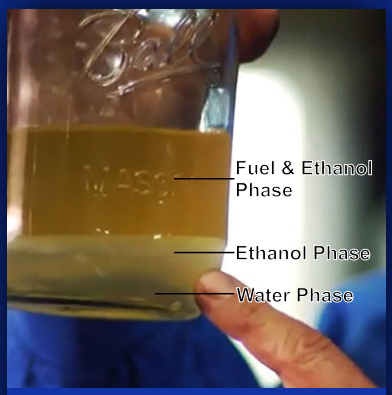
BENVEROY
Smart Fuel Solutions

Types of Fuel Contamination

INDEX

BENVEROY
Smart Fuel Solutions



Fuel Phase Separation caused by Hygroscopic nature of Ethanol.


Seized Injectors after prolonged use with Fuel contaminated by Illuminated Paraffin.


Corrosion inside underground fuel storage tank - caused by water attracted to hygroscopic Ethanol.

Types of Fuel Contamination

Contamination of Diesel or Petroleum not only causes a severe increase in Carbon Emissions, but can also lead to serious and often catastrophic engine damage or failure.

Ethanol Blending:

Several African countries are implementing or exploring the use of Ethanol in Petrol & Diesel to reduce reliance on imported fuels and promote domestic Biofuel production.

- **South Africa, Nigeria**, **Malawi**, and **Uganda** are among the countries actively involved in ethanol blending.
- Research and development efforts for ethanol production and blending are underway in countries like **Tanzania**, **Zambia**, **Mozambique**, **Madagascar**, Ghana and **Zimbabwe**.

Problems Caused by Ethanol Blending:

- **Water Contamination:** Ethanol, when mixed with gasoline, can lead to water contamination issues due to Ethanol's hygroscopic nature (its ability to attract and absorb water).
- **Fuel Phase Separation:** Where water and Ethanol with Diesel / Petrol separate from the gasoline and form a distinct layer at the bottom of the fuel tank.
- **Engine Damage:** This separated layer can clog fuel filters and carburetors, or be drawn into the engine, causing rough idling, stalling, or even engine damage.
- **Microbial & Fungal Growth:** The presence for this water layer also creates the perfect environment for Microbial & Fungal growth *(more info on the latter under 'Microbial, Fungal & Yeast Contamination')*

Illuminating Paraffin Blending:

The adding of Illuminating Paraffin to, predominantly, Diesel in order to save costs is fast becoming a major concern and regular occurrence in multiple African Countries.

Problems Caused by Illuminating Paraffin blending:

- **Reduced Flash Point:** IP lowers the flash point of diesel, making it more flammable and increases the risk of fire, especially around storage facilities.
- **Compromised Lubrication:** IP reduces the viscosity of diesel, which can lead to insufficient lubrication of fuel pumps and injectors.
- **Injector Issues:** Reduced lubrication can cause injectors to malfunction, leading to incorrect fuel delivery, increased fuel consumption, noisy operation, and black smoke.

BENVEROY
Smart Fuel Solutions

Abrasive metal particles found in Diesel fuel system, caused by Diesel with adulterated lubricity.

Fuel Pump Corrosion caused by water contamination also leads to the presence of abrasive metal particles within the fuel system.

Filter clogged by Microbial / Fungal contamination aka 'Diesel Bug'

Illuminating Paraffin Blending Continued:

- **Engine Damage:** In extreme cases, injector failure can cause engine damage, including piston crown failure.
- **Lower Cetane Levels:** IP reduces the cetane number of diesel, which can result in slower starting and rougher engine operation.
- **Increased Sulfur Content:** IP may increase the sulfur content, potentially leading to black smoke production.

Heavy Metal Contamination:

Heavy metal contamination in fuel, particularly from sources like leaded gasoline or industrial byproducts, poses significant environmental and health risks. These contaminants can be released into the atmosphere through combustion, leading to air and soil pollution.
Long-term exposure to heavy metals can cause various health problems, including respiratory issues, neurological damage, and even cancer.
Metal particles, especially rust and other debris, can act like sandpaper within the fuel system. As contaminated fuel passes through the system, these particles grind against engine components, causing them to wear down faster than they should.

