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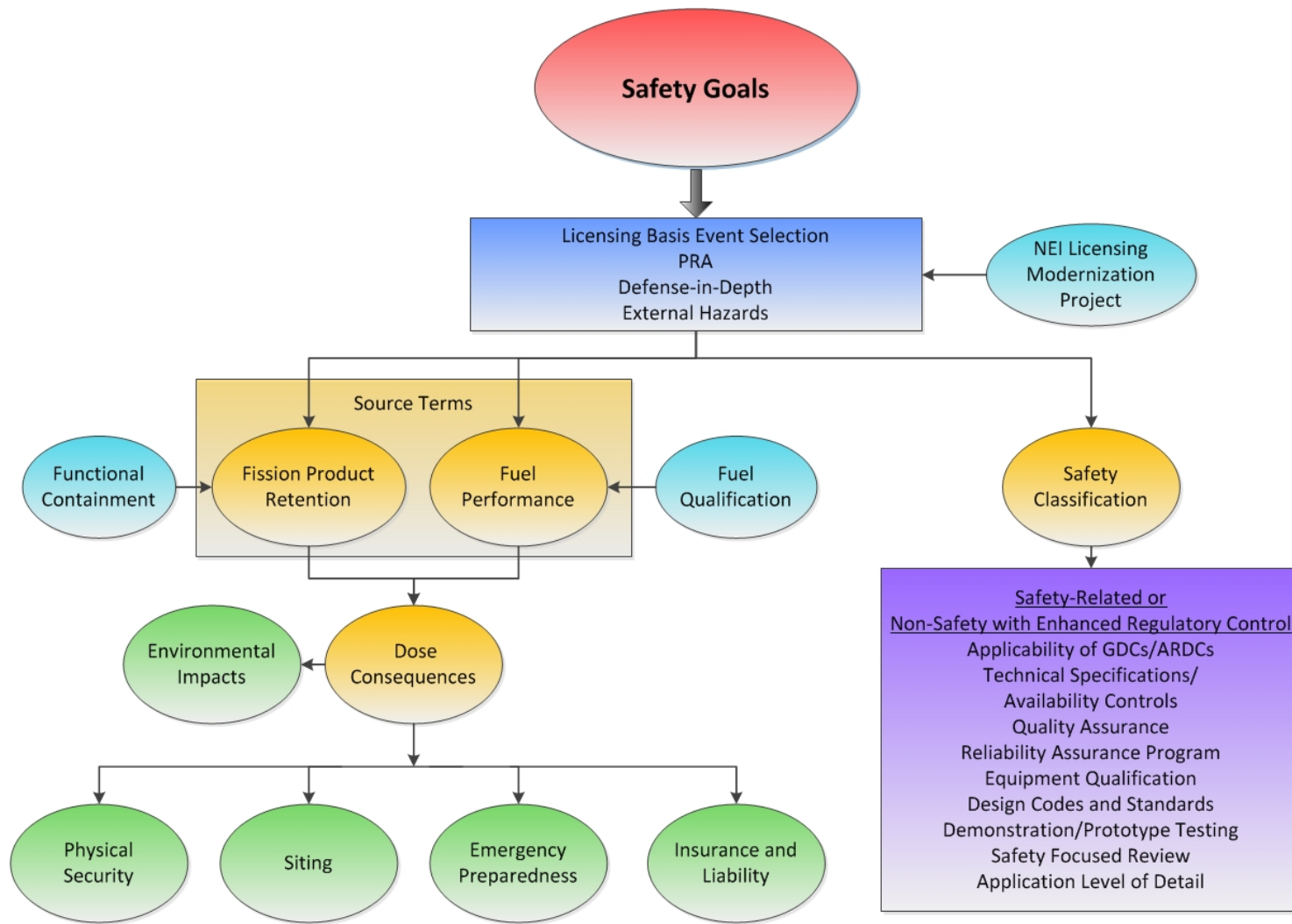
# Making the Case: Considerations for Demonstrating Safety of a Molten Salt Reactor

