SUBCHAPTER 4.8

SOLID AND HAZARDOUS WASTE

4.8 SOLID AND HAZARDOUS WASTE

4.8.1 Introduction

This subchapter identifies potential solid and hazardous waste impacts that may be generated by implementing the 2012 AQMP. The potential impacts to the generation of solid and hazardous waste associated with the implementation of the 2012 AQMP are described below.

The analysis of solid and hazardous waste impacts assumes that safety and disposal procedures required by various agencies in the state of California will provide reasonable precautions against the improper disposal of hazardous wastes in a municipal waste landfill. Because of state and federal requirements, some facilities are attempting to reduce or minimize the generation of solid and hazardous waste by incorporating source reduction technologies to reduce the volume or toxicity of waste generated, including improving operating procedures, using less hazardous or non-hazardous substitute materials, and upgrading or replacing inefficient processes.

4.8.2 2012 AQMP Control Measures with Solid and Hazardous Waste Impacts

Implementing some of the 2012 AQMP control measures could increase the generation and disposal of solid and hazardous waste in the region. Specifically, some control measures will encourage the use of electric vehicles which could result in an increase in waste associated with spent batteries. Other control measures could increase the generation of solid or hazardous waste due to installation of air pollution control equipment, such as activated carbon, filters, and catalysts. Finally, other control measures would encourage the early retirement of older equipment and replacement with newer and lower emission technology equipment which would generate additional waste. Table 4.8-1 lists the 2012 AQMP control measures with potential adverse solid and hazardous waste impacts through the addition of materials requiring disposal.

Evaluation of control methods for each control measure indicated that there are 23 control measures that could have potential solid and hazardous waste impacts. As shown in Table 4.8-1, three PM2.5 control measures and 20 ozone control measures could have significant impacts on solid and hazardous wastes.

TABLE 4.8-1

Control Measures with Potential Solid and Hazardous Waste Impacts

CONTROL MEASURES	CONTROL MEASURE DESCRIPTION (POLLUTANT)	CONTROL METHODOLOGY	POTENTIAL SOLID AND HAZARDOUS WASTE IMPACT
Short-Term PM2.5 Control Measures			
CMB-01	Further NOx Reductions from RECLAIM [NOx] –Phase I & II	Installation of SCR systems and burner replacement.	Potential increase in solid waste due to burner replacement & SCR catalyst disposal.
BCM-03 (*formerly BCM-05*)	Emission Reductions from Under-Fired Charbroilers [PM2.5]	Control options include ESPs, HEPA filters, wet scrubbers, and thermal oxidizers.	Potential increase in solid waste associated with air pollution control equipment (e.g., filters).
IND-01[a]	Backstop Measure for Indirect Sources of emissions from Ports and Port-Related Facilities	Potential control measures include electrification of sources, early retirement of equipment, air pollution control equipment on sources, use of alternative fuels.	Potential increase in solid waste due to early retirement of equipment, solid was associated with air pollution control equipment, EV battery disposal.
MCS-01[a]	Application of All Feasible Measures Assessment	Implement new retrofit technology control standards as new BARCT standards become available.	Potential increase in solid waste associated with air pollution control equipment (e.g., filters, early retirement of equipment).
Ozone Control Measures			
CMB-02	NOx Reductions from Biogas Flares	Construction of replacement flares.	Potential increase in solid waste from replacing old flares with new flares.
CMB-03	Reductions from Commercial Space Heating	Burner replacement.	Potential increase in solid waste due to burner replacement.
INC-01	Economic Incentive Programs to Adopt Cleaner, More Efficient Combustion Equipment [All Pollutants]	Control technologies for funding include fuel cells, diesel particulate filters (DPF), NOx reduction 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.	Potential increase in solid waste due to combustion equipment replacement, generation of solid waste from air pollution control equipment (e.g. used filters), and EV battery disposal.
ONRD-01	Accelerated Penetration of Partial Zero-Emission and Zero Emission Vehicles [VOC, NOx, PM]	Implement rebate incentive program to purchase low-emitting vehicles.	Potential increases in solid waste from EV battery disposal and early retirement of vehicles.
ONRD-02	Accelerated Retirement of Older Light- and Medium-Duty Vehicles [VOC, NOx, PM]	Continue Enhanced Fleet Modernization Program (EFMP) through 2023.	Potential increase in solid waste generation from early retirement of vehicles and EV battery disposal.
ONRD-03	Accelerated Penetration of Partial Zero Emission and Zero Emission Light-Heavy- and Medium-Heavy-Duty Vehicles [NOx, PM]	Would continue the state hybrid truck and bus voucher incentive project (HVIP) through 2023. Use of electric and alternative fuel vehicles.	Potential increase in solid waste generation from early retirement of vehicles and EV battery disposal.