Problems Caused by Heavy Metal Contamination:

- **Human Health:** Exposure to heavy metals can lead to various health problems, including neurological damage, respiratory issues, kidney problems, and increased cancer risk.
- **Fuel System Damage:** Fuel injectors, pumps, and fuel lines are particularly vulnerable to this abrasive wear. Contaminants can clog these parts, restrict fuel flow and cause them to fail.
- **Reduced Performance:** Damaged fuel injectors can lead to misfires, rough idling, and a loss of power, especially during acceleration or when going uphill.
- **Engine Failure:** In severe cases, the damage caused by contaminated fuel can lead to complete engine failure, requiring costly repairs or replacement.

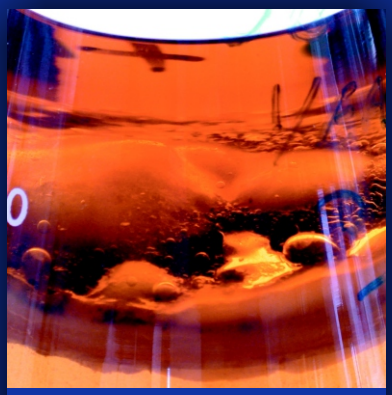
Microbial, Fungal & Yeast Contamination:

Microbial and fungal contamination in diesel and petroleum, often called 'diesel bug', is caused by Bacteria and Fungi that thrive in the presence of water, leading to fuel degradation, filter blockages, and potential system failures.
Microbial growth can lead to the formation of sludge and biofilms, which can clog filters and fuel lines.
This contamination is particularly prevalent in fuels containing Biodiesel or Ethanol due to its hygroscopic nature (attracting and holding water).
Species like Hormoconis resinae (a fungus) and various bacteria such as Clostridium, Desulfovibrio, and Pseudomonas are frequently found in contaminated fuel.
Yeasts such as Candida & Saccharomyces, and others can also contribute to fuel contamination.

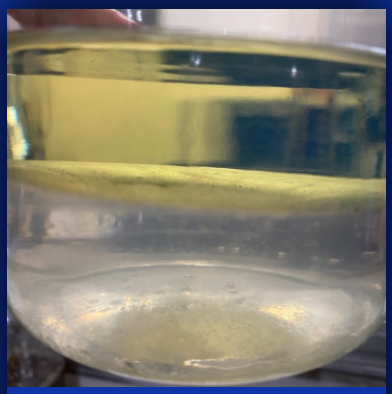
Problems Caused by Microbial & Fungal Contamination:

- Fuel degradation.
- Filter Clogging.
- Corrosion.
- Engine Deposits.
- Reduced Fuel Efficiency.
- Reduced Performance.

BENVEROY
Smart Fuel Solutions



Microbial growth in fuel caused by water contamination.



Water contamination & Fuel Phase Separation present in fuel.

Fuel System damage caused by water contamination.

Water Contamination:

Water contamination in diesel and petroleum fuels is a serious issue that can lead to engine damage, reduced performance, and costly repairs. Water can enter fuel systems through condensation, leaks, or poor handling, and it can cause corrosion, microbial/fungal growth (diesel bug), leading to fuel injector failure.
Diesel and Petroleum fuels are not naturally miscible with water. Water contamination can occur when water droplets mix with the fuel (suspended or emulsified water) or when it settles at the bottom of the tank as free water.
Water can also enter fuel tanks through condensation (moisture in the air), rainwater infiltration, faulty seals, or during fuel transfer.

Problems Caused by Water Contamination:

- **Corrosion:** Water promotes rust and corrosion of metal components in the fuel system, including the tank, fuel lines, and injectors.
- **Microbial & Fungal Growth (Diesel Bug):** Water provides an environment for bacteria, fungi, and other micro-organisms to thrive, leading to the formation of sludge and further contamination.
- **Engine Damage:** Water in fuel can damage fuel injectors, leading to poor combustion, reduced power, and even injector failure.
- **Reduced Fuel Efficiency:** Water displaces fuel, reducing the fuel's energy content and potentially leading to decreased fuel efficiency.
- **Fuel Filter Clogging:** Microbial growth and corrosion can lead to sludge and rust particles that clog fuel filters, disrupting fuel flow and causing engine problems.
- **Fuel Gelling or Freezing:** Water contamination of Diesel in cold climates, can lead to Fuel Gelling or Icing which results in clogging and failure to start.

