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AMAT guidelines

Reference document for the IAEA Ageing Management Assessment Teams (AMATs)

INTERNATIONAL ATOMIC ENERGY AGENCY

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AMAT GUIDELINES
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FOREWORD

Effective ageing management is an important element in any plant operator's arrangements for ensuring the safety of a nuclear power plant (NPP). The IAEA Ageing Management Assessment Team (AMAT) programme provides advice and assistance to utilities or individual nuclear power plants to strengthen and enhance the effectiveness of ageing management programmes (AMPs). Such AMPs are being required by an increasing number of safety authorities and implemented by an increasing number of utilities, often as a part of NPP life or life-cycle management programmes that involve the integration of ageing management and economic planning. An AMAT review can be a programmatic review of the AMP for a utility or NPP or a review focused on specific age-related problems or issues.

The guidelines set down in this report are primarily intended for IAEA-led AMAT team members as a basic structure and common reference for peer reviews of AMPs. However, the guidelines have also been designed to provide guidance to utilities or NPPs carrying out their own self-assessments or comprehensive programme reviews. The guidelines are intended to be generic, recognizing that there will be differences between utilities and NPPs and that the scope of the reviews will vary.

IAEA-led AMAT missions compare, as far as possible, the AMP for an NPP with guidance and equivalent good practices elsewhere. These are based on: guides and safety practices produced by international organizations; national policies and regulations; industrial codes and standards and the expertise of the AMAT members themselves.

AMAT reviews are performance-related in that they accept different approaches to the implementation of AMPs, depending on the design of the NPPs. Recommendations are made on items of direct relevance to safety. Suggestions made might indirectly enhance the effectiveness of the AMP only but would certainly stimulate the NPP staff to consider ways and means of improvment. Commendable good practices identified may be communicated to other utilities or NPPs for long term improvement.

The IAEA staff member responsible for this publication was J. Pachner of the Division of Nuclear Installation Safety.

EDITORIAL NOTE

In preparing this publication for press, staff of the IAEA have made up the pages from the original manuscript(s). The views expressed do not necessarily reflect those of the IAEA, the governments of the nominating Member States or the nominating organizations.

Throughout the text names of Member States are retained as they were when the text was compiled.

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CONTENTS

Part I

AGEING MANAGEMENT ASSESSMENT

I-1. INTRODUCTION

Effective ageing management[1] is a very important element in any operator's arrangements for ensuring the safety of a nuclear power plant (NPP). Thus, an ageing management programme (AMP) for systems, structures and components (SSC) important to safety is increasingly becoming a necessary review area when carrying out a periodic safety review (PSR) as described in the IAEA Safety Guide "Periodic Safety Review of Operational Nuclear Power Plants" [1].

Systematic AMPs are being required by an increasing number of safety authorities and being implemented by an increasing number of utilities, often as a part of NPP life of life-cycle management[2] programmes which involve the integration of ageing management and economic planning. It is recognized that economic considerations are an important aspect of decisions on the type and timing of ageing management actions and continued plant operation. However, since the present report is written from the safety perspective, it deals only with the ageing management which is a subset of the life management.

Typically, differences in AMPs are seen between utilities having one or more reactor designs and a large number of operating plants, and those utilities having perhaps only one reactor. Even small differences in the design and operation of reactors of the same type can lead to differences in the details of AMPs. Thus, it is readily apparent that, with the variations in the AMPs between different utilities in different countries, an absolute measure of the adequacy and effectiveness of the ageing management practices in any one utility or in any one country is not possible.

An Ageing Management Assessment Team (AMAT) can compare the AMP for a nuclear plant with existing guidelines and good practices elsewhere. The AMAT should be judgemental in evaluating the AMP with respect to these guidelines and practices, and it can provide recommendations and suggestions for improvement. For this comparison, the team should consider the arrangements of the utility at its headquarters and should visit an NPP site. Assessment reports from other relevant peer reviews or from self-assessments should also be taken into account in assessing the effectiveness of the AMP arrangements.

The working language of the IAEA-led AMAT reviews is English.

International guidelines referred to in this report are those produced by organizations such as IAEA, IEC, NEA of OECD and CEC. National guidelines include regulatory policy and regulations; industrial codes and standards.

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[1] Ageing management is defined as engineering, operations and maintenance actions to control within acceptable limits ageing degradation of systems, structures and components.

[2] Life management is defined as the integration of ageing management and economic planning to: (1) optimize the operation, maintenance, and service life of SSCs; (2) maintain an acceptable level of performance and safety; and (3) maximize return on investment over the service life of plant.

I-2. PURPOSE OF THE GUIDELINES

This report has been prepared to provide a basic structure and common reference for peer reviews of AMPs by IAEA-led AMAT missions. As such, it is addressed principally to the team members of the IAEA AMAT missions. The guidance presented is written also to be useful to utilities and NPPs carrying out their own AMP reviews.

AMAT missions can perform two types of review:

- a programmatic review of the overall AMP for the utility or NPP; or
- a review focused on specific age-related problems or issues (this could be for specific components or structures, e.g. pumps, steam generators, cables, valves, containments, or specific ageing mechanism, e.g. irradiation/thermal embrittlement, fatigue, corrosion, wear).

An AMAT review of the operation and effectiveness of an AMP is based on the review of NPP documents, practices and operating experience relating to the management of ageing. Typically, these documents address:

- AMP policy;
- selection of SSCs;
- understanding of ageing mechanisms;
- inspection, monitoring and assessment arrangements;
- actions taken to minimize degradation;
- actions taken to correct unacceptable degradation;
- setting up systems to provide feedback of experience;
- record-keeping and trending.

This list is not exhaustive and reference should be made to three IAEA publications containing guidance on ageing management programmes. These are a Technical Report, "Methodology for the Management of Ageing of Nuclear Power Plant Components Important to Safety" [2], a Safety Practices publication, "Data Collection and Record Keeping for the Management of Nuclear Power Plant Ageing" [3], and a Safety Report, "Implementation and Review of Nuclear Power Plant Ageing Management Programme" [4].

