IAEA-TECDOC-954

Procedures for self-assessment of operational safety

INTERNATIONAL ATOMIC ENERGY AGENCY

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The originating Section of this publication in the IAEA was:

Operational Safety Section
International Atomic Energy Agency
Wagramerstrasse 5
P.O. Box 100
A-1400 Vienna, Austria

PROCEDURES FOR SELF-ASSESSMENT OF OPERATIONAL SAFETY
IAEA, VIENNA, 1997
IAEA-TECDOC-954
ISSN 1011-4289

Printed by the IAEA in Austria
August 1997

FOREWORD

Self-assessment processes have been continuously developed by nuclear organizations, including nuclear power plants. Currently, the nuclear industry and governmental organizations are showing an increasing interest in the implementation of this process as an effective way for improving safety performance. Self-assessment involves the use of different types of tools and mechanisms to assist the organizations in assessing their own safety performance against given standards. This helps to enhance the understanding of the need for improvements, the feeling of ownership in achieving them and the safety culture as a whole.

Although the primary beneficiaries of the self-assessment process are the plant and operating organization, the results of the self-assessments are also used, for example, to increase the confidence of the regulator in the safe operation of an installation, and could be used to assist in meeting obligations under the Convention on Nuclear Safety. Such considerations influence the form of assessment as well as the type and detail of the results.

The concepts developed in this report present the basic approach to self-assessment taking into consideration experience gained during Operational Safety Review Team (OSART) missions, from organizations and utilities which have successfully implemented parts of a self-assessment programme and from meetings organized to discuss the subject.

The IAEA wishes to thank all the participants in the consultants meeting held in 1995 and the Technical Committee meeting held in 1996.

EDITORIAL NOTE

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1. INTRODUCTION

1.1. BACKGROUND

As part of the nuclear industry's response to the accidents at Three Mile Island in the USA in 1979 and the Chernobyl nuclear power plant (NPP) accident in 1986, programmes to evaluate operational safety performance of nuclear power plants and to encourage improvements were initiated. In the USA, for example, the Institute of Nuclear Power Operations (INPO) was founded by the nuclear utilities and began an operational safety evaluation programme for all nuclear power plants in the USA. For the same purpose and as a result of the Chernobyl accident the World Association of Nuclear Operators (WANO) was founded. Other countries such as the United Kingdom, Canada and France also initiated peer review programmes with similar objectives. On a broader international scale, the IAEA initiated the Operational Safety Review Teams (OSART) [1] programme for voluntary review of safety performance at nuclear power plants. The IAEA also initiated other voluntary programmes, such as Analysis and Screening of Safety Events Teams (ASSET) [2] and Assessment of Safety Culture in Organizations Teams (ASCOT) [3], to assist NPPs and operating organizations in evaluating and strengthening their safety performance.

In September 1994, IAEA Member States began the process of ratifying a new Convention on Nuclear Safety. This convention will establish, for the first time, internationally agreed obligations for ensuring the safety of nuclear power plants and the commitment of the signatory states to meeting them. Under the Convention on Nuclear Safety, Member States with nuclear power plants will report periodically to their peers on the measures taken to meet their obligations under the Convention. While the nature of the report to be made has yet to be determined, it could be expected that countries, in whose nuclear organizations comprehensive self-assessments are practised, will be in a stronger position to make their reports, and able to base them on current in-depth reviews of safety performance by those directly responsible for nuclear power plant operations.

The nuclear industry is showing an increasing interest in the self-assessment process. Many utilities, for reasons not related to the Convention, have chosen to implement a self-assessment process to help their management obtain current and accurate information about safety performance. Self-assessments used as part of an overall improvement programme are effective in enhancing nuclear safety and is a tool that can be developed and used by any nuclear power operating organization, taking into consideration the local characteristics and staff ideas. Experience has shown that when organizations objectively assess their own performance against standards of excellence, the understanding of the need for improvements is heightened and the feeling of ownership for achieving them is significantly enhanced. In this TECDOC the definition of the terms internal and external is dependent on the position of the person viewing the process of assessment, whether within or outside the organization or utility performing the assessment (see Fig. 1).

The IAEA is continually reviewing its services to its Member States, and is in the process of incorporating the self-assessment concept into several of its safety advisory services. As a step toward identifying the need and general outline for possible services that the IAEA could provide to assist Member States in developing self-assessment processes and perhaps more effectively meeting their obligations under the Convention on Nuclear Safety, the Operational Safety Services section called a Consultants meeting in

August 1995 and a Technical Committee meeting in August 1996. These meetings discussed self-assessment practices and considered how the IAEA could best assist utilities worldwide in this area; this document is a primary result of those efforts. In addition, the IAEA/OSS has been represented in international meetings on the subject.

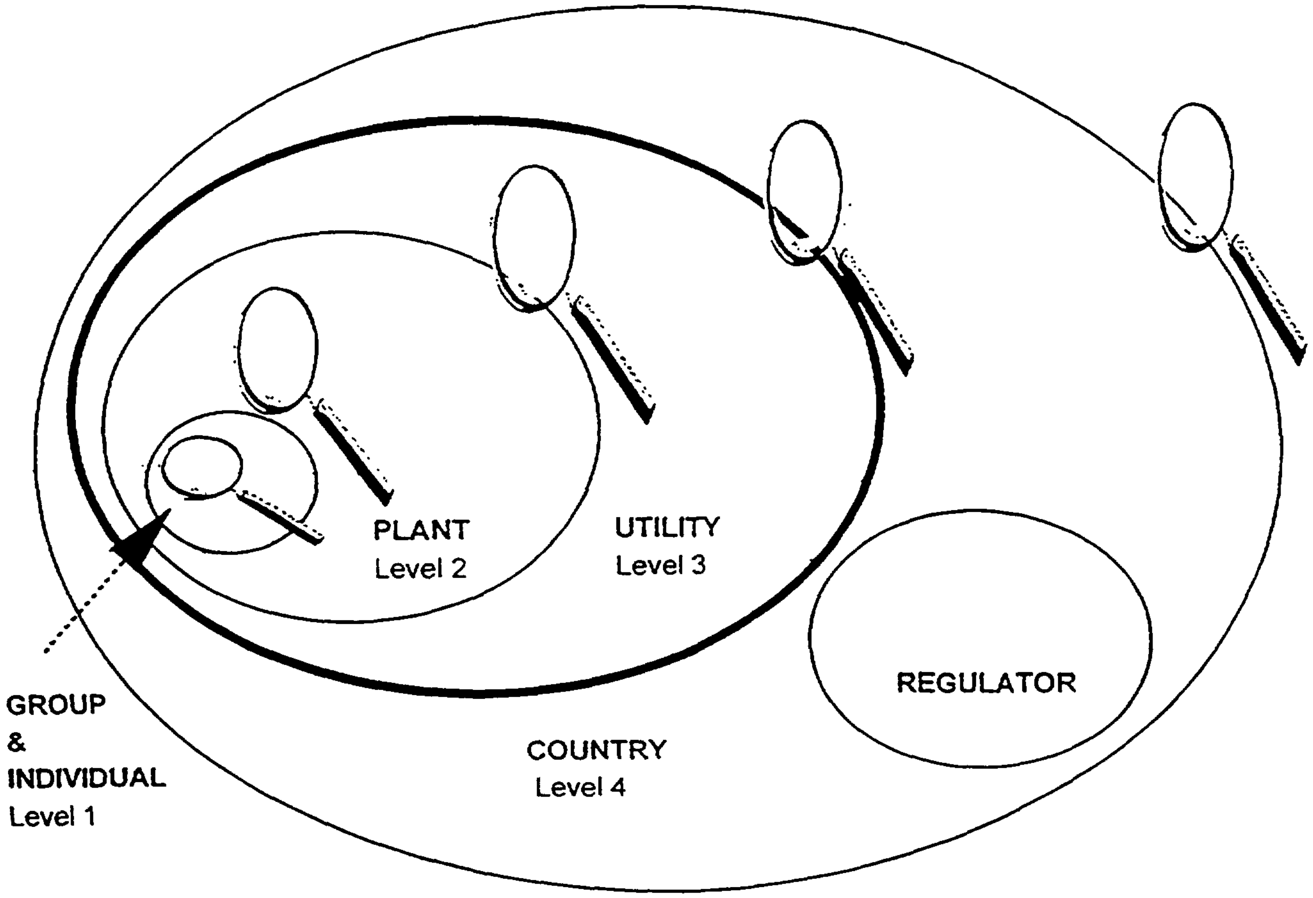

FIG.1. Self-assessment depending on the position of the viewer.

1.2. OBJECTIVES

Self-assessment of operational safety has been identified as an important mechanism that organizations can use to improve safety. The purpose of this publication is to present the basic approach to self-assessment. In so doing it sets out definitions, purpose and main attributes of self-assessment. These are based on experience gained from IAEA services to Member States, and from organizations and utilities which have successfully implemented various parts of self-assessment programme. The concepts developed in the TECDOC are intended to be sufficiently general to encapsulate the wide variety of processes found by the IAEA. Assessments conducted by organizations external to the utility or the operator of the nuclear power plant are not intended to be covered by these procedures although they are occasionally referenced.

The basic concepts and methods of self-assessment have proven to be applicable to other areas such as efficiency, reliability and overall economic performance. However, this TECDOC focuses primarily on the improvements that can be made in the area of safety.

The TECDOC applies to all utilities and organizations responsible for the operation of nuclear power plants and can be used by those who wish to develop, or are at any stage of the development of, an operational self-assessment process.

1.3. TERMS USED

The objective of **nuclear safety** is "to protect individuals, society and the environment from harm by establishing and maintaining in nuclear installations effective defences against radiological hazards."[4, p.2].

Ensuring **operational safety** is an obligation on the nuclear power plant operating organization. The objective of any operating organization is to take all reasonably practicable measures to prevent accidents in nuclear installations and to mitigate their consequences should they occur; to ensure with a high level of confidence that, for all possible accidents taken into account in the design of the installation, including those of very low probability, any radiological consequences would be minor and below prescribed limits; and to ensure that the likelihood of accidents with serious radiological consequences is extremely low" [4]. Characteristics of operational safety include: conservative decision making; operation of the plant within the safety analysis envelope; maintenance of defence-in-depth against unplanned events and their consequences through high levels of equipment reliability and human performance; and ensuring that all plant and procedure modifications are adequately considered for safety consequences.

Self-assessment is a structured, objective and visible procedure or set of procedures whereby individuals, groups and management within an operating organization evaluate the effectiveness of their own operational safety against predetermined targets, goals and other performance expectations. The self-assessment process is only complete when the corrective actions have been implemented and their adequacy confirmed.

2. PERFORMANCE EXPECTATIONS

Self-assessment is essentially a critical comparison of existing activities and results against a predetermined set of performance expectations.

The full set of performance expectations can be the set of goals, targets and objectives, including those set by the organization management, that are to be followed and achieved by the staff as a whole and may include performance expectations other than safety. The performance expectations may exist in different forms, such as qualitative executive management policy statements as well as quantitative performance measures, with their associated mutually agreed targets. The performance expectations must be visible and made public to all staff. They must be constructed in such a way as to ensure that relevant staff can recognize how they contribute to their achievement. Performance expectations concern, for example:

- demonstration of a good safety culture
- unavailability of safety systems
- radiation exposure
- completion of safety plant modifications
- industrial safety accident frequency rate
- improvement in communication.

The performance expectations should be set by:

- taking into account regulatory requirements as a minimum level
- considering attributes of the top performing plants in relevant areas
- looking at best practices published by international organizations and institutions.

In order to ensure that performance expectations will be achieved they must be measurable and trended. Trending is important in order to show that corrective actions are effective.

Targets should be reviewed on a regular basis to ensure that performance continues to improve. When targets are surpassed, this should be recognized as a successful outcome and as a foundation for the achievement of even higher levels of performance.

3. PURPOSE AND BENEFITS OF SELF-ASSESSMENT

The purpose of self-assessment is to promote improved safety performance through the direct involvement of personnel in the critical examination and improvement of their own work activities and work results. It is designed to ensure that line management is effective and monitoring operational safety performance and takes timely corrective actions to improve performance. At lower levels of the organization potential weaknesses can be detected and often resolved well before they reduce any margin of safe operation.

Self-assessments are also designed to identify and overcome process weaknesses and obstacles to the achievement of safety performance objectives. As a result the allocation of resources can be prioritized.

Experience of the application of self-assessment has shown that the following benefits can be gained from an effective programme:

- It maintains a continuous assessment of safety throughout the whole of the organization; this allows improvements to be made based on up-to-date factual knowledge and the objectives to be achieved.

- Staff awareness of the self-assessment process can result in a better understanding of the performance expectations and can broaden staff knowledge of the objectives to be achieved, and how they can be reached. Training of staff in the self-assessment processes can also result in enhancement of their individual skills.

