

U.S. NUCLEAR REGULATORY COMMISSION

REGULATORY GUIDE 1.101, REVISION 6



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EMERGENCY RESPONSE PLANNING AND PREPAREDNESS FOR NUCLEAR POWER REACTORS

A. INTRODUCTION

Purpose

This regulatory guide (RG) describes an approach that is acceptable to the staff of the U.S. Nuclear Regulatory Commission (NRC) to meet the regulatory requirements for emergency response planning and preparedness. This revision updates the list of NRC-developed and NRC-endorsed guidance documents acceptable to meet the regulatory requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) 50.47, “Emergency Plans” (Ref. 1), and 10 CFR Part 50, Appendix E, “Emergency Planning and Preparedness for Production and Utilization Facilities” (Ref. 2).

Applicability

This RG applies to all holders of, or applicants for, a power reactor operating license or construction permit under 10 CFR Part 50, “Domestic Licensing of Production and Utilization Facilities,” except those that have certified that they have permanently ceased operations and have permanently removed all fuel from the reactor vessel, as well as all holders of, or applicants for, a power reactor early site permit or a combined license under 10 CFR Part 52, “Licenses, Certifications, and Approvals for Nuclear Power Plants” (Ref. 3). This RG is for light water reactors, including those of an advanced design (e.g., AP1000 design).

Applicable Regulations

- 10 CFR Part 50 provides regulations for licensing production and utilization facilities.

Written suggestions regarding this guide or development of new guides may be submitted through the NRC’s public Web site in the NRC Library at <https://nrcweb.nrc.gov/reading-rm/doc-collections/reg-guides/>, under Document Collections, in Regulatory Guides, at <https://nrcweb.nrc.gov/reading-rm/doc-collections/reg-guides/contactus.html>.

Electronic copies of this RG, previous versions of RGs, and other recently issued guides are also available through the NRC’s public Web site in the NRC Library at <https://nrcweb.nrc.gov/reading-rm/doc-collections/reg-guides/>, under Document Collections, in Regulatory Guides. This RG is also available through the NRC’s Agencywide Documents Access and Management System (ADAMS) at <http://www.nrc.gov/reading-rm/adams.html>, under ADAMS Accession Number (No.) ML21111A090. The regulatory analysis may be found in ADAMS under Accession No. ML21004A168. The associated draft guide DG-1357 may be found in ADAMS under Accession No. ML21007A330, and the staff responses to the public comments on DG-1357 may be found under ADAMS Accession No. ML21111A091.

- 10 CFR 50.47(a)(i) provides, in part, that “no initial operating license for a nuclear power reactor will be issued unless a finding is made by the NRC that there is reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency”
- 10 CFR 50.47(b) provides 16 standards that must be met by licensees or applicants for the NRC to make a finding of reasonable assurance
- 10 CFR 50.47(b)(4) requires that onsite and offsite emergency response plans contain a standard emergency classification and action level scheme
- 10 CFR 50.54(t)(1) requires licensees to provide for the development, revision, implementation, maintenance, and periodic independent review of its emergency preparedness program
- Appendix E to 10 CFR Part 50 establishes minimum requirements for emergency plans for use in attaining an acceptable state of emergency preparedness
- Section IV.B.1 of Appendix E provides that emergency action levels (EALs) should be established as part of the emergency plan and should be based on in-plant conditions and instrumentation in addition to onsite and offsite monitoring
- Section IV.C.1 of Appendix E requires each emergency plan to define the emergency classification levels and the corresponding extent of response participation by the emergency response organization
- Section IV.F. of Appendix E establishes the requirements for the training-related content of emergency plans

Related Guidance

This RG provides a list of guidance documents to aid in the development and review of emergency preparedness and response plans. The following documents are acceptable guidance when developing emergency preparedness and response plans:

