Radiological Issues for Thin Liquid Walls of ARIES-IFE Study
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Objectives
- Develop activation approach and identify radiological issues for candidate liquid wall (LW) materials.

Representative Radial Build
- FLEXAC composite liner and LiPb/LiPb2O3 breeder.
- Energy partition:
  - T9: 1 MW
  - T10: 0.5 MW
- LiPb velocity: 5 m/s
- LW thickness: 20 mm
- Nuclear data:
  - Flibe: ENDF/B-VII.1
  - LiPb: ENDF/B-VII.1

LW Cycle
- Neutron and gamma transport analysis:
  - Flibe
  - LiPb
- Activation analysis:
  - Pb Flinabe

ACTIVATION ASSESSMENT
- Consider two extreme activation cases:
  - No mixing of LW material with breeder
  - Mixing of LW material with breeder module and outside chamber.

ARIES-IFE Operating Conditions
- HIB Fusion Yield 460 MJ
- Rep Rate 4 Hz
- # of Shots 190 million
- Chamber Radius 6 m
- Neutron Wall Loading ~3 MW/m²
- Plant Lifetime 40 FY
- Availability 85%

WDR - Tangential Injection
- No outside mixing of LW with breeder
- Neutron Wall Loading: ~3 MW/m²
- Plant Lifetime: 40 FY
- Availability: 85%

Conclusions
- In most cases, candidate liquids generate multi-thousand tonnes of high-level waste.
- Tangential injection scheme results in highest WDR.
- Pb and LiPb are more radioactive than Sn and Flibe.
- Online removal of transmutation products could allow disposal of liquid materials to be disposed in low-level waste or preferably, released for use in similar applications.
- Recommendation: Employ same breeding material for LW to minimize waste stream.

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