

**CLEARANCE OF
POTENTIALLY
ACTIVATED MATERIALS
AT ARGONNE NATIONAL
LABORATORY**



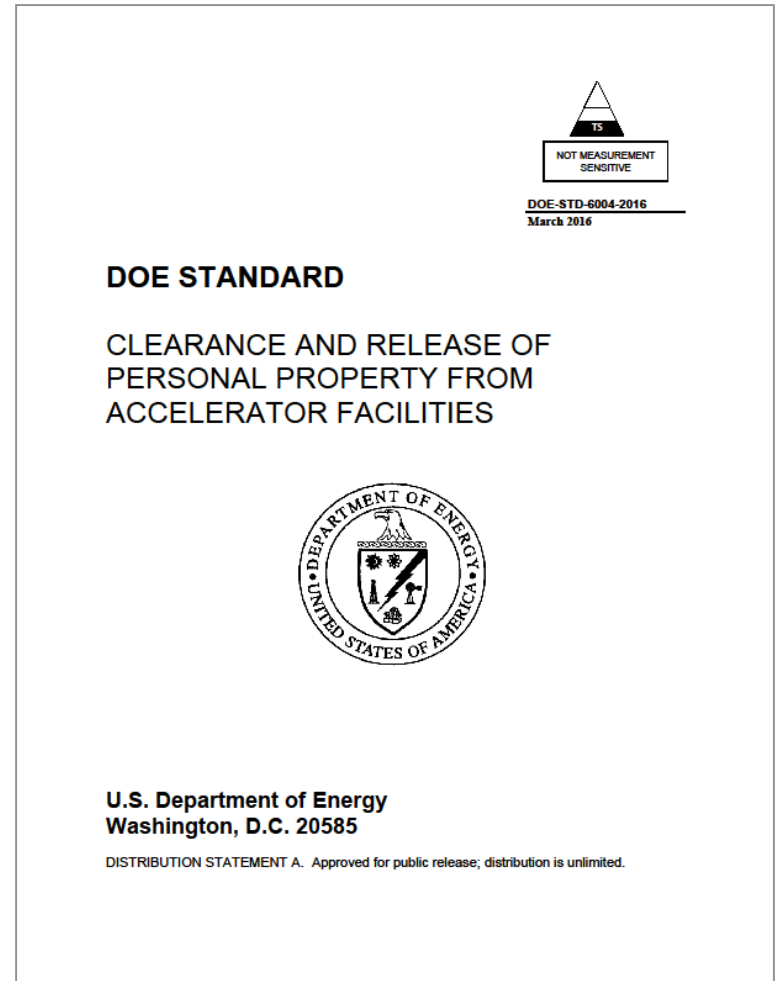
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DOE-STD-6004-2016

- In March 2016, DOE-STD-6004-2016, *Clearance and Release of Personal Property from Accelerator Facilities* was published.
 - The Standard provides an approach to establish clearance and release programs for accelerator facilities that meets the requirements of O458.1.
 - Applying the approach of the standard meets the constraint in O458.1 of less than 1 mrem/year for each clearance of personal property with potential residual radioactivity.



ARGONNE'S IMPLEMENTATION

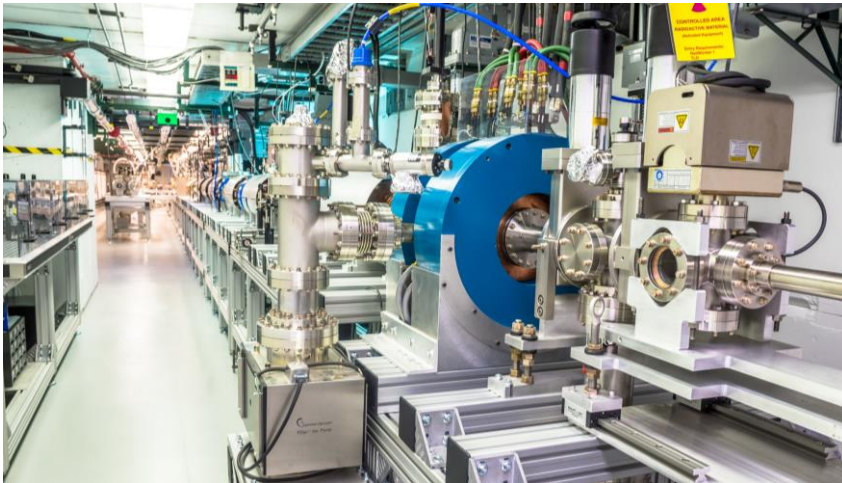
- The *Clearance Protocol for Potentially Activated Materials Technical Basis Document* (TBD) describes Argonne's approach for clearing and releasing personal property that may be impacted by activation from accelerators or other facilities
- It adopts a release protocol to evaluate materials for potential contamination based on:
 - Clearance Criteria
 - Process Knowledge
 - Measurement Protocols

