Working material

OSART mission highlights 2007–2009

Operational safety practices in nuclear power plants

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FOREWORD

The IAEA Operational Safety Review Team (OSART) programme provides advice and assistance to Member States in enhancing the operational safety of nuclear power plants (NPPs). Careful design and high quality of construction are prerequisites for a safe nuclear power plant. However, a plant's safety depends ultimately on the ability and conscientiousness of the operating personnel and on the plant programmes, processes and working methods. An OSART mission reviews a facility's operational performance against IAEA Safety Standards and proven good international practices.

OSART reviews are available to all countries with nuclear power plants in operation, and also approaching operation, commissioning or in earlier stages of construction (Pre-OSART). Most countries have participated in the programme by hosting one or more OSART missions or by making experts available to participate in missions. Operational safety missions can also be part of the design review missions of nuclear power plants and are known as Safety Review Missions (SRMs). Teams that review only a few specific areas or a specific issue are called Expert missions. Follow-up visits are a standard part of the OSART programme and are conducted between 12 to 18 months following the OSART mission.

This report continues the practice of summarizing mission results so that all the aspects of OSART missions are gathered in one publication. It also includes the results of follow-up visits. This report highlights the most significant findings while retaining as much of the vital background information as possible. This report is divided in two main sections.

Chapter 1 summarizes the most significant observations made during the missions and follow-up visits between 2007 and 2009. Chapter 2 describes the mains trends on issues and good practices that were identified in the period covered. Appendix I summarizes all the trends developed in the document in a table form.

Each chapter of the report is intended for different levels of management in the operating and regulatory organizations. Chapter 1 is primarily directed at the executive management level, Chapter 2 at middle managers and those involved in operational experience feedback. Individual findings varied considerably in scope and significance. However, the findings do reflect some common strengths and opportunities for improvement.

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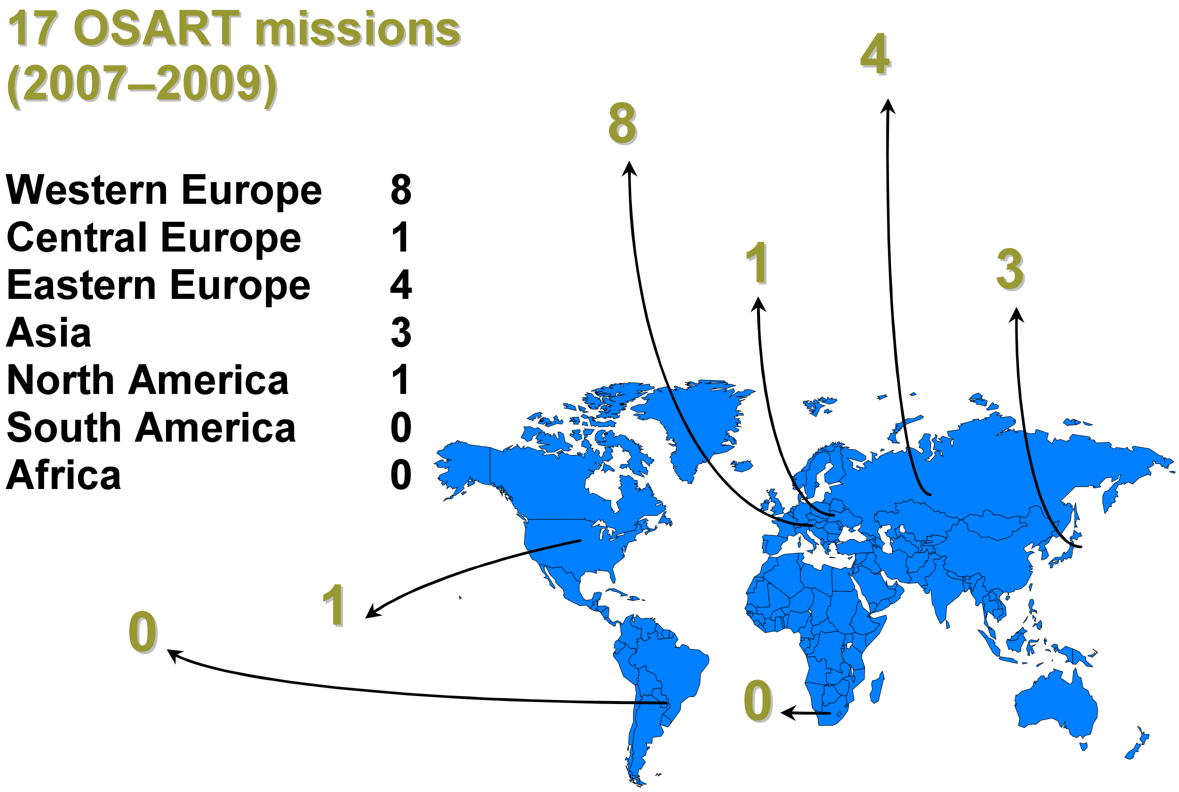
BACKGROUND

Many of the challenges faced by those responsible for ensuring the safe operation of nuclear power plants are common throughout the world. The results of an OSART mission are, therefore, of interest and possible application to many nuclear power plants and not solely to the plant in which they were originally identified. The primary objective of this report is to enable organizations that are constructing, commissioning, operating or regulating nuclear power stations to benefit from experience gained in the course of missions conducted under the OSART programme during the period 2007–2009.

In 1983, the IAEA set up the Operational Safety Review Team (OSART) programme to assist its Member States in the enhancement of safe operation of nuclear power plants. The service is available to all countries with nuclear power plants under construction, commissioning or in operation upon a request made to the IAEA by its Member States. By the end of 2009, altogether 155 OSART missions had been conducted at 98 nuclear power plants in 32 countries. There had also been 95 follow-up visits to review the implementation of previous OSART results. Seventeen (17) OSART missions were conducted during the period 2007–2009.



OSART teams consist of senior expert reviewers from NPPs and regulatory authorities in the various disciplines relevant to the mission. During technical discussions between reviewers and plant staff, operational safety programmes are examined in detail and their performance checked; strengths are identified and listed as good practices and weaknesses are listed as 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. OSART reviews are not regulatory inspections nor design reviews. Rather, OSART reviews consider the effectiveness of operational safety programmes and are more oriented to programme, process and management issues than to hardware. The performance or outcome of the various programmes is given particular attention. OSART teams neither assess the adequacy of plant design nor compare or rank the safety performance of different plants.

The OSART missions consist of three basic types: missions to operating power reactors (OSART); missions to power reactors under construction or at the pre-commissioning stage (Pre-OSART); and Expert missions which cover a limited range of topics or which differ in character from review missions. The IAEA also led a Peer Review of the effectiveness of the Operational Safety Performance Experience Review process (PROSPER) and the associated guidelines were issued in April 2003. Operational safety reviews performed in combination with design reviews are known as Safety Review Missions (SRMs).

The results of OSART missions completed by the end of 1996 have been summarized in OSART Results, IAEA-TECDOC-458; OSART Results II, IAEA-TECDOC-497; OSART Mission Highlights, 1988–1989. IAEA-TECDOC-570; OSART Good Practices, 1986–1989, IAEA-TECDOC-605; OSART Mission Highlights, 1989–1990, IAEA-TECDOC-681; Pre-OSART Mission Highlights, 1988–1990. IAEA-TECDOC-763; OSART Mission Highlights 1991–1992, IAEA-TECDOC-797; OSART Programme Highlights 1993–1994, IAEA-TECDOC-874; and OSART Programme Highlights 1995–1996, IAEA-TECDOC-1018; OSART mission highlights 2001–2003 – IAEA-TECDOC-1446. Since 1996, the results of OSART missions have been made available to Member States on the OSART Mission Results Database. A report on the OSART mission highlights 2003–2006 was released in 2007.

The OSART reviews normally cover nine areas, namely: management, organization and administration; training and qualification; operation; maintenance; technical support; operating experience feedback, chemistry; radiation protection; and emergency planning and preparedness.

Formal guidelines and criteria for evaluating safety culture were formulated and made available to the industry via INSAG-4 in 1991, INSAG-15 and TECDOC-1329 (December 2002), which provides guidelines for self-assessment of safety culture as a tool for the improvement of safety culture. However, OSART review guidelines and criteria have, from the beginning, included most of the fundamental characteristics of safety culture. Thus, OSART teams have reviewed safety culture in each review area in an integrated manner, as an important part of effective nuclear power plant management. Since October 1992, however, safety culture has been specifically assessed in all OSART missions and follow-up visits, both overall and in each of the nine major review areas.

The OSART Guidelines were revised in June 2005(Services Series number 12). During the review, recent INSAG Reports (INSAG-13, INSAG-15, INSAG-18, INSAG-19 and requirements of relevant recent Safety Guides (NS-G-2.4, NS-G-1.1) were incorporated. The IAEA Safety Review Services were evaluated by an external audit and it was recommended to promote the integrated approach to safety assessment. This was also taken into account in the revised version of the guidelines.

Over the twenty-six years of experience with the OSART programme, significant changes have taken place in OSART methodology, nuclear industry transparency and operational safety practices at power plants for in-depth reviews of operational safety. In this interval, the guidelines and experience of OSART team members have also evolved to reflect the higher standards for operational safety practices now being adopted worldwide.

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

Recommendation

A recommendation is advice on what improvements in operational safety should be made in that activity or programme that has been evaluated. It is based on IAEA Safety Standards or proven, good international practices and addresses the root causes rather than the symptoms of the identified concern. It very often 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 may indirectly contribute to improvements in operational safety, 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 ongoing 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 well based enough 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 operational safety 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 be brought to the attention of other nuclear power plants and be worthy of their consideration in the general drive for excellence. 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 attributes 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.. 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 objective that has been achieved or a good technique or programme that contributes directly or indirectly to operational safety and sustained good performance, that works well at the plant. However, it might not be necessary to recommend its adoption by other nuclear power plants, because of financial considerations, differences in design or other reasons.

1. INTRODUCTION AND MAIN CONCLUSIONS

1.1. Summary

During the period 2007–2009, 17 OSART missions reviewed plants around the world. As a result, this report contains the accumulated findings (good practices, recommendations and suggestions) that present a series of snapshots of the status of operational safety practices at NPPs.

The IAEA evaluated the general trends and achievements derived from the 17 OSART missions conducted during the period 2007–2009 and these are presented in this report.

The lower number of issues observed during the missions reflects an increased level of compliance with the IAEA safety standards by almost all the plants reviewed. Meanwhile, the high number of good practices recorded shows a high level of implementation of the best international practices in the industry. In this sense, plant managements and staff show that they clearly understand the importance of nuclear safety.

At many plants, the OSART teams were impressed by the level of preparation for the review, the openness of the counterpart teams and their readiness to cooperate.

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

The table below shows the number of issues (Recommendations + Suggestions = 274) and the number of Good Practices = 162) provided to the plants during the 17 OSART missions. All these findings form the basis of the evaluation proposed in the present report.

	MOA	TQ	OPS	MA	TS	OEF	RP	CH	EPP	COM	Total
Issues	28	24	50	28	28	27	29	33	23	4	274
Good Practices	22	22	19	20	14	14	18	20	13	0	162

The task of the assessment team formed by the IAEA was to evaluate and give a weight to the evaluation. To effectively transpose in wording statistical results, the group of experts decided to use the following statements:

– "In all plants" or "in all cases" is representative of frequency of issues, which were common to more than 90% of the cases or in more than 16 times out of 17 plant reviews.
– "In many plants" or "frequently" is used for a number of issue items found in about 9 to 15 plants out of 17 missions (from 50% to 90% of the cases).
– "In some plants" reflects that in 3 to 8 plants out of 17, the OSART missions found the same issue topic (from 15% to 50% of the cases).
– "In a few plants" means that the frequency of finding or the equivalent sort of issues appears in 1 to 2 plants against 17 visits (up to 15% of the cases).

The tendencies which are obtained from the assessment of Issues and Good Practices of 17 OSART missions are arranged to "Trends" for each review area.

