

REGULATORY ANALYSIS

DRAFT REGULATORY GUIDE (DG)-1337 RESTART OF A NUCLEAR POWER PLANT SHUT DOWN BY A SEISMIC EVENT (Proposed Revision 1 of Regulatory Guide 1.167, issued March 1997)

1. Statement of the Problem

The NRC issued Revision 0 of RG 1.167 in March 1997. The guide describes a process, inspections and tests acceptable to the NRC staff that can be used to demonstrate that a nuclear power plant is safe for restarting after a shutdown caused by a seismic event. It also describes long term evaluations to provide evidence that the power plant will continue to perform safely if future seismic events occur.

RG 1.167 currently endorses Electric Power and Research Institute (EPRI) NP-6695 "Guidelines for Nuclear Power Plant Response to an Earthquake" (1989). In the years following the issuance of EPRI-6695, a significant amount of experience has been gained on the effects of earthquakes on nuclear power plants worldwide and the actions needed for their restart. The International Atomic Energy Agency (IAEA) documented lessons learned from all significant earthquakes affecting nuclear power plants pre-2010 in Safety Reports Series No. 66, "Earthquake Preparedness and Response for Nuclear Power Plants" (2011). The report draws upon insights from three multiunit nuclear power plants in Japan and one in Armenia that experienced beyond-design-basis earthquakes. In addition to those plants, experience has been gained with the 2011 shutdown of the North Anna nuclear power plant following the Mineral, Virginia earthquake due to ground motion exceeding the safe shutdown earthquake. Based on the lessons learned in establishing the effects of the earthquakes on the plants and the actions undertaken to restart them, a significant update of the EPRI-6695 was prepared and published in 2013 as EPRI report 3002000720, "Guidelines for Nuclear Plant Response to an Earthquake." The EPRI report serves as the technical basis for the most recent revision of the American Nuclear Society/American National Standards Institute (ANS/ANSI) standard ANS/ANSI-2.23-2016, "Nuclear Power Plant Response to an Earthquake." ANS/ANSI-2.23-2016 provides guidance that implements both observed damage level and earthquake shaking level to determine post-earthquake actions; whereas, EPRI NP-6695 considers only observed damage level to determine post-earthquake actions for an event that exceeds the operating basis earthquake ground motion (OBE). In addition, ANS/ANSI-2.23-2016 builds on EPRI NP-6695 by adding guidance on action levels that clarify what should be done, when it should be done, and by whom. It provides more comprehensive guidance than EPRI NP-6695 for short term actions to be performed by a licensee following an earthquake, and for long term post-earthquake evaluations. Because of the more comprehensive guidance and the guidance on action levels in ANS/ANSI-2.23-2016, consideration needs to be given to revising the RG 1.167 in light of an industry consensus standard that incorporates lessons learned from restarting nuclear power plants shut down by earthquakes since issuance of Revision 0 of RG 1.167 in 1997.

2. Objective

The objective of this regulatory action is to assess the need to update the NRC guidance on restart of a nuclear power plant shut down by a seismic event.

3. Alternative Approaches

The NRC staff considered the following alternative approaches for providing NRC guidance on acceptable restart criteria for nuclear power plants shut down by a seismic event:

1. Do not revise Regulatory Guide 1.167.
2. Withdraw Regulatory Guide 1.167.
3. Revise Regulatory Guide 1.167.

Alternative 1: Do Not Revise Regulatory Guide 1.167

Under this alternative, the NRC would not revise this guidance, and applicants would continue to use the present version of this regulatory guide. This is considered the “No Action” alternative. If NRC takes no action, there would be no initial cost to NRC in revising the guide. However, the “no-action” alternative would not provide an update to newer standards or include knowledge and experience gained through restart of domestic and international nuclear power plants following earthquake induced shutdowns since 1997. This may result in requests to NRC from applicants for additional information. The requests will impose a burden on the NRC staff. Applicants would be burdened by the effort required to respond to the Requests for Additional Information (RAIs).

Alternative 2: Withdraw Regulatory Guide 1.167

Withdrawing this regulatory guide would eliminate the guidance regarding restart of a nuclear power plant shut down by seismic event. Applicants would be impacted by a withdrawal by having to propose and justify criteria to establish plant readiness for restart. NRC staff would be impacted by being required to review the alternate methods and procedures. The review may result in an increase in the number of RAIs which could extend the length of the review. Applicants would be burdened by the effort required to respond to the RAIs.

Alternative 3: Revise Regulatory Guide 1.167

Under this alternative, the NRC would revise Regulatory Guide 1.167. The value to NRC staff and applicants in revising the guide would be the benefits associated with guidance based on an industry standard that incorporates lessons learned from restarting nuclear power plants shut down by earthquakes since 1997. With such guidance, lessons learned are implemented into future reviews and response by licensees. In addition, the need for RAIs is reduced. These are benefits for both NRC and licensees. The impact on the NRC would be the costs associated with preparing and issuing the regulatory guide. New applications and amendments would benefit from updated guidance by reducing the need for RAIs.

4. Comparison of Alternatives

The three alternatives were compared against each other.

Alternative 1 and 2 do not preserve lessons learned by NRC staff and licensees obtained by working through the restart of the North Anna nuclear power plant. In the case of Alternative 1 and 2 applicants may adopt procedures such as those detailed in EPRI NP-6695 or ANS/ANSI-2.23-2016 cited above. Alternative 3 would be superior to Alternative 1 and

possibly 2 in that it would update the RG to include revised standards and procedures based on lessons learned since 1997.

With regard to NRC resources, Alternative 3 represents the greatest initial cost to the NRC, which is attributable to the costs associated with preparing and issuing the regulatory guide. However, when considered over the lifetime of the RG the potential for additional staff resources needed for evaluating licensee submittals which do not meet the RG, the overall cost to NRC of Alternative 3 is expected to be less than the overall cost of Alternatives 1 or 2.

With regard to licensee resources, Alternative 3 results in the greatest savings because the post-seismic event restart of a nuclear power plant is less likely to be delayed due to resolving differences between the current expectations and the lack of, or use of outdated guidance. These additional activities would lead to increased costs due to delayed restart of the plant and additional expenditure of licensee resources required to address NRC concerns or questions.

5. Conclusion

Based on this regulatory analysis, the NRC staff concludes that revision of Regulatory Guide 1.167 is warranted. The proposed action will enhance the licensee's ability to demonstrate plant readiness for restart to NRC subsequent to a seismic event. An updated guide will reduce staff review time and the need for requests for additional information, thus reducing costs to licensees, applicants, and the NRC. The cost to NRC in revising the RG and to licensees and applicants in adopting the revised RG are deemed to be less than the benefits accrued by the other alternatives considered. Revising this regulatory guide to endorse portions of a consensus standard such as ANS/ANSI-2.23-2016 is consistent with the NRC policy of evaluating the latest versions of national consensus standards to determine their suitability for endorsement by regulatory guides. This approach also will comply with the NRC's Management Directive (MD-6.5) – "NRC Participation in the Development and Use of Consensus Standards" (ML100600460). This is in accordance with Public Law 104-113, "National Technology Transfer and Advancement Act of 1995."