

Coal Burning vs. Co-firing Tires with Coal: Is Adding Tires more Polluting?

The short answer is YES. Adding tires to a fuel mix with coal increases pollution generally.

When arguing for burning tires in Coeymans, Lafarge provided a small number of data points to make their case. In reviewing the available data, we found 30 data points with information on tire burning, 16 of which made direct comparisons between coal and a mixture of tires and coal. This data is mostly from cement kilns, but a few data points are from paper mills or other industrial boilers.

This more comprehensive review of the available data shows that mixing tires in with coal generally increases emissions of various pollutants that have been studied. The data shows that tires in the fuel mix:

INCREASES: Chromium, Copper, Lead, Nickel, Zinc, Dioxins/Furans, PCBs, polycyclic aromatic hydrocarbons (PAHs), Sulfur Dioxide, Carbon Monoxide, and Benzene

MAY INCREASE (data isn't strong enough to say for certain, but it trends in the direction of increasing): Arsenic, Barium, Beryllium, Cadmium, Magnesium, Manganese, Mercury, Chlorine, and Hydrochloric Acid

DECREASES: Fluoride / Hydrofluoric Acid, Nitrogen Oxides (NO_x)

Below are the word-for-word arguments made by LafargeHolcim's Shelbee Hundley in an email to elected officials in the Town of Coeymans on Jan 9, 2019, along-side our responses based on a more comprehensive look at the data.

Note that their repeated assertions that the Clean Air Law does not have a corresponding limit are false. Section 8 of the Town of Coeymans Clean Air Law and the proposed County of Albany Clean Air Law incorporates state and federal limits as locally enforceable. This means that where the local law does not set more protective limits, the existing limits in state-issued permits may be locally enforced more regularly, using the required continuous emissions monitors, rather than relying on once per year stack tests as typically required in state permits for most pollutants.

Documentation for the studies behind the summaries below is available upon request from Mike Ewall, Esq. at 215-436-9511 or mike@energyjustice.net.

Pollutant	LaFarge Says....	The rest of the story...
<p>Dioxins / Furans (D/F)</p> <p>[Note that "PCDD/F" means polychlorinated dibenzodioxins (PCDD) and polychlorinated dibenzofurans (PCDF), which are the most toxic forms of dioxins and furans.]</p>	<p>Studies indicate that a slight increase may occur as a result of TDF; however, the Ravena Cement Plant is already subject to a D/F emission limitation per federal law that is more stringent than the emission limit being proposed by the "Clean Air Law".</p> <p>[Scrap Tire Handbook: Table 4-4 (page 54), Tires as a Fuel Supplement - Feasibility Study - Appendix B (page 71-76)]</p>	<p>Their first reference shows that, when burning just 12% tires in the mix at a California Portland Cement Company's Colton plant, they had a 57% increase in dioxins/furans. Their second reference shows results of two tests from 1990. One, in Davenport, CA, shows a dioxin/furan increase of 32% when burning 30% tires compared to just coal. The other, in Victorville, CA, shows a dioxin/furan increase of 72% when burning 25% tires compared to just coal.</p> <p>Lafarge fails to disclose that other tests at these same Davenport and Victorville cement plants showed much higher increases in dioxins/furans. The most extreme of the test results was a 1992 test at the Davenport plant which showed a 1,432% increase in tetrachlorinated dioxins and an increase of 2,230% in tetrachlorinated furans (see p.4 here). Other studies have shown significant increases as well. A complete list of all coal vs. coal/tire mixture dioxin emissions results we've seen before is available at www.energyjustice.net/tires. Three results showed decreases, while ten showed increases. The worse of the results was in Chester, PA where adding just 4-8% tires caused dioxins to increase over 4,000%.</p> <p>Dioxins are the most toxic human-made chemicals known to science. They are so toxic that if they might increase, discussion of other toxic emissions becomes far less relevant. EPA's Risk-Screening Environmental Indicators (RSEI) model has toxic weighting factors for 323 chemicals. Dioxins are the worst of them, and are given a toxic weighting that is 10,000 times as toxic as the second most toxic chemical, nearly 78,000 times as toxic as lead, and 140,000 times as toxic as mercury.</p> <p>Dioxin formation is complex, and depends a lot on temperature, the amounts of halogens (chlorine, bromine, fluorine) present, and on the presence of metal catalysts such as copper, iron and zinc (there are high levels of zinc in tires). Dioxin emissions spike when a facility is experiencing startup, shutdowns, and malfunctions -- exactly the times when testing is not normally done.</p> <p>Dioxin testing in the U.S. is typically done by sampling for six hours per year, under ideal operating conditions. Research from the UK found that continuous dioxin sampling shows higher dioxin emissions than typical stack tests, and research from Belgium shows that the difference can be 30-50 times higher than we're led to believe in the U.S. where facilities test for just 6 hours per year.</p> <p>Lafarge provided a 2015 document from their efforts to burn tires at their kiln in Nova Scotia. Interestingly, they admit that dioxin formation is complex, and recommend the use of continuous monitoring, just as the Clean Air Law would require. On p.26, the document they provided states: "Given the complex mechanisms leading to the formation of PCDD/Fs it is useful to continuously monitor its presence and to ensure that emissions remain within regulatory limits as is the case for the many studies conducted on fossil fuel replacement with TDF."</p> <p>They don't provide a copy of their current air permit to substantiate their claim that their dioxin limit is already stricter than the Clean Air Law. If they're right, they should have nothing to worry about. However, continuous testing could expose higher emissions than an annual 6-hour test.</p>

