# Current Areas of R & D Focus

***General***

**1.) Fuel and Cladding Material Properties at High Burnup**

**(Concern here is for transient conditions)**

- **Thermal diffusivity is different (lab vs in-reactor)**
- **Cladding ductility shows wide scatter due to $H_2$ concentration, sample preparation, and measurement techniques**
- **Must understand in-reactor behavior**

**2.) Failure Root cause Investigation**

**(To achieve zero defects, must understand causes)**

- **Poolside inspections valuable for identification**
- **Expensive hotcell studies done only if poolside investigation does not work**

**3.) Updated Codes and Analytical Tools**

**(Especially important for high BU in PWR's)**

- **Gadolinia absorbers, local boiling, effect of boiling on flow properties**
- **Integrated nuclear and thermal hydraulic codes**

# Current Areas of R & D Focus (cont.)

**4.) Transient Fuel Behavior**

**(Controversy over reactor-initiated accidents [RIA])**

- **All parties (regulators, utilities, and vendors) agree that simulated conditions are much more severe than reality**
- **Particularly interested in post-LOCA and post-DNB conditions**
- **Difficult to conduct meaningful experiments**

**5.) Next Generation Fuel**

**(Concern here is to increase reliability and operational flexibility)**

- **New fuel designs and materials**
- **>60 GWd/T burnup, load following, extended cycle time**
- **Water chemistry changes**

# Current Areas of R & D Focus (cont.)

**PWR Specific**

**1.) Cladding Corrosion**

***(Plant surveillance shows that cladding corrosion is limiting further BU extension)***

**2.) Water Chemistry Control**

- **Codes are now availible to predict corrosion rate as a function of:**

  **heat flux**
  **coolant temperature**
  **neutron fluence**
  **cladding hydrogen content**
  **cladding intermetallic particles**
  **heat treatment**
  **coolant Li concentration**

- **Reccomendation is to raise pH and reduce source of crud**

  **(requires 30% enriched $^{10}B$ to keep Li concentration<3 ppm)**

# Current Areas of R & D Focus (cont.)

**BWR Specific**

**1.) Finding cladding barrier that is resistent to PCI failures**

**2.) Reduce "fuel washout" from failed fuel**