Part two
Impact of the Department of Homeland Security (DHS) on radiation detection instrumentation

MORGAN COX, CHP

October 2008

Impact of the DHS on Radiation Detection Instrumentation

In memoriam

- John Leonowich, UNLV
- Sergio Lopez, MGPI
- George Newton, LRRI

May they rest in peace.

The DHS & Radiation detection

- Events/Milestones that precipitated the need for ionizing radiation detection, more and/or better:
- In the 19th century: The discovery of x-rays and natural radioactivity;
- In the 20th century: The medical uses of radiation, the advent of nuclear weapons and the emergence of nuclear power; and
- In the 21st century, the events of 9/11 & the formation of the Department of Homeland Security.

The DHS & Radiation detection

- Most of the earlier advances in radiation detection were for the purposes of radiation protection for workers, the public and/or the environment.
- For example, we can see the progress made in reducing exposures to workers by the uses of improved detection and dosimetry: first using film, then quartz fiber dosimeters, and now TLD, OSLD and electronic dosimeters. These latest forms of detection have lead to lowering doses to all concerned.

The DHS & Radiation detection

Similar analogies apply to the various types of radiation detectors with improvements to:

- -Ionization chambers;
- -G-M counters;
- -Proportional counters;
- -Scintillation detectors;
- -Solid state detectors; and some hybrid, combined and advanced detectors.
- Some examples.

The DHS & Radiation detection

Improved radiation detection technology & methodology are driven by three important forces, not necessarily in this order:

1) The needs & applications of various users;

2) The available current technology, and

3) Applicable regulations, federal, state and/or local.

The DHS & radiation detection markets

- By 2000 the overall market for radiation detectors was either stable or growing very slowly. Why?
- No new nuclear power plants were brought on line in the USA in ~25 years;
- US Department of Energy had nearly all of the instruments needed with few replacements; and
- Foreign competition was mainly fulfilling foreign requirements and competing for US markets.

Impact of the DHS

- The terrible events of 9/11 had little immediate effect on radiation detection.
- In late 2002 the DHS was proposed as a federal department.
- A threat from an RDD or “Dirty Bomb” was identified
- In November 2002 radiation detection experts were summoned to NIST to discuss new ANSI N42 standards needed quickly to cover instruments for uses by DHS-related personnel and agencies.
- The DHS officially became a federal department in January 2003.

Radiation detection markets

- By 2002 the overall market for radiation detectors was saturated or growing slowly. Why? Because there was little incentive to invest in new technology, and there were few new applications.
- Nuclear instrument manufacturers were merging and combining in an effort to maintain or increase market share. The number of manufacturers had decreased markedly. For example, affiliates in the Health Physics Society decreased in number from 114 in 1982 to 64 in 2008.

Direct effects of the DHS

- The DHS mandated the swift development of four new ANSI N42 instrument standards.
- The initial emphasis was on radiation *detection* and not on radiation *protection*, dose or exposure evaluation or reduction! Finding the device or the radioactive material was paramount.
- Then currently available radiation detectors were considered for possible use by DHS agencies.

The importance of quickly developing standards for test and evaluation of instruments was expressed most emphatically

- Battalion Chief Robert Ingram of the NYFD Center for Terrorism and Disaster Preparedness said:

“We need these standards, and we need them yesterday!”

The first ANSI standards for the DHS

- ANSI N42.32 for personnel radiation detectors;
- ANSI N42.33 for portable radiation detectors;
- ANSI N42.34 for portable radionuclide identifiers; and
- ANSI N42.35 for portal radiation monitors.
- All four were initiated in late 2002; three were published in 2003, and the fourth in early 2004.
- Never before or since were ANSI standards developed so quickly!

DHS testing & evaluation (T&E) protocols

- The DHS also mandated the developments of rigorous Testing &Evaluation protocols to accompany and parallel the four ANSI standards.
- Some 200 models of the various and relevant instruments covered by the standards were evaluated by DOE laboratories:
- Lawrence Livermore National Lab,
- Los Alamos National Lab;
- Oak Ridge National Lab, and
- Pacific Northwest National Lab.
- The DHS testing in 2 phases was completed in 2005.

Demands for new technology

- What the DHS did with the mandates for new ANSI instrument standards and for more rigorous testing and evaluation protocols was to light a fire under the radiation detection industry! How?

- By demanding new ideas, new technology and some resultant new and better instruments. The DHS tied some funding requirements to the standards for the procurement of radiation detectors for homeland security users. This provides some incentives to develop and produce new, smarter, faster and smaller radiation detectors.

Examples of required new technology

- Some examples of needed new technology:
- ANSI N42.32 for personnel detectors has an option for neutron detection. This points to the need for a pocket-sized detector with both photon and neutron detector (s). None exists yet that fully meet the requirements of the standard!
- ANSI N42.33 for portable survey instruments has a requirement for stable performance from a few μR/h or background to 10 mR/h.

REQUIRED NEW TECHNOLOGY (CONTINUED)

- ANSI N42.34 for portable radionuclide identifiers also calls for neutron detection. Here we see the need for two different detectors in the same instrument, plus photon spectroscopy.
- ANSI N42.35 for portal monitors now includes personnel, vehicular and package monitors with photon spectroscopic and neutron detection capabilities.
- So some new technology has definitely been required to meet the needs of the DHS, but there is still room for improvement.

Examples of Commercially Available Instruments (No Endorsement Implied)

Summary

- DHS emphasis has been on *detection* not protection, and innovative, new instruments are needed for detection.
- DHS has promoted miniaturization.
- DHS stimulated advanced photon spectroscopy.
- DHS has also stimulated better neutron detection.
- DHS has demanded better training, software, communications and more user friendly instruments.

The ANSI standards from ANSI N42.32 to ANSI N42.49 with a few exceptions are or will be published for use by DHS agencies. By general content these are:

- ANSI N42.32- personnel detectors
- ANSI N42.33- portable survey instruments (for photons)
- ANSI N42.34- portable radionuclide identifiers
- ANSI N42.35- portal radiation monitors
- ANSI N42.37- training with radiation detectors
- ANSI N42.38- spectroscopy-based portal monitors
- ANSI N42.39- portable neutron detectors
- ANSI N42.41- active interrogation systems (for cargo)

More ANSI standards for DHS

- ANSI N42.42- data formatting for radiation detectors
- ANSI N42.43- mobile & transportable portal monitors
- ANSI N42.44- checkpoint cabinet x-ray systems
- ANSI N42.46- photon and x-ray systems for cargo and vehicles
- ANSI N42.48- spectroscopic personnel detectors
- ANSI N42.49A and B- personal emergency radiation detectors, PERDs, alarming and non-alarming

ANSI standards for the DHS

Leadership

Bert Coursey- DHS/NIST

Lisa Karam- NIST

Mike Unterweger- NIST

Joe McDonald- PNNL (emeritus)

Lou Costrell- NIST (emeritus)

Sources for ANSI N42 standards

- morgancx@swcp.com
- unterweg@nist.gov
- louiscostrell@nist.gov
- http://www.hssd.us/ ANSI Homeland Security Database
- https://www.rkb.us/ Emergency Responder website
- New volunteers for standards work in the audience?