- A strong commitment to the self-assessment process can motivate staff to seek improvements in safety performance. The involvement of individuals in examining the effectiveness of activities for which they are responsible, or in which they are involved, can help them to understand the need for improvement, and should lead them to identify improvement actions, thus encouraging problem solving at the working level. This will assist in developing a greater sense of ownership and openness in which staff feel confident in bringing problems forward and in suggesting improvements.

- The self-assessment process, in conjunction with other forms of internal and external assessments, is a major factor in reaching the desired overall performance expectations and maintaining and enhancing safety culture.

- Although the primary beneficiary of strong self-assessments will be the plant and operating organization, the results of the self-assessments could be used, for example, to increase the confidence of the regulator in the safe operation of an installation or to assist the meeting of obligations under the Convention on Nuclear Safety. Such considerations may influence the form of assessment as well as the type and detail of the results.

- Self-assessments can help to improve communication and working relationship across all levels of the organization.

There should be no significant differences in the benefits of self-assessment due to local factors such as culture, resources or size of national nuclear power programme, provided the self-assessment processes are applied effectively.

4. SCOPE OF SELF-ASSESSMENT

The self-assessment process should permeate throughout all levels of the organization by being an integral part of the work pattern. In scope, it should cover all areas important to safe operation. The scope of assessment is illustrated in Fig. 2. It contains four layers of which three are within the area to which the self-assessment process is applied. These are:

- Independent internal assessment, where a group, within the utility but independent of the line organization being assessed, carries out the evaluation. Viewed from the outside of the utility, this is regarded as a self-assessment process.

- Management and supervision self-assessment, where the plant management on an ongoing process evaluates the effectiveness of performance in their respective areas of responsibility.

- Individual and work group self-assessment, where individuals and/or teams each assess their individual or group performance against a set of mutually agreed performance expectations.

Examples of different self-assessment processes are given in Table II.

Independent external assessment, carried out by a body that is external to the utility, is not considered to be part of the self-assessment processes described in this document. IAEA OSART and ASSET missions, INPO and WANO peer reviews as well as regulatory body reviews are examples of independent external assessment processes.

Self-assessment processes should be used at all levels of the organization in order to determine improvements and how performance expectations can be met.

It is envisaged that individuals and work groups will tend to examine immediate actions and their input to performance expectations while management and supervisors evaluate performance over a greater time period. With reference to Fig. 2 there is a correlation between the several layers and the frame adopted for self-assessment, i.e. in the base layer, the time frame is short and this time frame progressively increases as one moves upward on the triangle.

The commitment of the individuals and management at all levels is needed for the success of the self-assessment programme. This includes active involvement in developing and implementing the self-assessment plan and creating a positive self-assessment culture.

It is essential that those involved in the self-assessment of operational safety should have the opportunity to calibrate their findings by having independent confirmation by a body outside the nuclear power plant or utility. This should take place on a frequency consistent with the effectiveness and results of the self-assessment process in place.

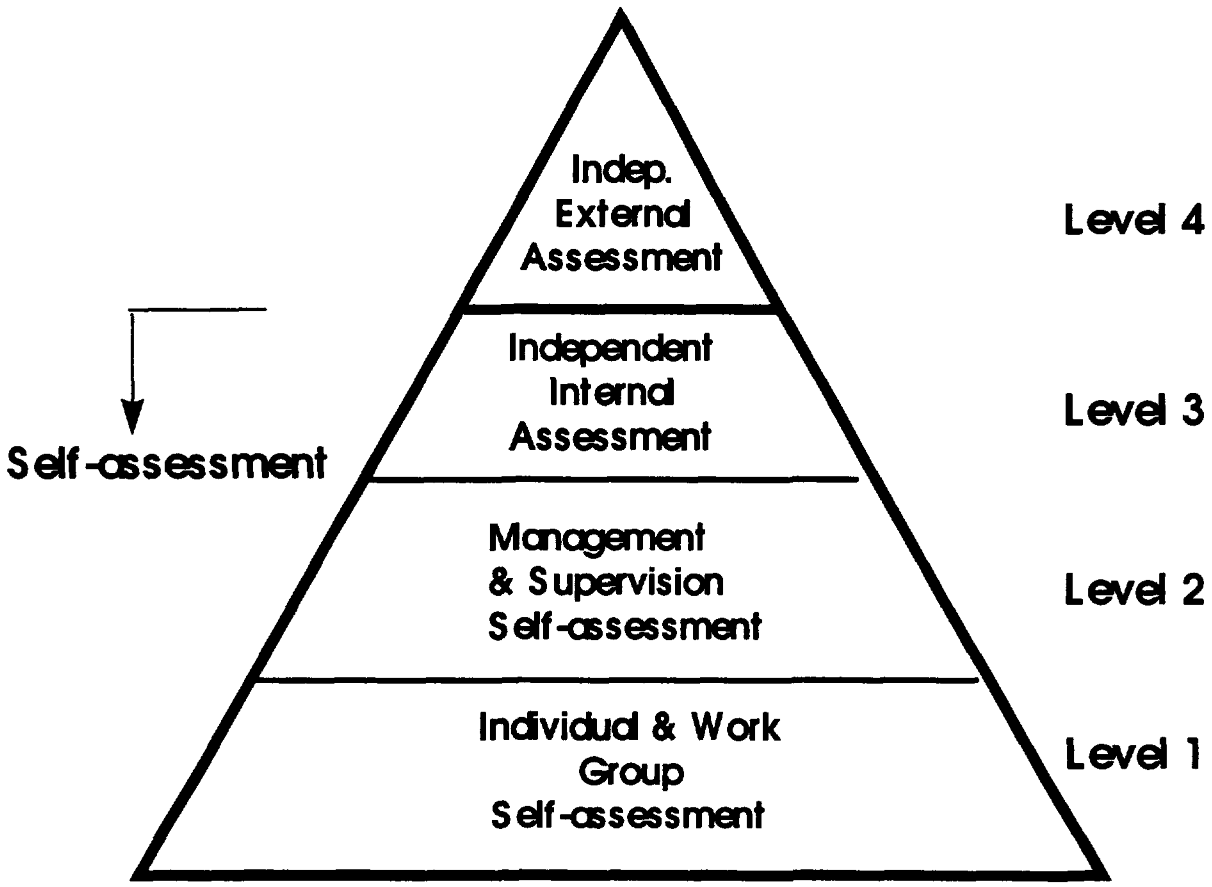

FIG. 2. Triangle of the assessment process

5. METHODS FOR SELF-ASSESSMENT

5.1. OVERVIEW

5.1.1. Management role

Self-assessment should be a continuous process initiated by management to evaluate the effectiveness of safety management and plant safety. This role is important to ensure that a high level of safety is maintained throughout the life of a nuclear installation, and to facilitate continuous improvement in all aspects of safety. Giving appropriate attention and resources to the self-assessment of operational safety is an essential part of the safety management system.

5.1.2. Creating a self-assessment culture

Much research has been performed in the area of organizational culture, and it turns out that the overall performance of many companies and corporations is strongly linked to cultural characteristics. In advanced societies, the organizations which are best suited to adapt to change are those with the clear advantage and have the highest probability of success.

Organizational cultures are often similar to those of their country of origin, but as we find more and more international companies, the link between the organizational culture and the culture of the country are less and less apparent. In fact, when we think of national cultures, we often think of characteristics or attributes which are easily noticed. However, when we think of organizational cultures, we often look more at behaviour, and in more and more cases, we look at the values that organizations hold as the core of their business, e.g., those attributes which act as the central focus of the entire organization.

In the nuclear business, we frequently speak of safety culture - for it must be that nuclear safety remains our central focus. This safety culture translates into a very simple axiom; we need to identify, assess and effectively resolve our own problems. Yes, we have built into our designs and processes several levels of defence in depth; but the more efficient we are at dealing with low level issues (before they ever get to the threshold of significance), the better we will be able to perform and produce our products in a manner which is deemed successful, irrespective of what measure we use for success. Our industry safety culture must transcend some of our traditional customs to ensure that nuclear power remains a viable option to produce electrical energy. The resources of this earth are limited, and if the world is to consistently try to improve the standard of living for all people, nuclear power has a vital role to play. Therefore, irrespective of national customs and characteristics, we must be willing to admit errors; we must raise issues within our organization, even if they appear trivial; supervisors and managers must encourage all workers to bring issues to them, and they must be responsive when the issues are brought forward; and finally, we must have reasonable priority schemes to assure the important items are the ones resolved first. Management has the overall responsibility to set the stage for the implementation of a solid safety culture.

Based on the experience of several organizations that have set up self-assessment processes, some of the actions by management to develop and maintain a culture that encourages effective self-assessment could include the following:

- Promulgating management expectations and scheduling self-assessment. This could include an explanation of the motivation and involvement of management and may considerably diminish the impact of the expected lack of time by managers and staff.

- Establishing a programme for technical exchange with other compatible industries/organizations, including other nuclear installations. This could balance internal lack of awareness of better ways to improve performance.

- Setting examples of encouraging and accepting constructive criticism as a method for improving performance. This could eliminate the unwillingness to accept criticism.

- Establishing data and information systems (surveillance, maintenance, operational data, etc.) to facilitate the systematic analysis of results. The provision of sufficient and consistent data and information will enhance the process of self-assessment.

- Establishing a comprehensive training programme, which could include assessment techniques, root cause analysis, team training, and use of databases. Achieving common purpose and teamwork, and an accurate estimation of training necessary to carry out the self-assessment process will assist the development of self-assessment within an organization.

- Anticipating ways to effectively deal with the possible large number of suggestions that will emerge as a consequence of an open environment for questions and new ideas. The implementation of an effective communication plan will encourage and facilitate constructive two-way communication of the issues.

- Reviewing existing processes, tools and techniques to identify those which already have the attributes of self-assessment. Any such processes that are considered to be effective could form the basis for the broader development of the self-assessment process.

- Encouraging participation in self-assessments by recognizing individual contributions, scheduling time for participation and including self-assessment experience in career development programmes.

- Maintaining a flexible process to accommodate specific needs. The self-assessment process should avoid complex procedures, wherever practicable, and be carefully managed to retain its simplicity and efficiency.

  Evaluating the effectiveness of the overall self-assessment programme periodically. Items that may be considered in this evaluation include : the rate of voluntary participation of plant staff in the self-assessment processes; number of ideas for improvement; results of staff appraisal feedback; reductions in the maintenance work backlog; reductions in the number of non-conformances arising from external audits; reduction of repeated events; and improvements of plant performance targets.

Management of some utilities which have successfully implemented self-assessment processes have established Safety Enhancement Plans for their nuclear installations. These Plans encapsulate actions, schedules, and management expectations, in support of the Corporate top level criteria and objectives, and provide a focus for the effective targeting of priority safety issues at the site level over the relevant planning period.

5.1.3. Role of the individual

To maximize effectiveness, the suggestions and recommendations from appropriate individuals should be sought and taken into consideration. Those personnel who actually perform the tasks on a regular basis are often best placed to understand potential weaknesses and how the process might be improved. The acceptance of individuals' suggestions by management (possibly combined with some form of reward) serves to enhance the commitment of the individual to both the desired performance level and striving for continuous improvement.

Management expectations and individuals' suggestions should be discussed and agreed upon. Objectives and criteria should be publicized to ensure that all staff involved understand and accept them. During organizational meetings and/or training, the performance expectations should also be discussed. Periodic feedback is needed so that staff may understand how their actual performance meets the broader company performance expectations.

5.1.4. Communication of the self-assessment process

The performance expectations, purpose and results of the self-assessment process should be visible to all plant staff, and they should be directly useful to management and staff at all levels.

Maximum benefit will be gained when the needs of the various groups within the organization, for which the self-assessment process is being developed, are considered. The identification of the customers, those who will be expected to make decisions on the basis of the results, is an essential step.

Although the primary beneficiary will be the plant and operating organization, the results of the self-assessments could be used, for example, to increase the confidence of the regulator in the safe operation of an installation or to assist the meeting of obligations under the Convention on Nuclear Safety. Such considerations may influence the form of assessment as well as the type and detail of the results.

5.1.5. Self-assessment process

The actual process used for conducting self-assessments depends on the level and scope of the assessment. There are, however, common steps that apply to all types of assessments. These are discussed in the following sections and summarized in Table I. The formality and extent of their implementation may vary depending upon the specific application.

TABLE I. SELF-ASSESSMENT PROCESS

Note: The following general steps may be used to conduct self-assessments at several levels. Each major step is described in the referenced sub-section of Section 5.

STEP	OBJECTIVE
1. Define the areas to be covered by the self-assessment (5.2)	Define the scope and objectives to be included in an overall self-assessment programme or to be applied to a specific self-assessment activity.
2. Define the performance expectation (5.3)	Define the expected level of performance to fully accomplish the desired safety goals.
3. Identify assessment process and schedule (5.4)	Provide plans, resources and schedules for completing the self-assessment.
4. Conduct performance comparison (5.5)	Compare the actual performance to the established performance expectations to identify differences.
5. Conduct performance assessment (5.6)	Determine the significance of observed differences between performance and expectations necessary to identify the extent and priority of needed corrective actions.
6. Implement corrective actions (5.7)	Implement actions to correct significant identified deficiencies.
7. Monitor effectiveness of corrective actions (5.8)	Monitor performance indications to verify that the actions are effective in resolving performance discrepancy.

