



# **Briefing on Economic Consequences**

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# **NRC Legal Authorities Concerning Offsite Property Damage**

**Lisa G. London, Acting Assistant  
General Counsel**

# Adequate Protection

- **Safety standard—Commission must find reasonable assurance of adequate protection (Atomic Energy Act, sec. 182a.)**
  - **Mandatory**
  - **Health & Safety findings (technical judgment of staff)**
  - **Cost cannot be taken into account**



# Offsite Property Damage

- **Damages to offsite property resulting from an unintended release of radionuclides from an NRC-licensed facility during or following a severe accident or other event at the facility**
- **The term “property” is broadly defined (e.g., business interests, land, buildings, equipment, vehicles, crops)**

# Existing Authorities

- **Atomic Energy Act (AEA)**
  - **“Minimize danger to life or property”**
  - **Discretionary authority**
  - **Authorizes NRC to regulate its licensees for the purpose of avoiding or mitigating offsite property damage**
  - **Cost can be taken into account**



# **Offsite Property/NRC Discretion**

- **Once adequate protection has been addressed, any regulatory action to protect offsite property is discretionary.**
- **NRC has broad authority under AEA.**
- **Any requirement to protect offsite property should be linked to a radiological harm or injury.**

# Conclusions

- **NRC has the authority to minimize damage to property from radiological harm.**
- **Any regulatory action to protect offsite property should be linked to protection from a radiological harm or injury.**



# **Regulatory Analysis and Backfitting**

**Deborah Jackson, Deputy Director  
Federal and State Materials and  
Environmental Management Programs  
Division of Intergovernmental Liaison and  
Rulemaking  
(FSME/DILR)**



# Topics

- **Regulatory Analysis (RA)**
- **Backfitting**
- **Scope of Materials Activities**
- **Experience: Offsite Property Damage in RAs**

# **Regulatory Analysis**

- **A structured evaluation of a proposed requirement with estimates of benefits and costs quantified to the fullest extent possible**
- **NUREG/BR-0058 and 0184 include explicit consideration of Offsite Property Damage (OPD)**

# **Backfitting/Issue Finality**

- **NUREG-1409 and NUREG/BR-0058**
- **Parts 50, 52, 70, 72, and 76**
- **Three "exceptions" – applicability explained in documented analysis**
- **If no exception, prepare a backfit analysis to determine if the proposed NRC action is a cost justified substantial safety enhancement**



# Experience: Offsite Property Damage

## Regulatory Action

- Emergency Preparedness for Fuel Cycle and Other Radioactive Material Licensees (1989) - **quantified OPD in supporting regulatory analysis**
- Integrated Safety Analysis Requirements for Part 70 Licensees (2000)
- Integrated Safety Analysis Requirements for Part 40 Uranium Conversion Licensees (under current review)
- Physical Protection of Spent Fuel in Transit (2012)
- Requirements for the Possession of Industrial Devices Containing Byproduct Material (2000) – **quantified OPD in supporting regulatory analysis**
- Physical Protection of Byproduct Material (2012)



