4.4.2 NITROUS OXIDE ABATEMENT TECHNOLOGIES FOR TRANSPORTATION

Technology Description

Nitrous oxide (N_2O) can be produced from fuel combustion and catalytic-converter operation in vehicles, primarily due to the nitrogen in the air. Little is understood about how much N_2O is produced by vehicles and under what conditions and with what catalytic-converter technology. The main research thrust in the near term is to begin to answer these basic questions.

Basic research is needed to understand the formation and magnitude of N_2O emissions from fuel combustion and catalytic-converter operation.

In addition to direct emissions of N_2O, nitrogen oxide (NO_x) emissions from mobile and stationary sources have a significant impact on atmospheric N_2O levels. More than 25 million tons of NO_x is emitted annually in the United States. Following transport and chemical interactions, approximately 7 million tons of these nitrogen emissions are deposited downwind. This compares to about 11 million tons of nitrogen deposited from fertilizer application. Since the 11 million tons is reported to account for about 70% of anthropogenic N_2O emissions, the 7 million tons from atmospheric deposition appear to be significant. In the past, greenhouse gas emissions inventories have ignored the atmospheric nitrogen deposition due to uncertainties involved. Research is needed to define the contribution of NO_x emissions to nitrogen deposition and subsequent N_2O emissions, and to identify the global warming benefits from ongoing and future NO_x emissions control programs.

System Concepts

- Better understand the formation and magnitude of N_2O emissions from fuel combustion and catalytic-converter operation.
- Evaluate the climate-forcing potential atmospheric nitrogen deposition, especially from combustion sources.
- Develop emission models to assess the potential climate benefits from changes in emissions from nitrogen oxides.

Representative Technologies

- Combustion and post-combustion NO_x control technologies used in the tropospheric ozone control program.

Technology Status/Applications

- NO_x control technologies are in place due to the ozone and acid deposition programs.

Current Research, Development, and Demonstration

RD&D Goals

- Accurately understand the amount of N_2O produced in various vehicles, how it forms, and how it can be reduced.
- Develop N_2O measurement techniques for emerging gasoline and diesel engines and their emission-control systems. Measurement technology is needed for both laboratory and field measurement.
- Develop vehicle- and engine-testing programs to generate data about N_2O emissions for a variety of vehicles and engines equipped with a range of current and advanced emission-control technologies and operated over a range of real-world operating conditions.

- Research on the relationship of N_2O emissions to technologies and approaches that reduce fuel consumption by stationary and mobile combustion sources, including programs that reduce vehicle miles traveled.
- Quantify the climate-forcing impacts due to NO_x emissions, nitrogen deposition, and N_2O emissions.

RD&D Challenges

- To establish linkages of NO_x emissions to climate-change impacts due to nitrogen deposition and enhance modeling capabilities to address these linkage issues.

Recent Progress

- EPA's ozone-control program has reduced emissions of NO_x.

Commercialization and Deployment Activities

- Additional NO_x emissions controls will be implemented in the future to meet ambient air quality standards for ozone and particulate matter.