

stringent sulfur standards or with other properties which make it unrepresentative of typical U.S. NRLM diesel fuel. Thus, current market prices are not a good indication of the long term price impact of the proposed 15 ppm cap.

Regarding engineering studies, the Engine Manufacturers Association (EMA) commissioned a study by Mathpro to estimate the cost of controlling the sulfur content of highway and nonroad diesel fuel to levels consistent with both 500 ppm and 15 ppm cap standards.²⁸¹ Mathpro used a higher rate of return on new capital so we adjusted their per-gallon costs to reflect our own amortization methodology. Also, the Mathpro study was completed in 1999 so we adjusted their costs for inflation to year 2002 dollars. After these two adjustments, Mathpro's cost to desulfurize the high sulfur non-highway pool to 500 ppm is 2.5 cents per gallon, while that for a 15 ppm cap is 5.8 cents per gallon.²⁸² The 500 ppm cost estimate compares quite favorably with our own estimate of 2.2 cents per gallon cost. One reason for our somewhat lower estimate for complying with the 500 ppm standard is that our refinery-specific analysis has only the lowest cost refineries complying as many more expensive refineries can continue to produce heating oil. It is likely that the refineries which our analysis show would comply are more optimized for desulfurizing diesel fuel than the average refinery used by Mathpro. This reason applies even more for 15 ppm cap standard as fewer, more optimized refineries need to comply to produce nonroad diesel fuel which complies with a 15 ppm sulfur cap standard. Furthermore, we considered the use of advanced desulfurization technologies for complying with the 15 ppm standard, while Mathpro did not. Since the Mathpro study was performed in 1999, cost estimates were not available for either of the two technologies which we included. The adjustment of the Mathpro costs and the comparison with our own cost estimates are discussed in detail in the Draft RIA. We request comment on the degree that the results of the Mathpro study for EMA and the comparison with real-world prices support our own cost estimates.

5. Supply of Nonroad, Locomotive and Marine Diesel Fuel

EPA has developed the proposed fuel program to minimize its impact on the supply of distillate fuel. For example: we have proposed to transition the fuel sulfur level down to 15 ppm in two steps, providing an estimated 6 years of leadtime for the final step; we are proposing to provide flexibility to refiners through the availability of banking and trading provisions; and we have provided relief for small refiners and hardship relief for any qualifying refiner. In order to evaluate the effect of this proposal on supply, EPA evaluated four possible cases: (1) whether the proposed standards could cause refiners to remove certain blendstocks from the fuel pool, (2) whether the proposed standards could require chemical processing which loses fuel in the process, (3) whether the cost of meeting the proposed standards could lead some refiners to leave that market, and (4) whether the cost of meeting the proposed standards could lead some refiners to stop operations altogether (*i.e.*, shut down). In all cases, as discussed below, we have concluded that the answer is no. Therefore, consistent with our findings made during the 2007 highway diesel rule, we do not expect this proposed rule to cause any supply shortages of nonroad, locomotive and marine diesel fuel. The reader is referred to the draft RIA for a more detailed discussion of the potential supply impact of this proposed rule.

Blendstock Shift: There should be no long term reduction in the amount of material derived from crude oil available for blending into diesel fuel or heating oil as a result of this proposal. Technology exists to desulfurize any commercial diesel fuel to less than 10 ppm sulfur. This technology is just now being proven on a commercial scale with a range of no. 2 diesel fuel blendstocks, as a number of refiners are producing 15 ppm fuel for diesel fleets which have been retro-fitted with PM traps or for pipeline testing. Therefore, there is no technical necessity to remove certain blendstocks from the diesel fuel pool. It costs more to process certain blendstocks, such as light cycle oil, than others. Therefore, there may be economic incentives to move certain blendstocks out of the diesel fuel market to reduce compliance costs. However, that is an economic issue, not a technical issue and will be addressed below when we consider whether refiners might choose to exit the NRLM diesel fuel market.

Processing Losses: The impact of the proposed rule on the total output of liquid fuel from refineries would be negligible. Conventional desulfurization processes do not reduce the energy content of the input material. However, the form of the material is affected slightly. With conventional hydrotreating, about 98 percent of the diesel fuel fed to a hydrotreater producing 15 ppm sulfur product leaves as diesel fuel. Of the 2 percent loss, three-fourths, or about 1.5 percent leaves the unit as naphtha (*i.e.*, gasoline feedstock). The remainder is split evenly between liquified petroleum gas (LPG) and refinery fuel gas. Both naphtha and LPG have higher valuable uses as liquid fuels. Naphtha can be used to produce gasoline. Refiners can adjust the relative amounts of gasoline and diesel fuel which they produce, especially to this small degree. This additional naphtha can displace other gasoline blendstocks, which can then be shifted to the diesel fuel pool. LPG, on the other hand, is primarily used in heating, where it competes with heating oil. Thus, additional LPG can be used to displace gasoline and heating oil, which in turn can be shifted to the diesel fuel pool. Thus, there should be little or no direct impact of desulfurization on refinery fuel production. The shift from diesel fuel to fuel gas is very small (0.25 percent) and this fuel gas can be used to reduce consumption of natural gas within the refinery. These figures apply to the full effect of the proposed standards (*i.e.*, the reduction in sulfur content from 3400 ppm to 15 ppm). For the first step of the proposed fuel program and that portion of the diesel fuel pool which would remain at the 500 ppm level indefinitely, the impacts would only be about 40 percent of those described above.

The use of advanced desulfurization technologies would further reduce these impacts. These technologies are projected to be used in the second step of reducing 500 ppm diesel fuel to 15 ppm sulfur. We project that the Linde process would reduce the above losses for the second step by 55 percent, while the Phillips SZorb process would have no loss in diesel fuel production.

Exit the NRLM Diesel Fuel Market: While the cost of meeting the proposed standards might cause some individual refiners to consider reducing their production of NRLM fuel or leave the market entirely, we do not believe that across the entire industry such a shift is possible or likely. As mentioned above, all diesel fuels and heating oil are essentially identical both chemically and physically, except for sulfur level. Thus, if a refiner could shift his high

²⁸¹ Hirshfeld, David, MathPro, Inc., "Refining economics of diesel fuel sulfur standards," performed for the Engine Manufacturers Association, October 5, 1999.

²⁸² The Mathpro costs cited reflect their case where current diesel fuel hydrotreaters are revamped with a new reactor in series, which is the most consistent with our technology projection.