INTERNATIONAL NUCLEAR SAFETY JOURNAL

ISSN 2285 – 8717
ISSN–L 2248 – 8717
http://www.insj.info

vol. 4 issue 3, 2015, pages 1 - 12

# Regulation of Emergency Operating Procedures and Severe Accident Management Guidelines – Past Experience and Further Work

**Cantemir CIUREA[1], Madalina TRONEA[1]**
[1]*National Commission for Nuclear Activities Control, Bucharest, Romania*
*Corresponding author: madalina.tronea@cncan.ro*

================================================================================

***Abstract***
The paper presents a review of the status of regulatory requirements on emergency operating procedures (EOPs) and severe accident management guidelines (SAMGs) in various countries, together with lessons learned from past inspection and review activities conducted by regulatory authorities in this area, as well as lessons learned from the Fukushima Daiichi accident with regard to SAMGs. An overview of the content and structure of the new regulation issued in Romania in 2014 to address in an integrated manner the preparedness of the response to transients, accidents and emergency situations for nuclear power plants is also presented. While mandatory requirements exist or are under development in most countries operating nuclear power plants, there is still a significant amount of work to be done for implementing comprehensive nuclear regulatory oversight of EOPs and SAMGs, including technical reviews and inspections to make sure that all the requirements are met and that all the relevant lessons learned from major accidents have been adequately used.

***Keywords***
*nuclear safety, emergency operating procedures, severe accident management, nuclear regulations*
================================================================================

## 1.0 Introduction

The emergency operating procedures (EOPs) and severe accident management guidelines (SAMGs) have been given increased regulatory attention first time after the accident at the Three Mile Island Unit 2 (March 28, 1979), and more recently after the accident at Fukushima Daiichi (March 11, 2011).

The safety reassessments conducted in Romania in response to the Fukushima accident included actions taken voluntarily by the operator based on the recommendations in SOER 2011-2 (Significant Operating Experience Report) issued by WANO (World Association of Nuclear Operators) - SOER 2011-2 "Fukushima Daiichi Nuclear Station Fuel Damage Caused by Earthquake and Tsunami", as well as actions devised by the National Commission for Nuclear Activities Control (CNCAN), based on the specifications for the "stress tests" required for all the nuclear power plants in the European Union [1]. A reassessment of the accident management program was undertaken in this context, including a review of the arrangements for severe accident management and on-site emergency preparedness and response. The resulting action plan [2] included specific actions for the provision of regulatory requirements on EOPs and SAMGs. [3]

In order to establish regulatory requirements on EOPs and SAMGs [4], CNCAN has taken account of the experience in other countries, particularly that of the USA and of Canada, as well as of the current international safety standards [5, 6] and the revision of the reactor safety reference levels issued by WENRA (Western European Nuclear Regulators' Association) [7, 8].

## 2.0 Review of international experience in the regulation of EOPs and SAMGs

The most extensive account of regulatory experience in establishing guidelines and requirements on EOPs and SAMGs and in reviewing and inspecting their implementation comes from the U.S. Nuclear Regulatory Commission (US NRC).

After the 1979 accident at Three Mile Island Unit 2, the US NRC issued orders requiring licensees to develop procedures for coping with certain plant transients and postulated accidents [9]. US NRC also provided guidance on responding to anticipated operational occurrences and accidents [10, 11, 12].

The results of the regulatory review of EOPs performed by US NRC, in particular with regard to the deficiencies identified, are summarized in an information notice [13] and dedicated NUREG documents outlining lessons learned from inspections performed in the period 1988 - 1991 [14, 15]. Common problems of a programmatic nature were noted in relation to the EOP development, implementation, maintenance and training. Some examples taken from reference [14] are presented below:

