

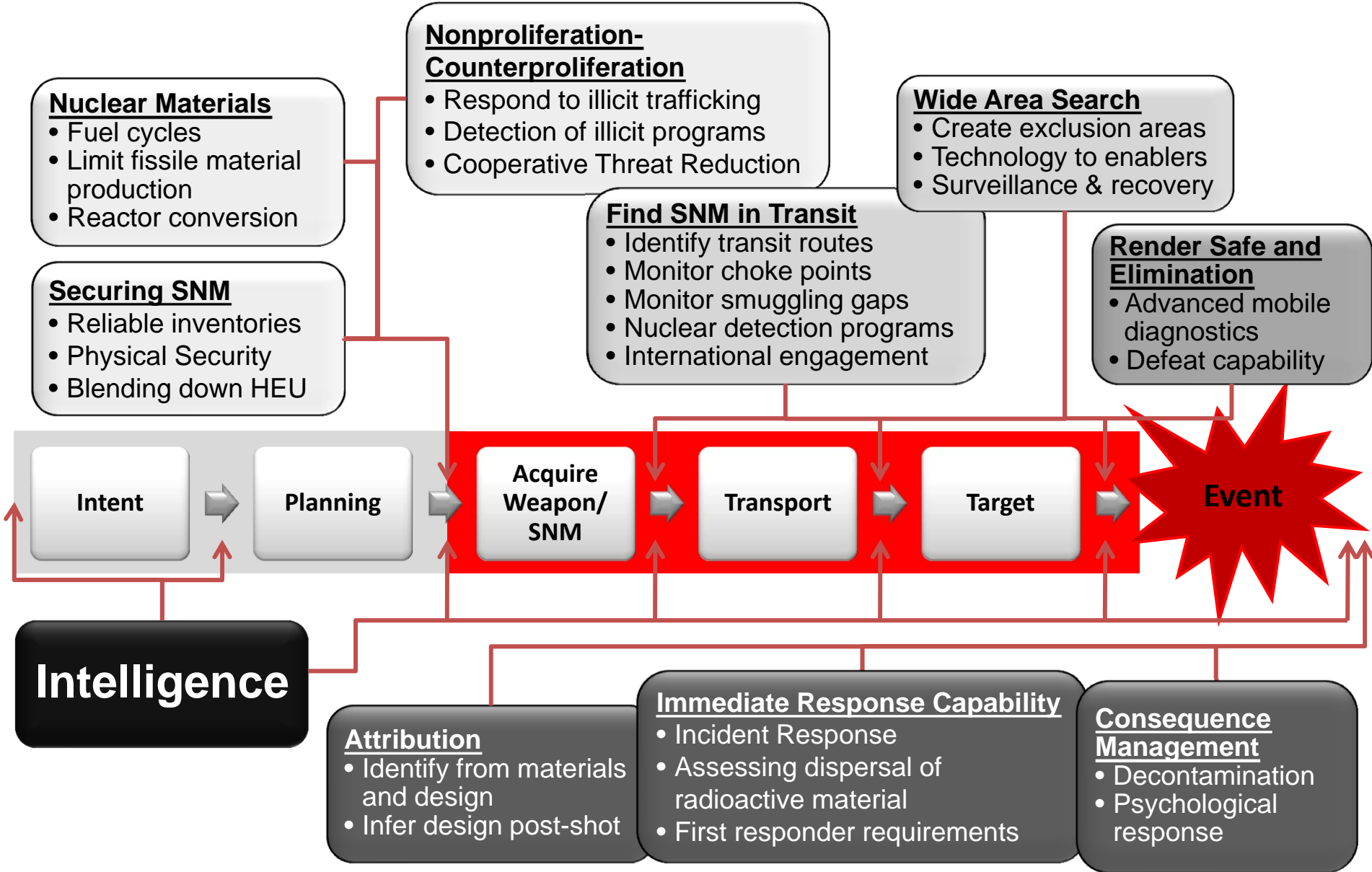
The Urgent Requirement for New Radioanalytical CRMs for Measurement Traceability in Nuclear Safeguards, Nuclear Forensics, and Consequence Management

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WHAT IS CNT?

