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# *Chemical, Biological, Radiological, Nuclear, and Explosives (CBRNE) Sensing XVIII*

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# Contents

**SESSION 4 RADIOLOGICAL, NUCLEAR, AND BIOLOGICAL**

# Authors

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1 Advances in Chemical Sensing I
**Augustus Way Fountain III**, U.S. Army Edgewood Chemical Biological Center (United States)

# Introduction

The 18th meeting of the CBRNE Sensing Conference met as part of the 2017 SPIE Defense + Commercial Sensing (DCS) Symposium in Anaheim, California. The Conference extended over the course of three days and contained 43 presentations. The Thursday sessions included joint sessions with the Micro- and Nanotechnology Sensors, Systems, and the Applications and Advanced Environmental, Chemical, and Biological Sensing Technologies session. Although the conference was smaller this year than in the most recent past, all of the sessions were well attended. We plan to continue the Conference and hopefully increase the number of papers presented as the Conference travels with the 2018 SPIE DCS Symposium to Orlando, Florida.

**Key Papers and Highlights:**

Nathaniel R. Gomer of ChemImage Corporation (10183-2) presented ChemImage's work on the use of hyperspectral imaging (HSI) for stand-off detection. The ultimate goal is to provide an end user an automated detection capability. ChemImage's VeroVision is a product that is able to use sunlight as the external light source and provide portable stand-off detection up to 20 m for solid and liquid agents. Using this and other ChemImage products (such as a Hyperspectral Raman Spatial Heterodyne Spectrometer), they are developing a sensor array suite that can be used as a passive stand-off detector.

David B. Kelley of Block Engineering (10183-3) presented work funded by the Intelligence Advanced Research Projects Activity (IARPA) Standoff Illuminator for Measuring Absorbance and Reflectance Infrared Light Signatures (SILMARILS) program. The work uses a mid-infrared HSI quantum cascading laser (QCL) to distinguish chemicals according to their reflectance spectrum. Currently, the limits of detection are slightly under 1 $\mu g/cm^2$, and the research group is developing signature models for different materials on multiple surfaces with varying morphologies.

Jan Larsen of the Technical University of Denmark (10183-6) presented research detailing an approach to detect drug- and explosives-precursors using colorimetric sensor technology for air sampling. The technology used a series of 0.7 mm diameter, 1-mm spaced ink dots in a 15x15 array on a disposable cassette. There were 27 dyes (8 replicates) in the process, but conceivably more or less inks can be used depending on what is to be detected. The absolute color of the dots was not important but rather the color change over time. Principal Component Analysis was used to determine whether an analyte could be discriminated or not. Explosive and illegal drug precursors were able to be discriminated, even with confounding substances.

Michael R. Papantonakis of the United States Naval Research Lab. (10183-14) presented research that investigated the physical and environmental factors that affect the persistence of explosive particles. While the research focused on explosive materials, similar work can be performed for chemical and biological agents. There are multiple confounding parameters that contribute to the fate of an agent on a particular surface, including particle and size density, temperature, chemical, airflow, humidity, and adlayer (fingerprint residues).

Sharene Young of the Department of Homeland Security, Science and Technology Div. (10187-1) presented an overview of the university/industry partnership to develop X-ray detection technologies from a technology readiness level (TRL) of 4/5 to 6/7. A major aspect of the program's Phase I was for stakeholder engagement with open communication, socialization of potential need, and implementation possibilities, where current interactions and relationships could foster future collaboration. Phase II involved preliminary Testing and Evaluation (T&E) (breadboard testing), signature T&E (Analysis of Alternatives), secondary T&E (data collection in "real world" test scheme), and critical design review (analysis of testing and design for improvements). Future programs of similar nature will focus on lower TRLs.

Julia R. Dupuis of Physical Sciences, Inc. (10194-101) presented her research on long wave QCLs for long-range surface contaminant stand-off detection. The limits of detection shown for chemical warfare agents, toxic industrial chemicals, toxic industrial materials, and explosives were approximately 0.1 $\mu g/cm^2$, although there was some noise at smaller concentrations.

Once again I want to thank my committee and co-Chairman who really make this conference happen. There is no way I could review all the abstracts and proceedings papers or host all the sessions without them. I am confident that this conference remains the most important means of bringing together the leaders in the field of CBRNE sensing from every sector; government, academia and industry. I hope to see the Conference return in full when we travel to Orlando next year.

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