

**State of California  
AIR RESOURCES BOARD**

**2011 Report on Air Emissions from Facilities Burning  
Waste Tires in California**

**April 2012**

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*“The energy challenge facing California is real. Every Californian needs to take immediate action to reduce energy consumption. For a list of simple ways you can reduce demand and cut your energy costs, see our Web-site at [www.arb.ca.gov](http://www.arb.ca.gov)*

## **Executive Summary**

This report summarizes pollutant emissions from facilities in California that burned waste tires as a supplemental fuel in 2009, the most recent year for which complete data are available. The report has been prepared pursuant to section 42889.4 of the California Public Resources Code.

Thirteen facilities in the state of California are permitted to burn waste tires in combination with coal, coke, or biomass. Of these, five cement plants and two cogeneration facilities burned 7.7 million tires as a supplemental fuel in 2009. These data were compiled from local air districts that have jurisdiction to grant air quality permits, and establish, track, and enforce emissions limits.

Emissions data reported are from the combustion devices (kilns and boilers) where waste tires were actually burned. It does not include emissions from other processes such as internal combustion engines, process heaters, etc. The following table summarizes the total emissions from kilns and boilers at the seven facilities where waste tires were burned in 2009. The emissions are for the whole combined-fuel process (e.g., coal, coke and tires), not just the waste tire portion.

**Criteria and toxic pollutant emissions from devices where waste tires were burned as a supplemental fuel in 2009**

<b>Criteria Pollutants</b>	
Total Organic Gases	94 tons/year
Reactive Organic Gases	61 tons/year
Oxides of Nitrogen	5,759 tons/year
Oxides of Sulfur	667 tons/year
Carbon Monoxide	3,104 tons/year
Total Particulate Matter	337 tons/year
Particulate Matter $\leq 10$ micrometers	233 tons/year
<b>Toxic Pollutants</b>	
Acetaldehyde	102 pounds/year
Benzene	89 pounds/year
Formaldehyde	403 pounds/year
Hydrogen Chloride	82,779 pounds/year (41.4 tons/year)
Total Metals	540 pounds/year
Total Polycyclic Aromatic Hydrocarbons	9 pounds/year
Hexavalent Chromium	76,268 milligrams/year (76.3 grams/year)
Dioxins	68 milligrams/year
Furans	93 milligrams/year

## Introduction

Pursuant to section 42889.4 of the California Public Resources Code, since 2001, the Air Resources Board (ARB) has published a report summarizing criteria and toxic air pollutant emissions generated from facilities that burn waste tires as a supplemental fuel. Specifically, this section requires the following:

*If facilities are permitted to burn tires in the previous calendar year, the State Air Resources Board, in conjunction with air pollution control districts and air quality management districts, shall post on its Web site, updated on or before July 1 of the subsequent year, information summarizing the types and quantities of air emissions, if any, from those facilities.*

Waste tires are defined in section 42807 of the Public Resources Code as follows:

*“Waste tire” means a tire that is no longer mounted on a vehicle and is no longer suitable for use as a vehicle tire due to wear, damage, or deviation from the manufacturer’s original specifications. A waste tire includes a repairable tire, scrap tire, altered waste tire, and a used tire that is not organized for inspection and resale by size in a rack or a stack in accordance with Section 42806.5, but does not include a tire derived product or crumb rubber.*

