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Docket: NRC-2022-0037
Design-Basis Floods for Nuclear Power Plants

Comment On: NRC-2022-0037-0001
Design-Basis Floods for Nuclear Power Plants

Document: NRC-2022-0037-DRAFT-0003
Comment on FR Doc # 2022-03791

Submitter Information

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General Comment

The attached Files Transmit the Department of Energy National Laboratory Regulatory Framework Coordination and Integration Group Responses and Comments on Draft Regulatory Guide (DG), DG–1290, ''Design Basis Floods for Nuclear Power Plants.'

Attachments

DG-1290 Comments_REV0

Denning_Comments on Proposed Revision to RG1.59 (003) (002) (003) DOE-NE Reviewed

DOE Labs RegDev Combined DG-1290 Comments Transmittal Letter CCN251384

Doc ID: DG-1290 **Revision Being Reviewed:**

Title: Plants **Person(s) Resolving Comments:**

Comment No.	Section	Reviewer	Old Text (If Applicable)
1	N/A	Cunningham	
2	N/A	Grabaskas/Cunningham	
3	N/A	Cunningham	
4		Grabaskas/Cunningham	
5	C.2, A-2, I-1.5	Grabaskas/Cunningham	
6		Cunningham	
7		Denning	

Feb-22

*Refer to Instr

Comment	Yes/No*
The draft guide states that its focus is large light water reactors and emphasizes the deterministic analysis methods that have traditionally been used. It's unclear why an update with this limited focus is necessary at this Kme. [Put another way, who is the customer of this draft?]	
While the DG highlights that both deterministic and probabilistic methods can be used, there is a focus on the application of deterministic methods. The DG has a lack of balance regarding the relative certainty of deterministic and probabilistic methods. In several places, the DG discusses the limitations and uncertainties of probabilistic methods, however, many of the underlying issues are germane to deterministic methods as well.	
In several places, the DG states a lack of widely accepted methods or standards for the performance of probabilistic flooding assessments. However, the NRC has endorsed PRA standards (in RG 1.200 and in trial-use RG 1.247) that include external flood PRA methods. The DG should note this and discuss why this acceptance is not relevant to defining design-basis floods.	
The discussion of combined events is written in deterministic terms ("to maintain a consistent level of conservatism") but implicitly acknowledges that probabilistic analyses are needed to reach an overall conclusion. For example, such analysis includes the probability of events occuring simultaneously and their associated severity.	
The DG identifies an average annual exceedance probability of 1E-6 per year as a "reasonable" criterion for selecting the design-basis flood. However, this value is in conflict with the selection of design-basis seismic motion (derived in RG 1.208) and also the selection of design-basis hazard levels (DBHLs) in the recently NRC-endorsed NEI 18-04. This revision offers an opportunity to either provide consistency in the determination of design-basis external hazards or to provide additional insight why the 1E-6 value is appropriate for flooding but not other external hazards.	
As noted in the DG, there are concerns regarding the impact of climate change on the determination of design-basis external hazards. The DG should *explicitly* state that the determination of design-basis external flood should reflect the conditions over the entire expected lifetime of the facility (or at the end of the liftetime).	
See attached (Denning_Comments on Proposed Revision to RG 1.59)	

uction, Use, Rev History tab

Resolution

Comments on DG-1290 as the Basis for Revision to Regulatory Guide 1.59

Draft Regulatory Guide (DG) 1290 represents an impressive documentation of a complex deterministic approach to assessing flooding risk at a reactor site. However, this document only reinforces the need for the treatment of flooding phenomena within a probabilistic framework. The concept of "probable maximum" has helped justify a very subjective basis for establishing nuclear power plant design bases for protection against low frequency, extreme natural phenomena hazards. We are now moving to a risk-informed regulatory basis for assuring adequate protection against accidents at new nuclear power plants. We need a probabilistic basis for assuring adequate protection against low frequency natural phenomena hazards consistent with this risk-informed approach. If DG-1290 were adopted as a revision to Regulatory Guide (RG) 1.59 at this time, it would send the wrong message to the designers of new nuclear power plants.

