



# Introduction to Using Waste Motor Oil as Fuel

by Jason Jelonek

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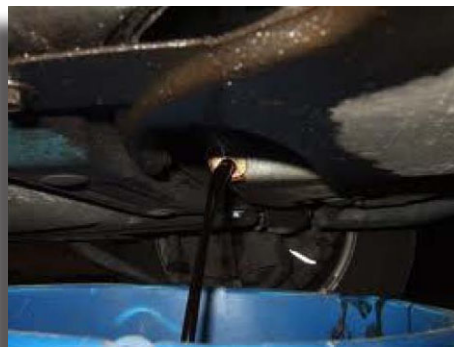
# Introduction to Using Waste Motor Oil as Fuel

by Jason Jelonek

Used motor oil from engines is a waste product that can be turned into fuel. Once the oil is cleaned and viscosity reduced, the waste oil can power a waste oil burner or diesel engine. Is it that simple? Yes, with the proper equipment and knowhow, it's being done by individuals across the globe.

Small-scale processing of WMO into fuel is still in the experimental stages. Many of us engage in maverick experimentation on our vehicles. Basic information from other's experimentation is gleaned from forums and we refine our processes through a never ending trial and error.

## WMO



Waste Motor Oil (WMO) is oil that comes out of an engine. It's also known as crankcase oil. This oil is the broken down, detergent depleted, contaminated oil that typically removed from vehicle engines after 3-5000 miles of use. The oil's detergents and viscosity break down, making it less effective as a lubricant inside the engine. Also, the oil is contaminated with debris sucked through the air intake, metal shavings from engine wear, glycol (antifreeze), uncombusted fuel and more.

## Safety

As with any experiment, safety is key. WMO is a flammable, toxic liquid that must be handled with care. Think of WMO as flammable toxic waste. The waste oil may contain lead, cadmium, chromium, arsenic, dioxins, benzene, polycyclic aromatics, magnesium, copper, and zinc. One quart of oil will contaminate 250,000 gallons of clean water. Essential safety equipment includes mats/spill guards, protective clothing, goggles and fire extinguishers. Remember, oil fires cannot be extinguished with water.

## Legal

There are Federal and State regulations on the transport, storage, and use of WMO. Also, Uncle Sam requires a road tax on fuel. Exemptions, special licenses, and permits vary by state. Some states have blenders licenses, allowing fuel additives like WMO to be used in vehicles. It's recommended you become familiar with your local laws before the "law" informs you. Ignorantia juris non excusat, you are liable even if you are unaware of the law. Use google to get informed. For example try searching "WMO Legal," "Florida WMO," etc. It's also suggested to keep records of how much oil you collect from each facility so there is record that the facility is disposing of their oil properly. Government agencies may want to track where the oil is going.

## How to Find WMO



Motor oil is considered trash by 99.9% of the public. In fact, it's considered worse than garbage, as you can't just dump it in a can. WMO isn't nearly as abundant as trash, so the key is finding it. To find this rather scarce "trash," you must know where to look. Here's a map to get you started:

- n Auto Repair Shops — look for independent shops, which may be more amicable to working with individuals
- n Auto Dealerships These — folks produce a lot of waste oil
- n Machinery shops
- n Trucking service company
- n Any organization that maintains their own fleets (construction companies, delivery services) —

Look for garages!

- n Schools
- n Airfields
- n Neighbors and friends — You can distribute containers to household in near your area, tell them that you will collect the motor oil when the cubie is full or they drop the cubie on our backyard if they can pass in your house.

## How to Collect WMO



Pump it! Use pumps, hoses, and tanks to collect the oil from the disposal site. You can pump it into containers like 5 gallon buckets with strong lids. Better yet would be to use a 275 gallon totes, 55 gallon drums, or old propane tanks in your pickup bed or trailer. Many cities have tank and barrel distributors to supply used containers. Additionally, you'll need a collection pump with vacuum hoses. It is good to have a suction screen on the end of a collection hose so that the pump doesn't get clogged or ruined from rags or other large debris.



**Transfer Pump** — Gear pump to make moving WMO Easy



**Totes** — These big tanks hold approximately 275 gallons of liquid. They can generally be purchased for \$125 from Craigslist or a local tank and barrel supplier.



**Tank Fittings** — Plumbing the tanks is best done with bulkhead fittings/adapters, or tank adapters. These can be found at Grainger or local plumbing supply warehouses.