TABLE 4.8-1 (CONTINUED)

Control Measures with Potential Solid and Hazardous Waste Impacts

CONTROL MEASURES	CONTROL MEASURE DESCRIPTION (POLLUTANT)	CONTROL METHODOLOGY	POTENTIAL SOLID AND HAZARDOUS WASTE IMPACT
Ozone Control Measures			
ONRD-04	Accelerated Retirement of Older On-Road Heavy-Duty Vehicles [NOx, PM]	Incentives to purchase low-emitting vehicles.	Potential increase in solid waste generation from early retirement of vehicles and EV battery disposal.
ONRD-05	Further Emission Reductions from Heavy-Duty Vehicles Serving Near-Dock Railyards [NOx, PM]	Accelerated use of hybrid electric or fuel cell trucks.	Potential increase in solid waste generation from early retirement of vehicles and EV battery disposal.
OFFRD-01	Extension of the SOON Provision for Construction/Industrial Equipment [NOx]	Extend SOON program from 2014 to 2023. Use of electric and alternative fuel construction/industrial equipment.	Potential increase in solid waste generation from early retirement of equipment and EV battery disposal.
OFFRD-02	Further Emission Reductions from Freight Locomotives [NOx, PM]	Replace existing engines with Tier 4 engines with control equipment (e.g., SCRs).	Potential increase in solid waste generation from early retirement of locomotive engines, solid waste generated from air pollution control equipment, and EV battery disposal.
OFFRD-03	Further Emission Reductions from Passenger Locomotives [NOx, PM]	Repower existing engines with Tier 4 engines with control equipment (e.g., SCRs).	Potential increase in solid waste generation from early retirement of locomotive engines, solid waste generated from air pollution control equipment (e.g., DPM filters and catalyst), and EV battery disposal.
OFFRD-04	Further Emission Reductions from Ocean-Going Marine Vessels While at Berth [NOx, PM]	Calls for increased percentage of ships at berth to cold iron.	Potential increase in solid waste generation from air pollution control equipment (e.g., catalysts) from ships at berth.
ADV-01	Actions for the Deployment of Zero- and Near-Zero Emission On-Road Heavy-Duty Vehicles [NOx]	Use of electric and alternative fuel vehicles.	Potential increase in solid waste generation from early retirement of vehicles and EV battery disposal.
ADV-02	Actions for the Deployment of Zero- and Near-Zero Emission Locomotives [NOx]	Use of electric and alternative fuel locomotives.	Potential increase in solid waste due to locomotive replacement and from EV battery disposal.
ADV-03	Actions for the Deployment of Zero- and Near-Zero Emission Cargo Handling Equipment [NOx]	Use of electric and alternative fuel cargo handling equipment.	Potential increase in solid waste due to CHE replacement and from EV battery disposal.
ADV-04	Actions for the Deployment of Cleaner Commercial Harbor Craft [NOx]	Use of electric and alternative fuel harbor craft and use of control equipment such as SCRs.	Potential increase in solid waste due to harbor craft replacement, EV battery disposal, and disposal of SCR catalyst.

TABLE 4.8-1 (CONCLUDED)

Control Measures with Potential Solid and Hazardous Waste Impacts

CONTROL MEASURES	CONTROL MEASURE DESCRIPTION (POLLUTANT)	CONTROL METHODOLOGY	POTENTIAL SOLID AND HAZARDOUS WASTE IMPACT
Ozone Control Measures			
ADV-05	Actions for the Deployment of Cleaner Ocean-Going Marine Vessels [NOx]	Use of electric and alternative fuel marine vessels. Use of control technologies such as SCR, wet/dry scrubbers, etc.	Potential increase in solid waste due to vessel replacement, EV battery disposal, and scrubber/catalyst disposal.
ADV-06	Actions for the Deployment of Cleaner Off-Road Equipment [NOx]	Use of electric and alternative fuel off-road equipment.	Potential increase in solid waste due to off-road equipment replacement and from EV battery disposal.
ADV-07	Actions for the Deployment of Cleaner Aircraft Engines [NOx]	Potential low emission aircraft technologies include alternative fuels, lean combustion burners, high rate turbo bypass, advanced turbo-compressor design, and engine weight reduction.	Potential increase in solid waste due to replacement of aircraft engines and burners.

a The specific actions associated with the control measure is unknown and, therefore, the impacts are speculative. In order to provide a conservative analysis, it is assumed that the control measure could require air pollution control technologies that are similar to those that are currently required (e.g., SCR, electrification, use of alternative fuels, etc.), and would have the potential to require construction activities that would generate noise.

4.8.3 Significance Criteria

Impacts to solid and hazardous waste facilities will be considered significant if any of the following occur:

- Published national, state, or local standards relating to solid waste are exceeded.
- The generation and disposal of solid or hazardous waste, when combined with existing waste generation, exceeds the capacity of designated landfills.

4.8.4 Potential Impacts and Mitigation

The goal of the 2012 AQMP is to improve air quality, however, some types of air pollution control equipment have the potential to create cross-media impacts. For example, removing pollutants from equipment exhaust streams may produce liquid or solid wastes that may require further treatment or disposal to publicly owned treatment works (POTWs) or landfills, respectively. Specifically, hazardous and non-hazardous waste maybe generated by some types of air pollution control equipment such as electrostatic precipitators, carbon adsorption units, oxidation devices, wet scrubbers, baghouses, and filtration equipment. Several control measures have been proposed in the 2012 AQMP which may require the use of these types of pollution control equipment (see Table 4.8-1). Solid waste impacts from these control measures are described in the following subsections.

