Consequence Evaluation for Spent Fuel Pool Accidents

Presentation to the Advisory Committee on Reactor Safeguards

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Consequence Assessment

Object of the analysis

Assess effect of 1 year of decay on offsite consequences
Assess effect of early vs. late evacuation

Summary of approach

Use the MACCS code with fission product inventories for 30 days and 1 year after final shutdown

Conclusion

Short-term consequences (early fatalities) reduced by a factor of 2 from 30 days to 1 year. Early evacuation reduces early fatalities by up to a factor of 100.

Long-term consequences (cancer fatalities and societal dose) less affected by additional decay and early evacuation

Results

Mean Consequences for Surry Population Density				
Decay Time Prior to Accident	**Distance (miles)**	**Early Fatalities**	**Societal Dose (person-rem)**	**Cancer Fatalities**
30 days	**0-100**	**1.75**	**4.77×10^6**	**2,460**
1 year	**0-100**	**1.01**	**4.54×10^6**	**2,320**
1 year[1]	**0-100**	**.0048**	**4.18×10^6**	**1,990**

[1]Based on evacuation before release.

Effect of Ruthenium

Small-scale Canadian tests with an air environment show significant ruthenium release following cladding oxidation.

MACCS calculations show that release of all ruthenium increases early fatalities by up to a factor of 100, because the assumed form (oxide) has a large dose per Ci inhaled due to its long clearance time from the lung.

Mitigating factors for ruthenium releases in spent fuel pool accidents

- **rubbling of the fuel may limit air ingression**
- **1 year half-life of ruthenium**

PHEBUS test planned to examine effect of air ingression on a larger scale in an integral facility

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1 year	**0-100**	**1.01**	**4.54×10^6**	**2,320**
1 year (100% ruthenium release)	**0-100**	**95.3**	**9.53×10^6**	**9,150**
1 year (100% ruthenium release)[1]	**0-100**	**.13**	**6.75×10^6**	**6,300**

[1]Based on evacuation before release.

Conclusion: Effect of ruthenium release can be very significant, but can be offset by early evacuation.