

PEAK Explains the Chemistry Behind DEF Purity, Deposit Prevention and Diesel Performance

Old World Industries' Scott Bredenberg joins EPARTRADE's Race Industry Now to examine how fluid quality, exhaust temperature and handling practices affect modern diesel aftertreatment systems.

Diesel exhaust fluid may contain only two primary ingredients, but its role in modern diesel operation involves a precise interaction of chemistry, temperature, dosing and contamination control.

During EPARTRADE's Race Industry Now Episode 643, **“DEFinitive Insights – Diesel Exhaust Fluid's (DEF) Purpose and How Purity Equals Peak Performance”** by PEAK, Scott Bredenberg, Training Manager at Old World Industries (OWI), explored the technical factors behind effective DEF use and the operating conditions that can compromise an otherwise properly functioning system.

Hosted by Brad Gillie from SiriusXM, Channel 90's *Late Shift*, the discussion offered practical insight for technicians, fleet operators and racing organizations that depend on diesel-powered transporters and support vehicles.

A precise formulation with a specific chemical purpose

Bredenberg explained that DEF consists of **32.5% high-purity, automotive-grade urea and 67.5% deionized water**. The urea is synthetically manufactured, while the water is treated to remove dissolved mineral salts and other impurities that could interfere with aftertreatment operation.

He identified ISO 22241 as the standard governing DEF composition and quality, emphasizing that the correct ingredient ratio is only part of the equation. Manufacturing controls, distribution practices and handling at the point of use all contribute to the quality of the fluid reaching the vehicle.

DEF operates within the selective catalytic reduction, or SCR, system. Injected into the exhaust stream upstream of the SCR catalyst, the fluid undergoes a sequence in which water evaporates and urea decomposes to generate ammonia. That ammonia participates in catalytic reactions that convert nitrogen oxides, commonly called NOx, into nitrogen and water.

The distinction matters: DEF supports a chemical process in the exhaust system. Its effectiveness depends on the interaction between the fluid, the dosing equipment, exhaust conditions and the catalyst.

SCR and DPF regeneration perform different jobs

One recurring misconception addressed during the webinar was the belief that DEF directly causes diesel particulate filter regeneration.

Bredenberg explained that the diesel particulate filter, or DPF, captures particulate matter. Regeneration uses heat to oxidize accumulated soot and restore the filter's capacity. The SCR system, meanwhile, uses DEF-derived ammonia to reduce NOx.

Although these components operate within the same overall aftertreatment system, they address different emissions.

That distinction also applies to troubleshooting. A warning message, derate or drivability complaint should not automatically be attributed to contaminated DEF. Bredenberg noted that sensor faults and other hardware problems can produce symptoms operators may mistakenly blame on the fluid itself.

Why exhaust temperature influences deposit formation

A central technical topic was the relationship between exhaust temperature and DEF deposits.

Bredenberg explained that extended idling, stop-and-go driving and low-load operation can reduce exhaust temperatures, creating less favorable conditions for water evaporation and urea decomposition.

Under those conditions, injected droplets may persist or contact system surfaces, allowing deposits to develop around the injector, within the exhaust mixing area or elsewhere in the SCR system.

During the discussion, he cited approximately **484°F, or 251°C**, as a favorable temperature reference for the process in the injection chamber. His broader point was that fluid quality alone cannot compensate for every operating condition: sufficient heat is an essential part of effective DEF conversion.

Some deposits may clear as normal operating conditions return, he explained. More substantial or persistent accumulations can harden and require physical cleaning or component service.

According to Bredenberg, significant buildup can restrict exhaust flow, increase backpressure and affect fuel economy. It can also interfere with aftertreatment performance and contribute to changes in DEF dosing as the system attempts to maintain NOx conversion.

Prevention and cleaning are different expectations

Bredenberg described OWI's **BlueDEF Platinum** as incorporating factory-blended technology designed to help prevent deposits and keep the SCR system clean.

He emphasized, however, that preventing new deposits should not be confused with reversing years of accumulated material. An older system with substantial buildup may require mechanical intervention.

His recommendation was to consider deposit prevention early, particularly when a vehicle is new or after SCR components have been replaced.

He also explained why OWI does not recommend adding separate aftermarket additives to its DEF products. Field mixing introduces uncertainty about the amount of fluid in the tank, the concentration of the added product and whether the intended treatment ratio has been achieved.

Factory blending, he said, allows the manufacturer to control the formulation and verify the finished product before distribution.

Purity must survive the entire handling process

Bredenberg stressed that maintaining DEF quality extends beyond the production facility.

He described OWI's triple filtration process and batch testing, along with controls intended to protect the fluid during distribution. Once DEF reaches a shop, bulk tank or vehicle, filling practices become another critical part of contamination prevention.

Even small amounts of foreign material can matter. Bredenberg used an example of a teaspoon of salt contaminating a 5,000-gallon load to illustrate the sensitivity of DEF to impurities.

For operators working in winter conditions, road salt near a filler opening represents one potential contamination source. Open containers, dirty dispensing equipment and accidental introduction of other liquids create additional opportunities for problems.

He also cautioned against diluting DEF with water. Changing its composition compromises the carefully controlled formulation rather than extending its useful supply.

Storage conditions affect usable life

Heat and direct sunlight were the principal storage concerns identified in the discussion.

Bredenberg explained that prolonged exposure to high temperatures can accelerate degradation, making storage location and inventory turnover relevant considerations for both individual users and bulk purchasers.

He noted that DEF can remain usable for multiple years under favorable storage conditions, while emphasizing the importance of avoiding excessive heat and direct sunlight.

Freezing presents a different situation. DEF freezes at approximately **12°F, or -11°C**, but Bredenberg explained that freezing does not inherently ruin the fluid. Once thawed, it remains

usable, and vehicle systems commonly incorporate tank heating to support cold-weather operation.

For operators carrying spare containers, the practical concern is having fluid available in a pourable state when a refill is needed.

Consumption should be evaluated against the duty cycle

Bredenberg placed typical DEF consumption at approximately **2% to 6% of diesel fuel consumption**, depending on vehicle class, load and operating conditions.

That equates to roughly two to six gallons of DEF for every 100 gallons of diesel consumed. He described lighter-duty applications as generally operating toward the lower end, with heavier applications often consuming a larger proportion.

For racing transporters and other heavily loaded vehicles, changing DEF consumption should therefore be considered alongside fuel use and duty cycle. Increased consumption alone does not establish a system fault.

Protecting performance through system efficiency

The performance benefit of proper DEF use is fundamentally about preserving efficient operation.

Bredenberg explained that keeping the SCR system clean supports effective NO_x conversion, appropriate dosing and normal exhaust flow. Conversely, deposits and system restrictions can contribute to lost efficiency, increased operating costs and service requirements.

For technicians and operators, the webinar's message was clear: understand the chemistry, account for operating conditions, protect fluid purity and diagnose the complete system. Those practices help keep diesel aftertreatment functioning as designed and the vehicles supporting the racing industry ready for the next trip.

For more information, [watch the full webinar here.](#)