IAEA Safety Standards and other publications for ageing management and long term operation of nuclear power plants

Nuclear Safety and Security Programme

IAEA
Nuclear Safety and Security

Foreword

Many nuclear power plants are completing their originally licensed lifetime and are in the process of extending, or have already extended, their operating life. Therefore, ensuring the safe and reliable operation of existing nuclear power plants in long term operation (LTO) is a priority for the IAEA, to protect people and the environment from the harmful effects of ionizing radiation.

The publication of IAEA Safety Standards, technical documents and safety review services assist Member States to prepare for safe long-term operation. The safety review service known as SALTO — Safety Aspects of Long Term Operation — comprehensively addresses strategies and specific technical elements of ageing management, a plant's preparation for safe LTO, and its conformance with relevant IAEA safety standards and guidance documents.

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Background

As of August 2024, out of the total number of nuclear power plants (NPPs) operating in the world, approximately 33% had been in operation for more than 40 years, and about 68% for more than 30 years (see Figure 1, 'Total number of reactors by age'— an overview from IAEA PRIS database — pris.iaea.org). Consequently, and in line with economic and energy supply growth and environmental quality, in the past decade many IAEA Member States have started to consider long term operation (LTO) of their NPPs beyond the time frame originally anticipated.

Recognizing the need to assist Member States in dealing with the challenges associated with ageing management and LTO, the IAEA has been developing publications on the safety aspects of ageing management since the 1990s. Subsequently, several standards and reports on the subject have been published, including both general methodological publications and others that address selected major structures and components. These publications have been issued in several series such as: IAEA Safety Standards Series, IAEA Safety Reports Series, IAEA Nuclear Energy Series and IAEA TECDOC Series. The most relevant documents pertaining to this area are highlighted in this brochure.

