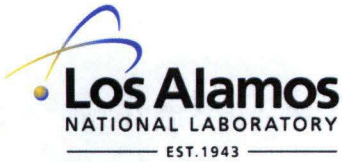
LA-UR- 12-01621

Approved for public release;
distribution is unlimited.

Title:	Potential Confirmatory Measurement of Plutonium
Author(s):	Duncan MacArthur,
Intended for:	Confirmatory Measurements Workshop



Form 836 (7/06)

Potential Confirmatory Measurement of Plutonium

Duncan MacArthur

Abstract: This set of slides addresses a number of issues inherent in confirmatory measurement of plutonium. These issues include the sensitivity and complexity of radiation signatures as well as methods, such as attribute and template measurement, for addressing the issues. The concept of "data-density" is useful in evaluating different potential measurement systems. After some discussion of types of material movement and generic threats, I conclude with a recommendation for a graded approach, where the level of monitoring is matched to the sensitivity of the situation

Potential Confirmatory Measurement of Pu

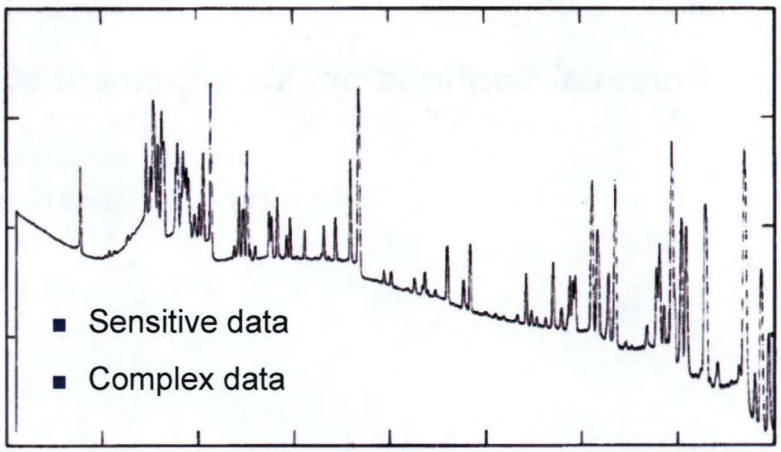
Duncan MacArthur

Los Alamos National Laboratory

Overview

- Information interpretation
- Radiation measurements
  - Attributes
  - Templates
- Confirmatory measurements
- Threats
- Approaches

Information Interpretation



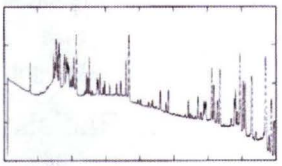
- Sensitive data
- Complex data

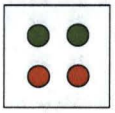
Sensitive Information

- Sensitivities - Not necessarily classified
  - Impurities
  - Isotopic composition
  - Geometry
  - Packaging
  - Etc.
- Similar to treaty verification problem
  - May be technically easier
  - Lower profile
  - Much more common

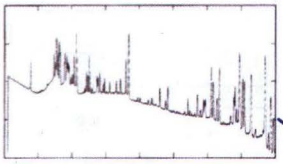
Data Density

- High-density
  - Complex
  - Requiring interpretation
  - Training requirements
  - More information than needed
- Low-density
- Why it's a problem
  - Mistakes
  - Lost time
- Approaches
  - Attributes
  - Templates

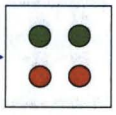




Attribute Measurement



Analysis and threshold comparison

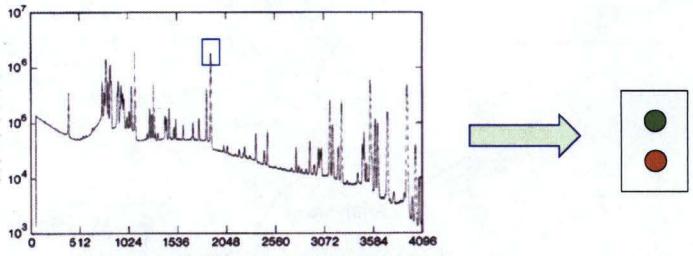


Neutron Count Rates:
Singles (S)
Doubles (D)
Triples (T)
→ Mass, Multiplication, Alpha ratio

Possible Attributes

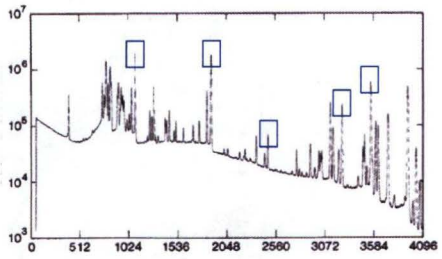
- Physical Characteristics
  - Size
  - Weight
- Radiation
  - ""It' s radioactive"
  - Gamma Based
    - Specific Pu peaks (Pu presence)
    - Combinations of Pu peaks (Isotopic Ratio)
    - Other peaks (^{241}Am ~ Age)
  - Neutron based
    - Fissile material mass
- How much confidence?

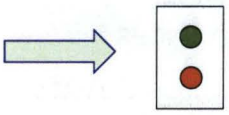
Simple Template



- Matches or not
- Same as an attribute

More Complex Templates





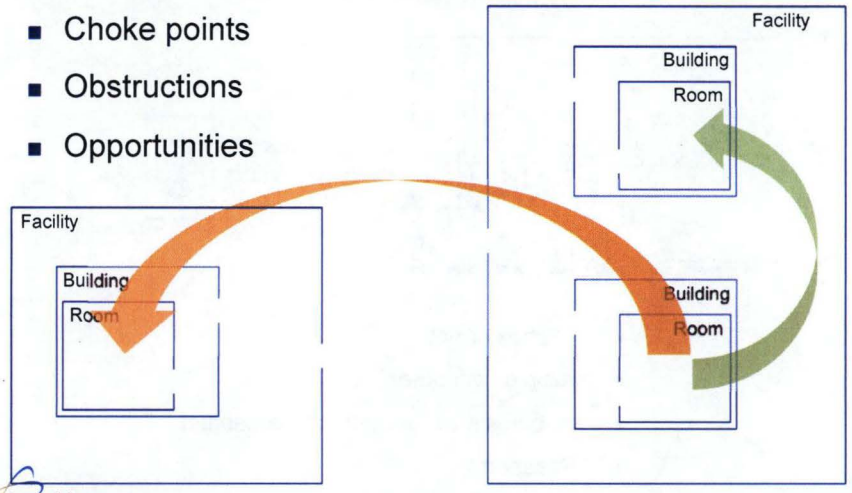
- Matches or not
- Multiple "attributes"
- Attributes may, or may not, be defined
- "Passport"

Material Shipments

- Continuity of Knowledge
  - Visual surveillance
  - Documentation
  - Measurements (Radiation and other)
    - "Choke points"
    - Portal monitors
    - Video
- Priorities
  1. Elimination
  2. Engineering controls
  3. Procedural controls

Inter-facility vs. Intra-facility

- Choke points
- Obstructions
- Opportunities



Threats

- Mistakes
  - Complexity
  - Interpretation required
  - Amount of human interaction
- Insider threat
  - Attractiveness
  - Access
  - Amount of human interaction
- Issues with "traditional" methods
  - Visual surveillance
  - Procedures

Approaches to Confirmatory Measurement

- Graded approach much like "graded safeguards"
  - Attractiveness
  - Physical features
  - Choke points
- Types of radiation measurements
  - None
  - Simple
  - Attributes or Templates

"Everything should be as simple as it is, but not simpler."
Albert Einstein