This report is intended to help the AMAT experts prepare for and conduct their review in the light of their own experience and knowledge. It outlines the contents and process of an adequate review and should not limit the experts' investigations.

I-3. OBJECTIVES OF AMP ASSESSMENTS

The effectiveness of an NPP Ageing Management Programme can be assessed by three complementary kinds of assessment: self-assessment, peer review and comprehensive programme review by the plant owner/operator. These assessments differ in the independence of the review team, the degree of formality and the interval between assessments [4]. An IAEA-led AMAT mission is a peer review of a plant AMP or specific aspect(s) of an AMP. Furthermore, an AMAT review is not a compliance check; it is intended to provide assistance to whoever asks for it.

The common objective of AMP assessments is to help ensure that NPP SSCs important to safety are fit for continued safe operation of the plant. Additionally, each kind of assessment has its own specific objective:

Self-assessment

Optimization of the ageing management programme by continuous improvement.

Peer review

Determination of whether the existing programme meets the generally accepted practices and identification of areas for future improvement.

Comprehensive programme review

Determination of whether the ageing of SSCs important to safety is being effectively managed, the required integrity and functional capability of SSCs are being maintained, and an adequate ageing management programme is in place for continued safe plant operation.

I-4. PROTOCOL

Preparation for an AMAT mission will be initiated only after the IAEA has been formally approached by a Member State and funding (e.g. through an existing Technical Co-operation project) has been established. The scope of the review should be agreed between relevant organizations (e.g. a utility or an NPP) and the IAEA at this stage.

The report prepared by an AMAT mission will be confidential to the Member State visited unless specifically stated otherwise. The decision to implement any recommendations of the report lies entirely with the utility or NPP concerned.

I-5. METHODOLOGY

I-5.1. Preparation

After a request for an AMAT mission has been received from a Member State and funding has been established, the designated team leader will arrange for:

- the establishment of liaison contacts with the utility or NPP which will host the AMAT mission;
- necessary preparatory activities, which could include a preparatory meeting; if necessary, and;
- the recruitment and briefing of team members.

At the same time, the host organization should nominate a counterpart in each review area, who will be the primary contact with the expert(s) in that area during the review.

The preparatory activities will include the consideration of and an agreement on:

- the type of review requested (i.e. programmatic or SSC problem oriented);
- the scope of the review (e.g. comprehensive or audit type programme review; focused on specific ageing mechanism, or ageing management of a specific SSC);
- the composition of the team;
- the work plan;
- the hosting organization preparation for the review, including a list of the documentation required during the AMAT mission;
- preparation of the advance information package (see Section I-6); and
- logistic support required (see Section I-7).

I-5.2. Team composition

The team will consist of a leader, who is always an IAEA staff member, and a number of experts appropriate to the scope and type of the review. The host country or the host organization may propose experts to serve as team members, although no experts from the host country may serve as a team member. The host country or host organization may also propose observers to the team for consideration by the team leader.

The team members are selected by the team leader, to provide the team with an adequate depth and scope of expertise in ageing management. The composition of the review team should reflect the purpose of the review, either a programmatic review or a review of specific age related problems. Ideally, each team member should have knowledge of subjects related to ageing management programmes in addition to expertise in other relevant disciplines. The team leader shall consider the proposals of the host country or the host organization for team members and observers.

I-5.3. AMP safety review mission team leader

The team leader is responsible for:

- official liaison with the host country and organization;
- selecting team members;
- co-ordinating the mission;
- participating in the entry and exit meeting;
- supervising the review, by daily team meetings, by ensuring that the work plan is met, by informing representatives of the host organization of the results and progress of the review and by resolving any issues requiring decision;
- co-ordinating the preparation of all technical notes;
- producing the final AMAT mission report.

The team leader may participate in some of the detailed area(s) of review, depending on the type and scope of the AMAT mission.

I-5.4. The review

The review team uses three methods to acquire the information needed to develop recommendations. These are:

- review of documents/written material;
- interviews with personnel; and
- direct observation of the NPP physical condition and organization, practices and activities associated with the ageing management programme.

Team members are expected to cover each topic to the extent necessary to make an informed judgement. Differences from international practices which are identified should be investigated to the extent required to document any concerns accurately in the Technical Notes and in sufficient detail to be readily understandable. Recommendations and suggestions should be formulated on the basis of weaknesses identified. Similarly, good practices encountered in the review should be documented for the benefit of other utilities and described in the technical notes in sufficient detail to be readily understandable.

I.5.4.1. Documents

The basis of the plant ageing management review will consist of team members' reviews of relevant regulatory documents, plant policies and procedures, including AMP programmatic aspects, operating procedures, surveillance and inspection procedures, maintenance procedures, operating experience feedback procedures, programme quality procedures, and results achieved. These will be assessed against guidance contained in relevant international and national guidelines.

In a comprehensive programme review, documentation covering the following aspects of the management of ageing should be reviewed:

(a) Documents produced by the regulatory body, or on its behalf, such as:

- legislation, regulations, or regulatory guides.

(b) NPP's policies and procedures relating to ageing management:

- operation;
- surveillance and inspection;
- maintenance;
- equipment qualification;
- operating experience feedback;
- quality assurance;
- spare parts management.

(c) The NPP's ageing management programme documents such as:

- policy on ageing management;
- organizational arrangements for management of ageing, including assignment of responsibilities;
- programme co-ordination;
- resource allocation and qualification of personnel;
- data collection and record keeping procedures, including configuration management procedures.

(d) Documents on the scope of the AMP including:

- screening methodology description and listing of SSCs covered by the programme.

(e) Documents on programme quality to determine:

- the degree of understanding of SSC ageing, including the application of research information, operating experience and applicable pilot studies;
- the effectiveness of established programmes for detection, monitoring and mitigation of ageing.

