ALGAE-X®
Fuel Conditioning

AFC-705

Fuel Catalyst

Powerful Full Spectrum High Concentrate Additive

- **Cleans Tanks & Fuel Systems**
- **Stabilizes Fuel**
- **Eliminates Carbon Deposits**
- **Improves Fuel Economy**
- **Reduces Emissions**
- **Great for Diesel, Gasoline, Kerosene, HFO and Biodiesel**

Optimal Fuel Quality Provides Peak Engine Performance

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ALGAE-X® Fuel Conditioning

Fuel Catalyst
AFC-705 / AFC-805

ALGAE-X® Fuel Catalyst is a **powerful full spectrum additive** and **tank cleaning agent**. It provides superior fuel quality for engines and storage tanks, lowering operating cost, maintenance and downtime.

The **Fuel Catalysts** unique formulation **eliminates** the build up of **sludge**, **improves combustion** and **reduces harmful emissions**.

AFC-705® / AFC-805® Fuel Catalyst is a concentrate that cleans heavily contaminated fuel systems and storage tanks. It dissolves tank sludge, stabilizes the fuel, restores **Optimal Fuel Quality,** and preserves the integrity of stored fuel up to 12 months.

AFC-705® / AFC-805® cleans your tanks, and when added with each refueling, enhances combustion, eliminates carbon deposits, reduces harmful emissions, and **lowers fuel consumption**.

AFC-705® + Anti Gel = AFC-805® a **winter additive** to reduce the pour point and **avoid fuel gelling**.

- **Stabilizes fuel**
- **Cleans entire fuel system**
- **Removes carbon deposits**
- **Reduces emissions and soot**

	AFC-705	AFC-805
Contents	combustion catalyst surfactant dispersant corrosion inhibitor lubricity enhancer	combustion catalyst surfactant dispersant corrosion inhibitor lubricity enhancer anti gel
Treatment ratio	1 : 5000	1 : 2500
8 oz bottle	320 gallons	N/A
16 oz bottle	N/A	320 gallons
1 gallon jug	5,000 gallons	2,500 gallons
55 gallon drum	275,000 gallons	137,500 gallons

Optimal Fuel Quality for Peak Engine Performance.

Eliminates Tank Sludge

- Cleans fuel storage and delivery systems
- Stabilizes and restores fuel quality
- Dissolves and disperses sludge and slime
- Eliminates costly tank cleaning and disposal fees

Reduces Harmful Emissions

- CO – HC's – NOX – SOX – PM
  VOC's – Carbonyls – PAH

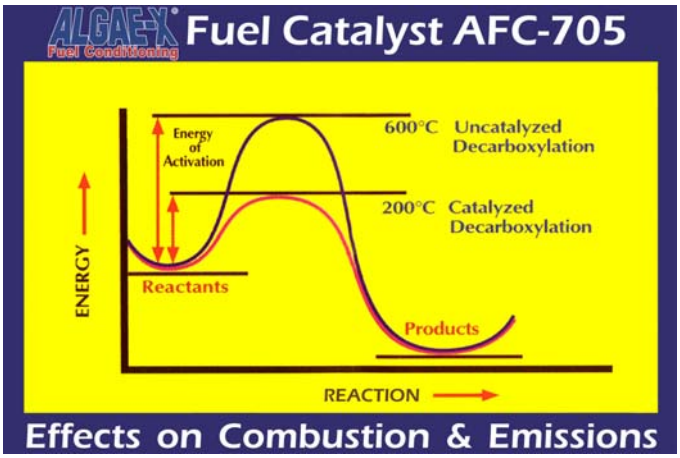
Provides Peak Engine Performance

- Improves combustion
- Removes and prevents carbon build up
- Prevents corrosion and coking of injectors
- Lowers fuel consumption
- Adds lubricity to low sulfur fuel
- Extends equipment life

AFC-805 lowers the pour point

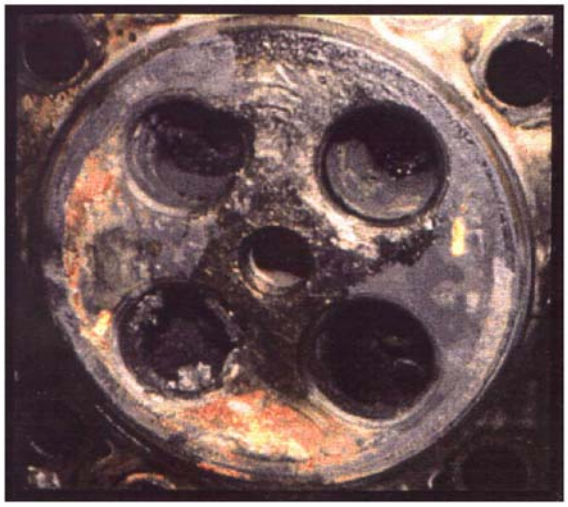
Use in Diesel, Gasoline, Kerosene, HFO, Hydraulic fluid, etc.

AFC-705 MONEY SAVING TECHNOLOGY

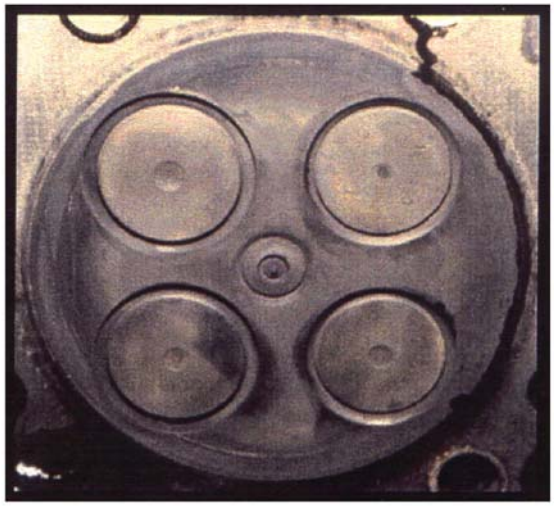


Clean Engines Save $$

Combustion chamber deposits are rapidly modified and removed during operation with AFC 705 treated fuel. Deposits removal reduces fuel consumption, oil consumption, emissions and maintenance costs.



Caterpillar D348 777 diesel engine head after 13,260 hours of continuous operation with untreated Fuel



Caterpillar 3408 diesel engine head after 13,788 hours of continuous operation with AFC 705 treated Fuel

INTRODUCTION

AFC-705 is a **High Performance, Full Spectrum Additive Package Concentrate**.
It combines combustion surface modifiers with lubricity enhancers, corrosion inhibitors, surfactants and dispersants. This unique formulation removes and prevents carbon-based deposits in the combustion chamber, eliminates microbial contamination, clogged filters, and the build up of sludge in fuel storage and delivery systems.

The **immediate results** of using **AFC-705** are:

1. **Cleaning and decontaminating the entire fuel system.**
2. **Lowering fuel consumption by 5 to 10%.**
3. **Reducing harmful exhaust emission.**
4. **Engines run better and smoke less.**

The **AFC-705** surfactant and dispersant components **break down and dissolve sludge and organic debris** in fuel tanks and filter systems. A very small dosage of AFC-705 decontaminates the entire system, restores fuel quality, and eliminates the need for costly tank cleaning procedures and disposal fees.

