Working material

SALTO Missions Highlights 2015–2018

Long term operation safety practices in nuclear power plants

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The originating Section of this publication in the IAEA was:

Operational Safety Section
International Atomic Energy Agency
Vienna International Centre
PO Box 100
1400 Vienna, Austria

FOREWORD

The IAEA Safety Aspects of Long Term Operation (SALTO) service provides advice and assistance to Member States considering extending the operating life of a nuclear power plant (NPP) beyond the original licensing term.

Careful design and high quality of construction, operation and maintenance are prerequisites for a safe NPP. However, a plant's safety depends ultimately on the ability and conscientiousness of the operating organization's personnel and on the plant programmes, processes and working methods. This also applies to all LTO related activities. The IAEA's SALTO safety review service compares a facility's LTO related activities and programmes against IAEA Safety Standards and proven good international practices.

SALTO safety review missions are available to all Member States considering LTO of their NPPs. Many Member States have participated in the programme by hosting one or more SALTO missions or by making experts available as reviewers. Preparedness for safe LTO can also be reviewed more generally as part of an Operational Safety Review mission (OSART) when a dedicated LTO area is included in the scope of the mission. Follow-up missions are standard parts of the SALTO programme and are conducted between 18 to 24 months after the original SALTO missions.

This report summarizes SALTO mission results from period 2015 to 2018. The report also includes, where applicable, the results of LTO area reviews performed during OSART missions and their follow-up missions. It highlights the most significant findings while retaining as much of the vital background information as practicable. This report is divided into six Sections:

Section 1: Provides an introduction to the SALTO safety review service;

Section 2: Provides an overview of missions analyzed in this document and wording used to group the results;

Section 3: Provides a detailed assessment of mission results, area by area, based on issues and good practices that were identified in the period covered and the assessment of overall SALTO mission results. It also provides an assessment of follow-up mission results;

Section 4: Summarizes the main areas for improvement identified during the missions between July 2015 and June 2018;

Section 5: Provides a comparison of the 2015-2018 mission results with those from 2005-2015 and broader cross-cutting issues. Individual findings vary considerably in scope and significance. However, the findings do reflect some common strengths and opportunities for improvement;

Section 6: Conclusions.

The IAEA officers responsible for this publication were Mr. R. Krivanek and Mr. S. Kunito of the Division of Nuclear Installation Safety.

1. INTRODUCTION

Many of the challenges faced by those responsible for ensuring the safe operation of NPPs are common throughout the world. The results of a SALTO safety review mission are, therefore, of interest and possibly applicable to many NPPs and not solely to the plant in which they were originally identified. The primary objective of this report is to enable organizations that are operating or regulating NPPs, or providing technical support to them, to benefit from experience gained from SALTO missions conducted during the period July 2015 to June 2018.

The IAEA started to develop guidance on NPP ageing management in the 1990s. Several reports on the subject were published, providing general guidance and more specific advice for selected major NPP components and structures. To support the increasing number of IAEA Member States that had decided to pursue LTO, the IAEA conducted an Extra-budgetary Programme on Safety Aspects of Long Term Operation of Water Moderated Reactors between 2003 and 2006. This led to the development of the SALTO safety review service. The methodology was verified during narrow-scope engineering review missions that included the objectives of an earlier IAEA review conducted by Ageing Management Assessment Teams. The approach was formalized in 2007 when the first full-scope SALTO safety review missions took place.

The SALTO safety review service is available to all Member States with NPPs by making a request to the IAEA. By June 2018, 36 SALTO missions had been conducted at 19 NPPs in 15 Member States (including 8 pilot SALTO missions). There had also been 9 SALTO follow-up missions to review the implementation of previous SALTO recommendations and suggestions. Also within this period, 11 NPPs had requested the LTO area to be included in OSART missions and in 3 OSART follow-up missions.

SALTO review teams consist of senior expert reviewers from NPPs, technical support organizations and regulatory authorities in the various disciplines relevant to the mission. During technical discussions between reviewers and plant staff, LTO and ageing management programmes are examined in detail and their performance is reviewed; strengths are identified as good practices, while areas for improvement can result in either recommendations or suggestions. The criteria used by the teams as they formulate their conclusions are based on IAEA Safety Standards and the best prevailing international practices and, therefore, may be more stringent than national requirements. SALTO safety reviews are neither regulatory inspections nor design reviews. Rather, they consider the effectiveness of LTO and ageing management programmes, and are more oriented to programme, process and management issues than to hardware. The performance or outcome of the various programmes receives particular attention. SALTO teams neither assess the adequacy of plant design nor compare or rank the safety performance of different plants.

The SALTO safety review service consists of the following elements:

- Workshops/seminars on IAEA safety standards, SALTO methodology and experience from LTO preparation;
- Pre-SALTO mission (typically 10 to 2 years before LTO, and more than one Pre-SALTO can be conducted if required);
- SALTO mission (typically less than 2 years before LTO);
- Follow-up SALTO mission (1.5-2 years after Pre-SALTO and SALTO mission).

A plant's preparedness for LTO can also be reviewed as an optional area of an OSART mission. In that case the review is performed by 1 expert, which leads to less detailed review compared with a SALTO mission.

To meet the needs of all Member States and plants, Expert Missions that focuses on specific review areas of a standard SALTO safety review service have also been developed and conducted. The scope of these missions can be tailored according to the request of the host organization, but the methodology employed is the same as for SALTO missions.

A standard SALTO safety mission reviews the following areas:

A. Organization and functions, current licensing basis (CLB), configuration/modification management;
B. Scoping and screening and plant programmes relevant to LTO;
C. Ageing management review, review of ageing management programmes and revalidation of time limited ageing analyses for mechanical components;
D. Ageing management review, review of ageing management programmes and revalidation of time limited ageing analyses for electrical and I&C components;
E. Ageing management review, review of ageing management programmes and revalidation of time limited ageing analyses for civil structures;
F. Human resources, competence and knowledge management for LTO (optional area).

These areas are further divided into sub-areas defined in the SALTO Guidelines and used to structure this report in its Sections 3 and 4.

Each SALTO mission was performed in accordance with the SALTO Guidelines, Service Series 26, published in 2014.

The terms 'recommendation', 'suggestion' and 'good practice' are defined as follows in the framework of SALTO safety reviews:

Recommendation
A recommendation is advice on what improvements in safety aspects of LTO should be made in that activity or programme that has been evaluated. It is based on IAEA Safety Standards, Safety Reports, or proven, good international practices and addresses the root causes rather than the symptoms of the identified concern. It illustrates a proven method of striving for excellence, which reaches beyond minimum requirements. Recommendations are specific, realistic and designed to result in tangible improvements. Absence of recommendations can be interpreted as performance corresponding with proven international practices.