(f) Records of results achieved, including:

- physical condition of the SSCs;
- equipment qualification status;
- relevant plant safety indicators;
- equipment performance trend records, including failure data;

- transient data, both design and actual; and,
- maintenance records.

In a review focused on a specific age-related problem or issue, all relevant documents and information should be reviewed, such as:

- significant event reports;
- inspection results and problems;
- assessment results;
- baseline data;
- operating and maintenance history;
- generic operating experience.

I.5.4.2. Interviews

After the review of written material, interviews with plant personnel can be used to:

- obtain additional information not covered in the documentation;
- review issues arising out of the documentation reviews;
- judge the effectiveness of the arrangements, duties and responsibilities of the plant's ageing management organization;
- determine whether administrative arrangements and technical programme elements meet established international guidelines and consensus;
- elicit individual opinions; and
- form a judgement of the knowledge base, training and resources of the utility and NPP staff.

An introductory meeting, during which an overview of a plant AMP is given and advance reference materials are briefly discussed, is considered one of the interviews.

The interviews also provide an opportunity for important information to be exchanged between reviewers and counterparts. Interviews should be give and take discussions; not interrogation of counterparts by reviewers. Properly conducted, such interviews form a critical part of the overall reviews.

I.5.4.3. Observations

Direct observation of the activities carried out within an AMP are an important aspect of the review process. The observation should, in general, cover:

- use of procedures and instructions;
- regular and specific reporting requirements;
- quality assurance and quality control programmes and methods;
- use of equipment; collection, storage and retrieval of data;
- implementation of maintenance, inspection and testing programmes;
- arrangements for monitoring and feedback;
- arrangements for updating technical assessments;
- management control; and
- physical condition of the NPP.

From these observations, the AMAT will form a view of:

- the management policy on and commitment to a systematic ageing management programme;
- the commitment of the staff;
- the capability of the staff in terms of resources and technical knowledge and skills;
- the physical condition and functional capability of the equipment;
- the effectiveness of vertical and lateral lines of communication;
- the traceability of data and safety assessments; and
- record keeping and trend monitoring.

On the basis of the interviews and observations, the AMAT can then, if appropriate, modify their preliminary views, which were based on the review of AMP documents, to form a judgement on the effectiveness of the programme. It may be that more than one iteration through document review, interview and observation will be necessary in order to form a final judgement.

I-5.5. Reporting

The AMAT review compares observed practices with existing national and international consensus guidelines and equivalent good practices elsewhere. The review should:

- identify programmatic strengths and weaknesses,
- provide advice on management of ageing of a specific component or class of components;
- make comparisons and offer proposals for improvement;
- consider how effectively NPP policies, programmes and procedures are implemented in practice.

The comparisons may result in recommendations or suggestions or the identification of good practices in accordance with the following definitions:

Recommendation: A recommendation is advice on how improvements in the ageing management programme can be made in areas that have been reviewed. Such advice is based on proven international practices and should address the root causes rather than the symptoms of concerns raised. A recommendation can be for an improvement in management or programmatic aspects of the overall programme or in dealing with a specific age-related problem. A recommendation should be specific, realistic and designed to result in tangible improvements.

Suggestion: A suggestion is either an additional proposal in conjunction with a recommendation, or may stand on its own. It may indirectly contribute to improvements in the ageing management programme, but it is primarily intended to make the programme performance more effective, to indicate enhancements of existing practices and to point out superior alternatives to current practices. In general, it should strongly encourage the plant management and staff to consider ways of enhancing performance.

Good practice: A good practice is an indication of an outstanding organization, arrangement, programme or performance, superior to those observed elsewhere, and more than just the

fulfilment of current requirements and expectations. It must be superior enough to be worth bringing to the attention of other nuclear plant operators as a model in the general drive for excellence.

Each working day of the review, the team leader will hold a brief co-ordination meeting where each team member should summarize findings for the day, including perceived strengths and weaknesses in order to allow all the review areas to be discussed at the same meeting. This should create the opportunity for team members to consolidate their views.

I.5.5.1. Technical notes

During the course of the review, after each co-ordination meeting, team members will write detailed technical notes on their observations and conclusions, including any recommendations, suggestions or good practices. These form the basis of oral presentations at the exit meeting. One or more copies of the technical notes are given to plant management prior to the exit meeting.

The technical notes are the 'field notes' of the individual team members and are not intended for distribution beyond the plant management.

Guidelines for drafting technical notes are presented in Part III.

I.5.5.2. The review team report

On completion of the review, the team leader will prepare the team report on the basis of the technical notes. This is an official team document that summarizes the team's main findings and conclusions from comparisons with proven international practices, including all recommendations, suggestions and good practices. Before the text is finalized, the management of the NPP whose AMP has been reviewed will be given the opportunity to comment. The final report will be submitted through official channels to the Member State concerned. The IAEA will restrict distribution to the utility concerned, the contributors to the report and responsible IAEA staff. Further distribution is at the discretion of the Member State.

I-5.6. Duration

The duration of the assessment review will be based on the type and scope of the review and agreed to between the management of the NPP being assessed and the team leader during the preparation phase described in Section I-5.1. As a minimum, the schedule will accommodate the AMAT mission activities of the indicated participants, as shown in Table I.

I-6. ADVANCE INFORMATION PACKAGE

To facilitate the AMP review within the limited time available, AMAT members must be informed in advance of the review about the regulatory environment, NPP description and organization, and in particular, about the organization of the AMP programme, including its operations, maintenance and technical support arrangements and practices relating to the management of ageing. In the case of an AMAT mission focused on a specific age-related problem, additional relevant information should be provided.

