# Winter is Coming: Prepare Diesel Fuel Systems Before the Temperature Drops

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Every year, locomotives, service equipment, fuel facilities, and maintenance teams find themselves dealing with plugged filters, fuel starvation events, frozen water, and equipment that ran perfectly the day before temperatures dropped.

The reality is that winter fuel reliability is rarely determined by emergency actions during a cold snap. More often, it is determined by thoughtful decisions made weeks or months earlier.

Water left in storage tanks. Fuel inventories not rotated. Seasonal fuel transitions delayed. Additives applied improperly. Biodiesel impacts misunderstood. Fuel quality concerns ignored because operations appear normal during warm weather. When temperatures fall, the fuel system simply reveals problems that were already there. The good news is that most winter fuel issues are predictable, preventable, and manageable.

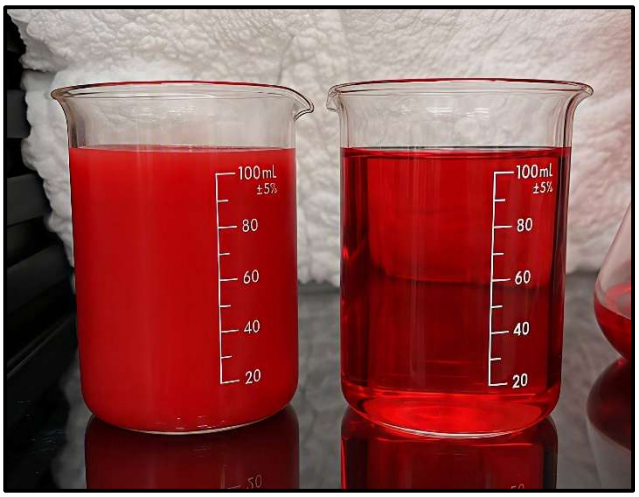
## Understanding the Real Enemy

Many people refer to any winter fuel failure as "fuel gelling." While gelling certainly occurs, it is only one of several causes of winter fuel filter plugging events.

A locomotive experiencing fuel starvation at 10°F may be suffering from:

- Diesel wax crystallization
- Biodiesel-related filter plugging
- Frozen water contamination
- Pipeline Drag Reducing Agent (DRA) contamination
- Microbial contamination
- Existing filter restrictions that become critical during cold weather
- Possibly other factors outside the scope of this short article

The corrective action depends entirely on identifying the actual cause. Treating every fuel-related winter event as "gelling" can result in unnecessary downtime, ineffective corrective actions, and repeated failures.




*Summer fuel (left) becomes cloudy and 'gels' while winter fuel (right) remains 'clear and bright' liquid in a cold test chamber.*

## Know Your Fuel's Cold Weather Limits

Three key fuel properties which largely determine winter operability:

### Cloud Point

Cloud Point is the temperature at which wax crystals first become visible in diesel fuel. At this point the fuel develops a cloudy appearance as paraffin wax begins coming out of solution. Cloud Point is often the earliest warning sign of approaching operability concerns.

### Cold Filter Plugging Point (CFPP)

CFPP represents the temperature at which a required volume of fuel can no longer pass through a standardized test filter. For most operations, this parameter is often more representative of real-world winter performance than Cloud Point alone.

### Pour Point

Pour Point is the lowest temperature at which the fuel will still flow. Once this threshold is reached, the fuel can no longer be pumped effectively.

Each of these properties can serve as a guide, or a relative measure, but they do not signify an absolute temperature where fuel changes from 'good' to 'bad'. A fuel advertised as "good to -20°F" may be referring to Cloud Point, CFPP, or Pour Point. Those are three very different claims.

## Water: The Most Preventable Winter Problem

While diesel wax receives most of the attention, water remains one of the most common causes of winter fuel trouble. Storage tanks naturally accumulate water through:

- Condensation
- Deliveries containing trace water
- Leaking tank components
- Poor housekeeping practices

As temperatures decline, free water can freeze in various locations throughout the fuel system, restricting fuel flow and creating symptoms nearly identical to fuel gelling. The solution is neither complicated nor expensive:

- Drain all tank bottoms routinely.
- Increase inspection frequency heading into winter.
- Investigate unexplained water accumulation.
- Replace damaged seals, vents, and access covers.
- Monitor overall fuel and fuel system health before severe weather arrives.

The best time to remove water from a tank is long before temperatures reach freezing.