The use of AFC provides Optimal Fuel Quality, clean tanks and filter elements.
It reduces operating cost, maintenance and downtime while extending equipment life.

The **AFC-705** combustion catalyst promotes the **removal of carbon deposits** in the combustion chamber. AFC treated fuel burns cleaner, more completely and will prevent the formation of new deposits. New engines stay clean while older engines become clean.

The complete elimination of deposits in the combustion chamber can **more than double engine life**. There is less wear on the engine parts and oil stays clean much longer. During inspection disassembly, a simple wipe down with a shop cloth shows that engine parts still look brand new. Machining marks and serial numbers are often clearly visible.

AFC-705 is **extremely cost effective** technology. It is designed to decontaminate the total fuel system, enhance combustion and fuel economy, while reducing harmful emissions, without spending a dime on redesigning engines or retrofitting refineries.

AFC-705 extends the life and performance of all equipment, such as, Engines, Turbines, Boilers, etc. using hydrocarbon based fuels like **diesel, gasoline, bio-diesel, HFO, hydraulic oil, turbine and kerosene fuels.**

THE BENEFITS OF AFC-705

The benefits of using **AFC-705 Fuel Catalyst** are derived from its unique formulation of dispersants, surfactants, combustion enhancers and deposit surface modifiers, targeting problems of contaminated fuel systems in storage tanks and deposits in engines, turbines and burners.

Remove engine deposits. AFC-705 combustion catalyst removes deposits by interacting with the surface of the deposit, lowering the energy of activation of its chemical bonds.
This allows the release of carbon in the form of $C0_2$ at the lower temperatures.

Prevent deposit formation. The **AFC-705** catalytic components inhibit the agglomeration process from forming heavy deposits. The agglomeration process is stopped at the primary and secondary particle formation phase, which results in smaller, lighter particles.

Reduce fuel consumption. Deposits in the combustion chamber absorb and protect the fuel from complete combustion. AFC-705 catalyses the combustion process. It destroys and removes deposits, which leads to the more efficient conversion of the fuel to $C0_2$. The surfactant component in AFC reduces the fuel droplet size, which enhances the combustion process, burning a higher percentage of the fuel before the exhaust valve opens. AFC treated fuel immediately reduces fuel consumption by 5 to 10 %.

Reduce Emissions. As deposits are removed, the emissions of CO, NO_x, SO_X, HC and particulates are drastically reduced.

Reduce carbon content of ash. The catalyst interferes with the agglomeration of combustion by-products by enhancing $C0_2$ production. With less carbon available to end up in the ash complex, the amounts of ash or soot will be significantly reduced.

Cooler Exhaust, Lower NO_x. Fuel has a limited amount of energy that becomes available during combustion through the production of $C0_2$. The catalytic components in **AFC-705** enhance the combustion process. When more of the fuels' energy is released during the combustion phase, less energy will be available to be released during the exhaust phase. The difference in energy release correlates to a temperature difference. Higher energy release in the combustion chamber means lower energy release during the exhaust phase which results in lower production of NO_x.

Extend lube oil life. AFC-705 treated fuel produces smaller and less abrasive particles, which in connection with the removal of deposits, result in cleaner, longer lasting lubrication oil, and leads to reduced engine wear, less maintenance and down time, lowering operating cost.

Extend Equipment life. Engine life can be more **than doubled** as the result of complete deposit removal, cleaner oil and reduced friction. Injectors, valves, rings and other associated parts show little sign of wear, even after extended use.

Enhance fuel lubricity with the **AFC-705's** Lubricity Enhancers.

Inhibit corrosion with the AFC-705 Corrosion Inhibitor.

TANK CLEANING WITH AFC-705

AFC-705 . . . it comes in a bottle and cleans your tank

One gallon of AFC-705 completely cleans a full 5000 gallon fuel tank. This full spectrum additive package cleans the entire fuel system, restores fuel quality and provides Optimal Fuel Quality for engines and storage tanks, improving fuel economy, reducing emissions and lowering operating cost, maintenance and down time.

We all agree that most engine failures originate in the fuel tank. Frequent filter changes, fuel dialysis and tank cleaning are generally viewed as good house keeping, and have become accepted as standard periodic maintenance.

The normal aging process of the fuel is often accelerated by microbial contamination, chemical incompatibility and condensation of water in the system. Oxidation, polymerization and stratification will lead to darkening of the fuel, the build up of tank sludge, filter plugging, corrosion, and fuel breakdown. We will see a slimy, jelly like layer develop in the water fuel interface, while a bio film is growing on the bottom, walls and baffles of service and storage tanks, inside fuel lines and delivery systems.

The process of fuel breakdown is most severe in the bottom of our tanks. Every time we fill our tanks, we mix and contaminate the fresh fuel with our residual fuel, and add new oxygen, which accelerates the problem. Because we primarily use the higher and therefore dryer layers of the fuel, it is easy to overlook the symptoms of this continuous process of fuel breakdown.

Suddenly we get a wake up call, and experience some or all of these symptoms:
-- clogged filters -- fouled and corroded injectors -- smoking engines -- loss of power and RPMs -- fuel pump problems -- and, ultimately complete engine failure. All of this can be **prevented by** simply monitoring fuel quality, and using the available **ALGAE-X technology.**

The surfactants and dispersants in AFC-705 break down and dissolve the tank sludge and bio-film. It eliminates clogged filter elements and recovers the BTU value that would otherwise be lost.

Traditionally tank cleaning meant filtering the fuel in the tank, or removing the fuel for filtration, or complete fuel disposal often in conjunction with opening the tank and physically removing tank sludge and bio-film. All these techniques are time consuming, costly and only partially effective in particular when we realize that filtration will only remove the suspended debris and has no effect on the bio-film growing on tank walls, bottom and baffles, or on the process of fuel break down. **At best we can expect only temporary relief at an extremely high price.**
ALGAE-X International provides Complete Solutions for Optimal Fuel Quality.

1. **LG-X Inline Magnetic Fuel Conditioner**
2. **AFC-705 Algae-X Fuel Catalyst**

We recommend the use of AFC-705 to completely decontaminate and clean the entire fuel system, with the simultaneous installation of an inline ALGAE-X Fuel Conditioner to insure continuous Optimal Fuel Quality, enhanced combustion, and reduced emissions.

The AFC catalyst enhances and complements the effects of the ALGAE-X inline magnetic fuel conditioner, and reduces fuel consumption by at least an extra five to ten percent.

When fuel economy is of primary importance the continued use of AFC-705 is strongly recommended in conjunction with the installation of an Algae-X inline magnetic fuel conditioner, LG-X or FC Series device.

LUBRICITY ENHANCER & CORROSION INHIBITOR

In low sulfur fuel, many of the fuel components that contribute to the lubricating properties of the fuel have been removed. The components used to formulate the lubricity enhancers in **AFC-705** work to offset these lower lubricating properties in two different ways, and over two different temperature ranges.