Suggestion
A suggestion is either an additional proposal in conjunction with a recommendation or may stand on its own following a discussion of the pertinent background. It is based on IAEA Safety Standards, Safety Reports, or proven, good international practices and addresses the root causes rather than the symptoms of the identified concern. It may indirectly contribute to improvements in safety aspects of LTO but is primarily intended to make a good performance more effective, to indicate useful expansions to existing programmes and to point out possible superior alternatives to on-going work. In general, it is designed to stimulate the plant management and supporting staff to continue to consider ways and means for enhancing performance.

Note: if an item is not sufficiently significant to meet the criteria of a ‘suggestion’, but the expert or the team feels that mentioning it is still desirable, the given topic may be described in the text of the report using the concept of ‘encouragement’ (e.g., The team encouraged the plant to…).

Good practice

A good practice is an outstanding and proven performance, programme, activity or equipment in use that contributes directly or indirectly to safe LTO and sustained good performance. A good practice is markedly superior to that observed elsewhere, not just the fulfilment of current requirements or expectations. It should be superior enough and have broad application to warrant bringing it to the attention of other NPPs for their consideration in improving performance. A good practice has the following characteristics:

- it is novel;
- it has a proven benefit;
- it is replicable (it can be used at other plants);
- it does not contradict an issue.

The characteristics of a given ‘good practice’ (e.g., whether it is well implemented, or cost effective, or creative, or it has good results) should be explicitly stated in the description of the ‘good practice’.

Note: An item may not meet all the criteria of a ‘good practice’, but still be worthy of note. In this case it may be referred to as a ‘good performance’ and may be documented in the text of the report. A good performance is a superior result that has been achieved or a good technique or programme that contributes directly or indirectly to safe LTO and that works well at the plant. However, it might not be appropriate to recommend its adoption by other NPPs, because of financial considerations, differences in design or other reasons.

2. OVERVIEW OF ANALYZED MISSIONS

During the period of July 2015 to June 2018, 14 SALTO missions were conducted around the world as listed in TABLE I. For 9 plants, safety aspects of LTO were reviewed in the frame of an OSART mission that included the LTO area, as listed in Table II.

TABLE I. EXPERT, PRE-SALTO AND SALTO MISSIONS

SALTO Mission No.	Plant	Mission type	Country	Year
23	Qinshan 1	Pre-SALTO	China	2015
24	Koeberg	Pre-SALTO	South Africa	2015
25	Doel 1/2	Expert Mission	Belgium	2016
26	Kozloduy 5	Pre-SALTO	Bulgaria	2016
27	Atucha 1	Pre-SALTO	Argentina	2016
28	Forsmark 1/2	Pre-SALTO	Sweden	2016
29	Armenian 2	Pre-SALTO	Armenia	2016
30	Doel 1/2	SALTO	Belgium	2017
31	Qinshan 1	SALTO	China	2017
32	Oskarshamn 3	Pre-SALTO	Sweden	2017
33	Ringhals 3/4	SALTO	Sweden	2018
34	South Ukraine 3	Pre-SALTO	Ukraine	2018
35	Angra 1	Pre-SALTO	Brazil	2018
36	Kozloduy 6	Pre-SALTO	Bulgaria	2018

TABLE II. OSART MISSIONS INCLUDING THE LTO AREA

OSART Mission No.	Plant	Country	Year
188	Bruce B	Canada	2015
189	Pickering	Canada	2016
193	Olkiluoto 1/2	Finland	2017
194	Krsko	Slovenia	2017
195	Sequoyah	United States of America	2017
197	Bugey	France	2017
199	Torness	United Kingdom	2018
200	Almaraz	Spain	2018
202	Loviisa	Finland	2018

This report summarizes the results of these missions, (good practices, recommendations, and suggestions) and provides a series of snapshots of the status of plants' activities to ensure safe LTO.

With respect to safe LTO, the amount and significance of recommendations and suggestions made during the SALTO missions correlates in principle with the level of compliance with the IAEA Safety Standards; the amount and significance of good practices indicates the level of implementation of the best international practices in the industry.

In most plants, the level of preparation for the review, the openness of the counterpart teams and their readiness to co-operate impressed the SALTO safety review teams.

While the nuclear industry has made significant advances in safety, there is always room for further improvement. SALTO safety review teams have identified many safety aspects of LTO where improvements are still needed. At the same time, the review teams and plants reviewed have provided the IAEA with valuable feedback that allows continuous improvement of the IAEA services aimed at safe LTO.

Table III shows the number of issues and the number of good practices identified during the 14 SALTO and 9 OSART missions. These findings formed the basis of the evaluation provided in Section 2 of this report. It should be noted that the depth of review and consequently the detail and number of issues arising from the 14 SALTO missions issues is significantly higher than the level of detail and number of issues from the 9 LTO reviews during OSART missions performed.

TABLE III. SALTO FINDINGS OVERVIEW

	Area A (O&F, CLB, CM)	Area B (S&S, PP)	Area C (Mech.)	Area D (E, I&C)	Area E (Civil)	Area F (HR, KM)	Total
SALTO and OSART Missions containing the area	14+9	14+9	14+9	14+9	14+9	12	-
Recommendations	16	31	20	24	22	17	130
Suggestions	26	17	17	16	7	8	91
Good Practices	2	5	3	3	1	2	16

The main task of the IAEA assessment team was to evaluate and weight the mission results. The following wording was used to group the results:

- Wording 'In all plants' or 'in all cases' is used when 21 or more issues were given during 23 different plant reviews for areas A-E, and when 11 or more issues were given during 12 different plant reviews for area F (more than 90% of the cases);
- Wording 'In many plants' or 'frequently' is used when 11 to 20 issues were given during 23 different plant reviews for areas A-E, and when 6 to 10 issues were given during 12 different plant reviews for area F (from 45% to 90% of the cases);
- Wording 'In some plants' is used when 4 to 10 issues were given during 23 different plant reviews for areas A-E, and when 2 to 5 issues were given during 12 different plant reviews for area F (from 15% to 45% of the cases);

– Wording ‘In a few plants’ is used when 3 or less issues were given during 23 different plant reviews for areas A-E, and when 1 issue was given during 12 different plant reviews for area F (up to 15% of the cases).

3. ASSESSMENT OF THE SALTO MISSION RESULTS AREA BY AREA

This Section provides a detailed assessment of mission result area by area based on issues and good practices that were identified during missions shown in Tables I and II for each sub area separately.

Where the facts or findings of the SALTO missions address a common problem, area for improvement is complemented by several examples of observation, and discussion on the weight of these findings.

3.1. Organization and functions, current licensing basis, configuration/modification management

TABLE IV. SUMMARY OF FINDINGS (AREA A)

Title		Rec.	Sug.	GP	Total
1.1	Related regulatory requirements, codes and standards	4	4		8
1.2	Organizational structure for LTO	3	7		10
1.3	Plant policy for LTO	2	1		3
1.4	LTO implementation programme	2	4	1	7
1.5	Current SAR and other CLB documents	5	2		7
1.6	Configuration/ modification management including design basis documentation		8	1	9
Total		16	26	2	44

3.1.1. Related regulatory requirements, codes and standards

Findings: 4 recommendations, 4 suggestions
Areas for improvement:

- In a few plants, there is an indication that regulatory expectations for safe LTO are not clear for the plant (3/23).
- In some plants, NPP and regulatory authority documents developed to provide requirements and guidance for LTO do not cover all safety aspects (4/23).