### Tips

Make friends with at least one other person running on WMO. Ask for a meeting, have some coffee, share stories, and see if there's any way you can help each other out. It's uplifting to share war stories, knowledge and share in the workload and rewards. Additionally, you will gain an oily shoulder to cry on when the day comes when you just can't go on, you have a major oil spill, or it just feels like too much work.

## WMO Filtering and Cleaning — The Most Important Step



Used Motor Oil is full of contaminants that will damage your fuel system and engine. It's crucial for success to insure you are cleaning your oil to the tolerance of your fuel system and engine. This will save a host of problems and greatly reduce risk of damage to your vehicle and mental health.

Engine-based contaminants include heavy metals (lead, copper etc), water, soot, glycol (antifreeze), unburnt fuel, and metal bits from engine wear. Remember, engines constantly filter the oil, so the particulate contamination isn't as bad when sourcing straight from an engine. However, 30 micron engine oil filters aren't fine enough for to reuse the fuel in vehicles.

Some of the worst contamination happens when the oil is outside of the engine, sitting at the autoparts store, where folks tend to pollute with spent filters, antifreeze, and who knows what else.

Alas, pre-filtering and de-watering our WMO is the lynchpin to success in burning the oil without destroying our engines. There are hundreds of ways people have come up with to pre-filter oil. While it can be quite confusing, it is nice to have options, allowing you can design a filtration process that meets your budget and abilities.

I wish there was a way to simplify pre-filtering. You almost need to become an expert on the subject to confidently clean waste oil. I'll give you some basic information to help get you started.

1. For most fuel systems, the WVO needs to be cleaned down to 10 micron absolute.
2. All free and suspended water needs to be removed from the oil
3. Oil is lighter than water and most contaminants, so time and gravity will separate the good from the bad. Settling is key!
4. The warmer the oil, the faster it will settle and filter.



Don't let the cleaning of your oil scare you off from running WMO. Learn about it, consider all of the factors and do the best that you can within your resources. If you are concerned about ruining your engine, heed those concerns. Take the precautions you feel are necessary. The most important thing to know is that the oil must be de-watered and cleaned to an absolute micron level before it enters your engine either by the filtration setup on your vehicle or during pre-filtering. Most sensible folk prefer to meticulously clean their oil prior to putting it into their vehicle to prevent gunk in the fuel lines and side-of-the-road breakdowns due to clogged filters. The vehicles filter systems should be used as backup, or precautionary for the contaminants that may have been missed or entered the oil after the pre-filtering.

## WMO Cleaning Methods/Steps

### **Step 1 — Settle**

This is my favorite step because it requires us to do nothing. Just let the oil sit and allow gravity to do the work for us. Gravity — Our filtering ally!

Oil is lighter than water. With enough time and heat, the water and most of the dirt will settle to the bottom. Settling is key and is something we all use.

How long do you settle? As long as possible is the short answer. It really depends on the contamination of the oil and temperature. We find out through a process of trial and error as to how long is necessary. If you are plugging your filters or flooding your centrifuge quickly (i.e., after 30 gallons of oil), then you should let the oil settle longer. To speed up the settling process, you can heat the oil with sunlight or other forms of heat, like band heaters for barrels.

### **Step 2 — Filtration and Centrifuging**

Once the oil has been properly settled, it's time to run it through a filter or centrifuge. Either pour the oil off the top of a container, or pump it off of the top of your tank, barrel, tote, etc.

#### ***Filtration***

Filtering is best done in stages, starting with a course filter (inexpensive and catches the large particles) and ending with a water blocking fine filter (with an absolute rating and water block to catch the really fine particles)

#### ***Initial Filtering***

Literally, anything porous can be used as a filter: House screen, blue jeans, old sheets, etc. You can get screens that fit nicely over the top of barrels. Also, bag filters can be used, which are hung like bags and oil is dumped or pumped through. Many folks also use house water filter housing and cartridges



for initial filtering. Their filter media is not good for final filtering as they don't have an absolute rating. Most filters do not block water either. They need to say something like "waterblock." Water blocking filters have a poly coated membrane, which swells and absorbs water, or blocks the water from passing.



**Filter Bags** — These are fabric bags that hang while oil is poured or pumped through. Oil is often recirculated through these 101 times. These filters are only rated at *nominal* micron levels.

### **Final Filtering**

Final filtering is the fine cleaning and polishing that needs to happen before burning the waste oil. This is the key step, and plan to spend your time and money selecting and purchasing quality filters or a centrifuge to complete this step.



