivity to sulfur in the exhaust, and useful life span of approximately five years. Ultimately, the material composition of the catalyst is dependent upon the application and flue gas conditions such as gas composition, temperature, et cetera. A typical catalyst dimension would be approximately 39" x 40" x 12" enclosed in 5" double-wall shell containing insulation. The number of catalyst blocks needed will depend on the quantity of flue gas being treated by the SCR.

The key hazards associated with catalyst use in SCRS are the crushing of the spent catalyst modules and transporting it for disposal or recycling. With respect to hazards and hazardous materials, this means that there will be an increase in the frequency of truck transportation trips to remove the spent catalyst as hazardous materials or hazardous waste from each affected facility. However, facilities that have existing catalyst-based operations currently recycle the catalysts blocks, in lieu of disposal. Moreover, due to the heavy metal content and relatively high cost of catalysts, recycling can be more lucrative than disposal. Thus, facilities that have existing SCR units and choose to employ additional SCR equipment, in most cases already recycle the spent catalyst and subsequently may continue to do so with any additional catalyst that may be needed.

A number of physical or chemical properties may cause a substance to be hazardous, including toxicity (health), flammability, reactivity, and any other specific hazard such as corrosivity or radioactivity. Based on a hazard rating from 0 to 4 (0 = no hazard; 4 = extreme hazard) located on the MSDS, the hazard rating for silica/alumina catalyst, for example, health is rated 1 (slightly hazardous), flammability is rated 0 (none) and reactivity is rated 0 (none). However, if nickel is deposited on the catalyst, the hazard rating is 2 for health (moderately toxic), 4 (extreme fire hazard) for flammability, 1 for reactivity (slightly hazardous if heated or exposed to water). The particular composition of the catalyst used in the SCR units, combined with the metals content of the flue gas will determine the hazard rating and whether the spent catalyst is considered a hazardous material or hazardous waste. This distinction is important because a spent catalyst that qualifies as a hazardous material could be recycled or reused by another industry (such as in the manufacturing of California Portland cement). However, spent catalyst that is considered hazardous waste must be disposed of in a Class III landfill. Due to the recycling of catalysts, less than significant impacts on hazards and hazardous waste are expected. Refer to Subchapter 4.8 - Solid and Hazardous Waste for a discussion on the disposal of spent catalyst modules.

<u>Use of NOx Reducing Additives:</u> SCONOx/EMx^{TM} technology is a relatively new proprietary post-combustion catalytic oxidation and adsorption process that is undergoing development for controlling NOx and CO emissions from boiler, steam generator, and process heater applications. The catalyst used in the SCONOx/EMx^{TM} system consists of a platinum base with a potassium carbonate adsorption coating over a ceramic substrate and has a catalyst life of three years that is guaranteed by the manufacturer. The catalyst simultaneously oxidizes NO to NO2, CO to CO2, and VOCs to CO2 and water. The NO2 is adsorbed onto the catalyst surface where it is chemically converted to potassium nitrates and nitrites. The catalyst is then exposed to hydrogen gas produced from reformed natural gas with high pressure steam to regenerate the adsorption layer. Because hydrogen is used for the catalyst regeneration process, a low oxygen atmosphere is necessary to prevent dilution. As such, the catalyst bed is designed with multiple compartments that are equipped with dampers that close at the beginning of the regeneration cycle. The catalyst used in the SCONOx/EMx^{TM} process has a life-span of approximately three years

As with catalysts used in SCRs, the key hazards associated with post-catalytic oxidation are associated with the crushing of the spent catalyst and transporting it for disposal or recycling. With respect to hazards and hazardous materials, this means that there will be an increase in the frequency of truck transportation trips to remove the spent catalyst as hazardous materials or hazardous waste from each affected facility. However, due to the high value of platinum (a precious metal), facilities employing post-catalytic oxidation will likely recycle the catalyst, in lieu of disposal, so little hazardous waste would be expected to be and disposed of at a hazardous waste landfill. Thus, due to the recycling of catalysts used in post-combustion catalytic oxidation, less than significant impacts on hazards and hazardous waste are expected.