IAEA Basis: SSR-2/2 (4.53-54); SSG-48 (2.31, 3.2, 3.31, 4.3, 7.2-5, 7.7, 7.19); NS-G-2.12 (3.2, 3.4-5, 3.14); SRS No. 57 (2.1-2)

Examples show that:
- Expectations of the regulatory authority for demonstration of preparedness for safe LTO are not clearly defined.
- Available documentation, both provided by the regulatory authority and developed by the plant, does not provide all necessary guidance on AM and the assessment of safe LTO.

It should be noted that the objective of the SALTO safety review is to review the plant's activities for safe LTO and provide advice on improvements to the plant. Since the regulatory

framework is developed and owned by the regulator, the regulator can also benefit from findings in this area.
Unclear regulatory expectations and unsuitable documentation related to requirements and guidance for LTO contribute to several issues identified in areas A and B directly and other areas indirectly. Therefore, it is essential that regulatory requirements for LTO are clearly and timely established in Member States that intend to pursue LTO.

3.1.2. Organizational structure for LTO

Findings: 3 recommendations, 7 suggestions

Areas for improvement:
- In a few plants, organization for support LTO is not fully established (3/23).
- In some plants, exiting organization is not adequate for supporting LTO (7/23).

IAEA Basis: GSR part 2 (4.21-23); SSR-2/2 (Requirement 14); SSG-48 (5.1-4, 5.7); NS-G-2.12 (4.2, 4.7-8)

Examples show that:
- The organizational roles and responsibilities for the LTO programme are not clearly defined.
- The current plant project arrangements might not always ensure timely and comprehensive integration of project-related activities into the line organizations.

This area is directly linked to the next sub-section on plant policy for LTO, since clear plant policy for LTO is a precondition for adequate LTO organization.

3.1.3. Plant policy for LTO

Findings: 2 recommendations, 1 suggestion

Area for improvement:
- In a few plants, the LTO policy is not established, leading to problems related to strategy, tasks, roles, responsibilities, organizational structure and how well the organization knows the LTO approach and expectations (3/23).

IAEA Basis: SSR-2/2 (Requirement 14 and 16, 4.5); SSG-48 (7.7-10), NS-G-2.12 (4.2)

Examples show that:
- A clear plant policy and project organization for the LTO project is not in place.

This aspect has a broad overall impact on the LTO programme and its implementation.

3.1.4. LTO implementation programme

Findings: 2 recommendations, 4 suggestions, 1 good practice

Area for improvement:
- In some plants, the content of the LTO implementation programme is not complete. (6/23)

IAEA Basis: SSR-2/2 (Requirements 14 and 16, 4.53); SSG-48 (4.2-6); NS-G-2.12 (4.35-38)

Examples show that:
- A clear and consistent process to demonstrate preparedness for safe LTO is not in place.
- Continuous improvement of ageing management process is not well established.

Measures to ensure implementation of LTO project results, commitments, documents updates, and activities need to be in place to ensure plant safety during LTO.

A good practice was recognized in this area related to the Integrated Risk Management for LTO both on programme and individual project level.

3.1.5. Current safety analyses report and other current licensing basis documents

Findings: 5 recommendations, 2 suggestions

Areas for improvement:
- In some plants, PSR is not comprehensive. (5/23)
- In a few plants, final safety analysis report (FSAR) is not being fully updated. (2/23)

IAEA Basis: SSR-2/2 (4.4, 4.6-7, 4.53); SSG-48 (4.2-6); SSG-25 (2.9,2.13); GSG-4 (3.166)

Examples show that:
- Not all PSR safety factors relevant for LTO are fully evaluated.
- FSAR is not being adequately updated for LTO.

Lack of comprehensive PSR can lead to missed opportunity to identify and implement safety upgrades and physical modification for safe LTO.

3.1.6. Configuration/modification management including design basis documentation

Findings: 8 suggestions

Areas for improvement:
- In some plants, design basis documentation is not adequately managed to ensure its availability for the plant. (6/23)
- In a few plants, function of design authority is not fully implemented. (2/23)

IAEA Basis: SSR-2/1 (Requirement 14, 5.3-4): SSR-2/2 (Requirement 10); SSG-48 (4.1-2, 4.11, 4.13-15, 5.26); SRS-65 (3.1.2)

Examples show that:

- Design basis documentation is not adequately managed to ensure its availability for the plant.
- The plant has not comprehensively assessed the knowledge and training needed to fulfil all design authority roles in modification processes.

Adequate design basis documentation and function of design authority are essential to ensuring safety during LTO.

The good practice is related to authorization of design engineers.

3.2. Scoping and screening, plant programmes relevant to LTO

TABLE V. SUMMARY OF FINDINGS (AREA B)

Title		Rec.	Sug.	GP	Total
2.1	Methodology and criteria for scoping and screening of SSCs for LTO	18	9	-	27
2.2	Plant programmes relevant to LTO	13	8	5	26
Total		31	17	5	53

3.2.1. Methodology and criteria for scoping and screening of SSCs for LTO

Findings: 18 recommendations, 9 suggestions

Areas for improvement:
- In many plants, scoping and screening is incomplete (19/23).

  The following type of issues were identified during the reviews (some items occurred in the same plant, so the sum does not correlate with the above total number):
  - Definition of criteria for scope setting and boundaries between systems, structures and components (SSCs) are unclear (7/23);
  - Incomplete documentation on process/ results on scope setting (4/23);
  - The methodology for scope setting is not established (3/23);
  - The methodology for scope setting is not consistently used for LTO (3/23);
  - Ageing of the active and short-lived systems and components (SCs) is not properly managed (3/23).

IAEA Basis: SSR-2/2 (Requirement 16, 4.54); SSG-48 (5.14-21, 5.70, 7.29, 7.33); NS-G-2.12 (4.14-16, 6.3); SRS-57 (4.1-2)

Examples show that:
- The scoping of SSCs is not complete and the scope setting process is not documented in sufficient and traceable manner.
- The identification of SSCs within the scope for LTO assessment is inadequate.
- The scoping and screening process is not comprehensive to ensure completeness of the AMR.
- Ageing of active and short-lived passive components was not assessed for LTO
- Not all scope setting results for ageing management and LTO have been documented and used in an appropriate and traceable manner.

– Methodology and guidance for the scoping and screening are not sufficiently detailed to ensure consistent identification of SSCs for LTO assessment.

The plants should give adequate attention to the scope setting methodology, its appropriate and timely application, as well as to the completeness of the outcome. Without a well-defined and justified scope, the plant cannot demonstrate that the ageing management of all safety relevant structures and components is adequate for LTO.

Other issues are related to inadequate usage of commodity groups, data management and work management. These factors affect the correctness and accountability of the results.

