

# Applying a Graded Approach and Adapting Guidance on Site Characterization of External Hazards for Advanced Reactor and Microreactor Applications

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# What's changing in nuclear?

- Reactor design characteristics
  - Smaller footprint
  - Lower radiological risk
  - Modular designs
  - Transportable designs
  - Pre-fabricated reactor units deployed to multiple sites

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# Why a graded approach?

- Graded approach to site characterization
  - Flexible and tailored assessments that align with the unique features of emerging reactor designs
  - Focus on screening for external hazards to which the design may be sensitive and determining margin
  - Leverage readily available information
- NUREG-2213 and different levels of SSHAC study

# A Graded Approach for Microreactors

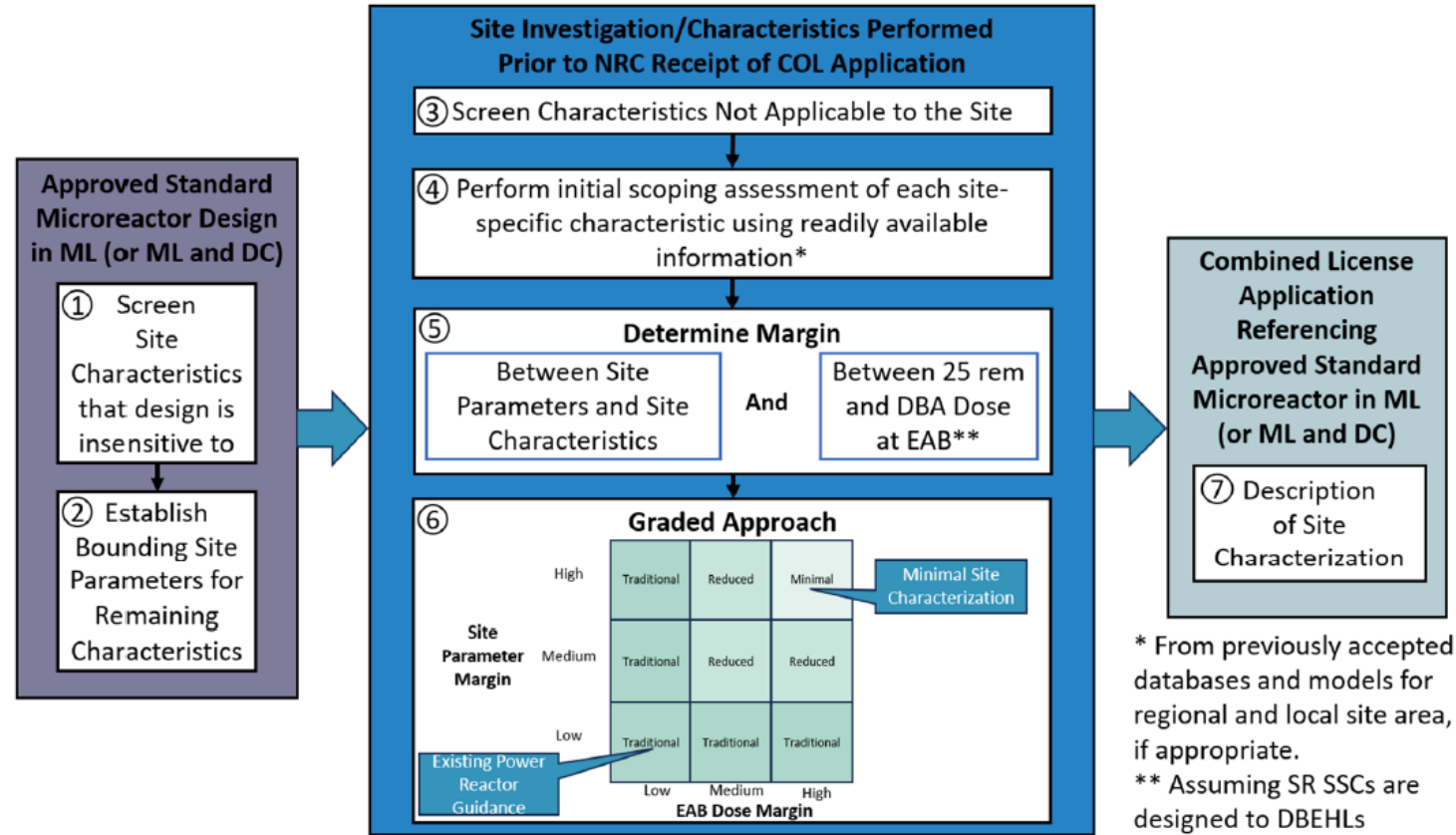


Figure 1: Conceptual Approach for Grading the Level of Site Investigation and Characterization

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# Considerations for a Graded Approach

- Hazard, site and design-specific considerations
  - Degree of grading may not apply equally to all hazards
  - Not all sites will consider the same hazards
  - Not all designs are sensitive to the same hazards
- How to leverage existing site characterization information?
- How to adapt current hazards analysis approaches within a graded approach?