A. The **first component** works by **coating the surfaces with a protective lubricating film**. This film also acts as a **corrosion inhibitor**, which keeps the parts clean and free of pits. The film works best at lower temperatures up to about 300^{O}C, and is constantly being replenished as it is broken down by friction and heat.

B. The **second component** breaks down **large abrasive particles into smaller smoother particles**. This component works at temperatures higher than 200^{O}C, and continues to work in conjunction with the combustion catalysts once it enters the combustion chamber.

The two components together address corrosion, lubrication and friction problems over the entire engine operating temperature range, and inhibit the formation of acids. **AFC-705** lubricity enhancers will not change the fuel specifications in any way. The sulfur content, BTU value and other specifications will remain unchanged.

The principle benefit of **AFC-705** lubricity enhancers is the **extended life of engine parts that rely on the fuel for lubrication**. Keeping these parts operating normally, solves many of the problems related to switching from a regular to a low sulfur diesel fuel. A small increase in available power will be noticeable, due to lower friction.

Engine parts will be more resistant to **acid corrosion** and will show less wear due to carbon grit. As a result, engine lubricating oil will stay cleaner much longer. The mineral content, carbon grit, and acid forming compounds in the oil will be much lower. **AFC-705** lubricity enhancers will not interfere with crankcase oil additives. Instead, they may actually help them to do a better job.

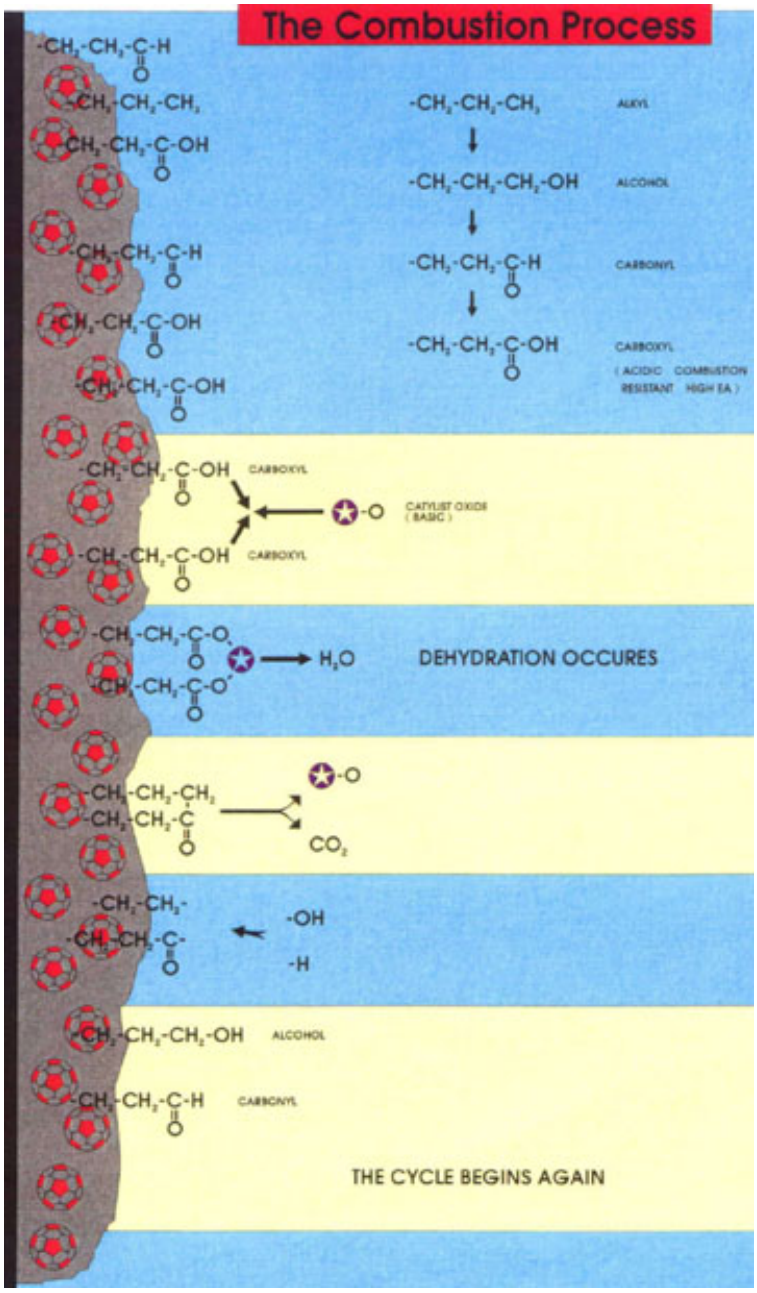
As in any maintenance situation, the effectiveness of **AFC-705** lubricity enhancers does not replace good maintenance practices. However, its use will significantly reduce maintenance requirements and down time, while extending equipment life.

The use of **AFC-705** is highly recommended, in particular in situations with low sulfur, or low lubricity fuel. The lubricity enhancer, and corrosion inhibitor package in the catalyst are designed, to improve engine performance, and increase the life of key engine parts, while saving in fuel and reducing harmful emissions.

EFFECTS OF AFC-705 ON COMBUSTION PROCESS

The **ALGAE-X®** catalyst complex interacts with the heavier, long chain, combustion resistant elements of the fuel, and existing carbon deposits. This interaction allows these deposits to break down and burn. The "molecular atomization" of the fuel, and the destruction and burning of the surface deposits produce the following positive effects on the combustion process:

Quicker, more complete combustion.
Optimal use of available oxygen.
Lower excess air requirements.
Removal of existing deposits
Better heat transfer.
Lower fuel consumption.
Increased overall efficiency.



EFFECTS ON COMBUSTION BYPRODUCTS

AFC 705 enhances the combustion process, which leads to the following positive effects on combustion byproducts:

Inhibition of new deposit formation
Removal of old carbon deposits
Prevention of new deposit formation
Decrease
- fuel consumption
- particulate, smoke and soot
- NOX, SOX, CO, and VOC emissions
- Carbon content in the ash
- fouling and corrosion due to decrease V205 activity
- cold-end corrosion due to decreased SO3 formation

These effects lead to a significant increase in energy output by burning a larger portion of the Carbon available in fuel, and an important reduction in corrosion due to much lower formation of SO_3, which increases the amount of SO_2, harmlessly captured in ash.

HOW AFC-705 WORKS ON DEPOSITS

The Deposit Removal Mechanism

Combustion Deposits are mostly carbon and aromatic compounds in a highly combustion resistant state. These deposits are the source of many engine problems, such as higher than normal fuel consumption, excessive harmful exhaust, and costly maintenance. Fuel problems and incomplete combustion ultimately cause complete engine failure.

Deposit formation begins with spherical molecules called primary particles and branched aromatic chains, both of which are produced in the early stages of combustion. The chain branches consist of alkyl, alcohol, carbonyl and carboxyl compounds. The alkyls oxidize to alcohol, oxidizing to carbonyl, oxidizing to carboxyl. The oxidation process stops with the carboxyl compounds, which are acidic and highly combustion resistant with a **high energy of activation**.