- NUREG-0654/FEMA-REP-1, Revision 1, “Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants,” issued November 1980 (Ref. 4), which provides specific acceptance criteria for complying with the standards set forth in 10 CFR 50.47
- NUREG-0654/FEMA-REP-1, Revision 2, “Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants,” issued December 2019 (Ref. 5), which provides specific acceptance criteria for complying with the standards set forth in 10 CFR 50.47
- NUREG-0396/EPA 520/1-78-016, “Planning Basis for the Development of State and Local Government Radiological Emergency Response Plans in Support of Light Water Nuclear Power Plants,” issued December 1978 (Ref. 6)

- NUREG-0696, “Functional Criteria for Emergency Response Facilities,” issued February 1981 (Ref. 7)
- NUREG/CR-7002, “Criteria for Development of Evacuation Time Estimate Studies,” issued November 2011 (Ref. 8)
- NUREG/CR-7002, Revision 1, “Criteria for Development of Evacuation Time Estimate Studies,” issued February 2021 (Ref. 9)
- NSIR/DPR-ISG-01, “Interim Staff Guidance: Emergency Planning for Nuclear Power Plants,” issued November 2011 (Ref. 10)
- NSIR/DPR-ISG-02, “Interim Staff Guidance: Emergency Planning Exemption Request for Decommissioning Nuclear Power Reactors” issued May 11, 2015 (Ref. 11)
- RG 1.219, “Guidance on Making Changes to Emergency Plans for Nuclear Power Reactors,” issued July 2018 (Ref. 12)

Purpose of Regulatory Guides

The NRC issues RGs to describe to the public methods that are acceptable to the staff for implementing specific parts of the agency’s regulations, to explain techniques that the staff uses in evaluating specific issues or postulated events, and to describe information that the staff needs in its reviews of applications for permits and licenses. Regulatory guides are not NRC regulations and compliance with them is not required. Methods and solutions that differ from those set forth in RGs are acceptable if supported by a basis for the issuance or continuance of a permit or license by the Commission.

Paperwork Reduction Act

This RG provides voluntary guidance for implementing the mandatory information collections in 10 CFR Part 50 that are subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.). These information collections were approved by the Office of Management and Budget (OMB), approval numbers 3150-0011. Send comments regarding this information collection to the FOIA, Library, and Information Collections Branch (T6-A10M), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to Infocollects.Resource@nrc.gov, and to the OMB reviewer at: OMB Office of Information and Regulatory Affairs (3150-0011), Attn: Desk Officer for the Nuclear Regulatory Commission, 725 17th Street, NW Washington, DC 20503; e-mail: oir_submission@omb.eop.gov.

Public Protection Notification

The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless the document requesting or requiring the collection displays a currently valid OMB control number.

B. DISCUSSION

Reason for Revision

The staff is issuing Revision 6 of RG 1.101 to endorse and update guidance that is available to licensees and applicants on methods acceptable to the NRC staff for complying with the NRC's regulations for emergency response plans and preparedness at nuclear power reactors. This revision endorses Revision 0 of the Nuclear Energy Institute (NEI) white paper, "Implementing a 24-Month Frequency for Emergency Preparedness Program Reviews," issued November 2019 (Ref. 13) and Appendix A, "Recommended Drill and Exercise Objectives," to NEI 06-04, "Conducting a Hostile Action-Based Emergency Response Drill," Revision 3, issued September 2016 (Ref. 14). This revision of the RG also consolidates previously developed and endorsed guidance documents into a single revision of the RG.

Background

In November 1980, the NRC published Revision 1 to NUREG-0654/FEMA-REP-1 to provide specific acceptance criteria for complying with the standards set forth in 10 CFR 50.47. NUREG-0654/FEMA-REP-1, Revision 1, is a joint NRC NUREG-series publication and Federal Emergency Management Agency (FEMA) guidance document. The NRC uses this document to evaluate the adequacy of the emergency plans and preparedness of nuclear power plant licensees while FEMA, as well as other Federal agencies, use this document to review and approve state, local, and tribal government radiological emergency plans. In October 1981, the NRC endorsed NUREG-0654/FEMA-REP-1 in Revision 2 of this guide.