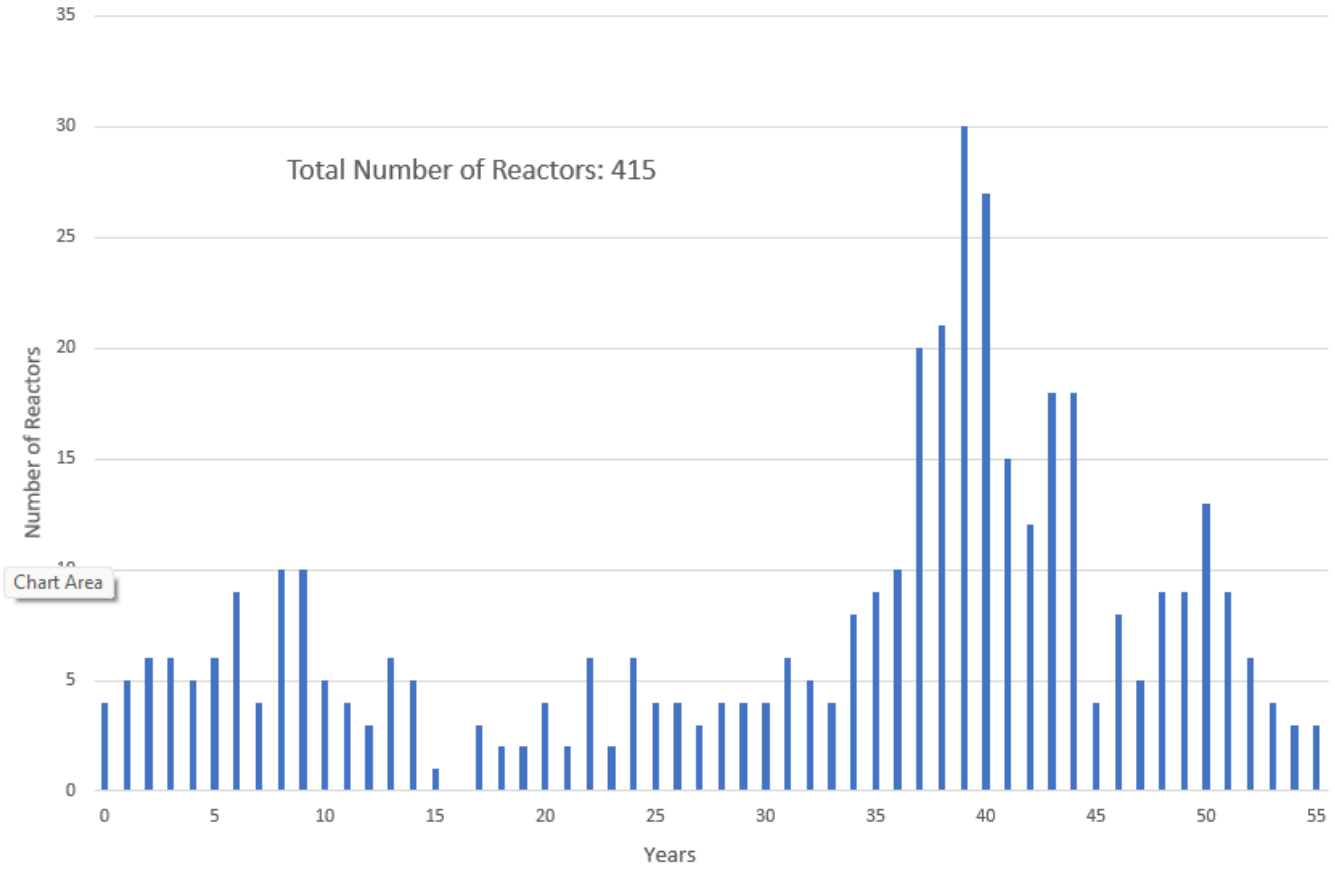


Figure 1: Total number of reactors by age. (Source: PRIS-IAEA, 28 August 2024)

IAEA Safety Standards and other publications structure

The IAEA is authorized by its Statute to promote international cooperation, including “to establish or adopt, in consultation and, where appropriate, in collaboration with the competent organs of the United Nations and with the specialized agencies concerned, standards of safety for protection of health and minimization of danger to life and property … and to provide for the application of these standards.”

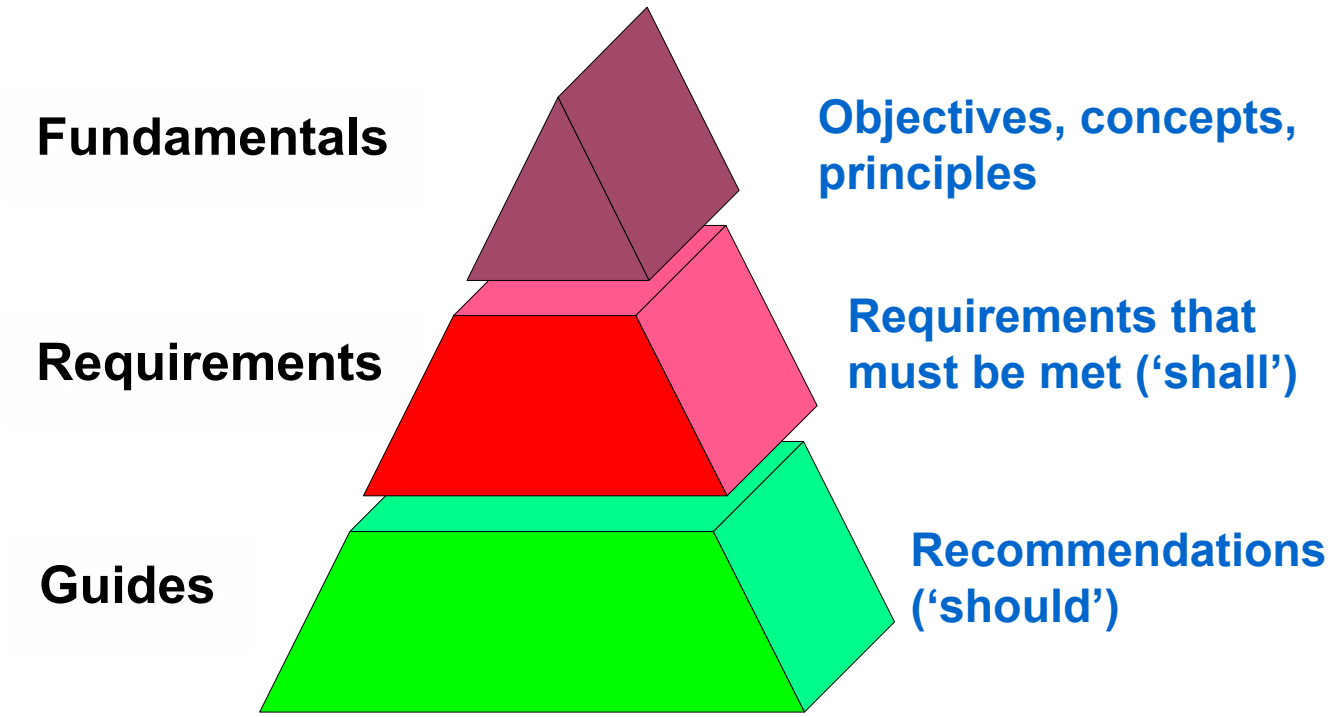
The IAEA Safety Standards are developed based on an open and transparent process for gathering, integrating and sharing the knowledge and experience gained from the use of technologies and from the application of the safety standards themselves.