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# Other Uses for a Graded Approach

- Expedited COL reviews
  - Similar to microreactor approach with approved standard design
  - Focus on hazards the design is sensitive to and that are present at the candidate site
- Brownfield site
  - Focus on applicability of existing site characterization information

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# Using Existing Site Characterization Information

- Many site may have site characterization information available from nearby facilities
  - NRC-licensed or others (i.e. brownfields or former coal sites)
- Determine which information is applicable for NRC licensing actions
  - Vintage of information
  - Methods used
  - Regulatory applicability to meet current requirements

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# Current Hazard Analysis Approaches

- Seismic Hazards
  - NUREG-2213 provides 4-level graded approach for performing SSHAC study
    - Level 3 studies developed for each operating NPP site in the U.S.
    - Level 2 Site Response Analysis study completed in 2019
    - Level 1 SSHAC Demonstration Project for site in Utah will be covered in two talks at this meeting
  - ANS 2.27, 2.29 and ASCE 43-19 provide guidance for graded approaches to seismic hazard characterization and design

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# Adapting Hazard Analysis Approaches

- Volcanic Hazards
  - RG 4.26
- Flooding Hazards for SMRs and Advanced Reactors
  - Proposed in Appendix K to DG-1290

# Regulatory Guide 4.26

- Flexible, stepwise approach with multiple off-ramps
- Leverage existing site characterization information
- Screen hazards and consider risk insights
- Evaluate SSC performance and mitigating actions in addition to or in place of detailed hazard analysis

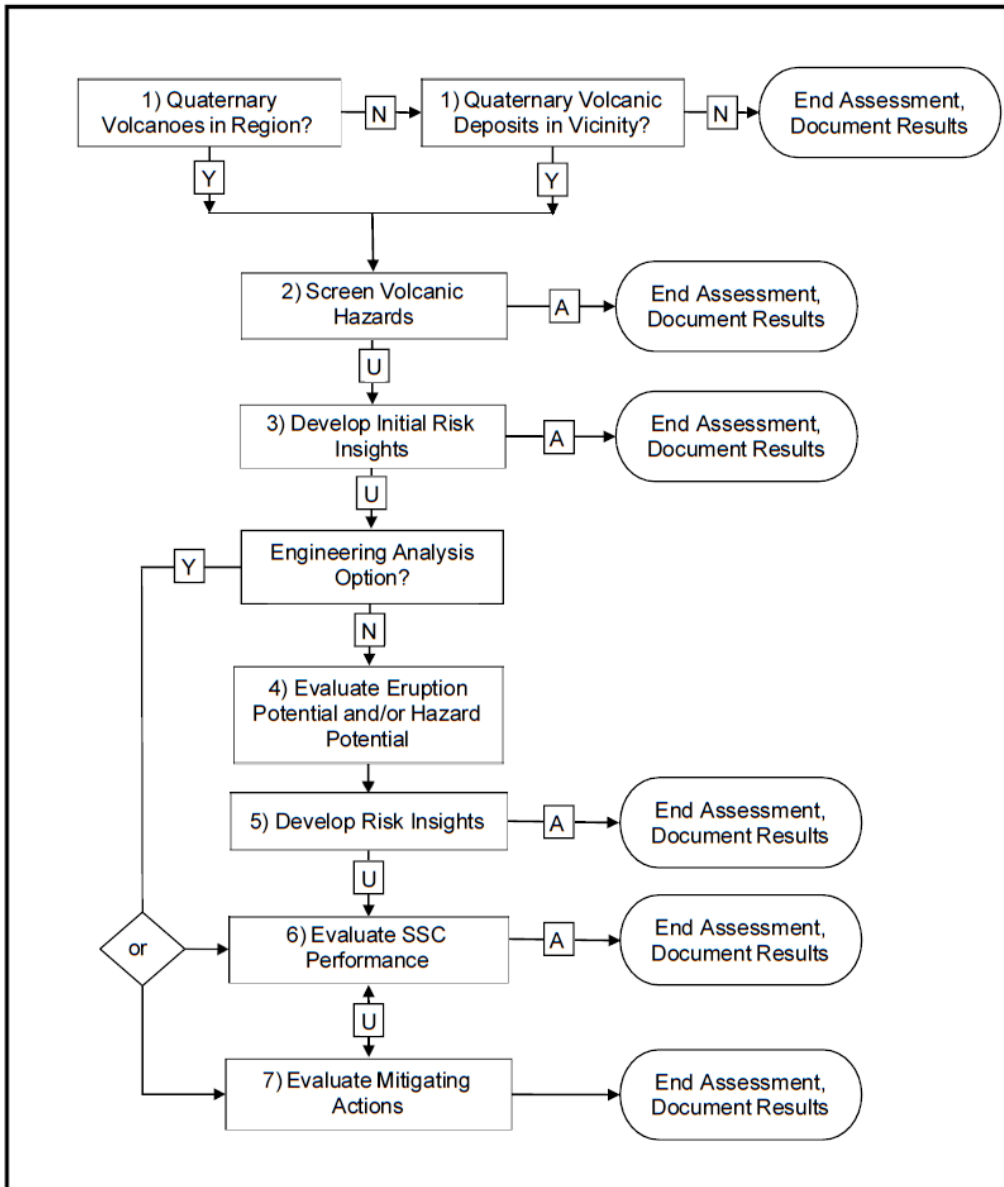


Figure 1 Flowchart for an acceptable volcanic hazards assessment

("Y" = Yes, "N" = No, "U" = Unacceptable performance, A = "Acceptable performance")

