



U.S. NRC

UNITED STATES NUCLEAR REGULATORY COMMISSION

Protecting People and the Environment

Material Attractiveness and the Part 73 Rulemaking with a Focus on RTRs

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Background

- NRC is in the process of revising its regulations for physical protection of special nuclear material (SNM)
 - Revise nuclear material categorization table
 - Put over 50 Orders into regulations – accumulated since 9/11/01
- NRC has a legislative mandate to make available for public comment its proposed regulatory changes
- Commission directed NRC staff to conduct “enhanced” stakeholder outreach, including with international partners
- Revisions to INFCIRC/225 recently issued– want to ensure consistency

Current NRC Approach

- Categorization table (I, II, III; Pu, U-235, U-233, irradiated fuel)
 - Nearly identical to Categorization Table in INFCIRC/225/Rev. 5
 - Cat I = “Formula Quantity of Strategic Special Nuclear Material”
 - Cat II = “SNM of Moderate Strategic Significance”
 - Cat III = “SNM of Low strategic significance”
 - Based on threat of IND
 - Approximately 50 yrs old

Current Table - App. M to 10 CFR Part 110

Material	Form	Category		
		I	II	III ^e
1. Plutonium ^a	Unirradiated ^b	2 kg or more	Less than 2 kg but more than 500 g	500 g or less
2. Uranium -235 ^c	Unirradiated ^b Uranium enriched to 20 pct U ²³⁵ or more	5 kg or more	Less than 5 kg but more than 1 kg	1 kg or less
	Uranium enriched to 10 pct U ²³⁵ but less than 20 pct.		10 kg or more	Less than 10 kg
	Uranium enriched above natural, but less than 10 pct U ²³⁵			10 kg or more
3. Uranium-233	Unirradiated ^b	2 kg or more	Less than 2 kg but more than 500 g	500 g or less

Current NRC Approach (cont.)

- Two-factor consideration - type and quantity
 - Ease of use
 - Insufficient to provide risk-informed, graded approach
 - Led to lack of consistency and transparency in regulations
 - 5 kg high enriched uranium (HEU) metal vs. 5 kg of HEU in soil
- “Right-size” security regulations by adding attractiveness to special nuclear material (SNM) categorization
 - Make appropriate to individual forms of SNM
 - Restore regulatory predictability / clarity

INFCIRC/225/Rev. 5 Attractiveness Factors

- “...the basis for a graded approach...depends on the type of nuclear material (e.g. plutonium and uranium), isotopic composition (i.e. content of fissile isotopes), physical and chemical form, degree of dilution, radiation level, and quantity.

Material Attractiveness Factors Considered

- Factors
 - Form (metals, compounds, solutions, in a matrix)
 - Weight percent of SNM in compound (dilution factor)
 - Calculations based on total weight of bulk material or item – should not include cladding material that is easily removed
 - Radiation level – considering changes

Initial Attractiveness Levels Considered

Uranium-235	
Nuclear Material	Attractiveness Level
Pure Products Metals, simple compounds (≥ 20 wt %) (compounds that can be converted to metal in a single step)	A
High-Grade Materials Complex compounds (≥ 20 wt %) (compounds that cannot be converted to metal in a single step; solutions (≥ 25 g/l))	B
Low-Grade Materials Metals and compounds (≥ 1 wt % and < 20 wt %); solutions (≥ 1 g/l and < 25 g/l)	C
All Other Materials Uranium ($< 10\%$ U-235); highly irradiated material (≥ 1000 R/h @ 1 m); metals and compounds (< 1 wt %); solutions (< 1 g/l)	D

Initial Attractiveness Levels Considered

Plutonium and Uranium-233	
Nuclear Material	Attractiveness Level
Pure Products Metals (≥ 20 wt %), simple compounds (≥ 20 wt %) (compounds that can be converted to metal in a single step)	A
High-Grade Materials Complex compounds (≥ 20 wt %) (compounds that cannot be converted to metal in a single step; solutions (≥ 25 g/l)	B
Low-Grade Materials Metals and compounds (≥ 1 wt % and < 20 wt %); solutions (≥ 1 g/l and < 25 g/l); Pu (≥ 80 % Pu-238)	C
All Other Materials Uranium (< 6 % U-233); highly irradiated material (≥ 1000 R/h @ 1 m); metals and compounds (< 1 wt %); solutions (< 1 g/l)	D

Los Alamos Study

- Logic Model
 - Acquisition Module
 - Processing Module
 - Weapons Module
 - Degradation Model

Stakeholder Interaction

- Other USG Agencies
- Industry
- Non-Governmental Organizations
- Foreign Governments

Initial Stakeholder Feedback

- Generally Consistent with INFCIRC/225
- Technically Sound
- Concern over complexity of the approach
- Concern over metals and compounds having different treatments