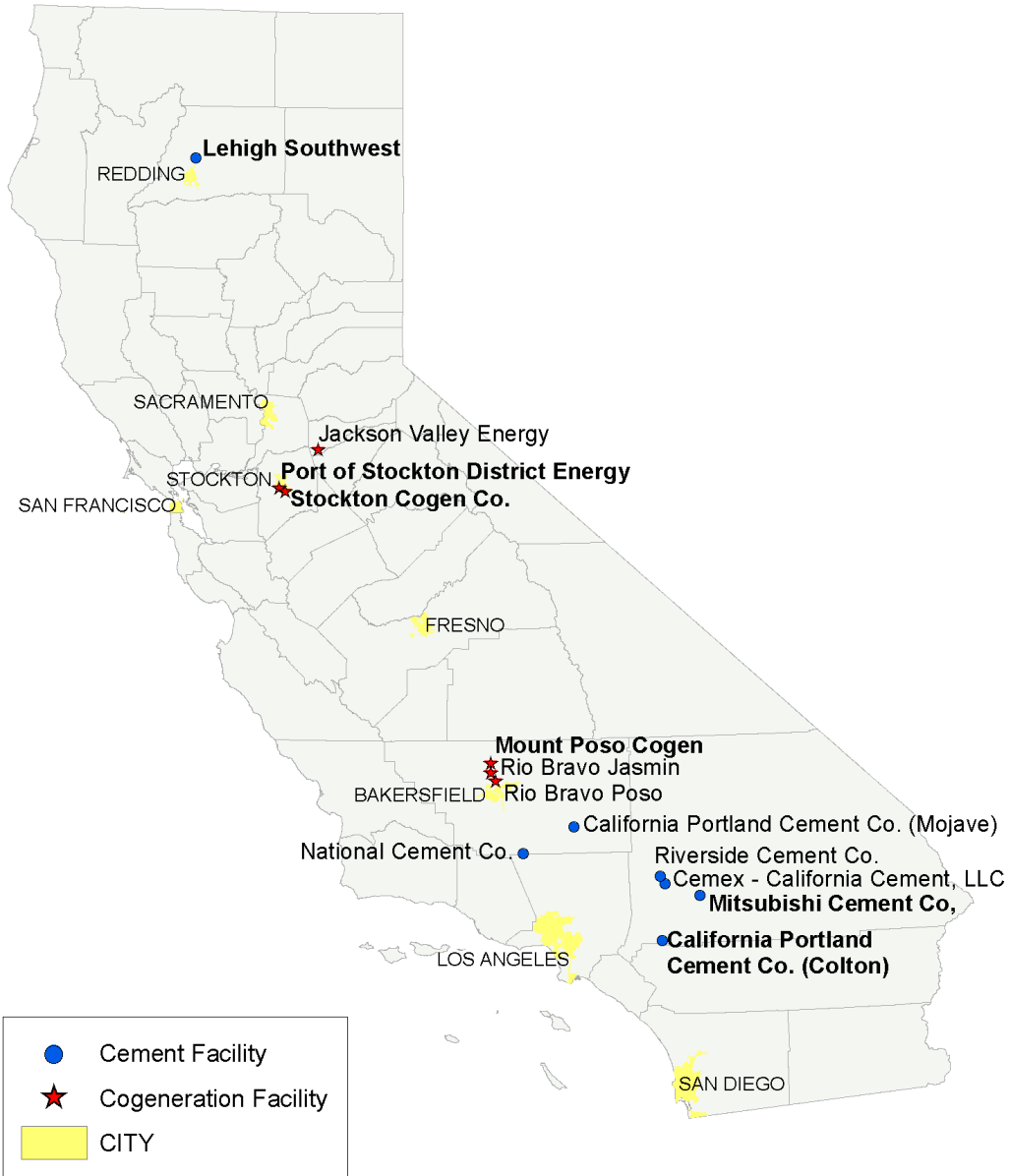
Tires have a heating value of approximately 13,000 to 15,000 British Thermal Units (BTUs) per pound, roughly the same as a superior quality coal. In California, waste tires are used as tire-derived fuel in two applications: cement kilns that often burn coal or coke, and cogeneration facilities producing electric power, generally from biomass.

This report summarizes the emissions from the combustion processes (kilns and boilers) where tires were actually burned, rather than the total facility emissions. A more comprehensive emissions inventory for all the operations at each facility is available on our website at [www.arb.ca.gov/app/emsinv/facinfo/facinfo.php](http://www.arb.ca.gov/app/emsinv/facinfo/facinfo.php).

## Facility Information

Thirteen facilities in the State are permitted to burn tire-derived fuel. Figure 1 shows the names and location of these facilities. Of these, seven facilities burned tires as a supplemental fuel in 2009. Five facilities are cement plants and two are cogeneration facilities.

