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INVESTIGATIONS OF IN-USE HEAVY-DUTY DIESEL VEHICLE EMISSIONS: EFFECT OF FUEL TYPE AND CONTROL TECHNOLOGY. *ANIKET SAWANT, Sandip Shah, David Cocker, University of California, Riverside, CA*

Emissions from a modern heavy-duty diesel engine are a complex function of numerous factors, including combustion characteristics within the engine and the control technology for treatment of tailpipe exhaust (if any). Fuel type is believed to influence both these factors. In addition, recent work has shown that emissions in the real world can be significantly different from those observed under controlled laboratory conditions. Previous work by this group has shown that control technologies tend to lower the particle-phase elemental and organic carbon (EC and OC) fractions to varying extents for a given fuel type.

The present work investigates emissions from a typical Class 8 diesel tractor within a fuel/control technology test matrix. The different fuels tested include current federal diesel, California ultra-low sulfur diesel, and biodiesel. These are tested in conjunction with control technologies such as oxidation catalysts and active and passive diesel particulate filters. Fuel/control technology combinations are discussed on the basis of emission rates for the particle-, semi-volatile, and gas-phase regimes, and an optimum combination (within the matrix) is presented.

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TREATING WASTE WITH WASTE: A PRELIMINARY EVALUATION OF WELDING FUME AS A SOURCE OF IRON NANOPARTICLES FOR GROUNDWATER REMEDIATION.
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Metallic iron has been shown to be an effective agent for treating hazardous and toxic chemicals in aqueous environments, through classical electrochemistry/corrosion reactions (Gillham R.W. & S.F. O'Hannesin, 1994). Recently, this approach to waste treatment has been extended to using iron nanoparticles for groundwater remediation (Masciangioli T. & W. Zhang, 2001). The use of nanometer-diameter particles potentially enhances reaction rates, while allowing the iron particles to remain suspended for long periods of time in ground water and to be transported effectively to where they are required.

Gas metal arc welding (GMAW) processes involving mild steel lead to an iron-rich fume composed primarily of nanometer-diameter primary particles. Although the fume is considered a waste product, and harmful to health if inhaled, the chemistry and size of the particles may make it a suitable source of iron nanoparticles for use in groundwater remediation. Successful implementation of such an application would encourage greater control of welding fume exposures within industry, while providing an inexpensive source of iron nanoparticles for groundwater remediation. Studies have indicated that primary particles from GMAW welding on mild steel are on the order of 5 nm and are primarily composed of a metallic iron core. There is some indication that a silica layer forms round the primary particles during formation, potentially preventing oxidation of the iron core in air. Generated particles agglomerate into open structured particles a few hundred nanometers in diameter with high specific surface areas. We hypothesize that the physical and chemical nature of the welding fume agglomerates make them well suited to redox-based groundwater remediation applications.

A series of preliminary experiments have been conducted to determine whether welding fumes might lead to reduction reactions that are comparable to those reported for synthetically generated iron nano-particles. Welding fume samples were collected using a novel electrostatic collector within a GMAW test chamber. To qualitatively evaluate the ability of the fume to participate in reduction reactions, the reduction of Cr(VI) to Cr(III) was studied in a range of aqueous environments. The welding fume was shown to rapidly reduce Cr(IV) to Cr(III) in an acidic environment: Similar results were obtained with an iron particle control. Preliminary evaluations are currently underway to evaluate the reduction of chlorinated hydrocarbons in the presence of welding fume. The results of both these experimental approaches will allow an initial evaluation of whether welding fume has the potential to be used in groundwater remediation, and other applications involving the treatment of hazardous waste.

Gillham R.W. & S.F. O'Hannesin, 1994. Enhanced degradation of halogenated alliphatics by zero-valent iron. Ground Water 32,958-967.

Masciangioli T. & W. Zhang, 2001. Environmental nanotechnology: Potential and pitfalls. Environ. Sci. & Technol. 34, 2564-2569.