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July 2020 High Burnup Workshop
Westinghouse Updates

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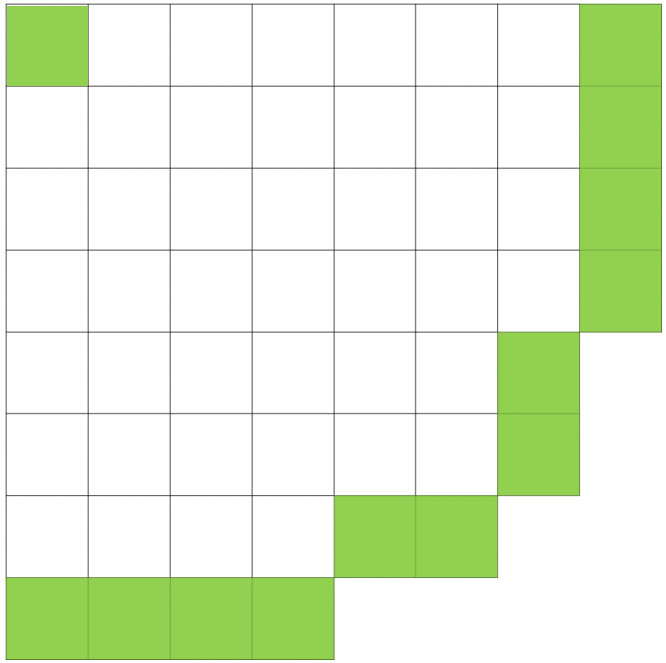
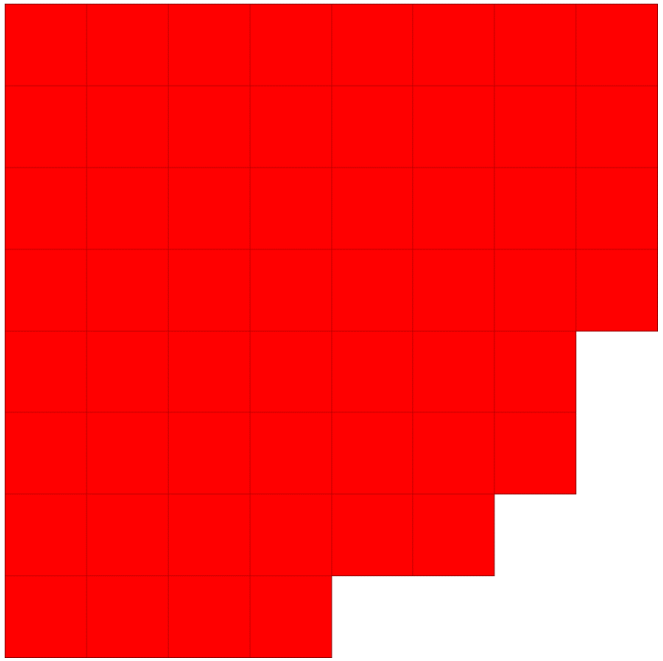
July 2020

Burnup Extension Program as 2-Step Process



Step 1: Increase burnup limit for rods that do not rupture during accidents to ~68 GWd/MTU



Step 2: Increase burnup limit for entire core to ~75 GWd/MTU with enrichment increase

Step 1 – Incremental Burnup Increase
Rod Average Burnup Limit of 68 GWd/MTU

- Applicable to current fuel products and current enrichments
- Demonstrate fuel designs can meet design criteria under extended burnup planned fuel cycles
- Address science behind rule changes for:
  - LOCA (Proposed 50.46c)
  - RIA (RG 1.236)
- Demonstrate no burst for rods between 62 & 68 GWd/MTU
  - Focus on Large-Break LOCA (LBLOCA) and Reactivity Insertion Accidents (RIA)

Step 1, Westinghouse expects to submit incremental burnup extension to US NRC in 4th quarter 2020

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Step 2 – Increase rod burnup limit to 75 GWd/MTU and enrichment to > 5 wt%

- Continue to expand database for high burnup fuel
- Demonstrate fuel designs can meet criteria with higher enrichment under extended burnup planned fuel cycles
  - Leverage advanced fuel products
- Address fuel fragmentation, relocation and dispersal (FFRD)
- Address impact of enrichment > 5 wt% on manufacturing facilities, transport, on site storage and back end

Step 2, Westinghouse has a dedicated, multidiscipline team focused on this effort

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Fuel Fragmentation, Relocation, and Dispersal Introduction

- FFRD is one of the main areas of focus for high burnup
  - Potential criticality concerns
  - Decay heat removal concerns
  - Radiological consequence concerns
- Most straightforward approach to address FFRD is to ensure that fuel rod integrity remains intact during accidents
  - Approach utilized for incremental burnup extension
- Significant increase in complexity if fuel rods fail
  - Amount of fuel susceptible to fragmentation, fuel fragment sizes, failure opening, fragment mobility, etc.

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Fuel Fragmentation, Relocation, and Dispersal Westinghouse Initiatives

- As part of incremental burnup extension, Westinghouse has updated codes and methods to better predict behavior of high burnup fuel in accident conditions
- In parallel Westinghouse has developed nuclear designs for high burnup and enrichment with different operating assumptions

- Westinghouse is now assessing FFRD potential and consequences across various safety and accident analyses
  - Primary areas of consideration are LOCA, RIA, and fuel handling accident

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Fuel Fragmentation, Relocation, and Dispersal Supporting Industry Initiatives

- EPRI / MPR exploring alternate approaches to address FFRD
  - Possible path includes risk-informed assessment of FFRD
  - Westinghouse has completed exploratory work indicating that burst may be precluded for small-break LOCA (SBLOCA) and intermediate-break LOCA (IBLOCA)

- Westinghouse is also working with national labs to assess conditions of interest for separate effect and integral effect testing on high burnup fuel

Westinghouse is committed to ongoing industry initiatives related to addressing FFRD

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Conclusions

- Westinghouse is nearing completion of topical report for first (incremental) step in burnup extension
- Integrated cross-functional area effort underway towards second step of burnup extension
  - Includes data generation, updates to codes and methods, consideration of FFRD, etc.
- Westinghouse is committed to supporting ongoing industry programs and initiatives related to high burnup and enrichment

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