- incomplete justification of departures from the generic technical guidelines;
- inconsistent use and control of the technical bases documents supporting the EOPs;
- instrumentation and equipment referred to in EOPs that was not capable of providing the intended function or that was inaccessible;
- procedure writer's guides not used for the development of EOPs;
- human factors principles not consistently applied in the procedure writer's guides, human factors skills not used in the development of the EOPs;
- potentially misleading wording, sequence or organization of EOPs, e.g. cautions found following instead of preceding the related action, action statements embedded in notes and cautions, logic statements poorly worded or having more than one possible meaning; excessive transitions or incorrect transitions between EOPs or parts of EOPs;
- readability standards for EOPs not addressed in procedure writer's guides, poor reproduction quality of printed EOPs;
- EOPs developed without a multi-disciplinary team approach, e.g. in some cases without plant engineering involvement;
- poor staffing of the EOP program, e.g. in some cases the staff assigned to manage the development and maintenance of EOPs consisted of one individual, sometimes with concurrent duties;
- lack of operators' involvement in the review of EOP revisions, or feedback from operators not used to correct and improve EOPs, resulting in poor operator understanding and acceptance of EOPs;
- outdated EOPs making reference to instruments, equipment and procedures that were no longer in use at the plant;
- verification and validation of EOP actions that were required to be performed outside of the control room were seldom conducted;

- tools required for local actions were not placed at the location where required for EOP-related use, or inaccessible or had not been adequately tested;
- in some cases the staffing needed for executing the EOP exceeded the technical specifications for minimum control room staffing, although this should have been revealed by a thorough validation of the EOPs.

Taking account of the experience with the regulatory review and inspection of licensees' EOPs, the US NRC issued a dedicated inspection procedure, IP 42001, issued in 1991 [16] and review guidance in NUREG-0800, Section 13.5.2.1 (issued for the first time in 1996) [17].

As regards the development and implementation of SAMGs, although not required under the US emergency preparedness regulations, these were developed by the nuclear industry on a voluntary basis, in response to the lessons learned from the TMI-2 accident. In Generic Letter 1988-20, "Accident Management Strategies for Consideration in the Individual Plant Examination Process" Supplement 2, issued in 1990 [18], the NRC encouraged, but did not require, licenses to develop and implement SAMGs.

Based on the lessons learned from the Fukushima Daiichi accident and on the results of the recent regulatory review and inspections performed to assess the availability and readiness of SAMGs based on a dedicated inspection procedure - Temporary Instruction 2515/184 [19, 20], Recommendation 8 from the NRC's Near Term Task Force (NTTF) Report [21] addresses the integration of EOPs and SAMGs, along with the extensive damage mitigation guidelines (EDMGs) implemented following the terrorist events of September 11, 2001.

Examples of problems encountered with the availability and readiness of SAMGs, based on reference [20], include:

- SAMGs not available in some cases at the required locations, or not properly controlled;
- while SAMGs appear to be updated to reflect design changes at a facility, there does not appear to be a consistent approach to conducting periodic reviews;
- personnel do appear to be properly trained and knowledgeable on SAMGs, exercises on SAMGs do not appear to be periodically conducted at all sites.

The Task Force recommended that the NRC orders the licensees to modify the EOP technical guidelines to include EOPs, SAMGs, and EDMGs in an integrated manner, specify clear command and control strategies for their implementation and stipulate appropriate qualification and training for those who make decisions during emergencies. The NRC staff has drafted a regulatory basis that recommends developing a proposed rule for the above mention purposes.

In May 2015, the NRC released a proposed rule for the Mitigation of Beyond-Design-Basis Events [22]. The proposed rulemaking would:

"1) *make generically-applicable requirements previously imposed by order for mitigation of beyond-design-basis external events and for monitoring spent fuel pool wide-range level*;

2) *include proposed provisions to have an integrated response capability*;

3) *include proposed requirements for increased emergency response capabilities for multi-unit events*;

4) *provide requirements for new reactor designs; and*

5) *address a number of petitions for rulemaking (PRMs) submitted in the aftermath of the March 2011 Fukushima Daiichi event*." [22].

The integrated response capability refers to strategies and guidelines for beyond-design-basis external events, the loss of large areas of the plant due to explosions and fires, and severe accidents.