3.2.2. Plant programmes relevant to LTO (maintenance, equipment qualification (EQ), in-service inspection, surveillance and monitoring, monitoring of chemical regimes etc.)

Findings: 13 recommendations, 8 suggestions, 5 good practices

Areas for improvement:

- In many plants, existing plant programmes are not adequate for LTO (15/23).

  Typical issues are given below (some items occurred in the same plant, so the sum does not correlate with the above total number):

  – Insufficient coordination of existing plant programmes with ageing management (11/23);
  – Insufficient evaluation of effectiveness of existing plant programmes (7/23).

IAEA Basis: SSR -2/2 (Requirement 14, 4.48-54); SSG-48 (3.35, 4.16-18, 5.38, 7.26-27); NS-G-2.12 (4.10-12, 4.32, 6.2); SRS-57 (3.3, 5.3)

Examples show that:

- Plant programmes relevant to LTO do not properly identify and address ageing effects and are not linked to the ageing management programmes.
- Trend monitoring of ageing management programme results does not fully meet the needs for safe LTO.
- The current plant programmes have not been evaluated for their effectiveness in managing ageing for LTO according to all nine attributes of an effective programme.
- The effectiveness and coordination of the existing plant programmes and AMPs has not been demonstrated for the period of LTO.

Other issues are related to data management, identification of equipment and specific programmes such as water chemistry, equipment qualification, obsolescence etc.

The good practices identified are related to intensive EQ programme, quality aspects of ISI, documents for specific inspection, preparation for major component replacement and integrated asset management system.

3.3. Ageing management review, review of ageing management programmes and revalidation of time limited ageing analyses for mechanical components

TABLE VI. SUMMARY OF FINDINGS (AREA C)

Title		Rec.	Sug.	GP	Total
3.1	Area-specific scoping and screening	1		1	2
3.2	Ageing management review	8	4	1	13
3.3	Review of ageing management programmes	3	3	1	7
3.4	Obsolescence management programme	1	1		2
3.5	Existing TLAAs	4	1		5
3.6	Revalidation of TLAAs	2	5		7
3.7	Data collection and record keeping	1	3		4
Total		20	17	3	40

3.3.1. Area-specific scoping and screening of SSCs for LTO

Findings: 1 recommendation, 1 good practice

Area for improvement:

- In a few plants, the scope setting of mechanical SSCs for LTO components is not properly implemented. (1/23)

IAEA Basis: SSR-2/2 (Requirement 14); NS-G-2.12 (4.14-15); SSG-48 (5.14-21); SRS 57 (4, 4.1)

The good practice is related to comprehensive implementation of leak rate testing of containment isolation valves.

3.3.2. Ageing management review

Findings: 8 recommendations, 4 suggestions, 1 good practice

Ares for improvement:

- In many plants, AMR of mechanical SCs for LTO is not adequately performed (e.g., gaps in condition assessment, identification of potential ageing effects, identification of relevant programmes to manage ageing, documentation) (12/23).

IAEA Basis: SSR -2/2 (Requirement 14, 4.50-54); SSG-48 (5.22-26, 5.55, 7.24-25); NS-G-2.12 (4.26, 4,31, 4.33, 4.42, etc.); SRS-57 (2.2, 5.1-3)

Examples show that:

- AMR for mechanical components has not covered the LTO period.
- The plant has not completed AMR, development and implementation of AMPs.
- The traceability of the actions to manage ageing of mechanical SSCs has not been properly formalized to support LTO.

The good practice is related to steam generator tube bundle ageing management.

3.3.3. Review of ageing management programmes

Findings: 3 recommendations, 3 suggestions, 1 good practice

Area for improvement:
- In some plants, AMPs for mechanical SCs are not adequately developed or implemented (e.g., gaps in identification of managed ageing effects, trending, acceptance criteria, corrective actions, documentation) (6/23).

IAEA Basis: SSR-2/2 (4.50-54); SSG-48 (5.37-39, 5.48-49); NS-G-2.12 (3.1, 3.3, 4.10)

Examples show that:
– AMP for mechanical components adequate to ensure effective ageing management during the LTO period.
– The review of AMPs and revalidation of TLAAs are not completed.

The good practice is related to piping and component analysis and monitoring system.

3.3.4. Obsolescence management programme

Findings: 1 recommendation, 1 suggestion

Area for improvement:
- In a few plants, a proactive programme for managing technological obsolescence is not developed/ fully established (2/23).

IAEA Basis: NS-G-2.12 (5.1-4)

3.3.5. Existing time limited ageing analyses

Findings: 4 recommendations, 1 suggestion

Area for improvement:
- In some plants, quality or identification of TLAAs for mechanical SCs is not complete or systematic (5/23).

IAEA Basis: SSR-2/2 (Requirement 16, 4.54); SSG-48 (3.34, 5.64); NS-G-2.12 (6.3); SRS-57 (6.1)

Examples show that:
– The plant has not considered all relevant sources of information for the identification of TLAAs for mechanical components and civil structures.

3.3.6. Revalidation of time limited ageing analyses

Findings: 2 recommendations, 5 suggestions

Area for improvement:
- In some plants, revalidation of TLAAs for mechanical SCs is not complete or adequate. (7/23)

IAEA Basis: SSR-2/2 (Requirement 16, 4.54); SSG-48 (3.34, 5.67-68, 7.28); NS-G-2.12 (6.3); SRS-57 (6.1)

Examples show that:
– Revision of TLAAs is not complete nor completely documented for SSCs in the scope.
– Current approach for identification and revalidation of TLAAs for mechanical components is not sufficiently comprehensive to support LTO.

3.3.7. Data collection and record keeping

Findings: 1 recommendation, 3 suggestions

Area for improvement:
- In some plants, data management (consistency and completeness) of mechanical SCs is not adequate (4/23).

IAEA Basis: SSR-2/2 (4.52, 5.27); SSG-48 (5.9-10, 5.57, 5.70); NS-G-2.12 (4.41); SRS-57 (5.2)

Examples show that:
– Databases are not linked to ensure a complete and accurate LTO evaluation.
– The plant's operating experience programme does not ensure that all relevant internal and external operating experience will be applied to AMP.

3.4. Ageing management review, review of ageing management programmes and revalidation of time limited ageing analyses for electrical and I&C components

TABLE VII. SUMMARY OF FINDINGS (AREA D)

Title		Rec.	Sug.	GP	Total
4.1	Area-specific scoping and screening	4	1		5
4.2	Ageing management review	2	4		6
4.3	Review of ageing management programmes	11	4	1	16
4.4	Obsolescence management programme	2	5	1	8
4.5	Existing TLAAs	2		1	3
4.6	Revalidation of TLAAs	1			1
4.7	Data collection and record keeping	2	2		4
Total		24	16	3	43

3.4.1. Area-specific scoping and screening of SSCs for LTO

Findings: 4 recommendations, 1 suggestion

Area for improvement:
- In some plants, the scope setting of electrical and I&C SSCs for LTO components is not properly implemented. (5/23)

IAEA Basis: SSR-2/2 (Requirement 16, 4.54); SSG-48 (5.16, 5.41); NS-G-2.12 (4.14-15); SRS-57 (4.1-2)

Examples show that:
– The plant's arrangements for scoping and screening of electrical and I&C components do not ensure that ageing management of all relevant components is sufficient.
– Screening out of newly installed electric and I&C components from the scope for LTO evaluations with respect to time of installation only does not assure appropriate scope of SSCs for LTO evaluation.