The various branch compounds are attracted to the primary particles, which spin at extremely high velocities. When a branch becomes attached to a primary particle, the entire chain structure is quickly wrapped around the primary particle forming a secondary particle. These secondary particles agglomerate and form a tertiary particles. This can happen when several primary particles become attached to the same chain on different branches, and then simultaneously become secondary and tertiary particle, as they wrap up the chain.

Tertiary particles agglomerating on a surface will become further coated to form quaternary particle. **The coated quaternary particles make up deposits**. The chain structures coating the surface of deposits leave exposed branches. It is at these branches where **AFC-705** catalyst begins to break down and destroy the deposits as it modifies the surfaces.

The carboxyl branches are **acidic**, and attract the **AFC-705** catalyst oxide which is **basic**. When the two combine a process called dehydration occurs and a water molecule is produced. What remains is a compound with a low **energy of activation**, which readily breaks down at high temperatures, releasing a CO_2 molecule and the catalyst oxide.

Upon releasing the CO_2 and the catalyst oxide, the end of the chain re-oxidizes to an alkyl, alcohol or carbonyl compound and finally to a carboxyl compound. When the end of the chain reaches this state, the catalyst oxide once again combines with the carboxyl, and starts the break down cycle again. Over time, the deposits are removed by being converted to CO_2 and water.

AFC-705 inhibits the formation of new deposits in much the same way as it destroys existing deposits. It interacts with the ends of the aromatic chains and the attachment sites on the primary particles. This interaction keeps the primary particles from wrapping up full chains, by blocking or destroying the attachment sites, and/or breaking the chains.

This interference stops the deposit agglomeration process at the primary and/or secondary particle agglomeration state. This results in much lighter and smaller particles that don't stick together and are more easily oxidized. The result of this interference is a lower mass of particulate emissions, and instead an increased energy output, and increased production of CO_2 and water, which are the desirable end products of the combustion cycle.

Deposits are the major source of emissions. Eliminating deposits lowers the production of soot and smoke. The use of AFC-705 enhances energy output and optimizes the production of CO_2 and water during the entire combustion process, which significantly lowers the output of both regulated and unregulated emissions.

ELIMINATING COMBUSTION DEPOSITS

AFC-705 technology is based on the catalytic effects of organo-metalics. The main active ingredients are synergistic, multifunctional combustion catalysts containing combustion surface modifiers and deposit surface modifiers. AFC-705 can be used with any liquid hydrocarbon fuel such as gasoline, diesel, residual fuel and HFO.

In an **AFC-705** treated environment, the surfaces of the fuel particles and deposits are modified such that the catalyst lowers the **energy of activation** of the deposit surfaces. The modified surface deposits can then burn up at a much lower temperature.

A typical engine develops a temperature gradient ranging from 200^{O}C at the combustion chamber wall, to 1200^{O}C in the combustion center. Many of the fuel components require a higher temperature than 600^{O}C to combust. It is not possible to completely burn heavy fuel components in temperatures ranging from 200^{O} – 600^{O}C. Incomplete combustion forms the deposits, harmful emissions, and the consequential mechanical problems.

Combustion chamber deposit surfaces and fuel particles treated with **AFC-705** begin to combust at temperatures as low as 200^{O}C and then burn over the entire temperature range. This results in complete combustion and eventually in the total removal of all engine deposits, while at the same time preventing new deposit buildup. Complete combustion leads to better performance, lower fuel consumption, lower emissions (CO, SO_x, NO_x, HC's and PM-10), lowering operating cost, maintenance and downtime.

The process of deposit removal begins immediately, and can take up to 600 hours or 4,000 miles. The actual time needed depends on operation, history, and age of the equipment. **AFC-705** treated fuel completely removes the deposits from fuel injectors, intake and exhaust valves, and other exposed combustion chamber parts of dirty engines, while preventing deposits in new engines.

In older engines the use of **AFC-705** treated fuel is even more pronounced than the new ones. The performance of new engines will not degrade and maintenance will remain at a minimum. A gasoline engine will not experience an octane requirement increase.

Fuel treated with **AFC-705 Combustion Catalyst** burns completely so that new engines stay clean, and older, dirty engines become clean. **AFC-705** is the most cost effective way to conserve energy and protect the environment while enhancing performance and engine life.

AFC-705 is available in 8oz bottles, 1 gallon containers, 55 gallon drums or by various sizes of tank trucks and rail cars.

AFC-705 treatment ratio is 1:5,000.

THE EFFECTS OF AFC-705 ON SO_X

The treatment of carbon based fuels with AFC-705 has a significant effect on trace sulfur combustion chemistry. In diesel engines, gasoline engines and open flame applications (boilers) the use of AFC-705 treated fuel will significantly reduce sulfur oxide (SO_X) emissions, and related sulfur acid corrosion problems.

AFC-705 does not react with the sulfur in the fuel nor does AFC-705 have any effect on the sulfur content of the fuel. AFC-705 does not effect fuel specifications at recommended treatment levels. Fuel containing one percent sulfur prior to AFC-705 treatment will still contain one percent sulfur after AFC-705 treatment. However, the use of AFC-705 will determine where the sulfur ends up and what its chemical state will be after combustion.

The combustion of sulfur in fuels invariably leads to the formation of sulfur dioxide $S + O_2 \rightarrow SO_2$ (1) and sometimes sulfur trioxide $2SO_2 + O_2 \rightarrow 2SO_3$ (2). Sulfur trioxide formation is catalyzed by vanadium pentoxide (V^{5+}). This is the most stable oxidation product of vanadium, when vanadium containing fuels are burned in air $4V + 5O_2 \rightarrow 2V_2O_5$ (3). The catalytic effect is thought to relate to the reversible dissociation $2V_2O_5 \rightarrow 2V_2O_4 + O_2$ (4) at temperatures between 700^O-1125^O C. The sulfur trioxide reacts with water vapor to form sulfuric acid $SO_3 + H_2O \rightarrow H_2SO_4$ (5) which is primarily responsible for acid corrosion problems in combustion equipment.

AFC-705 affects the production of gaseous SO_X emissions. It enhances the formation of CO_2 during the combustion phase thus limiting the amount of SO_X produced during the exhaust phase. The increased production of CO_2 reduces the amount of excess O_2 available for other reactions. The difference in the amount of CO_2 produced during the combustion and the exhaust phases correlates to a temperature differential. This temperature differential results in lower exhaust temperatures and shorter heat transfer times.

Minerals contained in fuel are generally oxidized to metal oxides during the combustion process. When vanadium is oxidized to V^{5+} the production of sulfur trioxide increases due to reversible dissociation, and sulfuric acid is ultimately formed. The use of AFC-705 inhibits the formation and reversible dissociation of V^{5+} during the exhaust phase by limiting the available O_2**,** high temperatures, and time periods needed for these reactions to occur.

