Report on Radio Frequency Identification 2010 Category I Vault Testing Program (and beyond)

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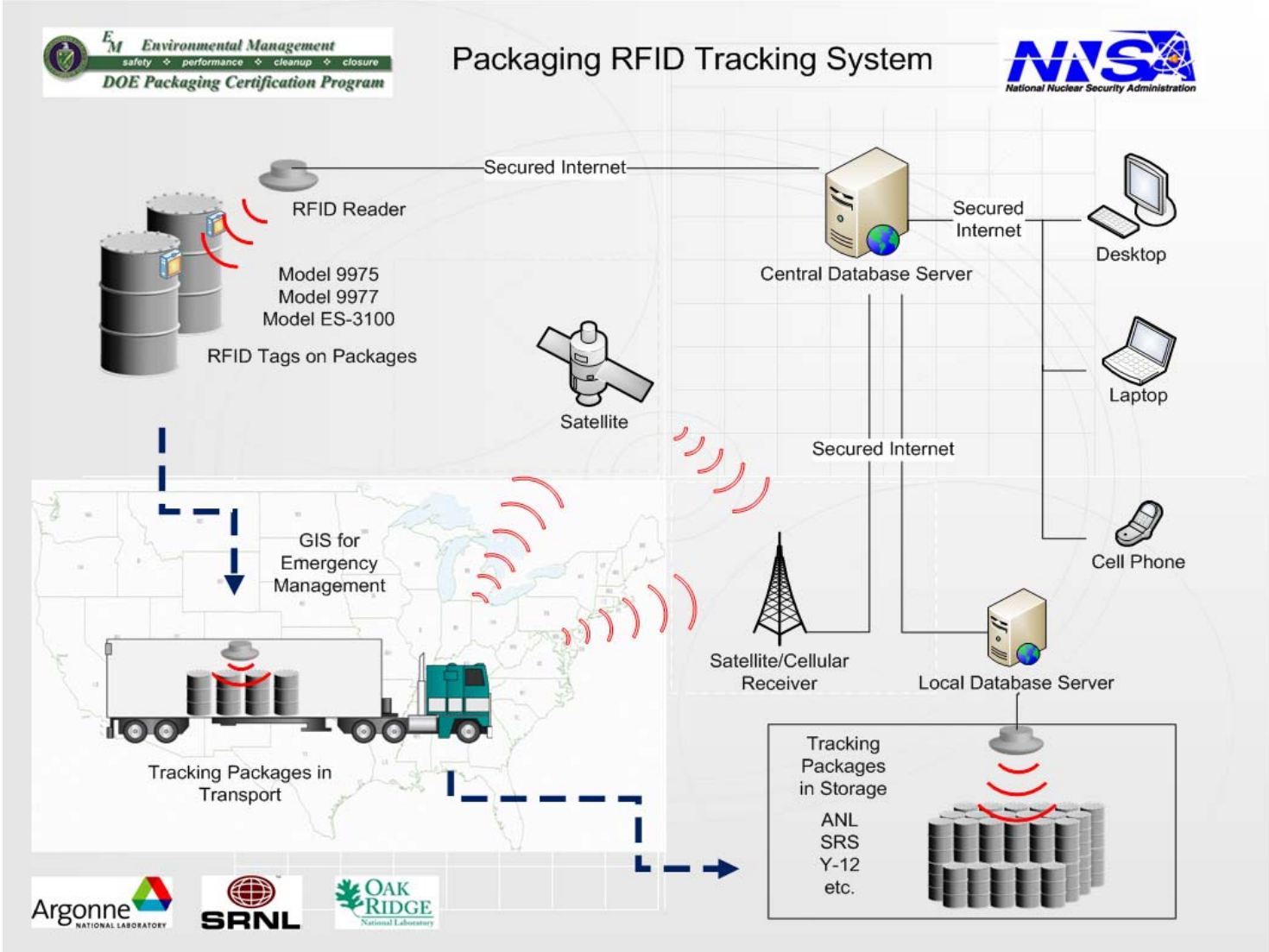
Work sponsored by Office of Packaging and Transportation (EM-45)