3.4.2. Ageing management review

Findings: 2 recommendations, 4 suggestions

Area for improvement:
- In some plants, AMR for electrical and I&C SCs for LTO is not adequately performed (e.g., gaps in condition assessment, identification of potential ageing effects, identification of relevant programmes to manage ageing, documentation) (6/23).

IAEA Basis: SSR-2/1 (5.49), SSR-2/2 (4.48, 4.51); SSG-48 (3.30, 4.28-29, 4.42, 7.2); NS-G-2.12 (4.29); SRS-57 (3.3)

Examples show that:
– Not all criteria and time limited ageing assumptions necessary for performing a comprehensive ageing management review of electrical and I&C equipment for the period of LTO have been established.
– The plant equipment qualification (EQ) of some safety related cables is not finalized.

3.4.3. Review of ageing management programmes

Findings: 11 recommendations, 4 suggestions, 1 good practice

Areas for improvement:
- In some plants, the equipment qualification (particularly environmental qualification) programme is not comprehensive (9/23).
- In some plants, AMPs for electrical and I&C SCs are not adequately developed or implemented (e.g., gaps in identification of managed ageing effects, trending, acceptance criteria, corrective actions, documentation) (4/23).

- In a few plants, some practice of storing equipment and furniture in close proximity of electrical and I&C safety equipment may jeopardize operability during and after a seismic event (2/23).

IAEA Basis: SSR-2/2 (Requirement 13, 4.48-49, 4.54); SSG-48 (5.38, 5.43, 5.46.); NS-G-2.12 (2.5); NS-G-1.6 (3.20, 4.10); SRS-3 (2.10); SRS-57 (3.3.2)

Examples show that:
– The equipment qualification programme is not fully established and implemented.
– The plant has not developed specific ageing management programmes for electrical and I&C components for LTO.
– Practices of equipment & material storage close to electrical and I&C safety equipment is not conducive to ensure equipment operability during and after a seismic event.

The good practice is related to comprehensive vibration monitoring of rotating equipment.

3.4.4. Obsolescence management programme

Findings: 2 recommendations, 5 suggestions, 1 good practice

Area for improvement:
- In some plants, a proactive programme for managing technological obsolescence is not developed/ fully established. (7/23)

IAEA Basis: SSR-2/2 (4.50); SSG-48 (6.1-7, 6.9-11); NS-G-2.12 (5.1, 5.3-7);

Examples show that:
– The plant has not yet established a comprehensive, proactive technological obsolescence programme.
– The newly developed proactive obsolescence management programme is not completely implemented.

The good practice is related to obsolescence management taking into consideration the long-term ageing management assessments and transition to decommissioning requirements.

3.4.5. Existing time limited ageing analyses

Findings: 2 recommendations, 1 good practice

Area for improvement:
- In few plants, quality or identification of TLAAs for electrical and I&C SCs is not complete or adequate (2/23).

IAEA Basis: SSR-2/2 (Requirement 13, 4.48-49); SSG-48 (4.23, 4.25, 7.17)); NS-G-2.12 (4.39, 7.3, 7.6-7); SRS-3 (2.3, 5.3.1); SRS-57 (3.3.2)

Examples show that:

– Attributes of time limited ageing analysis (TLAA) and environmental qualification (EQ) for motor operated valves (MOV) and cables are insufficiently described.

The good practice is related to activities linked to seismic qualification.

3.4.6. Revalidation of time limited ageing analyses

Findings: 1 recommendation

Area for improvement:
- In a few plants, revalidation of TLAAs for electrical and I&C SCs is not complete or adequate (1/23).

IAEA Basis: SSR-2/2 (4.54); NS-G-2.12 (6.3); SRS- 57 (2.2, 6)

3.4.7. Data collection and record keeping

Findings: 2 recommendations, 2 suggestions

Area for improvement:
- In some plants, data management (consistency and completeness) of electrical and I&C SCs is not adequate. (4/23)

IAEA Basis: SSR-2/2 (Requirement 15, 4.38, 4.52); SSG-48 (3.23, 5.9-10); NS-G-2.12 (4.10-12); NS-G-2.4 (6.78);

Examples show that:
– There are several stand-alone databases for SCs used in the LTO programme that are inconsistent and incomplete.

3.5. Ageing management review, review of ageing management programmes and revalidation of time limited ageing analyses for civil structures

TABLE VIII. SUMMARY OF FINDINGS (AREA E)

Title		Rec.	Sug.	GP	Total
5.1	Area-specific scoping and screening	1			1
5.2	Ageing management review	8	5		13
5.3	Review of ageing management programmes	8	2		10
5.4	Obsolescence management programme				
5.5	Existing TLAAs	3			3
5.6	Revalidation of TLAAs	2			2
5.7	Data collection and record keeping			1	1
Total		22	7	1	30

3.5.1. Area-specific scoping and screening of SSCs for LTO

Findings: 1 recommendation

Area for improvement:
- In a few plants, the scope setting of civil SSCs for LTO components is not properly implemented (1/23).

IAEA Basis: SSR-2/2 (4.51, 4.54); NS-G-2.12 (4.14); SRS- 57 (4.1)

3.5.2. Ageing management review

Findings: 8 recommendations, 5 suggestions

Area for improvement:
- In many plants, AMR for civil SCs for LTO is not adequately performed (e.g., gaps in condition assessment, identification of potential ageing effects, identification of relevant programmes to manage ageing, documentation) (13/23).

IAEA Basis: SSR-2/2 (Requirement 14, 4.50-51, 4.53-54); SSG-48 (5.26, 7.23); NS-G-2.12 (4.21, 4.26, 4.28-30); SRS-57 (4,5,6)

Examples show that:
- Not all degradation mechanisms and ageing effects of civil structures in LTO scope are thoroughly addressed and recorded.
- AMR for civil structures does not incorporate plant specific operating experience.
- The existing list of degradation mechanisms and ageing effects for AMR and AMP for civil structures and components is not complete.

AMRs for civil structures should receive more attention. Quality of AMRs is typically lower than AMRs for mechanical and electrical and I&C SSCs partially due to lack of relevant information from operating and maintenance history and previous monitoring and inspection activities and partially due to lower attention of power plants.

3.5.3. Review of ageing management programmes

Findings: 8 recommendations, 2 suggestions

Area for improvement:
- In some plants, AMPs for civil SCs are not adequately developed or implemented (e.g., gaps in identification of managed ageing effects, trending, acceptance criteria, corrective actions, documentation) (10/23).

