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# QUARTERLY STATUS REPORT

# FAST-RESPONSE ISOTOPIC ALPHA CONTINUOUS AIR MONITOR (CAM)

## CONTRACT NO. DE-AR26-98FT40365

**Fourth Quarterly Status Report**
**For the Period**
**July 4, 1999 - October 2, 1999**

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## DISCLAIMER

DE-AR26-98FT40365 Fourth Quarterly July 4, 1999 - October 2, 1999

## Project objective

The objective of this effort is to develop and test a novel Continuous Air Monitor (CAM) instrument for monitoring alpha-emitting radionuclides, using a technology that can be applied to Continuous Emission Monitoring (CEM) of thermal treatment system off gas streams. The CAM instrument will have very high alpha spectral resolution and provide real-time, on-line monitoring suitable for alerting workers of high concentrations of alpha-emitting radionuclides in the ambient air and for improved control of decontamination, dismantlement, and air emission control equipment.

Base Phase I involves the design, development, and preliminary testing of a laboratory-scale instrument. Testing will initially be conducted using naturally-occurring radon progeny in ambient air. In the Optional Phase II, the Base Phase I instrument will be critically evaluated at the Lovelace Respiratory Research Institute (LRRI) with characterized plutonium aerosols; then an improved instrument will be built and field-tested at a suitable DOE site.

## Major milestones

- Design criteria and specifications defined — Completed on schedule
- Prototype unit operational — Completed on schedule
- Performance of prototype unit demonstrated

## Accomplishments and technical progress

July 1999

In May, the prototype CAM instrument became operational, and initial data was taken using the instrument. Modifications to the prototype CAM instrument were begun in order to improve the instrument's performance. This work includes an improved detector mount for enhanced alignment of the detectors to the film, and an enhanced film tracking system, to improve alignment of the film to both the ESP and the detectors. Several changes to the film transport system are

being made to accommodate the enhanced film tracking system.

The replacement linear positioning slide and motor, to provide improved vertical alignment of the film within the instrument, were received in June. This month, the linear positioning slide was installed in the prototype CAM, and most of the remaining positioning slide components were received. Unfortunately, the wrong motor adapter was shipped by the manufacturer. Until the proper motor adapter is received, manual actuation of the replacement positioning slide will be used to provide film libration for the instrument. This delay is not expected tp impact the overall program schedule.

The prototype CAM instrument was operated several times to obtain additional performance data. Typical data from this month's testing is displayed in Figure 1. This Figure establishes how the response of the prototype CAM system reached steady-state conditions after approximately 80 minutes -- the time it took for the instrument to reach steady-state conditions (given the as-tested conditions). In addition, this Figure illustrates how the instrument indicates that a spike in the local concentration of radon progeny occurred at 100 minutes.

