IPNDV Working Group 3: Technical Challenges and Solutions
Chain of Custody (5)—Technology Data Sheet

November 4, 2016

Chain of Custody (CoC) Technology Name: Radiation Detection

Physical Principle/Methodology of Technology:

Radiation detection of CoC run unattended monitoring 24 hours a day, 365 days a year without requiring the presence of an inspector in the field. They continuously perform a wide variety of qualitative or quantitative measurements of processes throughout the nuclear disarmament process, by gross gamma-ray and neutron counting. An unattended monitoring system (UMS) with radiation detection collects the measurement data to a server computer via LAN cable or Wi-Fi. The collected data could be transferred to remote location for review, if necessary. UMSs are designed to maintain CoC in a cost-effective manner. The UMS contributes to avoid information leakage due to no human access.

Potential Monitoring Use Cases (pre-dismantlement, dismantlement, post-dismantlement, storage stage):

The functions depend on the system component. Potential use cases are monitoring the movements of warhead in pre-dismantlement and dismantlement, and warhead components (special nuclear material, or SNM) in post-dismantlement and storage stage.

Physical Description of Technology (e.g., approximate size, weight):

Radiation detector is necessary and it depends on the system (e.g., IC, ^{3}He tube, FC Si diode, etc.).

Data collection and review components must be installed in a cabinet. It's approx. 1 m x 1 m x 2 m. Lan cable wiring or Wi-Fi transceiver is necessary.

Time Constraints (e.g., measurement times including distance from object, time to install the equipment):

Measurement time and distance from target object depend on the container design and sensitivity of detector.

Basically, the systems are fixed on a floor or gate of entrance.

Technology Complexity (e.g., hardware, software, and ease of use by personnel):

All operations, e.g., measurement, monitoring, data collection, are automatically worked.

Infrastructure Requirements (e.g., electrical, liquid nitrogen, etc.):

Electricity, cabinet to install data collection/review components, LAN cable wiring or Wi-Fi transceiver

Technology Limitations (e.g., operational temperature range, differences in materials):

Operational temperature range depends on radiation detector.

Radiation detection is usable for plutonium mainly (it depends on the container design).

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Information Collected by the Technology (used to help determine if an information barrier is required for use):

Movements of warheads and SNM

Safety, Security, Deployment Concerns:

Safety Concerns: basically none (the presence of an inspector in the field is not required during monitoring).

Security Concerns: cyber security, physical security (in the case of monitoring system including CCTV).

Non-Proliferation Concerns: protection of NED design.

Technology Development Stage (Technology Readiness Level, TRL):

There are many cases for safeguards system introduced in nuclear facilities, e.g., plutonium fuel production facility.

Additional System Functionality (e.g., outside the monitoring use case):

Trigger of other measurements

Where/How the Technology Is Currently Used (e.g., international safeguards, border protection):

International safeguards

Examples of Equipment:

MiniGRAND based system (MGBS), Shift register based system (SRBS)*

* IAEA, *Safeguards Techniques and Equipment: 2011 Edition*, International Nuclear Verification Series No. 1 (Rev. 2), available at http://www-pub.iaea.org/MTCD/Publications/PDF/nvs1_web.pdf.