Planning standard 10 CFR 50.47(b)(4) requires that the emergency plan include a standard EAL scheme. An EAL is a predetermined, site-specific, observable threshold for a plant condition that results in an emergency classification. The NRC initially established guidance for the development of EALs in Generic Letter (GL) 79-50, "Emergency Plans Submittal Dates," issued 1979 (Ref. 15). Revision 2 of this guide endorsed subsequent guidance in Appendix 1 to NUREG-0654, which became the primary standard for the NRC's review of EAL schemes.

As the industry gained experience with the implementation and use of EAL schemes, it issued revised guidance documents on EAL scheme development to reflect lessons learned. The industry-developed guidance built upon and enhanced the foundation set forth in NUREG-0654. Revision 3 of this RG endorsed Nuclear Management and Resources Council (NUMARC)/NESP-007, Revision 2, "Methodology for Development of Emergency Action Levels," issued January 1992 (Ref. 16), and RG 1.101, Revision 4, endorsed NEI 99-01, Revision 4, "Methodology for Development of Emergency Action Levels," issued January 2003 (Ref. 17) as acceptable methods for licensees to consider in the development of their plant-specific EAL schemes.

Revision 5 of RG 1.101 issued in June 2005 provided guidance for co-located licensees on conducting emergency response planning activities and interactions in the years between participation in offsite full- or partial-participation exercises. Since the publication of Revision 5, the NRC has developed or endorsed several new or revised emergency planning guidance documents described in Section C of this RG.

In December 2019, the NRC published Revision 2 of NUREG-0654/FEMA-REP-1, which integrates nearly 35 years of lessons learned in radiological emergency preparedness and consolidates and clarifies previous guidance related to the development of emergency plans. The planning criteria and

guidance contained in Revision 2 of NUREG-0654/FEMA-REP-1 reflect changes to both NRC and FEMA regulations, guidance, policies, and doctrine, as well as advances in technology and best practices that have occurred since the document was originally issued in 1980. The NRC staff considers these criteria and guidance to be acceptable methods for complying with the onsite and offsite emergency response planning standards in 10 CFR 50.47.

Revision 2 of NUREG-0654/FEMA-REP-1 also defines the review period for emergency preparedness program reviews conducted in accordance with 10 CFR 50.54(t)(1) such that “12 months” in 10 CFR 50.54(t)(1) and “annual” in NUREG-0654/FEMA-REP-1 both mean 365 days. Thus, the program review should not exceed 365 days from the end date of the prior review to the completion of the next program review, which includes issuance of the review report. The requirement for all elements of the emergency preparedness program to be reviewed at least once every 24 months should not exceed 730 days from the end of the prior review to the completion of the next program review, which includes issuance of the review report.

Consideration of International Standards

The International Atomic Energy Agency (IAEA) works with member states and other partners to promote the safe, secure, and peaceful use of nuclear technologies. The IAEA develops Safety Standards and Safety Guides for protecting people and the environment from harmful effects of ionizing radiation. This system of safety fundamentals, safety requirements, safety guides, and other relevant reports reflects an international perspective on what constitutes a high level of safety. To inform its development of this RG, the NRC considered IAEA Safety Requirements and Safety Guides pursuant to the Commission’s International Policy Statement (Ref. 18) and Management Directive and Handbook 6.6 (Ref. 19). In development of this RG, the staff considered IAEA Safety Guide GS-R-2, “Preparedness and Response for a Nuclear or Radiological Emergency,” issued November 2015 (Ref. 20).

The NRC staff did not identify any IAEA Safety Requirements or Guides with information related to the topic of this RG.

Documents Discussed in Staff Regulatory Guidance

This RG endorses the use of one or more guidance documents developed by external organizations, and other third-party guidance documents. These codes, standards and third-party guidance documents may contain references to other codes, standards or third-party guidance documents (“secondary references”). If a secondary reference has itself been incorporated by reference into NRC regulations as a requirement, then licensees and applicants must comply with that standard as set forth in the regulation. If the secondary reference has been endorsed in a RG as an acceptable approach for meeting an NRC requirement, then the standard constitutes a method acceptable to the NRC staff for meeting that regulatory requirement as described in the specific RG. If the secondary reference has neither been incorporated by reference into NRC regulations nor endorsed in a RG, then the secondary reference is neither a legally-binding requirement nor a “generic” NRC approved acceptable approach for meeting an NRC requirement. However, licensees and applicants may consider and use the information in the secondary reference, if appropriately justified, consistent with current regulatory practice, and consistent with applicable NRC requirements.