5.2. DEFINING THE SELF-ASSESSMENT PROGRAMME

5.2.1. Management role

The primary focus of self-assessment is to ensure operational safety. Thus the overall self-assessment plan should include evaluation of operational activities, maintenance and testing to ensure that safety functions are maintained in accordance with operational limits and conditions.

A key management role in the self-assessment process is developing an overall self-assessment plan that effectively and efficiently achieves the stated goals. The self-assessment plan should identify the specific areas to be assessed and the extent and frequency of each assessment.

In developing the plan both preventive and corrective elements should be considered. Specifically periodic assessments of performance and programmes should be conducted to ensure that minor problems are not collectively reducing the margin of safety. In addition, self-assessments should be conducted to identify the causes of and to correct problems which have challenged safety.

While the overall assessment plan described in this section is comprehensive, management should schedule its implementation based on existing levels of performance and resources. This plan should be periodically reviewed and revised based on operational safety performance and feedback from the process.

5.2.2. Areas to be assessed

A first step in defining the areas to be assessed is to identify key functions and processes. This may be accomplished at both the corporate and site level. Examples of these functions and processes include but are certainly not limited to:

- reactivity control
- core cooling
- fission product containment
- radiation exposure control
- disposal of radioactive material
- plant modification process
- plant configuration control
- corrective action programme
- organization and administration
- conduct of operations
- engineering support
- operational experience feedback.

5.2.3. Extent of the assessment

Once the key functions and processes have been identified, the conditions that must be met to ensure acceptable performance should be determined. Collectively, self-assessments should consider all aspects of the key functions. These include the performance of individuals and workgroups, equipment and systems and processes/programmes. Examples of these conditions include:

- proper alignment of safety system valves, electrical power supplies, etc;
- acceptable performance of safety equipment, including calibration of instrumentation;
- adequate procedures and training for operation of safety equipment and systems;
- effective planning and conduct of maintenance to maximize the time safety equipment is available for service.

The next step is to recognize existing activities that demonstrate that elements of the required conditions are met. This includes periodic surveillance tests of safety equipment, checklists for operating equipment, etc. While the adequacy of these activities should be assessed periodically, a higher priority is to assess those areas not routinely reviewed.

The required conditions for accomplishment of functions that are not covered by existing reviews should be prioritized based on:

- their importance to ensuring the safety function;
- the existing performance based on other performance indicators or observations, and/or

– the frequency that the function is demonstrated.

Based on this review specific areas for self-assessment can be identified and prioritized. Often, it is also possible to divide the overall assessment into separate elements.

5.2.4. Frequency of self-assessment

The frequency of self-assessment in each area should be based on the importance of the area to accomplishing the key function and the degree to which performance may change with time. For example:

– the collective effect of safety equipment that is not available should be evaluated on a continuous basis;

– the performance of operators responding to simulated plan transients should be evaluated a few times per year;

– the proper alignment of safety system valves and power supplies should be evaluated prior to unit start-up, following maintenance activities and at other appropriate times;

– the adequacy of calibration procedures for safety related instrumentation may not require evaluation for several years if no changes to equipment or technician experience occur.

5.2.5. Documentation of the self-assessment plan

The self-assessment plan should be documented so that each staff member having responsibility for a part or parts of the self-assessment can clearly see how they are related to whole process. It should be readily apparent to management and staff how the several components of the overall assessment programme (see Fig. 2) are organized and applied, how the results are obtained and compiled in reports, and how the results generate actions to improve operational safety performance.

5.3. DEFINING PERFORMANCE EXPECTATIONS

5.3.1. Management role

The definition of performance expectations is the responsibility of management. All the necessary areas should be addressed based upon the business plan, public expectations, owner (utility) requirements and development of national/international standards. In addition, input from individuals working in the area being assessed should be incorporated.

Management should create a priority list and, taking into account the available resources and past performance in the areas in question, management should establish long and short term expectations along with an assessment schedule.

5.3.2. Objectives and criteria for the level being assessed

The highest level performance expectations (e.g. corporate level goals and objectives) should be converted into supporting objectives and criteria appropriate to the level intended for the self-assessment. Management should ensure that all the performance expectations are covered by both long and short term objectives and that no omissions or duplication exists.

To be effective, each assessment should be objectively based and be related to pre-established plant, department or unit goals and objectives. Experience has shown that the best methods are those that avoid unnecessary complexity and are relatively simple.

5.3.3. Key performance indicators

Based upon the defined objectives, all the involved organizational units should develop their performance indicators which are used to monitor performance on a continuing basis. These indicators should be unambiguous, simple and easily understandable for all individuals in the assessment process and the data underlying the indicator should be readily available and reliable. In such a way the commitment to achieve these required or expected performance results could be assured.

It is likely that performance indicators for several levels of activities of the organization already exist. The most effective indicators are those that are measurable, that indicate both long and short term trends and that take into account discussions of performance expectations and indicators between the management and staff in general.

Examples of performance indicators used by some organizations include:

- critical operating parameters
- number of open corrective maintenance work orders
- radiation exposure
- number of temporary plant modifications in place
- human performance indicators, such as the number of events caused by the failure to follow procedural requirements
- primary and secondary coolant parameters
- primary coolant system leak rate
- number of hours that key safety equipment is out of service
- number of corrective action items delayed beyond their original completion date
- number of field changes to plant design modifications.

5.3.4. Periodic review and revision

The objectives and criteria should be regularly reviewed in the light of expectations and the available best industrial practices and experiences. Steps should be taken to modify such performance expectations, if deemed appropriate, in order to facilitate continual improvement.

5.4. IDENTIFYING ASSESSMENT PROCESS/SCHEDULE

5.4.1. Management role

Management is responsible for defining the general process and schedule for conducting self-assessment and for providing personnel and other resources for its implementation. These should ensure an adequate and timely evaluation of key safety functions while minimizing the impact on routine activities.

5.4.2. Considerations for effective self-assessments

General principles for ensuring that self-assessments are effective while minimizing resource requirements include:

- Integrating the self-assessment activities into the normal work process where possible. For example, the review of trends in the operational log or surveillance tests performance trends should be conducted as a part of the normal review process.

- Including personnel most knowledgeable about the function, safety system, programme or process being evaluated in the self-assessment.

- Preparing for the assessment by reviewing performance indicators, standards, procedures and schedules prior to beginning the observation phases.

- Using existing data sources to focus the scope of the self-assessment. For example, the review of radiation exposure history may identify specific work groups or activities that contribute significantly to the total exposure, allowing focus in these areas.

- Optimizing the assessment based on plant activities. For example, self-assessments of some activities or processes may be most effective if done during an outage when direct observations are possible. In other cases, it may be more desirable to conduct the assessment prior to an activity to allow enhancement to be incorporated before the high activity period. An example may be the controls used to assure the redundant methods of core cooling are maintained during outages.

5.4.3. Examples of self-assessment methods

The method for conducting self-assessments is determined by the type, scope and frequency. These may vary from continuous monitoring of key parameters to in-depth assessments conducted by a multi-disciplined team.

Several self-assessment processes have been developed by utilities, nuclear organizations and nuclear power plants using a number of different types of tools and mechanisms as described in this Technical Document.

Processes included in specific comprehensive programmes typically consist of:

- operating experience feedback (OEF) analysis
- Quality Assurance (QA) surveillances and audits
- Safety System Functional Evaluations (SSFEs)
- management visibility and involvement
- self-verification programmes
- safety committee periodic meetings
- management/employee safety review committees.

The assessment matrix as depicted here represents the full spectrum of assessment types for utility nuclear organizations. It should be noted that a major difficulty in understanding the concept of self-assessment is accurately describing the term "self." Fig. 1 of this TECDOC clearly illustrates that "self" changes depending on the reference point of the observer. Since this document is oriented toward "line" organizations involved with the operation and support of nuclear facilities, it is most appropriate that the examples be focused on the bottom two rows of the matrix. However, since some important features of the assessment function flow into other regions of the matrix, a few examples are provided in categories "B" and "C".

The examples referred in this section and included in the annex to this TECDOC are provided to reinforce the important aspects of self-assessment processes. The selection of examples was made primarily among processes identified during the several meetings co-ordinated by the IAEA or in which the IAEA had representatives. Direct experience from the meeting participants was used to the extent practicable.

The examples are presented in terms of the following assessment matrix, Table II. Each major bin of the self-assessment portion of the matrix, i.e., the bottom two rows, has at least one example to illustrate either a concept or selected implementation attributes. In addition, portions of some self-assessment programmes fall within the category normally associated with independent internal assessments - these are also indicated within the matrix.

During the development of the examples, it was clear that most of the self-assessment processes could easily cross matrix boundaries depending on the unique situation, i.e., the actual conditions would dictate how a particular example would be classified in terms of the matrix. Specifically, representatives involved with selecting the examples noted that there was possible shifting between management/supervision and individual/work groups; as well as between the features of continuous/periodic and preventive/corrective, depending on the details of process usage. Distinctive characteristics were chosen from among the examples to highlight some of the aspects considered important by representatives directly involved with self-assessment processes. The examples are not considered comprehensive or exhaustive, but rather an attempt to demonstrate the link between the concepts found in the body of the TECDOC and their practical implementation. Further, the examples are provided in phraseology and terms

TABLE II. ASSESSMENT MATRIX

Assessment Type and Frequency	Continuous	Periodic	
		Preventive	Corrective
Independent External Assessment	Not covered in this document		
Independent Internal Assessment	A	B EDF - Corporate (example 1 of Annex) UK-Peer Evaluations (example 2 of Annex)	C Nuclear Electric Safety Audit Process (example 2 of Annex)
Management and Supervisory Level Self-Assessment	D Virginia Power - Windows (example 3 of Annex) Cofrentes - Safety Culture Enhancement (example 4 of Annex)	E EDF - Station Assessments (example 1 of Annex) UK- Station Evaluations (example 2 of Annex)	F Gundremmingen - Audit (example 6 of Annex) Forsmark - MTO (example 5 of Annex)
Individual and Work Group Self-Assessment	G Virginia Power - DR Process (example 3 of Annex) Cofrentes Self-Assessment (example 4 of Annex)	H EDF - Station Assessments (example 1 of Annex) Ignalina-Maintenance Days (example 7 of Annex)	I Cofrentes - Maintenance Improvements (example 4 of Annex)

Note: The letters A, B, C, etc., as indicated in the text, represent the group of processes in the organization related to that position in the table.

familiar to the organization providing the illustration; they represent a rather broad spectrum of organizational maturity regarding the self-assessment activity - from very mature organizations with years of practical experience to relatively inexperienced organizations just starting to practice self-assessment principles.

Independent internal assessment

A. Continuous

– independent review of critical operating parameters.

B. Periodic - preventive

– periodic assessment of compliance with regulatory and design requirements
– periodic assessment of important programmes
– independent reviews of changes to plant design or method of operation.

C. Periodic - corrective

- independent review of root cause evaluations and corrective actions taken in response to identified plant problems

- independent review of plant performance to verify that safety functions are maintained.

Management and supervision

D. Continuous

- high level of monitoring of key elements required for operational safety, such as assessing the collective impact of unavailable equipment on the margin of operational safety

- field observations and coaching. For example, the observation of work to verify procedure adequacy and use

- management observations of training. For example, observation of operator simulator training can be used to verify that operator performance meets expected standards.

E. Periodic - preventive

- team assessments of department, programme or processes; for example, team assessments using INPO/WANO performance objective and criteria

- safety system function assessments that consider the design, maintenance and operation of safety systems, such as electrical distribution

- team assessments of department, programme or processes; for example, team assessments using integrated performance trends by monitoring key performance indicators in areas important to safety.

F. Periodic - corrective

- root cause evaluations which determine the cause of safety significant events or problems

- integrated review of safety significant events to identify recurring problems, common event causes and verifications of effectiveness of prior corrective actions

- team assessments of interdepartmental interfaces based on identified programme implementation

- stand-down days where methods for improving work performance are collectively used.

G. Continuous

- individual self-checking, e.g. STAR (Stop, Think, Act, Review)

- interdepartmental team pre-job and post-job briefs to identify key elements for accomplishing the task and methods for improving performance (could also be E)

- routine review of equipment performance, e.g. completion of operator logs

- review of procedure adequacy during their implementation.

H. Periodic - preventive

- equipment surveillance tests, calibrations, etc., used to demonstrate acceptable performance

- periodic training evaluations.

I. Periodic - corrective

- conduct of trouble shooting activities
- working group review of interface problems
- post-maintenance testing to verify the effectiveness of the maintenance.

5.5. CONDUCTING PERFORMANCE COMPARISON

5.5.1. Purpose of performance comparison

Self-assessment is essentially a critical comparison of existing activities and results against a predetermined set of performance expectations.