1.2. Summary of trends classified by area

• Management, organization and administration

– In a few plants, there are indications that information dissemination systems are well developed. (2/17, Positive trend)
– In a few plants, there are indications that plants have not yet established mechanisms for management to ensure safe plant operation. (2/17)
– In a few plants, there are indications of insufficient use of tools or techniques to avoid human failures. (3/17)
– There are some indications that the use of performance indicators is not fully applied to improve safe plant operation. (4/17)
– In some plants, there are indications that the industrial safety policies or programmes are established but are not fully implemented in the field. (7/17).

• Training and qualifications

– Strict application of the Systematic Approach to Training (SAT) is not fully implemented in some plants. (4/17)
– Sufficient training tools such as lesson plans, training documents and instructions do not exist in a few plants. (2/17)
– In some plants, training equipment and training materials are insufficient or are not appropriately maintained. (7/17)
– In a few plants, training facilities such as simulator panels are not modified in a timely manner to replicate plant modifications. (2/17)
– In a few plants, there are inadequate programmes, including a training/coaching methodology, for trainers who are in charge of on-the-job training (OJT). (2/17)

• Operations

– In some plants, operator aids are not always followed in a sufficiently rigorous manner. (4/17)
– In a few plants, deficiencies exist in the area of operation of the emergency shutdown panel (ESP). (2/17)
– In a few plants, there are some deficiencies regarding the management of Operational Limits and Conditions (OLCs) such as recording and communication. (2/17)
– In a few plants, control of personnel access to the main control room has some deficiencies. (2/17)
– In some plants, operations field personnel are not identifying and reporting field deficiencies in a systematic manner. (7/17)
– In a few plants, prevention measures are not sufficient to prevent unauthorized access to safety systems. (3/17)
– In a few plants, error prevention techniques are not used sufficiently when manipulating safety systems. (3/17)
– In a few plants, adequate control of temporary modifications is not ensured. (2/17)

– In some plants, comprehensive fire hazard analysis for identifying potential fire risk and for combustible materials control is not fully implemented. (4/17)

• Maintenance

– In a few plants, particular attention is paid to supporting contractors who provide services in maintenance activities in enhancing their qualification. (3/17, Positive trend)
– In a few plants, there is an increased use of computerized monitoring systems for the control of the condition and characteristics of SSCs. (2/17, Positive trend)
– In a few plants, the programmes for the calibration of instruments and test equipment are not sufficiently implemented. (2/17)
– In some plants, the implementation of plant maintenance programmes was not fully adequate. (5/17)
– In a few plants, the maintenance procedures do not contain all the necessary information that may allow personnel to perform maintenance activities on time and in a reliable manner. (3/17)
– In a few plants, the observed maintenance work practices in the field show some areas that need improvement. (2/17)
– In a few plants, the foreign material exclusion (FME) programme is not consistently and effectively applied. (3/17)
– Some plants need to improve their material conditions programmes and reinforce their implementation. (6/17)
– In a few plants, there are indications that plant policies for the control of spare parts and hazardous materials are not followed. (3/17)

• Technical support

– In a few plants, computerized systems are applied for different activities relating to reactor engineering. (3/17, Positive trend)
– In a few plants, particular attention is paid to ensuring safe and secure use of computer and digital based systems. (2/17, Positive trend)
– In a few plants, there are some deficiencies in the safety assessment programme in the area of the application of plant specific PSA and the verification/validation of safety analysis. (2/17)
– In some plants, the trend analyses of safety related systems from surveillance results are not fully developed to monitor and evaluate their performance. (5/17)
– In a few plants, the plant surveillance programme is not sufficiently developed and implemented. (2/17)
– In some cases, the administrative and physical control of permanent and temporary modifications is not sufficient. (4/17)
– In a few plants, the control of modification documents is not adequately implemented. (2/17)
– In a few plants, the quality of operating and testing procedures in the area of reactor core management is insufficient. (2/17)

• Operating experience feedback

– In some plants, the operating experience programmes are not sufficiently developed and implemented. (4/17)
– In a few plants, low level events and near misses are not reported in a systematic and consistent manner. (2/17)
– In a few plants, programmes and procedures do not fully cover the analysis of low level events and near misses. (2/17)
– In a few plants, corrective actions for safety significant events are not prioritized. (2/17)
– In a few plants, an integrated and systematic process to incorporate Operating Experience (OE) lessons learned into plant programmes and activities is not implemented. (2/17)
– In some plants, the effectiveness of the Operating Experience(OE) programme is not sufficiently assessed. (6/17)

• Radiation protection

– In a few plants, there are unique and exclusive systems that radiation protection (RP) personnel have high motivation to ensure and improve their qualification (2/17, Positive trend).
– In some plants, measures for preventing the spread of contamination are not sufficient. (8/17)
– In a few plants, some incorrect demonstrations in training videos for radiation protection exist. (2/17)
– In some plants, measures to prevent contamination of personnel are insufficient. (4/17)
– In a few plants, the protective painted coating inside the radiation control area is inadequate. (2/17)
– In a few plants, the management of personal dose records is not sufficient. (2/17)
– In some plants, the radiation detection devices are not fully capable of measuring contamination of personnel. (6/17)

• Chemistry

– In a few plants, the chemistry management expectations or goals of the chemistry department are not clearly expressed. (2/17)
– In some plants, the chemistry control programmes are not comprehensive. (7/17)
– In some plants, the quality control programmes for chemistry surveillance activities are not adequately developed and not sufficiently implemented. (6/17)
– In some plants, the capability and working practices of the Post Accident Sampling System (PASS) are not sufficient for severe accident conditions. (5/17)
– In some plants, the housekeeping of chemicals in the laboratory (for example, storage and labelling) is not sufficiently implemented. (7/17)

• Emergency planning and preparedness

– In some plants, emergency preparedness arrangements are in place, but there are indications that those arrangements do not fully cover the required responses. (4/17)
– In a few plants, there is no individual on-site around the clock with the authority and responsibility to initiate the on-site emergency plan and notify the appropriate off-site notification point. (3/17)

– In some plants, the emergency operating facilities do not have appropriate measures and adequate equipment. (5/17)
– Prompt access to specially designated emergency equipment in time of need is not ensured in a few plants. (2/17)

• Commissioning

– No trends observed.

All trends with two and more occurrences out of the 17 missions are listed and evaluated. Positive trends are present when the number of positive occurrences (good practices) exceeds the number of negative occurrences (recommendations and suggestions).

	MOA	TQ	OPS	MA	TS	OEF	RP	CH	EPP	COM	Total
Negative Trends	4	5	9	7	6	6	6	5	4	0	52
Positive Trends	1	0	0	2	2	0	1	0	0	0	6

2. ASSESSMENT OF THE OSART MISSIONS RESULTS AREA BY AREA

The following summarizes the trends and tendencies identified in the findings.

Important trends are highlighted by a bullet; they can be used as stand-alone input to other evaluative documents. Where the facts or findings of the OSART missions address a common problem, the trend is complemented by a discussion on the weight of these findings and possible remedial actions.

In this evaluation, an attempt is made to define the level relevant to the different findings for policy establishment or policy implementation and in order to facilitate the future use of the results.

The lack of findings in a particular area of reviews is also discussed as a possible area of attention for the IAEA.

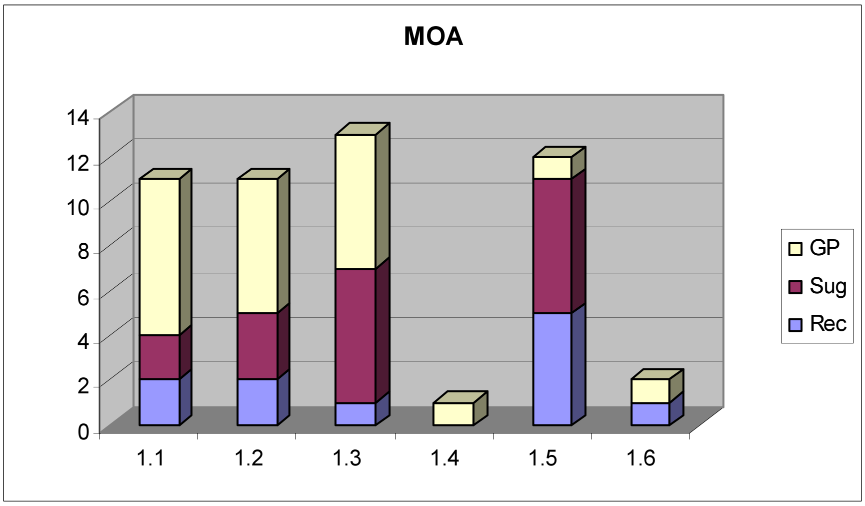
2.1. Management, organization and administration

2.1.0. Summary results from the evaluation

During the period covered by this report, the OSART teams identified 28 issues in the Management, Organization and Administration (MOA) area. Of these, 11 were recommendations and 17 suggestions. Some 22 good practices were also identified. These relatively high numbers are an indication of the attention this area attracts from both the OSART teams and plant management.

However, despite the high number of good practices identified, there were still a high number of issues raised. This indicates that the plants still have to conduct further improvements before reaching the best international standards.

Title		Rec.	Sug.	GP	Total
1.1	Organization and administration	2	2	7	11
1.2	Management activities	2	3	6	11
1.3	Management of safety	1	6	6	13
1.4	Quality assurance programme	0	0	1	1
1.5	Industrial Safety programme	5	6	1	12
1.6	Document and records management	1	0	1	2
Total		11	17	22	50



It is important to note that, despite the relatively large number of good practices identified during the 17 missions, they are often of a disparate nature and do not easily support each other in the development of trends.

2.1.1. Organization and administration

During the period covered by this report, the OSART teams identified 4 issues on this topic. Of these, 2 were recommendations and 2 were suggestions. A total of 7 good practices were also identified.

• Trend: In a few plants, there are indications that information dissemination systems are well developed. (2/17, Positive trend)

It is a common practice now that plants have developed and strengthened public relations activities such as plant information dissemination by using on-line information system or answering machines.

• Trend: In a few plants, there are indications that plants have not yet established mechanisms for management to ensure safe operation of the plant. (2/17)

The plants should establish an off-hours, on-site supervisory position to confirm that transients or abnormal conditions are properly managed.
In addition, while internal safety committees provide a high level of confidence in the safe operation of the plant, no independent safety review is provided by a periodic external review.

The results of missions show that plants do not yet possess fully established management mechanisms to provide means for independent safety reviews and the determination of plant condition.

2.1.2. Management activities

During the period covered by this report, the OSART teams identified 5 issues on this topic. Of these 2 were recommendations and 3 were suggestions. Additionally, 6 good practices were also identified.

• Trend: In a few plants, there are indications of insufficient use of tools or techniques to avoid human failures. (3/17)

It must be noted that the application of Human Performance Improvement (HPI) tools or techniques do not always fully meet plant management expectations. There are two reasons for this. Firstly, management expectations are not clearly and adequately communicated. Secondly, the expectations are not sufficiently supported and reinforced by the management team.

Some specific guidance should be provided by the managers to the staff on the use of error prevention techniques such as self-verification, peer checking, pre-job and post-job briefs as well as use of procedures and clear communication.

However, in other plants, there are good practices such as motivational programmes (e.g. selection of best field operator), behavioural improvement programmes and establishment of safety days.

2.1.3. Management of safety

During the period of this report, the OSART teams identified 7 issues on this topic. Of these, one was a recommendation and 6 were suggestions. Additionally, 6 good practices were also identified.

• Trend: There are some indications that the use of performance indicators is not fully applied to improve safe plant operation. (4/17)

Although most plants have a set of performance indicators, some plants do not use them effectively. To improve safe plant operation, plants should utilize these data to confirm trends or discover shortfalls. It was found that the effective application of key safety performance indicators (SPI), commensurate with plant safety goals and objectives, are not always done. In some cases performance indicators do not provide adequate information to properly contribute to safe plant operation as well as to ensuring appropriate oversight, trending and planning. Even if the set of performance indicators is defined, their use and trending is not consistently applied across of all sections and organizations.

Rigorous selection of an appropriate set of performance indicators and their proper tracking would benefit proactive plant management and safe plant operation.

2.1.4. Quality assurance programme

During the period of this report, the OSART teams identified no issues on this topic. One good practice was identified.

• No trends

All plants had implemented quality assurance programme that are described in the appropriate documents and procedures. They mainly differentiate in the scope of implementation. A few plants had transformed to an integrated management system.