# **Overview of Operating Reactor Regulatory Analyses and Backfitting**

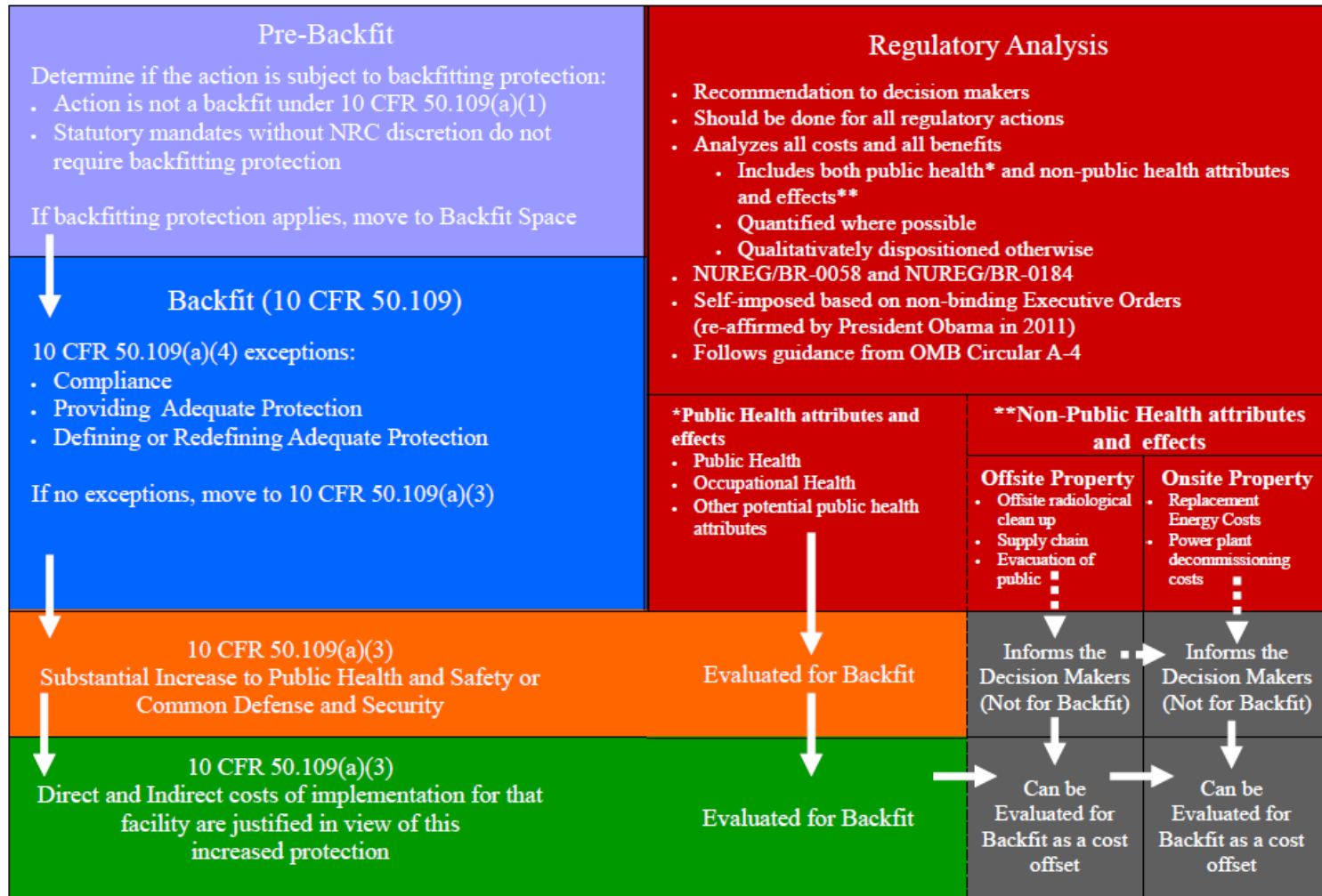
**Timothy McGinty, Director  
Office of Reactor Regulation  
Division of Policy and Rulemaking  
(NRR/DPR)**

# Overview

- **Relationship between Regulatory Analysis and Backfitting**
- **Examples of Regulatory Actions under the Backfit Rule**
- **10 CFR 50.63, “Station Blackout Rule” Backfit Analysis Example**

# Regulatory Analysis vs. Backfitting

## REGULATORY ACTIONS (Operating Reactors)



# Examples of Regulatory Actions within Backfit

<b>Determination Basis</b>	<b>Examples of Regulatory Actions</b>
<b>Not a backfit</b> <b>50.109(a)(1)</b>	• <b>Risk-Informed Categorization Rule (voluntary action) (2004)</b>
<b>Adequate Protection</b> <b>50.109(a)(4)</b>	• <b>Enforcement Action EA-12-049 Order on Reliable Hardened Vents (2012)</b>
<b>Cost-Justified Substantial Safety Enhancement</b> <b>50.109(a)(3)</b>	• <b>Station Blackout Rule (1988)</b>



# **Backfit Analysis Example**

- **Station Blackout Rule (SBO) – 10 CFR 50.63 (1988)**
  - **At the time of the rule, the risk level did not present an undue risk to public health**
  - **Core damage frequency decreased by  $2.6 \times 10^{-5}$  per reactor-year**
  - **Risk high for some plants, low for others**

# **SBO Backfit Analysis**

## **Substantial Increase to Health and Safety Evaluation**

- **NRC only evaluated public health**
- **Total averted dose to public from offsite release of radioactive material was 145,000 person-rem**

# **SBO Backfit Analysis**

## **Consideration of Benefits and Costs**

- **Quantified costs and benefits**
  - **Benefits included averted dose to public and site workers**
  - **Costs included Industry and NRC implementation and offsite and onsite property**
  - **Benefits > costs**

