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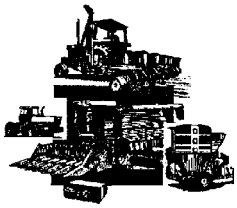

LIVING WITH FUEL CONTAMINATION

Farm Machinery Fact Sheet FM-16

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Several steps can be taken to alleviate the adverse effects of poor fuel quality.

Fuel quality is apt to decline when shortages or sudden price increases occur. Under such circumstances, fuel that normally would be discarded is sold and the risk of contamination is increased. Wholesalers and fleet buyers may be forced to buy whatever fuel is available—even when this fuel may be the cause of operating problems and added maintenance costs. Several steps can be taken to guard against excessive damage to the fleet from fuel contamination.

Most importantly, the fleet owners and operators must be aware of the sources of contamination in order to be able to establish preventive measures. Focus will be on four main types of fuel contamination—water, foreign particulate matter, biological growth, and wax formation—and suggested measures that may be taken to minimize their destructive effects.

Water Contamination

Water contamination is primarily a result of condensation within the tank, be it bulk storage or vehicular. Inability to keep tanks full at all times tends to create condensation when temperature changes occur. Normally, all vehicle manufacturers recommend that tanks be filled at the end of the working day. Obviously, when fuel shortages prohibit completely filling each tank on a daily basis, the threat of moisture condensation is increased.

Excessive amounts of water in the fuel will affect engine performance, dilute oil, and can lead to the formation of acids and varnish in the engine, as well as reduce the life of diesel fuel pumps and injectors. An authority on the rebuilding of diesel fuel pumps stated that since fuel supplies have become more critical, service life of pumps in many fleets has declined as much as 50%.

Excessive water in the fuel will also lead to rust formation, which interferes with pump operation and can clog injectors. Where ambient temperatures drop below freezing, water in fuel can also freeze and may even explode injector nozzles. Since the fuel filters supplied as standard equipment on most diesel engines are unable to filter water from liquid fuel, other means of protection must be sought.

Fuel/water separators have become extremely popular among users of heavy-duty diesel

engines for trucks, construction equipment, and ocean-going vessels. Several different makes are available, but all operate on the same basic principle.

Another variation of the same principle directs fuel flow through a tube mounted in freeze plug hole in the engine block. Other variations include heating with electrical power from the vehicle system, or with burners using fuel oil or gasoline.

Manufacturers of fuel heaters claim that the process of heating fuel improves economy in addition to providing fuel flow at almost any temperature. Heated fuel expands so that less actual volume is required, giving some improvement in kilometers per liter. Thermal efficiency of fuel also improves with preheating.

High Sulfur Fuels

Many of the more obvious fuel contamination problems such as icing of lines, wax formation, and injector damage are common in temperate and severe cold climates. In the tropics, however, effects of pump and injector wear due to water and particulate matter can be a major problem. Sulfur, particularly in the presence of water, vaporizes to form sulfuric acid, a highly corrosive element which attacks engine bearings and other components to severely reduce service life. The only solution to this problem, if high sulfur fuels must be used, is careful control of engine operating temperatures. A relatively high temperature of 86-90°C (185° to 195°F), or even slightly higher, will burn off a portion of the corrosive elements.

Fuel contamination is an increasing problem that operators must face. Although there may be little control over the causes, the only solutions seem to lie in identifying the type of contamination that regularly occurs, and taking rational steps to minimize its effects upon fleet operations.

The chance of biological contamination increases when fuel shortages prompt increased handling and fuel movement through additional tanks to meet spot shortages. The growth of microorganisms may be controlled through the use of biocides which are readily available on the market.

When purchasing a biocide, the difference between water-soluble and diesel fuel-soluble formulations should be understood. A water soluble treatment acts only in the tank that is treated. Consequently, contamination may begin all over when fuel is transferred to an untreated tank. Diesel fuel-soluble biocides actually become a part of the fuel and provide continuous protection from initial storage to entry into the engine fuel system. If a regular fuel supplier is used, fuel buyers may want to determine the type of treatment used before initiating a treatment program at the fleet level.