**"Spin On" or Cartridge Filters** — Many people use these for initial and final filtering. Diesel truck filters are often used with a micron rating of 10 absolute, with waterblock!



**Centrifuging** — is an extremely effective, sure, and simple way of “force-settling” the oil, de-watering it and cleaning it to ,1 micron. Oil can be cleaned and completely dewatered in one pass, making this a time and space saving solution. When filtering large quantities, centrifuges are an obvious choice. These “open bowl” centrifuges are becoming more and more popular due to their simplicity and effectiveness

### Tip

#### Absolute vs. Nominal Micron Rating

Most filters have an Absolute or a Nominal Micron rating. Absolute means absolutely no particles bigger than the stated rating will pass through the filter. Nominal means it only stops some, not all of the particles of the specified size. So, you can use a 20 micron nominal filter for initial filtering, but do not rely on it for final filtering. House water filters are only nominal.

### Spontaneous Combustion

Oil soaked rags and fabrics may spontaneously combust if left crumpled up long enough. It is a safe practice to properly discard all soaked rags, towels, and filtering fabric as you finish using them. Spontaneous combustion is more likely after fabrics have been washed and reacted with laundry detergent chemicals.

## Testing

If your on-board or vehicle filter clogs up quickly, like less than 1000 miles, you are not cleaning your oil well enough.

Hot Pan Test and/or Crackle Test — This is the widely accepted test for water in oil. It involves heating oil so that any remaining water turns to steam and bubbles. If you have no bubbles once heated, then you are water free! If the oil is popping and bubbles are bursting, then you have free water.

[More on the crackle test](#)

## Blending



For proper flow through fuel lines, filters, and injectors, the WMO needs to be thinned down to near the viscosity of diesel. To accomplish this, WMO is blended with other viscosity reducing fuels. There are a variety of ways to blend, with many folks documenting success with each. Here are some examples.

**Diesel, D2** — **Advantages:** readily available, fuel systems are designed for, can blend at high percentage

**Drawbacks:** Expensive, not the best at reducing viscosity

**Typical Blend:** 25–50% Diesel

**Kerosene, K2** — **Advantages:** can be blended in high percentage tolerant of heat, lubricating, and won't negatively affect combustion

**Typical blend** of 10–30% K2

**Regular Unleaded Gas, RUG** — **Advantages:** greatly reduces viscosity, readily available

**Drawback:** highly volatile

**Typical Blend:** 15%RUG

**Ethanol, E85** — **Advantages:** Reduces smoke, cheaper than diesel and RUG

**Drawbacks:** hard to find in some areas

**Typical Blend:** 15% E85

**Acetone** — **Advantages:** Excellent viscosity reducer

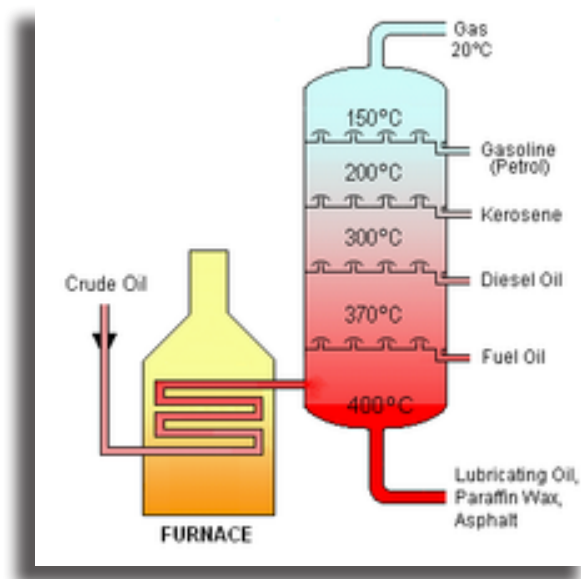
**Drawbacks:** Expensive, powerful solvent, highly volatile

**Typical Blend:** 10–20% Acetone

### Tech Tip

Blending can be done prior to cleaning for better flow through filters or a centrifuge.

## Cracking



Cracking is a process of breaking down heavy, complex hydrocarbon molecules into simpler, lighter hydrocarbons with the application of heat, catalysts, or solvents. It is a way to reduce the viscosity of WMO to diesel without adding any additives.

To crack WMO into diesel, heat to 625° F (330° C) and collect the vapors to yield #2 diesel-like product. That's essentially the same process large refineries undertake with crude oil, however, they refine the diesel distillate even further. This process has been shrouded in secrecy for decades, as oil companies keep tight lipped about their distillation processes.