This step of the self-assessment process involves the comparison of the organization, installation, department or individual's actual performance against the standard which has been set at the appropriate level. The result of the comparison should reveal an understanding of whether the performance expectation or target has been missed, achieved or exceeded.

5.5.2. Methods of performance comparison

Methods for performing the performance comparison include: data review, document review and direct observation.

Data review includes the comparison of previous data to establish performance expectations. This may include simple comparisons against performance indicators (see Section 5.3.3) or detailed statistical analysis of equipment performance or trends of human performance.

Document review includes the review of procedures for completing specific tasks or for implementing programmes or processes. The review may start by determining key steps that are required to successfully accomplish the task. It should then be verified that the document includes them in a clear and efficient manner.

Direct observation includes the review of work activities supplemented by interviews. The observation of normal work activities and infrequent evolutions are important in understanding how work processes are implemented and how actual performance compares to performance expectations.

Obtaining an insight into the comparison will be permitted by the prior identification of goals and objectives which are measurable. It may not always be possible to identify quantitative information for a process, although experience has shown that this is the situation for only a minority of processes. The exact nature of the comparison will of course be governed by the explicit characteristics of the process under scrutiny.

Examples of the distribution of an organization's assessment process, within which the above performance comparisons would be carried out, are given in Section 5.4. Examples of key performance indicators which have been utilized for performance comparisons at differing levels of self-assessment within organizations are presented as annex to this TECDOC.

5.6. COMPLETING PERFORMANCE ASSESSMENT

5.6.1. Purpose of the performance assessment phase

A key objective of the performance assessment phase is to characterize the most significant strengths and weaknesses highlighted during the performance comparison.

Performance strengths are identified on the basis of areas where actual performance consistently exceeds the established expectations with acceptably low resource requirements. It is important to identify strengths to encourage continued high performance and apply the methods used to attain high performance in other areas exhibiting a lower level of performance. Assessment of the significance of performance deficiencies is important in defining the priority of corrective actions.

5.6.2. Methods of performance assessment

The first step in the process is to determine the magnitude of difference between actual performance and previously established goals and criteria. Statistical trends should also be reviewed to determine historical performance and any cyclical behaviour.

The overall significance of the performance should be determined based on relationship to maintaining a key function, the magnitude of the difference and the performance trend.

Depending on the impact on safety, identified shortcomings and differences should be ranked. After ranking, priorities to perform additional analysis or corrective actions should be established. In cases of direct influences to safety barriers, short-term corrective actions should be implemented as soon as reasonably practicable.

5.6.3. Cause identification

The causes of all safety important deficiencies should be identified. For complex or high priority problems, root cause analysis methodology can be used. Before developing of corrective measures, operational experience feedback should be reviewed. For example, the effectiveness of corrective actions related to similar safety issues or to the same operational area (hardware, procedures, personnel training or management) should be analysed.

The areas where previous measures were not successful should be studied again by the corresponding level of organization.

5.6.4. Identification of corrective actions

For each safety significant problem, corrective action should be developed and scheduled and resources to implement should be defined.

5.6.5. Documentation

The results of self-assessment should be presented in formats and in levels of detail appropriate to the different levels of management. The degree of detail contained in the published results will differ according to level in the organization to which the results apply. However, the format should be as simple as possible while reflecting the extent of the self-assessment and basis for the conclusions.

Delivering the results should be accomplished as quickly as practical in order that the expectations of participants can be met and that operational safety can be improved using the process agreed upon.

5.7. IMPLEMENTING CORRECTIVE ACTIONS

An action plan reflecting the assessment results should be established by the responsible individuals. To achieve the intended results the necessary resources should be identified as part of the self-assessment plan.

For safety significant corrective actions a formal method of tracking implementation of the corrective actions should be established.

5.8. MONITORING EFFECTIVENESS OF CORRECTIVE ACTIONS

The self-assessment process should have indicators of the effectiveness of the corrective actions taken in response to identified deficiencies. Existing performance indicators should be used where possible. However, additional criteria may be warranted to allow timely monitoring of performance in areas of identified deficiencies.

REFERENCES

[1] INTERNATIONAL ATOMIC ENERGY AGENCY, OSART Guidelines, IAEA-TECDOC-744, Vienna (1994)

[2] INTERNATIONAL ATOMIC ENERGY AGENCY, ASSET Guidance for Plant Self-Assessment (Operational Safety Performance)
INTERNATIONAL ATOMIC ENERGY AGENCY, ASSET Guidance for Peer-Review of Plant Self-Assessment

[3] INTERNATIONAL ATOMIC ENERGY AGENCY, ASCOT Guidelines, IAEA-TECDOC-743, Vienna (1995)

[4] INTERNATIONAL ATOMIC ENERGY AGENCY, The Safety of Nuclear Installations, IAEA Safety Series No. 110, Vienna (1993)

Annex

EXAMPLES OF PROCESSES OF SELF-ASSESSMENT OF OPERATIONAL SAFETY

EXAMPLE 1: FRANCE (EDF)

EDF has implemented a comprehensive two-tiered programme for self-assessment which draws insights and capabilities from both the **corporate and station** organizations.

The **corporate** portion of the programme is periodic-based and focused on preventive actions to assure a high level of nuclear safety performance. Key concepts of this tier include: development of a detailed and personal vision for the station, complimentary to other assessment processes, and a continuous pursuit of excellence in operational performance.

At the corporate level, the large number of sites within EDF required the development of a system with the following goals:

- provide clear and objective appreciation of nuclear safety performance at each site

- promote inter-comparison between sites and provide a source of emulation of good performance.

As a result, the use of these goals promotes dynamic insights for those parts of the organization which have not reached a sufficient level of performance. It also might be possible to reduce external interventions for sites where the performance levels are good. Ancillary goals include assisting sites to establish their own improvement programmes, and promoting experience exchanges participation of peers from other sites.

These corporate level assessments are carried out by Nuclear Inspection - a group of some 25 individuals attached directly to headquarters management. The following elements describe the process phases:

- presentation on site where the proposed goals and actions are described

- development of an assessment plan based on other inspections, performance indicator analyses, LERs, event reports, etc.

- performance on site - this phase lasts 2 weeks and consists of observations and other forms of data gathering

- analysis of the information is performed at the Nuclear Inspection office. Draft reports are then issued to the sites

- draft reports are reviewed by site management. Results are discussed and agreed to. Once agreement is attained, the reports are finalized and published. Performance levels are determined in this phase

- the results are distributed to the site by corporate management. The site then has to perform the appropriate corrective actions.

The assessment methods are based on:

- references which capture EDF expectations of performance
  - functional areas are selected, such as operations, maintenance, radioprotection, etc.
  - objectives are classified by theme in each area; they are closely linked to nuclear safety and expressed through performances in a manner which can be directly measured

The following outline illustrates the concept:

Area: Operations Theme: Plant Status Control
Objective (one of the five defined) - The operators exercise effective surveillance from the control room to maintain nuclear safety process control.

Associated performance
- the operators are attentive and are not distracted from their responsibilities
- the operators maintain a current and precise knowledge of plant status
- the anomalies detected are quickly addressed to minimize unavailability.

Comparison of actual performance to assessment references
- a collection of facts at the lowest level regarding expected results is performed on site
- objectives which are not attained are determined during the analysis phase
- root cause(s)are then identified

analysis of the consequences on nuclear safety are carried out.

Conclusions
- nuclear Inspection issues compare the actual performance with the expected results
- problem statements are formulated and recommendations for improvement are developed.

An "intercomparison" of EDF sites is also performed. It, too, is carried out by Nuclear Inspection. For each site, diagrams are constructed (See Fig. 1, Example 1). The performance scale used is similar to that utilized by INPO. These diagrams are compiled and issued to all sites - good performances are identified and recorded.

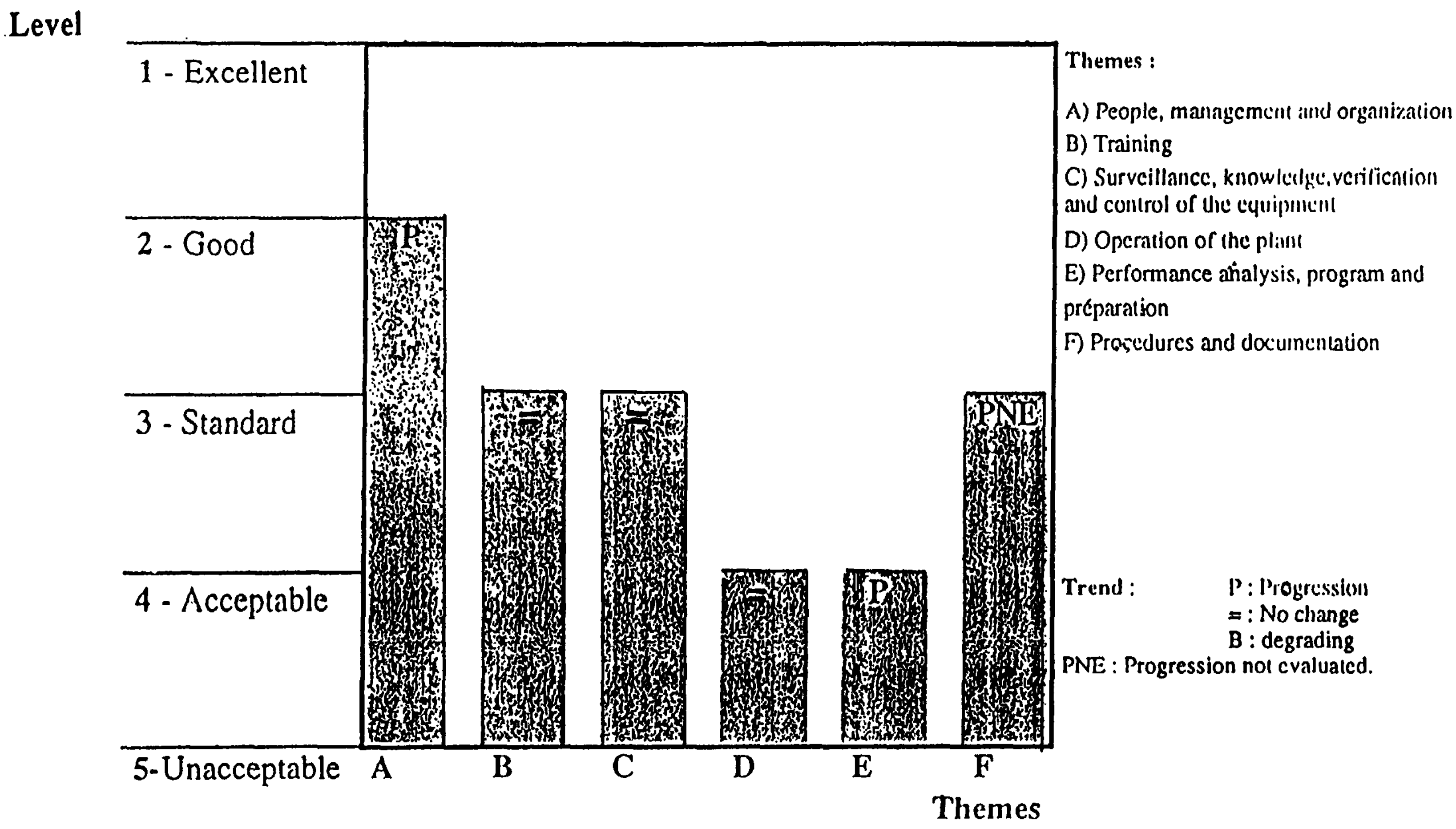

FIG. 1. Example 1 (France) - Bar graph for operations area

These assessment also take into account human factors by questioning and evaluating the existence and effectiveness of specific `lines of defense' to assure acceptable consequences of any possible human failure. It should be noted that human factors are accounted for in every area of assessment; they are not specifically evaluated as a separate field. Criteria used for the human factors segment of an assessment are along the lines of:

- evaluation of the individual and collective participation in the different phases of the work

- assess the logic of personnel through observation of work practices through the use of (and adherence to) procedures, standards and regulations
  - verify the existence of preventive measures such as the quality of staffing and relations between staff and management

The EDF assessment process is supplemented by external evaluations such as OSART Missions and WANO Peer Reviews. These activities assist in the comparison between EDF expectations and international standards. A site has such assessments (Internal, OSART or WANO) every two or three years.

The following outline highlights the activities associated with the second tier of the self-assessment process, i.e. the **station** evaluations

In addition to the assessment process described above, EDF promotes self-evaluation (SE) at each of their sites. These evaluations are considered preventive and periodic actions which place them primarily in bins "E " and "H" of the matrix. Of course, a major objective of the process is to identify appropriate corrective actions in response to the identified deficiencies. The major principles of the process are defined as follows:

- The station evaluations must be differentiated from the independent internal assessment efforts - the self-evaluations fully belong to the site, while the independent internal assessments are performed at the corporate level. As a site initiative, the goal is to give station personnel a more detailed and personal vision of the performance effectiveness of their respective organization.