The proposed rule would impose mandatory requirements on SAMGs and on their integration with the EOPs. The background notes for the proposed rule mention that the NRC staff does not intend to conduct a technical review of the plant owners groups' current guidelines for SAMGs, taking into account that the NRC performed such an assessment in the 1990s when the industry initially implemented the SAMGs and the updated guidelines for SAMGs reflect the revised Severe Accident Management Guidance Technical Report developed by the Electric Power Research Institute (EPRI) in 2012 [23] to incorporate lessons learned from the Fukushima Daiichi accident and include experience gained since the 1990s. [22]. The NRC staff will conduct inspections to verify that the licensees have updated their site-specific SAMGs, have included the SAMGs within the plant configuration management systems and have integrated the SAMGs with the other procedures and measures for responding to beyond-design-basis events.[22]

As regards the experience with SAMGs in Canada, based on the information provided in the Canadian Report under the Convention on Nuclear Safety [24], after the Fukushima Daiichi accident, all the nuclear power plant (NPP) licensees enhanced training programs to clarify roles and test SAMG effectiveness and also conducted validation drills. SAMGs are being incorporated into existing emergency plans. The actions identified for follow-up include the extension of the scope of SAMGs to include multi-unit and irradiated fuel bay events and validation and / or refinement of SAMGs to address lessons learned from Fukushima.

The Canadian Nuclear Safety Commission (CNSC) regulatory document on "Severe Accident Management Programs for Nuclear Reactors" (G-306) from 2006 [25] has been revised to take account of lessons learned from the Fukushima accident and has been re-issued as REGDOC-2.3.2 "Accident Management: Severe Accident Management Programs for Nuclear Reactors", published in September 2013. [26]

Most European countries operating nuclear power plants have regulatory requirements or guidance on EOPs and SAMGs, covering the relevant reference levels issued by WENRA [7, 8]. However, the ENSREG Peer Review Report on the Stress Tests Performed on European NPPs [27] pointed out that: "*The status of the legislative basis for accident management (AM) varies across the participating countries: some have relevant national guidelines or legislation already in place since the 1980s or 1990s while others are at different stages of preparation for new legislation. In several countries, licensing requirements are based on the regulations of the country of the reactor vendor. All the countries participating in this review, however, recognise the usefulness of the WENRA RLs applicable to AM for setting legal requirements (these are mainly in areas: F (design extension of existing reactors), LM (emergency operating procedures and severe accident management guidelines) and R (on-site emergency preparedness). Nevertheless, there are considerable differences, country to* *country, in how the RLs are incorporated into legislation. Some countries have developed specific regulations to address the RLs. In other countries the RLs are included as conditions within the operator's licence or operating permit. Elsewhere, the RLs are incorporated into the general national legal framework. All national legal frameworks provide for regulatory oversight of AM, including provision for regulatory assessment and inspections of this topic*."

Following the coming into force of the Council Directive 2014/87/Euratom of 8 July 2014 amending Directive 2009/71/Euratom establishing a Community framework for the nuclear safety of nuclear installations [28], all EU countries having nuclear installations or planning to construct and operate nuclear installations have to include, in their national regulatory frameworks, requirements on the development and implementation of SAMGs.

### 3.0 Lessons learned from the Fukushima Daiichi accident

With regard to the insights from the Fukushima Daiichi accident, we note the following:

- Severe accident management measures were not subject to regulation in Japan. The Japanese utilities voluntarily implemented SAMGs in the early 1990's. [29, 30]
- The National Diet of Japan independent investigation commission (NAIIC) report [30] revealed that the severe accident management measures in place at Fukushima were "*practically ineffective*"; these measures addressed only severe accidents initiated by internal events and disregarded the possibility that a severe accident is initiated by an external event such as an earthquake or a tsunami, even if such events were frequent in Japan; the investigation commission concluded that "*there were organizational problems within TEPCO. Had there been a higher level of knowledge, training, and equipment inspection related to severe accidents, and had there been specific instructions given to the on-site workers concerning the state of emergency within the necessary time frame, a more effective accident response would have been possible*."[30]
- TEPCO's manual for emergency response to a severe accident assumed that reactor readings could be monitored, but failed to account for a prolonged station blackout like the one that occurred at Fukushima, which prevented any monitoring. [30]
- The severe accident management equipment was not specifically qualified for the conditions in which it was expected to be used; because it was not subject to regulatory control, the standards used for such equipment were lesser than those used for safety-related SSCEs (systems, structures, components and equipment) expected to function under design basis conditions.[30]
- The SAMGs did not consider the possible state of the plant and the local environmental conditions such as the high radiation dose rates that may preclude manual actions from being taken [31]; additional challenges occurred because of a lack of contingency procedures for operating the containment venting system without power, as well as the lack of prestaged equipment, such as an engine-driven air compressor. [32]
- "*Response manuals with detailed anti-severe accident measures were not up to date, and the diagrams and documents outlining the venting procedures were incomplete or missing*" [30]; implementing-level procedures did not exist to address how to accomplish accident management strategies and actions. [33]
- Preparations to respond to simultaneous occurrence of severe accidents at multiple units proved to be insufficient; "*the corporate and station structure and staffing were*

*not designed to support the number of units that may be affected by a common-cause event*." [33]

- "*The severe accident management approach assigned most decision-making responsibilities to the control room crew based on the assumption that crewmembers could make the decisions necessary to implement emergency and accident management procedures. This decision-making approach did not provide for independent challenge or second checks by other groups within the organization.[...] Control room crews did not include an individual dedicated to maintaining an independent view of critical safety functions and advising control room management on courses of action to ensure core cooling, inventory control, and containment pressure control were maintained and optimized*." [33]
- The level of detail in system training materials did not support the depth of knowledge needed to understand the operation of certain systems (e.g. isolation condenser) important for accident management. Training of the reactor operators on full-scope simulators having significant differences from their actual units may have contributed to this lack of detailed understanding. [33]
- "*Accident management training was conducted through computer-based learning. Although the training material was sufficiently broad in scope, it lacked the depth and level of detail needed to create a questioning attitude for critical parameter assessment, including recognition of instrumentation limitations in accident environments. [...] Reliance on the computer-based training setting and on infrequent refresher training (every three years) creates vulnerabilities in knowledge retention and depth of understanding*." [33]
- In the 1980s and afterward, Japanese utilities and vendors made decisions to deviate from accident management strategies developed by the U.S. BWR Owners Group.[33]

The lessons learned from the Fukushima Daiichi accident with regard to SAMGs development, training and implementation include the following:

- "*Accident management provisions need to be comprehensive, well designed and up to date. They need to be derived on the basis of a comprehensive set of initiating events and plant conditions and also need to provide for accidents that affect several units at a multi-unit plant*." [29]
- "*Training, exercises and drills need to include postulated severe accident conditions to ensure that operators are as well prepared as possible. They need to include the simulated use of actual equipment that would be deployed in the management of a severe accident*." [29]
- "*For severe situations, such as total loss of off-site power or loss of all heat sinks or the engineering safety systems, simple alternative sources for these functions including any necessary equipment (such as mobile power, compressed air and water supplies) should be provided for severe accident management. Such provisions [...] should be located at a safe place and the plant operators should be trained to use them. This may involve centralized stores and means to rapidly transfer them to the affected site(s)*." [31]
- "*Severe Accident Management Guidelines and associated procedures should take account of the potential unavailability of instruments, lighting, power and abnormal conditions including plant state and high radiation fields*." [31]