2.1.5. Industrial safety programme

During the period of this report, the OSART teams identified 11 issues on this topic. Of these, 5 were recommendations and 6 were suggestions. Additionally, one good practice was identified.

• Trend: In some plants, there are indications that the industrial safety policies or programmes are established but they are not fully implemented in the field. (7/17).

Though plants have established standards and expectations on industrial safety that employees are required to meet, there are strong indications that behaviour in the field did not fully comply with the policies and programmes. It was found that communication and reinforcement of expectations, as well as supervision and couching, were not properly used by the management to achieve significant improvements in this area. Managers do not always identify and correct inadequate industrial safety practices and eliminate hazardous behaviour of own staff or contractors.
In particular cases, development, implementation and follow-up of corrective actions are not sufficiently considered.
Employees and contractors should understand the industrial safety policies and implement them in the field. Plant management and senior managers should encourage plant staff to keep the safety-first policy in their mind.

2.1.6. Document and records management

During the period of this report, the OSART teams identified one issue which was a recommendation on this topic. One good practice was identified.

• No trends

The OSART guideline and the OSART working notes are well developed in this area, nevertheless no trends are available as missions could not objectively review this area, as there is no specific IAEA safety standard dedicated to document and records management, that establishes general requirements for documentation control in the industry. There are separate requirements for operational procedures control, maintenance procedures and records control and others but they are not unified and consolidated.

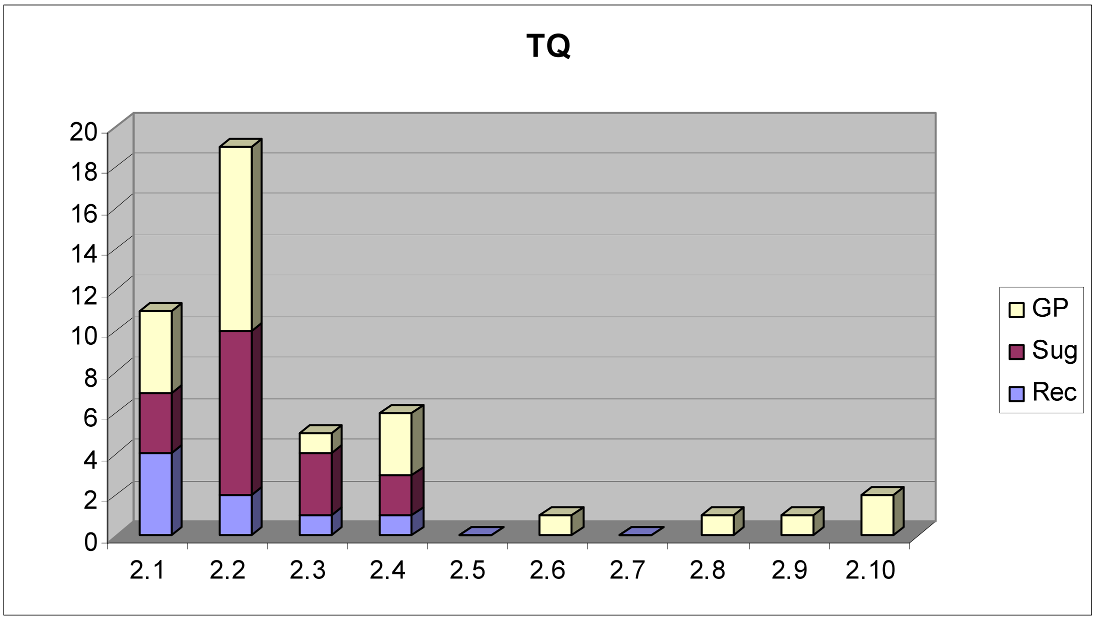
It is recommended to create a specific standard on documentation and records management.

2.2 Training and qualification

2.2.0 Summary results from the evaluation

The review of the training and qualification (TQ) area at the 17 OSARTs resulted in 46 findings from which there were 22 good practices, 8 recommendations and 16 suggestions. The distribution of the findings between the different topics of the TQ review is presented in the table below:

	Title	Rec.	Sug.	GP	Total
2.1	Training policy and organization	4	3	4	11
2.2	Training facilities, equipment and material	2	8	9	19
2.3	Quality of the training programmes	1	3	1	5
2.4	Training programmes for control operators and shift supervisors	1	2	3	6
2.5	Training programmes for field operators	0	0	0	0
2.6	Training programmes for maintenance personnel	0	0	1	1
2.7	Training programmes for technical plant support personnel	0	0	0	0
2.8	Training programmes for management and supervisory personnel	0	0	1	1
2.9	Training programmes for training group personnel	0	0	1	1
2.10	General employee training	0	0	2	2
	Total	8	16	22	46



2.2.1. Training policy and organization

During the period 2007–2009, OSART identified 11 findings i.e. 4 good practices, 4 recommendations and 3 suggestions.

• Trend: Strict application of the Systematic Approach to Training (SAT) is not fully implemented in some plants. (4/17)

Examples show that:
- SAT is not required by the quality assurance procedures.
- The performance based indicators are not used for the review of training programmes.
- Some managers are not trained to understand their roles in SAT.
- The SAT method is not used for technical support staff training.

To ensure plant training needs are properly evaluated, appropriate resources should be allocated. In addition, there should be a more comprehensive review of the numerous performance based evaluative inputs from the plant and worker performance in order to improve worker's knowledge and skill.

• Trend: Sufficient training tools such as lesson plans, training documents and instructions do not exist in a few plants. (2/17)

Examples show that:
– Some training performed by external companies does not have lesson plans.
– On-the-job training (OJT) is done without an OJT manual.
– The general training film for radiation protection has some incorrect examples.

To maintain the high level of training, appropriate training tools should be prepared.
In OJT, there should be a lesson plan to ensure consistent delivery of training.

2.2.2. Training facilities, equipment and material

During the period, OSART provided 10 issues in this area including 2 recommendations and 8 suggestions. 9 good practices were found.

• Trend: In some plants, training equipment and training materials are insufficient or are not appropriately maintained. (7/17)

Examples show that
– There are no special training mock-ups and/or practical training laboratories.
– No written, validated and approved simulator exercise scenarios are used.
– Uncalibrated torque wrenches were used for training programme.
– There is no process for the periodic review of training materials.

The plant should use appropriate practical training equipment (e.g. mock-ups for simulating work) and training materials (e.g. detailed written and validated simulator scenarios).

• Trend: In a few plants, training facilities such as simulator panels are not modified in a timely manner to replicate plant modifications. (2/17)

Examples show that:
– There is no effective simulator configuration management system.
– There is no process for the periodic review of simulator modifications.

An effective simulator configuration management system, including periodic review and timely modifications, should be established to ensure accurate and realistic simulator training.

2.2.3. Quality of the training programmes

During the period, 5 findings were proposed by the OSART: one recommendation, 3 suggestions and one good practice.

• Trend: In a few plants, there are inadequate programmes including a training/coaching methodology, for trainers who are in charge of on-the-job training(OJT). (2/17)

Examples show that:
– Not all OJT trainers are given OJT guidelines.
– Not all OJT trainers are trained, coached and evaluated.
– No OJT procedures are in place.
– The training programme does not give the trainers the appropriate tutorial skills.

The OJT trainers should receive appropriate training for coaching and tutorial skills.

2.2.4. Training programmes for control room operators and shift supervisors

Between 2007 and 2009, 5 findings were given in this area: one recommendation, 2 suggestions and 2 good practices were developed.

• No trends.

The issues were regarding human behaviour training, the requirement for the refresher training after a long absence and not reflecting the real circumstances to the simulator; however there are no trends on these findings.

2.2.5. Training programmes for field operators

No specific recommendations and suggestions were developed under this subsection during the 17 OSART missions.

• No trends.

2.2.6. Training programmes for maintenance personnel

No issues were found by the OSART teams during the period 2007–2009. One good practice was found in this area.

• No trends

2.2.7. Training programmes for technical support personnel

No findings were found by the OSART teams during the period 2007–2009.

• No trends.

2.2.8. Training programmes for management and supervisory personnel

No findings, during the period 2007–2009, were found by the OSART teams.

• No trends

2.2.9. Training programmes for training group personnel

No issues, during the period 2007–2009, were found by the OSART teams. One good practice was found in this area.

• No trends

2.2.10. Training programmes for general employee training

No issues, during the period 2007–2009, were found by the OSART teams. 2 good practices were found in this area.

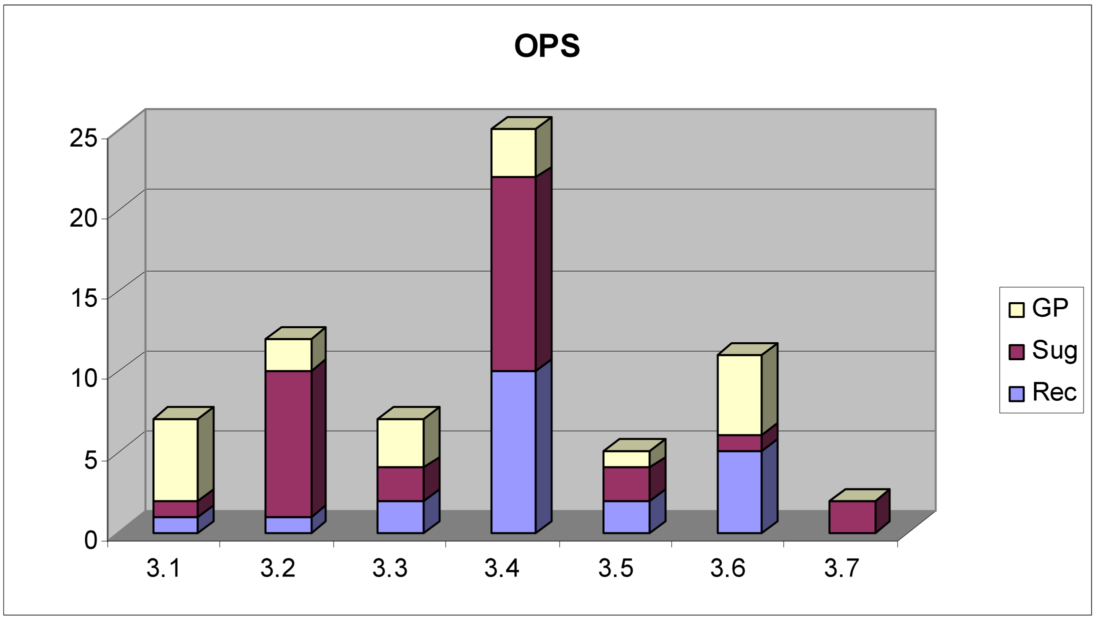
• No trends

2.3. Operations

2.3.0 Summary results from the evaluation

The review of the operations area in the 17 visited plants resulted in 69 findings of which 20 are recommendations, 29 are suggestions and 19 are good practices.
The distribution of the findings between the different topics of the review is presented below:

Title		Rec.	Sug.	GP	Total
3.1	Organization and functions	1	1	5	7
3.2	Operations facilities and aids	1	9	2	12
3.3	Operating rules and procedures	2	2	3	7
3.4	Conduct of operations	10	12	3	25
3.5	Work authorization	2	2	1	5
3.6	Fire prevention and protection programme	5	1	5	11
3.7	Management of accident conditions	0	2	0	2
Total		21	29	19	69



2.3.1. Organization and functions

In the area of organization and functions during the evaluated missions, 7 findings were identified, i.e. 5 good practices, one recommendation and one suggestion.

• No trends

The issues related to expectations for operations personnel which were not fully developed and the number of personnel to make up the minimum shift team staff. No trends are evident on these findings.

2.3.2. Operations facilities and operator aids

The review of the area of facilities and operator aids raised 12 findings – one recommendation, 9 suggestions and 2 good practices.

• Trend: In some plants, operator aids are not always followed in a sufficiently rigorous manner. (4/17)

Examples show that:
– Unauthorized yellow stickers are used as operator aids.
– There are some operator aids which are not in accordance with the relevant procedures.
– The document control for operator aids is not appropriate.

Adequate document control of operator aids is a prerequisite to ensure safe operation of the plant.