TABLE I. PARTICIPATION IN AMAT MISSION ACTIVITIES

AMAT MISSION ACTIVITIES	Team leader	Team members	NPP management	NPP personnel
– introductory meeting	X	X	X	X
– briefing meetings	X	X		
– documentation reviews		X		X
– interviews of counterparts by team members		X		X
– interviews with plant staff	X	X	X	
– plant walkdowns		X		
– direct observations of programme practices		X		
– compilation of technical notes	X	X		
– preparation of the team report including documentation of recommendations, suggestions and good practices	X	X		
– reporting to station management, including exit meetings	X	X	X	

The suggested contents of the advance information package are:

(a) Administrative arrangements:

- arrival logistics (airport, hotel, plant);
- transportation (airport-hotel, hotel-plant);
- hotel information (name, mailing address, telephone, telefax);
- contact points at the plant (names, mailing address, telephone, telefax);
- site accommodation, meeting room arrangements, clerical and interpretation support, office machines.

(b) Regulatory environment:

- overview of regulations on nuclear safety and radiation protection;
- regulatory requirements on ageing management.

(c) Plant specific information:

General (approximately 10 pages of written material plus charts and illustrations)

- utility and NPP organization charts;
- site and NPP design description;
- operating history, current status and future plans;
- list of normal operating procedures;
- list of maintenance procedures;
- outline of surveillance and inspection programmes;
- outline of corrective and preventive maintenance programs;
- outline of technical support organization including interfaces with external organizations;
- outline of operating experience feedback system.

(d) Ageing management information:

- ageing management policy;
- organization of the AMP (or life cycle management programme), participating organizations and their interfaces, responsibilities, structure and staffing;
- documented method and criteria for identifying SSCs included in the ageing management programme;
- ageing management procedures;
- list of SSCs included in the ageing management programme[3];
- procedure to maintain equipment qualification during their installed life[3].

(e) For a specific age-related problem:

- problem description;
- description of the advice sought.

The advance information package should provide, in English, an overview of the listed topics, not details and should be prepared, to the extent possible, using existing documentation. The package should be delivered to the AMAT members at least one month before the mission start.

I-7. SUPPORT ARRANGEMENTS

Prior to the assessment of the ageing management programme, as part of the preparation for the AMAT mission, arrangements have to be made with the NPP involved for the provision of the necessary support and facilities, including translation and interpretation, as appropriate.

To the extent possible, the documents identified under I-5.4.1 should be provided in English as it would facilitate their review by the AMAT. However, it is recognized that their translation could be cost prohibitive and therefore alternative arrangements could be made for their review, e.g. through NPP personnel competent in English.

At all times, there should be at least one meeting room of suitable size and privacy at the disposal of the review team. Additionally, full secretarial services, including typing and copying facilities, should be made available by the NPP throughout the assessment.

I-8. FOLLOW-UP

The follow-up of the findings and recommendations for further improvement resulting from the assessment of the ageing management programme depends on the type of assessment that has been performed. An IAEA-led AMAT mission is a peer review.

Self-assessment

The findings of the self-assessment of the ageing management programme should result in timely actions to improve the ageing management activities as part of a continuous improvement process. This improvement shall be verified as part of the subsequent self-assessment.

[3] These documents may be made available for review at the plant.

Peer review

The findings of a peer review are formally reported to the utility management along with the corrective actions agreed by the NPP. Subsequent evaluations will determine the effectiveness of these actions in improving the ageing management.

Comprehensive programme review

The deviations from the current requirements and the deficiencies of the ageing management programme together with the proposed corrective measures are reported to the utility/NPP management and the regulator. An implementation schedule should be agreed between the utility/plant management and the regulator. Appropriate follow-up should be provided to ensure compliance with this schedule.

Part II

SUPPLEMENTARY GUIDANCE FOR AMP PROGRAMMATIC REVIEW

This supplementary guidance is intended to assist members of an AMAT to identify and acquire the information relating to the programmatic review of an AMP which they need to develop and produce satisfactory technical notes. This guidance is intended to promote thought rather than to be prescriptive. It may also be used for self-assessment by a utility or an NPP.

The supplementary guidance has been developed for the following areas of review (more details in Table II):

- AMP strategy
- AMP organization
- AMP activities
- AMP results
- AMP monitoring.

TABLE II. AREAS OF REVIEW

II-1	II-2	II-3	II-4	II-5
AMP STRATEGY	AMP ORGANIZATION	AMP ACTIVITIES	AMP RESULTS	AMP MONITORING
– Regulatory policy and requirements – AMP policy – International guidance – Scope of AMP	– AMP organization and programme description – Resources: (a) human (b) financial (c) tools and equipment (d) external – Provisions for understanding SSC ageing	– SSC screening method – List of SSCs – Operational procedures – Surveillance – Assessment – Maintenance – Data collection and record keeping NB: assessment includes data analysis	– Physical condition of SSC – EQ established and maintained – Performance indicators	– Self-assessment programme – Peer reviews – Comprehensive reviews – Continuous improvement process

Each review area is subdivided into 'attributes', 'documentation' and 'review topics'.

The 'attributes' subsection gives desirable characteristics of an AMP relating to the review area.

The 'documentation' lists information which should be made available for the review.

The 'review topics' are intended only to act as pointers, indicating specific topics or activities within the AMPs which should be reviewed. These suggested topics may not cover all topics or activities associated with an AMP and therefore addressing all of them does not necessarily mean that an AMP has been fully reviewed. Above all, they must not be used as a

Yes/No checklist, or, in any way, used to constrain the reviewer, who should use judgement regarding the usefulness and applicability of any review topic to an NPP. The review topics should be updated in accordance with current knowledge, standards and practices and checked for consistency with the relevant national and international codes and standards.

There is no primary reference document on which the reviews should be based. Relevant IAEA documents are listed in the References section.

A plant walk-down checklist is given in the Appendix to this supplementary information.

II-1. AGEING MANAGEMENT PROGRAMME STRATEGY

To provide for the timely detection and mitigation of ageing degradation of SSCs important to NPP safety, NPP owners/operators should have in place a systematic ageing management programme (AMP).