- Self-evaluation is expected to promote questioning attitudes among the staff. It is also a conduit towards empowering a large segment of the staff, and leads to the relentless pursuit of excellence.

- As used at EDF, self-evaluation is a management tool which complements quality and nuclear safety audits and reviews, independent internal assessments. It is directly applied by management; however, the Nuclear Safety or Quality Departments may play a role of assistance and counsel.

- Some latitude is provided in the actual implementation of the processes since sites, in exercising their questioning attitudes, need to define the methods best suited to meet their objectives and goals

  - A key objective for the self-evaluation process is to "learn by doing." In the EDF environment self-evaluation is not necessary a "natural" way of doing business, therefore, confidence has to be built from the ground up. During initial evaluations, the goal is to learn to "self-evaluate"fundamentals and to create a climate of trust between the organizational hierarchy and staff. In order to establish a solid foundation and perpetuate the processes, it is important to begin with modest self-evaluation activities and develop a progressive strategy.

  - EDF believes that a rigorous process must be applied in order to have an efficient self-evaluation. The key elements in the process are:
    - select the area to be evaluated - usually defined by each department or at the site level using a variety of methods

    - define/update performance expectations - these expectations are generally defined by work groups

    - plan-training for those involved (as required) - the training plan is typically generated by individuals performing the evaluation. Training is carried out by the Quality department and enhanced communications are supported by management

    - perform the self-evaluation by collecting data - the respective manager normally leads the team for the self-evaluation of an organizational unit. Process self-evaluations are normally led by an assistant station manager

    - analyse the results and define corrective actions

    - establish an action plan - corrective actions are prioritized and integrated with overall plant action items

    - perform corrective actions

    - establish feedback loops to assure the appropriate lessons are learned from the activity

- As part of the self-evaluation processes, EDF seeks consistently high performance levels at all sites. To achieve this objective, a feedback network is managed at corporate level to help sites compare their methods.

EXAMPLE 2: UNITED KINGDOM (Magnox Ltd, Nuclear Electric Ltd, Scottish Nuclear Ltd)

One example from the UK is another two-tiered programme where self-evaluations are coupled with regularly scheduled UK Plant evaluations. The self-evaluations provide station management with a snapshot of progress regarding identified areas for improvement. The two elements of the programme are more fully described below.

UK evaluations (Peer Reviews) have been conducted regularly at all UK nuclear power stations since 1991. The process is continuing on a three year rolling programme and is a shared improvement activity. Magnox Electric, Nuclear Electric, British Nuclear Fuels and Scottish Nuclear all participate in the Peer Reviews which provide a foundation for the programme of continuous improvement within the companies. The process is managed by a core team within Magnox Electric, and includes seconded members from the other utilities. The UK Peer Evaluation programme was modeled closely on the INPO programme, and provides each station manager with an independent view of where the station lies with respect to the achievement of quality, the effective use of resources and staff attitudes.

The actual evaluations are conducted by a team of peers, from other UK stations, who have particular expertise in the areas to be evaluated. Strengths and Areas for Improvement (AFIs) are identified. Attributes considered include, but are not limited to: material condition of the plant and site, methods of working, accountability, competency of staff, effectiveness of controls, interfaces between groups and individuals, staff attitudes and overall response to plant needs.

Evaluations are organized into topic areas based on the established INPO and WANO Performance Objectives and Criteria. To address the identified AFIs, the station formulates an action plan, detailing the required corrective action, the responsible person and a target completion date. Progress against the action plan is formally addressed at accountability meetings held regularly between the station and company.

To provide the Station Management Team with a factual assessment of the status of the action plan, regarding its timeliness and effectiveness in addressing the specific AFIs, **stations** are encouraged to conduct a **mid-term review** consisting of a self-evaluation. A typical station self-evaluation programme is outlined in the diagram on Fig.1, Example 2.

The purpose of the Self-Evaluation is to confirm that the action plan has dealt with the root causes of the identified AFIs, and adequate progress is being made toward completion of the specific actions.

- The self-evaluation concentrates on the AFIs identified by the Plant Evaluation; new concerns are raised only if deemed to be significant.

- The self-evaluation is Performance related and concentrates on WHAT, not WHO, is wrong. In other words they are designed to find the facts and not place blame.

- Self-evaluations are conducted in-house, utilizing station staff who have previous evaluation experience, however non-evaluation experienced staff are also utilized.

- The self-evaluation process is not prescribed and stations can adapt the process as required. Several stations have utilized assistance from the Plant Evaluation Section while others have had assistance from sister stations to provide some measure of objectivity and independence into the process. A typical team consists of seven members although more may be utilized if resources permit.

- Experience to date has demonstrated the following benefits:
  - awareness of participants improved
  - self-evaluation is well received by the work force as a result of colleague involvement
  - the self-evaluation process results is greater understanding of root cause and solutions have greater ownership
  - self-evaluation complements and supports a quality improvement programme

A second example from the UK deals with periodic - corrective assessments at the internal independent level (category "C"). This example briefly describes the various methods that the Company utilizes to **audit safety**.

Formal audits and evaluations are considered, however, the process is also supported by various routine station safety audits, assessments and inspections. These are conducted by both management and staff at regular intervals, e.g. Permit for Work audits (Tag Out), safety inspections and tours, etc. A similar process is also utilized by Magnox Electric.

The Quality Department conduct audits of stations to confirm that the company policy is being implemented and is effective. These audits are carried out on an 18 month rolling program. While the audits do not specifically assess the station on safety issues, they do examine whether the station processes and programmes adequately cover the requirement to audit safety matters.

Each station conducts audits to a pre-defined programme. Some stations conduct specific audits on safety issues, while others address safety by auditing the various station department responsibilities which will include safety issues. The departments also conduct self-assessments prior to being audited.

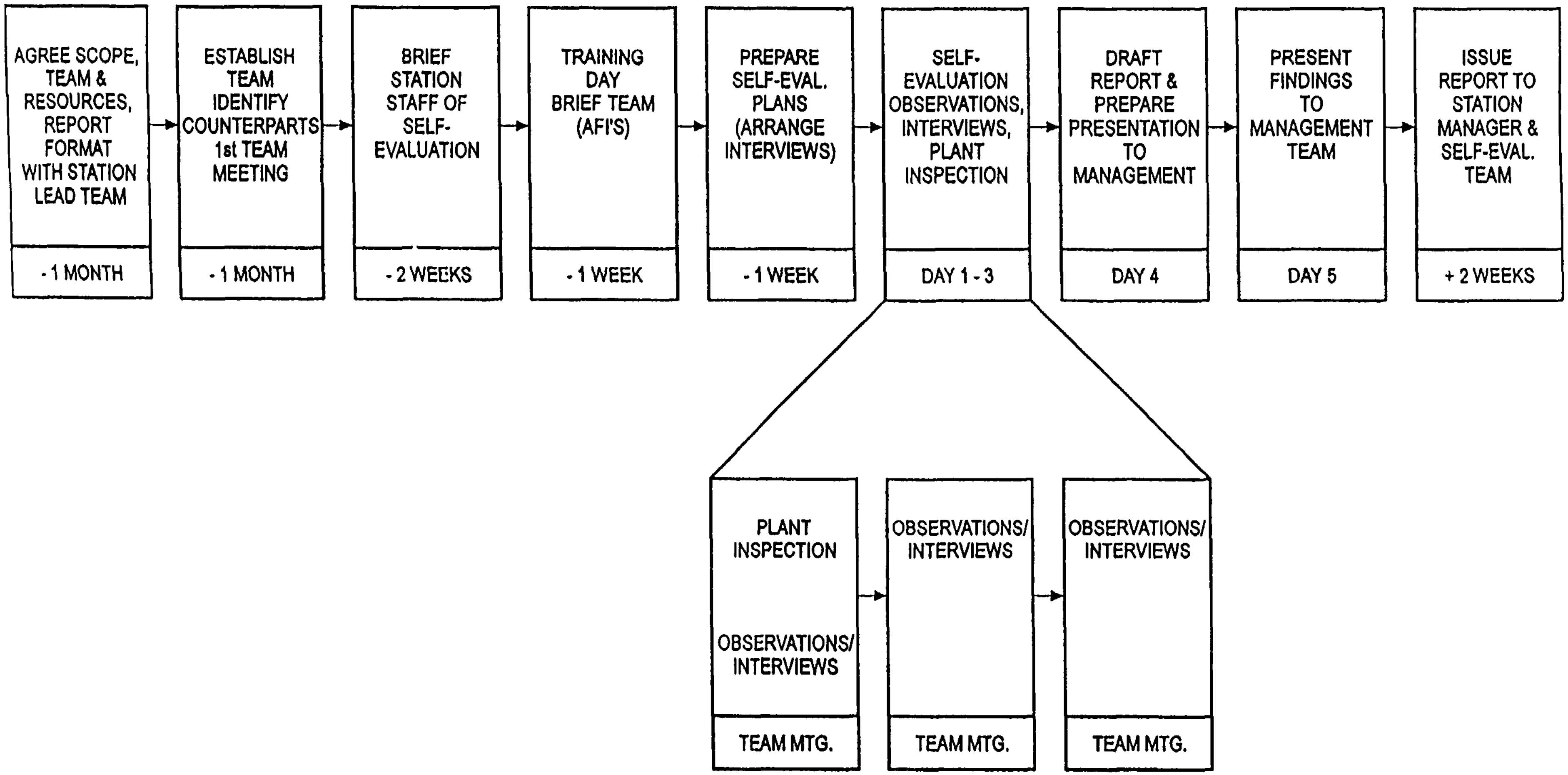

FIG. 1. Example 2 (United Kingdom) - Model self-evaluation programme

Station departments are held accountable for completing safety corrective actions by the Station's Director through monthly Station Safety Management accountability meetings.

The International Safety Rating System (ISRS) audit process is another element of the programme and involves a systematic review of location activities against twenty elements important for good safety management and culture. The audits are carried out by the company internal Health, Safety and Environment Division (HSED).

HSED conducts 12 monthly reviews of stations' progress on a rolling programme. In addition to the ISRS audits, HSED Site Inspectors produce regular Core Inspection Reports" on generic topical areas of concern as highlighted by the Division and their own observations of the safety performance of the site.

EXAMPLE 3: UNITED STATES OF AMERICA (Virginia Power Corporation)

Comprehensive self- assessment programmes contain a variety of elements, depending on management's vision and expectations, the culture and maturity of the organization, the age of the station, etc. A sample matrix illustrating a number of these elements is shown in Table I, Example 3.

TABLE I. EXAMPLE 3 (USA) - NUCLEAR BUSINESS UNIT (NBU) SELF-ASSESSMENT MATRIX

External Independent Assessment				· Senior Overview Boards	. INPO/Peer Assist Visits · Event Assessments
Internal Independent Assessment	Independent Oversight	· Field Observations		· Oversight Programme Audits	. Escalated Issues
Management Self-Assessment Programme	Individual	**Continuous**	**Preventive**	**Periodic**	**Corrective**
		. Communications · Field Observations & Observation bulletin board . Plant Monitoring	. Pre-job Briefs . Turnovers . Self-Check	. Benchmarking	. DRs . Work Requests
	Management Self-Assessment Programme	. Daily Statusing . Dept. Perfoirmance . Housekeeping Inspections . Supv. Monitoring & Coaching of Workers	. Dept. Level Assessments . Post Outage Critiques . Mgmt Off-Shift Inspections . Programmatic Assessments . Observations of Training & In-plant Tasks	. Windows . DR Trend Reports . Integrated Trending . NBP Indicators . Function Area Peer Review (e.g. pre INPO) . System Engr Qtrly Report . Significant and Precursor Events	. Root Cause Evaluations . HPES (Human Performance Enhancement System) . Issue Driven Assessments

One of the primary elements used by Virginia Power to summarize the elements of their self-assessment process is through the use of a color coded system analogous to the annunciator windows found in the control room of a nuclear station. Inputs to the various windows come from multiple "bins" within the matrix - when they are analyzed, they are given a composite rating which provides management insight into where corrective actions are needed.

The **Station Annunciator Windows Programme** is in the Attachment 1 - Example 3.

Examples of the Surry Performance Annunciator Panels are presented in Attachment 2 - Example 3.

Another segment of the Virginia Power self-assessment programme deals with the individual and group level categories through a process entitled **Deviation Reporting**.

Deviation Reports (DR) are used by all station personnel to document differences between actual and acceptable performance in safety significant activities or programmes. Examples of conditions warranting DR include:

- Failure of safety equipment to meet acceptance requirements during surveillance tests, calibration, etc.
- Degradation of safety equipment as indicated by operational leakage deterioration of electrical insulation, etc.
- Misalignment of safety system components such as valves or electrical switches.
- Failure to properly implement a procedure such as using incorrect bolt torque or calibration valves.
- Unplanned operation or maintenance of a component.
- Inadequate scope or implementation of a programme such that required elements were not accomplished. For example the failure to perform preventative maintenance or surveillance tests at the required frequency.
- Inadequate procedures that provide incorrect or incomplete guidance for completing safety related work.
- Radiation dose rates or exposures above expected or acceptable level.