• Trend: In a few plants, deficiencies exist in the area of operation of the emergency shutdown panel (ESP). (2/17)

Examples show that:
– An auxiliary panel of the ESP is switched off.
– Some procedures are missing in the ESP room.
– The room is not compatible with longer habitation (no chairs, no devoted phones).
– The ESP training is not regularly provided for plant operators.

Adequate conditions for operation of the ESP should exist in case of unavailability of the Main Control Room.

2.3.3. Operating Rules and Procedures

The review of the area of operating rules and procedures raised 7 findings – 2 recommendations, 2 suggestions and 3 good practices.

• Trend: In a few plants, there are some deficiencies regarding the management of Operational Limits and Conditions (OLCs) such as recording and communication. (2/17)

Examples show that:
– The OLC expiry time is not recorded.
– The shift turnover checklist does not contain the fact that the unit is in an OLC.

Without timely recording and communication of OLC entries and the time of expiry of the conditions to return the plant to normal operating conditions, FSAR assumptions may not be met with resulting safety implications. In addition, relevant justification information on OLCs should be readily available for the plant staff.

2.3.4. Conduct of operations

The review of the area of conduct of operations raised 25 findings – 10 recommendations, 12 suggestions and 3 good practices.

• Trend: In a few plants, control of personnel access to the main control room(MCR) has some deficiencies. (2/17)

Examples show that:
– Some personnel enter the MCR without permission.
– Some plant staff continue to wear hard hats while in the MCR.
– The formal limitation to the number of personnel present in the MCR is not clearly described in the procedures.

The access of plant staff to the MCR should be properly controlled to avoid distracting to the MCR operators.

• Trend: In some plants, operations field personnel are not identifying and reporting field deficiencies in a systematic manner. (7/17)

Examples show that:
– There are long standing deficiencies in the field such as oil or water leaks, missing hand wheels of valves and unreadable labelling.
– Inappropriate tagging practices are used.

Observations and corrective actions by field operators regarding deficiencies and labelling support the safe operation of the plant in all operating conditions.

• Trend: In a few plants, prevention measures are not sufficient to prevent unauthorized access to safety systems (3/17)

The examples show that:
– There are no chains, locks or warning signs for the safety related manual valves.
– The management of the keys for safety systems and equipment is not rigorous.

Sufficient measures against unauthorized access to systems and equipment important for the safety should be in force.

• Trend: In a few plants, error prevention techniques are not used sufficiently when manipulating safety systems. (3/17)

Examples show that:
– There are no peer checking or pre-job briefings for manipulations affecting reactivity such as a boron dilution or a control rod withdrawal.
– Stop, Think, Act, Review (STAR) is not used frequently.
– 3 way communication is very rarely used.
– Important information is not provided in the pre-job briefing.
– Important information regarding surveillance tests is not transferred to the shift supervisors.

Strict adherence to the tools or practices used to prevent or minimize human error is needed.

2.3.5. Work authorizations

The review of the area of work authorizations raised 5 findings – 2 recommendations, 2 suggestions and one good practice.

• Trend: In a few plants, adequate control of temporary modifications is not ensured. (2/17)

Examples show that:
– Some of the temporary modification tags were issued about 10 years ago.
– The plant does not apply a control system to ensure that operators are familiarized with the temporary modifications and temporary procedures.
– There is no clear separation of open and closed temporary instructions.

Proper control of temporary modifications and an appropriate system for operators to deal with temporary modified systems and instructions are needed.

2.3.6. Fire prevention and protection programme

The review of the area of fire prevention and protection programme raised 11 findings –5 recommendations, one suggestion and 5 good practices.

• Trend: In some plants, comprehensive fire hazard analysis for identifying potential fire risk and for combustible materials control is not fully implemented. (4/17)

Examples show that:
– There are no rules or procedures to manage the risk of exceeding the limits of amounts of combustible liquids.
– The plant does not have a process to systematically analyze the fire hazards.
– There are regular walkdowns by on-site fire brigade personnel in order to check the fire load. However, the current general fire load rule (limitation of combustible liquid in the room) is not strictly applied.

The development and implementation of a comprehensive fire hazard analysis and the utilization of the results to improve the practice of combustible materials control are needed.

2.3.7. Management of accident conditions

The review of the area of management of accident conditions raised 2 suggestions.

• No trends

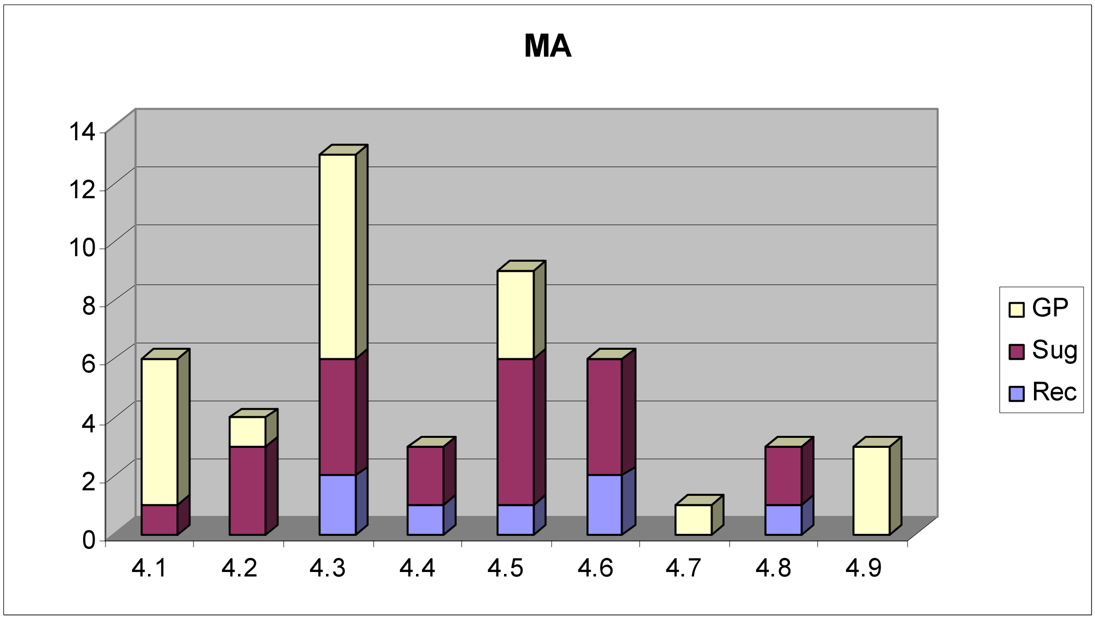
The issues related to insufficient qualification of instrumentation and guidelines for accident management. No trends were evident on these findings.

2.4. Maintenance

2.4.0 Summary results from the evaluation

The review of the maintenance area for the 17 plants resulted in 48 findings from which 7 are recommendations, 21 are suggestions and there are 20 good practices.
The distribution of the findings between the different topics of the maintenance review is presented bellow:

Title		Rec.	Sug.	GP	Total
4.1	Organization and functions	0	1	5	6
4.2	Maintenance facilities and equipment	0	3	1	4
4.3	Maintenance programmes	2	4	7	13
4.4	Procedures, records and histories	1	2	0	3
4.5	Conduct of maintenance work	1	5	3	9
4.6	Material conditions	2	4	0	6
4.7	Work control	0	0	1	1
4.8	Spare parts and materials	1	2	0	3
4.9	Outage management	0	0	3	3
Total		7	21	20	48



2.4.1. Organization and functions

In the area of organization and functions during the evaluated missions, 6 findings were identified of which 5 were good practices and there were one suggestion.

• Trend: In a few plants, particular attention is paid to supporting contractors who provide services in maintenance activities in enhancing their qualification. (3/17, Positive trend)

During recent years, plants have been focused on contractor management issues and it is noticeable that maintenance organizations pay increased attention on assurance of the adequate qualification of the contractor's staff performing maintenance activities. Support in terms of contractors' qualification includes refresher training, professional enhancement training, OE information utilization and training on industrial and radiation safety.

2.4.2. Maintenance facilities and equipment

The reviews of the maintenance facilities and equipment resulted in 3 suggestions and one good practice.

• Trend: In a few plants, the programmes for the calibration of instruments and test equipment are not sufficiently implemented. (2/17)

Though plant maintenance organizations pay more attention on assuring adequate maintenance facilities and tools, the results of the review show that a few examples exist where calibration programme for instrumentation and test equipment does not always provide for detection of inaccuracies.

An effective control of the calibration process should be employed to ensure traceability of instrumentation as well as measurement and test equipment in order to evaluate the validity of measurements or tests made.

2.4.3. Maintenance programmes

The reviews of the maintenance programmes resulted in 6 issues (2 recommendations and 4 suggestions) and 7 good practices.

• Trend: In some plants, the implementation of plant maintenance programmes was not fully adequate. (5/17)

Inadequate implementation of maintenance programmes for systems, structures and components (SSC) such as: improper supports for pipelines, unsecured equipment such as chains of the cranes, improperly insulated electrical cables, foreign material exclusion concerns and poor material conditions.

Plants should consider complete and effective implementation of maintenance programmes according to their scope and timing in order to prevent SSC degradation and to ensure their reliability.

• Trend: In a few plants, there is an increased use of computerized monitoring systems for the control of the condition and charactristics of SSCs. (2/17, Positive trend)

Nowadays, the use of computerized systems in the nuclear industry allows for appropriate monitoring of plant SSCs condition and characteristics. Computerized systems allow integrated use and analysis of different data gathering on-line and off-line from various applications such as vibration data, oil analysis, induction analysis, infrared thermography, ultrasonic analysis, electric power measurements and other characteristics. This approach creates new possibilities for efficient implementation of proactive and, in particular, predictive maintenance programmes.

2.4.4. Procedures, records and histories

In the area of procedures, records and histories the reviews resulted in 3 findings. (One recommendation and 2 suggestions)

• Trend: In a few plants, the maintenance procedures do not contain all the necessary information that may not allow personnel to perform maintenance activities on time and in a reliable manner. (3/17)

It was noted that some important information such as control points, foreign material intrusion risks, identification numbers of the tools for traceability, qualification requirements of the workers and acceptance criteria during post maintenance testing is missing in the maintenance procedures.

Plants should consider providing all necessary information in step-by-step procedures for all important maintenance activities in order to ensure work implementation is undertaken at low risk and with enhancement of the maintenance quality.

2.4.5. Conduct of maintenance work

The reviews of conduct of maintenance work resulted in 6 issues (one recommendation and 5 suggestions) and 3 good practices.

• Trend: In a few plants, the observed maintenance work practices in the field show some areas that need improvement. (2/17)

OSART teams noted a lack of a rigorous and professional approach in work performance, such as: inappropriate setting of scaffoldings, performing welding work without protection screens, incorrect cable termination and not following work permissions and procedures with sufficiently detailed information.

Plant management should provide adequate supervision and reinforce safe working practice in the field by promoting safe behaviour and improving the work control process.

• Trend: In a few plants, the foreign material exclusion (FME) programme is not consistently and effectively applied. (3/17)

The results of the review show that FME programmes are not comprehensive enough and their implementation still leaves room for improvements in all aspects of this topic such as policy, organization, planning, implementation and control.

Intrusion of foreign materials can strongly jeopardize the plant safety. Therefore, the plants should reinforce their FME programmes to ensure strict implementation and practices throughout the organization including contractors.

2.4.6. Material conditions

This review resulted in 2 recommendations and 4 suggestions.

• Trend: Some plants need to improve their material conditions programmes and reinforce their implementation. (6/17)

The OSART team's findings were regarding two areas of material conditions. They are related to material conditions programmes and the corrective actions that are taken to eliminate existing deficiencies. During the review, poor material conditions such as: leaks, no labelling and debris were found.

In a few plants, the programmes for elimination of small deficiencies in material conditions are not fully implemented or actions to eliminate deficiencies are not taken at all. In some cases, the reinforcement of different aspects of the programme such as identification, report, monitoring of condition and elimination of deficiencies is not sufficient.

2.4.7. Work control

The reviews of conduct of work control resulted in one good practice.

• No trends.

Though no trends are available for this topic, nevertheless a good practice was identified that reflected a common tendency to use a computerized work control system which allows more efficient work planning and adequate resource management.

