# Executive Summary

*Vehicle Standards*

Today's action sets new federal emission standards ("Tier 2 standards") for passenger cars, light trucks, and larger passenger vehicles. The program is designed to focus on reducing the emissions most responsible for the ozone and particulate matter (PM) impact from these vehicles -- nitrogen oxides (NOx) and non-methane organic gases (NMOG), consisting primarily of hydrocarbons (HC) and contributing to ambient volatile organic compounds (VOC). The program will also, for the first time, apply the same set of federal standards to all passenger cars, light trucks, and medium-duty passenger vehicles. Light trucks include "light light-duty trucks" (or LLDTs), rated at less than 6000 pounds gross vehicle weight and "heavy light-duty trucks" (or HLDTs), rated at more than 6000 pounds gross vehicle weight).[1] "Medium-duty passenger vehicles" (or MDPVs) form a new class of vehicles introduced by this rule that includes SUVs and passenger vans rated at between 8,500 and 10,000 GVWR. The program thus ensures that essentially all vehicles designed for passenger use in the future will be very clean vehicles.

The Tier 2 standards finalized today will reduce new vehicle NOx levels to an average of 0.07 grams per mile (g/mi). For new passenger cars and light LDTs, these standards will phase in beginning in 2004, with the standards to be fully phased in by 2007.[2] For heavy LDTs and MDPVs, the Tier 2 standards will be phased in beginning in 2008, with full compliance in 2009.

During the phase-in period from 2004-2007, all passenger cars and light LDTs not certified to the primary Tier 2 standards will have to meet an interim average standard of 0.30 g/mi NOx, equivalent to the current NLEV standards for LDVs.[3] During the period 2004-2008, heavy LDTs and MDPVs not certified to the final Tier 2 standards will phase in to an interim program with an average standard of 0.20 g/mi NOx, with those not covered by the phase-in meeting a per-vehicle standard (i.e., an emissions "cap") of 0.60 g/mi NOx (for HLDTs) and 0.09

[1] A vehicle's "Gross Vehicle Weight Rating," or GVWR, is the curb weight of the vehicle plus its maximum recommended load of passengers and cargo.

[2] By comparison, the NOx standards for the National Low Emission Vehicle (NLEV) program, which will be in place nationally in 2001, range from 0.30 g/mi for passenger cars to 0.50 g/mi for medium-sized light trucks (larger light trucks are not covered). For further comparison, the standards met by today's Tier 1 vehicles range from 0.60 g/mi to 1.53 g/mi.

[3] There are also NMOG standards associated with both the interim and Tier 2 standards. The NMOG standards vary depending on which of various individual sets of emission standards manufacturers choose to use in complying with the average NOx standard. This "bin" approach is described more fully in section IV.B. of this preamble.

g/mi NOx (for MDPVs). The average standards for NOx will allow manufacturers to comply with the very stringent new standards in a flexible way, assuring that the average emissions of a company's production meet the target emission levels while allowing the manufacturer to choose from several more- and less-stringent emission categories for certification.

We are also setting stringent particulate matter standards that will be especially important if there is substantial future growth in the sales of diesel vehicles. With higher sales of diesel cars and light trucks, these vehicles could easily contribute between one-half and two percent of the PM10 concentration allowed by the NAAQS, with some possibility that the contribution could be as high as five to 40 percent in some roadside situations with heavy traffic. These increases would make attainment even more difficult for eight counties which we already predict to need further emission reductions even without an increase in diesel sales, and would put at risk another 18 counties which are now within 10 percent of a NAAQS violation. Thus, by including a more stringent PM standard in the program finalized today, we help address environmental concerns about the potential growth in the numbers of light-duty diesels on the road -- even if that growth is substantial. The new requirements also include more stringent hydrocarbon controls (exhaust NMOG and evaporative emissions standards).