## Don't Let Fuel Sit Through Seasonal Changes

One of the most overlooked winter preparation activities is inventory rotation. Tanks with limited usage can sometimes retain fuel purchased during warmer months. That fuel may never have been treated for winter service or blended for low-temperature operation.

As temperatures drop, those dormant tanks often become the first locations to experience filter plugging events.

Before winter arrives:

- Review fuel inventory age.
- Rotate low-usage tanks.
- Verify winterized fuel has reached all locations.
- Avoid maintaining large quantities of summer fuel into winter months.

# Biodiesel Requires Additional Attention

The increasing use of biodiesel blends has added another layer of winter fuel management. Unlike traditional diesel gelling, biodiesel-related filter plugging can occur at most any temperature. However, certain biodiesel byproducts may form and affect filterability in the 35°F to 40°F (2°C to 4°C) range.

When this occurs, a brown, grease-like, or toothpaste-like material may form and plug filters. Unlike paraffin wax, this material often remains soft and pasty even after warming to room temperature. This distinction is important.

If the material melts quickly at 32°F (0°C), water ice is a prime suspect. If it melts over a broad band, below room temperature, wax crystallization is a likely suspect. If the material remains stable at room temperature, biodiesel byproducts may be present. In any case, additional laboratory investigation may be warranted.

The increased use of alternate fuels makes laboratory support and routine fuel analysis more important than ever. Biodiesel can be successfully managed in cold climates, but its low-temperature performance characteristics must be understood and incorporated into winter fuel planning.

# Cold Flow Improvers Are Preventative Tools, Not Emergency Fixes

Cold Flow Improvers (CFIs) remain a valuable component of winter fuel programs, but they are often misunderstood. CFIs work by modifying wax crystal formation as temperatures fall.

Rather than allowing large wax structures to develop, the additive helps maintain smaller crystals that pass through filters more effectively. However, there are several important limitations:

- CFIs are primarily preventative.
- CFIs must be added before wax forms, ideally with the fuel at least 15°F (8°C) above cloud point for proper mixing.
- Over-treating may reduce effectiveness.
- Not all products perform equally well with biodiesel blends.
- Proper mixing in the fuel tank is essential.

One of the most common mistakes occurs when additives are introduced after fuel has already experienced cold-weather problems. At that point, expectations often exceed chemistry. However, special classes of 'Rescue' additives may help reduce already-formed wax in cold fuel.

# Testing Beats Guessing

When winter fuel issues arise, speculation can be costly. The difference between wax crystallization, biodiesel contamination, DRA carryover, water freezing, and other operability issues cannot always be determined through visual inspection alone.

Routine fuel testing and retained fuel samples can provide valuable insight into:

- Water contamination
- Fuel cleanliness
- Cloud Point
- Cold weather operability
- Biodiesel concentration
- Unusual contaminants

Testing is particularly important when operating across large geographic territories where fuel sources, blending practices, and environmental conditions may vary substantially.

*Simple Jar Test – Fuel is drained from the bottom of a tank into a clean glass jar. The fuel is then inspected with a flashlight for any visual signs of cloudiness, water, and floating, suspended, or settled particulates or multiple layers, indicating free water.*

## A Simple Winter Preparation Checklist

Before temperatures begin falling, consider the following actions:

✓ Drain and inspect storage tank bottoms

✓ Verify winterized fuel inventories have reached all locations

✓ Rotate fuel in low-use tanks

✓ Review additive usage and application practices

✓ Replace marginal filters before cold weather arrives

✓ Increase fuel sampling frequency and testing to verify cold weather performance

✓ Verify supplier winter fuel transition schedules

✓ Investigate recurring water contamination issues

✓ Educate operating personnel on different plugging mechanisms

✓ Establish laboratory support contacts before problems occur

## Final Thoughts

Winter operability should be a year-round fuel quality initiative rather than a seasonal emergency. The organizations that experience the fewest winter fuel issues are typically the same organizations that monitor fuel quality consistently, maintain clean storage systems, and address small concerns before cold weather amplifies them.

Winter will test every fuel program. The question is whether those lessons are learned in September from early preparation efforts or in January beside a locomotive that won't load.

As with most maintenance challenges, the least expensive winter fuel problem is the one that never happens.

### Additional Members-only Content

Downloadable Fuel Filter Plugging Issues Guide

LMOA 2026 Annual Proceedings Book