C. STAFF REGULATORY GUIDANCE

This section includes industry-developed guidance documents that the NRC staff has previously determined to be acceptable to meet regulatory requirements for emergency response planning and preparedness for nuclear power plants and an industry-developed guidance document that the NRC is endorsing as a method that the staff also considers acceptable to meet regulatory requirements for emergency response planning and preparedness for nuclear power plants.

Previously Endorsed NEI Guidelines

1. NEI 99-01, Revision 6, “Development of Emergency Action Levels for Non-Passive Reactors,” November 2012 (Ref. 21), which is acceptable for use by licensees and applicants as a methodology to develop or upgrade EAL schemes in accordance with the requirements of 10 CFR 50.47(b)(4), related sections of Appendix E to 10 CFR Part 50, and the associated planning standard evaluation elements of NUREG-0654/FEMA-REP-1, Revision 1. The NRC endorsed this guidance in a memorandum to NEI, “U.S. Nuclear Regulatory Commission Review and Endorsement of NEI 99-01, Revision 6,” March 28, 2013. (Ref. 22)
2. NEI 99-01, Revision 5, “Methodology for Development of Emergency Action Levels,” February 2008 (Ref. 23), which is acceptable for use by licensees and applicants as a methodology to develop or upgrade EAL schemes in accordance with related sections of Appendix E to 10 CFR Part 50. In addition to clarifying certain sections of previous revisions, Revision 5 of NEI 99-01 formalizes enhancements to emergency planning associated with hostile action events for emergency preparedness programs. The NRC endorsed this guidance in a memorandum to NEI, “U.S. Nuclear Regulatory Commission Review and Endorsement of NEI 99-01, Revision 5,” February 22, 2008. (Ref. 24)
3. NEI 07-01, Revision 0, “Methodology for Development of Emergency Action Levels Advanced Passive Light Water Reactors,” July 2009 (Ref. 25), which is an acceptable reference for applicants to review in the development of new reactor applications if they are using the AP1000 or Economic Simplified Boiling Water Reactor design. Additionally, applicants may consider the template provided in NEI 07-01 as a reference for the development of an EAL scheme for any design using digital instrumentation and control, including licensed power reactors considering upgrading to digital instrumentation and control. The NRC endorsed this guidance in a memorandum to NEI, “U.S. Nuclear Regulatory Commission Review and Endorsement of NEI 07-01,” August 12, 2009. (Ref. 26)
4. NEI 10-05, Revision 0, “Assessment of On-Shift Emergency Response Organization Staffing and Capabilities,” issued June 2011 (Ref. 27), which is acceptable for use by licensees and applicants as a methodology to perform a detailed staffing analysis for on-shift personnel assigned emergency plan implementation duties as required by Section IV.A.9 of Appendix E to 10 CFR Part 50. The NRC endorsed the on-shift staffing method of NEI 10-05 in Section IV.C of the interim staff guidance (ISG), NSIR/DPR-ISG-01, “Interim Staff Guidance – Emergency Planning for Nuclear Power Plants,” November 2011.
5. Appendix A, “Recommended Drill and Exercise Objectives,” to NEI 06-04, “Conducting a Hostile Action-Based Emergency Response Drill,” Revision 2, issued July 2011 (Ref. 28), which is acceptable for use by licensees and applicants for the development and conduct of hostile action-based emergency response drills. The NRC endorsed Appendix A to NEI-06-04, Rev. 2, by letter dated September 19, 2011. (Ref. 29)

6. NEI 13-01, “Reportable Action Levels for Loss of Emergency Preparedness Capabilities,” Revision 0, issued July 2014 (Ref. 30), which is acceptable for use by licensees and applicants as a methodology that provides specific guidance for reporting the loss of emergency preparedness capabilities under 10 CFR 50.72(b)(3)(xiii). The NRC endorsed NEI 13-01 in NUREG-1022, Rev. 3, Supplement 1, “Event Report Guidelines 10 CFR 50.72(b)(3)(xiii),” September 2014. (Ref. 31)