This greatly reduces the catalytic effect V^{5+} has on the formation of Sulfur trioxide and thus the formation of sulfuric acid. By reducing the catalytic effect of vanadium, AFC-705 promotes the combination of SO_X compounds with other minerals in the fuel such as Na and Ni. This leads to the formation of stable mineral salts and mixed mineral sulfates found in the clinker or fly ash.

In this manner, **AFC-705 decreases the gaseous sulfur emissions** by increasing the particulate portion of the combustion residue products. AFC-705 treated fuels will therefore show slightly higher sulfate content in the ash than untreated fuel.

THE EFFECTS OF AFC-705 ON NOX

The **formation of NO_X** takes place when combustion **temperatures reach above 2500 °F** and **pressures are the highest**. This especially occurs when the engine is under high load or wide open throttle. NO_X formation is influenced by available **excess oxygen**, **time**, and **deposit buildup**.

AFC-705 significantly **lowers the amount of NO_X** production in internal combustion engines and open flame boilers.

This reduction correlates with **combustion deposit removal**. Carbon deposit build up in the combustion chamber causes higher compression. This directly affects the factors responsible for the formation of NO_X supports a direct connection between NO_X emissions and deposits. This connection is supported by the fact that clean engines using AFC-705 treated fuel produce lower amounts of NO_X. The process by which AFC-705 inhibits the formation of NO_X is a direct result of the process by which it removes existing and prevents the formation of new deposits, namely through the promotion of CO_2 production.

AFC-705 affects the three main factors enhancing the formation of NO_X. Fuel has a finite amount of energy, which is released through the production of CO_2. AFC-705 promotes the formation of CO_2 during the combustion phase. If more CO_2 or energy is produced during the combustion phase then less is available to be released during the exhaust phase. The difference in the amount of energy released during the two phases correlates to a temperature differential. This temperature differential, its magnitude and cause are important for three reasons.

Lower exhaust temperature. If the temperature of the combustion phase rises due to increased CO_2 production then the temperature of the exhaust phase will go down. This denies the nitrogen molecules the high temperatures needed to form NO_X compounds. Lower temperatures slow down the production of NO_X by requiring more time for the reactions to take place. The greater the amount energy released during the combustion phase and the associated lower exhaust gas temperature the lower the rate of NO_X production will be.

Shorter heat transfer time. The greater the magnitude of the temperature difference, the shorter the heat transfer time becomes. Increase in heat transfer to the surrounding engine components during combustion will decrease exhaust temperature and time for the conversion of nitrogen to NO_X compounds. The shorter the heat transfer time the lower the NO_X emissions.

Oxygen depletion. Increasing the production of CO_2 uses up more of the available oxygen. AFC-705 promotes the production of CO_2 during the combustion phase, lowering oxygen availability for NO_X reactions during the exhaust phase. Less available oxygen results in lower NO_X emissions

The combination of lower exhaust temperatures, shorter heat transfer time, less available oxygen, and the complete removal of carbon deposits cause a very significant reduction of NO_X emissions.

THE EFFECTS OF AFC-705 ON LOW SULFUR FUELS

In the past few years, the sulfur content of diesel fuel has become a major concern due to its contribution to SO_X emissions, especially SO_3, which combined with water forms acid. This has led to legislation requiring the removal of all but .05% of the sulfur in all diesel fuel used in over the road applications as of October 1, 1993. And new regulations will lower allowable sulfur content even more.

Although sulfur itself does not contribute to the performance of a fuel, the fuel components removed together with the sulfur to produce a low sulfur fuel did. These other fuel components have a BTU value, and give the fuel its lubricating properties. The latter is important since many engine manufacturers use the fuel itself to lubricate the fuel pump and other engine parts that come in contact with the fuel. These same components also provide an important portion of the total energy content of the fuel.

Low sulfur fuels have a lower BTU value, a lower lubricity factor and present significant problems for fuel producers and users alike. In the refining process, considerable amounts of extra work are required to remove the sulfur. The process may require extensive re-tooling of the refinery, which translates into a significant cost increase for the end user. The result is a lower energy yielding fuel at a higher cost.

Cost increase is not the only problem the end user will experience. There will be an immediate drop in fuel economy of about 3 to 7%, and a considerable loss of power resulting from the lower BTU value. Because of the reduced lubricating properties of the fuel vital engine parts will wear out more quickly, this can be noticeable in as little as one or two months. The reduction in lubricity will also contribute to a loss in usable power due to the increased friction the engine will have to overcome. Even a perfectly tuned engine will experience a noticeable drop in efficiency.

The traditional solution has been to add lubricity and anti-wear additive packages to the fuel. AFC-705 contains a premium lubricity and anti-wear additive package correcting the friction and wear problems.

New legislation offers another alternative. If it can be shown that a higher sulfur content fuel (.1-.2% sulfur content) can meet the emission standards of a lower sulfur fuel, being mandated for use in a particular area, then a waiver can be received for the use of that fuel. The benefits are that higher sulfur fuel will be easier to manufacture, less expensive to buy, and offer better fuel economy than the low sulfur fuel.

One may qualify to obtain a waiver by treating the higher sulfur fuel with AFC-705 Fuel Catalyst. AFC-705 will decrease the emissions of SO_X by catalyzing reactions between the sulfur and minerals in the fuel thus converting the combustion products of sulfur to harmless solid sulfur salts found in common soil and rock. A higher concentration of sulfur may therefore be present in the fuel while resulting in constant or lower SO_X emissions when compared to a reference low sulfur fuel.

AFC-705 also increases fuel economy of engines, turbines and burners. Lower fuel consumption to obtain the same energy output, immediately translates into lower overall emissions.

AFC-705 keeps the engine clean and free of deposits, which lowers maintenance and operating cost. The lubrication oil of engines using AFC-705 stays significantly cleaner and last much longer. Regardless of the type of fuel used, AFC-705 treated fuel will perform better than non-treated fuel. The results will always be immediately evident.

The cost of AFC treated fuel will always be significantly less than the cost of using low sulfur fuel.

In all applications, AFC-705 more than pays for itself. It saves money, and enhances your bottom line.

AFC 705 IN FUELS CONTAINING VANADIUM AND SULFUR

Crude oils from Alberta, Canada and from Venezuela contain considerable amounts of dissolved vanadium oxides. Normal refinery practice does not provide for the removal of these vanadium oxides. In fact, a major source of commercial vanadium is derived from the fly ash from burning Canadian crude.

In an engine where there is no catalysis for the fuel combustion, unused oxygen can cause the vanadium (oxidation state of three) to be oxidized to vanadium pentoxide, V_2O_5. This V_2O_5 can be a problem in itself because it deposits as a hard coating on the surface on the combustion chamber walls. Under many circumstances it has to be manually chiseled off.

If an engine is already damaged by vanadium deposits (V_2O_5) it is unlikely that AFC 705 can burn off these deposits. Whereas, if the deposits were carbon, adding AFC 705 to the fuel will definitely burn off these carbon deposits.

In addition, the presence of V_2O_5 can catalyze the transformation of sulfur dioxide, SO_2, to form sulfur trioxide, SO_3. This is important because sulfur trioxide (SO_3) and water gives the highly corrosive sulfuric acid.