- "*Emergency Response Centres should have available as far as practicable essential safety related parameters based on hardened instrumentation and lines such as coolant levels, containment status, pressure, etc., and have sufficient secure communication lines to control rooms and other places on-site and off-site*." [31]
- "*Emergency and accident procedures should provide guidance to vent containment to maintain integrity, purge hydrogen, and support injection with low-pressure systems. Procedures should also provide guidance for performing venting under conditions such as loss of power and high radiation levels and high temperatures in areas where vent valves are located*." [33]
- "*Optimum accident management strategies and associated implementing procedures (such as emergency operating procedures and accident management guidelines) should be developed through communications, engagement, and exchange of information among nuclear power plant operating organizations and reactor vendors. Decisions to deviate from these strategies and procedures should be made only after rigorous technical and independent safety reviews that consider the basis of the original standard and the potential unintended consequences*." [33]
- "*Clearly define and communicate the roles and responsibilities of emergency response personnel to help ensure effective post-accident communications and decision-making.*" [33]
- "*Conditions during and following a natural disaster or an internal plant event may significantly impede and delay the ability of plant operators and others to respond and take needed actions. The potential for such delays should be considered when procedures and plans for time-sensitive operator actions are being established*." [33]
- "*On-shift personnel and on- and off-site emergency responders need to have in-depth accident management knowledge and skills to respond to severe accidents effectively. Training materials should be developed and training should be implemented using the systematic approach to training*." [3]
- "*Actively participate and make best use of operating experience information shared in international organizations and forums*." [33]
- "*Robust training programmes are needed for every organization involved in the management of a severe accident, including nuclear power plant operating organizations, regulators, decision makers and off-site emergency responders. These training programmes need to take a practical, learning by-doing approach, using realistic training aids, and to allow for an evaluation of their effectiveness*." [34]
- "*There is a need for regulatory oversight of activities related to severe accident management. Regulatory bodies need to strengthen their inspection and oversight of licensees' severe accident management programmes and severe accident mitigation measures*." [34]
- "*For the purposes of severe accident management, the requirements for instrumentation and control systems need to take into account: - The number of plant parameters to be monitored by the instrumentation; - The environmental qualification requirements that best apply to this instrumentation to ensure that necessary and reliable information is available to the operators*." [34]
- "*The interface between SAMGs and the on-site emergency response arrangements needs to be strengthened to provide for continuous and well integrated coordination of reactor operation and emergency response. This needs to include consideration of a*

*single and integrated command and control system capable of making decisions regarding on-site operations during a severe accident without the need for off-site approvals*.” [34]

**4.0 Regulatory requirements on EOPs and SAMGs in Romania**

Work on the development of specific regulatory requirements on EOPs and SAMGs in Romania started in 2012. The regulation "Nuclear safety requirements on the response to transients, accidents and emergency situations at nuclear power plants" was officially issued in January 2014 [4] and provides requirements on:

- objectives, principles and factors to be taken into account for the response to transients, accidents and emergency situations on-site;
- transient and accident scenarios to be addressed in / covered by the EOPs;
- severe accident scenarios to be covered by the SAMGs;
- emergency situations to be covered by the on-site emergency response plan and emergency response procedures;
- establishment of the minimum number of staff with necessary qualifications to manage all scenarios required by the regulation (including combinations of events and scenarios in which multiple units on site are affected by accidents initiated by extreme external events beyond the design basis of the plants);
- facilities and equipment to be available for accident management and on-site emergency response, including in situations caused by extreme external events;
- development and validation of procedures; documentation of the technical basis for the procedures;
- configuration management in relation to the procedures and systems credited for accident management and emergency response;
- training programmes and exercises;
- use of operational experience for the improvement of accident management and emergency response.

The structure of the regulation is provided below:

- Chapter I – Scope and definitions
- Chapter II – Objectives and general principles
- Chapter III – Preparedness of the response to anticipated transients and design basis accidents
- Chapter IV – Preparedness of the response to severe accidents
- Chapter V – Preparedness of the response to emergency situations
- Chapter VI – Organization of the response to transients, accidents and emergency situations and training of the personnel
- Chapter VII – Facilities, equipment and resources for implementing the response to transients, accidents and emergency situations
- Chapter VIII – Requirements on documentation and records

- Chapter IX – Periodic review and continuous improvement of the preparedness of the response to transients, accidents and emergency situations
- Chapter X – Transitory and final provisions
- Annex 1 – Definitions
- Annex 2 – Reference documents

Since accident management and on-site emergency response are intrinsically coupled, it was decided that both should be addressed in the same regulation. It is expected that this approach would contribute to a better correlation between activities pertaining to the development of EOPs, SAMGs and emergency response procedures and plans as well as to the effectiveness of regulatory review and inspection activities.

