

ACTION PLAN

In Response To

COMMUNICATION 16:

The Future of Vehicle Fuels and Technologies: Anticipating Health Benefits and Challenges

March 2011

The HEI Research Committee thanks the Special Committee on Emerging Technologies (SCET) for its careful analysis and summary of a vast field and for distilling the most important technologies and fuels that are likely to be commercially available in the next ten years in the United States and other industrialized countries. SCET is to be commended for its careful and thorough – yet concise – summary of the state of knowledge, particularly regarding emissions and the potential for their health effects.

The Research Committee – which develops and implements HEI’s research plan – welcomes the many thoughtful suggestions by SCET and describes below the steps the Committee plans to take, or has already taken, to address the issues identified as of high priority by SCET.

INTERNAL COMBUSTION ENGINE TECHNOLOGIES

The Research Committee notes SCET’s conclusion that *the internal combustion engine is expected to remain the dominant technology in the market place during the next decade*. Based on SCET’s specific recommendations, the Research Committee plans the following steps:

Gasoline Direct Engine Technology (GDI): SCET points out that GDI is rapidly spreading in the light duty market as a means of increasing fuel economy. One of the major issues arising from GDI technology is emissions of PM, both mass and ultrafine particles (UFPs). The issues concerning fine PM have been discussed and reviewed recently by HEI as well as by the EPA and CARB. The ultrafine particles issue, on the other hand, has received less attention. Based on the SCET findings,

- *Action*: HEI is undertaking a review of the literature on UFP. The review will encompass information on the contribution of mobile sources to atmospheric UFPs, health effects of UFPs and the potential for environmental exposure leading to potential health effects in humans. HEI is forming a panel to review the literature in these areas, including HEI’s own contributions. The Panel’s report is expected to be completed by early 2012.
- *Action*: The Research Committee will also consider whether it should develop and implement short term (e.g. 1- and 3-month) animal exposure studies for GDI engine exposures.

Selective Catalytic Reduction: As SCET notes, the introduction of urea to control NOx emissions is a major new direction in emissions control and, given the possibility of formation of nitro-organic compounds, deserves close scrutiny. Plans for HEI's ongoing Advanced Collaborative Emissions Study (ACES) had anticipated and included this topic. Specifically, Phase 2 of ACES will perform detailed characterization of emissions from several 2010 engines, outfitted with particulate control and SCR or possibly other de-NOx devices, employing several engine operating cycles. These studies are scheduled to start during mid-2011, and their results will be available during 2012.

FUELS FOR INTERNAL COMBUSTION VEHICLES

SCET finds that our preponderant reliance on petroleum based fuels – gasoline and diesel – will continue in the near future. But new fuels and fuel blends derived from biological sources (and therefore potential renewable) and synthetic processes – are already on the market (such as ethanol) or being introduced (such as Fischer-Tropsch diesel). The new fuels have several advantages over conventional fuels but there are also questions about the emissions from the widespread use of such fuels.

Emissions from Biofuel-Powered Vehicles: As SCET emphasizes, the use of biofuels, particularly ethanol and biodiesel, is increasing rapidly and their use is likely to accelerate; the use of other fuels such as Fischer-Tropsch diesel, isobutanol, natural gas, and ethers may also be increasing. Relatively little *systematic* information is available on the emissions from vehicles powered by such fuels. The Research Committee agrees that understanding the emissions from these fuels as well as changes associated with their use for human exposure are important areas for research. However, the Committee also notes that research in these areas is currently being conducted by several research groups.

- *Action:* The Committee will convene an intensive workshop where data from all relevant groups active in biofuels emissions testing and characterization will be presented and assessed. The information presented will be the basis for the Committee's plan of future actions.

Issues Related to the Sources of Fuels: SCET discusses that new sources of crude or fuel may have significant environmental impacts. For example, the extraction of fuel from oil sands, heavy crude, oil shale, gas shale, coal, etc. is associated with serious environmental impacts, and the adverse environmental effects of fracturing for natural gas in the United States has received much attention recently. SCET recommends that such environmental impacts should be taken into account in an overall assessment of fuels. The Committee sees environmental impact as somewhat removed from HEI's current expertise but, given the importance of these issues, plans to monitor this area as one for potential future activity.

Additionally, in some cases, a change in composition of, and emissions from, the fuels extracted from the new sources relative to conventional petroleum fuel may also deserve attention. The report mentions that the proportion of such fuels in the overall fuel supply is likely to increase to significant levels in the future. The Research Committee agrees that these are important concerns.

- *Action:* HEI will review data on changes in composition of fuels and emissions as they become available to evaluate whether they need further study.

ELECTRIC DRIVE TECHNOLOGY

Hybrid and Electric vehicles are in the market and more models are rapidly being introduced. Hybrids are ~3% of current passenger car sales; plug-in and battery vehicles have been introduced recently. Sales of electric vehicles are projected to grow during the next decade. SCET identified three areas relevant to electric vehicles where further research or review is indicated:

Electro-Magnetic Fields: SCET points out that there are virtually no published data on exposures of vehicle occupants to electro-magnetic fields during operation of electric vehicles. It is likely that such exposures are low or very low, but if large numbers of people are exposed, this could be an area of concern.

- *Action*: in view of the paucity of information in this area, the Research Committee will launch an intensive search for information among researchers in the US and in other countries. The Committee will review any available data later this year and decide on an appropriate course of action.

Use of Lithium and Other Reactive Metals in Batteries: SCET points out that use of such metals presents the potential for human exposure throughout the life-cycle of metals and in the event of automobile accidents. The Research Committee recognizes that these are potentially important issues and the Committee is interested in them.

- *Action*: as a first step, the Committee and staff will survey available evaluations of exposure to and toxicity of lithium and other relevant metals; based on that review, the Committee will determine whether additional investigations of potential new exposures and health effects are warranted.

Displaced emissions: Although there are little or no tail-pipe emissions from the use of electricity, upstream or 'displaced' emissions from the electricity source – from coal-fired power plants, for example – should be considered. At this time and in the near future, the incremental load on power plants from vehicle battery charging is quite modest and unlikely to produce a significant change. However, as electrical vehicles become more widely used, this could be an issue that would need further study should power plant emissions remain undiminished.

- *Action*: HEI already has underway two comprehensive studies of the toxicity of different sources and components of particulate matter – its National Particle Component Toxicity Initiative (or NPACT) which will help elucidate power plant vs. other emissions.
- *Action*: The impact of regulatory steps to control power plant emissions is also a part of HEI's health outcomes (accountability) research program; HEI has sponsored studies in this area in the past and has now issued a new RFA on outcomes research.