4.8.4.1 Spent Batteries from Electric Vehicles

PROJECT-SPECIFIC IMPACTS: The following control measures encourage early retirement of older vehicles and replacement with electric or hybrid vehicles and could result in an increase in waste generated from batteries: IND-01, INC-01, ONRD-01, ONRD-02, ONRD-03, ONRD-04, ONRD-05, OFFRD-01, OFFRD-02, OFFRD-03, ADV-01, ADV-02, ADV-03, ADV-04, ADV-05, and ADV-06. The most common battery currently used in gasoline and diesel powered vehicles within the district is the lead-acid battery found in conventional automobiles and trucks. These batteries are disposed of through the well established lead recycling industry by companies such as Quemetco and Exide in southern California. Zero and Near-Zero Emission Vehicles operate with different battery types than the lead-acid battery. The common battery types available for hybrid and electric powered vehicles are nickel metal hydride (NiMH) and lithium ion (Li-ion).

The 2012 AQMP projects substantial penetration of fuel cell, electric and electric hybrid vehicles by 2023 as part of mobile source pollution control measures. The suggested control measures that have additional requirements for Zero and Near-Zero Emission Vehicles are shown in Table 4.8.2. The batteries that could power these vehicles have useful lives similar to or less than the life of a vehicle. Since some batteries contain toxic materials, the increased use of batteries may result in an incremental increase in solid and hazardous waste impacts. In addition, environmental impacts could occur if batteries were disposed of in an unsafe manner, such as illegal dumping or by disposal in an unlined landfill.

TABLE 4.8-2

Control Measures and Vehicle Retirement Quantities

CONTROL MEASURE	NUMBER OF VEHICLES
ONRD-01 – Incentivize light- and medium-duty trucks	9,000 vehicles
ONRD-02 – Accelerated retirement and replacement of pre-1992 light- and medium-duty vehicles	18,000 vehicles
ONRD-03 – Encourage the introduction of hybrid and zero-emission vehicles	5,000 vehicles
ONRD-04 – Accelerated retirement and replacement of pre-2010 heavy duty vehicles	5,000 vehicles
ONRD-05 – Replace 1,000 trucks with zero-emission vehicles	1,000 vehicles

Source: CEC, 2012a

The primary battery used in hybrid cars is the NiMH type. NiMH batteries are considered to be less toxic than lead-acid batteries. Another type is Li-ion batteries which are being developed for the next generation of hybrid cars, and may ultimately be the battery to power all electric vehicles. The reason for this is that the Li-ion battery has a higher energy density, allowing them to hold the most energy by weight or by volume. Additionally, the Li-ion battery is less toxic than both the lead-acid and NiMH batteries.

Planning is already underway to deal with tens of thousands of exhausted NiMH batteries from conventional hybrids and Li-ion batteries from electric cars. While there are more than two million conventional and plug-in hybrids and electric cars on the road in the U.S. alone, none have been around long enough to start contributing a meaningful flow of batteries to the recycling industry. Most hybrid batteries seem to be able to outlive the ten-year/100,000-mile warranties that they carried from the automakers, and many battery and automotive industry insiders say there appears to be no reason that Li-ion batteries will not last for 150,000 miles or more (Edmunds, 2012).

Recycling is an important aspect of battery life. The Li-ion batteries used in most EVs and plug-in hybrids, and the NiMH batteries used in most conventional hybrids, are not considered toxic. Both types, unlike conventional 12-volt lead-acid car batteries, are considered safe for landfills. But, since landfill space is at a premium, it is more beneficial for the environment and the economy if spent advanced-technology batteries are reduced to their components, which can be reused instead of being sent to landfills. Automakers, and the auto dismantling industry and its designated recyclers, are posed to handle the recycling of NiMH and Li-ion batteries (Edmunds, 2012).

Recycling is expected to help keep battery costs down because it will permit the reuse of the metals and rare-earth compounds that make these batteries work, which is cheaper than mining and processing all-new material. With Li-ion batteries accounting for as much as half the cost of a new EV, reducing battery costs through recycling will go a long way toward making electric-drive vehicles competitive with conventional cars. Having a market for used batteries will also help increase the resale value of electric-drive vehicles to the benefit of consumers. Additionally, advanced battery recycling helps reduce CO_2 emissions and energy use from processing new material (Edmunds, 2012).

The NiMH batteries found in hybrid vehicles are basically "zero-landfill" products. Whatever cannot be recycled is consumed in the recycling process, leaving no trash behind. The primary metals recovered are nickel, copper and iron. The principal rare earths are neodymium and lanthanum (Edmunds, 2012).

Li-ion batteries now are somewhere between 70 and 100 percent recyclable, depending on the particular chemistry of the batteries. There are approximately six different types in use, and more are being developed. The types are differentiated by the chemical formulation of the electrodes. These types include, but are not limited to, cobalt dioxide, nickel-cobalt-manganese (NCM), nickel-cobalt- aluminum (NCA), manganese oxide spinel (MnO), and iron phosphate (FePo). The components of Li-ion batteries that cannot be recycled are mostly consumed as fuel in the furnaces that are used to melt down the metals, which include cobalt, copper, iron, nickel, manganese and, in the future, lithium (Edmunds, 2012).

Li-ion batteries have a potential after-automotive use that can postpone destructive recycling for years. Even when an EV or hybrid battery can no longer hold and discharge sufficient electricity to power the car's motor, the pack can still carry a tremendous amount of energy. Battery manufacturers project the packs will still be able to operate at approximately 80 percent of capacity when they must be retired from automotive use. Auto companies are partnering with battery, recycling and electronics firms to figure out and develop post-automotive markets for lithium-ion battery packs (Edmunds, 2012).