The regulatory reviews and inspections for assessing compliance with the new regulation include review of procedures, inspection of control rooms, secondary control areas and emergency control centre, participation full-scope simulator exams and to emergency response exercises, review of records from past exercises and monitoring of the implementation of the post-Fukushima action plan.

All the relevant lessons learned from the Fukushima accident have been taken into account in the development of the regulation. However, it will be revised and improved for better alignment with the latest updates to the WENRA safety reference levels.

## 5.0 Conclusions and further work

Following the accident at Fukushima Daiichi, significant regulatory resources have been devoted worldwide to the review and inspection of the adequacy of licensees' implementation of EOPs and SAMGs and of their integration within the on-site emergency response. Particular areas of interest are related to the feasibility of operators' action under accident conditions such as those generated by extreme external events, sufficiency of staff for the response to events affecting multiple nuclear installations on a site, as well as validation of SAMGs and the related training of operating staff and technical support group.

Issues identified in the past as deficiencies in the licensees' programs for developing and maintaining EOPs and SAMGs may still be of concern. Comprehensive regulatory requirements and review, inspection and enforcement actions should be ensure that the occurrence of such problems is minimized. References 16, 19 and 35 - 37 may prove particularly useful in the establishment of regulatory review and inspection procedures in this area.

Given the fact that mandatory regulatory requirements on EOPs and SAMGs are or will soon be in force in all countries operating nuclear power plants, the regulatory authorities will have to devote more resources to the review and inspection activities necessary for verifying compliance with the new regulations.

Taking account of the experience accumulated up to date, some common approach and / or recommendations should be developed at international level on related issues, such as:

- the scope and depth of regulatory review of EOPs and SAMGs and of their integration with the emergency response plans and procedures;
- the regulatory resources dedicated to reviews and inspections on EOPs and SAMGs, including the required technical competences;

- the regulatory expectations with regard to the validation of EOPs and SAMGs and the need for revalidation after significant plant upgrades and / or on the occasion of periodic safety reviews;
- the particular aspects and challenges related to the validation of SAMGs;
- the reviews and inspections for verifying the feasibility of operators' actions under accident conditions such as those generated by extreme external events and the sufficiency of staff for the response to events affecting multiple nuclear installations on a site;
- the use of "realistic" or conservative assumptions in the technical bases for EOPs and SAMGs, taking account of the inherent uncertainties;
- expectations for the training of operating staff and technical support group in EOPs, SAMGs and transition from EOPs to SAMGs, including the scope and frequency of such training;
- the establishment of operational limits and conditions / technical specifications for equipment credited to support severe accident management and emergency response (e.g. with testing intervals, inspection requirements, administrative controls, etc.);
- the safety classification of SSCEs credited to support severe accident management;
- the assessment of the adequacy of instrumentation and control systems and components credited to support severe accident management.