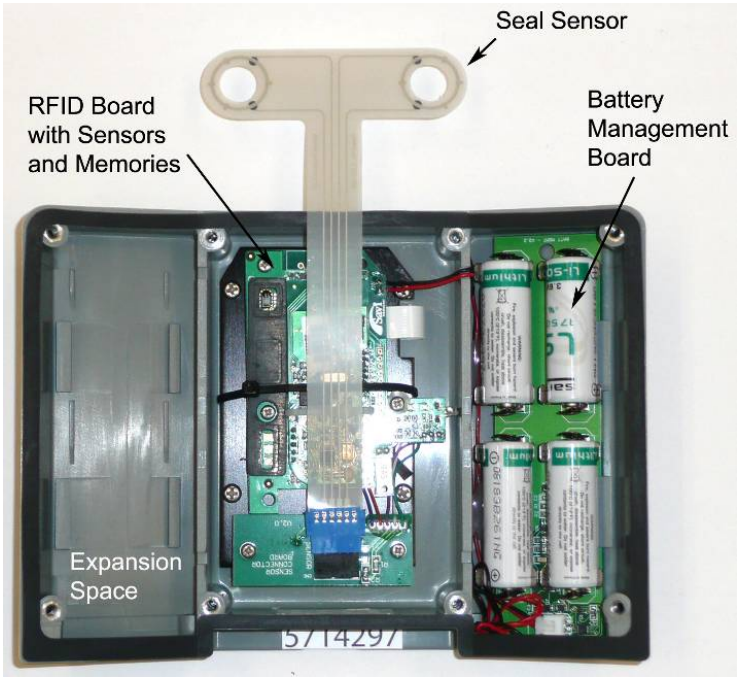
EM Environmental Management
safety ❖ performance ❖ cleanup ❖ closure
DOE Packaging Certification Program

U.S. DEPARTMENT OF ENERGY

ARG-US RFID tracking and monitoring system



ARG-US RFID surveillance tags — DOE patent pending



- **Universal form factor**
- **Full sensor suite (seal, shock, temperature, humidity, dosimeter, etc)**
- **Good radiation resistance (>17 yr at 200 mrem/h)**
- **Long battery life (>10 yr)**
- **Non-volatile memory**
- **Omni-communication range ≈100 m**
- **AES 256 encryption**