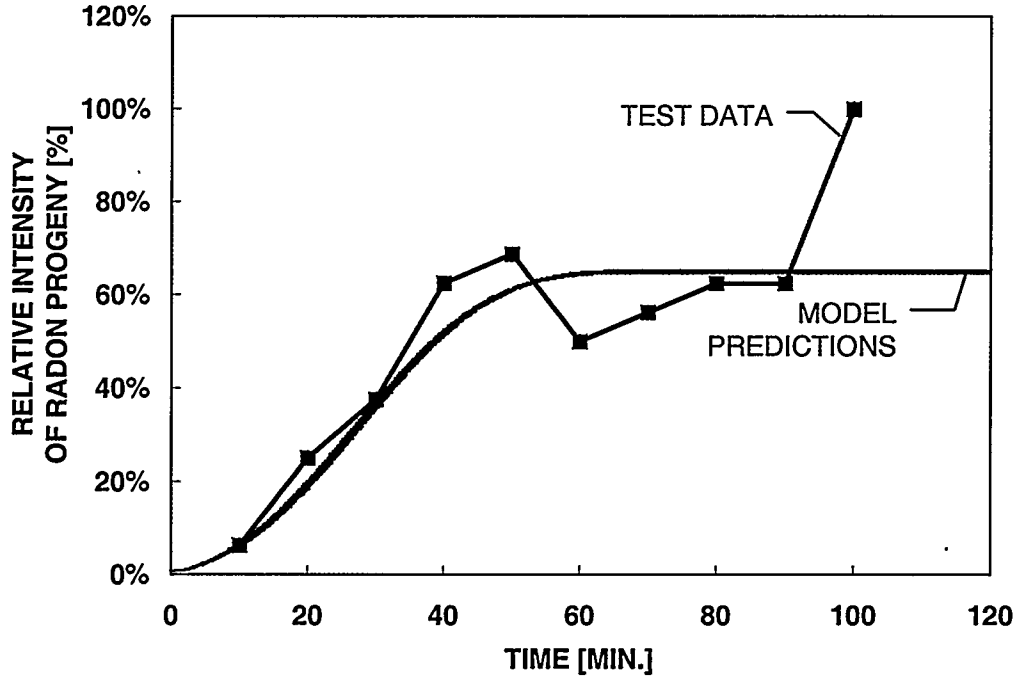


**Figure 1 Librating ESP CAM Results**

These data indicate that the transient analytical performance of the librating ESP CAM is described reasonably well by the performance model. Additional testing will be conducted in order to provide additional confirmation of the prototype CAM system's operation.

August 1999

In May, the prototype CAM instrument became operational, and initial data was taken using the instrument. Modifications to the prototype CAM instrument were begun during June in order to improve the instrument's performance. This work includes an improved detector mount for enhanced alignment of the detectors to the film, and an enhanced film tracking system, to improve alignment of the film to both the ESP and the detectors. Several changes to the film transport system are being made to accommodate the enhanced film tracking system.

The replacement linear positioning slide and motor, to provide improved vertical alignment of the film within the instrument, were received in June and installed in July. The correct motor adapter was received from the manufacturer this month, completing the linear positioning slide upgrade.

The prototype CAM instrument was operated several times to obtain additional performance data. Performance data was obtained for both the existing hardware configuration, and for an alternative, less complex arrangement. The alternative configuration involved simplifying the flow straightening arrangement at the air sample inlet to the electrostatic precipitator. With the less complex air inlet, signal response of the prototype CAM instrument was improved by 47%.

Detailed characterization of the incremental performance of the electrostatic precipitator (ESP) was conducted this month. These tests involved determining the relative collection efficiency of the precipitator as the sample air traverses from the inlet towards the outlet of the ESP. Tests were conducted using multiple 0.75 in. x 0.75 in. stainless steel coupons, which were sequentially exposed in the ESP and then counted under a silicon detector. Figure 2 illustrates the test results, with the greatest area of particulate collection being in close proximity to the ionizing wire. Fully 38% of the radon progeny were collected in a region extending from 3 in. to 3.75 in. from the ESP's air inlet. In addition, no radon progeny was collected within the first 0.75 inch of the ESP,

and nothing was collected on coupons more than 6" back from the ESP's inlet. These test results indicate that a maximum of 6" of ESP length is required to complete collection of the particulates of interest.

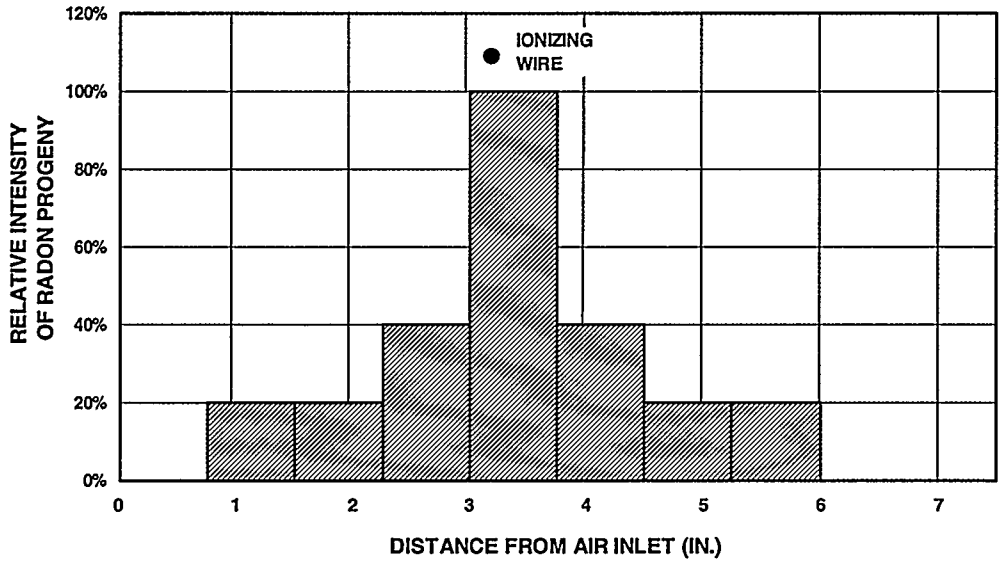


**Figure 2 Distribution of Radon Progeny Across ESP Collector Plate**

Additional testing will be conducted in order to provide additional confirmation of the prototype CAM system's operation.