For instance, several major power utilities are working with companies, including General Motors, Ford, Toyota and Nissan, to explore the use of the batteries for stationary storage of the power produced in off-peak periods by wind turbines and solar generation stations. Li-ion packs also are being tested as backup power storage systems for retail centers, restaurants and hospitals, as well as for residential solar power systems (Edmunds, 2012).

Two recycling firms have the technology to recycle NiMH and Li-ion batteries. One of these companies is the Belgium-based metals recycling company Umicore, who is preparing for the time when advanced-technology automotive battery recycling companies will be handling battery packs from hundreds of thousands of hybrids and EVs each year. Umicore is the European leader and is expanding in the U.S. The other company, Kinsbursky Brothers, handles most North American advanced automotive battery recycling through a joint venture with longtime battery recycling company Toxco. The Kinsbursky Brothers' Toxco operation appears to be the recycler most widely used by companies that sell hybrids and EVs in North America. The company also receives batteries from carmakers in Europe. (Edmunds, 2012).

Each operation uses a proprietary system and both now are concerned mainly with recycling NiMH batteries. Both companies also are handling small volumes of Li-ion packs as they work with automakers to develop the best recycling processes. Because of the sales pace for EVs and hybrid cars and trucks, it is expected that a commercially viable recycling market would take at least a decade to develop (Edmunds, 2012).

Both companies process batteries from automakers and dismantlers. Battery packs typically have a recycling-information sticker on them so wrecking yards, garages, and car dealers can get instructions for directing "end-of-life" batteries to the proper recycling operation. Toyota offers a $200-per-pack bounty to encourage dealers and others to turn in spent packs rather than discarding them. Once the packs are at the proper distribution point, the recyclers break down their constituent parts to salvage any wiring, electrical components and plastics that can be separately recycled (Edmunds, 2012).

Currently, Umicore does the initial component separation in Germany and soon will be conducting the process at a North American facility being built in Maxton, North Carolina. The battery cells will continue to be shipped to Umicore's industrial-scale pilot recycling plant in Hoboken, Belgium. The Hoboken facility put the cells through a process that separates their content into metal alloys and a slag that, when NiMH batteries are being recycled, concentrates the rare earth elements they contain. The recycler sells the metals to battery makers for reuse. The rare-earth concentrate from NiMH batteries is sold for reprocessing. Umicore sells the slag from Li-ion batteries to cement makers, who use it as an aggregate that helps strengthen concrete (Edmunds, 2012).

At Toxco, the process also starts by gathering batteries at a variety of collection points from automakers and wrecking yards. The company sends the batteries to facilities in Trail, British Columbia, and Lancaster, Ohio, where they are flash-frozen to ensure that the lithium does not cause a fire when the cells are broken into. Then metal shredders tear them apart. Toxco is increasing capacity at its Ohio facility under a federal grant it received in 2009. The additional space and new equipment will help the company improve the cost-effectiveness of lithium battery recycling (Edmunds, 2012).

Most battery and fuel cell technologies currently employ materials that have high economic value and, therefore, are recyclable. Additionally, both regulatory requirements and market forces require and encourage recycling. The following is a brief listing of some of the more important Federal and California regulations that have created requirements and incentives for the proper disposal and recycling of EV battery packs:

- The federal Battery Act promulgated in 1996 requires that each regulated battery be labeled with a recycling symbol. NiCad batteries must be labeled with the words “NiCad” and the phrase “Battery must be recycled or disposed of properly.” Lead-acid batteries must be labeled with the words “Lead,” “Return,” and “Recycle.”

- Current California and federal regulations require ZEV manufacturers to take into account the complete life-cycle of car batteries and to plan for safe disposal and/or recycling of battery materials.

- The California Health and Safety Code does not allow the disposal of lead-acid batteries at a solid waste facility or on or in any land, surface waters, water courses, or marine waters. Legal disposal methods for used lead-acid batteries are to recycle/reuse the battery or to dispose of it at a hazardous waste disposal facility. A lead-acid battery dealer is required to accept spent batteries when a new one is purchased.

- California Public Resources Code requires state agencies to purchase car batteries made from recycled material.

- The Universal Waste Rule requires that spent batteries exhibiting hazardous waste characteristics and that are not recycled need to be managed as hazardous waste. This includes lead-acid and NiCad batteries.

- Car manufacturers offer incentives to recycle batteries (e.g., Toyota offers $200 for spent battery packs to help promote battery recycling).

Recycling of lead-acid and nickel-cadmium batteries is a well-established activity. Eighty percent of lead consumed in the United States is used to produce lead-acid batteries and the lead recovery rate from batteries is approximately 80 to 90 percent. The remainder is plastic and fluids (e.g., sulfuric acid). According to the Lead-Acid Battery Consortium, 95 to 98 percent of all battery lead is recycled.

