

Maintaining Fuel Quality In A Stored Environment

Failed communications in a 911 call center. A major financial transaction processing company drops a hub. The loss of 10,000 fish at an aquarium. A primary data center collapses.

By Tim Brady

What do all of these true stories have in common? Poor fuel quality. In all of these cases, poor fuel quality shut down emergency standby power generators exactly when they were being counted on in the middle of a disaster. And the number of hurricanes, wildfires, blackouts, floods, earthquakes and the like in recent years has added significantly to the lore, though most are closely guarded stories and a PR person's nightmare.

The frightful truth is that many emergency generators—an organization's last line of defense in a catastrophe—will not perform as expected if and when that time comes. This article will share some insights into the issue to hopefully raise the percentage of emergency backup power systems that will operate as planned when needed.

At its essence, poor fuel quality is about what ends up in fuel that doesn't burn well, and the complete story will surprise even veteran operations managers. Diesel fuel contaminants should be grouped into the following categories: Water; Microbial Growths; Inorganic Particulate Matter; and naturally forming Fuel Breakdown By-Products. The origins of them all can be traced to either a site-specific problem or in a fuel delivery from upstream in the supply chain.

Water

Water is a widely acknowledged concern, but it need not be a problem as long as some manner of routine fuel maintenance is performed. If a tank is well-designed and is in good condition, with no means of water leaking in at the site, then only small amounts of water should be present. Water appears quite normally in most tanks through condensation.

This water can be removed easily through the use of a wide range of solutions that include absorptive eliminators and filters, coalescers, centrifuges and the like. All mobile tank cleaning systems used by tank cleaning services and permanently installed conditioning and filtration systems utilize one or more of these approaches and are effective at removal of normal levels of water content. A quality multi-spectrum additive often includes an emulsifier which can also pass small quantities through the system.

Microbial Growth

Microbial contamination (bacterial and fungal growth) is the most frequently mistaken problem. It only exists where there is water for it to grow in, so if you are diligent in carrying out a fuel maintenance program, you should never see the problem. Where it does exist in a long-ignored tank, microbes feed on the fuel, multiply and excrete waste products, all of which will end up clotting in your filters. These by-products are highly corrosive and pose a threat to many tanks.

The problem is that clogged filters are widely misinterpreted as containing microbial products, when they actually most often are deteriorated fuel by-products (sludge). This leads to endless streams of toxic biocides being needlessly dumped into tanks, which, when mistakenly used, make the problem worse. Often the result is diesel fuel now so spoiled that it needs to be disposed of and replaced, a costly and unnecessary consequence with serious environmental impacts. Not to mention that it may have sidelined the generator for several days. Again, take care of the water, and you'll never need a biocide.

Inorganic Particulate Matter

Other particulate pollutants in diesel fuel are mostly dirt, rust and other metallic particles that find their way into the fuel either during the many tank transfers that occur in the supply chain or from a corroding tank somewhere along the line. It is infrequent that the level of particulate matter is very high and is generally well-treated through conventional filtration that accompanies a standard tank cleaning system or permanent tank-side solutions.

