

[Back to Waste Tire Problems](#) | [Back to Emission Control for TDF](#)

Emissions from Open Tire Fires

Emissions from open tire fires have been shown to be more toxic than emissions from an incinerator, regardless of the type of fuel. Airborne emissions from open tire fires can have a serious impact on health and the environment.

Open tire fire emissions include "criteria" pollutants, such as particulate, carbon monoxide (CO), sulfur oxides (SOx), nitrogen oxides (NOx), and volatile organic compounds (VOCs). They also include "non-criteria" hazardous air pollutants, such as polynuclear aromatic hydrocarbons (PAHs), dioxins, furans, hydrogen chloride, benzene, polychlorinated biphenyls (PCBs); and metals, such as arsenic, cadmium, nickel, zinc, mercury, chromium and vanadium.²⁾

Data from a laboratory test program have also shown that open tire fire emissions contain 16 times more mutagenic compounds than from residential wood combustion in a fireplace, and 13,000 times more mutagenic compounds than coal-fired utility emissions with good combustion efficiency and add-on controls.³⁾

The emissions from an open tire fire can pose significant short-term and long-term health hazards to nearby persons (e.g. firefighters, residents, etc.). These health effects include irritation of the skin, eyes, and mucous membranes, respiratory effects, central nervous system depression, and cancer.

Case Study : Rhinehart Tire Fire Case, Winchester, VA - October 31, 1983

The Rhinehart tire dump contained approximately 5 million scrap tires over a 1.6 hectare (4 acre) site. A black smoke plume rose to 910 m (3000 ft) and extended over a distance of 48-80 kilometers (30-50 miles).

Analysis of the air samples taken in the plume indicated potentially hazardous levels of CO and PAHs. CO concentrations varied in the 50 to 100 ppm range. The NIOSH (National Institute for Occupational Safety and Health) recommended worker exposure limit, or Threshold Limit Value (TLV), for CO is 35 ppm over a 10-hour time weighted average (TWA).

TLV (Threshold Limit Value):⁴⁾

The TLV (Threshold Limit Value) refers to airborne concentrations that a healthy adult worker may be repeatedly exposed to for up to 10 hours a day, five days a week, without adverse health effects. TLVs are guidelines and not strict standards for determining safe or unsafe conditions for occupational exposures. The TLV is not applicable to sensitive receptors such as children and the elderly, who may suffer health effects at a lower levels.

Target Compounds⁵⁾

Recognizing the dangers to health and the environment caused by open tire fires, the Tacoma Pierce County Health Department published a report that identified a subset of 34 target compounds (weighted based on toxicity and expected ambient air concentrations) that should be considered for air monitoring during a tire fire.

To develop the target list, the author applied three evaluation criteria:

1. Compounds having a maximum measured airborne concentration exceeding 33 % of the TLV were used to approximate an equivalent worker inhalation dosage, since exposure to a fire could occur over a 24-hour period, as opposed to the 8-hours that the TLV is based upon.
2. Compounds identified as either suspected or confirmed human carcinogens were automatically listed as target compounds, regardless of recorded air concentration or emission level.
3. Compounds were also chosen by comparing the ratio of the detected value to the subchronic and chronic inhalation reference concentrations (RfC). The RfC is an estimate of the exposure concentration that would not result in appreciable risk of adverse health effects.

Target Compounds by Criteria

Target Compound	Criteria			
	Carcinogen	TLV	Subchronic RfC	Chronic RfC
Acenaphthene	X			
Acenaphthylene	X			
Arsenic	X			
Barium				X
Benz(a)anthracene	X			
Benzene	X			
Benzo(a)pyrene	X			
Benzo(b)fluoranthene	X			
Benzylchloride	X			
Butadiene	X			
Carbon monoxide		X		
Carbon tetrachloride	X			
Chloroform	X			
Chromium	X			
Chrysene	X			
Coal tar pitch (volatile)	X	X		
Cumene			X	X
1,2-Dichloropropane	X		X	X
Dibenz(a,b)anthracene	X			
Ethylene dichloride	X			
Hexachloroethane	X			
Hexane			X	X
Lead	X			
Methylene chloride	X			
Nickel	X			
Phenol	X			
Styrene	X			X
Sulfur dioxide		X		

Sulfuric acid		X		X
Toluene			X	X
1,1,2-Trichloroethane	X			
Trichloroethylene	X			
Vanadium		X		
o-Xylene		X		

Compounds with Maximum Reported Concentrations Exceeding 33% of Their TLV

Compound	Concentration	TLV	% TLV
	mg/m ³	mg/m ³	
Carbon monoxide	116.0000	29	400
Coal tar pitch volatile	4.2180	0.2	2,109
Sulfur dioxide	2.7500	5	52.00
Sulfuric acid	0.7900	1	79.00
Vanadium (as pentoxide)	0.0175	0.05	35.00

Compounds with Maximum Reported Concentrations Exceeding a Subchronic or Chronic RfC (mg/m³)

Compound	Concentration	Subchronic RfC	Chronic RfC
Barium	0.0035	0.005	0.0005
Cumene	0.094	0.09	0.009
1,2-Dichloropropane	0.035	0.013	0.004
Hexane	0.21	0.2	0.2
Styrene	5.41	none	1
Toluene	6.7	2	0.4

References:

1. Joel I. Reisman, Paul M. Lemieux, Air Emissions from Scrap Tire Combustion, EPA, Oct. 1997.
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3. P.M.Lemieux and D. DeMarini, Mutagenicity of Emissions from the Simulated Open Burning of Scrap Rubber Tires, U.S.Environmental Protection Agency, Control Technology Center, Office of research and Development, EPA-600R-92-127 (NTIS PB-92-217009), July 1992.
4. National Institute for Occupational Safety and Health, Rhinhart Tire Fire, Winchester, VA,U.S.Department of Health and Human Service, Health Hazard Evaluation Report, HETA 84-044-1441, March 1984

5. Adolfson Associates, Inc., in association with Kim Coble, Tire Fire Contingency Plan - Toxicology Aspects, prepared for Tacoma-Pierce County Health Department, Adolfson Associates, Inc., September 1994.

[*Back to Top*](#) | [*Back to Waste Tire Problems*](#) | [*Back to Emission Control for TDF*](#)