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<p>Polycyclic Aromatic Hydrocarbons (PAHs)</p>	<p>Studies indicate that a slight decrease is expected.</p> <p>[Scrap Tire Handbook: Table 4-4 (page 54)]</p>	<p>PAHs are cancer causing and quite problematic, as they're heavy and fall out more locally than many other pollutants. They're a family of chemicals. Some increase and some others decrease, depending on type. However, many of the well-known toxic PAHs have been found to increase, as the available data has shown:</p> <p>Case #1: increased in three tests (between 296% and 2,230%) but decreased by 68% in a fourth test</p> <p>Case #2: Acenaphthene 8,596% increase; Anthracene 4167% increase; Benzo(a)Anthracene 257% increase; Benzo(a)Fluoranthene 158% increase; Fluorene 834% increase; Naphthalene 450% increase</p> <p>Case #3: Total toxic PAH's: 2,190% increase (Naphthalene: 23,938% increase; Acenaphthylene: 18,836% increase; Phenanthrene: 1,824% increase; Anthracene: 2,775% increase; Pyrene: 1,089% increase; Fluoranthene: 291% increase)</p> <p>Case #4: increases in naphthalene, phenanthrene, fluoranthene, benzo-a-anthracene, chrysene, benzo-a-fluoranthene, benzo-k-fluoranthene, benzo-e-pyrene, and benzo-ghi-perylene</p> <p>Case #5: 88% increase</p> <p>Case #6: Anthracene: 2,191% increase; Benzo(a)anthracene: 489% increase; Dibenzo(a,h)anthracene: 28,272% increase; Fluoranthene: 235% increase</p>
<p>Volatile Organic Compounds (VOCs)</p>	<p>VOCs is a family of many compounds and, thus, impacts of TDF must be viewed as a cumulative impact. Studies indicate that a decrease or no change is expected. Additionally, the Ravena Cement Plant is currently subject to both a total hydrocarbons, which is an indicator of VOCs, by federal law and is also subject to a NYSDEC VOC emission limit. The "Clean Air Law" does not include similar limits.</p> <p>[Scrap Tire Handbook: Table 4-4 (page 54), Tires as a Fuel Supplement - Feasibility Study Table 3-1 (page 41)]</p>	<p>Of the two available data points on this, one showed that VOCs decreased 30%. Another showed that VOCs increased 120% to 3,366% (avg increase: 560%).</p>

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Nitrogen Oxides (NOx)	<p>Studies indicate that a decrease is expected. Additionally, there is less potential for NOx generation from TDF from fuel bound nitrogen.</p> <p>[Scrap Tire Handbook: Table 4-1 (page 44), Table 4-4 (page 54); Tires as a Fuel Supplement - Feasibility Study - Table 3-1 (page 41); Use of Scrap Tires as an Alternative Fuel Source at the Lafarge Cement Kiln, Brookfield, Nova Scotia, Canada - Table 4 (page 23)]</p>	<p>This is the one other pollutant for which decreases are generally found when adding tires in with coal. Available data shows four cases of NOx increases, but 11 cases of NOx decreases. Average decrease is about 23%.</p>
Sulfur Oxides (SOx)	<p>Studies indicate that a decrease is expected. Additionally, the potential for SO2 generation from TDF compared to other fuels is lower due to the lower sulfur content.</p> <p>[Scrap Tire Handbook: Table 4-1 (page 44), Table 4-3 (page 53); Air Emissions from Scrap Tire Combustion - Table A-9b (Page 80), Tires as a Fuel Supplement - Feasibility Study - Table 3-1 (page 41); Use of Scrap Tires as an Alternative Fuel Source at the Lafarge Cement Kiln, Brookfield, Nova Scotia, Canada - Table 4 (page 23)]</p>	<p>More likely to increase. In the literature, there are eight cases of increases and four cases of decreases. Increases average 43%. Decreases average 37%.</p>
Particulate Matter (PM)	<p>Studies have shown varying results; however, it can be expected that the PM emissions may decrease slightly due to the lower ash content of TDF. Additionally, the Ravena Cement Plant is already subject to and must continuously meet the most stringent PM emission limit in its industry by federal law. The "Clean Air Law" does not include a similar limit.</p> <p>[Scrap Tire Handbook: Table 4-1 (page 44), Table 4-3 (page 53), Table 4-4 (page 54) Air Emissions from Scrap Tire Combustion - Table A-9b (Page 80), Tires as a Fuel Supplement - Feasibility Study - Table 3-1 (page 41), Use of Scrap Tires as an Alternative Fuel Source at the Lafarge Cement Kiln, Brookfield, Nova Scotia, Canada - Table 2 (page 14)]</p>	<p>It's varying, as they say. Four cases of increases (avg. 152%). Five cases of decreases (avg 38%).</p>
Hydrochloric Acid (HCl)	<p>Studies indicate that a decrease is expected. The Ravena Cement Plant is also subject to a stringent HCl emission limit of 3 parts per million by federal law. The "Clean Air Law" does not include a HCl limit.</p> <p>[Scrap Tire Handbook: Table 4-3 (page 53), Air Emissions from Scrap Tire Combustion - Table A-9b (Page 80)]</p>	<p>Of the three emissions comparisons in the available research, two show increases of hydrochloric acid. There was a 29% decrease in one case, and increases of 36% and 73% in the others.</p>