Contaminant	Source	Effects	Solution
Water	<ul style="list-style-type: none"> • Condensation • Leaks • Fuel delivery 	<ul style="list-style-type: none"> • Combustion/Injector problems • Corrosion • Saturates filters • Supports microbial growth at bottom of tank 	<ul style="list-style-type: none"> • Fix flawed tanks • Water eliminators • Periodic tank cleaning • Automated conditioning and filtration system • Some additives can deal with small (normal) quantities
Microbial Growth	<ul style="list-style-type: none"> • Arrives through air or water • Requires water to thrive 	<ul style="list-style-type: none"> • Multiplies and produces waste matter • Clogs filters • By-product is corrosive 	<ul style="list-style-type: none"> • Biocide – only if highly advanced state • Periodic tank cleaning • Automated conditioning and filtration system
Particulate Matter	<ul style="list-style-type: none"> • Faulty tank breather • Tank corrosion • Fuel delivery • Tank installation 	<ul style="list-style-type: none"> • Abrasive wear and tear 	Filtration through: <ul style="list-style-type: none"> • Periodic tank cleaning • Automated conditioning and filtration system
Fuel Breakdown By-Products (most tank sludge)	<ul style="list-style-type: none"> • Natural deterioration process of all organic fuels • Accelerated by heat, temperature changes, pressure, presence of water 	<ul style="list-style-type: none"> • Incomplete combustion • Carbon deposits on injectors • Poor fuel economy • High emission levels (often visible smoke and soot) • Filter clogging 	Process reversal through magnetic restorative conditioning in some: <ul style="list-style-type: none"> • Tank cleaning systems • Automated conditioning and filtration system • Chemical breakdown with specialized additives

Fuel Breakdown By-Products

Least understood is the natural process whereby organic fuels break down. Diesel and other fuels are naturally unstable, and actually less stable today due to modern refining techniques (catalytic cracking) that are designed to produce more fuel per barrel of crude. Most major oil companies have documented on their Web sites that 6 to 12 months is the useful shelf life for their products, but the deterioration process begins as soon as the products leave the refinery.

This fuel breakdown is a process where agglomerating hydrocarbon chains bond together to create larger clusters. These larger compounds, present even in what visibly appears as clear and bright fuel, do not burn as efficiently. This incomplete combustion robs fuel economy, leaves carbon deposits on injectors, and raises emissions, often with visible smoke and soot.

As the process continues, with even larger compounds being formed, the fuel begins to appear “dirty.” Eventually it progresses to forming sludge that falls to the bottom of the tank. This clotting fuel is the material that is commonly clogging fuel filters and shutting down generators. Often it may happen when a tank gets low and new fuel is poured in, agitating the sludge and dispersing throughout the fuel, releasing the threat that had been lying dormant. Or maybe the new fuel delivery came from such an agitated tank upstream in the supply line.

There are solutions. Some multi-spectrum additives on the market do have agents that can dissolve some of the sludge and others that will retard further deterioration for some number of months. Magnetic fuel conditioning runs the fuel across a magnetic field and its inductive properties reverse the process, separating carbon chains in what effectively returns deteriorated products back to fuel again.

The Bottom of the Barrel

Water and tank sludge, of course, drop to the bottom of the tank, and a too-often overlooked but critical concern is that any tank cleaning be done properly by getting to the bottom of the tank. Access is frequently a limiting factor, but an inspection port can be installed to alleviate this problem. Similarly, when installing a recirculating conditioning and filtration system, the pickup tube into the tank is optimized when near the bottom (not using the fuel system's draw, which is several inches higher to avoid the very substances you wish to collect).

Take the Test

Any generator that is in a critical application ought to be a candidate for a routine fuel testing service, probably on a quarterly basis. All the talk about fuel quality means little if you don't have a benchmark to measure from. Be sure to get your samples from both a midpoint and the bottom of the tank.

Put Fuel Maintenance into the Vocabulary

Too often, fuel condition is overlooked, mostly out of ignorance of the issue. When that happens, the extreme of fuel removal, replacement, and possibly extensive tank cleaning or even tank replacement, is the cost. That is, if you're lucky and didn't have a generator failure in a real emergency situation. Only the business in question can determine the cost in the case of a total failure. But, generally, they wouldn't have a generator if total power loss was an acceptable outcome.

It is crucial that disaster-planning professionals become aware of the need for a fuel maintenance routine to assure the survival of critical systems in the event of an emergency. PEI members are perfectly positioned to advance this educational effort. It can also represent a value-add service, as well as potential source of revenue and profits. Perhaps most important, you will be participating in raising overall organizational survivability and reducing the human suffering and loss of life in the midst of the worst of catastrophes.



Sludge on an opened filter