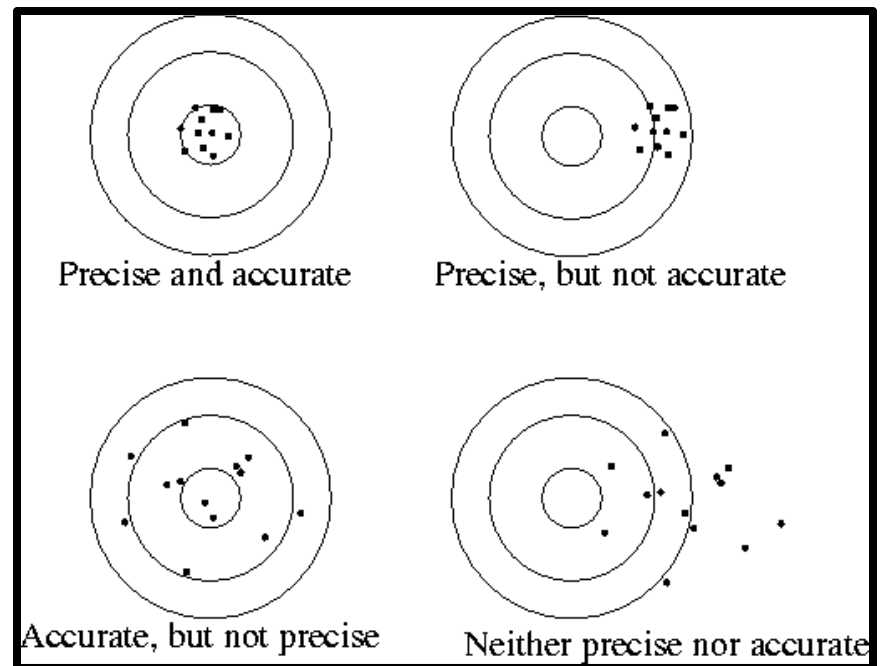


Metrology: science of measurement and its application

CRM: (Certified/Standard) reference material, documented by authoritative body, for specified property values with uncertainties and traceabilities, using valid procedures.

Traceability: "property of a measurement result whereby the result can be related to a reference through a documented unbroken chain of calibrations, each contributing to the measurement uncertainty."

CRM radioanalytical metrology uses:
instrument calibration, method accuracy and uncertainty, method development, method validation, establish measurement traceability, provide basis of comparison of laboratories over time, provide legal defensibility of measurement results, capability testing, readiness testing.



What is missing?

CRMs to support State-of-the-Art Measurement Capabilities and Metrology Infrastructure for Radioanalytical Measurements

Non-Existent

Not Good Enough for High Fidelity Attribution

Short Supply

Exceedingly Rare

Long Development Time

Very Expensive

Problem?

Required CRMs are needed NOW

5 years to develop one CRM

Few have the capability to develop required CRMs

CRM development require specialized non-existent facilities

Process is labor intensive and costly

How to Close this Gap?

Labor Force - Enlist increased numbers of capable metrologists

Prioritize - Focus their attention on this mission

Facilities - Establish specialized facilities

BL

Early funding/investment is paramount as waiting will cause:

- An increase in the amount of funding required to repair the situation to an acceptable level.
- Less flexibility in the timing of that repair to occur - causing much likely angst in the programmatic and budget portions of all affected players.
- Increased error in measurement that may lead to significant decision error resulting in damage or injury.

Failing to address this now will result in a CRM scarcity issue that will:

- Result in unplanned measurement scenarios (unexpected nuclides, activity levels, matrices) having negative impact – e.g. causing an inability to accurately triage massive numbers of contaminated because we do not have the right information.
- Result in more difficult processes needing accurate metrology, or erroneous attribution/retribution, force protection, life saving.
- Remain status quo which has limited capability.

What has been done thus far?

