

## V.K.3 Research & Development for Off-Road Fuel Cell Applications

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Contract Number: DE-FC36-04G014303

### Subcontractors:

- The Toro Company, Bloomington, MN
- University of California, Davis, CA (UC Davis)

Project Start Date: August, 2007  
Project End Date: March, 2012

### Introduction

Air filters are a critical part of a fuel cell system. They remove harmful contaminants from the oxidant stream before they reach and damage the fuel cell stack. However, filter suppliers routinely characterize air filters according to standard test procedures that are not suitable for fuel cell systems. These test methods evaluate contaminants at ppm levels when ppb levels are more representative; they only test one contaminant at a time when multiple contaminants exist in ambient air; and they do not evaluate the impact of ambient air conditions (temperature and humidity) on air filter performance. These shortcomings make it impossible to extrapolate the results from the standard test conditions to fuel cell test conditions. As a result, IdaTech proposes to evaluate air filters under “real life” conditions.

### Approach

- Determine reasonable air contaminant levels.
- Perform ex situ testing of air filters to evaluate breakthrough and filter capacitance at different contaminant levels, gas flow rates, temperatures and relative humidity.
- Utilize statistical design of experiments to plan and analyze experimental data.

### Results

The outdoor test shelter (Figure 1) for the test equipment was built. All electrical wiring is complete. All large items (compressor, chiller, etc.) are installed in the test shelter. Construction of the frames and mounts to house the filter housing, mass flow controllers, and sampling valve

### Fiscal Year (FY) 2011 Objectives

- Build test stand for evaluation of commercial air filters for off-road applications.
- Evaluate air-filtration technologies for off-road applications.

### Technical Barriers

This project addresses the following technical barriers from the Fuel Cells section (3.4.4) of the Fuel Cell Technologies Program Multi-Year Research, Development and Demonstration Plan:

(A) Durability

### FY 2011 Accomplishments

- Gathered information on the air contaminants that may have an effect on fuel cell operation.
- Built exterior test facility to house air filtration test stand.



FIGURE 1. Constructed Outdoor Test Shelter at UC Davis

manifold are complete. A National Electrical Manufacturers Association enclosure for the electrical equipment, instrumentation and gas analyzers has been prepared for equipment installation. Air heaters have been assembled and are ready for installation. Conduit has been installed to connect the test shelter to the control room.

### **Conclusions and Future Directions**

- Complete the installation of all test equipment and plumbing in the outdoor shelter.
- Start shaken with estimated completion of August 1 with testing commencing shortly thereafter.