Because most EV batteries are recycled, it is unlikely that the increase in battery use would create a significant adverse affect on landfill capacity in California. As mentioned earlier, electric batteries generally hold significant residual value, and 95 to 98 percent of all lead-acid batteries are recycled. In addition, the electric batteries that would power EVs are packaged in battery packs and cannot be as easily disposed of as a single 12-volt conventional vehicle battery. It should be noted that the increased operation of EVs associated with the implementation of the 2012 AQMP may actually result in a reduction of the amount of solid and hazardous waste generated in the SCAQMD's jurisdiction, as NiMH and Li-ion batteries have a much longer life span than conventional lead-acid batteries. Further, their size (over 100 pounds) makes them more difficult to handle and transport for unauthorized disposal. Additionally, the advanced-technology automotive battery recycling industry is setting up operations in states and countries where processing will have no impact on landfills either locally or within the state. Further, EVs do not require the various oil and gasoline filters that are required by vehicles using internal combustion engines. Furthermore, EVs do not require the same type or amount of engine fluids (oil, antifreeze, etc.) that are required by vehicles using internal combustion engines. Used oil and antifreeze are considered hazardous wastes under California regulations.

Even though batteries are comprised of materials with economic value, the increased use of electric batteries may require efforts at preventing disposal of spent batteries in municipal landfills or via illegal dumping. Illegal or improper disposal of electric batteries could result in significant solid waste impacts by allowing hazardous wastes to be disposed in municipal landfills. However, the recycling of batteries is required under law. Further some manufacturers pay $200 for used EV/hybrid batteries. The value, size, and length of life of NiMH and Li-ion batteries are such that recycling is expected to be more predominate than with lead acid batteries. Therefore, the use of EVs and hybrids are not expected to result in an increase in the illegal or improper disposal of electric batteries. Further, batteries associated with electric and hybrid cars are required to be recycled. Therefore, no significant increase in the disposal of hazardous or solid waste is expected due to increased use of electric or hybrid vehicles.

PROJECT-SPECIFIC MITIGATION: Based on the above information, neither solid nor hazardous waste impacts from increased use of electric or hybrid cars associated with the 2012 AQMP are expected to exceed the applicable solid and hazardous waste significance thresholds. Therefore, no mitigation measures are required.

REMAINING SOLID AND HAZARDOUS WASTE IMPACTS: There are no remaining solid and hazardous waste impacts since no significant impacts are expected due to increased use of electric or hybrid cars, and therefore, no mitigation measures are required.

4.8.4.2 Solid Waste Impacts Due to Air Pollution Control Technologies

Table 4.8-1 identifies those proposed control measures that may have potential project specific impacts on solid waste due to the addition of pollution control equipment that use filters, catalysts, etc., to collect and control pollutants, which may eventually need to be disposed and/or replaced. The following proposed control measures could potentially require or incentivize the use of pollution control equipment that use filters, catalysts, etc.: Control Measures BCM-03, MCS-01, CMB-01, INC-01, OFFRD-02, OFFRD-03, OFFRD-04, ADV-01, ADV-04, and ADV-05. It is difficult to quantify the number of facilities that would employ these types of equipment, the rate of disposal necessary to maintain the equipment, type of waste generated by the equipment (e.g., hazardous or non-hazardous) and the timing by which these technologies would come into use. However, known control technology historically used is examined qualitatively in the following paragraphs.

4.8.4.2.1 Filters/Precipitators

PROJECT-SPECIFIC IMPACTS: While it is speculative to identify the number of facilities and the quantity of equipment that would utilize filters/precipitators as a result of the proposed control measures, the quantity of particulate matter collected on filters and from electrostatic precipitators is expected to be small. Diesel particulate filters are estimated to collect about 10 to 150 grams of material per vehicle per year (CARB, 2002***)*** which is expected to be considered as hazardous waste. The amount of material collected from these types of control equipment is expected to be minor as described in the following paragraphs and could be handled within the capacity of existing disposal facilities.

The diesel PM filter system consists of a filter positioned in the exhaust stream designed to collect a significant fraction of the PM emissions while allowing the exhaust gases to pass through the system. Since the volume of PM generated by a diesel engine is sufficient to fill up and plug a reasonably sized filter over time, some means of disposing of this trapped PM must be provided. The most promising means of disposal is to burn or oxidize the PM in the filter, thus regenerating, or cleansing, the filter.

A complete filter system consists of the filter and the means to facilitate the regeneration (if not a disposable type filter).. The exhaust temperature of diesel engines is not always sufficient to initiate regeneration in the filter. However, a number of techniques are available to bring about regeneration of filters. It is not uncommon for some of these various techniques to be used in combination. Some of these methods include:

- Using a catalyst coated on the filter element. The application of a base or precious metal coating applied to the surface of the filter reduces the ignition temperature necessary for oxidation of the particulate;

- Using a NOx conversion catalyst upstream of the filter to facilitate oxidation of NO to NO_2 which adsorbs on the collected PM, substantially reducing the temperature required to regenerate the filter;

- Using fuel-borne catalysts to reduce the temperature required for ignition of the accumulated material;

- Throttling the air intake to one or more of the cylinders, thereby increasing the exhaust temperature;

- Using fuel burners, electrical heaters, or combustion of atomized fuel by catalyst to heat the incoming exhaust gas to a temperature sufficient to ignite the PM;

- Using periodically compressed air flowing in the opposite direction of the PM from the filter into a collection bag which is periodically discarded or burned; and

- Throttling the exhaust gas downstream of the filter. This method consists of a butterfly valve with a small orifice in it. The valve restricts the exhaust gas flow, adding back pressure to the engine, thereby causing the temperature of the exhaust gas to rise and initiating combustion.