Alas, some of us mavericks are re-inventing the wheel by making crude home based refineries with a simple array of metal containers, pipes, and valves. Search youtube for "cracking wmo." Safety is key.

### Fun Fact

There are even ways to crack plastic into diesel fuel. 9lbs of plastic will yield a gallon of diesel (1 kg yields 1 liter).

## Waste Motor Oil in Diesels



Burning in Waste Motor Oil in a vehicle is still in the experimental stages. I mean it works; you can burn WMO and power over the mountain pass. And oh yeah, it can be very profitable, saving loads of cold hard cash at the pump. Still under investigation however, is the longevity and compatibility with specific fuel systems. Many undertake "maverick" experimentation on their personal vehicles. These experiments are documented in forums, mainly in vehicle-specific forums.

Vehicles with direct injection systems have proven well with WMO and blends. The vehicles with robust injection and lift pumps are WMO friendly. Here are some popular vehicles to run on waste oils.

- n 94.5-2002 Ford Powerstroke
- n 94-2002 Dodge Cummins
- n 79-85 Mercedes Diesel
- n 90s VW TDI

## Tip

Common Rail Injection systems have not proven well with WMO.

## Forums

### ***Dodge Forums***

<http://www.turbodieselregister.com/forums/>

<http://www.dieseltruckresource.com/dev/>

<http://www.oilburners.net/forums/forumdisplay.php?14-Dodge-Cummins-Diesels>

### ***Ford Forums***

<http://www.powerstroke.org/forum/bio-diesel-alternative-fuels-supplements/45087-waste-motor-oil-fuel.html>

<http://www.oilburners.net/forums/forumdisplay.php?10-Ford-Diesel-Forums>

<http://www.ford-trucks.com/forums/>

<http://www.thedieselstop.com/forums/>

### ***GM Forums***

<http://www.oilburners.net/forums/forumdisplay.php?4-General-Motors-Diesels>

<http://www.duramaxforum.com/forum/>

### ***Mercedes Forums***

<http://www.mbca.org/forums/technical-forums/alternative-fuels-hybrids>

<http://www.benzworld.org/forums/>

<http://www.peachparts.com/shopforum/>

### ***VW Forums***

<http://www.oilburners.net/forums/forumdisplay.php?27-Volkswagen-TDI-Diesels>

<http://forums.tdiclub.com/>

## Waste Motor Oil in Burners



Waste Oil Burners are heaters that run on oil. Most are originally designed to run on the less viscous “fuel oil” and are modified to run on WMO. These burners are often found in shops or commercial facilities. Common mods are special nozzles and pre-heating the waste oil prior burning. The WMO should burn without any smell or smoke. A typical gallon of waste oil contains 140,000 to 165,000 BTU.

The most popular burners are Beckett AF or a Carlin gun-style oil burner. A conversion of a burner costs 300–1000.

There are two types of nozzle conversions:

**Pressure Nozzle** — need really clean oil and are easier to convert (5 micron min.)

**Siphon Nozzle** — require compressed air, but clog less frequently than Pressure Nozzles (50 micron min.)

The other main mod is the preheating. The viscous WMO needs to be heated to at least 200° F.

### Forums

<http://groups.yahoo.com/group/altfuelfurnace/>

<http://wasteoilheaterforum.com/index.php>





**Drip-Fed Waste Oil Burner** — These are far less complicated than the injection style burners. Waste oil simply drips from a copper tube on a hot steel plate, which causes the oil to vaporize and be burnt by a flame. These are very cost effective, yet need to be supervised like a campfire. There are some great examples on youtube.

### **Additional Reading, Plans, and Designs**

[http://journeytoforever.org/biofuel\\_library/ethanol\\_motherearth/me4.html](http://journeytoforever.org/biofuel_library/ethanol_motherearth/me4.html)

## **Oil Disposal**

### **\*Disposing of Sludge and Unusable Oil**

Remember, this is WMO toxic waste. Handle with care and dispose of properly. I've found that local Hazmat centers will take the garbage WMO in containers. Many accept only 15 gallons at a time due to transport laws. Make sure you say it is from personal use, otherwise, there is likely to be a fee.

### **Disclaimer**

Using waste motor oil as fuel is experimental and it can pose health, environmental, and legal risks. This guide is meant to be an introduction, not a literal means of making alternative fuel. If an area or method appeals to you, do more research and attempt at your own risk. WVO Designs will not be liable to any personal or property injury that results from using information in this guide.

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