

# **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**

<b>Mean Consequences for Surry Population Density</b>				
<b>Decay Time Prior to Accident</b>	<b>Distance (miles)</b>	<b>Early Fatalities</b>	<b>Societal Dose (person-rem)</b>	<b>Cancer Fatalities</b>
<b>30 days</b>	<b>0-100</b>	<b>1.75</b>	<b>4.77x10<sup>6</sup></b>	<b>2,460</b>
<b>1 year</b>	<b>0-100</b>	<b>1.01</b>	<b>4.54x10<sup>6</sup></b>	<b>2,320</b>
<b>1 year<sup>1</sup></b>	<b>0-100</b>	<b>.0048</b>	<b>4.18x10<sup>6</sup></b>	<b>1,990</b>

<sup>1</sup>**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 ingress**

**1 year half-life of ruthenium**

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

## Results

Mean Consequences for Surry Population Density				
Decay Time Prior to Accident	Distance (miles)	Early Fatalities	Societal Dose (person-rem)	Cancer Fatalities
1 year	0-100	1.01	$4.54 \times 10^6$	2,320
1 year (100% ruthenium release)	0-100	95.3	$9.53 \times 10^6$	9,150
1 year (100% ruthenium release) <sup>1</sup>	0-100	.13	$6.75 \times 10^6$	6,300

<sup>1</sup>Based on evacuation before release.

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