Endorsement of NEI Guidelines

1. The NRC staff endorses Revision 0 of the NEI white paper, “Implementing A 24-Month Frequency for Emergency Preparedness Program Reviews,” which is acceptable for use by licensees and applicants as a methodology to adopt the voluntary option for conducting periodic emergency preparedness program reviews at a 24 month frequency as allowed by 10 CFR 50.54(t)(1)(ii).
2. The NRC staff endorses Appendix A, “Recommended Drill and Exercise Objectives,” to NEI 06-04, “Conducting a Hostile Action-Based Emergency Response Drill,” Rev. 3, which is acceptable for use by licensees and applicants for the development and conduct of hostile action-based emergency response drills.

D. IMPLEMENTATION

The NRC staff may use this RG as a reference in its regulatory processes, such as licensing, inspection, or enforcement. However, the NRC staff does not intend to use the guidance in this RG to support NRC staff actions in a manner that would constitute backfitting as that term is defined in 10 CFR 50.109, "Backfitting," and as described in NRC Management Directive 8.4, "Management of Backfitting, Forward Fitting, Issue Finality, and Information Requests" (Ref. 32), nor does the NRC staff intend to use the guidance to affect the issue finality of an approval under 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants." The staff also does not intend to use the guidance to support NRC staff actions in a manner that constitutes forward fitting as that term is defined and described in Management Directive 8.4. If a licensee believes that the NRC is using this RG in a manner inconsistent with the discussion in this Implementation section, then the licensee may file a backfitting, or forward fitting, appeal with the NRC in accordance with the process in Management Directive 8.4.

REFERENCES¹

1. *U.S. Code of Federal Regulations (CFR)*, “Domestic Licensing of Production and Utilization Facilities,” Part 50, Chapter I, Title 10, “Energy.”
2. CFR, “Emergency Planning and Preparedness for Production and Utilization Facilities,” Appendix E, Part 50, Chapter I, Title 10, “Energy.”
3. CFR, “Licenses, Certifications, and Approvals for Nuclear Power Plants,” Part 52, Chapter I, Title 10, “Energy.”
4. U.S. Nuclear Regulatory Commission (NRC) and Federal Emergency Management Agency (FEMA), “Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants,” NUREG-0654/FEMA-REP-1, Revision 1, November 1980.
5. NRC and FEMA, “Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants,” NUREG-0654/FEMA-REP-1, Revision 2, December 2019.
6. NRC and the U.S. Environmental Protection Agency (EPA), “Planning Basis for the Development of State and Local Government Radiological Emergency Response Plans in Support of Light Water Nuclear Power Plants,” NUREG-0396/EPA 520/1-78-016, December 1978.
7. NRC, “Functional Criteria for Emergency Response Facilities,” NUREG-0696, February 1981.
8. NRC, “Criteria for Development of Evacuation Time Estimate Studies,” NUREG/CR-7002, November 2011.
9. NRC, “Criteria for Development of Evacuation Time Estimate Studies,” NUREG/CR-7002, Revision 1, February 2021.
10. NRC, “Interim Staff Guidance: Emergency Planning for Nuclear Power Plants,” NSIR/DPR-ISG-01, November 2011.
11. NRC, “Interim Staff Guidance: Emergency Planning Exemption Requests for Decommissioning Nuclear Power Plants,” NSIR/DPR-ISG-02, May 11, 2015
12. NRC, “Guidance on Making Changes to Emergency Plans for Nuclear Power Reactors,” Regulatory Guide 1.219, July 2018.

¹ Publicly available NRC published documents are available electronically through the NRC Library on the NRC’s public Web site at <http://www.nrc.gov/reading-rm/doc-collections/> and through the NRC’s Agencywide Documents Access and Management System (ADAMS) at <http://www.nrc.gov/reading-rm/adams.html>. The documents can also be viewed online or printed for a fee in the NRC’s Public Document Room (PDR) at 11555 Rockville Pike, Rockville, MD. For problems with ADAMS, contact the PDR staff at 301-415-4737 or (800) 397-4209; fax (301) 415-3548; or e-mail pdr.resource@nrc.gov.