*Gasoline Sulfur Standards*

The other major part of today's action will significantly reduce average gasoline sulfur levels nationwide. We expect these reductions could begin to phase in as early as 2000, with full compliance for most refiners occurring by 2006. Refiners will generally install advanced refining equipment to remove sulfur during the production of gasoline. Importers of gasoline will be required to import and market only gasoline meeting the sulfur limits. Temporary, less stringent standards will apply to refineries who produce fuel for use in the Geographic Phase-in Area[4] through 2006 and a few small refiners through 2007.

This significant new control of gasoline sulfur content will have two important effects. The lower sulfur levels will enable the much-improved emission control technology necessary to meet the stringent vehicle standards of today's rule to operate effectively over the useful life of the new vehicles. In addition, as soon as the lower sulfur gasoline is available, all gasoline vehicles already on the road will have reduced emissions–from less degradation of their catalytic converters and from fewer sulfur compounds in the exhaust.

Today's action will require that most refiners and importers meet a corporate average gasoline sulfur standard of 120 ppm and a cap of 300 ppm beginning in 2004. By 2006, the cap will be reduced to 80 ppm and most individual refineries must produce gasoline averaging no

[4]Alaska, Colorado, Idaho, Montana, New Mexico, North Dakota, Utah, and Wyoming

more than 30 ppm sulfur. The program builds upon the existing regulations covering gasoline composition as it relates to emissions performance. It includes provisions for trading of sulfur credits, increasing the flexibility available to refiners for complying with the new requirements. We intend for the credit program to ease compliance uncertainties by providing refiners the flexibility to phase in early controls in 2000-2003 and use credits gained in these years to delay some control until as late as 2006. As finalized today, the program will achieve the needed environmental benefits while providing substantial flexibility to refiners.

*Cost-Effectiveness of the Tier2/Sulfur Program*

A comparison of the costs of our program with the emission reductions it is estimated to achieve leads us to conclude that it is a cost-effective means of reducing pollution. As shown in Chapter VI, the cost-effectiveness of Tier 2/gasoline sulfur falls within the range of cost-effectiveness of other mobile and stationary source controls. For example, both the Tier 1 and NLEV vehicle standards had similar cost-effectiveness to the standards we are proposing today. For stationary sources, similar levels of reductions in NOx and hydrocarbon emissions could cost up to $10,000 per ton. We believe that the program we are finalizing today will be an efficient and significant step towards reaching attainment and maintenance of the NAAQS.

*Highlights of the Benefit-Cost Analysis*

We also made an assessment of the monetary value of the health and general welfare benefits that are expected to result from our standards near full implementation in 2030. We estimate that our Tier 2/gasoline sulfur standards would, in the long term, result in substantial benefits, such as: the yearly avoidance of approximately 4300 premature deaths, approximately 2300 cases of bronchitis, and significant numbers of hospital visits, lost work days, and multiple respiratory ailments (especially those that affect children). Our standards will also produce welfare benefits relating to agricultural crop damage, visibility, and nitrogen deposition in rivers and lakes. Total monetized benefits, however, are driven primarily by the value placed on the reductions in premature deaths. The adoption of a value for the projected reduction in the risk of premature mortality is the subject of continuing discussion within the economic and public policy analysis community within and outside the Administration. In response to the sensitivity on this issue, we provide estimates reflecting two alternative approaches. The first approach–supported by some in the above community and preferred by EPA–uses a Value of a Statistical Life (VSL) approach developed for the Clean Air Act Section 812 benefit-cost studies. This VSL estimate of $5.9 million (1997$) was derived from a set of 26 studies identified by EPA using criteria established in Viscusi (1992), as those most appropriate for environmental policy analysis applications.

An alternative, age-adjusted approach is preferred by some others in the above community both within and outside the Administration. This approach was also developed for the Section 812 studies and addresses concerns with applying the VSL estimate –reflecting a valuation derived mostly from labor market studies involving healthy working-age manual laborers– to PM-related mortality risks that are primarily associated with older populations and those with impaired health status. This alternative approach leads to an estimate of the value of a statistical life year (VSLY), which is derived directly from the VSL estimate. It differs only in incorporating an explicit assumption about the number of life years saved and an implicit assumption that the valuation of each life year is not affected by age.[5] The mean VSLY is $360,000 (1997$); combining this number with a mean life expectancy of 14 years yields an age-adjusted VSL of $3.6 million (1997$).