IAEA Basis: SSR-2/2 (4.50, 4.53, 4.54); SSG-48 (5.37-39, 5.47); NS-G-2.12 (2.5, 4.32-33); SSG-25 (3.8, 5.48); SRS- 57 (2.2, 5.3)

Examples show that:

– The plant has not completed the review and update of the AMPs for civil structures and components for the LTO period.
– Degradation mechanisms acceptance criteria and their applicability for some ageing effects are not complete.
– The plant procedures for ageing management of civil structures important for safety are not sufficiently developed, upgraded and rigorously implemented.
– Corrective actions for ageing effects of civil structures are not timely implemented.

Development and implementation of AMPs for civil SSCs typically lags that for mechanical and electrical and I&C SSCs as the effect of ageing on civil SSCs is normally not so urgent as on other SSCs and sufficient attention is not paid to them.

3.5.4. Obsolescence management programme

No findings.

3.5.5. Existing time limited ageing analyses

Findings: 3 recommendations

Area for improvement:
- In a few plants, quality or identification of TLAAs for civil SCs is not complete or systematic (3/23).

IAEA Basis: SSR-2/2 (Requirement 14); SSG-48 (5.25, 5.64, 5.67); NS-G-2.12 (6.3); SRS-57 (2.2, 6.1.4)

Examples show that:
– TLAA for containment prestress loss is not adequate.
– TLAA for containment prestressing tendons is not adequate.

3.5.6. Revalidation of time limited ageing analyses

Findings: 2 recommendations

Area for improvement:
- In a few plants, revalidation of TLAAs for civil SCs is not complete or adequate (2/23).

IAEA Basis: SSR-2/2 (4.54); SSG-48 (5.64-65, 5.67-68); SRS- 57 (2.2, 6)

Examples show that:
– Approach to revalidation of civil structure TLAAs is not comprehensive.

3.5.7. Data collection and record keeping

Findings: 1 good practice

The good practice is related to automatic calculation within the plant information system for the Local Leak Rate Tests (LLRT) parameters as well as the global containment leak rates.

3.6. Human resources, competence and knowledge management for LTO

TABLE IX. SUMMARY OF FINDINGS (AREA F)

Title		Rec.	Sug.	GP	Total
6.1	Human resources policy and strategy to support LTO	9	1	1	11
6.2	Competence management for LTO and recruitment, training, and qualification processes for personnel involved in LTO activities	2	4		6
6.3	Knowledge management and knowledge transfer for LTO	6	3	1	10
Total		17	8	2	27

3.6.1. Human resources policy and strategy to support LTO

Findings: 9 recommendations, 1 suggestion, 1 good practice

Area for improvement:
- In many plants, human resources policy and strategy to support LTO is not adequate or not fully developed (10/12).

IAEA Basis: GSR Part 2 (4.20-22, 4.27); SSR-2/2 (Requirement 4, 3.10-11); SSG-48 (4.1-2, 4.4); NS-G-2.12 (3.10, 4.2); GS-G-3.1 (4.1-2, 4.6-7)

Examples show that:
– The plant does not have a comprehensive strategy and plan for the management of human resources, and necessary competences, for LTO.
– Long term staffing plan for LTO is not established.
– A lack of sufficient trained and competent staff can negatively impact LTO.
– Human resources activities are not coordinated in a sustainable way to support LTO.

The good practice is related to the succession planning for positions identified as safety related positions.

3.6.2. Competence management for LTO and recruitment, training, and qualification processes for personnel involved in LTO activities

Findings: 2 recommendations, 4 suggestions

Area for improvement:
- In many plants, competence management is not adequate or fully implemented (6/12).

IAEA Basis: GSR Part 2 (Requirement 9, 4.20-23, 4.25-26); SSR-2/2 (3.10-11); GS-R-3 (2.8, 4.2); GS-G-3.1 (4.4, 4.6-7),

Examples show that:

- Systematic, coordinated and well-embedded competence and knowledge management is not developed and implemented to support the plant LTO.
- The plant has not finalized the process of identifying and enhancing the knowledge and competences related to ageing management for LTO period.

3.6.3. Knowledge management and knowledge transfer for LTO

Findings: 6 recommendations, 3 suggestions, 1 good practice

Area for improvement:

- In many plants, knowledge management or knowledge transfer processes for LTO are not adequate or fully implemented (9/12).

IAEA Basis: GSR Part 2 (Requirement 9, 4.20-23, 4.25-26); SSR-2/2 (3.10-11, 4.23, 5.5); GS-R-3 (2.8, 4.2-4, 5.7); GS-G-3.1 (4.2, 4.4, 4.6-8); GS-G-3.5 (4.13-14),

Examples show that:

- There is no systematic plan for the transfer of LTO related knowledge into the line organization.
- Knowledge management and knowledge transfer for LTO is neither formalized nor implemented in the organization.
- The plant has not systematically analysed and implemented all the components of an integrated knowledge management process.

The good practice is related to ‘Key Knowledge’ training process.

3.7. SALTO and OSART LTO area follow-up

SALTO follow-up missions are an integral part of the service and take place approximately 2 years after the main missions. In the period July 2015 to June 2018 there were 4 SALTO follow-up missions to review the implementation of previous SALTO results. Issues from 1 OSART LTO area were reviewed during the OSART follow-up mission in this period.

TABLE X. SALTO FOLLOW-UP MISSIONS

SALTO Mission No.	Plant	Country	Year
19	Ringhals-1/2	Sweden	2016
20	Dukovany	Czech Republic	2016
21	Tihange-1	Belgium	2016
22	Laguna Verde	Mexico	2017

TABLE XI. OSART FOLLOW-UP MISSIONS WITH LTO AREA

OSART Mission No.	Plant	Country	Year
188	Bruce B	Canada	2017

The following are the results of the follow-up missions regarding the resolution of the findings (totally 50 issues):

TABLE XII. RESOLUTION OF ISSUES

Status of issues	Issues	%
Resolved	16	32.0
Satisfactory progress	27	54.0
Insufficient progress	7	14.0

The results of the follow-up missions demonstrate the effectiveness of the SALTO programme and in particular the commitment of NPP personnel to implement improvements identified by SALTO teams. The IAEA Operational safety section also offers supporting activities (i.e. workshops, supports missions) after the individual missions.

4. SUMMARY OF AREAS FOR IMPROVEMENT

In this Section the summary of areas for improvement classified by each area is provided for the missions in Tables I and II. The area of 'Human resources, competence and knowledge management for LTO' was only reviewed as part of 12 SALTO missions. It should be also noted that the numbers provided for each area for improvement given in brackets provide the number of mission reviews in which this issue was observed against the total number of reviews.