ARG-US RFID system testing at Savannah River Site

Offline Compatibility Test

To ensure
compatibility with
existing surveillance system

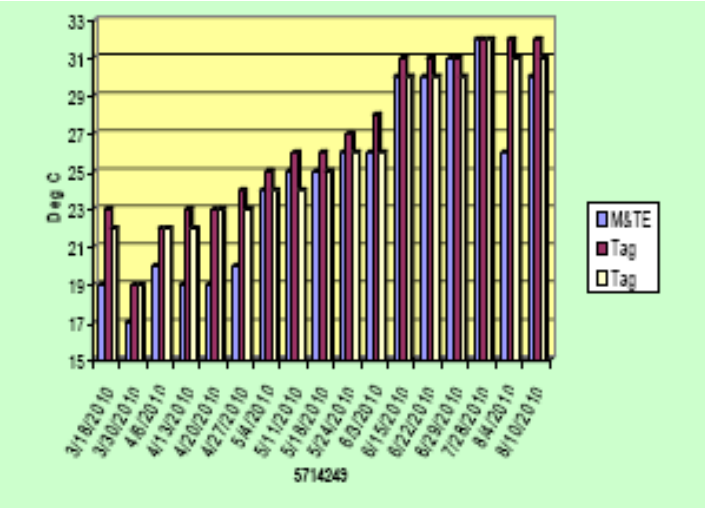
In Facility Test

To demonstrate
operating performance
and reliability of

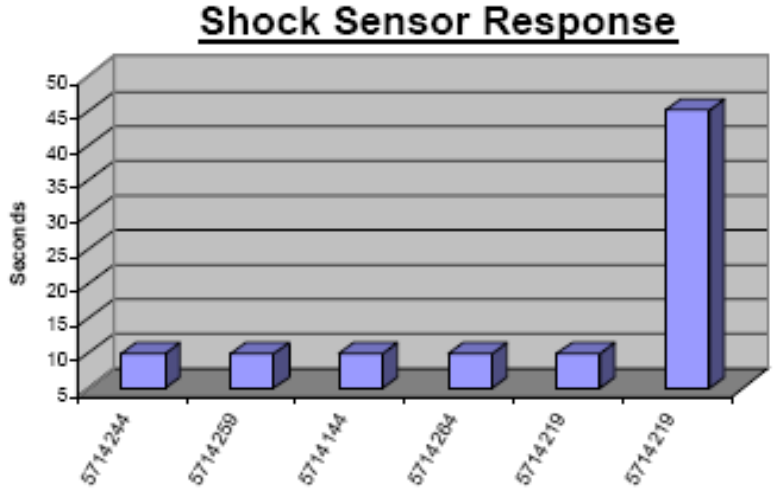
- temperature recording
- humidity recording
- shock sensitivity
- tamper indication
- battery status

