Canadian Petroleum Products Institute | Institut canadien des produits pétroliers

Ultra Low Sulphur On-road Diesel (ULSD)

Questions & Answers

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BACKGROUND

Q1. What is ULSD?

A: ULSD stands for Ultra Low Sulphur Diesel. It is sometimes referred to as the new, on-road (highway) 15 ppm LSD (Low Sulphur Diesel). It is a clean burning diesel fuel that is defined by Environment Canada to have a maximum sulphur content of 15 mg/kg (parts per million mass or simply ppm). ULSD will completely replace the current on-road LSD, which can have as much as 500 ppm sulphur content. ULSD is required for use in engines that will be equipped with advanced emission control systems starting with the 2007 model year.
ULSD may smell or appear slightly different from the current on-road LSD.

Q2. Why is ULSD being required for on-road use?

A: In order to reduce emissions from diesel vehicles, Environment Canada has established strict new emissions standards for new on-road, heavy-duty diesel vehicles and engines. Starting with the 2007 model year, compliance with these emission standards will effectively require that new heavy-duty diesel engines be equipped with the next generation of advanced emission control systems. These systems are very sensitive to sulphur levels in the diesel fuel, and cannot tolerate the levels of sulphur allowed in the current on-road LSD. Therefore, Environment Canada has established regulations to significantly lower the maximum allowable amount of sulphur in diesel fuel and thereby enable the effective operation of advanced emission control systems.
Environment Canada's emission regulations are also phasing-in stringent emission standards that apply to diesel powered light-duty trucks and passenger vehicles. These vehicles are also expected to use advanced emission control systems, in conjunction with 15 ppm ULSD, in order to meet these new standards.
Additional information about these Regulations can be obtained from the Environment Canada website: http://www.ec.gc.ca/CEPARegistry/regulations/detailReg.cfm?intReg=63
and
http://199.212.18.76/CEPARegistry/regulations/detailReg.cfm?intReg=65

Q3. When will the ULSD requirement take effect?

A: Refiners and importers must ensure that all volumes of on-road diesel fuel they produce or import are ULSD-compliant on June 1, 2006. Retail outlets must be compliant by September 1, 2006, but this may be extended to October 15, 2006 pending the outcome of a requested amendment. The extension, if granted by Environment Canada, would allow 22 ppm ULSD to be sold from September 1 until October 15, and would align with a similar extension provided in the U.S. regulation.

Q4. Will the requirement be extended to off-road diesel fuel? When?

A: Yes, Environment Canada also has finalized similarly stringent standards for off-road (sometimes referred to as non-road) diesel fuel that will be phased in over several years. Beginning in 2007, off-road, locomotive, and marine diesel fuel must meet a sulphur specification of 500 ppm. Beginning in 2010, off-road diesel fuel must meet the ULSD sulphur specification of 15 ppm (locomotive and marine fuel will remain at the 500 ppm sulphur level). Beginning in 2012, locomotive and marine diesel fuel will be required to meet the 15 ppm sulphur standard.

Q5. Are the new Canadian diesel sulphur requirements the same as the U.S. highway diesel fuel sulphur standards?

A: Environment Canada's approach on the *Sulphur in Diesel Fuel Regulations* is to align with the requirements (timing and level) of the U.S. federal regulations. The U.S. Environmental Protection Agency's rules are somewhat different with respect to how the implementation occurs. Initially only 80% of the on-highway diesel fuel must meet the 15 ppm sulphur maximum criteria. For several years after the 2006 introduction period they will allow a 500 ppm maximum on-highway diesel fuel to co-exist with the 15 ppm maximum on-highway diesel fuel. Notwithstanding the above, it is anticipated that most U.S. retail service stations and truck stops that have only one diesel tank will sell ULSD exclusively. Larger service stations and truck stops with more than one diesel tank and the ability to completely segregate these products to avoid contamination will be more likely to have 15 ppm ULSD and 500 ppm LSD available. By 2010, if a retail outlet sells on-highway diesel fuel, it must be ULSD.
All retail outlets in the U.S. selling 15 ppm ULSD and/or 500 ppm LSD are required to label their diesel fuel dispensers to indicate which fuel is being sold from that dispenser.

***NOTE*:** Because Canada will not have two grades of on-road diesel fuel, the Canadian regulations do not require that pumps be labeled. However, it is the intention of CPPI member companies to label ULSD fuel pumps with a circular yellow label having a black centre and the words *Low Sulphur Diesel*. This identification is one additional level of information to help customers avoid misfueling their vehicles.

Q6. Will ULSD be available for cross-border operations into Mexico?

A: Mexico will begin the transition to ULSD in 2008; however, the Mexican government has indicated that ULSD should be available near the U.S. border in 2007.