# **SBO Backfit Analysis**

## **Consideration of Benefits and Costs**

- **Non-Quantified costs and benefits**
  - **Met qualitative safety goals**
  - **Defense-in-depth**

# Observations

- **Adequate protection consideration under backfitting does not consider offsite property**
- **Backfit analysis considers offsite property damage as an averted cost, rather than a safety benefit (enhancement)**



# **Considering Offsite Contamination in Environmental Analysis**

**Scott Flanders, Director  
Office of New Reactors  
Division of Site Safety and  
Environmental Analysis  
(NRO/DSEA)**

# Overview

- **Accident Considerations under National Environmental Policy Act (NEPA)**
- **Severe Accident Evaluations in NEPA Documents**
- **Consideration of Offsite Property Damage**



# **Consideration of Accidents in Implementation of NEPA**

- **Appendix D rulemaking in 1971**
- **1980 policy statement**
- **1989 Limerick decision**



# **Severe Accident Evaluations**

- **Severe accident impacts include offsite property damage**
- **Impacts of severe accidents presented as environmental risk**
- **Realistic estimate of environmental consequences**

# OPD in Environmental Impact Statement

	Release Category Description (Accident Class)	Cost <sup>(d)</sup> (\$/Ryr)
IC	Intact containment	$1.5 \times 10^{-1}$
BP	Containment bypass, fission products released directly to environment	$2.2 \times 10^{+2}$
CI	Containment isolation failure occurs prior to onset of core damage	$7.1 \times 10^{+0}$
C <sup>FE</sup>	Early containment failure, after onset of core damage but before core relocation	$4.4 \times 10^{+1}$
C <sup>FI</sup>	Intermediate containment failure, after core relocation but before 24 hours	$1.7 \times 10^{+0}$
C <sup>FL</sup>	Late containment failure occurring after 24 hours	$5.6 \times 10^{-3}$
<b>Total</b>		$2.7 \times 10^{+2}$

(d) Cost risk includes costs associated with short-term relocation of people, decontamination, interdiction, and condemnation. It does not include costs associated with health effects (Jow et al. 1990).

Note: Taken from NUREG-1939, Table 5-17



# **What is a SAMAMA?**

## **What is a SAMMDA?**

- **Severe accident mitigation alternative (SAMAMA): Feature or action that would prevent or mitigate the consequences of a severe accident**
- **Severe accident mitigation design alternative (SAMMDA): Proposed physical addition or enhancement**

# **SAMA/SAMDA Analysis**

- **A systematic search for potentially cost beneficial enhancements to further reduce nuclear power plant risk**

# **Cost-Benefit Evaluation**

$$\begin{aligned} \text{Net Value} &= \text{Averted Cost} - \\ &\quad \text{Implementation Cost} \\ &= \{ \text{public exposure} \\ &\quad + \text{occupational exposure} \\ &\quad + \text{offsite property damage} \\ &\quad + \text{on-site cleanup and decon} \\ &\quad + \text{replacement power} \} \\ &\quad - \text{Cost of alternative} \end{aligned}$$



**Options for enhancing the  
regulatory framework  
consideration of economic  
consequences**

**Richard Correia, Director  
Office of Regulatory Research  
Division of Risk Analysis  
(RES/DRA)**

# Overview of Options

- **Option 1: Status Quo**
- **Option 2: Enhanced Consistency of Regulatory Analysis Guidance**
- **Option 3: Exploring the Merits of Potential Changes to the Regulatory Framework**

# **Option 1 - Status Quo**

- **Pros**

- **Maintains regulatory stability**
- **Requires minimal additional resources**

- **Cons**

- **May not accomplish consistency across programs**
- **May not be responsive to possible stakeholder concerns**
- **May result in inefficiency**



# **Option 2 - Enhanced updates**

- **Pros**

- **Systematic approach and addresses agency-level needs**
- **More comprehensive guidance**
- **Helps harmonize guidance across the agency**

- **Cons**

- **Requires more resources than Option 1**
- **May not be responsive to possible stakeholder concerns**

# **Option 3 - Explore changes**

- **Pros**

- **Provides a Commission statement on the importance of land contamination**
- **Allows for stakeholder input to proposed revisions**

- **Cons**

- **Could increase regulatory uncertainty**
- **Increased complexity**
- **Requires substantial staff resources**

