RENNSLI

TECHNICAL BULLETIN

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EMISSIONS REDUCTION

Exhaust Emissions

Today, many countries are facing adverse health and air quality issues that, in part, are directly related to exhaust emissions from a variety of industries. It's no secret engine and open flame emissions are a leading contributor to environmental pollution.

This is why RENNSLI Solid Fuel Catalyst Additives (RENNSLI, FEROX, 801RACING) has made "fighting emission" one of its three pillars in improving the overall quality and performance of your fuel. Our Fuel Additives addresses emissions of hydrocarbon-based fuels at their source, the combustion process. With addition of our combustion catalyst more fuel is burnt in the engine for energy as opposed to being send out the exhaust. This approach not only reduces harmful emissions but also results in increases in engine power and overall fuel efficiency.

From smoke opacity to unburned hydrocarbons, various tests of RENNSLI Fuel Catalyst Additives have shown a significant correlation to decreases in harmful emissions.

Reducing Exhaust Emissions:

Rennsli's technology has been used successfully in the global market for thirty years. Customers in various industries have realized the measurable benefits of using our products. This document provides documented examples of the benefits we have through third parties and our customers, who have been able to verify combustion efficiency due to the capacity of our technology.

With emissions regulation becoming increasingly stringent, many industries relying on fossil fuels are scrambling to meet these new standards. Some address the problem post-combustion by attempting to collect and filter harmful emissions before they enter the atmosphere. Others have adopted more efficient engine technology or bio-blended fuels that yield lower emissions.

RENNSLI reduces exhaust emissions preventing incomplete combustion with the fuel combustion catalyst, with the help of this, the production of byproducts is reduced and better fuel economy is achieved.

Emission reductions related to Rennsli technology can be classified into two general categories: reduction of specific pollutants, e.g. NOx, CO2, etc., and reduction of exhaust particles, i.e. opacity or smoke. Rennsli products have a profound effect in both categories. The evidence we have with respect to emission reductions includes the following:

No.	Test	Result	Place	Date
1	Automotive Research Division, Final Report for Intertek Proposal No. 51445 Diesel Fuel Additive Testing	**9.2%** NOx reduction	Intertek USA, Inc.	October 21, 2014
2	Utah State Mobile Emission Testing Diesel Vehicle Inspection Reports 102725 2003 Caterpillar 330CL Long Reach Excavator	**77.9%** opacity reduction (smoke)	Utah, USA	December 1, 2011 to February 7, 2012
3	Utah State Emission Testing of twenty-three gasoline vehicles with baseline data compared to treated fuel	**7.21% - 22.67%** reduction in NOx	Utah, USA	November 2009 to July 2010
4	Corporation of the City of Hamilton *Memorandum Regarding Fuel Catalyst*,	**70%** - Reduction of polluting emissions	Hamilton, Ontario, Canada	April 22, 1996

		and smoke particulates		
5	Hamilton Fire Department *Letter Regarding Ferox Fuel Additives*	**65-70**% Reduction of exhaust smoke	Hamilton, Ontario, Canada	August 16, 1994
6	Ferox Petrochemical Corporation *Evaluation of Ferox Treated Fuel at McCartney Construction Co., Inc.*	**8.66 - 38.82%** Reduction in unburned hydrocarbons	Winter Park, Florida	February 3, 1993
7	Ferox, Inc. *City of Leesburg, Florida. Smoke Reduction Test*	**51%** Reduction in unburned hydrocarbons	Vineyard, Utah	December 1992

Understanding Emissions

In an ideal world, engines would be perfectly efficient, burning all the fuel that entered the combustion chamber with the only by-products being water, carbon dioxide, and energy **(ex. $C_{16}H_{34} + O_2 = H_2O + CO_2 +$ Energy)**. Unfortunately, our engines are not 100% efficient, resulting in the creation of harmful emissions. These emissions are the by-products of unburnt fuel (Sulfur Oxides, Carbon Monoxide, Nitrogen Oxides, Particulate Matter).

Effects of Harmful Emissions:

Sulfur Oxides

- At high concentrations, gaseous SO_x can harm trees and plants by damaging foliage and decreasing growth
- SO_2 and other sulfur oxides can contribute to acid rain which can harm sensitive ecosystems
- SO_2 and other sulfur oxides can react with other compounds in the atmosphere to form fine particles that reduce visibility (haze)
- Deposition of particles can also stain and damage stone and other materials, including culturally important objects such as statues and monuments

Carbon Monoxide

- Breathing air with a high concentration of CO reduces the amount of oxygen that can be transported in the bloodstream to critical organs like the heart and brain

- When CO levels are elevated outdoors, they can be of particular concern for people with some types of heart disease where the heart needs more oxygen than usual
- At very high levels, which are possible indoors, CO can cause dizziness, confusion, unconsciousness and death

Nitrogen Oxides

- Breathing air with a high concentration of NO_2 can irritate airways in the human respiratory system and can aggravate respiratory diseases, such as asthma
- Longer exposures to elevated concentrations of NO_2 may contribute to the development of asthma and potentially increase susceptibility to respiratory infections
- NO_2 and other NO_x interact with water, oxygen and other chemicals in the atmosphere to form acid rain
- The nitrate particles that result from NO_x make the air hazy and difficult to see though
- NO_x in the atmosphere contributes to nutrient pollution in coastal waters

Hydrocarbons

- Unburnt hydrocarbons are toxic and considered a carcinogen
- Breathing air with a high concentration of hydrocarbons has been linked to the development of, asthma, liver disease, lung disease, and cancer
- Hydrocarbons in the atmosphere can react with sunlight and other pollutants, such as nitrogen oxide and nitrogen dioxide to form Ozone which is a main component of photochemical smog

Particulate Matter

- Particulate matter less than 10 micrometers in diameter can get deep into your lungs, and some may even get into your bloodstream
- Particle pollution exposure has been linked to a variety of health problems, including:
    - nonfatal heart attacks
    - irregular heartbeat
    - aggravated asthma
    - decreased lung function
    - increased respiratory symptoms, such as irritation of the airways, coughing or difficulty breathing.
    - premature death in people with heart or lung disease
- Fine particles (PM2.5) are the main cause of reduced visibility (haze) Particles can be carried over long distances by wind and then settle on ground or water. Depending on their chemical composition, the effects of this settling may include:
    - making lakes and streams acidic
    - changing the nutrient balance in coastal waters and large river basins
    - depleting the nutrients in soil
    - damaging sensitive forests and farm crops
    - contributing to acid rain