The prime responsibility for safety rests with the person or organization responsible for activities involving nuclear technology. Regulating safety is a national responsibility. The IAEA safety standards help countries in these endeavours.

The IAEA safety standards serve as a global reference and reflect an international consensus on what constitutes a high level of safety for protecting people and the environment from harmful effects of ionizing radiation. The safety standards cover all nuclear and radiation applications utilized for peaceful purposes.

The Safety Standards Series consists of three types of publications: The Safety Fundamentals, the Safety Requirements and the Safety Guides (www.iaea.org/resources/safety-standards). While the first of these establishes the fundamental safety objective and principles of protection and safety, the second sets out the requirements that must be met to ensure the protection of people and the environment, both now and in the future. The Safety Guides provide recommendations and guidance on how to comply with the requirements.

The users of safety standards in Member States differ depending on the applications of nuclear technology and which safety standard category is relevant. The principal users are the regulatory bodies and other relevant national authorities, but they are also used by joint sponsoring organizations, by organizations that design, manufacture and operate nuclear facilities, and by organizations involved in the use of radiation related technologies.

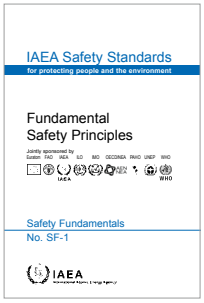


The IAEA provides for the application of the standards and, under the terms of Articles III and VIII.C of its Statute, makes available and fosters the exchange of information relating to peaceful nuclear activities and serves as an intermediary among its Member States. For this purpose, the IAEA issues several series of publications such as:

- Safety Reports: provides practical examples and detailed methods that can be used in support of the safety standards implementation. More information is available here: www.iaea.org/publications/search/type/safety-reports-series.
- Nuclear Energy Series: comprises informational publications to encourage and assist research on, and the development and practical application of, nuclear energy for peaceful purposes. The Nuclear Energy Series and technical reports provide additional, more detailed information on the status of and advances in technology, and on experience, good practices and practical examples in the areas of nuclear power, the nuclear fuel cycle, radioactive waste management and decommissioning. More information is available here: www.iaea.org/publications/search/type/nuclear-energy-series.

Other safety related IAEA publications issued are TECDOCs, emergency preparedness and response publications, radiological assessment reports, IAEA Nuclear Safety and Security Glossary and the International Nuclear Safety Group's (INSAG) Reports. The IAEA also issues reports on radiological events, training materials, and other special safety related publications. The IAEA Nuclear Security Series are publications that address nuclear security and related areas.

Specific Safety Standards related to LTO

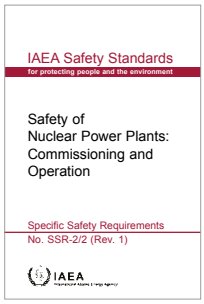


SF-1 Fundamental Safety Principles (2006) covers the fundamental safety objective and ten associated safety principles, and briefly describes their intent and purpose. The fundamental safety objective — to protect people and the environment from harmful effects of ionizing radiation — applies to all circumstances that give rise to radiation risks. The safety principles are applicable, as relevant, throughout the entire lifetime of all facilities and activities, existing and new, utilized for peaceful purposes, and to protective actions taken to reduce existing radiation risks.

They provide the basis for requirements and measures for the protection of people and the environment against radiation risks and for the safety of facilities and activities that give rise to those risks. These include, in particular, nuclear installations and uses of radiation and radioactive sources, the transport of radioactive material and the management of radioactive waste.

The most relevant safety requirements for ageing management and LTO are:

SSR-2/1 Safety of Nuclear Power Plants (Rev.1): Design (2016) establishes requirements applicable to the design of nuclear power plants (NPPs) and elaborates on the safety objective, safety principles and concepts that provide the basis for deriving the safety requirements that must be met for the design of a NPP. In particular, requirement 31 in this publication on 'Ageing management' notes the need to consider relevant degradation mechanisms for safety components at the design stage. Further, requirements: 14 – 'Design bases for items important to safety', 15 – 'Design limits' and 29 – 'Calibration and testing' are also relevant for LTO.

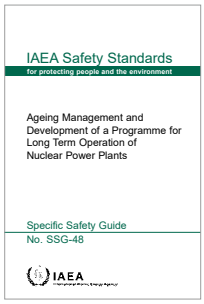


SSR-2/2 Safety of Nuclear Power Plants (Rev.1): Commissioning and Operation (2016) describes the requirements to be met to ensure the safe commissioning, operation, and transition from operation to decommissioning of NPPs. This revision includes developments in areas such as long-term operation of NPPs, plant ageing, periodic safety review, probabilistic safety analysis review and risk informed decision-making processes. In addition, the requirements are governed by, and must apply, the safety objective and safety principles which are established in the IAEA Safety Standards Series No. SF-1, Fundamental Safety Principles. In particular requirement 14 on 'Ageing management' and requirement 16 on 'Programme for long term operation' are the basis for safe preparation of LTO. Also relevant are requirements: 10 'Control of plant configuration', 11 'Management of modifications', 12 'Periodic safety review' and 13 'Equipment qualification.'