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Hydrofluoric Acid (HF)	<p>A slight decrease is expected as studies shown a decrease in the emissions of fluorinated compounds. Additionally, studies show that TDF contains less flourine [sic] reducing the potential for HF formation.</p> <p>[Air Emissions from Scrap Tire Combustion - Table A-10b (Page 82), Use of Scrap Tires as an Alternative Fuel Source at the Lafarge Cement Kiln, Brookfield, Nova Scotia, Canada - Table 2 (page 14)]</p>	<p>This is consistent with the research. Of the three emissions comparisons on hydrofluoric acid, or fluorides generally, they each showed slight decreases, from 6% to 22%.</p>
Carbon Dioxide (CO2)	<p>A slight decrease in CO2 emissions is expected as a result of TDF usage.</p> <p>[Use of Scrap Tires as an Alternative Fuel Source at the Lafarge Cement Kiln, Brookfield, Nova Scotia, Canada - Table 4 (page 23)]</p>	<p>That makes sense. Tires are mostly oil. It burns a little hotter than coal.</p>
Carbon Monoxide (CO)	<p>Studies have shown varying results; however, the Ravena Cement Plant is currently subject to a NYSDEC emission limit of 2.5 lb/ton of clinker and is required to continuously monitor with CEMS. The "Clean Air Law" does not include a CO limit.</p> <p>[Scrap Tire Handbook: Table 4-4 (page 54); Air Emissions from Scrap Tire Combustion - Table A-9b (Page 80), Tires as a Fuel Supplement - Feasibility Study - Table 3-1 (page 41)]</p>	<p>Of all the pollutants discussed, this is the least worth worrying about. However, of the seven emissions comparisons in the available research, six show increases of carbon monoxide. The average increase was 57%, and maximum was 114%.</p>
Chromium (VI)	<p>Studies indicate that a minor increase or a minor decrease can be expected.</p> <p>[Scrap Tire Handbook: Table 4-4 (page 54), Tires as a Fuel Supplement - Feasibility Study - Appendix B (page 71-76)]</p>	<p>Increased in 11 of 15 tests, by an average of 900%. Combustion increases the portion of chromium that comes out as cancer-causing Chromium (VI) -- as opposed to the safe Chromium (III) form.</p>

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Mercury (Hg)	<p>The studies provided indicate that a slight increase can be expected; however, the Ravena Cement Plant is already subject to a mercury emission limitation by federal law that is significantly more stringent than the emission limit currently being proposed in the "Clean Air Law". The facility must demonstrate compliance at all times and is equipped with CEMS per federal law.</p> <p>Note that while the studies indicate that there may be a slight increase, for facilities utilizing TDF, it is common practice to increase TDF in the fuel blend to reduce mercury emissions due to the lower mercury content in TDF.</p> <p>[Scrap Tire Handbook: Table 4-4 (page 54), Tires as a Fuel Supplement - Feasibility Study - Appendix B (page 71-76)]</p>	<p>Mercury increased in 6 of 10 tests. Increases ranged from 14% to 1,900%. Decreases averaged just 14% except for one decrease of over 99%.</p>
Other Toxic Metals (Arsenic, Cadmium, Lead, Manganese, Nickel, Selenium, Zinc)	<p>Studies indicate that generally no change or a decrease is expected in most metals primarily due to lower concentrations in the fuel. No change or a slight increase in zinc may be expected. Many of these metals are (or become) particulate bound and the Ravena Cement Plant is subject to and must continuously meet the most stringent particulate matter emission limit in its industry by federal law. The "Clean Air Law" does not include a similar limit.</p> <p>[Scrap Tire Handbook: Table 4-3 (page 53), Table 4-4 (page 54); Air Emissions from Scrap Tire Combustion - Table A-9b]</p>	<p>This is not true based on available data.</p> <p>Arsenic: increased in 4 of 5 tests, with some increasing as much as 265-300%</p> <p>Cadmium: increased in 8 of 12 tests, with a couple increases in the 1,000% range (10 times)</p> <p>Lead: increased in 17 out of 19 tests; increases were large, averaging 450%, not including one huge increase of 9,100%</p> <p>Manganese: increased in all 5 tests, average increase of 139%</p> <p>Nickel: increased in all 8 tests; average increase of 310%</p> <p>Selenium: increased in both of two tests; 220% increase in the one with available data; also found in tires are higher level than in coal</p> <p>Zinc: increased in 7 of 8 tests; average increase of 893%; tires are known to be high in zinc, which is a problem since it helps increase dioxins/furans</p>