2.4.8. Spare parts and materials

The reviews of spare parts and materials resulted in 3 issues (one recommendation and 2 suggestions).

• Trend: In a few plants, there are indications that plant policies for the control of spare parts and hazardous materials are not followed. (3/17)

This trend shows that there are several issues in spare part management aspects. The main concerns are related to the storage and control of spare parts, inadequate tagging of hazardous, flammable and fragile items, improper segregation of non-conforming items and incomplete traceability of some safety related equipment.

Most of the findings could be avoided by improving existing practices and enhancement of the control over the spare parts and hazardous materials.

2.4.9. Outage management

The reviews of outage management resulted in 3 good practices.

• No trends.

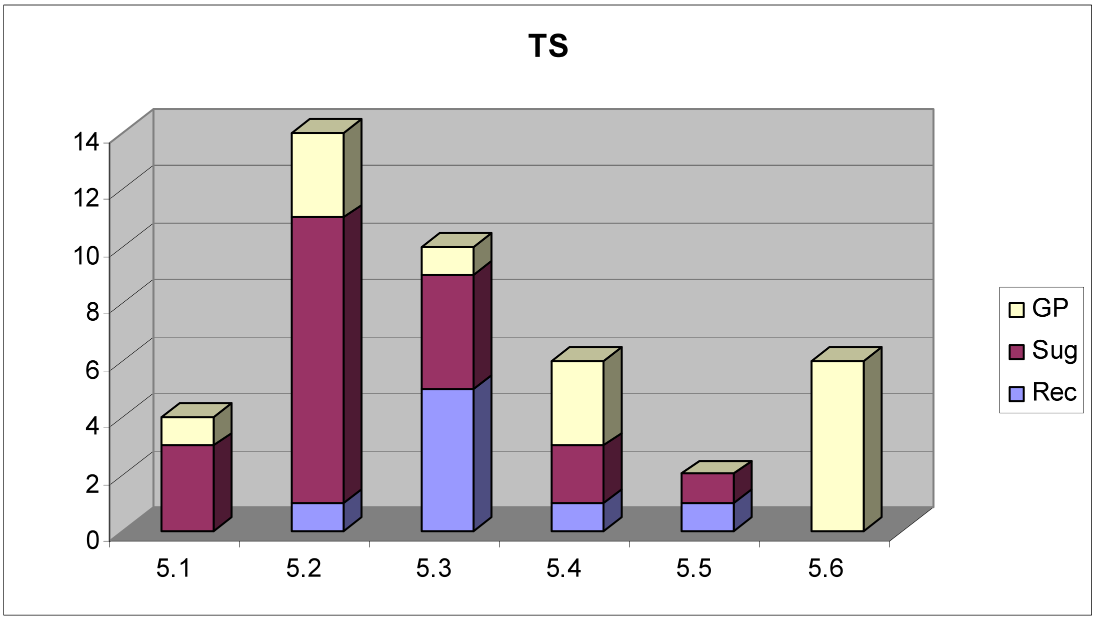
Good practices are identified in outage management relating to thorough planning of the main outage activities and effective risk management during outage scheduling.

2.5. Technical support

2.5.0 Summary results from the evaluation

The review of the area resulted in 42 findings from which there are 8 recommendations, 20 suggestions and 14 good practices.
The distribution of the findings between the different topics of the Technical Support (TS) review is presented below:

Title		Rec.	Sug.	GP	Total
5.1	Organization and functions	0	3	1	4
5.2	Surveillance programme	1	10	3	14
5.3	Plant modification system	5	4	1	10
5.4	Reactor core management (reactor engineering)	1	2	3	6
5.5	Handling of fuel and core component	1	1	0	2
5.6	Computer based systems important to safety	0	0	6	6
Total		8	20	14	42



2.5.1. Organization and functions

In the area of organization and functions, 3 suggestions and one good practice were identified.

• Trend: In a few plants, there are some deficiencies in the safety assessment programme in the area of the application of plant specific PSA and the verification/validation of safety analysis. (2/17)

Many NPPs worldwide have developed a plant specific Probabilistic Safety Analysis report, however in one NPP, the results of the analysis have not been consistently applied. In another NPP, the validity and quality of the safety analysis results was not ensured.

Comprehensive safety analysis with the thorough verification and validation of their results should be considered to provide a valuable support for decision making and safety related engineering activities.

Nevertheless, the OSART team also found a good practice in this area where a high quality and comprehensive PSA, with state-of-art methods and tools, is continuously and extensively used by the plant in several areas.

2.5.2. Surveillance programme

In the area of surveillance programme during these periods, 14 findings were identified. 11 of them are issues including one recommendation and 10 suggestions and 3 of them are good practices.

• Trend: In some plants, the trend analyses of safety related systems from surveillance results are not fully developed to monitor and evaluate their performance. (5/17)

In order to assure safety related SSCs availability, a comprehensive surveillance programme is to be carried out. As a result of this surveillance, a wide range of data is available for the comprehensive evaluation and timely mitigation of possible degradation of the SCC. However, in some cases, plants do not conduct systematic and thorough analysis of the results or trends from these surveillance tests.

Plants should undertake a comprehensive and systematic analysis of surveillance test results using acceptance criteria to ensure early detection of SSCs vulnerability and unavailability.

• Trend: In a few plants, the plant surveillance programme is not sufficiently developed and implemented. (2/17)

In order to ensure safe and reliable operation of all SSCs, and their availability at all times to perform dedicated functions, a comprehensive plant surveillance programme should be in place at the NPP and its implementation should be assured.

2.5.3. Plant modification system

In the area of the system for plant modification, 10 findings are identified. 9 of them are issues including 5 recommendations and 4 suggestions and one is a good practice.

• Trend: In some cases, the administrative and physical control of permanent and temporary modifications is not sufficient. (4/17)

Review teams found that control of the modification process is not always comprehensively implemented. In some cases, control of modifications does not guarantee that all necessary steps of the modification process are fully implemented to prevent inconsistencies in plant configuration. In other cases, control of temporary modifications does not ensure definitive identification and timely resolution.

Plants should reinforce the control of permanent and temporary modifications to maintain plant safety throughout the plant lifetime according to design.

• Trend: In a few plants, the control of modification documents is not adequately implemented. (2/17)

For example, some documents are not finalized at the hand-over stage of a modified system and qualification files do not reflect the design and qualification parameters.

All required documents should be finalized before handover of a modification to Operation Department to ensure thorough verification and control.

2.5.4. Reactor core management (Reactor engineering)

In the area of reactor core management (reactor engineering) during this period, 6 findings are identified. Three of these are issues including one recommendation and 2 suggestions, and 3 of them are good practices.

• Trend: In a few plants, the quality of operating and testing procedures in the area of reactor core management is insufficient. (2/17)

The OSART teams found some deficiencies such as not revised and not updated testing procedures as well as procedures for nuclear physics tests or reactivity control that are not detailed enough and do not provide clear and precise requirements.

It is obvious that procedures regarding reactor core management should be up–to-date, contain detailed information and provide clear and precise requirements for core management actions in order to ensure adequate monitoring and control over such parameters.

• Trend: In a few plants, computerized systems are applied for different activities relating to reactor engineering. (3/17, Positive trend)

A large number of computerized applications are used for a wide range activities relating to reactor engineering to support better core and fuel management.

2.5.5. Handling of fuel and core components

In the area of fuel handling during this period, one recommendation and one suggestion were identified.

• No trends

The observations made by the OSART teams show that there are concerns regarding the rigorous manner for fuel handling activities and non-nuclear materials management in the spent fuel pool area.

2.5.6. Computer based systems important to safety

In the area of computer applications important to safety during this period, 6 findings are identified. All of them are good practices.

• Trend: In a few plants, particular attention is paid to ensuring safe and secure use of computer and digital based systems. (2/17, Positive trend)

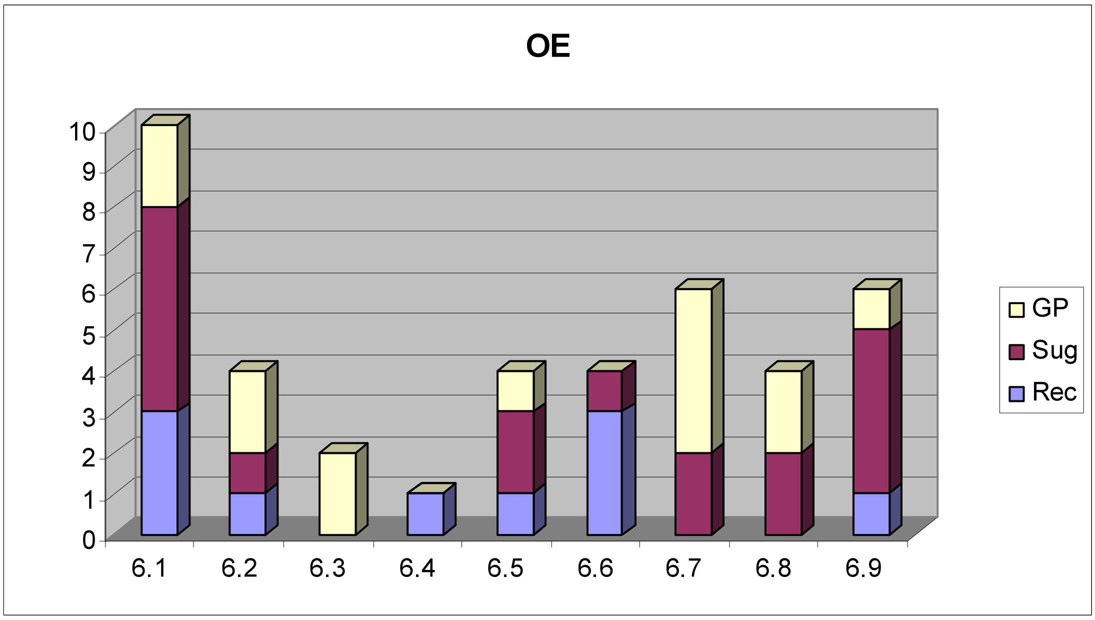
Computer and digital based systems application in NPPs should be protected from unauthorized access and potential information damage. A graded approach is used to provide adequate protection of hardware and data by means of reducing the risk of mixing and changing data and by using authorization limitations and physical separation. Protection needs are identified based on the importance of system functions and the separation into “zones” or “environments” is done considering the grade or the functions performed.

2.6. Operational experience feedback

2.6.0 Summary of results from the evaluation

The review of this area resulted in 41 findings from which there are 10 recommendations, 17 suggestions and 14 good practices.
The distribution of the findings between the different topics of the Operational Experience feedback (OE) review is presented below:

	Title	Rec.	Sug.	GP	Total
6.1	Management, organization and functions of the OE program	3	5	2	10
6.2	Reporting of operating experience	1	1	2	4
6.3	Sources of operating experience	0	0	2	2
6.4	Screening of operating experience information	1	0	0	1
6.5	Analysis	1	2	1	4
6.6	Corrective actions	3	1	0	4
6.7	Use of operating experience	0	2	4	6
6.8	Data base and trending of operating experience	0	2	2	4
6.9	Assessments and indicators of operating experience	1	4	1	6
Total		10	17	14	41



2.6.1. Management, organization and functions of the OE program

In the area of management, organization and functions of the OE program, 10 findings (3 recommendations, 5 suggestions and 2 good practices) were identified.

• Trend: In some plants, the operating experience programmes are not sufficiently developed and implemented. (4/17)

Examples show that:
– Event reporting practices have some problems with timeliness and accuracy or quality.

– Corrective actions are not prioritized.
– Except for reportable events required by law, the performance indicators (the number of in-depth analysis, the number of corrective actions that are open or overdue, and so on) are not used
– The OE feedback process is not optimized. (2 kinds of reporting forms, many committees for OE)

A comprehensive and optimized OE programme should be developed and implemented.

2.6.2. Reporting of operating experience

In the area of reporting of operating experience during the mentioned period, 4 findings (one recommendation, one suggestion and 2 good practices) were identified.

• Trend: In a few plants, low level events and near misses are not reported in a systematic and consistent manner. (2/17)

Examples show that:
– In some cases, fault reports regarding low level events and near misses are not written.
– Some low level events and near misses are reported but not recorded for further trending.

A comprehensive, systematic and integrated low level events and near miss reporting programme should be developed by the plants.