Submittal of DRs support the following self assessment activities.

- Allowing the systematic assessment of deficiencies identified during normal activities to determine their significance.

- Communication problems to proper levels of management in a timely manner.

- Supporting timely corrective actions. These actions may include root cause evaluation to determine the causes and extent of significant problems.

- Supporting longer term performance trends of equipment, personnel and programme performance. Both the types of events (e.g. pressure transmitter failures, operations tagging errors) and causes (e.g. future to self check, inadequate change management) can be trended.

- Identifying areas that warrant more detailed self assessments based on the significance, number and trends. For example, DR and DR trends are included in the performance windows discussed in the above Section.

The Deviation Report form, Corrective Action Assessment form and Threshold Screening Categories are given in Attachment 3 - Example 3.

A third part of the Virginia Power self-assessment programme deals with Operating Critical Parameters as explained below.

Key safety functions are continuously monitored using **operating critical parameters**. The parameters address the following safety functions:

- fission product barriers
- safety system availability
- reactivity monitoring and control A
- monitoring and assessment instruments
- plant equipment availability that may affect safe operation

These parameters are continuously monitored by Shift Technical Advisors and periodically documented using windows as shown in Attachment 4 - Example 3. Examples and guidance for these windows are also provided.

Attachment 1 - Example 3

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Station Annunciator Windows Program

The Station Annunciator Windows Program is a tool Management uses to monitor performance issues and concerns by providing an evaluation of performance against established performance criteria. The Program provides quarterly integration of plant information in a format that flags areas requiring Management focus. Criteria is established to grade performance as follows:

- Green - Significant Strength
- White - Satisfactory
- Yellow - Improvement Needed
- Red - Significant Weakness

For those items graded Red or Yellow, the department head is required to identify corrective action which is reviewed by Station Management.

1. **Criteria**

   a. Criteria should be established for each panel that can be used to accurately grade the performance for the area under consideration. (In some cases, the criteria may be subjective.)

   b. The criteria should be evaluated on a routine basis by the Sponsors and the Windows Coordinator to ensure it is providing effective assessment. Changes to the criteria must be approved by management.

   c. The criteria for panels experiencing long term (four or more quarters) Green trends should be evaluated for possible modification of the criteria.

   d. The criteria for panels experiencing recurring Yellow or Red trends should be evaluated for possible ineffective corrective action or inappropriate criteria.

   e. Commonality between North Anna's and Surry's Annunciator Windows Program should be maintained.

2. **Justification Section**

   The Justification Section will be completed by the panel's Sponsor and should contain the basis for the panel being rated its particular color. Important dates of events should be included when the criteria is trended for performance over multiple quarters.

3. **Documentation Section**

The Documentation Section should contain the source of the information used to establish the panel's color. The panel's Sponsor is responsible for maintaining this information current.

4. **Action Section**

The Action Section should be completed by the panel's Sponsor whenever the panel has been assessed as Yellow or Red. Information provided in this section should identify the corrective actions being taken to prevent recurrence of a Yellow or Red panel.

5. **Yellow and Red Panel Management Presentation**

a. The Sponsors for all panels graded Yellow or Red should present to management the basis for the color and the corrective actions taken or being taken to prevent recurrence.

b. Each Sponsor will provide common causal factor analysis to determine if there are common causal factors occurring across multiple departmental boundaries. The Root Cause Program Manual contains a description of casual factors that can be used to test the problem areas for applicability. This information will be used by management to make appropriate corrective actions.

c. For those panels with repeating Red or Yellow colors, or for those Red panels that were Yellow the previous quarter, the Sponsor should describe why the events have recurred. Additional corrective actions to prevent recurrence should be presented.

Attachment 2 - Example 3

VIRGINIA POWER

Surry Performance Annunciator Panel

Third Quarter 1996

PERSONNEL PERFORMANCE

Operations	Maintenance	Radiological Protection	NSS	Engineering	Station Support

EQUIPMENT PERFORMANCE

Reactor Trips	Unplanned ESF Actuations	RCS and Secondary System Integrity	Fuel Reliability	Key Safety Sys Perform/Avail	System Materiel Condition
Net Gen Thermal Performance	Capacity Factor	Emergency Preparedness Equipment	Chemistry Performance		

PROGRAM PERFORMANCE

Operations Program	Maintenance Program	Radiological Protection Program	Site Services Program	Engineering Program	Security Program
Regulatory Performance Program	Emergency Preparedness Program	Safety and Loss Prevention Program	Safety Assessment Program	Materials Program	Training Program
Planning and Scheduling Program	Procedure Program	Business Plan Performance	Adherence To Nuclear Safety Policy	Significant and Precursor Events	Complacency Avoidance

RED - SIGNIFICANT WEAKNESS
YELLOW - IMPROVEMENT NEEDED
WHITE - SATISFACTORY
GREEN - SIGNIFICANT STRENGTH

LEGEND

4Q/95	1Q/96	2Q/96
Third Quarter 1996		

50

VIRGINIA POWER

Surry Performance Annunciator Panel

Panel Operations

Third Quarter 1996

LERs	Station Deviations	Security Log	Personnel Exposure
RWP Compliance and Bad Worker Practices	Industrial Safety		

RED	☐	- SIGNIFICANT WEAKNESS
YELLOW	☐	- IMPROVEMENT NEEDED
WHITE	☐	- SATISFACTORY
GREEN	☐	- SIGNIFICANT STRENGTH
	☐	- UNASSESSED

VIRGINIA POWER

Surry Performance Annunciator Panel

Panel Key Safety Sys Perform/Avail

Third Quarter 1996

Unit 1 AFW	Unit 2 AFW	EDG Unavailability	EDG Reliability
Unit 1 LHSI Unavailability	Unit 2 LHSI Unavailability	Unit 1 Containment/ Quench Spray	Unit 2 Containment/ Quench Spray
Unit 1 HHSI	Unit 2 HHSI	Recirculation Spray	

RED ☐ - SIGNIFICANT WEAKNESS
YELLOW ☐ - IMPROVEMENT NEEDED
WHITE ☐ - SATISFACTORY
GREEN ☐ - SIGNIFICANT STRENGTH
☐ - UNASSESSED

VIRGINIA POWER

Surry Performance Annunciator Panel

Panel Operations Program

Third Quarter 1996

Audits and Inspections	Self-Assessments	Operator Work-Arounds	Shift Logs and Rounds
Qualifications and Training	Operations Drawings, Documents, and Proc	Operations Status and Configuration Cont	Labeling
Tagging			

RED - SIGNIFICANT WEAKNESS
YELLOW - IMPROVEMENT NEEDED
WHITE - SATISFACTORY
GREEN - SIGNIFICANT STRENGTH
- UNASSESSED

Surry Power Station

VIRGINIA POWER

Performance Annunciator Panel Reporting System

QUARTER: 3
YEAR: 1996

Area: Personnel Performance

Panel: Operations

LERs

Color: **WHITE**

	Second Quarter 1996	First Quarter 1996	Fourth Quarter 1995
Last Three Quarters	YELLOW	WHITE	WHITE

Justification

LER S2-96-004-00, Turbine / Reactor Trip due to High Level in the Steam Generator on 6/6/96.
Trip caused by equipment malfunctions and interface design Steam Generator water level is extremely difficult to control at low power levels. REA submitted to improve control at low power This is not a personnel performance related LER.

One LER last quarter charged to Operations.

Documentation

Licensing LER Log

Criteria

Green - 0 LERs within the last 2 quarters.
White 0 LERs for current quarter
Yellow 1 LER
Red - 2 or more LERs.

(Revised 10/96)

VIRGINIA POWER

Performance Annunciator Panel Reporting System

QUARTER: 3
YEAR: 1996

Area: Equipment Performance

Panel: Key Safety Sys Perform/Avail

Unit 2 LHSI Unavailability

	Second Quarter 1996	First Quarter 1996	Fourth Quarter 1995
Color: GREEN	GREEN	GREEN	GREEN

(Last Three Quarters)

Justification

	Monthly	YTD Goal	%YTD Goal	
July	6.43	35		2-SI-P-1A T/O for 2-MOP-S1-001
August	0	40		
September	0	45	14.3%	

Total Hrs YTD - 6.4

Documentation

Definition: Safety system unavailability is the total number of hours that safety trains are not operable due to failure, maintenance, testing, or other causes.

Source of input: Nuclear Business Plan Performance Indicators

Criteria

Green - Unavailable hours <= 50% of goal.
White - Unavailable hours <= 100% of goal.
Yellow - Unavailable hours <= 120% of goal.
Red - Unavailable hours > 120% of goal.

VIRGINIA POWER

Performance Annunciator Panel
Reporting System

QUARTER: 3
YEAR: 1996

Area Program Performance

Panel Operations Program

Self-Assessments

		Last Three Quarters		
		Second Quarter 1996	First Quarter 1996	Fourth Quarter 1995
Color	WHITE	GREEN	WHITE	

Justification

Although Operations received a violation for failure to follow procedures that require operator logs to be maintained, failure to follow procedures has been documented through self-assessments as a problem in Operations.

Since the schedule was met and no other items identified by the NRC during the quarter, the window should be Green.

Discussions in the MRB Meeting on October 23, 1996 indicated that implementation of corrective actions identified through self-assessments needs attention, so it was decided to downgrade the rating to White

Documentation

Departmental Self-Assessment Schedule
NRC/INPO/Pre-INPO/N/0 Findings LERs, SNS identified significant issues and program related Deviations Reports count as Weaknesses.

Criteria

Weaknesses that should have been identified through Self-Assessment // Self-Assessment performed on-schedule and in accordance with VPAP-0104 Requirements

Green - None // Met
White - <= 3 // Met
Yellow - > 3 DRs 1 LER NRC Weakness, Pre-INPO Finding // Missed Scheduled completion date or performed inadequately
Red >= 1 Violation/INPO Finding // Not Performed

(Revised 2/2/96)

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Attachment 3 - Example 3

VIRGINIA POWER

Deviation Report

VPAP-1501 - Attachment 1

Problem Identification

1. DR Number	2. Unit ☐1 ☐2	3. Date of Discovery	4. Page of

5. System/Program	6. Equipment Name Description/Subject	7. Equipment Mark No. (PASSPORT)

8. Description of Deviation (See DR Submittal Checklist on reverse.)

9. Initial Actions/Corrective Actions/Results (See DR Submittal Checklist on reverse.)

10. Problem Resolved? ☐ Yes ☐ No	11. Work Request/Work Order Number

12. Personnel Directly Involved (Name(s))

13. Submitted By (Print Name)	14. Badge No.	15. Department	16. Extension	17. Date

+ Forward To Shift Supervisor Immediately

Key: DR-Deviation Report

Form No. 731065(Apr 96 (Front)

Deviation Report

Shift Supervisor Review

18 Unit Conditions Unit 1 % Power	Unit 1 Mode	Unit 2 % Power	Unit 2 Mode
19 System/Component Inoperable? ☐ Yes ☐ No ☐ Unknown	20 T S Violation? ☐ Yes ☐ No	21 Applicable T S Sections	22 LCO Entered? ☐ Yes ☐ No
23 Describe LCO Sections			
24 Reportability Within 48 Hours ☐ Not Required	☐ Immediate ☐ 1 Hour	☐ 4 Hour ☐ 24 Hour	☐ 48 Hour CFR Reference ____
25 Shift Supervisor (Signature)	26 Date	27 Time (2400 Hours)	

Reportability Review

28 Reporting Classification ☐ 10 CFR 20	☐ 10 CFR 50 73 ☐ Appendix R	☐ 10 CFR 73 71 ☐ Potential 10 CFR 21	☐ Non-reportable ☐ Other
☐ Comments ____			
29 Reportability Review (Signature)			30 Date

Additional Management Review (Optional)

31 Signature	32 Date

Supervisor Station Nuclear Safety Review

33 SNSOC Review Requested ☐ Yes ☐ No	34 Supervisor Station Nuclear Safety (Signature)	35 Date

SNSOC Review (Optional)

36 Signature	37 Date

Deviation Report Submittal Checklist

The major functions of a Deviation Report are to

- Identify and communicate a deviating condition to management
- Evaluate impact of deviating condition on equipment operability
- Evaluate reportability of a deviating condition
- Initiate corrective actions to correct the deviating condition
- Identify trends in deviating conditions

In order to facilitate successful accomplishment of these functions the following information if known shall be included in Block 8 or 9 of this Deviation Report

- When deviating condition occurred
- Description of the deviating condition
- Cause of the deviating condition
- How the deviating condition was discovered
- Effects of the deviating condition on unit operation plant equipment or Station programs
- Applicability of the deviating condition to similar equipment including the other unit
- Operability of affected equipment
- Initial actions taken
- What needs to be done to correct the deviating condition