Since water is one of the products of hydrocarbon combustion, much damage occurs to all metal parts of the combustion chamber and the exhaust system, resulting from the acid that is produced when vanadium is in the fuel.

The use of AFC 705 results in the complete use of the oxygen present in combustion, leaving little or no oxygen to oxidize the mixed vanadium oxides to the V_2O_5. By using up all the available oxygen to burn the fuel completely, there is little or no oxygen left over to oxidize the SO_2 to SO_3 whether V_2O_5 is present or not.

In new engines and boilers, the use of AFC 705, will significantly diminish the formation and deposits of V_2O_5, and therefore prevent production of SO_3 and the resultant acids. This clearly and significantly diminishes engine damage caused by acidic corrosion.

As a result, engine life and overhaul cycles will be dramatically extended, while engine maintenance, down time, and overall cost of operations will be significantly reduced. The cost of ALGAE-X AFC 705 is more than justified on the basis of its effect on preventing the oxidation of the vanadium oxides and sulfur which are very difficult to remove from fuels.

THE EFFECT OF AFC-705 ON FUEL SPECIFICATIONS

Data from independent testing laboratories using ASTM procedures demonstrate that AFC-705 fuel treatment does not significantly change any of the commonly accepted fuel specifications. The data shown below are representative of AFC-705 at the recommended 1:5,000 treatment ratio in a baseline #2 diesel fuel. The data in this report is within the limits of uncertainty as specified in the reference methods.

The data in the following table confirms that AFC-705 fuel treatment does not cause any fuel instability nor are there any significant changes in fuel specifications, which would cause the fuel to be harmful to an internal combustion engine or any other combustion equipment. The use of AFC-705 treated fuels will not void equipment warranties.

TEST DESCRIPTION	FINAL RESULT - BASELINE	FINAL RESULT – TREATED	LIMITS/* DILUTION	UNITS OF MEASURE	TEST METHOD	DATE
ASTM D-86 DISTILLATION			*1		ASTM D-86	10/06/93
Initial Boiling Point	340	344	1	Deg. F	ASTM D-86	
05% Evaporated Temperature	424	420	1	Deg. F	ASTM D-86	
10% Evaporated Temperature	453	452	1	Deg. F	ASTM D-86	
15% Evaporated Temperature	471	469	1	Deg. F	ASTM D-86	
20% Evaporated Temperature	485	483	1	Deg. F	ASTM D-86	
30% Evaporated Temperature	509	509	1	Deg. F	ASTM D-86	
40% Evaporated Temperature	528	528	1	Deg. F	ASTM D-86	
50% Evaporated Temperature	548	548	1	Deg. F	ASTM D-86	
60% Evaporated Temperature	565	565	1	Deg. F	ASTM D-86	
70% Evaporated Temperature	584	582	1	Deg. F	ASTM D-86	
80% Evaporated Temperature	606	604	1	Deg. F	ASTM D-86	
90% Evaporated Temperature	633	631	1	Deg. F	ASTM D-86	
95% Evaporated Temperature	659	656	1	Deg. F	ASTM D-86	
End Point	673	672	1	Deg. F	ASTM D-86	
% Recovery	97.9	97.9	0.1	Vol. %	ASTM D-86	
% Residue	1.6	1.5	0.1	Vol. %	ASTM D-86	
% Loss	0.5	0.6	0	Vol. %	ASTM D-86	

TEST DESCRIPTION	FINAL RESULT – BASELINE	FINAL RESULT – TREATED	LIMITS/* DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH.
Acid Number	0.002	0.002	0.002	mg KOH/g	ASTM D-664	10/06/93	DD
Ash Content, Routine	<0.001	<0.001	0.001	Wt%	ASTM D-482	10/07/93	DD
Gross Heating Value	19201	19110	1	BTU/lb	ASTM D-240	10/04/93	QE
Sulfur by X-Ray Spectro-photometry	0.039	0.039	0.005	Wt%	ASTM D-4294	10/05/93	PCW
Pour Point	15	20	-60	Deg. F	ASTM D-97	10/07/93	MQ
Cloud Point	14	18	-40	Deg. F	ASTM D-2500	10/07/93	MQ
Gravity, API @ 60 Deg F	31.9	31.9	-20	Deg. API	ASTM D-287	10/04/93	PCW
Conradson Carbon	0.04	0.04	0.01	Wt%	ASTM D-189	10/02/93	QE
Copper Strip Corrosion	1a	1a			ASTM D-130	10/02/93	PCW
Flash Point, PMCC	142	142	70	Deg. F	ASTM D-93	10/05/93	QEW
Cetane Number, Neat	43.6	44.3	20	Cetane #'s	ASTM D-613	10/31/93	FB
Water, Karl Fischer	65	49	1	Ppm	ASTM D-1744	10/08/93	DD
Accelerated Stability	0.54	0.54		mg/100ml	ASTM D-2274	10/08/93	DD
Particulate Contaminants	6.9	5.7	0.1	mg/l	ASTM D-2276	10/08/93	D
Viscosity @ 100 Deg F	3.7	3.70	0.01	CSt	ASTM D-445	10/07/93	DE

The enclosed tables describing the Effect of AFC-705 on Fuel Specifications are within the limits of uncertainty as specified in the reference methods. There is no significant change in fuel specifications. The differences in the test values will not affect fuel performance in the field to any noticeable degree.

POUR POINT AND CLOUD POINT

POUR POINT

The pour point is the lowest temperature at which a petroleum product will begin to flow. Pour point is measured at intervals of 5^{O} F. This interval gives a range in which to account for error inherent in the measuring procedure. A sample with a pour point of 10.5^{O} F and a sample with a pour point of 14.5^{O} F would be labeled as having a pour point of 15^{O} F. Even with the 4^{O} difference they would be considered the same. However, a sample with a pour point of 15.5^{O} F would be labeled as having a pour point of 20^{O} F even though it is only 1^{O} higher than the 14.5^{O} F sample mentioned before. Due to experimental and operator error, sample variations of one interval are not considered significant. Since the measured values for the two samples are only one interval apart the difference is not significant.

CLOUD POINT

The cloud point is the temperature at which wax crystals begin to form in a petroleum product as it is cooled. Cloud point is measured at intervals of 2^{O} F. An example similar to the one used illustrating the pour point procedure applies here. Differences of one interval are not considered significant. Wax crystals depend on nucleation sites to initiate growth. The difference in the cloud points of the two samples is explained by the fact that any fuel additive will increase the number of nucleation sites, which initiate clouding. A change in temperature at which clouding starts to occur is therefore expected upon addition of any additive. The difference between the cloud point values for the two samples is not abnormal and is not significant.

COMBUSTION CATALYST TREATMENT RATIOS

The AFC-705 combustion catalyst compound is the deposit control and combustion surface modifier, which acts as a catalyst breaking down carbon deposits. The deposits are reduced through a process called de-carboxylation, the release of a carbon atom in the form of $C0_2$.