CLEARANCE CRITERIA

- DOE-STD-6004-2016 establishes 3 options for release levels:
 1. Indistinguishable from Background (IFB) at a level lower than the ANSI N13.12-2013 Screening Levels
 2. A criterion equal to the ANSI Screening Levels (derived from dose criterion of 1 mrem/y to the public)
 3. A criterion higher than the ANSI Screening Levels via authorized limits
- Argonne National Laboratory has chosen to adopt the *preferred* IFB release levels
- For releases using the IFB criterion, DOE approval of the site's material clearance and release program is required; however, DOE approval for each release is **not** required.

PROCESS KNOWLEDGE

Activation Potential at Argonne



Current Operations:

- Advance Photon Source (APS)
- Argonne Tandem Linear Accelerator System (ATLAS)
- Low Energy Accelerator Facility (LEAF)
- Argonne Wakefield Accelerator (AWA)
- Neutron Generators (e.g., D-T)

Legacy Operations

- Reactor Facilities
- Intense Pulsed Neutron Source (IPNS)

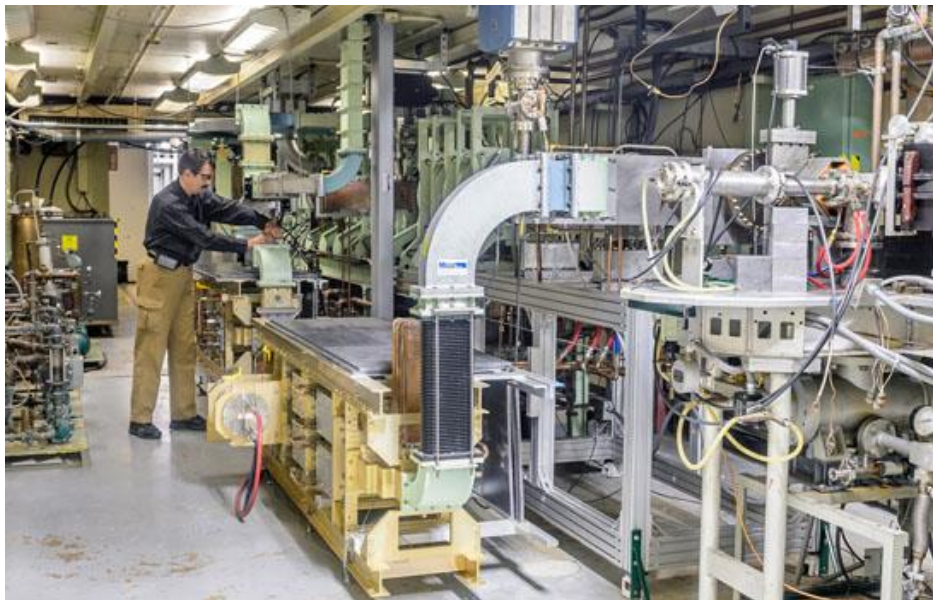
MEASUREMENT PROTOCOL

- Typically, scans of the entire surface of all potentially impacted objects are performed using portable instrumentation (e.g., NaI, scintillation, gas proportional).
- Use of confirmatory measurement (e.g., liquid scintillation, gamma spectroscopy, portal gate monitor) to supplement the surface scans
- The percentage of items surveyed with confirmatory measurements will be performed using a graded approach



PROJECT-SPECIFIC TBD

- Due to the variations between the types of facilities at Argonne, each facility or project must develop facility-specific documentation, including:
 - Process knowledge (e.g., beam parameters, operation modes, and beam losses)
 - Measurement methods
 - Application of MARSSIM/MARSAME and description of impacted areas
 - Estimation of detection capability for proxy radionuclides
 - Bounding conditions that limit the application of the technical basis