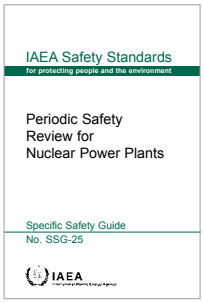
Additionally, other documents that contain general requirements that can influence ageing management and LTO are:

- IAEA Safety Standards Series No. GSR Part 1 (Rev. 1) Governmental, Legal and Regulatory Framework for Safety
- IAEA Safety Standards Series No. GSR Part 2 Leadership and Management for Safety
- IAEA Safety Standards Series No. GSR Part 4 (Rev. 1) Safety Assessment for Facilities and Activities

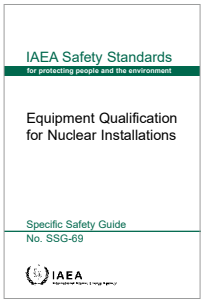
The most relevant safety guides for ageing management and LTO are:



SSG-48 Ageing Management and Development of a Programme for Long Term Operation of Nuclear Power Plants (2018) that supplements and provides recommendations on meeting the requirements related to ageing management and long term operation that are established in SSR-2/1 (Rev.1), Safety of Nuclear Power Plants: Design, SSR-2/2 (Rev.1), Safety of Nuclear Power Plants: Commissioning and Operation. It provides guidance for operating organizations on implementing and improving ageing management, obsolescence management and on developing a programme for safe long-term operation for NPPs. It may also be used by regulatory bodies in preparing regulatory requirements, codes and standards, and in verifying effective implementations in the above-mentioned areas.



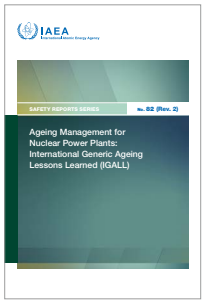
SSG-25 Periodic Safety Review for Nuclear Power Plants (2013) provides recommendations and guidance on conducting periodic safety review (PSR) at an existing NPP. PSR is a comprehensive safety review of important aspects of safety, carried out at regular intervals, typically every ten years. In addition, PSR may be used to support the decision-making process for licence renewal or long-term operation, or to restart a nuclear power plant following a prolonged shutdown. The review process described in this Safety Guide is valid for NPPs of any age and may have wider applicability, for example to research reactors and radioactive waste management facilities, by means of a graded approach. Although PSR may not be an appropriate means for identifying safety issues in the decommissioning phase, the documentation resulting from PSR of an operating NPP will be an important input when planning for decommissioning.



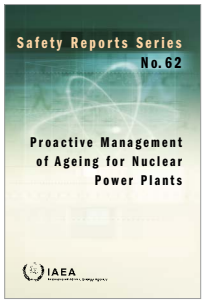
SSG-69 Equipment Qualification for Nuclear Installations. Periodic Safety Review for Nuclear Power Plants (2021) provides recommendations on a structured approach to the establishment and preservation of equipment qualification in nuclear installations, to confirm reliable performance of safety functions by such equipment during operational states and accident conditions, to avoid vulnerability due to common cause failure of the equipment. It applies primarily to equipment that performs one or more safety functions, but it may also be applied to items not important to safety, in accordance with national requirements. The qualification process covers electrical, instrumentation and control, and active mechanical equipment, and components associated with it, for example, seals, gaskets, lubricants, cables, connections and mounting/anchoring structures.

Safety Reports Series

The most relevant safety reports for ageing management and LTO are:

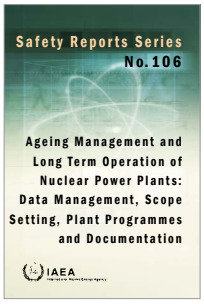


SRS-82 Ageing Management for Nuclear Power Plants: International Generic Ageing Lessons Learned (IGALL) (Rev 2, 2024), which provides a common internationally agreed basis on what constitutes an acceptable ageing management programme for the design of new plants and safety reviews, and to serve as a roadmap on ageing management processes. It addresses ageing management of passive and active structures and components that are susceptible to ageing degradation for water moderated reactors that can influence, directly or indirectly, the safe operation of the plant. The information provided is relevant for plants under normal operation, for plants considering LTO, as well as for new plants including new designs. It emphasises that ageing management should be implemented from the start of operation of nuclear power plants and that adequate provisions to facilitate effective ageing management should be made during the plant design, construction, commissioning, operation, and decommissioning. This safety report will be periodically updated at 5–6 year intervals, while dynamic information in the document will be updated on the IAEA's IGALL website every two years.