The relatively cool surface temperature of the deposit layer restricts de-carboxylation from happening naturally in an internal combustion engine. The catalyst reduces the temperature needed for de-carboxylation from about $600^{O}C$ to about $200^{O}C$. It enables the chemical reaction to occur on the cooler surface of the deposits.

The interaction of the catalyst with the exposed surface of the deposits causes the release of a water molecule and a carbon molecule in the form of CO_2. The deposit surface re-oxidizes to a carboxyl state and continues interacting with the catalyst molecules.

The effectiveness of AFC-705 in removing carbon deposits is related to the surface area and mass of the deposits, the amount of new deposit material being formed during combustion and the amount of catalyst present. Results will be different for each combustion chamber because of its unique history of deposit buildup. However, due to the similarity in basic chemical reactions the end result will be the same in spite of all the differences.

Once an old engine is clean, the minimum amount of catalyst needed is the amount required to inhibit new deposit formation. A new engine needs only this minimum amount to remain clean, and a dirty engine will not get any worse. The exact amount in each case depends on the size of the combustion chamber and the fuel being used. The concentration of AFC-705 catalyst in treated fuel is higher than the necessary minimum requirement. It ensures zero new deposit formation, and the complete removal of all old deposits.

The optimum amount to use in a dirty engine is the amount necessary to inhibit new deposit formation plus completely saturate all exposed surfaces of existing deposits. Excess amounts of catalyst beyond the surface saturation point, will not speed up the deposit removal process.

The concentration of the active ingredient has been calculated such that the majority of the dirty engines in operation will receive a sufficient amount of combustion catalyst required for total deposit surface saturation.

The recommended treatment ratio for **AFC-705 is 1:5000**. Concentrations higher than 1:2500 are not recommended. Concentrations of 1:100 may begin to produce perceptible changes in fuel specifications.

1 oz of AFC-705 treats 40 Gallons of fuel.
1 gallon treats 5000 gallons.

AFC-705 AN ALTERNATIVE TECHNOLOGY

An average reduction of five (5) to ten (10) percent in the consumption of petroleum based fuels and a very significant reduction of emissions is possible without spending a dime redesigning combustion engines, turbines and burners, or retrofitting refineries. All we need to do is treat our fuel with AFC-705.

AFC-705 contains a multi component combustion catalyst, which promotes the removal of engine deposits especially those in the combustion chamber. While removing deposits, AFC-705 treated fuel burns cleaner and more completely, thus eliminating the formation of new deposits. New engines stay clean and older engines become clean. Initially the use AFC-705 treated fuel will often show reductions in fuel consumption far greater than the average five (5) to ten (10) percent. The reduction of emission will increase with the removal of the existing deposits.

In addition, the use of AFC treated fuel will significantly lower equipment operating and maintenance costs, while engine life can be more than doubled. There is less wear on the engine parts and engine oil stays cleaner much longer. When disassembling an engine, a simple wipe down with a shop cloth will show that the parts look as good as new, often with all the serial numbers clearly readable and machining marks still clearly visible.

AFC-705 is extremely cost effective technology. This complete additive package improves fuel consumption and reduces emissions. It extends engine life, decontaminates and cleans the total fuel system, dissolves tank sludge, lowers operating and maintenance cost, while enhancing your bottom line. The AFC additive package perfectly complements magnetic fuel conditioning.

WARRANTY

The manufacturer guarantees that the use of AFC-705 treated fuel will in no way damage or void the warrantees of engines burning that fuel. Engine warranty is based in part on the condition that only a fuel meeting certain specifications can be used in the engine. The proper addition of AFC-705 to a fuel will not change that fuels specifications and therefore will not void the warranty.

Since the product was first introduced in 1989 there has never been an incident where the use of AFC-705 has caused engine damage. However, should a problem occur, the manufacturer will take full responsibility for any unusual engine damage not due to normal engine wear that is proven to be caused by the proper use of AFC-705.

Algae-X International.

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MATERIAL SAFETY DATA SHEET

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FAX: [+1] (239) 690-1195

SEPTEMBER 8, 2006
(UPDATED)

EMERGENCY TELEPHONE NUMBERS:

CHEMTREC® - ONLY IN THE EVENT OF A CHEMICAL EMERGENCY INVOLVING A SPILL, LEAK, FIRE, EXPOSURE OR ACCIDENT

(800) 424-9300 -- USA
(202) 483-7616 (collect) -- INTERNATIONAL

M A T E R I A L S A F E T Y D A T A S H E E T

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SECTION 1 ----- PRODUCT / CHEMICAL IDENTIFICATION------

PRODUCT NAME: AFC-705

SECTION 2 ------PRODUCT INFORMATION / COMPOSITION------

MATERIAL	CAS NUMBER	%
PROPRIETARY ADDITIVE PACKAGE		70-80
LIGHT AROMATIC NAPHTHA, NAPHTHALENE DEPLETED	64742-94-5	20-30
*(ETHYLBENZENE)	100-41-4	<1.5

*DISCLOSURE AS A TOXIC CHEMICAL IS REQUIRED UNDER SECTION 313 OF TITLE III OF THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 AND 40 CFR part 372.

SECTION 3 ------HAZARD IDENTIFICATION------

IRRITANT!

MAY BE HARMFUL BY INHALATION, INGESTION OR SKIN ABSORPTION. VAPOR OR MIST IS IRRITATING TO THE EYES, MUCOUS MEMBRANES AND UPPER REPSIRATORY TRACT. MAY CAUSE SKIN IRRITATION. INGESTION MAY CAUSE: WEAKNESS, TEMPORARY NERVOUS SYSTEM DEPRESSION, GASTROINTESTINAL DISTURBANCES, DIZZINESS, CONFUSION, INCOORDINATION, NAUSEA, HEADACHE AND LOSS OF CONSCIOUSNESS.

TO THE BEST OF OUR KNOWLEDGE, THE CHEMICAL, PHYSICAL, AND TOXICOLOGICAL PROPERTIES OF THIS COMPOUND HAVE NOT BEEN THOROUGHLY INVESTIGATED

REFER TO SECTION 4 FOR FIRST-AID MEASURES

SECTION 4 ------FIRST AID MEASURES------

IN CASE OF CONTACT WITH EYES, IMMEDIATELY FLUSH WITH COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MINUTES. SEPARATE EYELIDS WITH FINGERS TO INSURE ADEQUATE FLUSHING.

IN CASE OF CONTACT WITH SKIN, IMMEDIATELY WASH WITH SOAP AND COPIOUS AMOUNTS OF WATER. REMOVE CONTAMINATED CLOTHING PROMPTLY AND WASH BEFORE REUSE.

IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING GIVE ARTIFICIAL RESPIRATION, PREFERABLY BY MOUTH-TO-MOUTH. IF BREATHING IS DIFFICULT, GIVE OXYGEN.

IF INGESTED, DO NOT INDUCE VOMITING. ALLOW VICTIM TO RINSE HIS MOUTH AND THEN TO DRINK 2-4 CUPFULS OF WATER. NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON.

CALL A PHYSICIAN.