Organization and functions, current licensing basis, configuration/ modification management

- In a few plants, there is an indication that regulatory expectations for safe LTO are not clear for the plant (3/23).
- In some plants, NPP and regulatory authority documents developed to provide requirements and guidance for LTO do not cover all safety aspects (4/23).
- In a few plants, organization for supporting LTO is not fully established (3/23). In some plants, exiting organization is not adequate for supporting LTO (7/23).
- In a few plants, the plant LTO policy is not established, leading to problems related to strategy, tasks, roles, responsibilities, organizational structure and how well the organization knows the LTO approach and expectations (3/23).
- In some plants, the content of the LTO implementation programme is not complete (6/23).
- In some plants, PSR is not comprehensive (5/23). In a few plants, final safety analysis report (FSAR) is not being fully updated for LTO (2/23).
- In some plants, design basis documentation is not adequately managed to ensure its availability for the plant. (6/23)
- In a few plants, function of design authority is not fully implemented. (2/23)

Scoping and screening and plant programmes relevant to LTO

- In many plants, scoping and screening is incomplete (19/23).

  The following type of issues were identified during the reviews (some items occurred in the same plant, so the sum does not correlate with the above total number):
  - Definition of criteria for scope setting and boundaries between systems, structures and components (SSCs) are unclear (7/23);
  - Incomplete documentation of the process/ results of scope setting (4/23);
  - The methodology for scope setting is not established (3/23);
  - The methodology for scope setting is not consistently used for LTO (3/23);
  - Ageing of the active and short-lived systems and components (SCs) is not properly managed (3/23).

- In many plants, existing plant programmes are not adequate for LTO (15/23).

  Typical issues are given below (some items occurred in the same plant, so the sum does not correlate with the above total number):

  - Insufficient coordination of existing plant programmes with ageing management (11/23);
  - Insufficient evaluation of effectiveness of existing plant programmes (7/23).

Ageing management review (AMR), review of ageing management programmes (AMPs) and revalidation of time limited ageing analyses (TLAAs) for mechanical components

- In a few plants, the scope setting of mechanical SSCs for LTO components is not properly implemented (1/23).
- In many plants, AMR of mechanical SCs for LTO is not adequately performed (e.g., gaps in condition assessment, identification of potential ageing effects, identification of relevant programmes to manage ageing, documentation) (12/23).
- In some plants, AMPs for mechanical SCs are not adequately developed or implemented (e.g., gaps in identification of managed ageing effects, trending, acceptance criteria, corrective actions, documentation) (6/23).
- In a few plants, a proactive programme for managing technological obsolescence is not developed/ fully established (2/23).
- In some plants, quality or identification of TLAAs for mechanical SCs is not complete or systematic (5/23).
- In some plants, revalidation of TLAAs for mechanical SCs is not complete or adequate (7/23).
- In some plants, data management (consistency and completeness) of mechanical SCs is not adequate (4/23).

Ageing management review, review of ageing management programmes and revalidation of time limited ageing analyses for electrical and I&C components

- In some plants, the scope setting of electrical and I&C SSCs for LTO is not properly implemented (5/23).
- In some plants, AMR for electrical and I&C SCs for LTO is not adequately performed (e.g., gaps in condition assessment, identification of potential ageing effects, identification of relevant programmes to manage ageing, documentation) (6/23).
- In some plants, the equipment qualification (particularly environmental qualification) programme is not comprehensive (9/23).
- In some plants, AMPs for electrical and I&C SCs are not adequately developed or implemented (e.g., gaps in identification of managed ageing effects, trending, acceptance criteria, corrective actions, documentation) (4/23).
- In a few plants, the practice of equipment storage in close proximity of electrical and I&C safety equipment may jeopardize operability during and after a seismic event (2/23).
- In some plants, a proactive programme for managing technological obsolescence is not developed/ fully established (7/23).
- In few plants, quality or identification of TLAAs for electrical and I&C SCs is not complete or systematic (2/23).
- In few plants, revalidation of TLAAs for electrical and I&C SCs is not complete or adequate (1/23).
- In some plants, data management (consistency and completeness) of electrical and I&C SCs is not adequate (4/23).

Ageing management review, review of ageing management programmes and revalidation of time limited ageing analyses for civil structures

- In a few plants, the scope setting of civil SSCs for LTO components is not properly implemented (1/23).
- In many plants, AMR for civil SCs for LTO is not adequately performed (e.g., gaps in condition assessment, identification of potential ageing effects, identification of relevant programmes to manage ageing, documentation) (13/23).
- In some plants, AMPs for civil SCs are not adequately developed or implemented (e.g., gaps in identification of managed ageing effects, trending, acceptance criteria, corrective actions, documentation) (10/23).
- In a few plants, quality or identification of TLAAs for civil SCs is not complete or systematic (3/23).
- In a few plants, revalidation of TLAAs for civil SCs is not complete or adequate (2/23).

Human resources, competence and knowledge management for LTO

- In many plants, human resources policy and strategy to support LTO is not adequate or not fully developed (10/12).
- In many plants, competence management is not adequate or fully implemented (6/12).
- In many plants, knowledge management or knowledge transfer processes for LTO are not adequate or fully implemented (9/12).

5. ASSESSMENT OF OVERALL SALTO MISSIONS TRENDS

5.1 Comparison mission results with 'SALTO Missions Highlights 2005-2015'

Table XIII (same as TABLE III) shows the number of issues and the number of good practices identified during the 14 SALTO (No. 23-36) and 9 OSART missions.

TABLE XIII. FINDINGS OVERVIEW (missions during July 2015-June 2018)

	Area A (O&F, CLB, CM)	Area B (S&S, PP)	Area C (Mech.)	Area D (E, I&C)	Area E (Civil)	Area F (HR, KM)	Total
Recommendations	16	31	20	24	22	17	130
Suggestions	26	17	17	16	7	8	91
Good Practices	2	5	3	3	1	2	16
Missions	14+9	14+9	14+9	14+9	14+9	12	-

Table XIV shows results of SALTO missions Highlights 2005-2015 on findings overview, that is, the number of issues and the number of good practices identified during the 13 SALTO (No. 9-11 and 13-22) and 2 OSART missions:

TABLE XIV. FINDINGS OVERVIEW (missions during July 2007- June 2015)

	Area A (O&F, CLB, CM)	Area B (S&S, PP)	Area C (Mech.)	Area D (E, I&C)	Area E (Civil)	Area F (HR, KM)	Total
Recommendations	16	25	25	18	21	4	120
Suggestions	22	13	28	11	11	4	88
Good Practices	1	1	6	6	0	3	17
Missions	13+2	13+2	13+2	13+2	13+2	5	-

These tables show that missions between July 2015 and June 2018 (3 years period) identified more issues (221) than those during the eight years from 2007-2015 (208).

Trend: This shows intensive activity in this area with high demand from Member States.

Number of issues per mission per area has decreased (2015-2018 vs. 2005-2015):

Area A: total 42 > 38, per mission 1.83 < 2.53*;
Area B: total 48 > 38, per mission 2.09 < 2.53;
Area C: total 37 < 53, per mission 1.61 < 3.53;
Area D: total 40 > 29, per mission 1.74 < 1.93;
Area E: total 29 < 32, per mission 1.26 < 2.13;
Area F: total 25 > 8, per mission 2.08 > 1.6.

*Note: 42 issues in the period of 2015-2018 (divided by 14 missions in the period means 1.83 issue per mission) comparing to 38 issues in the period of 2005-2015 (divided by 13 missions in the period means 2.53 issue per mission).