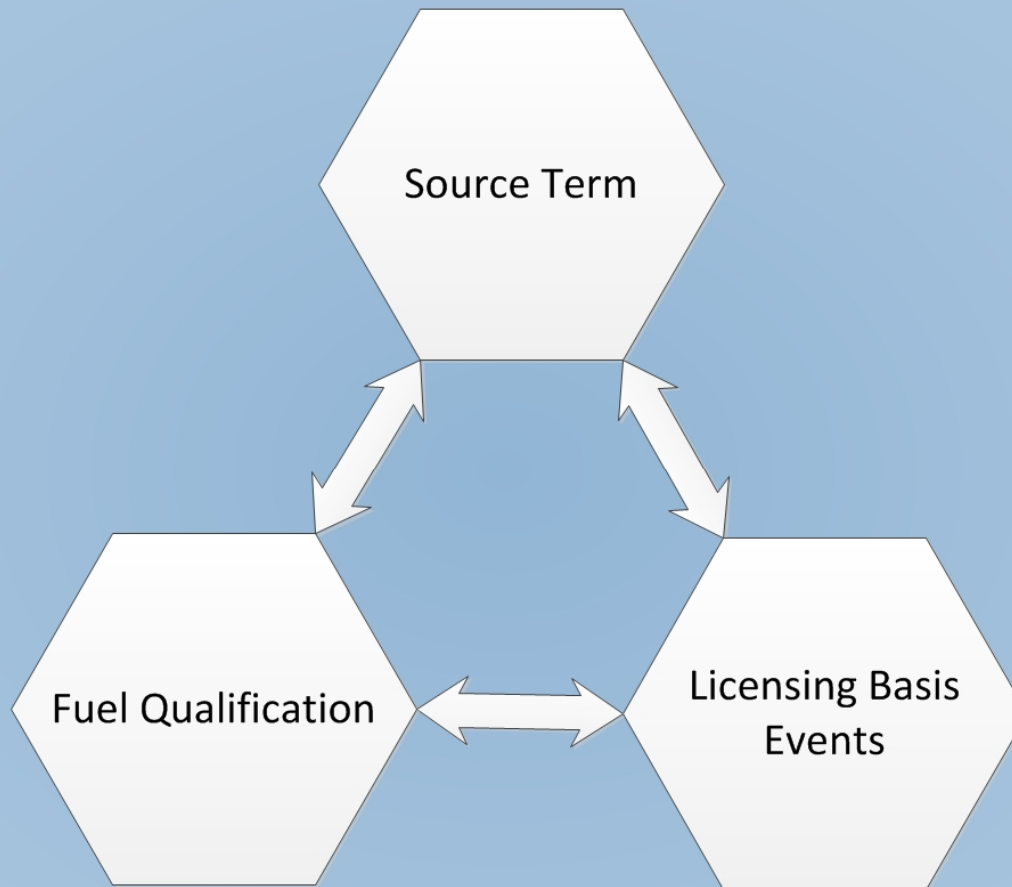
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# What is the safety case for an MSR?

- What kinds of accidents can happen?
- How often do they happen?
- What happens during an accident?
- How does fuel behave?
- Where are the fission products? How do they move around? Can they be released to the environment? What are the dose consequences?
- ***Why is that outcome acceptable?***





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# Mechanistic Source Term

- “SMR and non-LWR applicants can employ modern analysis tools to demonstrate quantitatively the safety features of those designs. MST analysis methods can also be used by applicants to demonstrate the ability of the enhanced safety features of plant designs to mitigate accident releases.”
  - SECY-16-0012, “Accident Source Terms and Siting for Small Modular Reactors and Non-Light Water Reactors,” ML15309A319

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# SECY-93-092

ML040210725

- The performance of the reactor and fuel under normal and off normal conditions is **sufficiently well understood** to permit a mechanistic analysis.
- The transport of fission products can be **adequately modeled** for all barriers and pathways to the environs, including specific consideration of containment design.
- The events considered in the analyses to develop the set of source terms for each design are selected to **bound severe accidents and design-dependent uncertainties**.

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# SECY-05-0006

ML043560093

- Scenarios are to be selected from a design-specific probabilistic risk assessment (PRA).
- Source term calculations are based on verified analytical tools.
- Source terms for compliance should be 95 percent confidence level values based on best estimate calculations.
- Source terms for emergency preparedness should be mean values based on best estimate calculations.
- Source terms for licensing decisions should reflect scenario-specific timing, form, and magnitude of the release. This approach puts the burden on the applicant to develop the technical basis. **An applicant could, however, propose to use a conservative source term.**

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# Fuel Qualification

- What is the role of the fuel in the overall safety case?
  - How is reactivity controlled?
  - How is the fuel temperature controlled?
  - What happens to fission products?
  - What other issues need to be considered?
- Designers need to define the required performance for their specific design



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# Fuel Qualification

Fuel qualification is a process which provides high confidence that physical and chemical behavior of fuel is sufficiently understood so that it can be adequately modeled for both normal and accident conditions, reflecting the role of the fuel design in the overall safety of the facility. Uncertainties are understood such that any calculated fission product releases include appropriate margin to ensure conservative calculation of radiological dose consequences.

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# Licensing Basis Event Selection

- “Licensing Modernization Project” initiative
  - technology-inclusive, risk-informed, and performance based regulatory guidance for licensing advanced non-LWRs.
  - NEI, Southern Company, et al.
- Modernization of Technical Requirements for Licensing of Advanced Non-Light Water Reactors: Selection of Licensing Basis Events Draft Report Revision 0 (ML17104A254)

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# NRC Feedback

- High level comments
  - Recharacterize frequency-consequence curve
  - Relationship between events and regulatory programs
  - Consider performance measures other than Safety Goals
  - More information on external events
  - Describe role of mechanistic source term
- Markup of LMP white paper (ML17145A574)

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# Future Work

- NEI white papers pending
  - Defense-in-depth
  - Safety system classification
  - Consolidated LMP submittal after public interaction
- Encourage participation by designers: need to know if a specific design is taking a different approach
- Part 50 issues

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# Regulatory Engagement

- “To provide for more timely and effective regulation of advanced reactors, the Commission encourages the earliest possible interaction of applicants, vendors, other government agencies, and the NRC to provide for early identification of regulatory requirements for advanced reactors and to provide all interested parties, including the public, with a timely, independent assessment of the safety and security characteristics of advanced reactor designs”

- Commission advanced reactor policy statement, 73 FR 60612