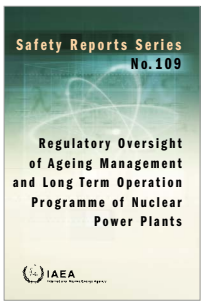


SRS-62 Proactive Management of Ageing for Nuclear Power Plants (2009): This publication provides practical examples of how to manage ageing effects effectively and proactively. It provides guidance and good practices for maintaining and enhancing the safety and performance of NPPs by facilitating the implementation of proactive ageing management throughout their lifetime. This publication provides in-depth information on the proactive management of the ageing of structures, systems, and components throughout their lifetime. It is a key element of the safe and reliable operation of NPPs.

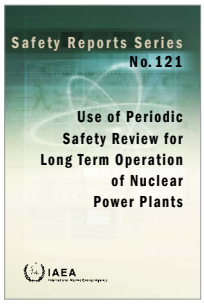
Recent Safety Reports Series (SRS)



SRS-106 on Ageing Management and Long-Term Operation of Nuclear Power Plants: Data Management, Scope Setting, Plant Programmes, and Documentation (2022) provides specific information on selected topics from SSG-48: data collection and record keeping for ageing management and LTO assessment, scope setting of structures, systems and components (SSCs) for ageing management and LTO assessment, plant programmes relevant to ageing management and LTO, the corrective action programme and documentation of ageing management and LTO assessment. The publication is applicable to NPPs throughout their entire lifetime, including operation beyond the time frame originally established for their operation and decommissioning, and considers several of the different reactor designs that exist worldwide. It also applies to facilities for spent fuel storage and radioactive waste management at NPPs. It may also be used as a basis for ageing management for other nuclear installations and for radioactive waste management facilities.



SRS-109 on Regulatory Oversight of Ageing Management and Long Term Operation Programme of Nuclear Power Plants (2022) provides practical information based on existing regulatory practices of the IAEA Member States for regulatory oversight of ageing management including equipment qualification, design modifications, replacement or refurbishment of structures, systems and components for ensuring safe LTO of NPPs. This Safety Report addresses a number of issues including the regulatory framework, regulatory requirements and guides, regulatory processes, competence and preparation of the regulatory body for oversight of the plant preparedness for, and implementation of, an LTO programme and other plant programmes with respect to ageing management. This Safety Report complements the IAEA Safety Standards Series No. GSR Part 1 (Rev. 1), SSR-2/2 (Rev. 1), SSG-48, and GSG-13.

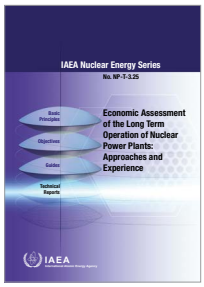


SRS-121 on Use of Periodic Safety Review for Long Term Operation of Nuclear Power Plants (2023) addresses the assessment scope, methods and applicable criteria within the periodic safety review and long term operation programmes framework, to support decision making for long term operation of nuclear power plants. A periodic safety review is a comprehensive safety review of important aspects of safety, carried out at regular intervals, typically every ten years. In addition, PSR may be used to support the decision-making process for licence renewal or long-term operation, or to restart a nuclear power plant following a prolonged shutdown, and is considered an effective way to obtain an overview of nuclear power plant safety, and can support the justification to operate a nuclear power plant beyond the original time frame. The review considers life limiting processes and features of structures, systems and components important to safety, and whether there are any foreseeable circumstances that could endanger the safe operation of the nuclear power plant.

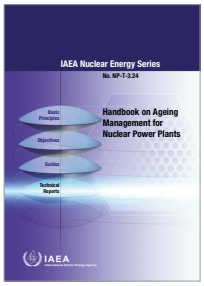
Technical reports and TECDOCs relevant to ageing management and LTO

To fulfil the objective of fostering the exchange of information related to safe operation of NPPs, and with particular focus on ageing management and LTO, the IAEA has documented relevant practices and experience in the Member States, in the form of technical reports or TECDOCs. In the following section, the most relevant documents are grouped in five main technical areas related to LTO. These documents reflect the latest information available as at August 2024.