While it is speculative to identify the number of facilities and the quantity of equipment that would utilize filters as a result of the proposed control measures, the quantity of additional filters being disposed of is expected to be small and could be handled within the capacity of existing disposal facilities. Additionally, the volume of particulate material collected on filters is very small (150 grams per vehicle per year). Based on the above considerations, no significant adverse solid and hazardous waste impacts are anticipated to occur from the use of particulate filters or traps.

State law requires hazardous waste generators to attempt to recycle their wastes before disposing them. The Office of Environmental Health Hazards Assessment (OEHHA) has implemented a hazardous waste exchange program to promote the use, reuse, and exchange of hazardous wastes. The program is designed to assist generators of hazardous wastes to recycle their wastes and encourage the reuse of the wastes. The DTSC also publishes a directory catalog of industrial waste recyclers annually so that industries will know where to buy, sell, or exchange their wastes.

PROJECT SPECIFIC MITIGATION: Based on the above information, neither solid nor hazardous waste impacts from using particulate filters are expected to exceed the applicable significance thresholds because most of the additional waste generated is expected to be relatively small. Therefore, no mitigation measures are required.

REMAINING SOLID AND HAZARDOUS WASTE IMPACTS: Since no significant adverse solid and hazardous waste impacts are expected due to the use of particulate filters, mitigation measures are not required, and solid and hazardous waste impacts remain less than significant.

4.8.4.2.2 Carbon Adsorption

PROJECT-SPECIFIC IMPACT: While none of the proposed solid and hazardous waste control measures specifically designate the use of carbon adsorption as air pollution control equipment, some do encourage a variety of options which could include carbon adsorption. Carbon adsorption is used to control VOC emissions primarily from stationary sources. The amount of solid waste, which may be generated by the carbon adsorption process would depend on the number of carbon adsorbers installed, the operating characteristics, and the frequency of carbon replacement. Most of the control measures have alternative methods of compliance (e.g., reformulation of material).

If carbon adsorption systems are used, the amount of hazardous waste generated on an annual basis is expected to be minimal. Most activated carbon used in carbon adsorption control devices is reclaimed and reactivated, resulting in negligible impacts on solid waste disposal facilities. Activated carbon can have a useful lifetime of five to 10 years; however, the operating characteristics of the control device may result in a shorter lifetime.

Spent carbon is usually recycled and reused rather than disposed in landfills. Most facilities contract out with vendors that take the spent carbon and deliver regenerated carbon. Another alternative to the land disposal of regenerated carbon is to burn the spent carbon in a thermal incinerator. With thermal incineration, the organic materials contained in the carbon are oxidized to carbon dioxide, water, and in most cases, harmless combustion by-products. Incineration destroys the toxic constituents and significantly reduces the volume of carbon to be disposed of, thus reducing solid waste impacts. The disadvantage of incineration is that without additional add-on control devices, there may be an increase in criteria pollutant emissions.

Further, it is not expected that carbon adsorption will be used in a majority of the cases where it is as a control option. It is expected that facilities will continue to choose other more cost-effective options to comply with control measures. Based on these considerations, the solid waste impacts resulting from the use of carbon adsorption are expected to be less than significant.

PROJECT SPECIFIC MITIGATION: Based on the above information, neither solid nor hazardous waste impacts from using carbon adsorption control equipment are expected to exceed the applicable significance thresholds because most of the additional waste generated is expected to be relatively small. Therefore, no mitigation measures are required.

REMAINING SOLID AND HAZARDOUS WASTE IMPACTS: Since no significant adverse solid and hazardous waste impacts are expected due to the use of carbon adsorption control equipment, mitigation measures are not required, and solid and hazardous waste impacts remain less than significant.

4.8.4.2.3 Particulate Traps/Prefilters/Filters/HEPA Filters

PROJECT-SPECIFIC IMPACTS: A number of control measures in the 2012 AQMP could require the collection and disposal of additional particulate matter including BCM-03, MCS-01, INC-01, and OFFRD-03. These measures could result in increased collection of particulate matter that would then need to be disposed.

Baghouses, pre-filters, filters, and HEPA filters collect particulate emissions from stationary and mobile sources of particulate emissions. These types of filtration control equipment can effectively remove particulate matter, including heavy metals, asbestos, as well as other toxic and nontoxic compounds. Polytetrafluoroethylene (PTFE) membranes or HEPA filters can increase a system's removal efficiency up to 99.9 percent. In general, as particulate size decreases, the surface area to volume ratio increases, thus, increasing the capacity of these filters to adsorb smaller particles (including hazardous materials). An increase in the use of membranes and filters may result in an incremental increase of solid waste requiring disposal in landfills over what would be produced if the 2012 AQMP were not adopted. In some cases, waste generated will be hazardous (e.g., the collection of toxic emissions). The increase in the amount of waste generated from the use of filters and the collection of additional particulate matter is expected to be minimal, because filtration control equipment is already used in practice or required by existing rules, especially for stationary sources. Control measures that may include filtration control equipment will generally require increased control efficiencies and/or better housekeeping and maintenance requirements for the filtration devices. As a result the incremental amount of material collected by filters is expected to be small. Further, the larger filters used in baghhouses are cleaned and reused, so minimal additional waste would be expected from collecting more PM due to greater efficiency. Therefore, the potential impacts from the use of additional filtration equipment on solid and hazardous waste generation are less than significant.