Key LCO-Limiting Condition for Operation, CFR-Code of Federal Regulations, TS-Technical Specifications

Form No 731054(Apr 96) (Back)

VIRGINIA POWER

Corrective Action Assignment and Response for Deviation Reports

VPAP-1601 - Attachment 1

DR Classification

1. DR Number	2. Significance:	☐ Significant	☐ Potentially Significant	☐ Routine
	3. Frequency:	☐ Frequent	☐ Occasional	☐ Infrequent

Corrective Action Assignments ■ N/A

4. Corrective Action Plan Development Assignment ☐ SNS ☐ Training ☐ Planning ☐ Licensing
☐ Eng. ☐ Ops ☐ Maint. ☐ RP ☐ NSS ☐ Procedures ☐ Other ______

5. Other Departments Assigned Actions or Questions ☐ SNS ☐ Training ☐ Planning ☐ Licensing
☐ Eng. ☐ Ops. ☐ Maint. ☐ RP ☐ NSS ☐ Procedures ☐ Other ______

6. Assigned Actions/Response Details
☐ Category 1 RCE ☐ Other ______
☐ Category 2 RCE
☐ Category 3 RCE
☐ Initial Action Acceptable
☐ Close to WO
☐ MPFF Evaluation

7. Corrective Action Plan Due Date	8. SNS Initiator (Signature)	Date

Corrective Action Plan Response ■ N/A

9. Corrective Action Plan (See Corrective Action Response Checklist on reverse)

10. Responding Department Name	11. Responding Supervisor (Signature)	Date	12. Phone Numbe

Review and Closure ■ N/A

13. Comments

14. SNS Reviewer (Signature)	Date	15. SNS Independent Reviewer (Signature)	Date
16. SNSOC Review ☐ Required ☐ Recommended ☐ Not Required	17. SNS Supervisor (Signature)		Date

18. Management Tracking

WO Number	CTS Number	RCE/HPES Number
Other		REA/DCP Number

19. SNSOC Approval	Date

Key: DR-Deviation Report, Eng-Engineering, Ops-Operations, Maint-Maintenance, RP-Radiation Protection, NSS-Nuclear Site Services, SNS-Station Nuclear Safety, MPFF-Maintenance Preventable Functional Failure; RCE-Root Cause Evaluation, HPES-Human Performance Enhancement System, SNSOC-Station Nuclear Safety and Operating Committee, CTS-Commitment Tracking System, WO-Work Order, REA-Request for Engineering Assistance, DCP-Design Change Package

Form No. 731075(Apr 1
(Front)

Corrective Action Assignment and Response for Deviation Reports

9. Corrective Action Plan (continued)

Corrective Action Response Checklist

The major functions of a Corrective Action plan are to:

- Identify the cause of the deviating condition
- Document the equipment operability impact of the deviating condition
- Determine the extent of a deviating condition
- Determine the corrective actions necessary to correct the deviating condition and prevent recurrence

In order to ensure these functions are successfully accomplished, the basic expectation is that the following information shall be included in each Corrective Action Response:

- The cause of the deviating condition, or if the cause cannot be determined, a description of the action taken in an attempt to determine the cause
- The impact of the deviating condition on equipment operability and the basis for the operability determination
- The applicability of the deviating condition to similar components in a redundant train, another system, and the other unit
- Corrective action that has already been taken in reponse to the deviating condition
- Additional corrective action that must be taken to correct the deviating condition and prevent recurrence, including the basis for each

It is expected that Corrective Action responses are ready for review and closure when submitted to SNS. This means that any remaining corrective actions have been initiated, the departments responsible for their completion have concurred with the proposed corrective action and an appropriate vehicle is being used to track the remaining corrective action to completion.

Note: Attach additional documentation if required.

Form No. 731075(Apr 96)
(Back)

ATTACHMENT 3

(Page 1 of 1)

Threshold Screening Categories

SIGNIFICANT	POTENTIALLY SIGNIFICANT	ROUTINE
Fatality Reactor Trip Exceeding a Safety Limit as defined in Tech Specs Severe or unusual plant transients classified as significant using the INPO criteria Radiation overexposure that exceeds NRC limits Offsite Radioactive Release in excess of regulatory limits Fuel Handling or storage events that involve a significant release of radioactivity, challenge to Spent Fuel cooling or spent fuel radioactivity control Entry into Emergency Plan as Site Area Emergency or General Emergency Other events of the same level of significance based on management review	An event that is reportable under 10CFR50.72 or 10CFR50.73 Forced plant shutdown due to major equipment damage or regulatory/safety issues Unplanned reduction in Nuclear Safety Margin: • Inadequate reactivity control • Inoperable train of a safety system • Loss of redundant emergency power sources • Loss of ability to monitor or control key plant processes • Loss of decay heat removal capability Plant Design Configuration Control: • Deficiencies in plant design control that challenge compliance with design or licensing basis • Inadequate configuration control that challenges compliance with design or licensing basis Reduction in Radiological Safety Margin • Any unplanned airborne or liquid effluent radioactive release • Exposure of personnel above administrative limits • Potential for violation of limits on release of radioactive materials • Significant increases in radiological sources Any significant defect in any spent fuel storage cask structure, system, or component, which is important to safety Severe personnel injury (e.g., "Lost Time Accident") Notification of Unusual Event or Alert Abnormal failure frequency of equipment important to safety or reliability Other events of the same level of significance that involve nuclear safety, regulatory interest, plant reliability, or personnel safety based on Management review.	Non-radiological environmental event Component out-of-specification Failure in redundant system without common cause Non-Technical Specification Administrative violation Other events of the same level of significance

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Attachment 4 - Example 3

SURRY POWER STATION AT POWER CRITICAL PARAMETERS

1 0 Purpose

This operating instruction provides the STA with guidance and instructions for entering information into the AT POWER Critical Parameters Assessment This includes the Critical Parameters Windows as well as the major functional area scoresheet

2 0 References

2 1 Surry Power Station Technical Specifications
2 2 VPAP-2802, Notifications & Reports
2.3 Surry Power Station Emergency Plan
2 4 EPIP-1 00, Station Emergency Manager Controlling Procedure
2 5 Surry Power Station Abnormal Operating Procedures
2 6 Surry Power Station Emergency Operating Procedures
2 7 VPAP-2103, Off-site Dose Calculation Manual
2 8 VPAP-2602, ERFCS
2 9 ASNS-3000, Nuclear Safety Policy
2 10 Generic Letter 91-18
2 11 VPAP-1408, System Operability
2 12 Technical Report PE-0014, SPS Response to RG-1 97
2 13 VPAP-2401, Fire Protection Program
2 14 SOER 94-01, Conservative Decision Making & Operator Work Arounds
2 15 RCE 95-08, Rod Control System Failures
2 16 ET NAF-96031, Rev 0, PSA Evaluation of On-Line Maintenance

3 0 Background

3 1 Recent experience with utilization of the Surry CSD/RSD Critical Parameters has prompted Station management to request implementation of similar concepts for unit power operation In response to this Station Manager Level I Commitments have been established to provide this assessment of at power operating conditions and functions This instruction will provide the guidance and criteria to determine the status of the required at power functions shown in Attachment 1

3 2 Awareness of operator work-arounds shall be such that the aggregate of outstanding work-arounds does not impede the operator from operating the unit in accordance with procedures or affect his ability to respond to abnormal and emergency situations (ASNS-3000) As a matter of application, a lower level block should be considered CONDITION YELLOW if **one** (1) Safety-Related (SR) or important to safety (NSQ) System, Structure or Component (SSC) required to function during abnormal and emergency situations requires operator compensatory actions, Admin Controls, or Temporary Modifications to maintain the SSC in an operable state

3 3 Due to several Unit 2 Reactor Trips and recurring Rod Control System urgent failure alarms in May/June of 1995, additional attention to the condition of HVAC systems for the Normal Switchgear Rooms has been enacted In order to focus this attention on establishing actions to repair ventilation system components for the NSGRs, criteria for the "RCCA's" Critical Parameter have been revisedto reflect NSGR HVAC requirements to ensure the reliability of the Rod Control System

3 4 The Maintenance Rule, 10CFR50 65, requires that an assessment of the total plant equipment out of service for maintenance be taken into account to determine the overall effect on performance of safety functions Pursuant to this requirement, a matrix identifying risk significant combinations of equipment out of service has been developed and is provided by Reference 2 16 Criteria have been added to the "ESF Systems," "Heat Sink," "Electrical Power Supplies," and "Secondary Systems,"critical parameter windows to account for the effects of on-line maintenance on overall station risk

CAUTION

At no time should there be a condition Orange or Red status on any block. Management should be notified immediately if not already notified in response to the deviation condition. If a condition orange or red status exists, continued unit operation may not be allowed by Technical Specifications, or a unit Reactor trip may be required or has occurred.

4.0 Instructions

4.1 General Instructions and Information

4.1.1 The Critical Parameter Chart is a visual representation of the equipment, systems and function operability or availability associated with continued unit operation during HSD conditions or above.

4.1.2 The windows are stacked in columns. The Top Level window of each column represents an At Power required function.

4.1.3 The lower level blocks list the functions or systems required to accomplish and provide the necessary safety margins for the applicable function. The upper block gives the status of the function or system requirement based on the status of the blocks below it. The following is a general explanation of the block patterns:

	Fully Operable Condition Green
	Acceptable but degraded/LCO of > 6 hrs to HSD may be in effect Condition Yellow
	Degraded Condition/HSD required within 6 hrs Condition Orange - Contingency actions may be required
	Unacceptable condition/Unanalyzed Condition Condition Red

4.1.4 Each STA is to stay cognizant of the Equipment/System/Plant status, and keep the At Power Critical Parameters marked up to date. Prior to each shift turnover, the STA will update the Critical Parameters Chart.

4.1.6 Following the determination of the overall status for each of the five functions, the STA is to update the status of the Critical Parameters Chart. After the chart is updated, the time and date shall be provided in the space provided.

4.1.7 The At Power Critical Parameters shall be provided to the Operations Shift Supervisor.

4.1.8 Provide the At Power Critical Parameters to the Supervisor SNS for presentation at the morning status meeting.

4 2 Updating the Window Status

4 2 1 Updating the Status Window

4 2 1 1 To change the block status, first click on the box requiring the change

4 2 1 2 Next, select "OBJECT ATTRIBUTES" from the menu (or hit "F7") Then select the desired pattern from the "Background Pattern" selections Then select "OK " (Block status can also be changed by double clicking in the block)

4 2 1 3 To add information as required in the explanation blocks perform the following

a) When all block statuses are updated, select "FILE FILL FORM" from the menu or hit "Ctrl-F2" to switch to "PERFILL", and fill in the CSD/RSD Critical Parameters form

b) Select "SAVE" changes option

d) The system date & time will be automatically filled in Use "TAB" and "SHIFT-TAB" to move from one filed to the next to enter the data in the appropriate fill-in selection, or click in the fill in space to select the fill in field.

e) Enter appropriate value into the selected window When completed select "FILL-DATA SAVE/APPEND" OR "Ctrl-S" to save changes to form Select appropriate file name from popup list, then select the "APPEND" option

4 2 1 4 Explanation of off-normal status should be limited to one line

4 3 Lower Level Blocks

General *The lower level blocks are intended to show the status of the required functions or systems necessary to* maintain safe power operation of the unit These blocks will be used to determine the status of the top level blocks The lower level block status patterns are to be determined according to the following criteria

4.3.1 FISSION PRODUCT BARRIERS:

4.3.1.1 Fuel Cladding:

Fuel Cladding

a) This block is used to illustrate the relative margin of safety for the fuel cladding barrier. This margin is based on the following items:

1) Reactor Coolant System activity indicates NO fuel failure,
2) Core power distribution limits of Technical Specification 3.12.B SATISFIED, and
3) Safety limits for the reactor core of Technical Specification 2.2 are SATISFIED.

b) Block status is determined as follows:

CONDITION	CRITERIA
GREEN	•Conditions #1, #2, and #3 above met
YELLOW	•Condition #1 above not met, and Tech Spec limits not exceeded. Some minor fuel defects detected. OR •An LCO has been entered IAW Tech Spec 3.12.B due to exceeding power distribution limits of this specification.
ORANGE	•RCS Activity Tech Spec Limits of Tech Spec 3.1.d exceeded OR •Limiting Condition for Operation of Tech Spec 3.12 exceeded OR •Safety Limits of Tech Spec 2.2 have been exceeded.
RED	•Letdown Rad Monitor reading >1x10E6 CPM, thus requiring declaration of an ALERT or greater as per the Station Emergency Plan OR •Core Safety Limit of Tech Spec 2.2 exceeded and RCS Letdown Rad Monitor above previous levels. OR •RCS Activity levels of Tech Spec 3.1.D exceeded by >25%.