II-1.1. Attributes

The NPP owner/operator should take account of regulatory policy and guidance when setting up and implementing the AMP. Any regulatory requirements or guidelines should be regarded as minimum criteria.

In order that the AMP is managed effectively and retains credibility, the owners/operators must make positive commitments to its implementation and execution. The overall aim of the AMP should be set out in a clear policy statement which commits the owner/operator to the maintenance of adequate safety margins in the SSCs important to safety, i.e. the required integrity and functional capability of both passive and active SSCs in excess of their normal operating requirements.

Due account should be taken of any available national and international guidance and good practice in the field of ageing management.

The scope of the AMP should be clearly defined and should include SSCs important to safety.

II-1.2. Documentation

- regulatory policy and requirements
- international guidelines
- AMP policy of the NPP
- AMP scope document.

II-1.3. Review topics

(a) the policy of the nuclear safety authority on AMPs;

(b) additional regulatory requirements and guidance provided by the nuclear safety authority;

(c) the AMP policy document of the owner/operator of the NPP. The review should be able to readily identify clear policy statements regarding:
   - the maintenance of safety margins in SSCs;
   - the owner/operator's commitment to the AMP;

- regular programme reviews and self-assessments;
- the operator/owner's intent to continuously improve the AMP;

(d) the degree to which the AMP has used taken of available international guidance and good practice;

(e) the scope of the AMP.

II-2. ORGANIZATION OF AN AGEING MANAGEMENT PROGRAMME

Existing NPP programmes such as Preventive Maintenance, In-service Inspection, Equipment Qualification, and component specific programmes contribute to the management of ageing of NPP systems, structures and components. Whereas utilities have made a significant start in implementing AMPs, organizational problems may exist because the division of responsibility for relevant programmes is distributed among several NPP organizations including operations, maintenance, technical support and engineering. To effectively manage NPP ageing, the division of responsibility requires co-ordination and integration mechanisms to facilitate the application of a systematic ageing management process which is illustrated in Fig. 1. [4].

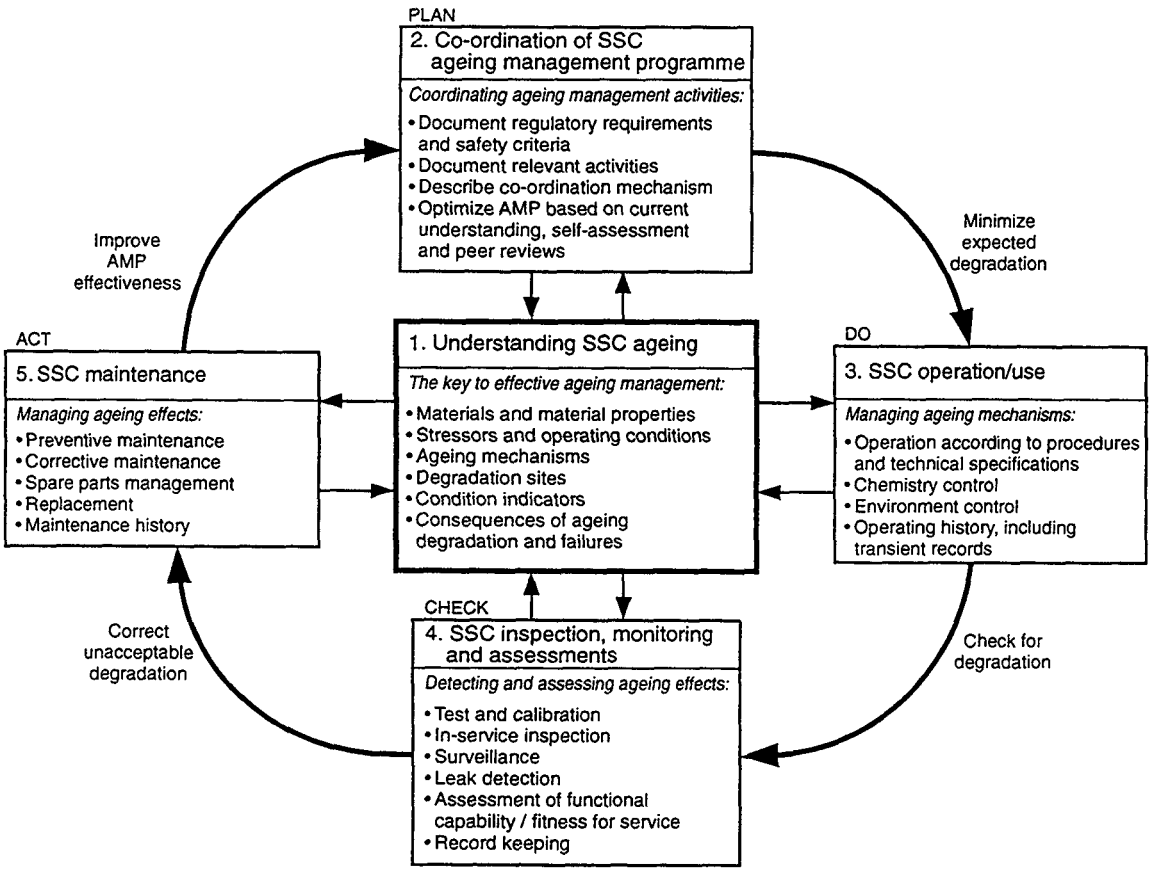

FIG. 1. Systematic ageing management process.

Many of the existing programmes referred to in para. 213 have been developed in response to both safety and economic objectives. As a result, gaps may exist between existing programmes relevant to managing the ageing of SSCs. Due to possible gaps, and without co-ordinating and integrating mechanisms, utilities may not have the necessary assurance of plant safety and reliability to the end of NPP service life. These shortcomings may be overcome by having an integration of existing programmes within a comprehensive and proactive AMP to maintain the material condition of the NPP.