PROJECT SPECIFIC MITIGATION: Based on the above information, neither solid nor hazardous waste impacts from using baghouses, pre-filters, filters, and HEPA filters are expected to exceed the applicable significance thresholds because the most of the additional waste generated is expected to be relatively small. Therefore, no mitigation measures are required.

REMAINING SOLID AND HAZARDOUS WASTE IMPACTS: Since no significant adverse solid and hazardous waste impacts are expected due to the use of baghouses, pre-filters, filters, and HEPA filters, mitigation measures are not required, and solid and hazardous waste impacts remain less than significant.

4.8.4.2.4 Catalytic Oxidation

PROJECT-SPECIFIC IMPACTS: The 2012 AQMP could result in the increased use of catalytic oxidation to control emissions. The following control measures could rely on catalytic oxidation technologies for emission control: Control Measures CMB-01, OFFRD-03, OFFRD-04, ADV-04, and ADV-05. Catalytic oxidation beds generally use a precious metal to aid in the combustion of air pollutants at relatively low temperatures. Catalytic 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 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 (RWQCBs) 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, no significant impacts on waste disposal are expected.

PROJECT SPECIFIC MITIGATION: Based on the above information, neither solid nor hazardous waste impacts from using catalytic oxidation control technologies are expected to exceed the applicable significance thresholds because the most of the additional waste generated is expected to be relatively small. Therefore, no mitigation measures are required.

REMAINING SOLID AND HAZARDOUS WASTE IMPACTS: Since no significant adverse solid and hazardous waste impacts are expected due to the use of catalytic oxidation control technologies, mitigation measures are not required, and solid and hazardous waste impacts remain less than significant.

4.8.4.3 Solid Waste Impacts Due to the Retirement of Equipment

Control Measures IND-01, MCS-01, CMB-01, CMB-02, CMB-03, INC-01, ONRD-01, ONRD-02, ONRD-03, ONRD-04, ONRD-05, OFFRD-01, OFFRD-02, OFFRD-03, ADV-01, ADV-02, ADV-05, ADV-06, and ADV-07 could result in the early retirement of equipment (e.g., burners, on-road trucks and vehicles, off-road vehicles, gasoline fueled engines, diesel fueled engines, and locomotive and aircraft engines). Solid waste impacts could occur since the older equipment or vehicle parts would be taken out of service in the district and scrapped and disposed of in district landfills. It is expected that some older trucks, vehicles, and locomotive engines could be relocated to other areas, such as Mexico.

Approximately 80 percent of a vehicle can be recycled and reused in another capacity. Batteries, catalytic converters, tires, and other recoverable materials (e.g., metal components) are removed and the metal components of the vehicle are shredded. The shredded material is then sent for recovery of metal content. Therefore, the amount of solid waste landfilled as a result of the proposed control measures would be relatively small since most of the parts being replaced have commercial value as scrap metal. Currently, there are a limited number of vehicles and parts that can be scrapped per year because of the limited number of scrapping and recycling facilities in the district. It is expected that gasoline and diesel engines could also be recycled for metal content, or rebuilt and sold to other areas. It is expected that parts and equipment would be scrapped in the near future, regardless of the 2012 AQMP control measures as they are older vehicles or have older components. The primary solid waste impact is expected to be accelerated replacement and disposal of equipment and parts before the end of their useful life. Further, these control measures are not expected to mandate that older vehicles, engines, or other equipment be scrapped. The control measures are expected to allow a number of different control methods to comply with the required emission reductions. The most cost effective control measures would be expected to be implemented. Control measures that would require new equipment will generally require that retirement occurs as the life of the old equipment is exhausted and new equipment is put into service. Based on the above, scrap metal from vehicle and engine replacements are expected to be recycled and not disposed of in landfills. Any small increase that may occur from miscellaneous parts is expected to be within the total permitted capacity of over 100,000 tons per day for all facilities in the district, so that no significant impacts would be expected.

The California Integrated Waste Management Act of 1989 (AB 939) requires cities and counties in California to reduce the amount of solid waste disposed in landfills by 25 percent by 1995 and by 50 percent by 2000, through source reduction, recycling and composting activities. Later legislation mandates a 50 percent diversion requirement be achieved every year. SB 1016 (Wiggins) – Diversion: Alternative Compliance System (effective January 1, 2009) moves CalRecycle from the previously existing solid waste diversion accounting system to a per capita disposal based system. SB 1016 does not change the 50 percent requirement in AB 939, rather measures it differently. Compliance is the same under the new system as it was under the old system. To evaluate compliance, CalRecycle will look at a jurisdiction's per capita disposal rate as an indicator of how well its programs are doing to keep disposal at or below a jurisdiction's unique 50 percent equivalent per capita disposal target. The 50 percent equivalent per capita disposal target is the amount of disposal a jurisdiction would have had during the base period had it been at exactly a 50 percent diversion rate. The target is calculated using the average of 2003-2006 per capita generation for each jurisdiction. The generation average is then divided in half to determine the 50 percent equivalent per capita disposal target. This number does not determine compliance. Compliance is based on CalRecycle evaluating that a jurisdiction is continuing to implement the programs it choses and is making progress in meeting its target (CalRecyle, 2012a).

