Domestic Nuclear Detection Office (DNDO)

Graduated Rad/Nuc Detector Evaluation and Reporting (GRaDER®) Program Testing Update

Meeting Focus:

ANSI – HSSP Workshop on CBRNE Standards

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Website: http://www.dhs.gov/GRaDER
Email:
GRaDER.Questions@hq.dhs.gov
GRaDER.Comments@hq.dhs.gov
GRaDER.Applications@hq.dhs.gov

Agenda

- GRaDER® program description and process
- Equipment classes included in program
- Description of compliance levels 1 and 2
- 2011 Testing results
- Lessons learned
- Path forward

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GRaDER® Mission & Objectives

GRaDER® Mission:

*Identify radiation detection products that **satisfy standards** and Homeland Security mission requirements.*

*Enable Federal, State, local, tribal and territorial agencies to make more **informed** radiological/nuclear detector procurements.*

Pertinent DNDO Objective:

Thoroughly characterize detector system performance before deployment.

GRaDER® objectives:

- Provide infrastructure for the collection of high integrity test data.
  - Standardize instrument testing and results
  - NVLAP accreditation and proficiency assessments
- Testing program that is self-sustaining
  - Manufacturers pay labs
  - Labs submit and maintain accreditation
- Develop and fund Government Post Market Surveillance program
- Encourage development of better Rad/Nuc equipment

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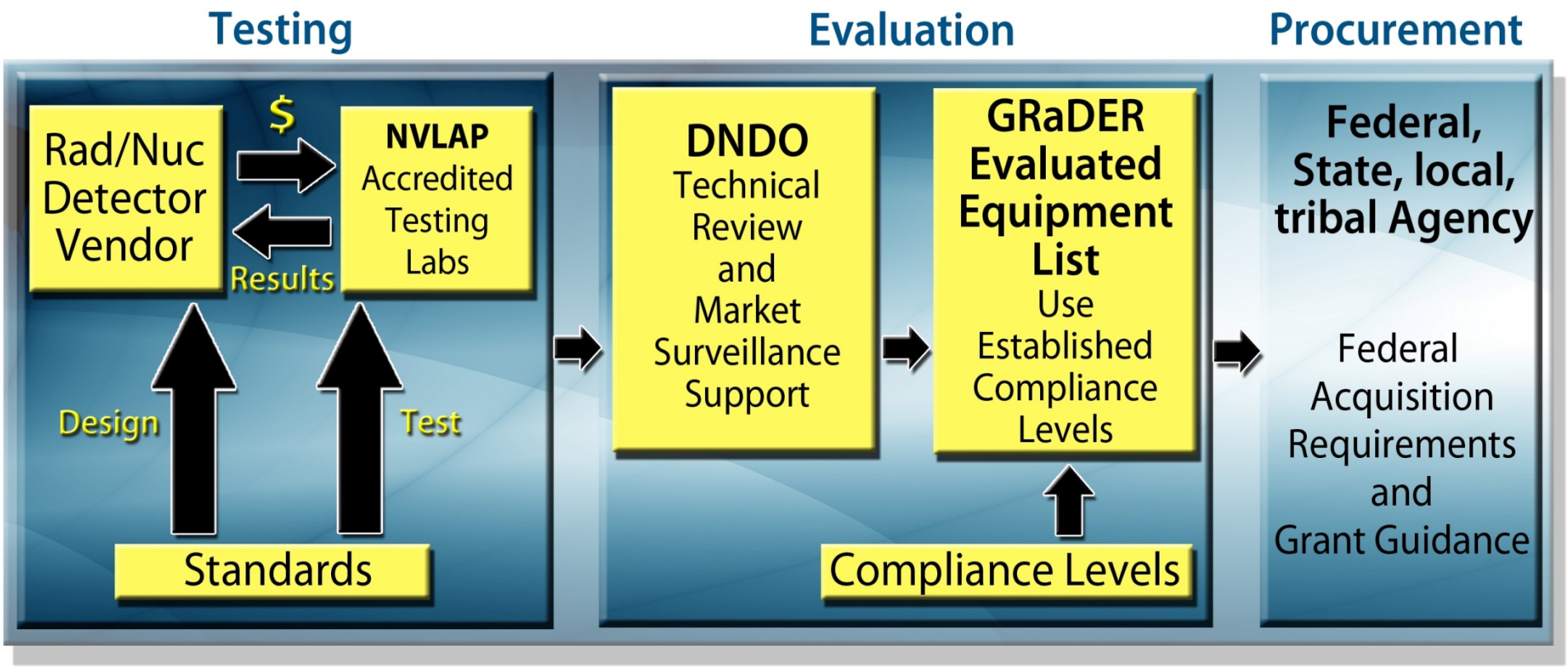
GRaDER® Process