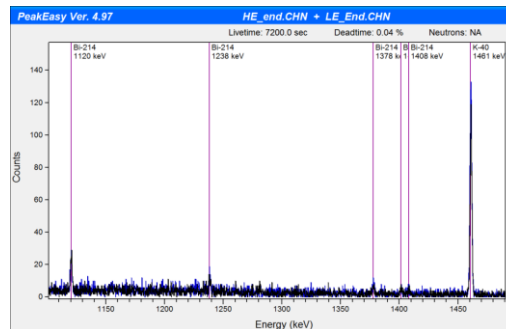
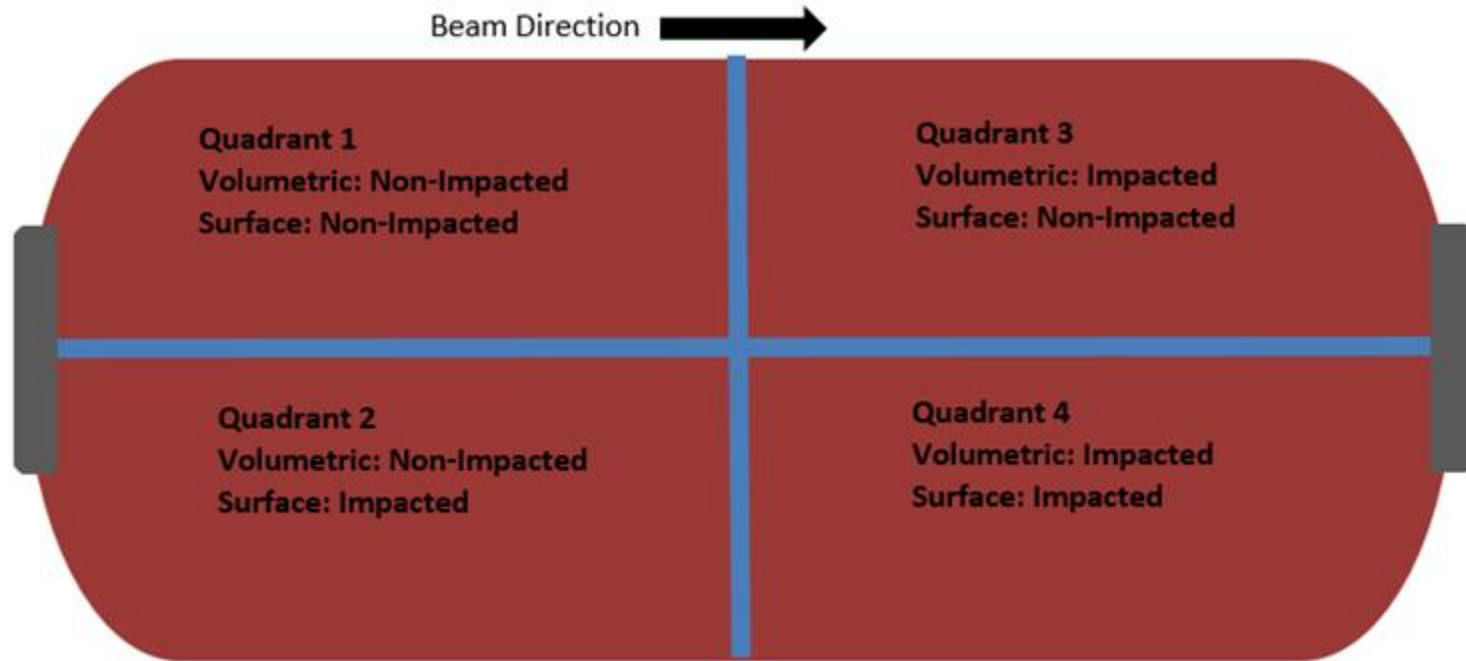
THE CLEARANCE PROTOCOL APPLIED

Tandem Van De Graaff Tank at ATLAS



- 160,000 lbs
- 42'x15'x14'

THE CLEARANCE PROTOCOL APPLIED



FUTURE APPLICATIONS

The APS Upgrade project



QUESTIONS?

VOLUMETRIC CONTAMINATION

- One of the key concepts from DOE-STD-6004-2016 is Proxy Radioisotopes
 - Typical proxy radioisotopes Na-22, Mn-54, Co-60
 - Proxy radioisotopes contribute to most (if not all) of the surface dose rate due to their high-energy and high-intensity gamma rays.
 - Hard-to-measure radioisotopes (e.g., H-3, Fe-55, etc) can be indirectly estimated by the measurements of proxy radioisotopes.
- Proxy radioisotopes are typically Group 1 radionuclides in the ANSI Screening Levels; therefore, the detection level must be less than 3 pCi/g for these isotopes

VOLUMETRIC RADIOACTIVITY SCREENING LEVELS

From *DOE-STD-6004-2016* and *ANSI N13.12-2013*

Group Number	Description	Screening Level
Group 1	High-energy gamma emitters, radium, thorium, transuranics, and mobile beta-gamma emitters (e.g., ^{22}Na , ^{54}Mn , ^{60}Co , ^{65}Zn , and ^{152}Eu)	3 pCi/g
Group 2	Uranium and selected beta-gamma emitters (e.g., ^{57}Co , ^{58}Co , and ^{59}Fe)	30 pCi/g
Group 3	General beta-gamma emitters (e.g., ^7Be)	300 pCi/g
Group 4	Low-energy beta-gamma emitters (e.g., ^3H and ^{63}Ni)	3,000 pCi/g
Group 5	low-energy beta emitters (e.g., ^{55}Fe)	30,000 pCi/g