Q7. How do the new Canadian diesel sulphur requirements compare to the European Union's sulphur standards?

A: The standards are similar, but not exactly the same. The EU currently has a maximum sulphur content of 50 ppm for diesel fuel for general on-road use. Some new European vehicles are equipped with advanced emission control technology which requires a lower sulphur level fuel, and 10 ppm diesel fuel is available in the marketplace for these vehicles. The EU is expected to ratify a proposed 2009 requirement for all diesel fuel to have a maximum sulphur content of 10 ppm.

Q8. How long have Environment Canada and the industry been planning to introduce ULSD into the marketplace?

A: Work on this initiative began more than a decade ago. Since then, in North America, the heavy duty engine, automotive and refining industries have invested billions of dollars in new technology, conducting studies and making necessary changes to vehicle design and refining and distribution systems. The oil industry is on track to introduce ULSD in June 2006, and the heavy-duty engine, vehicle and automotive manufacturers will have the necessary changes in place for the 2007 model year.

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SUPPLY AND DISTRIBUTION

Q9. Do all service stations and truck stops have to offer ULSD for sale?

A: No. Environment Canada's regulations do not require service stations and truck stops to sell ULSD. However, wherever diesel fuel is sold in Canada for on-road applications, only ULSD may be sold.

NOTE: Because Canada will not have 2 grades of on-road diesel fuel (unlike the U.S.) the Canadian regulations do not require that pumps be labeled. However, it is the intention of CPPI member companies to label ULSD fuel pumps with a circular yellow label having a black centre and the words *Low Sulphur Diesel*. This identification is one additional level of information to help customers avoid misfueling their vehicles.

Q10. Do you expect the introduction of ULSD to cause supply disruptions?

A: At this time, refiners are not anticipating major supply disruptions. That said, introduction of the new fuel is being phased in over a three to four month period starting in June of 2006 to facilitate a smooth transition to ULSD.
Historically, the introduction of a new on-road fuel into the North American marketplace has resulted in some temporary, localized supply imbalances. This is especially true in areas farthest from the refineries, where the fuel must pass through multiple distribution modes and hand-off points.

Q11. Will ULSD transportation by tank truck require any changes in load sequencing, equipment procedures, or special equipment?

A: Yes. Tank truck loading and handling procedures must be in place to ensure little or no increase in sulphur during this last leg of the distribution process. Oil company and trucking company representatives require sequence loading procedures that will be based on what other petroleum products – if any – have been hauled in a tank truck prior to loading the ULSD. In some cases, there may be a need for dedicated equipment or extra draining or cleaning prior to loading. The Canadian Petroleum Products Institute (CPPI) has issued a handbook titled "*Recommended Management Practices, Ultra Low Sulphur Diesel (ULSD) Distribution System*" which will be helpful in understanding the system's needs.

Q12. What is the "northern supply area" and why is the implementation date different for these areas?

A: The following information is quoted from Environment Canada's website.

"The regulations use the term "northern supply area" to denote some remote northern locations of Canada that have a later implementation date for the 15 mg/kg limit that applies to sales and offers to sell. The area includes: all of Nunavut, most of the Northwest Territories and some of the northern Yukon; a 50 km strip of land along the Hudson Bay and James Bay coast in northeast Manitoba and northern Ontario; northern Quebec, and all of Labrador. The area excludes primary roads in the North." See the maps below.

"Generally, it is difficult to supply these northern locations, especially in the winter. The northern supply area includes remote northern regions of Canada that are supplied with fuel by barge. Fuel shipments to these areas take place from mid-May to September. Refuelling facilities in these areas are generally slow to turnover their diesel fuel stock. For these reasons, the regulations provide for a later implementation date for the 15 mg/kg sulphur concentration limit on sales of, and offers to sell, diesel fuel in these areas."

"The sulphur limits for diesel fuel sold or offered for sale for on-road vehicle use, for the Northern Supply Area, are as follows:

500 mg/kg until August 31, 2007; and 15 mg/kg after August 31, 2007."

Q13. Can you offer any assurance that a farmer can get the ULSD for a 2007 model year or later diesel-powered truck and fill up fuel containers with Regular Sulphur Diesel (RSD) for farm equipment?

A: Most off-road equipment, including farm equipment, currently uses off-road Regular Sulphur Diesel (RSD). The sources of off-road diesel fuel will not immediately be affected by the change to the ULSD in the on-road market. So, any farmer who is currently using off-road fuel should be able to continue to purchase off-road fuel. However, over time, the off-road diesel fuel also will be changed. Per Canadian General Standards Board CAN/CGSB-3.6, off-road diesel fuel (RSD), currently has a 5000 ppm maximum sulphur content and, under Environment Canada's Regulations, it must be reduced to 500 ppm maximum in 2007 and then to 15 ppm maximum in 2010. After 2012, all on-road and off-road, locomotive and marine diesel fuel will be required to meet a 15 ppm sulphur standard.

