Diesel Emissions Evaluation Program
Project Summary

Evaluation of Biodiesel Fuel and a Diesel Oxidation Catalyst in an Underground Metal Mine

Part 3 - Biological and Chemical Characterization

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Complete Report

Executive Summary

This study was conducted as part of a collaborative multidisciplinary, international effort to evaluate the effects of using a 50% biodiesel fuel blend (hereafter referred to as the blend fuel) and an advanced-type diesel oxidation catalyst (DOC) on underground metal mine air quality. The primary objective of this portion of the study was to evaluate the effects of using the 50% biodiesel fuel blend (with an advanced-type DOC) on potentially health-related DPM components, particularly polynuclear aromatic hydrocarbons (PAH), nitro-PAH, and mutagenic activity. This was accomplished by examining high-volume sampler filters containing the submicrometer particles, which are considered to be diesel in origin. Comparisons were also made for DPM and DPM component concentrations, such as the soluble organic fraction (SOF) and solids (SOL). All samples were collected at Inco, Ltd.'s Creighton Mine #3 in Sudbury, Ontario. The procedures employed for sampling and analyses were generally the same as used in previous underground mine studies.

With use of the blend biodiesel fuel as compared to a D2 fuel with an advanced-type DOC, there was a general trend of at least 20% reductions in downwind concentrations of DPM and most DPM-components, based on data obtained using high-volume samplers. The reductions in SOL (up to 30%) and mutagenic activity (about 75%) concentrations were found to be significant, whether or not the data were normalized on a brake-specific basis. The reductions in DPM (about 20%) were found to be significant only when normalized on a brake-specific basis. Although large reductions (up to 75%) were also present for DPM-associated PAH concentrations, these reductions were significant only for PYR due to the relatively high variability between sampling dates associated with the measurements. However, analysis of the PAH data without one set of the D2 fuel plus DOC data (having unexplainably low PAH values) resulted in significantly lower concentrations for FLU, BbF, and BkF, in addition to the lower PYR concentrations.

Based on the results of this study, use of this blend fuel plus an advanced-type DOC in an underground mine environment should result in significant reductions in those DPM components potentially of human health concern.

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