

Consequence Evaluation for Decommissioning Plants

**Briefing for
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1h-1

Consequence Evaluation

As part of new generic study to support decommissioning rulemaking, NRR requested RES estimate offsite consequences for severe spent fuel pool accident to allow comparisons of decommissioning risk with reactor risk. Rulemaking would relax requirements for EP and insurance.

Approach

Using the MACCS code, calculated the consequences of a severe spent fuel pool accident.

Earlier studies (GSI-82) calculated consequences for accidents occurring 12, 30, and 90 days after final reactor shutdown.

This new generic study examined the effect on offsite consequences of up to a year of radioactive decay. RES results given in memo from A. Thadani to S. Collins, Nov 1999.

Follow-on Work

ACRS comments on new generic study:

**ruthenium and fuel fines release fractions too low
 plume spreading too low**

NRR requested an assessment to address ACRS comments

Our assessment concluded (memo from F. Eltawila to G. Holahan, August 2000):

Increasing ruthenium release fraction: A large increase in consequences (factor of 20 to 100 for prompt fatalities). However, increase can be largely offset by early evacuation.

Plume spreading: Factor of 1.1 to 15 decrease in prompt fatalities. Up to 60% increase in cancer fatalities and population dose. However, expect similar effects for reactor accidents.

Representative Results

Source Term	Consequences within 100 Miles (Surry population density, 95% evacuation)		
	Early Fatalities	Societal Dose (rem)	Cancer Fatalities
SFP - low	.4	4×10^6	2,000
SFP - high	50	10×10^6	10,000
Surry NUREG-1150- worst case early fatalities	13	4×10^6	2,000

Source Term	Consequences within 100 Miles (Surry population density, 95% evacuation)		
	Early Fatalities	Societal Dose (rem)	Cancer Fatalities
SFP - low*	.02	4×10^6	2,000
SFP - high*	.5	8×10^6	7,000
Surry NUREG-1150- worst case early fatalities	13	4×10^6	2,000

*Based on early evacuation.

More Follow-on Work

Revised NRR approach to rulemaking (as of August 2000)

Estimate the risk as a function of time from 30 days to 10 years.

Based on the decline in risk, decide at what time EP and insurance requirements can be relaxed.

NRR is continuing to request our assistance and may be focusing on consequence reductions as a technical basis for the rulemaking.

Consequences as a function of time from 30 days to 10 years.

RES calculations are underway.

Research Issues

Release magnitude: Need data on ruthenium releases; currently assume release fraction up to that of a volatile fission product (i.e., 0.75)

Release rate: Need integrated analysis of heatup, propagation, and release; currently assume that, after hottest assembly reaches 800C, all assemblies release fission products in 30 minutes. (Also, the time to 800C is based on adiabatic conditions with no cladding oxidation.)

Emergency response: Need systematic consideration of emergency response; currently use evacuation assumptions and relocation criteria for large, early release from NUREG-1150 study.

Mitigation: Need consideration of prevention and mitigation, such as ad hoc sand filtering.