Revised Table

	Uranium-235			
Nuclear Material	Attractiveness Level	Cat I	Cat II	Cat III
High-Grade Materials Metals and compounds (≥ 20 wt %), solutions (≥ 25 g/l)	A	≥ 5 kg	≥ 1 kg < 5 kg	\geq RQ < 1 kg
Low-Grade Materials Metals and compounds (≥ 1 wt % and < 20 wt %); solutions (≥ 1 g/l and < 25 g/l)	B	N/A	≥ 25 kg?	\geq RQ < 25 kg?
All Other Materials Uranium (< 10% U-235); highly irradiated material (≥ 1000 R/h @ 1 m); metals and compounds (< 1 wt %); solutions (< 1 g/l)	C	N/A	N/A	\geq RQ

Revised Table

	Plutonium and Uranium-233			
Nuclear Material	Attractiveness Level	Cat I	Cat II	Cat III
High-Grade Materials Metals and compounds (≥ 20 wt %); solutions (≥ 25 g/l)	A	≥ 2 kg	≥ 0.4 kg < 2 kg	$\geq RQ$ < 0.4 kg
Low-Grade Materials Metals and compounds (≥ 1 wt % and < 20 wt %); solutions (≥ 1 g/l and < 25 g/l); Pu (≥ 80 % Pu-238)	B	N/A	≥ 10 kg?	$\geq RQ$ < 10 kg?
All Other Materials Uranium (< 6 % U-233); highly irradiated material (≥ 1000 R/h @ 1 m); metals and compounds (< 1 wt %); solutions (< 1 g/l)	C	N/A	N/A	$\geq RQ$

Continuing Feedback

- Concern about changes from higher to lower categories (Perceived as significant reduction in security)
- Concern about large quantities of HEU or Pu in dilute materials

Need to Retain Current Categorization

- Concern about changes from higher to lower categories
(Perceived as significant reduction in security)
- Concern about large quantities of HEU or Pu in dilute materials
- Need to demonstrate “High Assurance of Adequate Protection”
- Potential consequence linked to the Category
- Protection Strategies must be informed by the risk

Current Approach

- Maintain existing categories (allows emphasis on potential consequences)
- Allow for alternative security measures for levels of dilution (dilution identified in INFCIRC/225 and serves as a proxy for processing difficulty)
 - Moderate -- <20 weight percent and ≥ 1 weight percent
 - Very -- < 1 weight percent

Protection Strategies – non-dilute

- Cat I
 - Containment
- Cat II
 - Immediate Detection with Pursuit and Recovery
- Cat III
 - Detection and Recovery

Protection Strategies – moderately dilute

- Cat I
 - Immediate Detection with Pursuit and Recovery
- Cat II
 - Prompt Detection and Response and Recovery
- Cat III
 - Detection and Recovery

Protection Strategies – very dilute

- Cat I, II, III
 - Detection and Recovery

Issues for Discussion

- Security Plans
- Security Organizations
- Controlled Access Areas
- Alarm Stations
- Security Program Review
- Maintenance and Testing

Security Plans

- Regulatory Basis says Licensee must develop, implement, revise and oversee security procedures that implement physical protection requirements and security plans.
- Does this management system need to be a document or a process

Security Organization

- Need to identify what constitutes a security organization at an RTR
 - Reactor operators?
 - Campus police?
 - Etc.?

Controlled Access Area

- Issue of spent fuel pools and ability of existing facilities to accommodate CAA requirement if the self-protection threshold is eliminated

Alarm Stations

- Requirement to locate CAS in bullet resistant enclosure
- Requirement to be continuously staffed with trained and qualified alarm station operator

Security Program Review

- Annual security exercise may be fulfilled through conduct of a tabletop exercise
- Approaches for 2-year physical security program review
 - May not require a “security” expert
 - Possibility of inter-facility peer review

Maintenance and Testing

- Requirement for daily testing of communications between CAS and LLEA

Weight Percent Calculation

- How do we best derive this for the population of RTRS?

Other Topics – Cat I (MD)/Cat II

- Safeguards Contingency Plans
- Training and Qualification Plans
- Isolation Zone
- Protected Area
- Hardened CAS
- SAS
- Deadly Force
- Armed Security Officers

Other Issues – Cat III

- Security Plans

Rulemaking Schedule

- Regulatory Basis to FSME – Jan 2015
- Proposed Rule to OCM – Sept 2016
- Final Rule Published – Oct 2018

Conclusions

- Approach “right sizes” security requirements
- Provides incentives for dilution, which makes material less attractive and adds difficulty to the adversary’s acquisition of material and delay to an adversary’s ability to use material, providing more defense in depth
- Maintains high assurance of adequate protection