# Figure 1. Permitted Tire Burning Facilities



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Tire Burning.mxd

About 7.7 million waste tires were reported as burned by these facilities in 2009. According to the most recent report on waste tire management by the California Department of Resources Recycling and Recovery (CalRecycle), about 7 million of these waste tires were generated in California. In all of these facilities, the tires were burned in combination with coal, coke, or biomass, usually in a mixture that contained less than twenty percent waste tires. Table 1 displays the number of tires burned at facilities in 2009, along with the percentage of tires used as part of the total fuel mix.

**Table 1. Number of tires burned and percentage of tires in total fuel burned in 2009 by facilities permitted to burn waste tires**

<b>Air District</b>	<b>Facility Name And Location</b>	<b>Tires Burned in 2009</b>	<b>Total Fuel (Tons)</b>	<b>Tires in Fuel (%)</b>
South Coast	California Portland Cement Company Colton, CA	1.2 million	58,786	21
Kern County	California Portland Cement Company Mojave, CA	0	--	0
Mojave Desert	Cemex – California Cement, LLC Apple Valley, CA	1.6 million	233,880	7
Shasta County	Lehigh Southwest Redding, CA	0.6 million	27,620	21
Mojave Valley	Mitsubishi Cement Company Lucerne Valley, CA	1.9 million	156,238	12
Kern County	National Cement Company Lebec, CA	1.6 million	59,500	26
Mojave Desert	Riverside Cement Company Oro Grande, CA	0	--	0
San Joaquin Valley	Jackson Valley Energy Partners Lone, CA	0	--	0
San Joaquin Valley	Mount Poso Cogeneration Company Bakersfield, CA	0.2 million	183,626	1
San Joaquin Valley	Port of Stockton District Energy Stockton, CA	0	--	0
San Joaquin Valley	Rio Bravo Jasmin Bakersfield, CA	0	--	0
San Joaquin Valley	Rio Bravo Poso Bakersfield, CA	0	--	0
San Joaquin Valley	Stockton Cogeneration Company Stockton, CA	0.6 million	197,976	3
<b>Total Tires Burned <sup>(1)</sup></b>		<b>7.7 million</b>		

<sup>(1)</sup> Total may differ from the sum of tires burned at individual facilities due to rounding.

As shown in Table 1, the percentage of tires burned as part of the total fuel mix ranged from 1 to 26 percent. The number and of tires burned and total weight were reported by the facility operators to the local air districts. Under State law, the local air districts are responsible for granting air quality permits, establishing and enforcing emissions limits, and tracking facility emissions.

## Criteria Pollutant Emissions

Table 2 summarizes the criteria pollutant emissions from the cement kilns or boilers where tires were part of the fuel mix burned in 2009. The data were reported by the local air districts to ARB's California Emissions Inventory Database and Reporting System (CEIDARS). The pollutants reported below are total organic gases (TOG), reactive organic gases (ROG), oxides of nitrogen (NOx), oxides of sulfur (SOx), carbon monoxide (CO), total particulate matter (PM), and particulate matter 10 micrometers or less in diameter (PM<sub>10</sub>).

**Table 2. Criteria pollutant emissions from kilns and boilers where waste tires were burned as a supplemental fuel in 2009 (tons per year)**

	TOG	ROG	NOx	SOx	CO	PM	PM <sub>10</sub>
<b>Cement Facilities</b>							
California Portland Cement	6	5	433	32	46	19	18
Cemex – California Cement	20	20	2,507	4	672	124	89
Lehigh Southwest	4	3	186	24	501	25	24
Mitsubishi Cement	34	24	1,689	449	359	51	49
National Cement	10	8	686	3	1,402	13	12
<b>Total Cement Facilities</b>	<b>74</b>	<b>60</b>	<b>5,501</b>	<b>512</b>	<b>2,980</b>	<b>232</b>	<b>192</b>
<b>Cogeneration Facilities</b>							
Mount Poso Cogeneration	<1	<1	179	49	73	51	20
Stockton Cogeneration	20	1	79	106	51	54	21
<b>Total Cogeneration Facilities</b>	<b>20</b>	<b>1</b>	<b>258</b>	<b>155</b>	<b>124</b>	<b>105</b>	<b>41</b>
<b>Grand Total <sup>(1)</sup></b>	<b>94</b>	<b>61</b>	<b>5,759</b>	<b>667</b>	<b>3,104</b>	<b>337</b>	<b>233</b>

<sup>(1)</sup> Grand total may differ from the sum of individual facility emissions due to rounding.