- 3 NIST workshops (2006, 2009, 2010)
- 43 Hex-charts covering the CRMs (multitude of forms) and Special Facilities (Gap, Solution Options, Cost)
- Draft NIST Special Publication of Hex-charts and Support Papers
- Briefed Issue at Feb'12 & July 2012 STRATCOM CWMD GSC (CENTCOM, DTRA, JPM-RND NSWCDD, J8-JRO-CBRN, NORTHCOM, PACOM, STRATCOM, USATA, DHS/DNDO/NTNFC); Briefed Issue at PACOM April'12 (Camp Smith, HI)
- Crafted STRATCOM R/N CRM Quad-chart and White Paper for FY15 DoD Budget inject
- DHS NTNFC CRM effort focus on Interdicted Radiological and SNM – 1st CRM 2012

Workshops

Intercomparison Program for Radionuclide Isotopic Studies (February 2006)

Radionuclide and Nuclear Material Certified Reference Material (August 2009, February 2010)

Charles Martin Johnson (USAF), Stephen LaMont (LANL), William Pramenko (VIP)



Focus Issues

Pre-Boom:

Safeguard Material Characterization

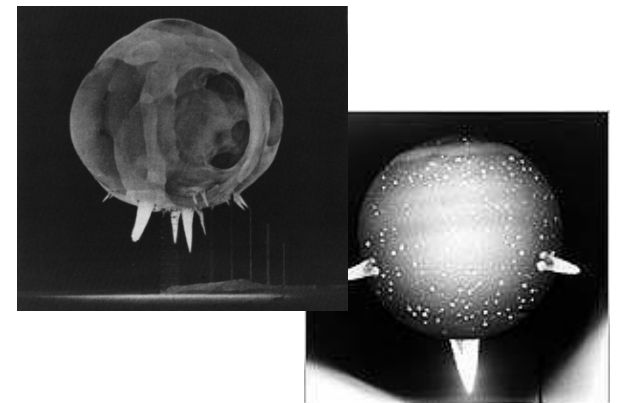
Pre-Det Nuclear Forensics

Detecting Nuclear Technologies

Post-Boom:

Post-Det Nuclear Forensics

Consequence Management



Safeguard Material Characterization

Plutonium & Uranium Isotopic Reference Materials

Production of Plutonium Non Destructive Assay Standards

Automation of Plutonium & Uranium Assay

Preparation and Characterization of Destructive Analysis (DA) of Pu/U Standards

Accurate High Resolution Isotopic Analysis of Uranium Materials

Advanced Gamma-spectrometry Data Acquisition and Analysis Systems

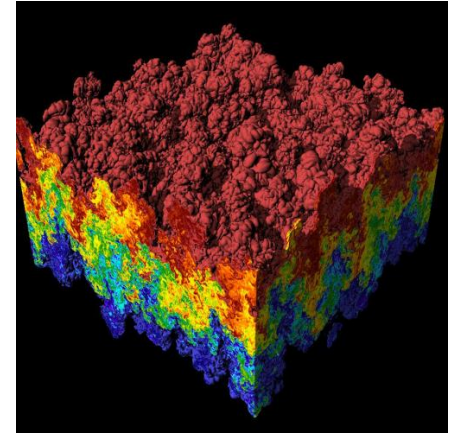
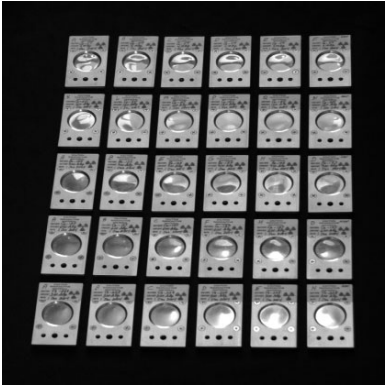
High Precision/High Accuracy Mass Spectrometric Analysis Capability for Preparation and Verification of Radionuclide Certified Reference Materials at NIST



Pre- Det Nuclear Forensics RM

- NM RMs certified actinide activity/isotopics CRS, ISS
- 99.99%+ ID tracer/isotope ratio standard solutions
 ^{233}U , ^{244}Pu , ^{229}Th , ^{243}Am , ^{236}Np , ^{236}Pu
- Radiochronometry RMs
 $^{234}\text{U} - ^{230}\text{Th}$, $^{235}\text{U} - ^{231}\text{Pa}$, $^{241}\text{Pu} - ^{241}\text{Am}$,
 $^{137}\text{Cs} - ^{137}\text{Ba}$
- Cs and Nd Burn-up Standards
- Trace elements standards for uranium fuel cycle
- Pu in U ($10^{-6} - 10^{-2}$)
- U/Pu(1:1, 1000:1)/U minor isotope 1-um particles on swipes
- Oxygen isotope standard for uranium oxide