NUGEG/CR 7046, *Design-Basis Flood Estimation for Site Characterization at Nuclear Power Plants in the United States of America*, describes the basics of a Probabilistic Flood Hazard Assessment approach: "*The following discussion is based on a hybrid approach similar to that recommended by the National Research Council (1988) where a numerical runoff simulation model is used in conjunction with the probabilistic representation of the statistical distribution of extreme meteorological events. The PFHA consists of two discrete components: 1. probability distributions of meteorological input variables (such as precipitation, air temperature, relative humidity) of extreme events. derivation of probability distribution of flood hazards (such as discharge, flow depth and velocity, duration of inundation) using a numerical runoff simulation model or combination of models. The probabilistic approaches for estimation of extreme value distributions have been in existence for some time. Both parametric and nonparametric approaches are now sufficiently well understood that they can be applied in practice.*"

Why do we need a probabilistic approach rather than the traditional "probable maximum" approach:

1. Ultimately, what is meant by "probable maximum" is a subjective judgment of "very low probability" rather than a maximum value that for a physical phenomenon is unlikely to exist. For example, although there are arguments about limits on maximum precipitation, in practice one can always develop exceptions to the limits.

2. Extent of flooding involves a complex interplay of phenomena: intensity of rainfall, over-topping of dams, failure of dams, melting of snow, drainage, and rise in water height, which need to be compounded in assessing the probability of ingress of water into a building, immersion of vital equipment, and the failure of that vital equipment. The dependencies among the frequencies of events must be considered to realistically assess the associated risk.

3. Climatological changes will affect the risk of high consequence meteorological events. To assess the frequency of very low frequency events, it is typical risk assessment practice to look for evidence of paleo-data, such as pre-historic floods. In reality, paleo-data are representative of the climate of the era in which they occurred and may have no actual relevance to current conditions. In contrast, it is likely that over the lifetime of a new nuclear plant, e.g. 80 years, the local climate of the plant will change substantially. Although there are significant uncertainties in projecting future rainfall patterns, there are models that can be used to make those predictions based on different scenarios of greenhouse gas emissions for the locality of a plant. These impacts, including uncertainties, should be accounted for in

assessing the risk of low frequency natural phenomena events leading to the failures of vital equipment. To do that, we cannot use the compounding of "probable maxima."

In 1994, with funding from the United States (U.S.) Nuclear Regulatory Commission (NRC), the Army Corp of Engineers developed the technical basis for an improved RG 1.59 for the analysis of the adverse effects of flooding. The new approach was based on a hierarchical assessment approach (HHA) tailored for the estimation of the design basis flood hazard at a nuclear power plant site. Although the intent was to provide a deterministic approach to the development of the design basis flood, the approach describes a probabilistic approach, Probabilistic Flood Hazard Assessment (PFHA) *for potential use after an overall probabilistic framework could be adopted by the NRC*. The Army Corps of Engineers has documented the approach in Manual No. 1110-2-1417.

We do not endorse the Army Corps of Engineers approach or mean to imply that an acceptable approach to assessing the risk of low frequency natural hazards (in-particular flooding risk over the lifetime of the plant) currently exists. Nevertheless, the elements of such an approach do exist and such an approach is feasible and worthy of development. In the interim, it would be premature to issue a revision to R.G. 1.59.

April 11, 2022 CCN 251384

U. S. Nuclear Regulatory Commission
Office of Administration
Attention: Program Management, Announcements and Editing Staff
Mail Stop: TWFN 7 A60M
Washington, DC 20555-0001

SUBJECT: Department of Energy National Laboratory Regulatory Framework Coordination and Integration Group Response and Comments on Draft Regulatory Guide (DG), DG–1290, ''Design Basis Floods for Nuclear Power Plants.'

Submitted via regulations.gov

Dear Program Management, Announcements and Editing Staff:

The attached comments are provided for the Nuclear Regulatory Commission Office of Nuclear Regulatory Research Staff's consideration regarding draft regulatory guide (DG), DG–1290, ''Design Basis Floods for Nuclear Power Plants.' The comments are provided in response to Federal Register Notice #87 FR 1026, Docket number NRC-2022-0037.

The Regulatory Framework Coordination and Integration Group coordinates technical reviewers from four of the DOE National Laboratories; Idaho National Laboratory, Oak Ridge National Laboratory, Pacific Northwest National Laboratory, and Argonne National Laboratory. The attached review comments are specifically from the Idaho National Laboratory and Argonne National Laboratory team members. Overall, the team believes that the DG-1290 could be improved by incorporating more guidance on acceptable risk-informed probabilistic approaches to nuclear power plant flooding analysis. These improvements will provide for improved regulatory certainty, ultimately further supporting advanced reactor licensing while maintaining the option for deterministic approaches for use where appropriate. The comments provide technical and regulatory based topics for desired improvement and are endorsed by the DOE Office of Reactor Fleet and Advanced Reactor Deployment (NE-5).

If you have any questions or need additional Information, please contact me at (208) 390-5697.

Sincerely,

Scott E. Ferrara, Regulatory Development Engineer
Regulatory Support

Attachments

cc: (PDF)
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NRC Document Control Desk