SECTION 5 ------FIRE FIGHTING MEASURES AND EXPLOSION DATA------

FLASH POINT: 158ºF (70ºC) (TAG CLOSED CUP)

EXTINGUISHING MEDIA:

WATER SPRAY

CARBON DIOXIDE, DRY CHEMICAL POWDER, ALCOHOL OR POLYMER FOAM.

SPECIAL FIRE FIGHTING PROCEDURES:

WEAR SELF-CONTAINED BREATHING APPARATUS AND FULL PROTECTIVE CLOTHING TO PREVENT CONTACT WITH VAPOR AND/OR TOXIC FUMES.

UNUSUAL FIRE OR EXPLOSION HAZARDS: NONE

SECTION 6 ------ACCIDENTAL SPILL OR LEAK PROCEDURES------

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED:

SHUT OFF ALL SOURCES OF IGNITION. EVACUATE AREA. WEAR SELF CONTAINED BREATHING APPARATUS, RUBBER BOOTS, AND HEAVY RUBBER GLOVES. SPILLS ARE VERY SLIPPERY. ABSORB ON SAWDUST, SAND OR VERMICULITE, PLACE IN A CLOSED CONTAINER AND HOLD FOR WASTE DISPOSAL. VENTILATE AREA AND WASH SPILL SITE AFTER MATERIAL PICKUP IS COMPLETE.

SECTION 7 ------PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE------

PLEASE REFER TO SECTION 8

SECTION 8 ------EXPOSURE CONTROL / PERSONAL PROTECTION------

CHEMICAL SAFETY GOGGLES AND A FACE SHIELD
IMPERVIOUS RUBBER GLOVES
OSHA/MSHA-APPROVED RESPIRATOR
SAFETY SHOWER AND EYE BATH
MECHANICAL EXHAUST REQUIRED
IRRITANT
COMBUSTIBLE LIQUID
AVOID BREATHING VAPOR
DO NOT GET IN EYES, ON SKIN, OR ON CLOTHING
AVOID PROLONGED OR REPEATED EXPOSURE
WASH THOROUGHLY AFTER HANDLING
KEEP TIGHTLY CLOSED WHEN NOT IN USE
KEEP AWAY FROM HEAT, SPARKS OR FLAMES
STORE IN A COOL, DRY PLACE

SECTION 9 ------PHYSICAL AND CHEMICAL PROPERTIES------

APPEARANCE: CLEAR, DARK AMBER LIQUID WITH A HYDROCARBON ODOR
BOILING POINT: <212 ºF
VAPOR PRESSURE: NOT TESTED
VAPOR DENSITY: NOT TESTED
SPECIFIC GRAVITY: 0.87 – 0.93 @ 24ºC
EVAPORATION RATE: NOT TESTED
SOLUBILITY IN WATER: NEGLIGIBLE

SECTION 10 ------STABILITY AND REACTIVITY DATA------

STABILITY: STABLE
INCOMPATIBILITIES:

STRONG OXIDIZING AGENTS

THERMAL DECOMPOSITION GENERATES: CARBON DIOXIDE, CARBON MONOXIDE, AND NITROGEN OXIDES
HAZARDOUS POLYMERIZATION: WILL NOT OCCUR

SECTION 11 ------TOXICOLOGICAL INFORMATION------

ANIMAL DATA:

LIGHT AROMATIC NAPHTHA (NAPHTHALENE DEPLETED):

INHALATION 6 hour LC50	>14.4 mg/l in rats
ORAL LD50	~5000 mg/kg in rats

TLV-TWA 100 ppm (PETROLEUM CARRIER SOLVENT)

LIGHT AROMATIC NAPATHA IS A MODERATE SKIN IRRITANT, A SLIGHT EYE IRRITANT AND A SKIN PHOTOSENSITIZER IN ANIMALS. TOXIC EFFECTS OF A SINGLE INHALATION EXPOSURE TO VERY HIGH CONCENTRATIONS INCLUDE HYPERACTIVITY, SALAVATION, INCOORDINATION, TREMORS, IRREGULAR RESPIRATION, AND NON SPECIFIC EFFECTS SUCH AS WEIGHT LOSS AND IRRITATION. LONG-TERM INHALATION EXPOSURE PRODUCED NO SIGNIFICANT EFFECTS FROM EXPOSURE TO CONCENTRATIONS OF UP TO 400 ppm FOR ONE YEAR. NO ANIMAL TEST REPORTS ARE AVAILABLE TO DEFINE CARCINOGENIC, MUTAGENIC, DEVELOPMENTAL OF REPRODUCTIVE HAZARDS.

TO THE BEST OF OUR KNOWLEDGE, THE CHEMICAL, PHYSICAL, AND TOXICOLOGICAL PROPERTIES OF THIS COMPOSITION HAVE NOT BEEN THOROUGHLY INVESTIGATED

SECTION 12 ------ECOLOGICAL INFORMATION------

LIGHT AROMATIC NAPHTHA: LC50, WHITE CRAPPIE, 4.2 mg/l

SECTION 13 ------DISPOSAL PROCEDURES------

DISSOLVE OR MIX THE MATERIAL WITH A COMBUSTIBLE SOLVENT AND BURN IN A CHEMICAL INCINERATOR EQUIPPED WITH AN AFTERBURNER AND SCRUBBER.
OBSERVE ALL FEDERAL, STATE, AND LOCAL DISPOSAL REGULATIONS.

SECTION 14 ------TRANSPORTATION INFORMATION------

NON-BULK SHIPMENTS

GROUND, AIR, OCEAN THIS MATERIAL IS **NOT REGULATED**, FOR TRANSPORTATION TO, THROUGH AND FROM THE UNITED STATES **AS PER CFR 49, 173.150(f).**

BULK SHIPMENT

GROUND, AIR, OCEAN (DOMESTIC SHIIPMENTS ONLY)

PROPER SHIPPING NAME

PETROLEUM PRODUCTS, N.O.S. (LIGHT AROMATIC NAPHTHA)
UN 1268
NO LABEL REQUIRED (COMBUSTIBLE LIQUID)

SECTION 15 ------REGULATORY INFORMATION------

THIS MATERIAL IS AN EPA REGISTERED FUEL ADDITIVE

SECTION 16 ------ADDITIONAL COMMENTS AND INFORMATION------

IRRITANT!

ALWAYS USE PERSONAL PROTECTIVE EQUIPMENT AND FOLLOW SAFE LABORATORY PRACTICES DURING THE HANDLING OR DISPOSAL OF THIS CHEMICAL.

THE ABOVE INFORMATION IS BELIEVED TO BE CORRECT AS OF THE DATE HEREOF. HOWEVER, NO WARRANTY IS MADE, EITHER EXPRESSED OR IMPLIED, REGARDING ITS ACCURACY OR THE RESULTS TO BE OBTAINED FROM THE USE OF SUCH INFORMATION. ALGAE-X INCORPORATED SHALL NOT BE HELD LIABLE FOR ANY DAMAGE RESULTING FROM HANDLING OR FROM CONTACT WITH THE ABOVE PRODUCT.