Because tires are burned in combination with other fuels, the data represent emissions from the whole combined-fuel process (e.g., coal and tires), not just the tire-derived fuel portion. As shown in Table 1, tires make up between 1 to 26 percent of total fuel burned.

## Toxic Pollutant Emissions

Table 3 summarizes the estimated toxic air pollutant emissions from the cement kilns and boilers where tires were part of the fuel mix burned in 2009. Toxic emission estimates are reported as pounds per year except for hexavalent chromium, dioxins and furans which are reported as milligrams per year.



**Table 3. Estimated toxic pollutant emissions from kilns and boilers where waste tires were burned as a supplemental fuel in 2009**

	Acetaldehyde	Benzene	Formaldehyde	Hydrogen Chloride	Total Metals	Total PAHs <sup>(2)</sup>	Hexavalent Chromium	Dioxins	Furans
	Pounds per year						Milligrams per year		
<b>Cement Facilities</b>									
California Portland Cement	5	7	19	624	6	1	637	1	1
Cemex – California Cement	21	27	75	2,482	26	3	2,536	2	2
Lehigh Southwest	3	3	9	293	3	<1	300	<1	<1
Mitsubishi Cement	14	18	50	1,658	17	2	1,694	2	2
National Cement	5	7	19	631	7	1	645	1	1
<b>Total Cement Facilities</b>	<b>48</b>	<b>62</b>	<b>172</b>	<b>5,688</b>	<b>59</b>	<b>7</b>	<b>5,812</b>	<b>6</b>	<b>6</b>
<b>Cogeneration Facilities</b>									
Mount Poso Cogeneration	26	13	111	37,100	231	1	33,907	30	42
Stockton Cogeneration	28	14	120	39,991	250	1	36,549	32	45
<b>Total Cogeneration Facilities</b>	<b>54</b>	<b>27</b>	<b>231</b>	<b>77,084</b>	<b>481</b>	<b>2</b>	<b>70,456</b>	<b>62</b>	<b>87</b>
<b>Grand Total <sup>(1)</sup></b>	<b>102</b>	<b>89</b>	<b>403</b>	<b>82,779</b>	<b>540</b>	<b>9</b>	<b>76,268</b>	<b>68</b>	<b>93</b>

<sup>(1)</sup> Grand total may differ from the sum of individual facility emissions due to rounding.

<sup>(2)</sup> Polycyclic Aromatic Hydrocarbons

The estimated emissions in Table 3 are based on source tests in which tires were burned in combination with other fuels. As such, the data represent emissions from the whole combined-fuel process (e.g., coal and tires), not just the tire-derived fuel portion. Cement plant emission factors were derived from a source test at Mitsubishi Cement. Emission factors for cogeneration facilities are based on a source test at Stockton Cogeneration.

As shown in Table 3, toxic emissions from cogeneration facilities, that had comparable total fuel usage as cement plants (see Table 1), were generally higher than those from cement plants, even though a smaller number of tires were burned. Cogeneration facilities reported total fuel composition that generally included more coal, “other fuels,” and “scraps.” The more diverse fuel composition and combustion temperatures at cogeneration facilities are likely related to the relatively higher toxic pollutant emissions.

## **Conclusions**

Of thirteen facilities permitted to burn waste tires in California, seven burned tires as a supplemental fuel in 2009. These facilities burned approximately 7.7 million waste tires in combination with coal, coke, or biomass. As is typical for combustion sources, the bulk of emissions for the combined fuel was criteria pollutants, particularly NO<sub>x</sub> and CO, with comparatively lower SO<sub>x</sub>, PM<sub>10</sub>, TOG and ROG. Toxic pollutant emissions appear higher for cogeneration facilities than cement plants even though the number of tires burned and criteria pollutant emissions are generally lower. As mentioned previously, emission values in this report represent total emissions in devices which burned tires.

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