CLAD BALLOONING ACCIDENT

12/13/2010

INTRODUCTION

The fuel pins in PWRs and in BWRs are subject to internal pressures generated by two sources of pressure:

1. The He gas fill introduced between the cladding and the fuel pellets that provides a thermal bonding between them. It is also used to detect any leaks after the welding manufacturing process.
2. The fission product gases, such as Kr, Xe, and I, buildup in the matrix of the ceramic UO_2 fuel pins.

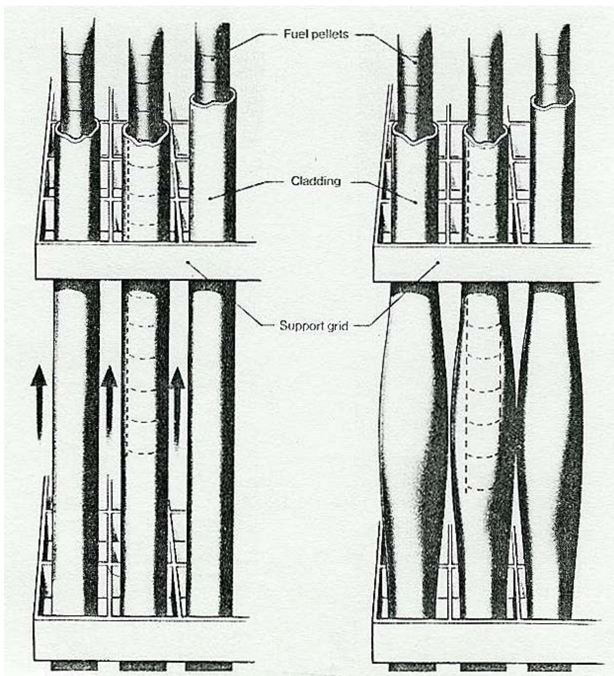

Figure 1. Clad ballooning can lead to flow obstruction and fuel damage.

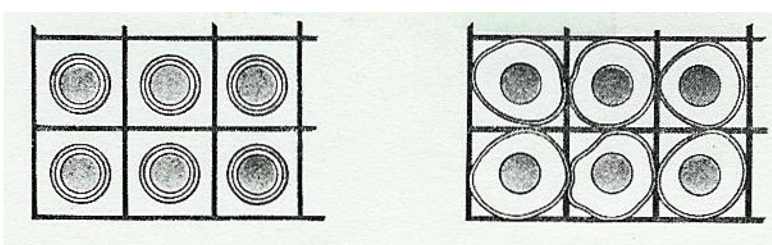

Figure 2. Clad ballooning obstructing flow in a square fuel pins lattice.

ACCIDENT OCCURRENCE

If the external coolant pressure becomes less than the internal pressure inside the cladding, the cladding swells and undergoes a ballooning process.

If the temperature is high enough, the cladding can even burst relasing the fission product gases into the coolant.

The most serious result from clad ballooning is that it may cause the blockage of the flow channels and result in a permanent restriction of the coolant flow.

A coolant flow restriction results in an increase in the cladding and fuel temperatures resulting in severe fuel damage.

PREDICTION AND SIMULATION MODELS

The use of the conservative proprietary "evaluation" safety analysis computational models may reveal that the calculated temperature lies actually within the range for clad ballooning.

On the other hand, the use of the public-domain "best-estimate" safety analysis computational models can lead to realistic results in calculations of clad ballooning with a careful accounting of the statistical uncertainties involved.