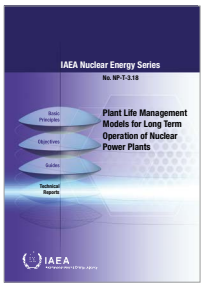
a. Organization, management and economic aspects



IAEA Nuclear Energy Series NP-T-3.25 Economic Assessment of the Long-Term Operation of Nuclear Power Plants: Approaches and Experience (2018) describes the various approaches to the techno-economic assessment of a project for the long term operation of a NPP in its specific market environment. It examines the process of defining the technical scope required to prolong the operating licences of NPPs and highlights the need for further studies on technical cost drivers, and economic assessments to better define the economic aspects of long-term operation.



IAEA Nuclear Energy Series NP-T-3.24 Handbook on Ageing Management for Nuclear Power Plants (2017) has been developed in compliance with relevant IAEA safety standards and draws on lessons learned from ageing management practices worldwide. It provides an overview of the topic and guidance on proactive ageing management within NPPs. It also covers ageing mechanisms effects on structures, systems and components, and the regulatory framework as well as some details on innovative techniques and research and development in this field. The information is presented concisely with clear flow charts and with structured reference to the underlying principles. The handbook can support NPP staff, maintenance managers, vendors, personnel at research organizations and regulators in their work related to the ageing of structures, systems and components.



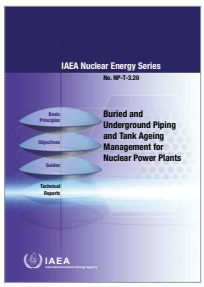
IAEA Nuclear Energy Series NP-T-3.18 Plant Life Management Models for Long Term Operation of Nuclear Power Plants (2015) presents a collection of sample licensing practices for long term operation among IAEA Member States. Three different plant life management models used to obtain long term operation authorizations are described and comparisons drawn against the standard periodic safety review model. Lessons learned and warnings about possible complications and pitfalls are also described to minimize the licensing risk during operation and future long-term operation applications. The main purpose of this publication is to support NPP owners and operators planning an extension of plant operation beyond the original design life. It also serves as a useful guide for those interested in procuring, from the beginning, the necessary tools to implement ageing management in their plant with long term operation in mind.

IAEA TECDOC No. 1736 Approaches to Ageing Management for Nuclear Power Plants (2014) complements the IAEA Safety Report 82 on proven ageing management programmes, the main deliverable of the International Generic Ageing Lessons Learned (IGALL) Programme for Nuclear Power Plants and presents a summary of the national approaches taken by Member States.

Other documents that collect experiences and practices on organization, management and economic assessment of ageing management and long-term operation are:

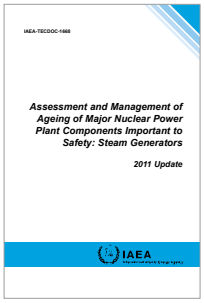
- COMPUTER MANUAL SERIES No. 20, PLEXFIN A Computer Model for the Economic Assessment of Nuclear Power Plant Life Extension, 2007;
- IAEA-TECDOC-1503 Nuclear power plant life management processes: Guidelines and practices for heavy water reactors, 2006;
- IAEA-TECDOC-2018 Design Basis Reconstitution for Long Term Operation of Nuclear Power Plants, 2023.

b. Mechanical components



IAEA Nuclear Energy Series NP-T-3.20 Buried and Underground Piping and Tank Ageing Management for Nuclear Power Plants (2018) is one in a series of reports on the assessment and management of ageing of the major NPP components. It deals with buried and underground piping and tank systems that form part of an NPP and addresses potential ageing mechanisms, age related degradation, and ageing management as well as condition assessments for the material and components of such systems. The intended target audience for this publication are NPP owners, operators, designers, engineers and specialists.

IAEA-TECDOC-1852 Dissimilar Metal Weld Inspection, Monitoring and Repair Approaches (2018) outlines the main aspects and issues to be considered when developing and improving dissimilar metal weld inspections in NPPs. It presents good practices and lessons learned and provides guidance to inspection organizations and their managers, operating staff and to the local suppliers who provide inspection services for utilities, as well as some practical case studies. It covers requirements for an in-service inspection programme, different inspection techniques and methods, inspection qualification and evaluation of the results and challenges for ultrasonic inspection of dissimilar metal welds. The inspection programme and its requirements are based on the safety classification or safety significance of the component. An important aspect of this publication is the details provided on dissimilar metal weld repairs and replacement techniques and how to mitigate or remove cracks and corrosion that might adversely affect plant safety margins.