2.6.3. Sources of operating experience

In the area of sources of operating experience during the mentioned period, 2 good practices were identified.

• No trends

There are 2 positive findings regarding information exchanges with other NPPs or conventional plants.

2.6.4. Screening of operating experience information

In the area of screening of operating experience information during the mentioned period, one recommendation was identified.

• No trends

There is one issue regarding the screening process for in-house operating experience information.

2.6.5. Analysis

In the area of analysis during the mentioned period, 4 findings (one recommendation, 2 suggestions and one good practice) were identified.

• Trend: In a few plants, programmes and procedures do not fully cover the analysis of low level events and near misses. (2/17)

Examples show that:
– The analysis of low level events does not identify the origin of the deficiencies.
– For low level events and near misses, there are no formal requirements for risk based analysis, common cause analysis and precursor analysis.

The process of analysis of low level events and near misses should be formalized.

2.6.6. Corrective actions

In the area of corrective actions during the mentioned period, 4 findings (3 recommendations and one suggestion) were identified.

• Trend: In a few plants, corrective actions for safety significant events are not prioritized. (2/17)

Examples show that;
– Corrective or improvement actions included in the outage action list are not prioritized.
– The plant does not have a system to effectively manage all pending corrective actions. It is one of the root causes to the repetitive events regarding exceeded testing intervals.

Corrective actions should be prioritized according to their impact on safety and realistic targets for their completion should also be set.

2.6.7. Use of operating experience

In the area of use of operating experience during the mentioned period, 5 findings (2 suggestions and 3 good practices) were identified.

• Trend: In a few plants, an integrated and systematic process to incorporate Operating Experience (OE) lessons learned into plant programmes and activities is not implemented. (2/17)

Examples show that:
– OEs are currently not used in pre-job briefings.
– A just-in-time library has not been put in place, this results in OE information not being easily accessible to the plant personnel and not being effectively used during pre-job briefings.
– Training materials do not identify those OE commitments that should be preserved.

Enforcement of the effective use of OE throughout the plant should be undertaken.

2.6.8. Data base and trending of operating experience

In the area of data base and trending of operating experience during the mentioned period, 4 findings (2 suggestion and 2 good practices) were identified.

• No trends

There are two issues regarding the event coding system and searching tool and the trend analysis of significant events.

2.6.9. Assessments and indicators of operating experience

In the area of assessments and indicators of operating experience during the mentioned period, 6 findings (one recommendation, 4 suggestions and one good practice) were identified.

• Trend: In some plants, the effectiveness of the Operating Experience (OE) programme is not sufficiently assessed. (6/17)

Examples show that:
– There is no comprehensive or regular monitoring of the effectiveness of the OE feedback process in place.
– The overall effectiveness of corrective actions was not evaluated in the self-assessment.
– Key indicators such as “the number of recurrent events, number and age of reports awaiting evaluation etc.” are not used in tracking the effectiveness of the OE process.
– There are no requirements for the self-assessment of the OE process at departmental level.
– There is no plant procedure which contains an integrated description/explanation of the overall plant OE system/programme or process.
– The plant has not established any guidance or methodology to determine the effectiveness of the OE process.

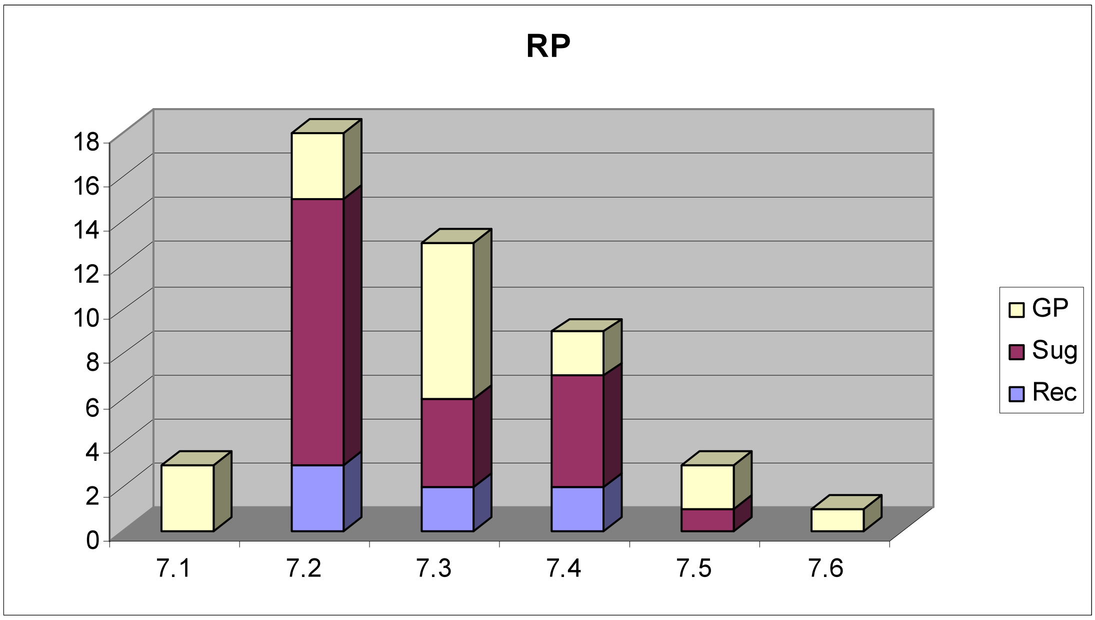
A consistent and systematic monitoring, evaluation and self-assessment programme for the measurement of the overall OE process effectiveness should be established.

2.7. Radiation protection

2.7.0 Summary results from the evaluation

The review of the area resulted in 47 findings from which there are 7 recommendations, 22 suggestions and 18 good practices.
The distribution of the findings between the different topics of the Radiation Protection review is presented below:

	Title	Rec.	Sug.	GP	Total
7.1	Organization and functions	0	0	3	3
7.2	Radiation work control	3	12	3	18
7.3	Control of occupational exposure	2	4	7	13
7.4	Radiation protection instrumentation, protective clothing and facilities	2	5	2	9
7.5	Radioactive waste management and discharges	0	1	2	3
7.6	Radiation protection support during emergencies	0	0	1	1
	Total	7	22	18	47



2.7.1. Organization and functions

In this subject, 3 good practices were reported.

• Trend: In a few plants, there are unique and exclusive systems that radiation protection (RP) personnel have high motivation to ensure and improve their qualification (2/17, Positive trend).

Examples show that:
– Yearly voluntary competitions among RP personnel within the RP department are organized. The winner of a site competes against the winners of other sites.

– A job classification is carried out annually by RP managers to investigate the competence considering the results of qualification examination, training records, social behaviour, skill, knowledge and experience.

2.7.2. Radiation work control

There are 18 findings consisting of 3 recommendations, 12 suggestions and 3 good practices in this subject.

• Trend: In some plants, measures for preventing the spread of contamination are not sufficient. (8/17).

Examples are as follows:
– Preventive measures such as the regular use of hand or foot monitors are not strictly applied.
– Personal items are not always measured when exiting the Radiation Controlled Area(RCA).
– “Clean” and possible contaminated paths cross.
– The programme of radiation survey was not capable of identifying contamination, and a programme does not exist for all relevant parts of the plant.
– Laboratories are not adequately radiologically classified.
– Plastic packed waste from the RCA was not labelled as to whether it was contaminated or not.

Clear procedures and fully implemented rules can prevent the spread of contamination.

• Trend: In a few plants some incorrect demonstrations in training videos for radiation protection exist. (2/17)

Examples show that:
– The proper use of personal protective equipment is not emphasized through practical training.
– The plant training video demonstrates incorrect contaminated shoe removal.
– The plant training video shows incorrect placing of equipment and tools on the floor without using a plastic sheet.

Appropriate training can reduce the risk of spreading contamination and unnecessary personnel exposure.

• Trend: In some plants, measures to prevent contamination of personnel are insufficient. (4/17).

Examples show that:
– In some cases plant workers do not follow the necessary requirements to prevent contamination.
– Incorrect behaviour was observed and tolerated by RP staff.

Appropriate behaviour of personnel reduces the risk of personnel contamination and unnecessary exposure.

• Trend: In a few plants, the protective painted coating inside the radiation control area is inadequate. (2/17)

Examples show that:
– Floors are the main affected areas of damage.
– Defects range from large cracks to holes.
– Protective coating is missing after the removal of equipment.

Establishing a surveillance and repair programme which allows prioritization and repair of these defects, after reporting in a timely manner, could prevent undue exposure of workers as well as limiting the production of additional solid waste.

Good practices have been identified using a camera system as an additional supervisory tool to follow workers actions, an advanced radiation monitoring system to provide easily accessible information regarding the area radiation situation and a portable radiation survey system combined with a pocket personal computer.

2.7.3. Control of occupational exposure

In this topic, 6 issues (2 recommendation and 4 suggestions) and 7 good practices have been identified.

• Trend: In a few plants, the management of personal dose records is not sufficient. (2/17)

Examples show that:
– The procedure for the dose commitment assessment from internal contamination is not available.
– Personal external exposure records provide only the value of annual effective dose in the given year, but separate records for the neutron dose or dose estimation in case of loss of dosimeter, is missing.
– Both electronic personal dosimeter and thermo luminescent dosimeter exposures are recorded, but the official, legal dosimeter is not defined..

The proper management of personal exposure records serves to assess accurate personal exposures..

OSART missions identified 7 good practices in this area aimed towards the reduction of radiation exposure, but all by different means. The means include seismically qualified fixed structures for blankets of lead shielding, sensitive detectors and dosimeters, lowered alarm levels, valve position display and a mobile crud removal system.

2.7.4. Radiation protection instrumentation, protective clothing and facilities

In this topic, 7 issues (2 recommendation and 5 suggestions) and 2 good practices have been identified.

• Trend: In some plants, the radiation detection devices are not fully capable of measuring contamination of personnel (6/17).

Examples show that:
– The personal contamination monitors at the exits from the RCA do not provide entire body monitoring due to geometric detection limitations.
– Sensitivity of monitors is not sufficient to monitor the workers skin contamination in compliance with the plant threshold.
– The overall surface area of the detectors is not large enough.

RCA exit monitors with correct dimension and sensitivity prevent contaminated workers exiting the RCA and possible spreading contamination inside the plant.

However good practices have been identified in the areas of contamination checks of large objects as well as in dose accounting and the personal control system.

2.7.5. Radioactive waste management and discharges

In this topic, one suggestion and 2 good practices were identified.

• No trends:

The issue is related to instructions on waste sorting at the source which are not satisfactorily developed and implemented. (1/17)

The good practices relate to improvements in the oversight and control over transportation and a mobile decontamination system for primary systems.

2.7.6. Radiation protection support during emergencies

Reviews in this topic resulted in one good practice.

• No trends.

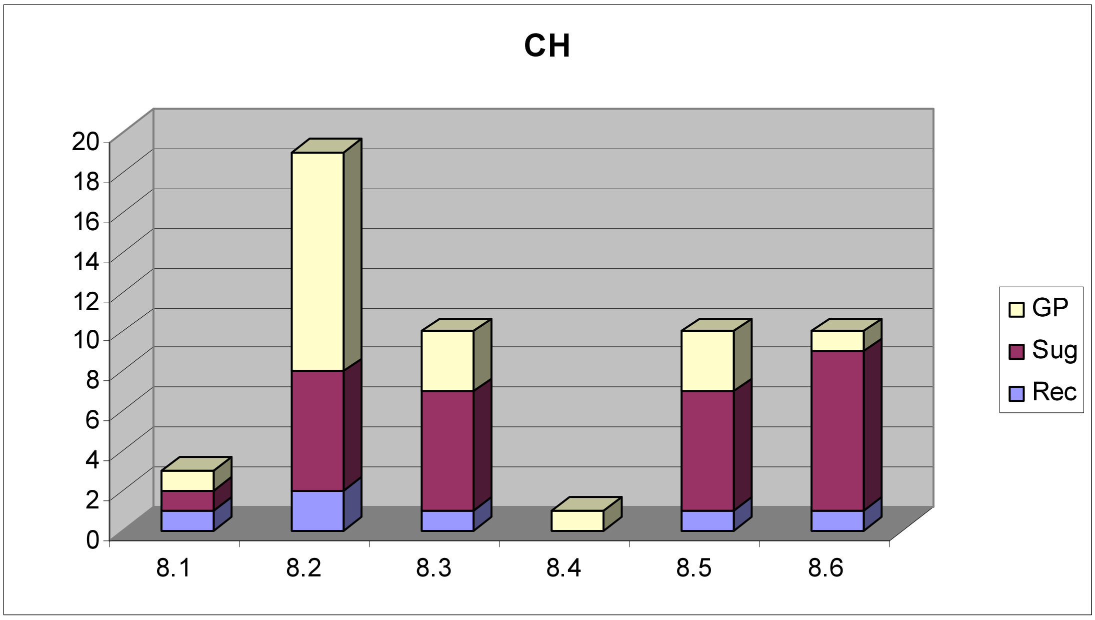
The good practice is related to an additional and automated radiation monitoring system.