Q14. Who enforces the standards and what are the penalties for failing to meet those standards?

A: The following information is from Environment Canada's website.

"Compliance with regulations is mandatory. Environment Canada's Compliance and Enforcement Policy for CEPA 1999 sets out the criteria for responses by Environment Canada enforcement officers to alleged violations. Under subsections 272 and 273 of the *Canadian Environmental Protection Act,*1999 (CEPA 1999), every person who is found guilty of contravening or failing to comply with the Act or its regulations is subject to fines, imprisonment or other court orders. These sections should also be read in conjunction with s. 276 of the Act which provides that where an offence is committed or continued on more than one day, then each day on which the offence occurred may be prosecuted as a separate offence.
A copy of Environment Canada's Enforcement and Compliance Policy is available on request from the address listed below:
Director
Enforcement Branch, Environment Canada
351 St. Joseph Boulevard Gatineau, Quebec K1A 0H3"

You may also obtain a copy of the policy at:
http://www.ec.gc.ca/CEPARegistry/documents/policies/candepolicy/toc.cfm

"In addition to financial and administrative penalties, if there is a contravention of the regulation, the Minister may require a producer, processor, importer, retailer or distributor to take any or all of the following measures:

- provide notification of the relevant characteristics of the fuel and of any danger to the environment or to human life or health that might be posed by the fuel;
- replace the fuel with fuel that meets the applicable requirement;
- accept return of the fuel from the purchaser and refund the purchase price;
- take other measures to mitigate the effect of the contravention on the environment or on human life or health; and
- report on the steps taken."

Further details on Enforcement and Compliance are available at:
http://www.ec.gc.ca/CEPARegistry/enforcement

COST

Q15. Does ULSD cost more to produce?

A: Canadian refiners have had to make major capital investments in processing equipment to take the sulphur level down to ultra-low levels. One government/ industry study* reports that these capital investments will be approximately $2.5 billion. The processes and the tight tolerances needed to produce ULSD also cause further increases in refinery operating and maintenance costs. These factors raise the manufacturing cost to refiners and suppliers of ULSD. Capital investments have also been made by pipelines, terminals, tank truck carriers, and other parties throughout the distribution system.

** ECONOMIC AND ENVIRONMENTAL IMPACTS OF REMOVING SULPHUR FROM CANADIAN GASOLINE AND DISTILLATE PRODUCTION*
By: Purvin & Gertz Inc & Levelton Associates: August 2004
For: Canadian Petroleum Products Institute, Natural Resources Canada, Environment Canada, Industry Canada

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VEHICLE OPERABILITY / PERFORMANCE

Q16. How will the use of ULSD affect the power and fuel economy of existing diesel cars, trucks and off-road engines and equipment?

A: Generally, the processes that remove sulphur also reduce aromatics and the density of fuel, which may lower the energy content per litre by about 1%. This could result in a small decrease in the peak power of the engine. However, under typical operating conditions there should be no noticeable impact on the overall power of the vehicle. The reduction in energy content could result in a similar reduction in overall fuel economy.

Q17. How will ULSD affect the operations of the existing fleet?

A: Engine and vehicle manufacturers expect ULSD to be fully compatible with the existing fleet and are not anticipating that current owners will have to make any changes to their equipment to operate with the new fuel.

Past ULSD-test fleet studies showed some fuel system leaks, but they are believed to be due to the specific test fuels that may differ from the ULSD entering the market this year. This effect is similar to that seen during the transition from high sulphur diesel to low sulphur diesel in 1993, but that transition changed the fuel chemistry to a much greater degree than the upcoming introduction of ULSD. Since the fuel formula change to ULSD is likely to be, comparatively, very small and since fleet seals should have been adapted long ago, any impact on seals during the transition to ULSD is expected to be extremely low, if it occurs at all. The most vulnerable vehicles are probably older (pre-1993), high mileage vehicles with original seals still in place. These vehicles may require preventive maintenance in the form of upgrading certain engine and fuel system seals. Maintenance records should be reviewed to ensure that fuel system seals have been changed with recommended materials at recommended intervals. Check with your dealer or the vehicle manufacturer for additional information. One of the reasons for this fact sheet is to encourage truck fleets to be aware of potential issues before the introduction of ULSD.

