

NRC Financial Assurance Requirements for "Possession Licenses for Production of Radioactive Material Using an Accelerator"

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Regulatory Basis for NRC Jurisdiction

- Energy Policy Act of 2005, Section 651(e), required NRC to take jurisdiction over accelerator-produced radioactive materials
- Rulemaking "Requirements for Expanded Definition of Byproduct Material" issued October 1, 2007 (72FR 55864)

Regulatory Basis for NRC Jurisdiction

- NRC definition of *Byproduct material* now includes...
- "...(2)(ii) any material that
 - (A)has been made radioactive by use of a particle accelerator, and
 - (B) is produced, extracted or converted after extraction...for use for a commercial, medical or research activity..."
 - (referred to as "production accelerators")

NRC Production Accelerator Licenses

19 NRC licenses issued for production accelerators in NRC states

- 7 in R-1; 11 in R-II; 1 in R-IV
- 12 affiliated with radiopharmacies
- 6 at medical/research facilities
- 1 at non-medical research facility
- all 19 required financial assurance

Regulatory Basis for Financial Assurance

• 10 CFR 30.35

- -Unsealed byproduct material with half-lives greater than 120 days
- Sealed byproduct material with half-lives greater than 120 days
- 10 CFR 40.36
 - dispersible source material
- 10 CFR 70.25
 - Unsealed special nuclear material



Financial Assurance (FA)

For unsealed materials, a <u>prescribed amount</u> of Financial Assurance may be used:

- \$225,000: if licensed amount is greater than 1 E+3 but less than 1 E+4 times the applicable quantity of appendix B to Part 30 (App B quantity)**
- \$1,125,000: if licensed amount is greater than
 1 E+4 but less than 1 E+5 times App B quantity**

** for multiple radionuclides, the "unity rule" is used and the "sum-offractions" must be calculated



Financial Assurance (FA)

For unsealed materials, a <u>Decommissioning</u> <u>Funding Plan (DFP)</u> must be used, if the licensed amount is greater than 1 E+5 times the Appendix B quantity**.

Any licensee MAY use a DFP; often, the amount of FA determined by the DFP cost estimate is lower than the \$1,125,000 prescribed amount.

** for multiple radionuclides, the "unity rule" is used and the "sum-offractions" must be calculated



"incidentally activated" radioactive materials typically include unsealed byproduct material with half-lives greater than 120 days as:

- Used targets and housings
- Contaminants in product
- Other activated cyclotron parts, etc.
- Potential for activated concrete floor, etc.



Typical "incidentally activated" materials requested for authorization:

- Na-22, half-life 2.6 years
- Mn-54, half-life 303 days
- Co-57, half-life 270 days
- Co-60, half-life 5.3 years
- Zn-65, half-life 245 days
- Any...with atomic numbers 3-83...



Determining the FA required for a single radionuclide: cobalt-57, 5 millicuries

- Appendix B does not list Co-57
- Therefore, must use Appendix B value of 0.1 microcurie for "any radionuclide, other than alpha emitting..."
- then

> 1 E+3 x 0.1 uCi = 100 uCi \$225,000 (or DFP)
> 1 E+4 x 0.1 uCi = 1,000 uCi \$1,125,000 (or DFP)
> 1 E+5 x 0.1 uCi = 10,000 uCi requires DFP



Determining the FA required for 5 mCi Co-57

- 5,000 microcuries Co-57 is
 - > 1E+3 times the applicable value (100 uCi), and
 - > 1E+4 times the applicable value (1000 uCi), BUT
 - ≤ 1E+5 times the applicable value (10,000 uCi)
- Therefore requires <u>either</u>
 - \$1,125,000 prescribed amount, OR
 - could use a DFP



Determining the FA required

for multiple activation products

Radionuclide	Max on	10 CFR 30		1 E+3 times	Max/1 E+3	fraction		
	license	Appendix B		Appendix B	Арр В			
				(millicuries)	(millicuries)			
	(millicuries)	uCi	mCi					
Na22	0.05	0.1	0.0001	0.1	0.05/0.1	0.50		
Mn54	100	10	0.01	10	100/10	10.00		
Co57	5	0.1	0.0001	0.1	5/0.1	50.00		
Co60	50	1	0.001	1	50/1	50.00		
Zn65	300	10	0.01	10	300/10	30.00		
Sum-of-fractions (unity rule)								



Determining the FA required

for multiple activation products

R/N	Max on license (mCi)	Max/1E+3 App B (mCi)	Fraction	Max/1E+4 App B (mCi)	fraction	Max/1E+5 App B (mCi)	fraction
Na22	0.05	0.05/0.1	0.5	0.05/1	0.05	0.05/10	0.005
Mn54	100	100/10	10	100/100	1	100/1000	0.1
Co57	5	5/0.1	50	5/1	5	5/10	0.5
Co60	50	50/1	50	50/10	5	50/100	0.5
Zn65	300	300/10	30	300/100	3	300/1000	0.3
Sum-of-fractions (unity rule)		[\$225K]	140.5	[\$1,125K]	14.05	Need DFP	1.405



Determining the FA required for multiple activation products

- Sum-of-fractions exceeds 1, when using 1 E+5 times the applicable values
- Therefore requires use of a DFP (= cost estimate + means of adjustment every 3 years + financial instrument + certification statement)



ALL 19 NRC licenses required FA

- 2 required first level prescribed amount of \$225,000 (low use, research facilities)
- 17 required (or used) a DFP, with cost estimates ranging \$50,000 \$57,000,000
 - 10 in range \$300,000 \$600,000
 - 5 exceeding \$1,000,000 at facilities with other activities requiring FA; cost estimate not able to be separated for cyclotrons

NRC Financial Assurance Guidance

- NUREG-1757, "Consolidated Decommissioning Guidance," Volume 3, "Financial Assurance, Recordkeeping, and Timeliness" (1757 Volume 3) – Issued September 2003; under revision
- <u>http://www.nrc.gov/about-</u> nrc/regulatory/decommissioning/finanassur.html

