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Lubricant and Fuel Additives

Essential Products in Modern Life

ATC Document 87

December 2006

LUBRICANT AND FUEL ADDITIVES –
ESSENTIAL PRODUCTS IN MODERN LIFE

Lubricants and fuels are absolutely essential for the efficient operation of modern engines, motors, and machinery just as surely as water is necessary for survival of life. Unfortunately, both are sometimes taken for granted. Lubricants and fuels are critical to the efficient movement of people and goods, affording ever increasing environmental safeguards, bringing new benefits to consumers while at the same time encouraging market growth and prosperity. Most lubricating oils and fuels are derived from petroleum-based raw material, which must be fortified with specialty additives to assure their long service life and desired performance enhancements (see Appendix below for further details on lubricant and fuel additives). Petroleum products which contain little or no performance enhancing additives might be considered by some to be more environmentally-friendly but will work for a small fraction of the time normally expected by consumers today. Failure to replace these worn out fluids will lead to catastrophic machine failure at great potential personal cost.

In view of this, the technological advancement and resulting benefits enjoyed by all modes of transport and many industrial applications over the last two decades have been seen as a positive societal benefit by most. European society continues to challenge manufacturers to produce ever more efficient and reliable machinery and engines to serve its growing economy. This is only achievable if industry is allowed sufficient opportunity to commit the resource necessary to develop more robust lubricants. Historically, the use of petroleum products containing inadequate levels of additives has resulted in more frequent replacement, producing excessive volumes of waste oils, higher engine emissions to the atmosphere, more expensive consumer equipment repairs through premature lubricant failure, and a significant burden upon those resources dedicated to the recycling of used equipment in general.

Specialty additives for petroleum-based products are specifically designed to assure the enhanced long-term service stability of lubricants and fuels now required by equipment manufacturers of high performance machines and internal combustion engines. Today, lubricating oils must survive very harsh extremes in operating temperatures, pressures, and oxidative conditions destructive to fuel and lubricant products. Even in applications requiring highly specialised formulations based upon more biodegradable components like vegetable oils and synthetic esters, performance additives are still necessary to assure effectiveness of the product. As a consequence, the preferred functional and structural characteristics of lubricant and fuel additives also impart a natural resistance to biological degradation in laboratory simulations, and thus may be considered ***“persistent”*** (“**P**”).

Furthermore, functional lubricant and fuel additives must also be infinitely soluble in petroleum based blending stocks (e.g., oil, gasoline, and diesel). As a result of this physical property, there is a concern that such oil soluble chemicals have the potential to transport through cell membranes if living organisms are exposed to lubricants and fuels for long periods of time. Theoretically, this kind of biological transport mechanism can lead to storage of petroleum additives in body tissues. For this reason, the desired oil solubility of lubricant and fuel additives raises concerns about their potential to exhibit “***bioaccumulative*”** (or “**B**”) behaviour in the environment. However, the assumption that such substances may actually bioaccumulate does not take into account their actual use and containment management, quite apart from the fact that they typically exhibit negligible water solubility that limits their bioavailability in aquatic environments.

From a purely practical perspective, what can the consumer expect as a consequence of one proposal to ban such substances, or insistence upon their immediate replacement in an Authorisation scheme? To answer this question we must briefly examine the unique development process itself. On average, a lubricant additive developer will need one to three years to understand how a single existing substance proposed as an alternative lubricant or fuel additive may be useful in a specific application. If a completely new chemical additive is called for, the initial development phase can take anywhere from four to seven years to mature. Once the alternate substance is "in hand", another year or two is often required to confirm alternative manufacturing processes and formulating techniques. During this time, any necessary product hazard and safety evaluations must be conducted. Even then, the potential new product is not yet ready for market until its overall performance has been investigated and proven to the satisfaction of all affected equipment manufacturers and potential downstream users. Developing this calibre of quality assurance for both industry and the consumer requires an additional one to two years of dedicated resource before final market entry and the realisation of anticipated consumer benefits. All in all, a development lead time of between four to nine years is not atypical, making the prospect of immediate mandatory substitution completely unworkable.

Withdrawal of a key petroleum component without allowing sufficient time to develop and fully test an alternative chemistry could lead to potentially catastrophic socio-economic impact with the non-availability of lubricants or fuels with the necessary performance characteristics. Consequences could include any or all of the following; increased fire hazards, increased fuel consumption, reduced engine reliability, mechanical failure, increase in emissions to the environment, and shorter service intervals leading to increases in waste. Such negative effects could be realised in any engine from the smallest two-stroke motorcycle or outboard motor to those which power massive ocean-going vessels or airplanes. Furthermore, the timelines presented presume best-case developmental programs using known chemical classes of additives. If new classes of additive chemicals need to be developed to achieve the requisite technical attributes without "B" and/or "P" properties, then a substantially longer development period could be anticipated. Under these circumstances, immediate substitution without socio-economic consideration would be impractical for the reasons already discussed.

We are mindful that all stakeholders wish to avoid all reasonable circumstances wherein lubricant and fuel additive products might contribute to the potential environmental burden that chemicals represent by entering food chains or causing harm to wildlife species. Lubricants are most often manufactured, distributed, and used in relatively closed systems, and disposal measures now increasingly capture and incinerate used fluids which have reached the end of their intended life cycle. Unintended releases to the environment should always be minimised and avoided wherever possible through application of enhanced risk reduction practices throughout their life cycle. We must remember that the empirical laboratory tests used to estimate the "B" and "P" potential of lubricant and fuel additives have very limited predictive power regarding their actual adverse environmental impacts, while their profound Socio-Economic value is relatively easier to gauge in this debate. As the vast majority of lubricants and fuels are intended to undergo limited release to the environment with use in relatively closed systems, when reasonable substitution efforts fail to produce "safer" alternatives with appropriate performance characteristics, then a socio-economic case for retaining them in commerce should remain a regulatory option.

<u>APPENDIX</u>

REPRESENTATIVE CLASSES AND
FUNCTIONS OF LUBRICANT AND FUEL ADDITIVES

A. Dispersants and Detergents

1. Maintain cleaner engines by suspending dirt, soot, and metal particles in combustion engines,
2. Prevents oil thickening from aggregation of these particles, and
3. Neutralizes acidic combustion products that cause corrosion, and
4. Extend lubricant life, avoid excessive and frequent fluid changeover.

B. Oxidation inhibitors

1. Prevent oxygen-induced degradation of base oils, and
2. Inhibit formation of corrosive acids and insoluble deposits in fuels and engines.

C. Film-forming additives (friction modifiers & antiwear agents)

1. Bind to metal surfaces, providing fluid barrier between sliding metal surfaces,
2. Increases operating efficiency, decreases metal wear,
3. Reduces engine, fuel pump, transmission and axle breakdowns, and
4. Reduce noise, vibration and harshness of equipment function.

D. Rust & corrosion inhibitors

1. Provide protective coating that resists development of corrosion,
2. Inactivates corrosion reactions between oxygen, acid, water and the metal.

E. Anti-foam and seal conditioners

1. Prevent lubricants and fuels from entering the environment

F. Conductivity improvers

1. Reduces flammability risk of fuels caused by static discharges
2. Allows high pumping speeds to be maintained.

G. Others

Biocides, cetane improvers, pour point depressants, emulsifiers, and extreme pressure agents are other essential additives contributing to robust properties of lubricant and fuel products.