Both approaches are imperfect, and raise difficult methodological issues which are discussed in depth in the recently published Section 812 Prospective Study, the draft EPA Economic Guidelines, and the peer-review commentaries prepared in support of each of these documents. For example, both methodologies embed assumptions (explicit or implicit) about which there is little or no definitive scientific guidance. In particular, both methods adopt the assumption that the risk versus dollars trade-offs revealed by available labor market studies are applicable to the risk versus dollar trade-offs in an air pollution context.

EPA currently prefers the VSL approach because, essentially, the method reflects the direct, application of what EPA considers to be the most reliable estimates for valuation of premature mortality available in the current economic literature. While there are several differences between the labor market studies EPA uses to derive a VSL estimate and the particulate matter air pollution context addressed here, those differences in the affected populations and the nature of the risks imply both upward and downward adjustments. For example, adjusting for age differences may imply the need to adjust the $5.9 million VSL downward as would adjusting for health differences, but the involuntary nature of air pollution-related risks and the lower level of risk-aversion of the manual laborers in the labor market studies may imply the need for upward adjustments. In the absence of a comprehensive and balanced set of adjustment factors, EPA believes it is reasonable to continue to use the $5.9 million value while acknowledging the significant limitations and uncertainties in the available literature. Furthermore, EPA prefers not to draw distinctions in the monetary value assigned to the lives saved even if they differ in age, health status, socioeconomic status, gender or other characteristic of the adult population.

Those who favor the alternative, age-adjusted approach (i.e. the VSLY approach)

[5] Specifically, the VSLY estimate is calculated by amortizing the $5.9 million mean VSL estimate over the 35 years of life expectancy associated with subjects in the labor market studies. The resulting estimate, using a 5 percent discount rate, is $360,000 per life-year saved in 1997 dollars. This annual average value of a life-year is then multiplied times the number of years of remaining life expectancy for the affected population (in the case of PM-related premature mortality, the average number of $ life-years saved is 14.

emphasize that the value of a statistical life is not a single number relevant for all situations. Indeed, the VSL estimate of $5.9 million (1997 dollars) is itself the central tendency of a number of estimates of the VSL for some rather narrowly defined populations. When there are significant differences between the population affected by a particular health risk and the populations used in the labor market studies - as is the case here - they prefer to adjust the VSL estimate to reflect those differences. While acknowledging that the VSLY approach provides an admittedly crude adjustment (for age though not for other possible differences between the populations), they point out that it has the advantage of yielding an estimate that is not presumptively biased. Proponents of adjusting for age differences using the VSLY approach fully concur that enormous uncertainty remains on both sides of this estimate - upwards as well as downwards - and that the populations differ in ways other than age (and therefore life expectancy). But rather than waiting for all relevant questions to be answered, they prefer a process of refining estimates by incorporating new information and evidence as it becomes available.

The results indicate that using EPAs preferred approach to valuing reductions in premature mortality, total monetary benefits realized after nearly a full turnover of the fleet to Tier 2 vehicles would be approximately $25.2 billion in 2030. Using the alternative, age-adjusted approach to value reductions in premature mortality yields total monetized benefits of $13.9 billion in 2030. Comparing this estimate of the economic benefits with the adjusted cost estimate indicates that the net economic benefit of the tier 2/gasoline sulfur standards to society are approximately $20 billion in 2030. Using the alternative, age-adjusted approach to valuing premature mortality, net benefits are approximately $8.5 billion. Due to the uncertainties associated with this estimate of net benefits, it should be considered along with other components of this RIA, such as: total cost, cost-effectiveness, and other considerations of benefits and costs that could not be monetized.