Wax Formation

The formation of wax is a particularly annoying problem for diesel engine users in areas where temperatures of 0°C (32°F) are likely to occur. The wax clogs filters to the degree that fuel flow to the engine is completely restricted. Many fuel distributors no longer provide fuel specially blended for seasonal ambient temperatures.

As a result, cloud point and pour point are considerations for some engine users who have never before faced the problem.

There are two accepted approaches to avoiding wax problems. First is use of a pour point depressant. This is a chemical supplied in liquid form and may be added to fleet storage tanks or directly to vehicle tanks. By chemical action the nature of wax formation is altered so that the globules are small enough to pass readily through the fuel filter.

Wax depressants are offered under a variety of trade names. Manufacturers claim that these chemicals lower the normal wax formation point 12-20°C. Some fleets are using wax point depressants with a great deal of success. After all, oil refiners have used them for many years. There are so many brand names on the market with varying claims for effectiveness, as well as some that claim improved economy, improved engine power, etc., that some confusion does exist.

Selection of a depressant should take into consideration its effect upon other fuel system and engine components, and results must be carefully evaluated. If fuel is purchased on the road, drivers may need to be carefully instructed in the proper amounts of additive to measure into tanks.

A second approach to prevent wax formation is to preheat the fuel. Fuel warmers generally have a high rate of acceptance at high altitudes, in the northern and southern temperate zones, and in Arctic conditions. The most popular designs will direct fuel from the tank through a heat transfer device mounted near the rear of the engine. Coolant is diverted from the engine block through a series of tubes placed adjacent to fuel lines in a tank or cylinder.

Mounted in the fuel line between the tank and the primary filter, a separator first directs fuel through a series of baffles to induce a centrifugal flow of fuel at varying speeds. At high speeds the heavier water and larger solid particles are thrown from the fuel stream to run down the walls of the housing into a sump, which is periodically drained. The fuel is then directed into an upward path at slow speeds to permit even more of the heavier elements to drop out. It then is coalesced (on some models) for even greater moisture elimination, and finally passes through a filter which removes most of the remaining particulate matter.

Manufacturers of these separator devices claim up to 99.5% efficiency in water removal. These claims are substantiated by truck dealers in many areas who report that most fleets are specifying such separators as extra cost options on 100% of their new truck orders.

Foreign Particulate Matter

Another problem resulting from higher fuel costs and lessened availability is the higher concentration of foreign particulate matter in fuels. This, in large part, is due to the pumping of storage tanks to dangerously low levels, where condensate and particulate matter have settled. Under normal circumstances, tanks are never pumped completely empty, and water and sediment which settle to the tank bottom are periodically drained to preserve fuel quality. Increased fuel costs, however, make disposal of even these relatively small amounts of fuel less desirable. The practice of pumping down tanks to near the lower water and sediment level may create enough agitation to pick up contaminants in the fuel stream.

Again, use of fuel/water separators, as previously described, has the incidental benefit of the removal of most particulate matter before the fuel reaches the primary and secondary filters. Fleet and truck operators are reporting that filter replacement intervals are four to ten times longer than before separator installation.

For fleets that fuel all trucks and other equipment from their own storage tanks, it may be easier to install larger separators at the pumps, rather than on the vehicles themselves, to perform the same function. A recent introduction to the market is a model that also has the ability to separate and filter used engine oil—filtering it into the fuel stream at prescribed proportions. Many of the major engine manufacturers now approve use of properly filtered engine oil if the quantity does not exceed roughly 5% of fuel volume. This amounts to a significant reduction in overall fuel cost.

Biological Contamination

Still another source of fuel contamination is biological contamination. This is the growth of algae and other microscopic life in storage tanks. Although freshly refined oil is pure, bacterial growth can occur in the boundary layer between fuel and water in the tank. When disturbed by pumping agitation, this growth enters vehicle tanks in the form of a green slime and can quickly clog fuel filters and interfere with engine operation.

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