Trend: This shows better understanding and clarity of IAEA Safety Standards, better IAEA support of NPPs prior to the missions through workshops and participation of plant experts in SALTO missions as observers and in IGALL Programme. It leads to better preparedness for SALTO missions by the plant. The exception is relatively new area F, introduced in 2012, where number of issues per mission has increased and better IAEA support of NPPs is needed.

Number of good practices per mission has decreased (0.70 good practices per mission in 2015-2018 vs. 1.13 good practices per mission in 2005-2015) while number of good performances is increasing (not shown in this report).

Trend: This shows good information exchange and sharing of experience which is strongly supported by IAEA. It should be noted that since good practices has to be novel, they can be identified only once but if implemented in some other plants, they are recognized as a good performance.

5.2 Comparison follow-up mission results with 'SALTO Missions Highlights 2005-2015'

Table XV (same as TABLE XII) shows the results of the follow-up missions regarding the resolution of the findings (total 50 issues) after the 4 SALTO follow-up missions and 1 OSART follow-up mission.

TABLE XV. RESOLUTION OF ISSUES (follow-up missions during July 2015-June 2018)

Status of issues	issues	%
Resolved	16	32.0
Satisfactory progress	27	54.0
Insufficient progress	7	14.0

Table XIV shows results of SALTO missions Highlights 2005-2015 on resolution of issues, that is, the number of issues classified status after the 6 SALTO follow-up missions and 2 OSART follow-up missions:

TABLE XVI. RESOLUTION OF ISSUES (follow-up missions during July 2007- June 2015)

Status of issues	issues	%
Resolved	37	48.1
Satisfactory progress	35	45.5
Insufficient progress	4	5.2

Trend: Share of 'resolved' issues has decreased from 48% in 2007-2015 to 32% in 2015-2018 and share of 'insufficient progress' issues has increased from 5% in 2007-2015 to 14% in 2015-2018 due to significant delays in implementation of LTO programmes in several NPPs, mostly due to political decisions in those countries and reorganization in utilities.

5.3 Classification considering cross-cutting issues over areas

Cross-cutting issues over several review areas of SALTO guidelines (SVS-26, 2014) are increasing. To illustrate trends more clearly the following evaluations were conducted.

5.3.1 Classification by broader categories

Table XVII shows the results of classification by broader categories of all 221 issues raised during the review period of July 2015 to June 2018 (SALTO and LTO areas of OSART). The analysis was performed by utilizing results of SALMIR (SALTO Mission Results database).

TABLE XVII. FINDINGS OVERVIEW (classified by broader categories)

Categories	Original Area in SALMIR	issues	%
1. Existing / plant programme	[2.2, 3.4, 3.7, 4.4, 4.7, 4.8, 5.4, 5.7]	38	17.2
2. Ageing management programme	[1.4, 3.3, 4.3, 5.3]	37	16.7
3. Scope setting	[2.1, 3.1, 4.1, 5.1]	34	15.4
4. Ageing management review	[3.2, 4.2, 5.2]	31	14.0
5. Human resources and knowledge/ competence management	[6.1-6.3]	25	11.3
6. Time limited ageing analysis	[3.5, 3.6, 4.5, 4.6, 5.5, 5.6]	20	9.0
7. Overall management	[1.1, 1.2, 1.3]	21	9.5
8. Design and safety analysis	[1.5, 1.6]	15	6.8

Table XVII shows following trends:

– The number of issues belonging to Top 4 categories is broadly similar (app. 15%);
– A least one issue is raised for every core topic (scope setting, AMR, AMP and TLAA) during every SALTO mission;
– Issues on SALTO missions core topics (scope setting, AMR, AMP and TLAA - categories 2,3,4,6) account for approximately 55% of all issues.

5.3.2 Classification by key words

Table XVIII shows the results of analysis of issues using specific key words raised at area A - E of 14 SALTO missions except for scope, AMR, AMP and TLAA.

TABLE XVIII. ISSUES WITH SPECIFIC KEYWORDS (Area A-E)

Keyword	Missions the issue was raised	Number of missions	%
a. Equipment/ environmental qualification (EQ)	23, 24,26-35	12	85.7
b. Data management/ DB	24,25,27,28,30,32-35	9	64.3
c. Obsolescence management	23,24,26-29,31,34,36	9	64.3
d. Organization	24,25,27,28,30,32,34-36	9	64.3
e. Safety analysis (PSR, FSAR)	27,29,30,31,34,35	6	42.9

Table XIX shows the results of analysis of issues using specific key words raised at area F of 12 SALTO missions.

TABLE XIX. ISSUES WITH SPECIFIC KEYWORDS (Area F)

Keyword	Missions the issue was raised	Number of missions	%
f. Knowledge management	23-25, 27-35	12	100.0
g. Human resources/ staffing	23-25, 27, 28, 32,33,35	10	83.3
h. Competence management	23,24,28-33, 35	9	75.0

Trend: These tables show common issues in other than core topics in many plants, some with frequency of more than 80%, such as:

- Knowledge management;
- Equipment / Environmental Qualification;
- Human resources /staffing.

6. CONCLUSIONS

The SALTO safety review service was launched in 2005. The first mission which can be considered full-scope Pre-SALTO/ SALTO mission was conducted in 2007. Since then the Agency has significantly improved the methodology and efficiency of the SALTO safety review service, trained a large pool of SALTO reviewers and performed many SALTO and other ageing management and LTO oriented workshops and support missions. The Agency Safety Standards have been also significantly improved.

Despite much better trained reviewers and improved methodology of SALTO missions, the decreasing number of issues per mission per area (see section 5.1) over the last three years demonstrates significant improvement in plants` understanding and clarity of IAEA Safety Standards, better IAEA support of NPPs prior to the missions through workshops, and the benefits of participation of plant experts as observers in SALTO missions and in the IGALL (International Generic Ageing Lessons Learned) Programme. The have all led to overall better preparedness for SALTO missions by nuclear power plants.

The exception is the relatively new ‘Area F’ (Human resources, competence and knowledge management for LTO), introduced in 2012, where the number of issues per mission increased over the period 2015-2018 compared to the period 2012-2015. The reason for the increased number of issues is the improved methodology and training of SALTO reviewers. The Agency also plans to provide enhanced support to NPPs prior to SALTO missions. Operational Safety Section (of the IAEA Nuclear Safety and Security Department) cooperates closely in this matter with the IAEA Nuclear Energy Department.

The decreasing number of good practices per mission (see section 5.1) and increasing number of good performances (not shown in this report) also demonstrates improved information exchange and sharing of experience which is strongly supported by the IAEA. The IGALL Programme, launched in 2010, plays a key role in this regard.

There are some areas with a very high frequency of issues (in some cases in more than 80% of missions). Knowledge management, equipment/ environmental qualification, data management and obsolescence management are examples of topics where improved Agency guidance is still desired and improved Agency support prior to the missions needed.