# DG-1290, Appendix K

- End the flood evaluation at the earliest possible point in the process.
- Focus on flood causing mechanisms of importance to the design
- Consider PRA or comparable analysis
- Iterate between evaluation of SSCs performance and mitigating actions and design reassessment to achieve satisfactory result.

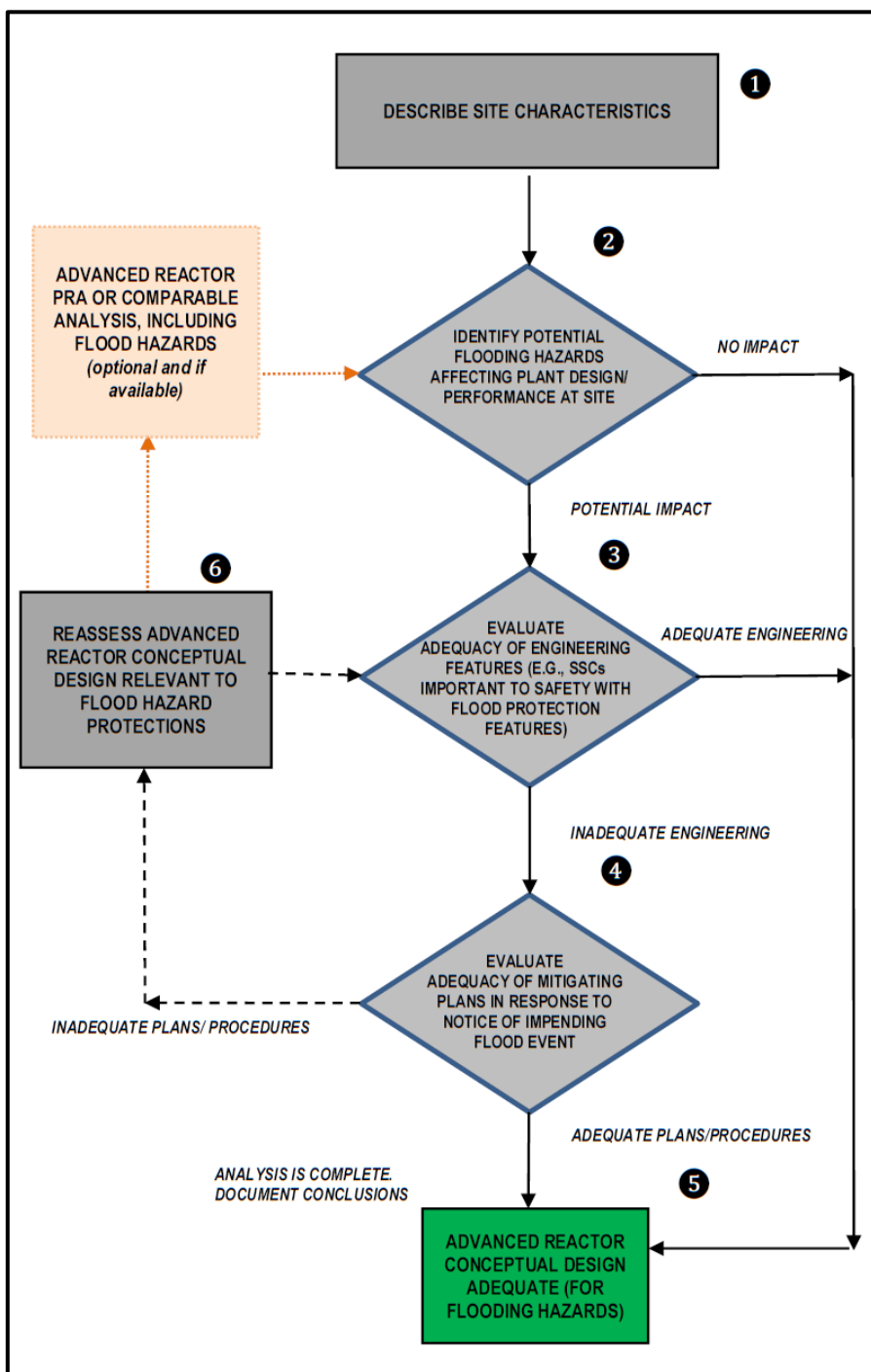


Figure K-1, DG-1290, Rev. 1

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Thank you!