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IAEA International Generic Ageing Lessons Learned programme phase 1 results

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HIGHLIGHTS

- International Generic Ageing Lessons Learned (IGALL) Programme was commenced to develop a practical guide for ageing management programmes.
- Results of IGALL Phase 1 are publicly available on IAEA web sites.
- 76 ageing management programmes and 27 time limited ageing analyses is provided.
- More than 2000 consolidated line items in ageing management review tables was prepared.
- The IGALL represents a common internationally agreed basis on what constitutes acceptable ageing management programme.

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ABSTRACT

This paper presents purpose and results of the IAEA International Generic Ageing Lessons Learned (IGALL) programme phase 1. The IGALL programme phase 1 (2010–2013) was successfully completed in September 2013. The IGALL safety report, which includes consolidated IGALL database information on 76 ageing management programmes, 27 time limited ageing analyses and more than 2000 consolidated line items in ageing management review tables was prepared for publication. The IGALL database was made publicly available in February 2014. The IGALL safety report represents a common internationally agreed basis on what constitutes acceptable ageing management programmes, as well as a knowledge base on ageing management for design of new plants, design reviews, safety reviews (such as periodic safety review), etc., and serves as a roadmap to available information on ageing management. The IAEA IGALL programme assures that information contained in the IGALL safety report will be kept updated and creates an international network for continuous discussion and development of AMPs and TLAAs as recommended tools to manage ageing.

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1. Introduction

Systematic ageing management provides for the availability of safety functions throughout the service life of the plant and decommissioning, taking into account changes that occur with time and use. This requires addressing both the physical ageing of systems, structures and components (SSCs), resulting in the degradation of their performance characteristics, and obsolescence of SSCs, i.e. their becoming out of date as compared to the latest technology, standards and regulations.

Effective ageing management throughout the service life of an SSC requires the use of a systematic approach to managing ageing that provides a framework for coordinating all programmes and activities relating to the understanding, detection, monitoring, control and mitigation of ageing effects of the plant components or structures, including maintenance, in-service inspection, testing and surveillance, as well as operations, technical support programmes (including the analysis of any ageing effects and degradation mechanisms) and external programmes such as research and development.

Many IAEA Member States have already taken actions to address the topic of ageing in their nuclear power plants. In 2009, the IAEA conducted a Technical Meeting where Member States recommended establishing an international platform for discussion between regulators and utilities regarding implementation of

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acceptable ageing management programmes (AMPs). The recommendations were to:

- Develop and maintain a document which can serve as a practical guide for implementing, maintaining and improving AMPs, made up of best practices and universal knowledge on proven AMPs for safety related SSCs;
- Establish a common basis for discussion between regulators and utilities with regard to implementation of acceptable AMPs.

In response, the IAEA commenced the International Ageing Lessons Learned (IGALL) programme.

2. IGALL programme phase 1 deliverables

The aim of the IGALL programme is to develop and maintain documents and a database to provide a technical basis and practical guidance on managing ageing of mechanical, electrical and instrumentation and control components and civil structures important to safety of nuclear power plants.

The increasing number of participating Member States (26) and international organizations in the IGALL programme in 2013 shows the high significance of ageing for operating NPPs. The IGALL programme phase 1 (2010–2013) was successfully completed at a Technical Meeting in September 2013, attended by 64 participants from 25 Member States and the European Commission. The IGALL safety report (SRS No. 82, International Atomic Energy Agency, 2015), which includes consolidated IGALL database information on 76 AMPs, 27 time limited ageing analyses (TLAAs) and more than 2000 consolidated line items in ageing management review (AMR) tables was prepared for publication. The IGALL database was made publicly available on:

http://gnssn.iaea.org/NSNI/PoS/IGALL/SitePages/Home.aspx.

It contains the information relevant for SSCs important to safety:

- A generic sample of AMR tables;
- A collection of proven AMPs;
- A collection of typical TLAAs.

This information is based on approaches developed and implemented in various types of reactor designs in participating Member States and will be periodically updated.

A technical document TECDOC-1736 (International Atomic Energy Agency, 2014) on national approaches to ageing management was also prepared for publication as a result of the programme. It explains national practices of 18 Member States in the area of ageing management and preparation for long term operation (LTO) in connection with implementation and utilization of the new IGALL safety report.

The content of each national approach covers the following:

- National regulatory requirements for ageing management and LTO;
- Management of physical ageing;
- Management of obsolescence;
- Scoping and screening of SSCs for ageing management and LTO;
- AMR for LTO;
- Review of AMPs for LTO;
- Revalidation of TLAAs for LTO.

The IGALL programme is being implemented in coordination with national and international partners on ageing management (the European Commission and the Organization for Economic Co-operation and Development's Nuclear Energy Agency, etc.).

3. IGALL safety report highlights

The IGALL safety report, as a main IGALL programme deliverable, contains three major parts, an ageing management review which summarizes information on AMR and provides a roadmap to the AMR tables, ageing management programmes presenting basic concepts of AMPs and describing the 9 generic attributes of an effective AMP and time limited ageing analysis providing general information on TLAAs.

3.1. Ageing management review

Scope setting and screening are essential prerequisites for AMR. The SSCs that are subject to AMR are identified through a scope setting and screening process as described in IAEA documents SSR-2/2 and SRS No. 57 (International Atomic Energy Agency, 2008, 2011). Each plant may use an individual approach based on its current licensing basis and national regulatory requirements.

The AMR process involves the identification of, but is not limited to, the following elements:

- System;
- Structure/component;
- Ageing effect/degradation mechanism;
- Critical location/part;
- Material;
- Environment;
- AMP; and
- TLAA(s).

For structures and components that are identified as being subject to an AMR in general, or in scope of LTO, it is required to demonstrate that the effects of ageing will be adequately managed to ensure that intended safety functions of SSCs are fulfilled over the entire operating lifetime of the plant (SSR-2/2, International Atomic Energy Agency, 2011).

Taking as a basis the AMR tables of NUREG-1801 Rev. 2 United States Nuclear Regulatory Commission (2010), participating Member States have provided their own AMR results by comparing their structure/component information and data towards the relevant line in the tables in NUREG-1801 Rev. 2 United States Nuclear Regulatory Commission (2010). In cases when the line items of NUREG-1801 Rev. 2 United States Nuclear Regulatory Commission (2010) were not fully or partly applicable, a new line item has been added with the complete information of the participating Member State in each column.

After compilation of information provided by each Member State, clarification, and discussion, the information was consolidated/ reconciled into an "IGALL AMR line item", i.e. only one line for each combination of system, structure/component, ageing effect/degradation mechanism, material, environment, AMP, etc. is provided in the IGALL AMR tables.

The IGALL AMR tables could be used as an internationally agreed basis on what constitutes an acceptable AMP and/or TLAA for each critical location/part of SSCs, ageing effect/degradation mechanism, material and environment.

AMR is implemented on a plant-specific basis using established procedures and methods in line with the national regulatory requirements (TECDOC-1736, International Atomic Energy Agency, 2014). The IGALL AMR tables may be used as an additional basis to supplement plant specific AMRs (for development or review).

The AMR tables in the IGALL provide a knowledge base on ageing management for design of new plants, design reviews, safety reviews (such as periodic safety review), etc., and could serve as a roadmap to information on ageing management.

The elements identified during the plant specific AMR can be compared to the applicable line items in the IGALL tables, to

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