Interim results — March to August 2010

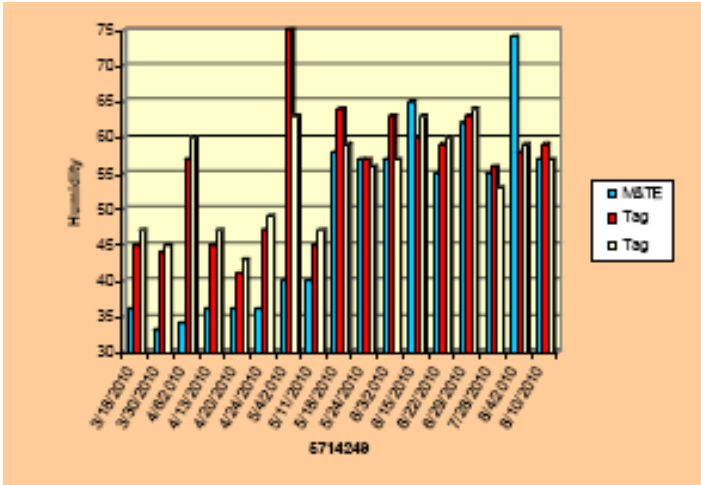
Temperature Sensor Response



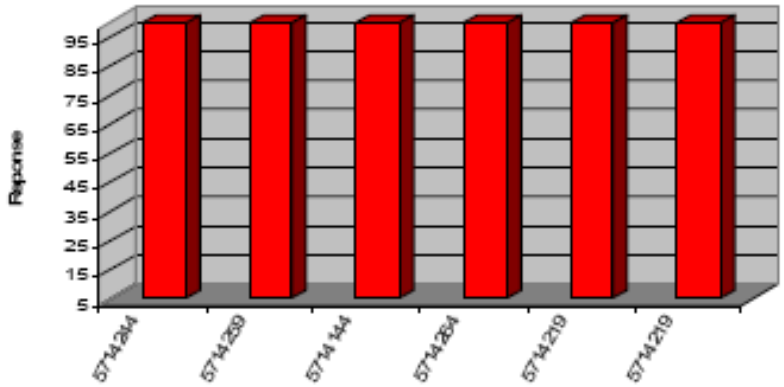
Shock Sensor Response



Humidity Sensor Response

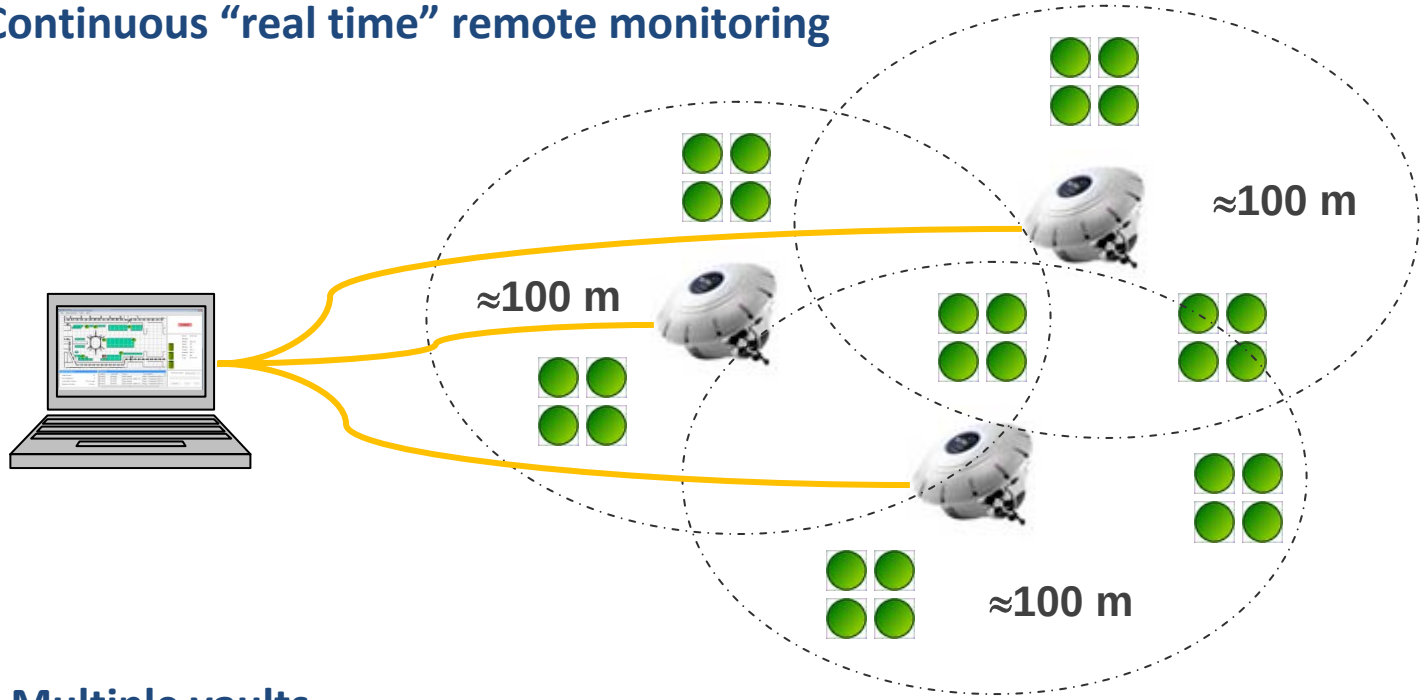