## 6.0 References


1. ENSREG, EU "Stress Test" Specifications, Annex I to the Declaration of ENSREG, May 13, 2011, http://www.ensreg.eu/sites/default/files/EU%20Stress%20tests%20specifications_1.pdf
2. CNCAN, Romanian National Action Plan post-Fukushima, December 28, 2012, http://www.cncan.ro/assets/stiri/Romanian-National-Action-Plan-post-Fukushima-rev.0-December2012.pdf
3. C. Ciurea, Regulatory Actions post - Fukushima, paper presented at Nuclear 2013, May 2013, http://www.nuclear.ro/conference/nuclear%202013/book%20of%20abstracts.pdf
4. CNCAN, Nuclear safety requirements on the response to transients, accidents and emergency situations at nuclear power plants, January, 2014, available only in Romanian (Norme de securitate nucleară privind pregătirea răspunsului la tranzienţi, accidente şi situaţii de urgenţă la centralele nuclearoelectrice), http://www.cncan.ro/assets/NSN/Ordin-CNCAN-32014.pdf
5. IAEA, Severe Accident Management Programmes for Nuclear Power Plants, Safety Guide, IAEA Safety Standards Series No. NS-G-2.15, Vienna, 2009, http://www-pub.iaea.org/MTCD/publications/PDF/Pub1376_web.pdf
6. IAEA, Safety of Nuclear Power Plants: Commissioning and Operation: Specific Safety Requirements, IAEA Safety Standards Series No. SSR-2/2, Vienna, 2011, http://www-pub.iaea.org/MTCD/publications/PDF/Pub1513_web.pdf
7. Western European Nuclear Regulators' Association (WENRA) Reactor Harmonization Working Group (RHWG), Reactor Safety Reference Levels, January 2008, http://www.wenra.org/media/filer_public/2012/11/05/list_of_reference_levels_january_2008.pdf
8. Western European Nuclear Regulators' Association (WENRA) Reactor Harmonization Working Group (RHWG), Reactor Safety Reference Levels, November 2013 update in

relation to lessons learned from Tepco Fukushima Dai-ichi accident, http://www.wenra.org/media/filer_public/2013/11/21/updated_reference_levels_for_existing_npp_-_november_2013.pdf

9. US NRC 6th Report to CNS, NUREG-1650 Revision 5, The United States of America Sixth National Report for the Convention on Nuclear Safety, 2013, http://pbadupws.nrc.gov/docs/ML1330/ML13303B021.pdf
10. US NRC, NUREG-0737, "Clarification of TMI Action Plan Requirements", 1980, http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr0737/final/sr0737.pdf
11. US NRC, NUREG-0737, Supplement 1, "Requirements for Emergency Response Capability", 1983, http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr0737/sup1/sr0737sup1.pdf
12. US NRC, NUREG-0899, "Guidelines for the Preparation of Emergency Operating Procedures" 1982, http://pbadupws.nrc.gov/docs/ML1025/ML102560007.pdf
13. US NRC, Information Notice No. 86-64: Deficiencies in Upgrade Programs for Plant Emergency Operating Procedures, 1986, http://www.nrc.gov/reading-rm/doc-collections/gen-comm/info-notices/1986/in86064.html
14. US NRC, NUREG-1358, "Lessons Learned From the Special Inspection Program for Emergency Operating Procedures Conducted March - October 1988", 1989
15. US NRC, NUREG-1358, Supplement 1, "Lessons Learned From the Special Inspection Program for Emergency Operating Procedures Conducted October 1988-September 1991", 1992
16. US NRC, IP 42001, "Emergency Operating Procedures", Washington, DC, June 28, 1991, http://www.nrc.gov/reading-rm/doc-collections/insp-manual/inspection-procedure/ip42001.pdf
17. US NRC, NUREG-0800, Standard Review Plan, Section 13.5.2.1, "Operating and Emergency Operating Procedures, rev. 2, 2007, http://pbadupws.nrc.gov/docs/ML0701/ML070100635.pdf
18. US NRC, Accident Management Strategies for Consideration in the Individual Plant Examination Process (Generic Letter No. 88-20, Supplement No. 2), 1990, http://www.nrc.gov/reading-rm/doc-collections/gen-comm/gen-letters/1988/gl88020s2.html
19. US NRC, TI 2515/184, "Availability and Readiness Inspection of Severe Accident Management Guidelines (SAMGs)", 2011, http://pbadupws.nrc.gov/docs/ML1111/ML11115A053.pdf
20. US NRC, Summary of Observations, Temporary Instruction 2515/184, "Availability and Readiness Inspection of Severe Accident Management Guidelines (SAMGs)", 2011, http://www.nrc.gov/NRR/OVERSIGHT/ASSESS/Summary-of-Observations-TI-2515-184.pdf
21. US NRC, SECY-11-0124, "Recommended Actions To Be Taken without Delay From the Near Term Task Force Report", 2011, http://pbadupws.nrc.gov/docs/ML1124/ML11245A127.pdf
22. US NRC, SECY-15-0065, Proposed Rule: "Mitigation of Beyond-Design-Basis Events" (RIN 3150-AJ49), 2015, http://pbadupws.nrc.gov/docs/ML1504/ML15049A201.html
23. EPRI, Severe Accident Management Guidance Technical Basis Report, Report No. 1025295, Palo Alto, CA, 2012, http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=1025295
24. CNSC, Canadian National Report for the Convention on Nuclear Safety - Sixth Report, 2013, http://www.nuclearsafety.gc.ca/pubs_catalogue/uploads/Canadian-National-Report-for-Convention-on-Nuclear-Safety-Sixth-Report-ENG.pdf