Graduated Rad/Nuc Detector Evaluation and Reporting (GRaDER[SM]) Program



* NVLAP – National Voluntary Laboratory Accreditation Program

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GRaDER® Categories & Standards

Category	Title	ANSI Standard
1*	Alarming Personal Radiation Detectors (PRD's)	N42.32 – 2006
2	Portable Radiation Detection Instrumentation (Survey Meters)	N42.33 – 2006
3*	Hand-held Instruments for the Detection and Identification for Radionuclides (RID's)	N42.34 – 2006
4	Radiation Detection Portal Monitors (RPM's)	N42.35 – 2006
5	Spectroscopic Radiation Portal Monitors (SRPM's)	N42.38 – 2006
6*+	Mobile and Transportable Systems	N42.43 – 2006
7	Spectroscopic Personal Radiation Detectors (SPRD's)	N42.48 – 2008

- Categories in cost share program, Fall 2010-Summer 2011
- + Also tested backpacks to Draft N42.53

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GRaDER® Equipment Categories

- **Category 1** - Alarming Personal Radiation Detectors (PRDs) ANSI N42.32




- **Category 2** - Survey Meters ANSI N42.33





- **Category 3** – Radioactive Isotope Identification Devices (RIIDs) ANSI N42.34



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GRaDER® Equipment Categories

- **Category 4** - Radiation Portal Monitors (RPM's) ANSI N42.35




- **Category 5** - Spectroscopic Radiation Portal Monitors ANSI N42.38

- **Category 6** - Mobile and Transportable Systems ANSI N42.43





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GRaDER® Equipment Categories

- **Category 7** – Spectroscopic Personal RadiationDetectors (SPRDs)

ANSI N42.48

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GRaDER® Compliance Levels

- **Level 0** – Equipment has been tested, but:
  - the test results are not available,
  - the test results are being evaluated, or
  - the test results do not meet the minimum subset of the standards as set forth in each category.
- **Level 1** – Equipment meets a ***subset*** of the applicable ANSI standard performance requirements. Defined at http://www.dhs.gov/GRaDER
  - *DNDO-selected; focus on radiation detection and other essential elements of standard.*
- **Level 2** – Equipment fully meets the applicable ANSI standard sections.
- **Level 3** – Equipment meets Level 1 or Level 2 and also satisfies the requirements of the applicable technical capability standard (government unique standard).
  - *Technical Capability Standard released for RIDs, Oct 2011.*

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Equipment Models Tested in FY 2011

Government Shared Cost campaign:

- 7 Radioisotope Identification Devices (RID)
- 7 Personal Radiation Detector (PRD)
- 2 Backpacks

Total: 16 Rad/Nuc technologies

Vendor Funded testing:

- Retest after adjudication, if necessary (< Level 1 or incomplete testing).
- Independent testing using the published GRaDER model

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RIID Test Results (Example Detailed)

Single radionuclide identification {6.6} — Fail — Fail

The manufacturer did not provide radionuclide-specific test results. Two out of three instruments have less than 8 correct ids (out of 10 trial some nuclides.

Number of correct identifications for unshielded sources:

S/N	1001	1002	1003
^{40}K	3#	2#	6#
^{57}Co	10	10	10
^{60}Co	10	10	10
^{67}Ga	10	10	10
^{99m}Tc	10	10	10
^{125}I	9##	9##	9*
^{131}I	0###	0###	0###
^{133}Ba	6####	6####	6####

#also id some on this list: Ra226, Tl208, Th228, Th232, Elevated U concentration. ##elevated radiation field, also id K-40.
###also id Xe-133. ####also id Cs-137.
*also id K-40 and Cs-137.

S/N	1001	1002	1003
^{137}Cs	10	10	10
^{192}Ir	10	10	10
^{201}Tl	0*	0*	0*
^{226}Ra	10	10	10
^{232}Th	0**	0**	0**
^{233}U	N/A	N/A	N/A
^{235}U	10***	10***	10***
^{238}U	10****	10****	10****
RGPu	0+	0+	0+
^{241}Am	10	10	10

*also id Xe-133, Tl-204. **also id Th-228. ***id as HEU.
****id as DU, also K-40.
+also id some on the list: Am-241, K-40, Cs-137, shielded B-133, Pu in Am-241, Elevated U Conc.

Number of correct identifications for shielded sources:

S/N	1001	1002	1003
^{40}K	N/A	N/A	N/A
^{57}Co	10	10	10
^{60}Co	10	10	10
^{67}Ga	10	10	10
^{99m}Tc	10	10	10
^{125}I	N/A	N/A	10
^{131}I	10	10	10
^{133}Ba	7*	8*	7*

*also id Cs-137.