# **Public Meetings**

- **May 24, 2012**
  - **Strong stakeholder interest**
  - **Limited specific feedback**
- **August 29, 2012**
  - **Continued strong stakeholder interest**
  - **Public expressed support for Option 3 and a desire for greater transparency on how offsite property damage is considered in analyses**

# **Staff Recommendation: Option 2**

- **Would enhance the currency and consistency of the existing framework**
- **Would be done more systematically**
- **Would provide more comprehensive guidance**

# Acronyms

- **AEA- Atomic Energy Act**
- **OPD- Offsite Property Damage**
- **RA- Regulatory Analysis**
- **NEPA- National Environmental Policy Act**
- **SAMA- Severe Accident Mitigation Alternative**

# Acronyms

- **SAMDA- Severe Accident Mitigation Design Alternative**
- **PRA- Probabilistic Risk Assessment**
- **TMI- Three Mile Island**
- **CDF- Core Damage Frequency**
- **SBO- Station Blackout Rule**

# **Back-up Slides**

# Reference Citations

Citation	Regulatory Action
54 FR 14051 ML062020791	- Emergency Preparedness rule (1989) and RA
65 FR 56211 ML003715338	- Integrated Safety Analysis for Part 70 rule (2000) and RA
ML12095A037	- Integrated Safety Analysis Requirements for Part 40 Uranium Conversion Licensees RA
ML120050180	- Physical Protection of Spent Fuel (2012) RA
65 FR 79162 ML003714035	- Requirements for the Possession of Industrial Devices rule (2000) and RA
ML113290229	- Physical Protection of Byproduct Material (2012) RA



# SBO Cost-Benefit Analysis (1988)

<b>Parameter</b>	<b>Benefit (averted dose)</b>	<b>Cost (\$1000)</b>
<b>Public health (accident)</b>	<b>143,000</b>	
<b>Occupational health (accident)</b>	<b>1,500</b>	
<b>Industry implementation</b>		<b>60,000</b>
<b>NRC implementation</b>		<b>1,500</b>
<b>Total</b>	<b>144,500</b>	<b>61,500</b>

Using the 1988 person-rem conversion factor,<sup>1</sup> the cost benefit comparison yields

Benefits	\$144,500,000
Costs	<u>61,500,000</u>
Net Benefits	83,000,000

<sup>1</sup> In 1988, the Regulatory Analysis Guidelines used a dollar per person-rem amount of \$1,000 as a surrogate for all averted offsite losses, health as well as property.

# SBO Cost-Benefit Analysis (Differences if calculated today)

<b>Parameter</b>	<b>Benefit (\$1000)</b>	<b>Cost (\$1000)</b>
<b>Public health (accident)</b>	<b>286,000<sup>1</sup></b>	
<b>Occupational health (accident)</b>	<b>3,000<sup>1</sup></b>	
<b>Onsite property<sup>2</sup></b>		
• <b>Replacement energy costs</b>		<b>(19,000)<sup>3</sup></b>
• <b>Refurbishment costs</b>		<b>(19,000)<sup>3</sup></b>
• <b>Decontamination costs</b>		<b>--<sup>3</sup></b>
<b>Offsite property<sup>4</sup></b>		<b>&lt; 0<sup>5</sup></b>
<b>Industry implementation</b>		<b>60,000</b>
<b>NRC implementation</b>		<b>1,500</b>
<b>Total</b>	<b>289,000</b>	<b>&lt; 23,500</b>

<sup>1</sup> In 1995, the NRC adopted a \$2000 per person-rem conversion factor and limited its scope solely to health effects.

<sup>2</sup> This term considers the expected monetary effects on onsite property, including replacement power, decontamination, and refurbishment costs for the proposed action. Treated as an averted cost in accordance with NUREG/BR-0184 guidance.

<sup>3</sup> Values calculated in NUREG-1109 but included as a supplemental consideration and not part of cost-benefit justification. The 1988 estimated values shown are products of the number of facilities affected times the value of avoided damage times the estimated reduction in accident frequency discounted at a 10% real discount rate. Estimated cost for refurbishment and cleanup is \$1.2 billion.

<sup>4</sup> This term considers the expected monetary effects on direct (e.g., land, food, water) and indirect (e.g., tourism) for property consequences resulting from an accident. These costs include interdiction measures (e.g., decontamination, cleanup, evacuation).

<sup>5</sup> Offsite property consequences are separately valued as an averted cost.