25. CNSC, Regulatory Guide "Severe Accident Management Programs for Nuclear Reactors" (G-306), 2006, http://www.nuclearsafety.gc.ca/pubs_catalogue/uploads/G-306_e.pdf
26. CNSC, Regulatory Document REGDOC-2.3.2 "Accident Management: Severe Accident Management Programs for Nuclear Reactors", 2013, http://www.nuclearsafety.gc.ca/eng/acts-and-regulations/regulatory-documents/published/html/regdoc2-3-2/index.cfm
27. ENSREG, Peer Review Report, Stress Tests Performed on European Nuclear Power Plants, 2012, http://www.ensreg.eu/sites/default/files/EU%20Stress%20Test%20Peer%20Review%20Final%20Report_0.pdf
28. Council Directive 2014/87/Euratom of 8 July 2014 amending Directive 2009/71/Euratom establishing a Community framework for the nuclear safety of nuclear installations, 2014, http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2014.219.01.0042.01.ENG
29. IAEA, The Fukushima Daiichi Accident, Report by the Director General, Vienna, 2015, http://www-pub.iaea.org/books/IAEABooks/10962/The-Fukushima-Daiichi-Accident
30. The National Diet of Japan, The Official Report of the Fukushima Nuclear Accident Independent Investigation Commission, Executive Summary, 2012, http://warp.da.ndl.go.jp/info:ndljp/pid/3856371/naiic.go.jp/wp-content/uploads/2012/09/NAIIC_report_lo_res10.pdf
31. IAEA, Mission Report: The Great East Japan Earthquake Expert Mission — IAEA International Fact Finding Expert Mission of the Fukushima Dai-Ichi NPP Accident following the Great East Japan Earthquake and Tsunami, Vienna, 2011, http://www-pub.iaea.org/MTCD/meetings/PDFplus/2011/cn200/documentation/cn200_Final-Fukushima-Mission_Report.pdf
32. INPO 11-005, Special Report on the Nuclear Accident at the Fukushima Daiichi Nuclear Power Station, Institute of Nuclear Power Operations, 2011, http://pbadupws.nrc.gov/docs/ML1134/ML11347A454.pdf
33. INPO 11-005 Addendum, Lessons Learned from the Nuclear Accident at the Fukushima Daiichi Nuclear Power Station, Institute of Nuclear Power Operations, 2012, http://www.wano.info/Documents/Lessons%20Learned.pdf
34. IAEA, Report on Severe Accident Management in the Light of the Accident at the Fukushima Daiichi Nuclear Power Plant - International Experts Meeting, Vienna, 17-20 March 2014, published in Vienna, 2015, https://www.iaea.org/sites/default/files/iem7-severe-accident-management.pdf
35. IAEA, Guidelines for the review of accident management programmes in nuclear power plants, IAEA Services Series No. 9, Vienna, 2003, http://www-pub.iaea.org/MTCD/publications/PDF/svs_009_web.pdf
36. IAEA, Implementation of Accident Management Programmes in Nuclear Power Plants, Safety Reports Series 32, Vienna, 2004, http://www-pub.iaea.org/MTCD/Publications/PDF/Pub1167_web.pdf
37. IAEA, Development and review of plant specific emergency operating procedures, Vienna, 2006, http://www-pub.iaea.org/MTCD/publications/PDF/Pub1226_web.pdf