OHVT STUDY OF COMPARATIVE TOXICITY OF ENGINE EMISSIONS: PART B, STATUS OF TOXICITY RESULTS

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The goals of the emission sample study are to: (1) develop and validate the capability for rapid comparisons between the toxicities of collected engine emission samples and (2) obtain information on the relative toxicities of diesel and gasoline emission samples. The approaches used do not provide a comprehensive evaluation of health hazard or risk, but provide quantitative comparisons of relative toxicity among samples that should at least qualitatively, and perhaps quantitatively, parallel the relative hazards from inhaling the respective emissions. This project was initiated in response to the need for preliminary toxicity screening of emissions during the development of fuel, engine, and after-treatment strategies, by methods less costly and time-consuming than animal inhalation studies. The strategy was to adapt and evaluate existing screening tests for this purpose.

Particle (filter mass) and semi-volatile organic (PUF/XAD mass, SVOC) samples were provided to LRRI and NIOSH after extraction and concentration in acetone. The particle and SVOC fractions were tested either separately or combined in their original collection (i.e., emission) ratios. Multiple doses were applied to all biological test systems on a mass basis; thus, the results will reflect comparative potency per unit of collected mass. Vehicle mass emission rates will need to be considered to relate these data to potential comparative hazard per unit of vehicle use.

Mutagenicity in bacteria (Ames test) was evaluated using multiple tester strains having sensitivities to different forms of mutations and different chemical species. LRRI evaluated mammalian cell toxicity and activation using A549 cells of human lung origin and rat alveolar macrophages. LRRI also evaluated responses in intact lungs by exposing rats by intratracheal instillation. With the exception of traffic tunnel samples, LRRI has tested the particle and SVOC fractions in combination to date. NIOSH evaluated DNA and chromosome damage in V79 cells of hamster lung fibroblast origin. NIOSH has tested the particle and SVOC fractions separately to date.

The initial toxicity tests are completed, and results are being analyzed statistically for significance of differences among samples and significance of relationships between toxicity and chemical composition. Additional tests are being conducted as remaining sample masses permit to complete the testing particle and SVOC fractions both separately and combined, to confirm reproducibility, and to evaluate the influence of certain experimental variables. Samples collected from an inhalation study of diesel emissions (conducted under another program) are also being evaluated by these tests as a step toward validating the ability of the screening tests to predict responses to inhaled emissions and the relative toxicities of inhaled diesel and gasoline emissions.