*N-Methylaniline (NMA) Dosing:

PetroSA pursued a three-year deal – potentially worth R11-billion – to buy chemically adulterated Unleaded Petrol from little-known company Nako Energy.
Tests found that the fuel – sourced from the UAE – was dosed with N-Methylaniline, a chemical additive that improves the octane levels of low-quality fuel, like an 89 Petrol (which is cheaper due to a simpler refining process) into a 95 Petrol, however, it leads to other problems, including gum build-up that can seriously damage engines.
The recommended safe percentage of NMA additive is below 1.2%, but the NMA dosed Petrol in South Africa tested positive (by Astron & Sasol's independent labs) for a 6.6% NMA content as well as high levels of gum.
Despite the adverse test results and alarm from the fuel industry, PetroSA agreed to buy another cargo of the same fuel at a cost of R634-million.

“This particular blend it was supposed to be a gamechanger,” PetroSA's former head of trading Vusi Xaba, who oversaw the deal, recently told us.
Octane-boosters are an everyday part of the fuel business: until it was banned, lead was used to boost the octane of fuel. It has since been replaced by compounds like benzene and ethanol, but recently other chemical additives have been creeping into fuel as well.

***Source:** www.amabhungane.org*

***Title:** Dirty Fuels Part 2: PetroSA's R11-Billion 'Contaminated' Petrol Deal.*

***Journalist:** Susan Comrie*

***Date:** 8 June 2025*

BENVEROY
Smart Fuel Solutions

Problems Caused by N-Methylaniline Dosing:

- **Highly Toxic Emissions:** Exposure can cause a range of health problems, including respiratory irritation, skin and eye irritation, methemoglobinemia, liver and kidney damage, as well as potential impacts on the central nervous system. High levels of exposure can even lead to death.
- **Gum Buildup:** N-Methylaniline (NMA) gum buildup in engines can lead to several issues, primarily due to its tendency to form sediments and potentially cause corrosion. It can also lead to engine knocking and potentially damage the engine's computer by interfering with octane number readings.
- **Sediment Formation:** NMA, when present in gasoline, can form sediments within the engine, particularly in the combustion chamber. These sediments can disrupt the normal operation of the engine.
- **Corrosion:** NMA can contribute to heavier copper strip corrosion, which can lead to corrosion within the engine itself, potentially damaging engine components.
- **Engine Knocking:** NMA can interfere with the engine's ability to accurately read the octane number, potentially causing the engine to knock or experience premature detonation. This can damage engine components and reduce performance.
- **Environmental Impact:** NMA is a nitrogen-containing compound, and when it reacts with oxygen, it forms nitrogen oxides (NOx), which are harmful greenhouse gases.

Used Transformer Oil (UTO) Blending:

Blending Used Transformer Oil (UTO) into diesel fuel poses several risks to engines and the environment due to the potential for increased emissions, engine damage, and harmful environmental impacts.

Problems caused by UTO Blending:

- **Pollution:** Used transformer oil contains contaminants like PCBs, PAHs, heavy metals, and other harmful substances. Improper disposal or combustion of these oils can release these pollutants into the air, soil, and water, contaminating ecosystems and posing risks to human and animal health.
- **Increased Emissions:** Blending UTO with diesel can lead to higher levels of pollutants like NO, CO, and CO2 in exhaust gases. This contributes to air pollution and can exacerbate respiratory problems and other health issues.
- **Flue Gas Contamination:** The combustion of UTO blends can result in elevated levels of sulfates, sulfides, nitrates, and nitrites in flue gases. These compounds can contribute to acid rain and other environmental problems.
- **Injector Clogging:** The high viscosity and potential for particulate matter in UTO can clog fuel injectors, leading to poor engine performance, reduced power, and potential engine damage, according to a car question and answer website.
- **Increased Wear:** UTO may lack the necessary lubricating properties of standard diesel fuel, leading to increased wear and tear on engine components like fuel pumps and injectors.
- **Combustion Issues:** The properties of UTO, such as its ignition temperature and viscosity, can differ significantly from diesel fuel, potentially causing incomplete combustion and reduced engine efficiency.

BENVEROY
Smart Fuel Solutions

Contact Details:

Vernon Bartlett
(Director)

+27 79 524 1461
+27 71 607 7798
vernon@benveroy.com

Werner Pretorius
(Sales & Operations Manager)

+27 82 927 4805
ops@benveroy.com

Unit 11
Lakeview Industrial Park
Malcolm Moodie Crescent
Jet Park
Gauteng Province
Republic of South Africa
1518