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RISK PERSPECTIVE OF DECOMMISSIONED SPENT FUEL POOLS

Spent Fuel Pool Cooling Risk Analysis
Frequency of Fuel Uncovery (per year)

INITIATING EVENT	CASE 1	CASE 2	CASE 3
Loss of Offsite Power - Plant centered and grid related events	2.3E-06	4.0E-06	2.2E-05
Loss of Offsite Power - Events initiated by severe weather	2.5E-06	1.3E-05	8.6E-06
Internal Fire	9.4E-06	2.1E-05	8.9E-05
Loss of Pool Cooling	4.8E-07	1.1E-06	3.8E-05
Loss of Coolant Inventory	3.6E-06	5.9E-05	1.7E-04
Seismic Event	2.0E-06	2.0E-06	2.0E-06
Cask Drop[1]	1.5E-05	1.5E-05	1.5E-04
Aircraft Impact	4.0E-08	4.0E-08	4.0E-08
Tornado Missile	2.0E-07	1.0E-06	2.0E-07
Total	3.5E-05	1.2E-04	4.7E-04

[1] THE RANGE OF VALUES FOR FREQUENCY OF FUEL UNCOVERY FROM HEAVY LOAD DROPS WAS FROM 1E-8 TO 1E-4 PER YEAR. WE BELIEVE THAT THE 1E-5 PER YEAR FREQUENCY IS PROBABLY CLOSEST TO "REALITY."

Spent Fuel Pool Cooling Risk Analysis
Risk from Spent Fuel Pool Accidents at Decommissioned Plants
(Distance in miles = 0-100)

INITIATING EVENT	CASE 1		CASE 2		CASE 3	
	Early	Late	Early	Late	Early	Late
Loss of Offsite Power - Plant centered and grid related	1.5E-6	5.0E-3	3.8E-6	9.0E-3	1.5E-5	4.8E-2
Loss of Offsite Power - severe weather	1.7E-6	5.5E-3	1.2E-5	2.9E-2	3.9E-6	1.9E-2
Internal Fire	6.3E-6	2.0E-2	2.0E-5	4.7E-2	6.0E-5	1.9E-1
Loss of Pool Cooling	3.2E-7	1.0E-4	1.1E-6	2.5E-3	2.5E-5	8.3E-2
Loss of Coolant Inventory	2.4E-6	7.8E-3	5.7E-5	1.3E-1	1.1E-4	3.7E-1
Seismic Event	1.3E-6	4.4E-3	1.9E-6	4.5E-3	1.3E-6	4.4E-3
Cask Drop	1.0E-5	4.9E-2	1.4E-5	3.4E-2	1.0E-4	3.3E-1
Aircraft Impact	2.6E-8	8.7E-5	3.8E-8	9.0E-5	2.7E-8	8.7E-5
Tornado Missile	1.3E-7	4.4E-4	9.6E-7	2.3E-3	1.3E-7	4.4E-4
Total	2.3E-5	7.6E-2	1.2E-4	2.7E-1	3.1E-4	1.0

The evacuation is assumed to begin three hours prior to release of fission products to the environment. If evacuation is delayed until about 1.3 hours after release, the early fatalities go up by about a factor of 20 and there is minimal increase in late fatalities (less than 20 percent).

COMPARISON OF SPENT FUEL POOL RISK TO RISKS SIMILAR POPULATIONS FACE IN DAY-TO-DAY LIVING

natural radiation dose excluding
man-made sources such as
medical = 230 mr/yr

0 - 100 miles (100 people/mi^2) = 3.1×10^6 people
x 230 mr/yr x 30 years x 10^{-3} rem/mr
$\cong 2.2 \times 10^7$ person rem or 7.2×10^5 person rem/yr

0 - 500 miles = 78.5×10^6 people
x 230mr/yr x 30 yrs x 10^{-3} rem/mr
$\cong 5.4 \times 10^8$ person rem or 1.8×10^7 person rem/yr

From Statistical Abstract of U.S.:

Implied cancer risk (i.e., risk of death) = 2.5×10^{-3} per year
So, within 100 mile radius there would be 7.8×10^3 naturally occurring cancer fatalities,
and within 500 mile radius there would be 2.0×10^5 naturally occurring cancer fatalities.

From paper on computation of energy risks:

Within 10 mile radius (~30,000 people), there would be the following average number of accidental deaths:

motor vehicles =	8
falls =	3
burns =	1
other =	~1
Total =	12

WHAT WOULD IT TAKE FOR THE NRC TO GRANT A RISK-INFORMED EXEMPTION FOR EMERGENCY PREPAREDNESS FOR DECOMMISSIONED PLANTS?

NECESSARY CONDITIONS

1. Have adequate instrumentation to track and alarm temperature rise and level changes in the spent fuel pool.

2. Have Technical Specification requirements for diesel-driven fire pump, spent fuel pool level instrumentation, spent fuel pool temperature instrumentation, and spent fuel pool area radiation monitors to protect the spent fuel pool until the decay heat level in the pool is so low that no Zirconium cladding fire can occur.

3. Add higher level of action in emergency response planning above the "alert" level to deal with situations where a spent fuel pool fuel cladding fire may occur. The timing of the warning should be commensurate with the potential consequences of having a release followed by evacuation of local residents.

4. Have two reliable sources of makeup to the spent fuel pool.

5. Utility must provide for staff review a description of what measures (e.g., installed crane stops, improved procedures, added restrictions on movement of casks until fuel is greater than some specified age) it has taken to adequately reduce heavy load drop concerns.

6. Provide assurance that the spent fuel pool has seismic capacity greater than or equal to three times the SSE or perform a plant-specific analysis of the spent fuel pool fragility and convolute it with the site-specific hazard curves to provide a measure of the risk from beyond design bases earthquakes at the site.

HELPFUL CONDITIONS

1. Retain as high a level of plant-specific experience and overall power plant knowledge within the certified fuel handler ranks as possible.

2. Provide multiple sources and paths for makeup to the spent fuel pool.