Detecting Nuclear Technology

Surrogate Materials and Testing of Radiation Detection Instruments

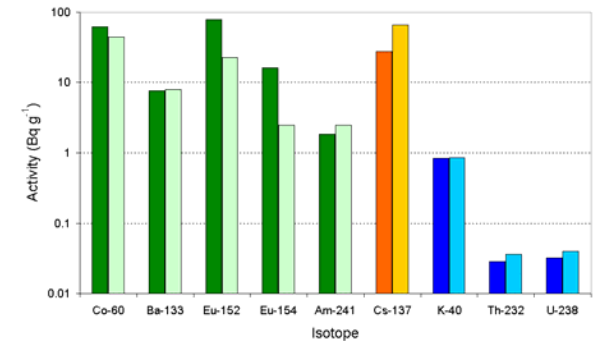
Advanced Radiation Transport Simulation

Bio-terror Incident Response Consequence Management:
Radiation Decontamination of Critical Infrastructure

Low Gas Flow - National Measurement Capability



Post-IND Material Characterization



Mass Separator for Purification of Isotopic Radionuclide CRMs

IDMS Th229, U233, Np236, Am243, Pu242, Pu244 CRMs of Radioisotopes

Multi-Event Material

Single Event Material

Fresh Fission Simulated Urban Event & nano-particle Reference Material

Neutron deficient lanthanide tracer CRMs

Nuclear Matrix Preparation Laboratory



Consequence Management



Reference Laboratory Program to Support Radioanalytical Analysis During a Radiological/Nuclear Incident

Critical Needs for Clinical Laboratory NIST Traceability

Environmental Matrix Certified Reference Materials to Support Radioanalytical Analyses During a Rad/Nuc Incident



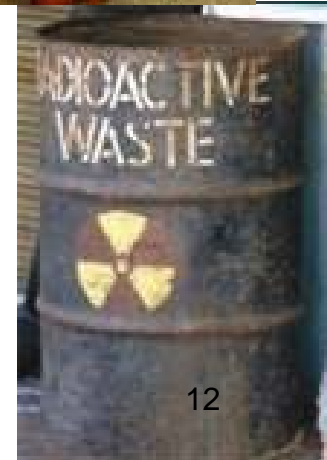
CRMs to Support the Monitoring of Food by Radioanalytical Analyses



Laboratory Capabilities and Capacities Exercise Program

Gamma Spectrum - National Measurement Capability

Low-level Isotopic Uranium in Synthetic Urine Standards for DU Exposure



Contributing Agencies- Workshops

U.S. Air Force, Brooks AFB
Aldermaston Weapons Establishment
Centers for Disease Control and Prevention, NCEH
Environmental Protection Agency, NAREL
Federal Bureau of Investigation
Food and Drug Administration, WEAC
Idaho National Lab
International Atomic Energy Agency
JROC
Lawrence Berkeley National Lab
Lawrence Livermore National Lab
Los Alamos National Laboratory
National Physical Laboratory, UK
Navarro Research and Engineering, Inc.
National Institute of Standards and Technology
New Brunswick Lab
Oak Ridge National Lab
Pacific Northwest National Lab
Sandia National Labs
Tauri Group
Y12 National Security Complex

Attacking the Gap

- Obtain Feedback from Relevant Parties regarding where the CRM gap fits into their Mission Space.
- Open up Discussion to Develop Mechanisms/Approaches to Tackle the Gap.
- Follow-up with staff coverage and more Formal Movement.
- Coordinate SMEs to Support the Effort.

Course of Action Options:

- COA1. Recommend USG address issues involving CRMs that directly impact their mission. Commission NIST to analyze this problem and submit paper (including LLNL report, Spec Pub draft, hex charts 1-43) within six months.
- COA 2. Recommend project management by OLES at NIST or Army Laboratory at Redstone to accomplish these CRMs in support of USG missions as defined in COA 1.
- COA 3. No action.

Thank you