II-2.1. Attributes

The AMP should have a structure and organization which facilitates that all assigned functions are performed satisfactorily. This requires:

- a manager with an appropriate background in NPP engineering, maintenance and operation to oversee the AMP and to supervise the AM organization;
- competent and sufficient staff of the AM organization capable to integrate and co-ordinate effectively existing plant and external AMP programme activities and perform AMP evaluations on the basis of documented acceptance criteria;
- adequate funding to maintain the AMP, independent of other plant budget allocations;
- sufficient numbers of qualified and well-trained operations, maintenance and technical support staff that understands the systematic ageing management process and is capable of performing required AM actions/tasks;
- adequate and appropriate equipment and tools to perform AM actions;
- formal communication links with external agencies and other NPPs, specialized NPP teams and consultants in areas in which the AMP organization is not self-sufficient;
- mechanisms to incorporate industry and in-house operating experience and research relating to age-related degradation of SSCs.

II-2.2. Documentation

- description of the AMP structure and functions;
- description of the NPP organizations contributing to the AMP and their interrelationships;
- description of the AM organization staff, identifying their qualifications, experience and training;
- information on consultants used and their qualifications;
- description of an operating experience feedback system;
- descriptions of how the AM organization uses external agencies such as other NPPs, manufacturers, research laboratories and national or international agencies and advisory bodies, and the process by which advice given is used.

II-2.3. Review topics

(a) the structure of all organizations participating in AMP and their interfaces;

(b) the division of responsibilities between each of the participating organizations;

(c) the principal criteria used to determine the size and structure of the AM organization;

(d) the technical, professional and financial resources allocated to the AM organization;

(e) the independence of AMP funding from short term budget fluctuations;

(f) the qualifications required for staff engaged in the various functions of the AMP;

(g) the previous experience (design, operation, engineering, project management and co-ordination) of AM organization staff;

(h) the effectiveness of the NPP training program to ensure the competency of operating, maintenance and technical staff to carry out ageing management activities;

(i) the adequacy of the equipment and tools provided to NPP staff to perform tasks associated with the AMP;

(j) the mechanism for feedback of relevant operating experience and research results;

(k) and their application in the AMP;

(l) the ability of the AM unit to obtain external expert advice when necessary;

(m) the mechanisms for obtaining and using advice from national and international organizations.

II-3. AGEING MANAGEMENT PROGRAMME ACTIVITIES

In order that the NPP ageing management programme is effective, several key activities have to be carried out. Each of these activities is regarded as essential and the programme will not be effective if any one of them is omitted or inadequately performed.

II-3.1. Attributes

There should be a documented and verifiable selection process for the screening of SSCs. There are thousands of components in an NPP and careful selection and prioritization is necessary to facilitate effective use of limited resources.

There should be operational procedures to control, within acceptable limits, service conditions that influence the rate of age-related degradation of SSCs.

A systematic plant surveillance programme (including testing, inspection and monitoring) should be in place that provides for detection of ageing degradation of SSCs important to safety before their integrity and functional capability is impaired.

An efficient data collection and record-keeping system should be in place so that trend analyses can readily be performed to predict SSC performance and remaining service life. It should also allow identification and evaluation of degradation, failures and malfunctions of SSCs caused by ageing effects.

The NPP should have a system for performing assessment of current and future functional capability of SSCs important to safety, based on information from data collection.

A plant maintenance programme (including replacement) should be in place that provides for timely mitigation of ageing degradation of SSCs important to safety to ensure their continued functionality within acceptance criteria.

An equipment qualification programme should be implemented to ensure that equipment important to safety will be capable of performing its safety functions throughout its installed life.

Spare parts programmes should be in place to ensure the availability of spare parts and prevent their degradation while in storage.

II-3.2. Documentation

- SSC screening procedure/methodology;
- list of SSCs covered by AMP;
- operating procedures;
- surveillance programme procedures, including testing, surveillance and monitoring procedures;
- maintenance procedures;
- equipment qualification programme procedures;
- documented assessment methods for SSCs;
- data collection and record-keeping system, description and procedures;
- spare parts programme procedures.

II.3.3. Review topics

(a) SSC screening methodology document, the list of SSCs included in the AMP, and examples of how the methodology has been used;

(b) safety margins and/or acceptance (fitness for service) criteria specified for the SSCs covered by the AMP;

(c) ageing assessment methodology for SSCs and examples of assessments made to identify the appropriate ageing management actions;

(d) operating procedures for SSCs and the degree to which they are consistent with current understandings of ageing of SSCs;

(e) plant surveillance programme and its role within the AMP;

(f) inspection and surveillance procedures for SSCs and their effectiveness in the timely detection of ageing degradation;

(g) operational limits and conditions important for controlling the rate of ageing degradation of SSCs;

(h) maintenance programmes and their integration into the AMP;

(i) preventive maintenance programmes and the extent to which they are completed, including the ratio of corrective to preventive maintenance;

(j) schedule of minimum preventive maintenance, including its technical basis and the links to the current understanding of SSC ageing;

(k) basis for adjusting testing, surveillance and maintenance, to account for AMP results and the feedback of operating experience;

(l) the changes to the AMP in response to unanticipated ageing phenomena;

(m) data collection and record keeping system, including its effectiveness and its user friendliness (both for data input and for trend analysis);

(n) maintenance histories, including:

- the frequency of maintenance history updates
- the level of authorization for updating records
- samples of maintenance histories
- consistency in the maintenance of records;

(o) procedures and mechanisms in place to maintain EQ during the equipment's installed life;

(p) systematic analyses and corrective action taken to address the effects of equipment failure on EQ.

II-4. AGEING MANAGEMENT PROGRAMME RESULTS

The purpose of the AMP is to ensure required integrity and functional capability of SSCs important to safety throughout NPP service life.