S/N	1001	1002	1003
^{137}Cs	10	10	10
^{192}Ir	10	10	10
^{201}Tl	0*	0*	0*
^{226}Ra	N/A	N/A	N/A
^{232}Th	0**	0**	0**
^{233}U	N/A	N/A	N/A
^{235}U	N/A	N/A	N/A
^{238}U	N/A	N/A	N/A
RGPu	N/A	N/A	N/A
^{241}Am	N/A	N/A	N/A

*also id Xe-133, Tl-204. Also id Th-228.

Simultaneous radionuclide identification {6.7} — Pass — Fail

The instruments were used to identify RGPu and ^{133}Ba simultaneously.
Correct identifications out of 10 trials:

	1001	1002	1003
RGPu Ba-133	8*	7*	5*

*also id Cs-137 .
Level 1 requirement only requires the identification of RGPu or ^{133}Ba.

Interfering ionizing radiation (Gamma) {6.8} — Pass

All 3 units were able to identify ^{241}Am and ^{60}Co in the presence of ^{232}Th.

Number of correct identifications out of 10 trials

Gamma interference ^{232}Th	1001	1002	1003
^{241}Am	10	10	10
^{60}Co	10	10	10

Interfering ionizing radiation (Beta) {6.9} — Pass

All three units were able to identify ^{137}Cs in the presence of a pure beta emitter.

Number of correct identifications out of 10 trials

Beta interference ^{90}Sr	1001	1002	1003
^{137}Cs	10	10	10
^{90}Sr (beta only)	8	10	9

False identification {6.10} — Pass — Pass

All Units: DUT stated "move closer" during the ID process.

Number of correct identifications out of 10 trials

	1001	1002	1003
No source	10	10	10

Interference from surrounding material {6.11} — Pass — Pass

All Units correctly identified Cs-137 in the presence of backscattered radiation.

Number of correct identifications out of 10 trials

	1001	1002	1003
^{137}Cs	10	10	10

Variation of identification based on angle of incidence {6.12} — Pass

The requirements for correct identification for ^{241}Am, ^{60}Co and ^{137}Cs in the vertical and horizontal planes were all met.

Number of correct identifications out of 10 trials.
Angular positions: A – 0 degree, B --- -45 degree, C -- +45 degree.

	^{241}Am *		^{60}Co		^{137}Cs	
Plane / Angle	Ver.	Hor.	Ver.	Hor.	Ver.	Hor.
1001						
A	10	10	10	10	10	10
B	10	10	10	10	10	10
C	10	10	10	10	10	10
1002						
A	10	10	10	10	10	10
B	10	10	10	10	10	10
C	10	10	10	10	10	10
1003						
A	10	10	10	10	10	10
B	10	10	10	10	10	10
C	10	10	10	10	10	10

Neutron response {6.13} — Not Implemented

This test was not required because the instruments respond in count rate.

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GRaDER® Program Strategy

At the outset of GRaDER® Testing, DNDO assumed

1. As labs provided Self-Declaration of Conformity (SDOC), they were fully prepared to obtain accreditation from NVLAP
2. Each element of the standard would be a simple Pass/Fail
3. Test protocols in standard would be straightforward and unambiguous
4. Evaluating testing results provided by the labs would be consistent and easy to score pass/fail

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Lessons Learned after 1st Round of Testing

After testing, what DNDO learned:

1. Labs experienced lessons learned
2. Every vendor failed documentation requirements; that's an easy fix
3. Many standard elements were not black/white in interpretation
4. Some standard elements are still unmet by today's commercial instruments
5. Changes occurring in standards and market require substantive equipment modifications (eg. He-3 shortage)
6. For some elements, vendor states instrument will not pass

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Major Takeaways

- No instruments pass even Level 1 (some come close)
- In general, no instrument passed all standard elements but at least one instrument passed every element
- Technical issues with how standard is written
- Test protocols were not consistently interpreted across all labs
- GRaDER testing provides significant value to vendor, to user, and to standards committees!

Path forward for Future GRaDER® Testing

- With current results in hand, a larger team (including F/S/L users) should re-evaluate Level 1 requirements
- Standards committees and vendors should consider making changes; DNDO has submitted recommendations to ANSI Standards comm. reps.
- DNDO may consider another round of testing
- When ANSI standards are followed, ITRAP+10 testing will be considered as GRaDER testing

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Results Information Sharing

GRaDER® Evaluated Equipment List (GEEL)

- 2011 Test results are available.
- Will be accessible through the FEMA Responder Knowledge Base (RKB), HSIN webpage.

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