P.10 Diagnostic Instrumentation and Analysis Laboratory Support to DOE's Environmental Management Program

M. John Plodinec (plodinec@dial.msstate.edu, 662-325-2105)
Diagnostic Instrumentation and Analysis Laboratory
Mississippi State University
205 Research Boulevard
Starkville, MS 39759

Abstract

DIAL was established over 20 years ago to support the Department of Energy's magnetohydro-dynamic power program. Its historic mission has been to develop instrumentation and to test the performance of components and systems intended for use in severe environments. Its high-temperature testing capabilities and its ability to rapidly deploy very sophisticated instrumentation in the field has been an important component of its success. This has enabled DIAL to characterize the performance of critical components and systems under real-world conditions, through testing either at the DIAL facilities or at its customers' sites.

In accomplishing its past mission, DIAL has built up an engineering staff which is experienced in putting together whatever instrumentation and equipment is needed to characterize and solve processing problems. DIAL has provided its services to a diverse group of customers including DOE-EM's Office of Science and Technology (OST). Thus, DIAL is ideally suited to solve complex problems which are multi-disciplinary in nature.

DIAL's support of the HEPA filter technical working group is a good example of DIAL's ability to pull together a team that mixes scientific and engineering disciplines focused on solving real-world problems. Recently, DOE and the Environmental Protection Agency signed a Memorandum of Understanding to for joint R/D activities. Under this MOU, two working groups have been formed, one on Hg and one on HEPA filter performance and monitoring. These Working Groups consist of DOE and EPA personnel, contractors, and state regulators. DIAL's role is to act as the "operations arm" of the HEPA filter performance working group, collecting and codifying information and performing targeted testing. Initial objectives are to determine

(1) the "state of the art" for particulate monitoring,
(2) the viability of using particulate monitors to measure normal releases from HEPA filter systems,
(3) the practicality of using particulate monitors for identifying filter breakthrough, and
(4) HEPA filter performance during both normal operations and under challenging conditions.

DIAL has already provided a great deal of information to the rest of the Working Group on the current status of instrumentation, and on DIAL's preliminary prioritization of test conditions to be examined. DIAL's Combustion Test Stand will be a key asset once testing is underway.

Another excellent example of DIAL's team approach to providing solutions to important DOE problems has been its efforts to improve the reliability of waste transfers at Hanford. DIAL's team represents chemistry, chemical engineering, and fluid flow engineering. DIAL has provided significant enhancements in the computer code being used at Hanford to determine how to mobilize and safely transfer waste from one tank to another, and how to reliably process the waste. The most important of these have been development of quantitative phase diagrams for the double-salts (e.g., fluoride-sulfate) in the waste. These diagrams have been confirmed through comparison to the results of analysis of actual waste. In addition, DIAL engineers have begun to identify critical velocities for reliable waste slurry transfer to prevent transfer line plugging, and are seeking convenient indicators of incipient plug formation.

DIAL is also developing tools that will be needed by emerging DOE programs such as the stewardship program. DIAL is developing very sensitive and yet robust systems based on cavity ringdown spectroscopy that will be able to detect minute quantities of airborne radioactivity, as well as species regulated under RCRA. DIAL also has quantitative techniques available for monitoring the condition of buildings and structures. These are likely to be needed to ensure the integrity of facilities that cannot be effectively decontaminated, but must have provide long-term containment of radioactive species.

Unlike other laboratories, DIAL can carry out testing at its customers' sites. In March and then in June, a team of DIAL personnel carried out successful campaigns to characterize the conditions inside a lead glass furnace used to produce glass for TV screens. The DIAL team measured glass surface temperatures, furnace wall temperatures, glass surface velocity, and the radiative heat flux from five different directions. Gas temperatures, velocities, and compositions were also determined. These measurements required development of custom probes able to withstand the high temperature environment (ca. 2000°C) inside the furnace. These measurements are being used to benchmark a computer model of the furnace, and, eventually, to help to optimize furnace design and operation. These measurements highlight DIAL's capability to take sophisticated instrumentation into the field, and use it to make difficult measurements at a customer's location.