Catalyst Used in Thermal Oxidizers: The 2012 AQMP could result in the increased use of catalyst used in thermal oxidizers to control emissions. The following control measures could rely on catalytic oxidation technologies for emission control including CMB-01, OFFRD-03, OFFRD-04, ADV-04, and ADV-05. Catalytic oxidation beds in thermal oxidizers generally use a precious metal to aid in the combustion of air pollutants at relatively low temperatures. Thermal oxidizers require periodic replacement of the catalyst bed. The expected life of the catalyst is approximately three to five years, depending on the concentration of materials and type of exhaust flows controlled. Metals used in the catalyst are generally recovered because they are made from precious and valuable metals (e.g., platinum and palladium). Metals can be recovered from approximately 60 percent of the spent catalyst generated from the operation of catalytic oxidizers (SCAQMD, 2003a). These metals could then be recycled. The remaining material would most likely need to be handled as hazardous waste and disposed of at a hazardous waste landfill.

If the catalyst is not hazardous, jurisdiction for its disposal then shifts to local agencies such as regional water quality control boards or county environmental agencies. The RWQCB has indicated that if a spent catalyst is not considered a hazardous waste, it would probably be considered a Designated Waste. A Designated Waste is characterized as a non-hazardous waste consisting of, or containing pollutants that, under ambient environmental conditions, could be released at concentrations in excess of applicable water objectives, or which could cause degradation of the waters of the state. The type of landfill that the material is disposed at will depend upon its final waste designation. Due to the recycling of catalysts used in catalytic oxidation and the fact that this technology is not expected to be widely used because of cost, less than significant impacts on hazards and hazardous waste are expected.

PROJECT-SPECIFIC MITIGATION – USE OF CATALYSTS: Less than significant impacts on hazards associated with the use of catalysts were identified so no mitigation measures are necessary or required.

REMAINING IMPACTS – USE OF CATALYSTS: The hazard impacts associated with the use of catalysts in various technologies are expected to be less than significant. Thus, no remaining hazard impacts associated with catalyst use are expected.

4.4.4.5 Start-up, Shutdown and Turnaround Procedures

PROJECT-SPECIFIC IMPACTS – START-UP, SHUTDOWN AND TURNAROUND PROCEDURES: The SCAQMD received a comment (see Comment 3-11 and Response to Comment 3-11) on the June 28, 2012 version of the NOP/IS asserting that implementation of Control Measure MCS-03 as proposed in the 2012 AQMP could result in the increased safety issues when diverting or eliminating process streams that are vented to flares, and installing redundant equipment to increase operational reliability during start-up, shutdown and turnarounds of process units. The comment, however, did not identify specify the safety issues of concern. Currently, SCAQMD Rule 1123 - Refinery Process Turnarounds, contains specific exemptions in the rule language that address (and prevent) situations that could potentially damage equipment, cause the malfunction of pollution control or safety devices, or cause violations of safety regulations. As with all control measures and the rule development process, participation by the affected parties, including the refineries and their representatives, as well as other industries and their representatives, will be paramount in effectively and safely implementing MCS-03.

In its current form, MCS-03 is in its early stages and is very broad and there is insufficient information to be able to identify specific equipment or processes. Start-up, shutdown or turnaround often results in higher emission rates from pieces of equipment that are interconnected, either upstream or downstream, to the equipment undergoing start-up/shutdown. Refinery operations, for example, typically rely on flares to minimize the emissions impact resulting from start-up, shutdown and turnarounds. However, there are adverse environmental impacts associated with the use of flares as well. As a result, there is the potential that MCS-03 could reduce potential hazard impacts, at least at some types of facilities.

As such, to identify any impacts at this time without knowing the specific design features would be speculative. This measure would be implemented in two phases, beginning with a technical assessment to be completed in the 2012/2013 timeframe. Once the technical assessment is completed, phase 2 would include implementing MCS-03 begins, and if a proposed rule or rule amendment is developed as a result, the CEQA document for the proposed rule or rule amendment will identify and analyze the specific environmental impacts at that time.