September 1999

In May, the prototype CAM instrument became operational, and initial data was taken using the instrument. Modifications to improve the prototype CAM instrument's performance that were begun during June were completed in August. This work included an improved detector mount for enhanced alignment of the detectors to the film, and an enhanced film tracking system to improve alignment of the film to both the ESP and the detectors. Several changes to the film transport system were also made to accommodate the enhanced film tracking system.

The prototype CAM instrument was operated several times this month to obtain additional performance data. Performance data was obtained for both the existing hardware configuration, and for an improved, parallel-flow airflow arrangement. The alternative configuration involved rotating the air sample inlet

to the electrostatic precipitator by 90 degrees, in order to improve the uniformity of particle deposition onto the film. With the improved, parallel-flow air inlet, signal response of the prototype CAM instrument was improved by a factor of five (See Figure 3).

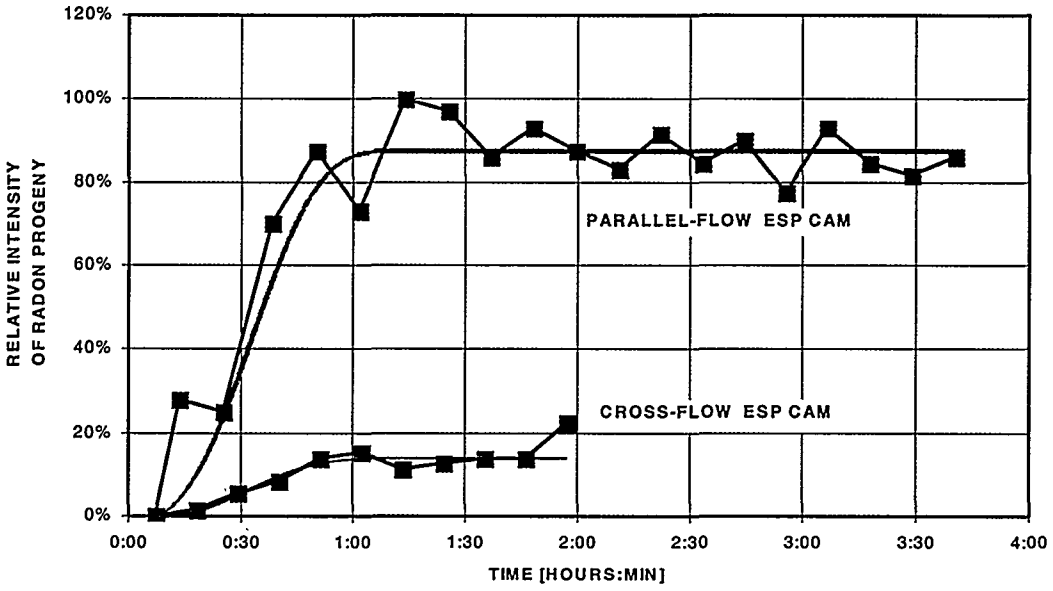


**Figure 3 Sensitivity Improved by 5X With Parallel-Flow Design**

Additional testing will be conducted in order to provide additional characterization of the prototype CAM system's operation and performance.

### Assessment of current status

The project is on schedule and underspent. Measures are being put into place that will correct the spending discrepancy in the near future.

### Plans for the next two months

A Poster Paper presentation titled "Development of a Fast-Response Isotopic Air Monitor" will be made at the Industry Partnership for Environmental Technology Development and Deployment, Federal Energy Technology Center (FETC), Morgantown, WV, October 12-14, 1999.

The Laboratory Prototype Testing Task will continue.

A Topical Report will be submitted that summarizes the work conducted during the Design Criteria and Specifications Task.

A paper copy of the LRRI NEPA Application will be submitted.

The Phase I NEPA approval will be received for Phase I activity by LRRI.

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