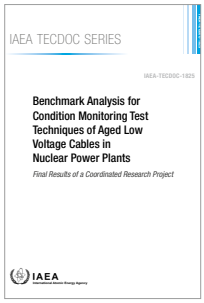
IAEA-TECDOC-1668 Assessment and Management of Ageing of Major Nuclear Power Plant Components Important to Safety: Steam Generators (2011) details practices for the assessment and management of the ageing of nuclear power plant steam generators. It emphasizes safety and engineering aspects and also provides information on current inspection, monitoring and maintenance practices for managing the ageing of steam generators. The information provided on these issues is targeted at researchers, operation and maintenance personnel, technical support organizations, and vendors and equipment suppliers, but it is also a valuable source for regulators and advisors for plant life management in NPPs.

Other documents that collect experiences and practices on ageing management of mechanical components are:

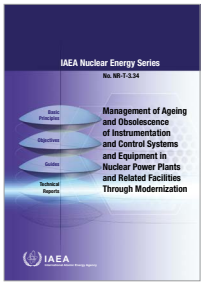
- IAEA-TECDOC No. 1957: Ageing Management of Nuclear Power Plants during Delayed Construction Periods, Extended Shutdown and Permanent Shutdown Prior to Decommissioning, 2021;
- IAEA TECDOC No. 1556: Assessment and Management of Ageing of Major Nuclear Power Plant Components Important to Safety: PWR Pressure Vessels, 2007;
- IAEA-TECDOC No. 1557: Assessment and Management of Ageing of Major Nuclear Power Plant Components Important to Safety: PWR Vessel Internals, 2007;
- IAEA TECDOC No. 1505: Data Processing Technologies and Diagnostics for Water Chemistry and Corrosion Control in Nuclear Power Plants (DAWAC), 2006;

- IAEA-TECDOC No. 1470: Assessment and Management of Ageing of Major Nuclear Power Plant Components Important to Safety: BWR Pressure Vessels, 2005;
- IAEA-TECDOC No. 1471: Assessment and Management of Ageing of Major Nuclear Power Plant Components Important to Safety: BWR Pressure Vessel Internals, 2005;
- IAEA TECDOC No. 1361: Assessment and Management of Ageing of Major Nuclear Power Plant Components Important to Safety Primary Piping in PWRs, 2003;
- IAEA TECDOC No. 1197: Assessment and Management of Ageing of Major Nuclear Power Plant Components Important to Safety: CANDU Reactor Assemblies, 2001;
- IAEA TECDOC No. 1181: Assessment and Management of Ageing of Major Nuclear Power Plant Components Important to Safety: Metal Components of BWR Containment System, 2000;
- IAEA-TECDOC No. 1037: Assessment and Management of Ageing of Major Nuclear Power Plant Components Important to Safety: CANDU Pressure Tubes, 1998.

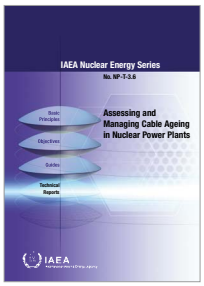
c. Electrical and I&C components



IAEA TECDOC No. 1825 Benchmark Analysis for Condition Monitoring Test Techniques of Aged Low Voltage Cables in Nuclear Power Plants (2017) provides information and guidelines on how to monitor the performance of insulation and jacket materials of existing cables and establish a programme of cable degradation monitoring and ageing management for operating reactors and the next generation of nuclear facilities. This research was conducted through a coordinated research project (CRP) conducted between 2012 and 2014 with participants from 17 Member States. This group of experts compiled the current knowledge in a report together with areas of future research and development to cover aging mechanisms and means to identify and manage the consequences of aging. They established a benchmarking programme using cable samples aged under thermal and/or radiation conditions and tested before and after ageing by various methods and testing organizations. The results of these benchmark tests were then compared to identify the best condition monitoring methods and establish recommendations for improvements. The conclusions of the data analysis provided insight into condition monitoring techniques which yield usable or traceable results.



IAEA Nuclear Energy Series NP-T-3.34 Management of Ageing and Obsolescence of Instrumentation and Control Systems and Equipment in Nuclear Power Plants and Related Facilities Through Modernization (2022) provides information on how to address ageing and obsolescence issues for I&C systems and it provides detail on modernization considerations and information from relevant recent operator experience. An appendix summarizes cable ageing management through condition monitoring, and several annexes describe Member States' practices and experience with I&C ageing management and modernization.

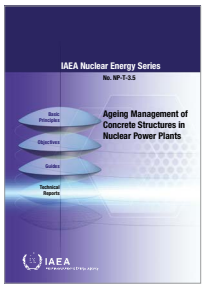


IAEA Nuclear Energy Series NP-T-3.6 Assessing and Managing Cable Ageing in Nuclear Power Plants (2012) addresses all relevant issues related to cable ageing and presents a summary of key issues in cable ageing in nuclear power plants. In particular, it provides guidelines for cable qualification and cable ageing management in nuclear facilities, reflecting the technical advances of the prior 15 years.