2.8. Chemistry

2.8.0 Summary results from the evaluation

The 17 OSART missions provide 53 findings in the chemistry area. From those 6 were recommendations, 27 were suggestions and 20 were good practices. Details are shown in the following table:

	Title	Rec.	Sug.	GP	Total
8.1	Organization and functions	1	1	1	3
8.2	Chemistry control in plant systems	2	6	11	19
8.3	Chemical surveillance programme	1	6	3	10
8.4	Chemistry operational history	0	0	1	1
8.5	Laboratories, equipment and instruments	1	6	3	10
8.6	Quality control of operational chemicals and other substances	1	8	1	10
	Total	6	27	20	53



2.8.1. Organization and functions

In this subject, one recommendation, one suggestion and one good practice were reported.

• Trend: In a few plants, the chemistry management expectations or goals of the chemistry department are not clearly expressed. (2/17)

Examples show that:
– No formalized process on chemistry management expectations is available.
– Safety expectations are not issued in a procedure.
– No goals are set for primary system chemistry.
– Hand written procedures were found which were not approved.

An appropriate policy in goal setting would promote improvements in plant chemistry and clear rules enhance correct decisions without endangering the integrity of systems and components.

The good practice is related to monitoring and tracking of liquid and gaseous releases.

2.8.2. Chemistry control in plant systems

In chemistry control in plant systems, 2 recommendations, 5 suggestions and 10 good practices were reported.

• Trend: In some plants, the chemistry control programmes are not comprehensive. (7/17)

Examples show that:
– A consistent shelf life management programme is not implemented.
– Chemistry control procedures are not sufficiently focused on operational, industrial and/or nuclear safety.
– Chemistry specifications and the chemistry control programme are not in accordance with international guidelines and chemistry experiences.
– The plant does not accurately verify all contributing parameters to the secondary water treatment.
– The control of water chemistry parameters in secondary systems is not sufficiently comprehensive to identify and trend corrosion processes.
– The procedures to support all chemistry laboratory activities are not fully developed and controlled.

It is important that appropriate information is contained in procedures to prevent personnel injury or improper chemistry control which could affect the safety and reliability of the plant.

The good practices are related to the treatment of resins and liquid waste management.

2.8.3. Chemistry surveillance programme

In this topic, one recommendation, 6 suggestions and 3 good practices were reported.

• Trend: In some plants, the quality control programmes for chemistry surveillance activities are not adequately developed and not sufficiently implemented. (6/17)

Examples show that:
– An independent quality control standard was not used in the calibration of instruments.
– The instrument for boron titration is not regularly controlled.
– Data for validation of the analytical method are not available in the plant.
– Calibration data in some laboratory instruments are not labelled.
– Corrections on the data sheet are done without signature.
– One of the chemistry instruments has been controlled with a laboratory instrument which is not included in the quality control programme.

– A comprehensive data management system does not exist to gather all the chemistry data, monitor the frequency of measurements, quality of data and their validity, which is important to control the quality analysis.
– The plant chemical surveillance programme is not sufficiently comprehensive to deal with all chemistry aspects of safety related system.

Comprehensive quality control for chemical surveillance activities will contribute to the reliable operation of important systems.

2.8.4. Chemistry operational history

In this topic, one good practice was reported.

• No trends

There is one good practice that is related to low sulphur resin.

2.8.5. Laboratories, equipment and instruments

In this topic, 10 findings (7 issues including one recommendation and 6 suggestions, and 3 good practices) were reported.

• Trend: In some plants, the capability and working practices of the Post Accident Sampling System (PASS) are not sufficient for severe accident conditions. (5/17)

Examples show that:
– Practical training for PASS on taking liquid samples and transporting them in a shielded container for analysis has not been done.
– There is no postulated activity of the sampled media from PASS in the beyond design basis accident conditions, therefore no radiological calculations exist to estimate individual doses for the whole process of sampling activities and to verify that sampling can actually be performed.
– The PASS does not have the capability to dilute gaseous samples.
– Sampling bottles for obtaining liquid samples from the liquid phase are not adequately shielded during processing.
– Gas samples from the containment atmosphere are not adequately shielded during processing and transportation.

PASS and sampling containers should be adequate to ensure shielding and dilution of sampled media. In addition, the sampling method and practical training under the expected accident condition should be undertaken.

2.8.6. Quality control of operational chemicals and other substances

In this topic, one recommendation, 8 suggestions and one good practice were reported.

• Trend: In some plants, the housekeeping of chemicals in the laboratory (for example, storage and labelling) is not sufficiently implemented. (7/17)

Examples show that:
– Some hazardous chemical bottles are stored without hazardous pictograms.
– Some bottles are stored without any labelling.
– There are specific cabinets for hazardous chemicals which are not locked. Only poisons are stored in locked cabinets.
– Some chemicals are incorrectly labelled.
– There are open flasks with extremely flammable chemicals in the locked cabinet.
– In the chemical store cabinet, the flammable substances are stored together with oxidizing substances.
– There is no limitation for the storage quantity for liquids in cabinets.

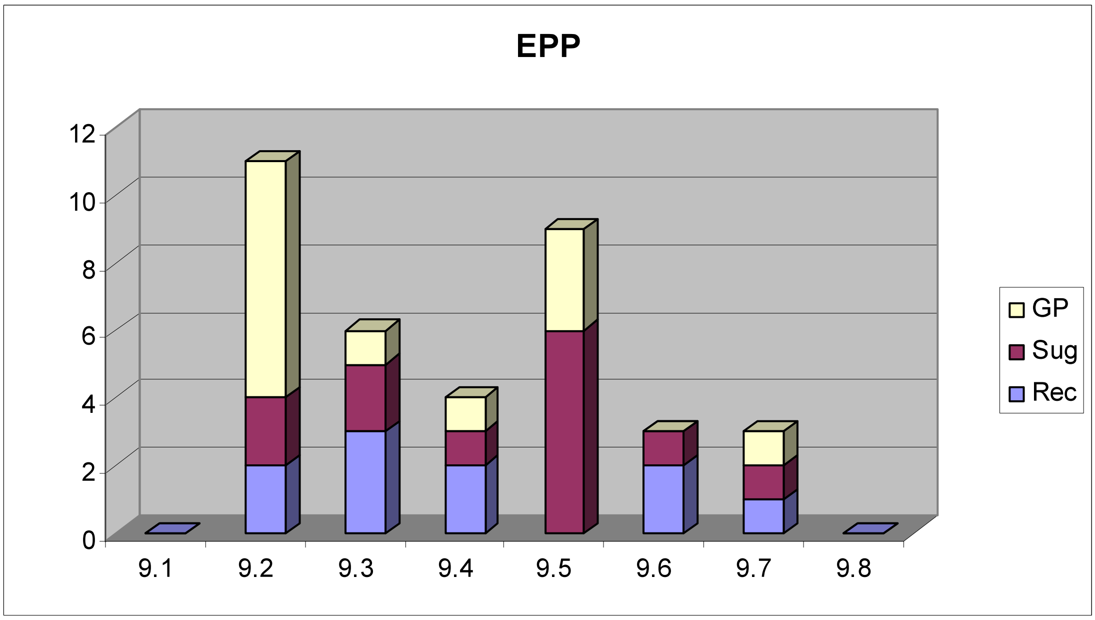
The management of chemicals should be established to ensure that industrial safety protection is provided to the personnel regarding the labelling of chemicals, availability of equipment and availability of safety information.

2.9. Emergency planning and preparedness

2.9.0 Summary results from the evaluation

The OSART teams identified 35 findings in the emergency planning and preparedness (EPP) area. Of these 10 were recommendations and 12 were suggestions. 13 good practices were identified.

Title		Rec.	Sug.	GP	Total
9.1	Emergency programme	0	0	0	0
9.2	Response functions	2	2	7	11
9.3	Emergency plans and organization	3	2	1	6
9.4	Emergency procedures	2	1	1	4
9.5	Emergency response facilities	0	6	3	8
9.6	Emergency equipment and resources	2	1	0	3
9.7	Training, drills and exercises	1	1	1	3
9.8	Quality assurance	0	0	0	0
Total		10	13	13	36



2.9.1. Emergency programme

The OSART teams identified no issues and no good practices in this area.

• No trends.

2.9.2. Response functions

The OSART teams identified 2 recommendations and 2 suggestions in this area. 7 good practices were also identified.

• Trend: In some plants, emergency preparedness arrangements are in place, but there are indications that those arrangements do not fully cover the required responses. (4/17)

Examples are:
– The plant was not fully prepared to implement precautionary urgent actions.
– There was no specific emergency alert signal and there was an absence of radiation monitoring measurements at the on-site emergency centre and on-site fire brigade vehicles.
– Emergency preparedness arrangements for measures to provide protection for all individuals who are on site are not fully updated.
– The on-site assembling programme is not fully adequate.
– The procedure describing the methods for emergency classification does not sufficiently guarantee the timely classification of emergency scenarios.

Adequate protective measures prevent unnecessary radiation exposure to individuals at the site during emergency situations.

7 individual good practices have been identified by the OSART such as communication tools, technical handbook for senior managers, accidental release analysis programme and comprehensive emergency plan for unexpected events.

2.9.3. Emergency plans and organization

The OSART teams identified 3 recommendations and 2 suggestions in this area. One good practice was also identified.

• Trend: In a few plants, there is no individual on-site around the clock with the authority and responsibility to initiate the on-site emergency plan and notify the appropriate off-site notification point. (3/17)

Examples show:
– The site emergency director, who is authorized to initiate the on-site emergency plan, is only present at the plant during office hours.
– The authorization to initiate the external alarm lies with the State representative.
– There are no plans to improve the practice.

Such an authorization would allow a more timely implementation of protective actions.

One good practice is related to harmonized measuring points between a plant located near a border to a neighbouring country, the national authorities and the neighbouring authorities.

2.9.4. Emergency procedures

The OSART teams identified 2 recommendations and one suggestion in this area. One good practice was also identified.

• No trends

The issues are related to inconsistencies in the infrastructure.

The good practice relates to reliable computer based maintenance for emergency documentation.

2.9.5. Emergency response facilities

The OSART teams identified 6 suggestions and 3 good practices in this area.

• Trend: In some plants, the emergency operating facilities do not have appropriate measures and adequate equipment. (5/17)

Examples are:
– No analyses are performed to prove that assembly points are capable to accommodate all relevant personnel.
– There are no contamination monitors at the entrance of the main and the alternative emergency facility.
– Inadequate habitability design and precautions of the emergency operating facilities and the local public information centre.
– Insufficient air tightness of the emergency centre.

Emergency plant facilities should be in an appropriate condition to ensure the safety of the emergency personnel.

The good practices are related to the medical facilities, equipment and procedures for the treatment and transportation of contaminated casualties.

2.9.6. Emergency equipment and resources

The OSART teams identified 2 recommendations and one suggestion in this area.

• Trend: Prompt access to specially designated emergency equipment in time of need is not ensured in a few plants. (2/17)

Examples show:
– Equipment may be downstream of the prevailing wind-direction.
– The dose meters for the off-site fire brigade are stored in the controlled area.

The equipment necessary to respond to an accident should be placed at the most suitable location ensuring life saving actions and ALARA exposures to emergency personnel.

2.9.7. Training, drills and exercises

The OSART teams identified one recommendation, one suggestion and one good practice in this area.