In 2010, California's statewide disposal was 30.4 million tons and population was 37.2 million residents. This resulted in a per resident disposal rate of 4.5 pounds/resident/day. The rate was the same in 2009 (CalRecycle, 2012c).

Almost all (99 percent) of California's 30.4 million tons of disposedal waste was were landfilled in California, while approximately one percent was exported to landfills out of state. An additional 0.8 million tons were transformed at three permitted waste-to energy plants in California, but not included in the disposal rate estimate because of provisions in the law that allow limited diversion credit for transformation (CalRecycle, 2012c).

California's disposal of 30.4 million tons in 2010 is a slight decline of 0.7 million tons from 2009. However, it is 13.6 million tons less than the high of 44 million tons in 1989, and 12.1 million tons less than the second highest amount of 42.5 million tons recently recorded in 2005. In 2010, the per employee disposal rate reached a historic low of 11.7 pounds per employee per day, per resident "diversion rate equivalent" was 65 percent, and per employee "diversion rate equivalent was 63 percent (CalRecycle, 2012c).

In the future, it is anticipated that the California economy will rebound and solid waste generation will increase as people find work, build more, produce more, and buy more. Statewide disposal is expected to increase in the likely event of an economic rebound. If these increased flows of materials are not planned for, they may end up in landfills rather than being recycled back into the economy.

Many cities and counties had not met the 20 and 50 percent waste reduction goals of AB 939 prior to the adoption of the 50 percent equivalent per capita disposal target associated with SB 1016. Table 4.8-3 shows that within the counties within the district as well as statewide, targets are still short of meeting diversion standards. The generation of additional waste associated with control measures in the 2012 AQMP could impact the abilities of cities and counties to further reduce wastes. However, as discussed above the increase in solid waste that is expected to be diverted to a landfill is small and many of the waste streams are recyclable. Therefore, the 2012 AQMP is not expected to have adverse impacts on landfills.

TABLE 4.8-3

Summary of Per Capita Target Compliance (2010)

LOCATION	NUMBER OF JURISDICTIONS WITHIN LOCATION	NUMBER OF JURISDICTIONS MEETING POPULATION TARGET	PERCENT OF JURISDICTIONS MEETING POPULATION TARGET	NUMBER OF JURISDICTIONS MEETING EMPLOYEE TARGET	PERCENT OF JURISDICTIONS MEETING EMPLOYEE TARGET
State of California	415	18	4%	51	12%
Los Angeles County	74	2	3%	4	5%
Orange County	35	1	3%	2	6%
Riverside County	25	0	0%	4	16%
San Bernardino County	26	0	0%	2	8%

Source (CalRecyle, 2012b)

PROJECT SPECIFIC MITIGATION: Due to the monetary value of scrapped engines, vehicles and equipment, significant solid or hazardous impacts associated with the early retirement of such equipment were not identified, are not significant and, therefore, no mitigation measures are required.

REMAINING SOLID AND HAZARDOUS WASTE IMPACTS: Since no significant adverse solid and hazardous waste impacts are expected due to scrapped engines, vehicles and equipmen, mitigation measures are not required, and solid and hazardous waste impacts remain less than significant.

4.8.5 Summary of Solid and Hazardous Waste Impacts

The following is a summary of the conclusions of the analysis of solid and hazardous wastes impacts associated with implementation of the 2012 AQMP.

- Spent Batteries: The analysis indicates that no significant solid and hazardous waste impacts associated with spent batteries are likely to occur because due to battery recycling. Lead acid batteries are currently required to be recycled. NiMH and Li-ion batteries more common with EVs and hybrids have a long battery life, are valuable, and usually have a monetary incentive associated with return of the battery to the manufacturer. Two firms in the United States are currently recycling NiMH and Li-ion batteries. For these reasons, the increased use of EVs and hybrids are not expected to result in a significant increase in the illegal disposal of batteries.

- Solid and Hazardous Waste Impacts due to Air Pollution Control Technologies: No significant solid and hazardous waste impacts were identified due to air pollution control technologies as part of the 2012 AQMP. The solid and hazardous waste impacts associated with the use of carbon adsorption are considered less than significant, since spent carbon is usually recycled and reused rather than disposed in landfills. The increase in the amount of waste generated from the use of filters and the collection of additional particulate matter from the control technologies are expected to be minimal as the amount of material collected is small. Finally the impacts associated with catalytic oxidation are not expected to be significant because the catalysts used are largely recycled; therefore, no significant impacts on solid or hazardous waste disposal are expected.

- Early Retirement of Equipment: Control measures that would require new equipment can require that retirement occurs as the life of the old equipment is exhausted and new equipment is put into service. For equipment that may be retired before the end of its useful life, that equipment may be reused in areas outside the district. Equipment with no remaining useful life is expected to be recycled for metal content. Therefore, no significant solid and hazardous waste impacts were identified due to implementation of the control measures.

Summary of PM2.5 Control Measure Impacts: The impacts associated with PM2.5 Control Measures were evaluated and determined to be less than significant for solid and hazardous waste generation (CMB-01, BCM-02, BCM-03, BCM-04, IND-01, EDU-01 and MCS-01).

Summary of Ozone Control Measure Impacts: The Ozone Control Measures were evaluated and determined to be less than significant for solid and hazardous waste generation (CMB-01, CMB-02, CMB-03, INC-01, ONRD-01, ONRD-02, 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).