Seal/Open Alarm Response



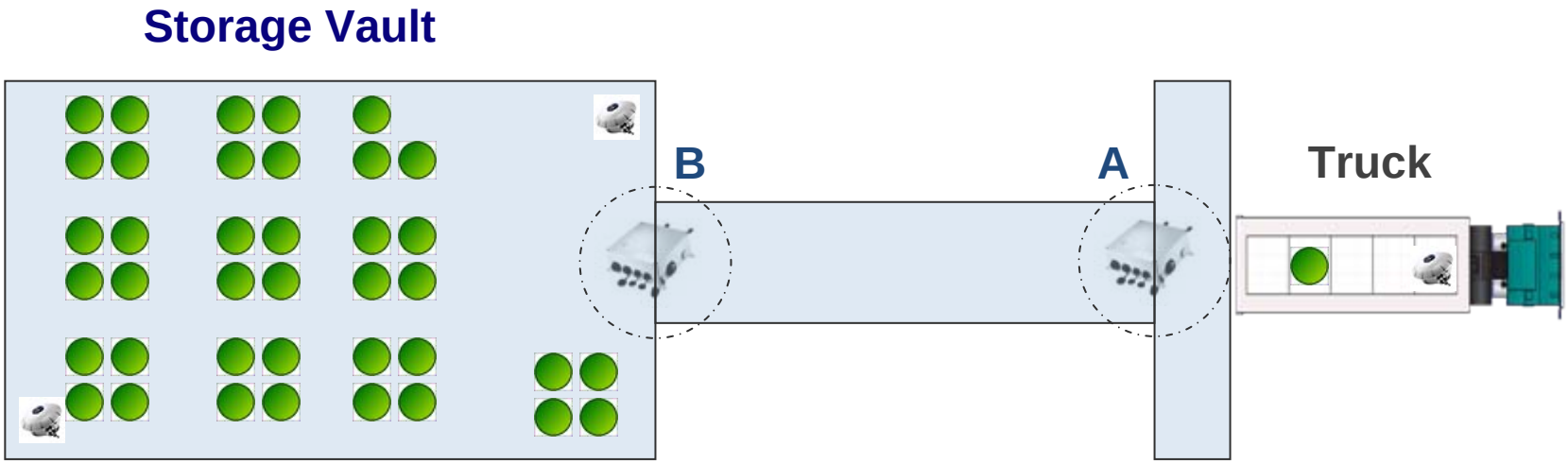
Multi-Reader ARG-US OnSite — next step

- Control computer (or server) running ARG-US OnSite
- Multiple readers connected via Ethernet
- Continuous “real time” remote monitoring



