

Considerations in Assessing Potential Cost Impacts Associated with Nuclear Power Reactor Accidents

OECD/NEA Workshop on Approaches to Estimation
of the Costs of Nuclear Accidents
28-29 May 2013

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“No Single Cost of an Accident”

- Many applications (for example):
 - Reactor siting, design, and operation; licensing and regulation; national policy –energy, economy, public health, and environmental protection; asset protection and liability/risk management; public information
- Varying goals, approaches and products
- How potential cost impacts should be estimated, or if they should be included at all, is highly dependent on the intended application

Typical Potential Cost Impacts

- Human Health and Safety
- Environmental & Ecological Impacts
- Property Damage or Loss
- Replacement Energy
- Socio-Economic Disruption
- Recovery & Remediation

Human Health and Safety

- “When exposures occur over large populations, large geographical areas, or long time periods, the total collective effective dose is not a useful tool...” (ICRP Publication 103)
- “Therefore, the Scientific Committee does not recommend multiplying very low doses by large numbers of individuals to estimate numbers of radiation-induced health effects within a population exposed to incremental doses at levels equivalent to or lower than natural background levels.” (UNSCEAR 2012)
- “Thus, for populations in which almost all individuals are estimated to receive a lifetime dose of less than 100 mSv above background, collective dose is a highly speculative and uncertain measure of risk and should not be used for the purpose of estimating population health risk.” (Health Physics Society 2010)

Human Health & Safety (cont'd)

- Evaluate the significance of “for a given dose, the ICRP system of protection is more conservative for internal than for external exposures.”
- Determine how to recognize the importance of psychological consequences as a human health issue
- Evaluate significance of costs of protection and care for infants, children and pregnant women (fetus/embryo)

Environmental & Ecological Risk

- Radiation protection of non-human species is a work-in-progress
- Assessment of cost impacts is highly dependent upon the selection of protective endpoints
- Assessments sometimes include issues better related to property damage and socio-economic disruption

Property Damage or Loss

- Cost estimates for property damage may include double counting –cost of loss of the asset benefits and cost of their replacement
- Offsite property damage typically includes contamination-based actions: condemnation, restriction of access or use, or loss or reduction in value –criteria are variable and situation-specific
- Some costs are in fact transfers

Replacement Energy

- Some analyses include replacement energy costs associated with shutdown of other reactor units
- Estimated costs of shutdowns due to risk insights are not specific to an accident (e.g., could have arisen from non-accident event or analyses)
- Estimated costs of shutdowns due to policy or political considerations are speculative and arbitrary

Socio-Economic Disruption

- Guidance and plans for managing protracted situations are a work-in-progress, especially at regional, national and international levels
- Protective actions for areas with elevated, but not high dose rates may produce more harm than good
- Cost assessments should avoid memorializing spillover responses

Recovery & Remediation

- Recovery and remediation costs are highly uncertain
 - Rehabilitating evacuated areas
 - Large-scale decontamination and waste management
 - Control and fate of contamination-free, slightly contaminated, and decontaminated foodstuffs, water and consumer products
- US emphasis is on resilience – recovery of socio-economic stability in a “new normal”
- Radiation protection concept is optimization

Value Ranking - Operator's Perspective

1. Prevent or mitigate initiating events
2. Prevent or mitigate core damage
3. Maintain containment
4. Prevent or mitigate significant releases
5. Enhance emergency response preparedness
6. Facilitate recovery and remediation

MAKING SAFE NUCLEAR ENERGY SAFER AFTER FUKUSHIMA

FLEX is a flexible and diverse strategy developed by the nuclear energy industry to quickly and effectively implement the Nuclear Regulatory Commission (NRC's) Fukushima task force recommendations. The FLEX protection strategy addresses the main safety challenges at Fukushima—the loss of cooling capability and electrical power resulting from a severe natural event that exceeded the plant's design basis—to make U.S. facilities even safer. It builds on safety steps taken by industry during the past three decades by providing a fast, effective and efficient way to apply the lessons learned from Japan's experience.

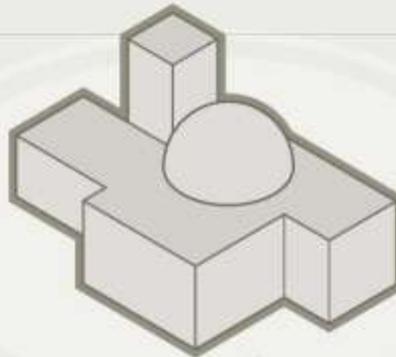
MULTIPLE LAYERS OF POWER SUPPLY

Backup generators provide reliable electrical power and cooling capability if an extreme event disables the normal plant equipment. Additional battery banks provide electrical power and cooling capability if an extreme event disrupts regular and other backup power supply.



ADDITIONAL SPENT FUEL MONITORING

Additional equipment in spent fuel storage pools will provide another layer of monitoring to ensure temperature and water levels are maintained.



ADDITIONAL PUMPS

To ensure cooling procedures are maintained during and after an extreme event, additional pumps can supply water where needed.



PREPARING OUR PEOPLE

Nuclear plant and emergency response workers will use the FLEX approach to support key safety functions across multiple reactors. Capabilities and training will be verified for nuclear plant workers to assure the continued viability and reliability of equipment. Communications capabilities will be expanded to include satellite phones and equipment to connect personnel at the plant with government emergency communications networks. Specific strategies include the following:

Enhanced Training



Expanded Maintenance and Testing of Equipment



Satellite Communications



PUBLIC OPINION

74% of Americans believe that U.S. nuclear power plants are safe and secure.

80% of Americans believe U.S. nuclear power plants have been made safer as we've learned from experience and added technology.

REGIONAL CENTERS

Additional emergency equipment will be stationed in off-site support centers to provide another layer of safety and ensure prolonged reliable operation.



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