In conclusion, due to the speculative nature of the potential safety hazards that may be associated with implementing Control Measure MCS-03, no safety hazards can be identified at this time. Thus, no hazard impacts associated with the safety of implementing start-up, shutdown, and turnaround procedures are expected.

PROJECT-SPECIFIC MITIGATION – START-UP, SHUTDOWN AND TURNAROUND PROCEDURES: No impacts on hazards associated with safety issues pertaining to implementing Control Measure MCS-03 were identified so no mitigation measures are necessary or required.

REMAINING IMPACTS – START-UP, SHUTDOWN AND TURNAROUND PROCEDURES: No remaining hazard impacts associated with safety issues pertaining to implementing Control Measure MCS-03 are expected.

4.4.5 Summary of Hazards and Hazardous Materials Impacts

The following is the summary of the conclusions of the analysis of hazard impacts associated with implementation of the 2012 AQMP.

- Reformulated Products: The analysis indicates that the fire hazard impacts associated with reformulated coatings, adhesives, solvents, lubricants, mold release, and consumer products are expected to be significant. While an increase of future compliant reformulated materials could be expected to result in a concurrent reduction in the amount of materials formulated with conventional solvents, the possibility exists that facilities currently using water-based products could switch to using reformulated solvent-based products made with acetone or other flammable or extremely flammable chemicals. The analysis also indicates that the health hazard impacts associated with reformulated coatings, adhesives, solvents, lubricants, mold release, and consumer products are expected to be less than significant because even if manufacturers could potentially use replacement chemicals that could pose new or different health risks, SCAQMD Rule 1401 and 1402 would limit potential exposures to nearby receptors. Further, as with the use of all chemicals, conventional or reformulated, facilities and their workers would be required to continue to comply with existing health protective procedures when handling both flammable and toxic materials.

- <u>Use of Alternative Fuels:</u> The hazard impacts associated with the use of all alternative fuels except LNG and the use of batteries in electric/hybrid vehicles due to implementation of the 2012 AQMP control measures were determined to be less than significant when users comply with existing regulations and recommended safety procedures. Hazard impacts associated with the transportation of LNG were determined to be significant, requiring mitigation. Further, significant hazards impacts due to LNG transportation were determined to remain significant after mitigation. Lastly, any increase in the use of alternative fuels will result in a concurrent decrease in the amount of conventional fuels used in the district.
- <u>Ammonia Use in SCRs and SNCRs:</u> The use of ammonia in SCR and SNCR technologies could be potentially significant due to implementation of the control measures. While the use of aqueous ammonia at concentrations less than 20 percent by volume is expected to reduce hazard impacts associated with ammonia use, the potential for an on-site spill of aqueous ammonia could pose a significant hazards impact. Accordingly, significant hazard impacts are expected from the increased use of ammonia in SCR and SNCR technologies and mitigation measures are required.
- <u>Start-up, Shutdown and Turnaround Procedures:</u> No hazard impacts to pertaining to safety issues associated with implementing Control Measure MCS-03 were identified.
- <u>Use of Catalysts:</u> The analysis indicates that the hazard impacts associated with the use catalysts are expected to be less than significant.

Summary of PM2.5 Control Measure Impacts: The hazard impacts associated with PM2.5 Control Measures (CMB-01, IND-01, and MCS-01) were evaluated and determined to be less than significant for reformulated coatings, adhesives, solvents, lubricants, mold release, and consumer products; alternative fuels; ammonia use in SCRs, and fuel additives.

Summary of Ozone Control Measure Impacts: The hazard impacts associated with the Ozone Control Measures (21 control measures, see Table 4.4-1) were evaluated and determined to be less than significant for reformulated coatings, adhesives, solvents, lubricants, mold release, and consumer products; all alternative fuels except LNG, and start-up, shutdown and turnaround procedures. Significant hazards impacts due to LNG transportation were determined to remain significant after mitigation.