



# D I A L

**Diagnostic Instrumentation & Analysis Laboratory**  
Mississippi State, MS 39762-5932

## **Commercial Chlorine Analyzer Demonstrated During TVS Shakedown**

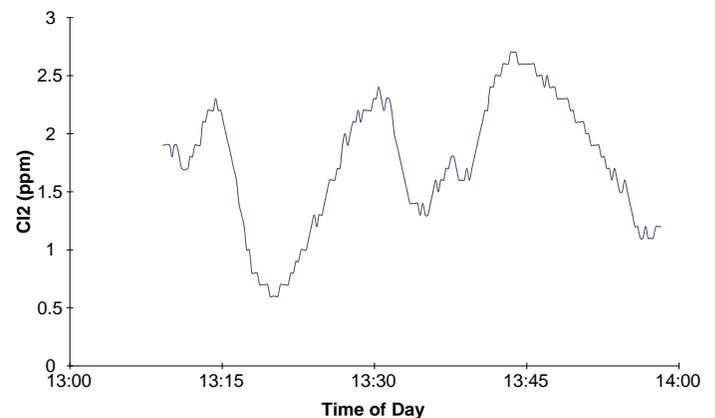
The U.S. Department of Energy is interested in the timely and cost-effective solution to environmental restoration and waste management of contaminated sites. To achieve this objective, the use of commercial technology is desired where possible. At the Diagnostic Instrumentation and Analysis Laboratory (DIAL) located at Mississippi State University, a program has been developed to help achieve this goal.

The Field Application, Coordination, Testing and Support (FACTS) program is focused on locating promising technology in the private sector and evaluating its potential for application to DOE's problems. In exchange for the loan of an instrument for testing, the manufacturer gains an unbiased demonstration of the instrument and exposure to those within DOE who may be interested in such an instrument.

Recently, a chlorine analyzer manufactured by MDA Scientific was evaluated during testing of the Transportable Vitrification System (TVS) at Clemson, South Carolina. The TVS is a thermal melter and off-gas treatment system which will be used at DOE sites to stabilize hazardous waste in a glass matrix. Combustible gases and regulated hazardous air pollutants are removed in the downstream components of the off-gas treatment system.

A Single Point Monitor (SPM), manufactured by MDA Scientific, Inc.\*, was selected for this test. The heart of the analyzer is MDA's proprietary Chemcassette Detection System. The Chemcassette is a small cassette of paper tape that has been specially formulated to react with specific gases or a specific family of gases. A gas sample

is passed over the tape for a pre-determined period of time. A chemical reaction between the gas and the tape results in a color change (stain) of a small dot on the tape. The intensity of the color of the stain is proportional to the concentration of gas in the sample. Traditional colorimetric techniques are used to measure the intensity of the stain which is then reported in concentration units on the front panel of the instrument. The SPM used for this demonstration was configured to detect chlorine although it can also respond to other halogens.



### **TVS chlorine concentration at stack.**

Chlorine was introduced at several locations in the TVS off-gas system. Background readings obtained with the MDA Scientific SPM detected chlorine in levels frequently above the full scale value of the SPM. The source of chlorine was traced to the substitution of a chlorinated material in the feed for the oxide form of the material originally anticipated. After sufficient time passed without adding feed material, the chlorine levels dropped to levels which allowed varying amounts

of chlorine to be added to the gas stream for testing purposes.

Initial testing consisted of gathering a set of background data. Although chlorine was present in the feed, there was a period of time during which the chlorine levels were within the detection limits of the SPM. This series of data was plotted (see figure) to reveal a cyclic variation in the chlorine levels.

To test the response of the MDA Scientific SPM, the melter was maintained at operating conditions without having feed material added. This allowed residual chlorine in the melt to be purged from the system. As a result, very low, stable chlorine levels were obtained. Chlorine was then injected into the off-gas system at various locations and detected downstream of treatment units. Results of this test are shown in Table 1.

**Table 1: Chlorine measurements of injected chlorine.**

Chlorine Injection Location	Cl <sub>2</sub> Added (ppm)	Cl <sub>2</sub> Measured After Treatment
Before Packed Bed Cooler	1.5	0.17
After Packed Bed Cooler	1.2	0.09
After Packed Bed Cooler	15.3	0.72
After Packed Bed Cooler	33.0	2.13
Entrainment Separator	17.4	1.70
Entrainment Separator	5.4	0.48
Before HEPA	5.9	0.08

As shown above, the TVS downstream components were quite effective in removing the chlo-

rine gas and the MDA Scientific SPM detected the chlorine under field operating conditions.

Testing of the MDA Scientific Chlorine Single Point Monitor was successful. The main drawback to this instrument for this test was its limited range. The manufacturer has other models available, but they were not available for this test. A few minor problems were noted and are being investigated by the manufacturer.

Overall, the SPM performed well. The Chemcassette technology is quite reliable. An added advantage of this technology is that, for certain instrument models, a simple Chemcassette change and the insertion of a different electronic key will allow the same instrument to detect some 80 other gases. This makes these models ideally suited for an application where several gases need to be monitored on a routine basis.

A more detailed description of these results is contained in *Transportable Vitrification System Shakedown Test: Field Applications, Coordination, Testing & Support (FACTS)*, DIAL 10575 DIAL Trip 96-1.5.

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