Other documents that collect experiences and practices on ageing management of electrical and I&C components are:

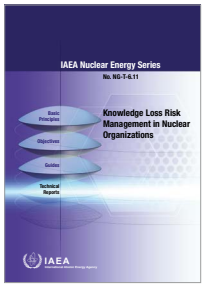
- IAEA TECDOC No. 1402: Management of Life Cycle and Ageing at Nuclear Power Plants: Improved I&C Maintenance (2004);
- IAEA TECDOC No. 1188; Assessment and Management of Ageing of Major Nuclear Power Plant Components Important to Safety: In-containment Instrumentation and Control cables. Vol I and II (2000);
- IAEA-TECDOC No. 1147: Management of Ageing of I&C Equipment in Nuclear Power Plants (2000).

d. Civil structures

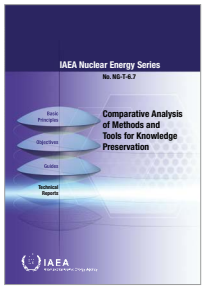


IAEA Nuclear Energy Series NP-T-3.5 Ageing Management of Concrete Structures in Nuclear Power Plants (2016) is one in a series of reports on the assessment and management of ageing of major NPP components. Current practices for assessment of safety margins (fitness for service) and inspection, monitoring and mitigation of ageing related degradation of selected concrete structures related to NPPs are documented. Implications for and differences in new reactor designs are addressed. This information is intended to help all involved directly and indirectly in ensuring the safe operation of NPPs, and also to provide a common technical basis for dialogue between plant operators and regulators when dealing with age related licensing issues. This report is an update of IAEA-TECDOC-1025: 'Assessment and Management of Ageing of Major Nuclear Power Plant Components Important to Safety: Concrete Containment Buildings,' published in 1998.

e. Recruiting, human resources, knowledge management and competence management for LTO



IAEA Nuclear Energy Series NG-T-6.11 Knowledge Loss Risk Management in Nuclear Organizations (2017) provides a methodology to enable knowledge loss risk management to ensure safe, reliable and efficient operation of nuclear facilities. It focuses on aspects of knowledge loss risks associated with employee attrition and provides guidance on how to mitigate them. The described methodology has proved itself in nuclear power plants and can be adopted by any other nuclear related organization. The publication includes examples of best practices (case studies) of effective knowledge loss risk management gathered from NPPs and nuclear related organizations.



IAEA Nuclear Energy Series NG-T-6.7 Comparative Analysis of Methods and Tools for Nuclear Knowledge Preservation (2011) draws on the results of a coordinated research project on comparative analysis of methods and tools for knowledge preservation in nuclear organizations. The project was initiated in 2005 and was conducted until 2007 by the IAEA to enhance the capacity of Member States to maintain and preserve the information and knowledge resources related to the peaceful uses of nuclear energy. The project participants explored methods and tools used to capture, interpret, analyse and disseminate data and information, as well as the knowledge ultimately derived from them. Furthermore, a survey tool on the current status of knowledge preservation in nuclear and supporting organizations was developed. The analysis of the survey served as a basis for the recommendations and conclusions on good practices in knowledge preservation.

Other related Safety Standards

Other relevant safety guides containing guidance in processes related to ageing management and LTO are:

- IAEA Safety Classification of Structures, Systems and Components in Nuclear Power Plants; Safety Guide No. SSG-30 IAEA, Vienna (2014)
- IAEA, Format and Content of the Safety Analysis Report for Nuclear Power Plants, Safety Guide No. SSG-61, IAEA, Vienna (2021);
- IAEA, Application of Management system for Facilities and Activities, Safety Guide No. GS-G-3.1, IAEA, Vienna (2006);
- IAEA, The Management System for Nuclear Installations, Safety Guide No. GS-G-3.5, IAEA, Vienna (2009);
- IAEA, The Operating Organization for Nuclear Power Plants, Safety Guide No. SSG-72, IAEA, Vienna (2022);
- IAEA, Evaluation of Seismic Safety for Nuclear Installations, Safety Guide No. SSG-89, IAEA, Vienna (2024);
- IAEA, Maintenance, Testing, Surveillance and Inspection in Nuclear Power Plants, Safety Guide No. SSG-74, IAEA, Vienna (2022);
- IAEA, Modifications to Nuclear Power Plants, Safety Guide No. SSG-71, IAEA, Vienna (2022);
- IAEA, Recruitment, Qualification and Training of Personnel for Nuclear Power Plants, Safety Guide No. SSG-75, IAEA, Vienna (2022);
- IAEA, Operating Experience Feedback for Nuclear Installations, Safety Guide No. SSG-50. IAEA, Vienna (2018).

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