13. Nuclear Energy Institute (NEI), white paper, "Implementing a 24-Month Frequency for Emergency Preparedness Program Reviews," Rev. 0, November 2019.²
14. NEI, "Conducting a Hostile Action-Based Emergency Response Drill," NEI 06-04, Revision 3, Appendix A, "Recommended Drill and Exercise Objectives," September 2016.
15. NRC, "Emergency Plans Submittal Dates," Generic Letter 79-50, 1979.
16. Nuclear Management and Resources Council (NUMARC), "Methodology for Development of Emergency Action Levels," NUMARC/NESP-007, Revision 2, January 1992.
17. NEI, "Methodology for Development of Emergency Action Levels," NEI 99-01, Revision 4, January 2003.
18. NRC, "Nuclear Regulatory Commission International Policy Statement," Federal Register, Vol. 79, No. 132, July 10, 2014, pp. 39415-39418.
19. NRC, Management Directive 6.6, "Regulatory Guides".
20. International Atomic Energy Agency (IAEA), "Preparedness and Response for a Nuclear or Radiological Emergency," IAEA Safety Guide GS-R-2, Vienna, Austria, November 2015.³
21. NEI, "Development of Emergency Action Levels for Non-Passive Reactors," NEI 99-01, Revision 6, November 2012.
22. NRC, memorandum to the NEI, "U.S. Nuclear Regulatory Commission Review and Endorsement of NEI 99-01, Revision 6," March 28, 2013 (ADAMS Accession No. ML12346A463).
23. NEI, "Methodology for Development of Emergency Action Levels," NEI 99-01, Revision 5, February 2008.
24. NRC, memorandum to the NEI, "U.S. Nuclear Regulatory Commission Review and Endorsement of NEI 99-01, Revision 5," February 22, 2008. (ADAMS Accession No. ML080430535).
25. NEI, "Methodology for Development of Emergency Action Levels Advanced Passive Light Water Reactors," NEI 07-01, Revision 0, July 2009.
26. NRC, memorandum to the NEI, "U.S. Nuclear Regulatory Commission Review and Endorsement of NEI 07-01," August 12, 2009. (ADAMS Accession No. ML092190035).

2 Publications from the NEI are available at its Web site <http://www.nei.org> or by contacting the headquarters at Nuclear Energy Institute, 1201 F Street, NW, Suite 1100, Washington DC 20004-1218; by phone at 202-739-8000, or by fax at 202-785-4019.

3 IAEA Safety Requirements and Guides may be found at www.iaea.org/ or by writing the International Atomic Energy Agency, P.O. Box 100 Wagramer Strasse 5, A-1400 Vienna, Austria; telephone (+431) 2600-0; fax (+431) 2600-7; or e-mail Official.Mail@IAEA.Org. It should be noted that some of the international recommendations do not correspond to the requirements specified in the NRC's regulations, and the NRC's requirements take precedence over the international guidance.

27. NEI, "Assessment of On-Shift Emergency Response Organization Staffing and Capabilities," NEI 10-05, Revision 0, June 2011.
28. NEI, "Conducting a Hostile Action-Based Emergency Response Drill," NEI 06-04, Revision 2, Appendix A, "Recommended Drill and Exercise Objectives," July 2011.
29. NRC, Letter to NEI, "NRC Endorsement of Revised NEI 06-04 Rev. 2, Conducting a Hostile Action-Based Emergency Response Drill" Appendix A, Exercise Objectives," September 19, 2011 (ADAMS Accession No. ML112570092).
30. NEI, "Reportable Action Levels for Loss of Emergency Preparedness Capabilities," NEI 13-01, Revision 0, July 2014.
31. NRC, "Event Report Guidelines 10 CFR 50.72(b)(3)(xiii) NUREG-1022, Revision 4, Supplement 1-Final Report," September 2014.
32. NRC, Management Directive 8.4, "Management of Backfitting, Forward Fitting, Issue Finality, and Information Requests."