II-4.1. Attributes

The effectiveness of the AMP is indicated directly by the results of the programme. These results should confirm that:

- The actual physical condition of the SSCs covered by the AMP in terms of required safety margins (i.e. integrity and functional capability of passive and active SSCs) is satisfactory, including:
  - SSC condition and/or functional indicators, provided by IS, surveillance, testing or condition monitoring and their trends conform to acceptance criteria;
  - ambient environment parameters (e.g. temperature, humidity, radiation fields) and their trends are within specified limits;
  - system parameters (e.g. pH, conductivity, activity, temperature, pressure), their transients and trends are within acceptable limits.

- The qualification of SSCs covered by the EQ programme has been satisfactorily established and maintained (the effectiveness of the EQ programme should be reviewed if it is credited in the AMP), including:
  - list of equipment covered by the EQ programme and a procedure that controls any changes to the list;
  - qualification reports and other supporting documents (e.g. EQ specification, qualification plan);
  - verification that the installed equipment is qualified according to specification;
  - procedures and mechanisms to maintain qualification during the equipment installed life;
  - the analyses of the effect of equipment failures on EQ and the appropriateness of corrective action;
  - auditable records of all qualification measures.

– Relevant plant performance indicators such as maintenance preventable failures or safety system unavailability are satisfactory.

II-4.2. Documentation

– list of SSCs covered by the AMP;

– list of equipment covered by the EQ programme;

– the report of the findings, conclusions and recommendations resulting from plant walkdowns;

– qualification records;

– SSC test and inspection records;

– SSC failure reports (including, where appropriate, root cause analysis);

– statistical data of SSC failures and failure rates.

II-4.3. Review topics

(a) major findings, conclusions and recommendations resulting from plant walkdowns;

(b) special attention given to certain SSCs based on these results;

(c) degree to which condition and/or functional indicators of the SSCs covered by the AMP and the trends of these indicators conform to the acceptance criteria;

(d) records of ambient environmental conditions (e.g. temperature, humidity, radiation in plant areas in which the SSCs covered by the AMP are located), including deviations from specified conditions;

(e) records of system parameters (e.g. pH, conductivity, activity, temperature, pressure), for the systems covered by the AMP including transients, trends and deviations from specified values;

(f) qualification reports or other documents (e.g. EQ specifications, qualification plans) which establish and document preservation of the qualifications of equipment covered by the EQ programme;

(g) statistical information about failures and failure trends of SSCs covered by the AMP;

(h) routine reports from the maintenance and surveillance organizations on age related degradation of SSCs covered by the AMP;

(i) trends of AMP process indicators, such as post-maintenance test results, surveillance test results, ratio of preventive to corrective maintenance and rework frequency.

II-5. AGEING MANAGEMENT PROGRAMME MONITORING

AMP monitoring is, for the purpose of this document, understood as a review of the effectiveness of an NPP ageing management programme including all the mechanisms necessary to facilitate continuous improvement of the programme.

There are three complementary types of AMP assessments:

– self-assessment;
– peer review of relevant programmes; and,
– comprehensive AMP review.

These assessments differ in the independence of the review team, the degree of formality, rigour of the assessment process and the interval between reviews.

II-5.1. Attributes

The objective of self-assessment is to provide for an ongoing programme optimization. Such ongoing assessment of the effectiveness of an AMP should be carried out usually on an annual basis, by the AMP unit through monitoring ageing management actions and evaluation of both SSC specific indicators of effectiveness and programme level performance indicators. The AMP self-assessment should allow those in charge of AMP to take timely actions to improve AMP activities and organization interfaces.

The objective of a peer review of relevant existing programmes is to determine whether these programmes meet generally accepted standards and to identify areas for improvement. Their review should therefore include all of the programmes important to ageing management, like preventive maintenance programme, in-service inspection programme, EQ programmes, and others, and should be usually carried out as a part of an overall plant audit. Such audit should be carried out by an independent organization with expertise in audit techniques and credible auditors. The IAEA-led AMAT mission would focus only on the review of the AMP.

The objective of a comprehensive programme review is to determine whether ageing in an NPP is being effectively managed, so that the required integrity and functional capability of SSCs are maintained and whether an adequate AMP is in place for future plant operation. A comprehensive programme review should include all the important aspects of the management of ageing as listed in Table II. For an objective judgement on AMP effectiveness, agreed indicators of effectiveness should be in place for each of these aspects. The requirement for a comprehensive independent review may be established by the national regulatory authority. Such a review is normally conducted within the framework of a periodic safety review of an operational NPP. The conduct and documenting of the review is be the responsibility of the plant and the evaluation of the results of the review is the responsibility of the regulator. The review scope, procedure and indicators of effectiveness should be agreed in advance with the regulator.

II-5.2. Documentation

- relevant regulatory policy and requirements;
- policy and procedures for the assessment of AMP effectiveness;
- list of indicators of AMP effectiveness;
- reports on any other reviews relevant to the AMP;
- records of any corrective actions carried out as a result of the AMP review.

II-5.3. Review topics

(a) regulatory requirements for the AMP review;

(b) policy for the AMP review and improvement;

(c) performance indicators for measuring the effectiveness of the AMP;

(d) updates of performance indicators in accordance with current knowledge, standards and practices, and relevant national and international codes;

(e) records of self-assessments performed to evaluate the effectiveness of the AMP;

(f) plans and procedures for the conduct and reporting of self-assessments;

(g) capability of the NPP owner operator to evaluate AMP effectiveness;

(h) records of peer reviews carried out to determine whether the AMP (programmes important to ageing management) meet generally accepted standards and practices;

(i) independence of the peer review teams;

(j) results of the peer reviews, including areas identified for improvement;

(k) follow-up to determine the effectiveness of corrective actions or improvement programs;

(l) records of any comprehensive reviews conducted to determine the effectiveness of AMP program management;

(m) roles of the operator and national regulatory authority in preparation, implementation and evaluation of the results of such reviews;

(n) procedures of the comprehensive AMP review;

(o) corrective actions arising from the results of any comprehensive AMP review and the agreed upon schedule for the completion of those actions;

(p) a commitment of all members of the NPP staff to continuous improvement;

(q) relationship between the periodic safety review programme and any comprehensive AMP review.