• No trends.

One issue is related to an incomplete process of registration of training qualifications. The other is that a site evacuation exercise was held without realistic transportation methods and an inadequate evacuation route.

2.9.8. Quality assurance

The OSART teams did not identify any issues or good practices in this topic area.

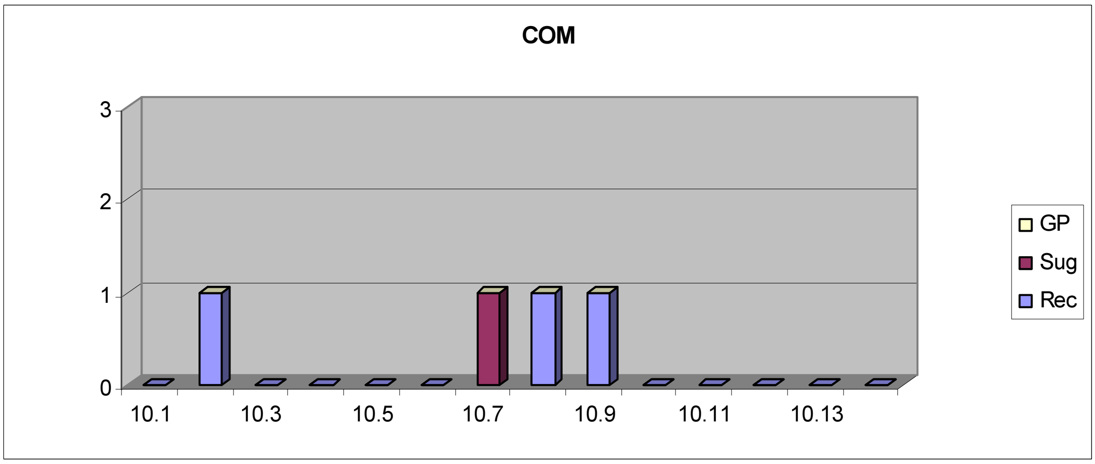
• No trends.

2.10. Commissioning

2.10.0 Summary results from the evaluation

The OSART teams identified 4 issues in the Commissioning area. Of these, 3 were recommendations and one a suggestion. No good practice was identified.

Title		Rec.	Sug.	GP	Total
10.1	Organization and functions	0	0	0	0
10.2	Commissioning programme	1	0	0	1
10.3	Training in commissioning	0	0	0	0
10.4	Preparation and approval of test procedures	0	0	0	0
10.5	Control of test and measuring equipment	0	0	0	0
10.6	Conduct of tests and approval of test results	0	0	0	0
10.7	Maintenance during commissioning	0	1	0	1
10.8	Interface with operations	1	0	0	1
10.9	Interface with construction	1	0	0	1
10.10	Interface with engineering (designer)	0	0	0	0
10.11	Initial fuel loading	0	0	0	0
10.12	Plant handover	0	0	0	0
10.13	Work control and equipment isolation	0	0	0	0
10.14	Control of temporary modifications	0	0	0	0
Total		3	1	0	4



2.10.1. Organization and functions

The OSART teams did not identify any issues or good practices in this topic area.

• No trends

2.10.2. Commissioning programme

The OSART teams identified one recommendation in this area.

• No trends.

There is one issue regarding the schedule and criteria of taking over from the constructor to the operator. The correct order should be considered to avoid the use of a temporary supporting system.

2.10.3. Training in commissioning

The OSART teams did not identify any issues or good practices in this topic area.

• No trends

2.10.4. Preparation and approval of test procedures

The OSART teams did not identified any issues or good practices in this topic area

• No trends

2.10.5. Control of test and measuring equipment

The OSART teams did not identified any issues or good practices in this topic area

• No trends

2.10.6. Conduct of tests and approval of test results

The OSART teams did not identified any issues or good practices in this topic area

• No trends

2.10.7. Maintenance during commissioning

The OSART teams identified one suggestion in this area.

• No trends.

There is one issue regarding the corrosion control to keep systems and equipment in good condition and to avoid problems or unnecessary maintenance in the future.

2.10.8. Interface with operations

The OSART teams identified one recommendation in this area.

• No trends.

There is one issue regarding fire safety during the commissioning phase which is related to the cooperation between the constructer and the operator.

2.10.9. Interface with construction

The OSART teams identified one recommendation in this area.

• No trends.

The issue is related to insufficient control of foreign material exclusion in the construction area.

2.10.10. Interface with engineering (designer)

The OSART teams did not identified any issues or good practices in this topic area

• No trends

2.10.11. Initial fuel loading

The OSART teams did not identified any issues or good practices in this topic area

• No trends

2.10.12. Plant handover

The OSART teams did not identified any issues or good practices in this topic area

• No trends

2.10.13. Work control and equipment isolation

The OSART teams did not identified any issues or good practices in this topic area

• No trends

2.10.14. Control of temporary modifications

The OSART teams did not identified any issues or good practices in this topic area

• No trends

2.11. OSART at the follow-up visit

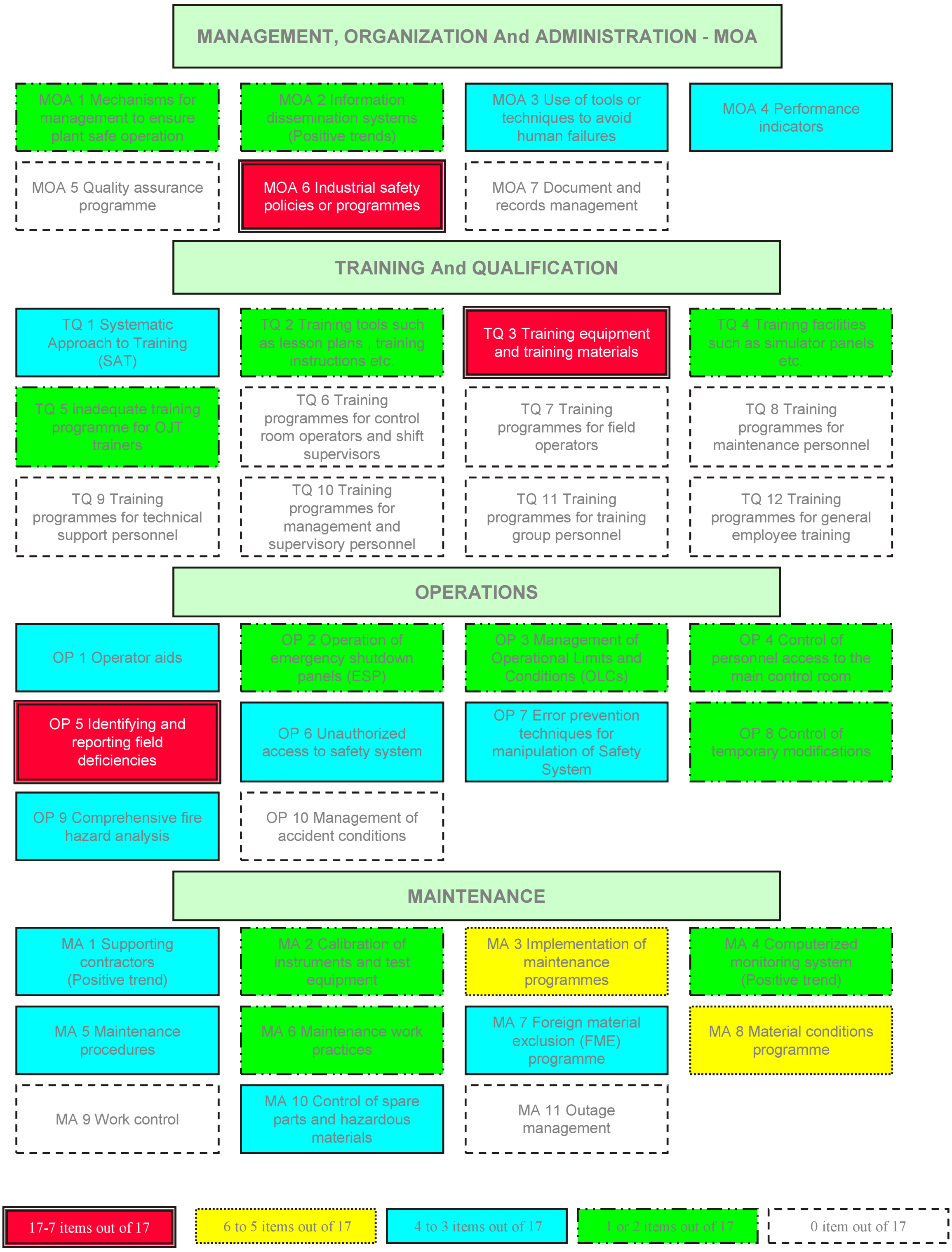
OSART follow-up visits are conducted as an integral part of the OSART process, approximately 18 months to two years after the main OSART mission. From 2007 to 2009, 13 follow-up visits were conducted.

During this period, 98% of the issues (recommendations and suggestions) were either totally resolved or satisfactory progress was made. Only 2% of the issues were concluded as having “insufficient progress”. Among 279 issues, no issues were withdrawn.

These results of the follow-up visits demonstrated the effectiveness of the OSART service and the commitment of the plants to implement improvements identified by OSART teams.

APPENDIX I

OSART 2007–2009 Trends



TECHNICAL SUPPORT

- TS 1 Plant specific PSA and verification /validation of safety analysis
- TS 2 Trend analyses of surveillance results
- TS 3 Plant surveillance programme
- TS 4 Administrative & physical control of permanent/temporary modifications
- TS 5 Control of modification documents
- TS 6 Quality of reactor core management related procedures
- TS 7 Computerized systems for reactor engineering (Positive trend)
- TS 8 Handling of fuel and core components
- TS 9 Particular attentions to computer & digital based systems (Positive trend)

OPERATING EXPERIENCE FEEDBACK

- OE 1 Operating experience programmes
- OE 2 Reporting of low level events and near misses
- OE 3 Sources of operating experience
- OE 4 Screening of operating experience information
- OE 5 Analysis of level events and near misses
- OE 6 Priority of corrective actions
- OE 7 Utilization of OE lessons learned
- OE 8 Data base and trending of operating experience
- OE 9 Assessment of OE programme effectiveness

RADIATION PROTECTION

- RP 1 RP personnel's high motivation (Positive trend)
- RP 2 Prevention of contamination spreading
- RP 3 Training materials or measures for RP
- RP 4 Measures to prevent contamination of personnel
- RP 5 Protective painted coating in RCA
- RP 6 Management of personal dose records
- RP 7 Radiation detection devices
- RP 8 Radioactive waste management and discharges
- RP 9 Radiation protection support during emergencies

CHEMISTRY

- CH 1 Chemistry management expectations or goals
- CH 2 Chemistry control programme
- CH 3 Quality control programme for chemistry surveillance activities
- CH 4 Chemistry operational history
- CH 5 Capability & working practices of PASS
- CH 6 Control of chemicals (storage, labelling)

17-7 items out of 17 | 6 to 5 items out of 17 | 4 to 3 items out of 17 | 1 or 2 items out of 17 | 0 item out of 17

EMERGENCY PLANING and PREPAREDNESS

- EPP 1 Emergency programme
- EPP 2 Emergency preparedness arrangements
- EPP 3 Authority and responsibility to initiate on- site Emergency Plan
- EPP 4 Emergency procedures
- EPP 5 Emergency operating facilities
- EPP 6 Prompt access to emergency equipment
- EPP 7 Training, drills and exercises
- EPP 8 Quality assurance

COMMISSIONING

- COM 1 Organization and functions
- COM 2 Commissioning programme
- COM 3 Training in commissioning
- COM 4 Preparation and approval of test procedures
- COM 5 Control of test and measuring equipment
- COM 6 Conduct of tests and approval of test results
- COM 7 Maintenance during commissioning
- COM 8 Interface with operations
- COM 9 Interface with construction
- COM 10 Interface with engineering (designer)
- COM 11 Initial fuel loading
- COM 12 Plant handover
- COM 13 Work control and equipment isolation
- COM 14 Control of temporary modifications

17-7 items out of 17 | 6 to 5 items out of 17 | 4 to 3 items out of 17 | 1 or 2 items out of 17 | 0 item out of 17

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