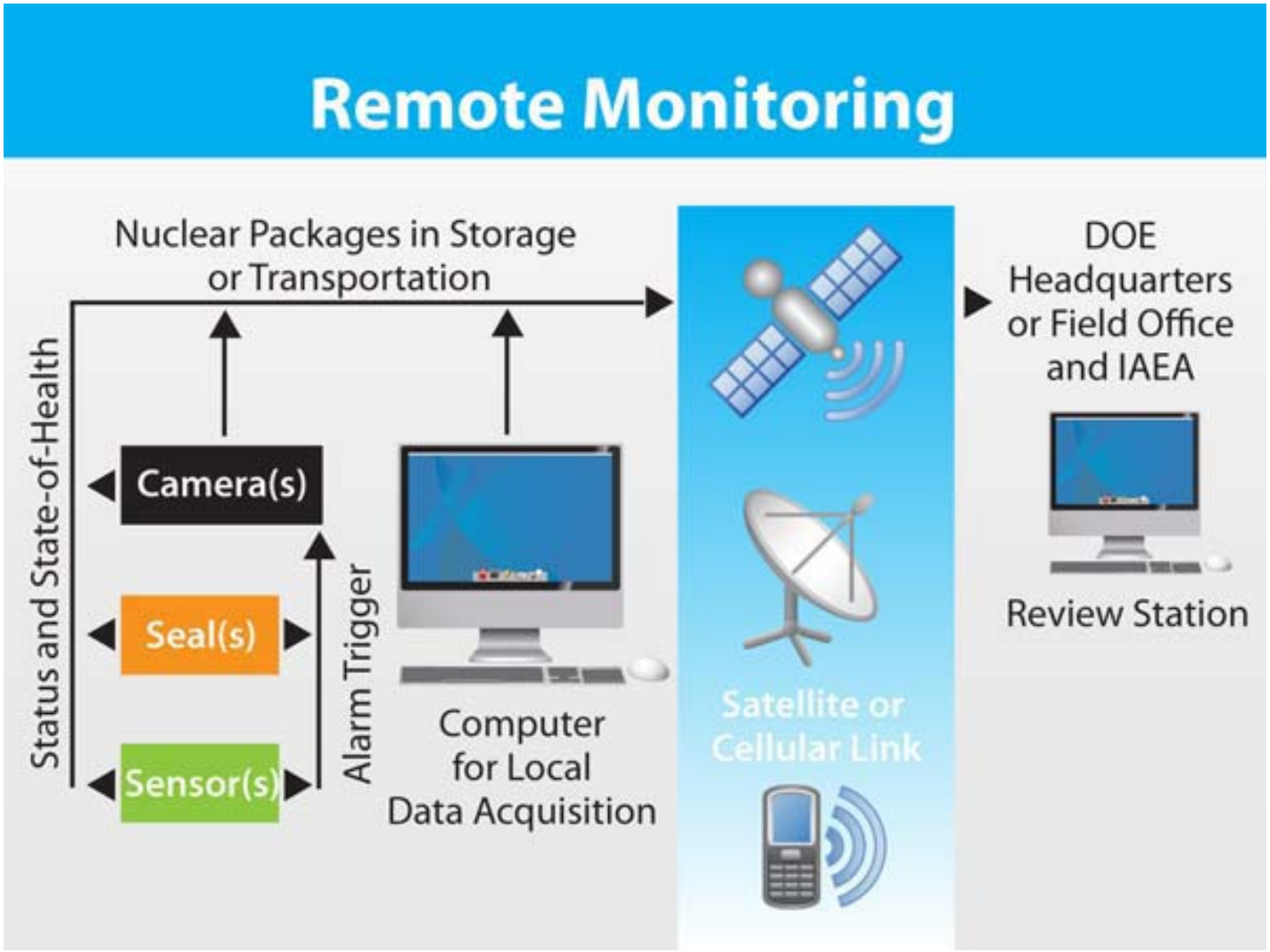
- Multiple vaults
- Sensor network

Multiple readers and signposts check-in and -out



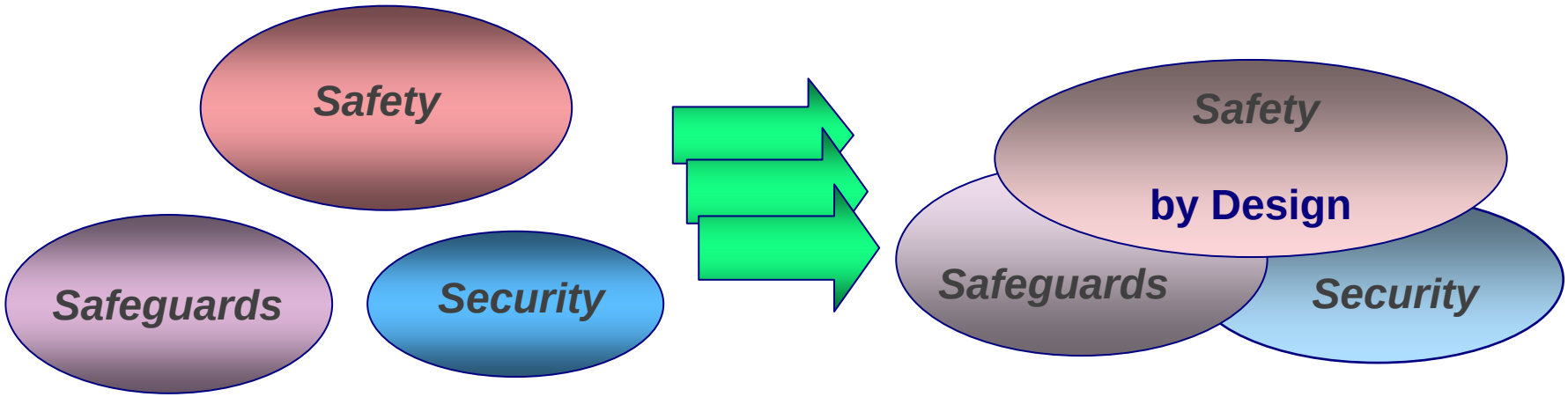
- Set up 2 signposts (A and B) in serial to determine directionality of drum movement
- If tag is read by Signpost A then Signpost B, drum is added to the vault
- If tag is read by only Signpost B, drum is being moved within the vault
- If tag is read by Signpost B then Signpost A, drum is removed from the vault and picked up by reader in the truck
- Maintaining chains of custody and continuity of knowledge

Security and safeguards enhancement



Enhancing safety, security and safeguards of nuclear and radioactive materials

- Nuclear Safety — accident Prevention
- Nuclear Safeguards — non-proliferation
- Nuclear Security — physical Protection



Enhanced by a robust container-based RFID system, e.g., ARG-US, with tamper-indicating seals, 24/7 remote monitoring, and automatic alarms notification via secured Internet

Potential benefits of ARG-US RFID for nuclear and radioactive materials packages in storage and transport

- Enhanced safety, security, safeguards and materials accountability
- Real-time access of status, i.e., State of Health, and event history data, including continuous monitoring of environmental conditions of packaging for aging management and long-term storage
- Reduced radiation exposure and need for manned surveillance
- Overall cost savings
  - Increased packaging maintenance intervals
  - Increased contents verification intervals
- Challenges: Confidentiality, Integrity, and Availability (CIA);
  RF security, information assurance;
  transparency vs. privacy