Appendix

CHECKLIST FOR PLANT WALKDOWN

Direct observation of the results of the AMP should be an important part of the AMAT review process. In case of an AMP programmatic review a tour of the plant will be made to determine the physical condition of the SSCs included in the AMP. This tour will also include the AMP supporting facilities such as the maintenance workshop, laboratories, spare parts storage and calibration facilities.

In the case of a review focused on a specific age-related problem, the tour will be limited to relevant SSCs and facilities.

Documentation

- list of SSCs covered by the AMP
- plant layout and SSC location lists
- plant zoning plans (environmental, radiation)
- description of the plant SCC identification scheme.

Review points/specimen questions

The review team should determine in the field whether:

(a) SSCs are properly identified;

(b) SSCs are at the locations indicated by plant documentation;

(c) SSCs match the descriptions given in plant documentation;

(d) SSCs are in good working order, i.e., that:

- there are no fluid leaks
- SSCs are properly protected from adverse environmental conditions and vibrations
- good lubrication practices are evident
- fasteners and supports are properly installed
- electrical connections are properly preserved and insulated
- SSCs are free of dirt, dust or contamination
- there are no adverse cracks or erosion, scratches, colour change, corrosion or mechanical or service wear;

(e) level of vibration of rotating equipment is within acceptable limits;

(f) spare parts are suitably stored taking account of shelf-life;

(g) obsolete and defective equipment is stored separately;

(h) test and calibration facilities are properly equipped;

(i) calibration equipment is in good working order;

(j) instruments indicate expected values;

(k) maintenance facilities are adequate to the safe and effective performance of maintenance work;

(l) plant laboratories are sufficiently equipped to support the AMP;

(m) there is an adequate central filing of documents, databases and other information sources.

Part III

GUIDE TO DRAFTING TECHNICAL NOTES

III-1. INTRODUCTION

Writing the technical notes is one of the AMAT reviewer's most important tasks. The team members, having followed the AMAT Guidelines and supplementary guidance, will collect a large amount of information that must be recorded. These facts, impressions and conclusions must be written clearly and concisely since, once the team leaves, all the NPP has to work from is the technical notes.

In writing the technical notes, the following should be taken into account:

- Emphasis should be given to the reviewers' observations, with clear conclusions and the minimum of description;
- The language should be clear, concise, objective and impersonal;
- Short, direct sentences aid understanding;
- The official names (or official translation) should be used to designate organizational units, positions and systems; and
- If abbreviations or acronyms are used, they should be introduced upon their first use.

The technical notes should be written in English, day-to-day from the first day of review, and modified and supplemented, as necessary, throughout the entire period of the review.

It should be emphasized that this guide on drafting technical notes:

- is not intended to substitute for the AMAT guidelines and supplementary guidance; and
- is not to be used as a strict list with an obligation to describe every item listed or to prohibit addressing any other items.

III-2. FORMAT

In case of a programmatic review, each area of review should be designated by a number and a bold and capitalized heading:

1. AGEING MANAGEMENT PROGRAMME STRATEGY

2. GENERAL ATTRIBUTES OF AGEING MANAGEMENT PROGRAMME

3. AGEING MANAGEMENT PROGRAMME ACTIVITIES

4. AGEING MANAGEMENT PROGRAMME RESULTS

5. AGEING MANAGEMENT PROGRAMME MONITORING

This should be followed by the name(s) (family name and initials of given names) of the reviewer(s). If there are several reviewers, their names should appear in alphabetical order, followed by the name(s) of observer(s) and marked as such, e.g.:

Expert: J. Doe

or

Experts: J. Doe and A.N. Other (observer)

or

Experts: J. Doe and Q. Smith and A.N. Other (observer).

For each area of review, the text should be about three to five pages in length. It should commence with a summary description of the performance in the area. This summary reflects the details presented in the rest of the section; it should be not more that half a page long and should be produced after the review is completed. The subareas should be designated by a two digit number and a capital subheading, e.g. as in:

2. GENERAL ATTRIBUTES OF AN AMP

2.1. AMP ORGANIZATION

2.2. AMP RESOURCES

Further subdivisions, if necessary, should be structured under appropriate subheadings as shown in the following sample layout. Each subarea could be several paragraphs long, including recommendations, suggestions and good practices. Recommendations, suggestions and good practices (defined in Section I-5.5) should be numbered as follows.

III-3. NUMBERING SYSTEM

Recommendations, suggestions and good practices are identified by a four digit number. The first three digits give the area and subarea of the review and the fourth digit is '1' for recommendations and suggestions, or '2' for good practices.

Each recommendation and suggestion must be preceded and supported by a *'basis'* which is a statement of the concern giving rise to a recommendation or suggestion. It should briefly identity the issue but not introduce new material or thoughts.

If there are several recommendations and/or suggestions related to one basis, these should be itemized and each individual item identified (a), (b), (c), etc.

If there is neither a recommendation nor a suggestion then the relevant subarea should include a suitable phrase to this effect, e.g. "In the area reviewed the performance corresponds with normal proven and effective international practices". If good practices are identified, then the subarea number need not be included.

SAMPLE LAYOUT

2.2. AMP RESOURCES

2.2.1. Human resources

Preamble: highlights of good performance and problem areas, if any.

2.2.1.1. Recommendations and suggestions

(1) Basis:

(a) Recommendation
(b) Recommendation
(c) Suggestion

If there is another Basis and subsequent recommendation(s) and/or suggestion(s):

(2) Basis:
Etc.

If a good practice is identified, then 2.2.1.2 would be inserted in a similar format:

2.2.1.2. Good practices

Good practice:

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