The transition to ULSD may dislodge some deposits from the tank and create a need to change fuel filters ahead of their regularly scheduled maintenance. In addition, filters on storage tanks or dispenser pumps may also require filter changes during the initial introduction of ULSD.

Like LSD, ULSD requires good lubricity and corrosion inhibitors to prevent unacceptable engine wear. When necessary, as with LSD, additives to increase lubricity and inhibit corrosion will be added to ULSD prior to its retail sale. With these additives, ULSD will perform as well, or better than, LSD for preserving engine life and maximizing intervals between oil changes in the existing fleet.

Q18. Because the process of removing sulphur from diesel tends to reduce lubricity, what is being done to adjust for this problem?

A: Lubricity is a measure of the fuel's ability to protect the various parts of the engine's fuel injection system from excessive wear. The processing required to reduce sulphur to 15 ppm also tends to remove naturally occurring lubricity agents in diesel fuel. To manage this change, the Canadian General Standards Board has a lubricity specification defined in CAN/CGSB-3.517 for all diesel fuel that has been in effect for many years (in the U.S. the equivalent standard is ASTM D975 as issued by ASTM International). If a fuel lacks sufficient lubricity, suppliers add lubricity additives to ULSD, or to the RSD, to ensure that it meets the required lubricity specification when dispensed at the retail pump. This approach has been used successfully in Europe since the late 1990s.

Q19. How do I know that the lubricity additive works? Is it expected to meet certain standards for effectiveness? If so, what are they?

A: All diesel fuel, including ULSD, needs to meet the lubricity specifications defined in the Canadian General Standards Board CAN/CGSB-3.517. The lubricity specification can be met based on any one of five test methods, including the High Frequency Reciprocating Rig (HFRR) test (D 6079) which requires a wear scar no larger than 460 microns (which is more stringent than the ASTM D975 specification of 520 microns).

Q20. Can Regular Sulphur Diesel (RSD) be burned without operational problems in 2007 model year and later diesel cars and trucks?

A: No. Presumably this question arises when an operator permanently assigns an on-road engine to an off-road application.

Beginning with the 2007 model year, on-road diesel engines will be equipped with advanced emission control systems to significantly reduce smog-forming emissions. These systems could experience significant impairment in emission control efficiency and durability issues if operated on RSD. The use of RSD is also likely to significantly reduce fuel economy due to excessive back pressure in advanced emission control systems with particulate filters. Using RSD in a vehicle designed for ULSD may invalidate the manufacturer's warranty. Operational experience with 2007 model year and later technologies is developing but is insufficient to predict the full impact of such misfueling.

Q21. Will my diesel engine be harmed if I mix ULSD and biodiesel in the fuel tank?

A: The term biodiesel refers to mixtures of conventional diesel fuel and a bio-based component. These mixtures may contain the bio-based component in concentrations ranging from one percent (B1) to levels approaching one hundred percent (B100) by volume. The Canadian General Standards Board biodiesel blend standard is CAN/CGSB-3.520 and covers biodiesel ester blends from B1 to B5. Most engine manufacturers allow biodiesel blends (that meet CGSB, and ASTM, standards) up to B5.

ULSD and biodiesel fuel have different properties. In particular, as the ambient air temperature drops, biodiesel creates waxes sooner than petroleum-based diesel. Therefore, special care needs to be taken when blending the two fuels together, especially in cold weather because, without proper blending, the bio-based component may separate in the fuel tank and could potentially plug filters and hence cause engine problems.

ENVIRONMENTAL / HEALTH IMPACTS

Q22. How will ULSD affect air quality and human health?

A: While existing engines and vehicles will also benefit through some emissions reduction, the primary reason for introducing 15 ppm ULSD is to enable the effective operation of advanced emission control technology on new on-road diesel engines. The engine and fuel changes are needed to meet new stringent exhaust emission standards for particulate matter, hydrocarbons, and nitrogen oxides, resulting in emission reductions of up to 90% from individual vehicles. These reductions will help to reduce ground level ozone and ambient levels of toxic compounds.
Environment Canada estimates that there will be significant air quality and health benefits that will increase over time. These benefits will be largely realized by about 2020, after most of the vehicle fleet has been replaced.

Q23. What do we know about ULSD's impact if released in the environment? Could it have unforeseen consequences for groundwater, lakes and streams, sewer systems, or plant and animal life?

A: ULSD formulation is not expected to have any different impacts than the previous diesel fuel formulation. Compared to gasoline, all distillate / diesel fuels have very low solubility in water. ULSD will also have very low water solubility and is not expected to present any significant ecological differences compared with 500 ppm LSD should it be released to surface waters or ground water. Federal and provincial requirements for underground storage systems require daily or continuous monitoring for fuel releases, and corrective action is required if fuels are released.