

***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 (72FR55864)**



# ***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-III; 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 prescribed amount of Financial Assurance may be used:**

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

**\*\* for multiple radionuclides, the “unity rule” is used and the “sum-of-fractions” must be calculated**





## ***Financial Assurance (FA)***

**For unsealed materials, a Decommissioning Funding Plan (DFP) must be used, if the licensed amount is greater than  $1 \text{ E}+5$  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-of-fractions” must be calculated**



## ***FA at Production Accelerators***

**“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.**





## ***FA at Production Accelerators***

**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...**



# ***FA at Production Accelerators***

**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**



# ***FA at Production Accelerators***

## **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
  - $\leq 1E+5$  times the applicable value (10,000 uCi)
- **Therefore requires either**
  - \$1,125,000 prescribed amount, OR
  - could use a DFP



# FA at Production Accelerators

## Determining the FA required for multiple activation products

Radionuclide	Max on license (millicuries)	10 CFR 30 Appendix B		1 E+3 times Appendix B (millicuries)	Max/1 E+3 App B (millicuries)	fraction
		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)						140.50



# FA at Production Accelerators

## 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	<b>Need DFP</b>	<b>1.405</b>



# ***FA at Production Accelerators***

**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)**





# ***FA at Production Accelerators***

## ***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
- **<http://www.nrc.gov/about-nrc/regulatory/decommissioning/financial-assur.html>**



# ***FA at Production Accelerators***

**Any Questions?**