4.3.1.2 RCS Integrity:

RCS
Integrity

a) This block is used to illustrate the relative margin of safety for the Reactor Coolant System barrier and is based on consideration of the following:

1) Reactor Coolant System Unidentified and Total leakage,
2) RCS primary to secondary leakage,
3) Heatup and cooldown limits of Technical Specification 3.1.E,
4) Pressurizer PORVs & Block Valves,
5) Pressurizer Safety Valves,
6) Reactor Head Vents,and
7) Reactor Coolant Pump seal leakoff flow.

b) Block status is determined as follows:

CONDITION	CRITERIA
GREEN	•Items listed above are all acceptable IAW their related Tech Specs and conditions for a more severe status do no exist.
YELLOW	•Unidentified RCS leakage is greater than 0.5 GPM, or RCS total leakage greater than 3 GPM, OR •Total primary to secondary leakage is greater than 15 gpd for ALL S/G's, OR •Administrative limits on heatup or cooldown rates exceeded OR •One Pressurizer PORV or Block Valve is inoperable, OR •BOTH Reactor Head Vent flowpaths are inoperable, OR •RCP seal leakoff for any RCP is outside AP-9.00, Attachment #1 limits.
ORANGE	•RCS leakage greater than allowed per Tech Specs and unit shutdown is required, OR •RCS cooldown is approaching Critical Safety Function Status Tree red path (100 degrees F per hour) OR •Two (2) Pressurizer PORVs or Block Valves are inoperable, OR •#1 seal leak-offf for any RCP is <0.8 GPM, or is >6.0 GPM, OR other RCP parameters require pump shutdown IAW AP-9.00. OR •BOTH Reactor Head Vent flowpaths are inoperable for >30 days. OR •Any Pressurizer Safety Valve is Inoperable.
RED	•RCS leakage greater than allowed by Tech Specs and Safety Injection is required per AP-16. OR •RED PATH condition exists on Integrity CSFST following unit transient.

Surry Unit 2 Operating Critical Parameters

Fission Product Barriers	Safety Systems	Reactivity	Monitoring and Assessment	Plant Availability
1 Fuel Cladding	4 ESF Systems	8 Nuclear Instruments	11 Fission Products Barrier Monitoring	14 Reactor Power
2 RCS Integrity	5 Heat Sink	9 RCCA's	12 Radiological Assessment	15 Regulatory Significant Systems
3 Containment Integrity	6 Electrical Power Supplies	10 Makeup Sources	13 Accident Assessment Capability	16 Secondary Systems
	7 ESF Instruments & Controls			17 Control Instrumentation

Component/Equipment/System Out-of-Service that causes the YELLOW, ORANGE, or RED Condition above.

#	Equipment/Mark Number	Explanation
2	2-RC-PCV-2456	Pressurizer PORV Block Valve closed, but still energized to evaluate PRT in-leakage.
13	ICCM Train 'A'	Operable with degraded plasma display. OP-66 being performed once per shift.
17	Ch. IV Pimp	Noise on isolator causing spikes in control circuit. P-250 point off-scan.

Fully Operable
Acceptable
CONDITION GREEN

Acceptable, but degraded/LCO of >6 hours to HSD may be in effect. CONDITION YELLOW

Degraded Condition/HSD may be required within 6 hours. CONDITION ORANGE-Contingency actions may be required. Condition may be reportable.

Unacceptable Condition/Unalyzed Condition. CONDITION RED

DATE: 06/19/96

TIME: 06:00

EXAMPLE 4: SPAIN (Iberdrola)

Iberdrola has a two pronged approach to self-assessment. The utility sees self-assessment as an important element of the organization safety culture which drives into a programme where safety culture characteristics are developed and a programme which pursues continuous quality improvement. Iberdrola considers self-assessment as an integrated system composed of external and internal tools for plant and corporate management decision making so as to obtain an overall improvement in safety and quality. Characteristics important to the development of a strong safety culture are defined at the top level, and are reviewed periodically to assure they remain valid. In this manner the management level establishes the framework of the self-assessment process, while the teams implement the actual processes within the established framework.

INTRODUCING AND FOSTERING SELF-ASSESSMENT CULTURE

Performance programmes, (even with good results) whose requirements hardly change lead to monotony and complacency. On the other hand, encouragement for continuous improvement, searching for new options and innovative ideas, is a determining factor towards success. This was very clear and IBERDROLA saw a Self-Assessment culture as an important element of the organization's safety and continuous quality improvement programmes.

This vision should come from the senior management and flow downwards throughout the entire organization to all personnel whose contribution is certainly important.

In 1992, IBERDROLA senior nuclear management, supported by the General Manager of the Electrical Generation Area, decided to take action in developing and implementing both programmes at its Cofrentes NPP. Therefore, two pilot programmes were established to drive for quality, as a top management policy. It was actively pursued by corporate and stations managers and, at the same time, involved craftsmen, regardless of their post in the plant, in problems identification and solution, a team work approach was adopted together with a better organization structure.

The final aim was to get participation of almost everybody and, consequently, each individual, as part of the process, must feel personally involved in the programme and specially motivated to enhance performance in their particular job. This implies a cultural change process. Therefore, bearing in mind the ideas stated above, safety culture and continuous quality improvement programmes were developed for Cofrentes NPP in order to:

- strengthen a safety culture to further improve in safety, reliability, efficiency, quality and innovation in plant operations

- get senior management support for this policy and its necessary resources

- involve managers and craftsmen in developing better attitudes and abilities through teamwork training, problems finding and the processes simplification.

Management of quality and safety culture concepts were thoroughly analysed to become integrated in the Cofrentes Safety Culture Plan and Continuous Quality Improvement Programme.

SAFETY CULTURE PLAN

Safety culture is a compound of intangible attitudes and attributes throughout the organization that promotes the safe operation of the plant, as defined in INSAG-4. Safety culture is also a result-oriented value since those intangible human characteristics do lead to tangible results which can be measured.

IBERDROLA "Safety Culture Plan" was applied at Cofrentes NPP early in 1993. The Plan was first conceived as a specific and efficient tool to reinforce and improve safety activities as well as quality and efficiency of significant processes. It was designed to incorporate innovative techniques in certain areas in an attempt to establish the framework to enhance the safe management of the plant. Safety, efficiency-quality and innovation objectives were incorporated within the document.

The plan detailed the main elements and the strategic global and specific objectives which were identified as the keys to get a remarkable safety and performance record.

In April 1995, Cofrentes NPP "Safety Culture Plan" was presented at the topical meeting organized by the OCDE/NEA and the ANS in Vienna. As a result of this meeting it became apparent that a new transformation towards a direct quantification of safety culture level was needed; therefore the appropriate measures to develop specific safety culture factors were undertaken to quantify them through using the dynamics of a continuous improvement methodology.

Once organizational factors which influence safety culture of the Cofrentes technicians were identified, a programme to prioritize and analyse each one was established. Knowing the present situation, conducting problem diagnosis, establishing targets to be achieved and identifying performance indicators allowed an action plan to be developed to accomplish the preestablished objectives.

Thirteen cultural factors were considered in the Plan, three of them have been analysed and another four are under study. The programme will be completed in 1999.

An example is enclosed of one of the cultural factors developed. This relates to quality in **Communications in Work Process.**

CONTINUOUS QUALITY IMPROVEMENT Programme

IBERDROLA developed a "Continuous Quality Management and Participation Programme" for Cofrentes NPP which began in 1992. It goes beyond what could be considered as a quality-team improvement initiative, and in reality, it is an essential component in the structure of a new management system.

The Programme consists of the three basic components: People, Processes and Policy and their interrelationships which influence and improve the management behaviour and the key technical processes of the Plant.

Phase-I initial objectives were:

- to implement a global participation system based upon day-to-day improvement

- to motivate people by highlighting the importance of their participation, opinions and ideas, no matter what their position

- to develop team-work attitudes

- to get people involvement so as to focus our attention on work process simplification.

In reality, the creation of a working environment and team-dynamics that assist in problem identification and solutions, as well as promoting professionalism and inter departmental communications were pursued.

Voluntary teams were established to deal with chosen important subjects in the following areas:

- design modification
- radiological protection
- refuelling outages
- information and communication
- housekeeping.

The teams decided the issues within the areas selected by the guidance team that they would like to solve. Each team has:

- one facilitator, for methodology orientation and logistic support

- one co-ordinator, to manage meetings and report to the organization about the team's progress

- five to seven members who form the work-team to identify problems and select improvements.

Most of the team members were voluntary technicians.

After perceiving the effectiveness of this programme and work-force involvement, IBERDROLA expanded the programme to 24 teams with the participation of 170 voluntary people analysing up to 24 selected tasks. This means that more than 45% of the Cofrentes work-force was participating directly in the programme and some 58% were co-operating in one way or another. In 1995 the number of teams was increased to 43, some of them had already commenced their second quality project. In 1995 an additional training effort was made to teach approximately up to 80% of Iberdrola Cofrentes staff. They were trained in problem solving techniques and team working methods. 15 additional teams are expected to be started by the end of 1995.

During 1995 and 1995 the "Process Management" (Phase II) was also started as a pilot programme under the concept of "quality in daily work". The aim is to maintain control and improve key work processes.

A map of 4 macro processes with 43 medium processes was developed. Seven medium processes were selected, deployed, documented and their management system started. From these medium processes, 14 microprocesses were also chosen and developed.

CONCLUSIONS

The level of safety and self-assessment culture in a nuclear organization can be described through the behaviour of individuals and groups who handle and manage nuclear safety. Therefore to improve the culture of the organization there must be first an improvement in the management culture. It is at the higher level where the policies, framework and groundrules must be established to create the norms of behaviour and the environment needed for people to accomplish the safety and production objectives.

IBERDROLA's Nuclear Management understood the crucial importance of cultural factors such as: personnel accountability and empowerment, team-work, vertical and horizontal integration, quality of training, company´s policies with clear mission and goals, process simplification, and, of course self-assessment.

- It was also clear that human and financial resources were too valuable to be used in activities that do not really increase safety and/or efficiency. Consequently allocating the available resources for the best return in the safe generation of the nuclear units is a primary goal.

- Strengthening safety and self-assessment cultures, in order to attain the higher level of performance, involves a continuous effort. Long term improvements are needed, with well established objectives and sustained commitments, to comply with global objectives and self-assessment and this will undoubtedly contribute to these goals.

- In 1992, IBERDROLA, established a policy in this matter, since the only available information was the general guidance expressed in the INSAG-4 document, i.e. there was a lack of known practical methodologies and indicators for safety management and self-assessments as well as no known quantification criteria for cultural factors to be taken into account.

- There could be different means to achieve a top plant performance level. There is not a fixed standard plan of actions for all plants. Instead, once the Company General Policy and global goals are established, a careful individual plant evaluation should be performed to establish the appropriate plan for each plant.

- Cofrentes Safety Culture Plan and Continuous Quality Improvement Programme forms the combined mechanisms to improve further in this field. The programmes are underway with satisfactory results, although they have not been yet quantified. Moreover this is a long term effort and it appears to be the right way to proceed.

- Safety culture is a result oriented value and some kind of indicators or factors can be established to correlate plant safety with organization behaviour. Safety culture levels and trends are assessed to avoid complacency and be prepared to withstand present and future challenges in order to obtain a good safety record, be commercially competitive and accepted by the public.

- External and internal self-assessment tools are being used for improving safety and quality and also for plant and corporate management decision making. Safety systems functional evaluation and inspection, operating experience feedback analysis, cultural factors assessment, performance indicators, quality audits and the continuous quality improvement programme are among the more important tools used by the nuclear organization in this endeavour.

- Two specific examples of this process follow. The first corresponds to a topic which belongs to the **Communication Cultural Factor** and the second pertains to a medium process of **Maintenance Optimization**.

The **Communication in Work Process** Team was a Task Force set up by the Steering Team and was responsible for studying communications between individuals involved in safety-related working processes.

The areas of work to be examined, were:

- focus on communications relating to safety-related processes especially with respect to Safety Culture
- modify attitudes and create an enhanced safety culture, increasing awareness of the importance of good communications among the personnel
- the action plan should be presented to a Steering Team within 2 months
- develop a coherent and effective task indicator.

The Team compiled information on the characteristics of an ideal communication method and produced a format making it possible to evaluate communications of all types. More specifically, those communications occurring during the performance of safety related activities (See Table I, Example 4).

Following determination of these characteristics, each was given an effectiveness rating of between 0 and 5, this was accomplished by both Team members and other people involved in safety-related processes. Subsequently, an average rating was obtained for each characteristic, this being considered as the Valid Client Requirements.

Through a brainstorming process the Team selected the eleven safety-related processes to be studied and evaluated, with regard to communication.

Each process was broken down into a sequence of the activities and the phases in which communications occur identified. These were evaluated in accordance with the "valid client requirements".

In order to be able to determine the current situation and the target performance, two situations were evaluated, the normal situation and the ideal situation for each process.

- Defined/normal situation: The Team subjectively considered the communications that actually occur within the selected process. The evaluation being accomplished as shown in Table I, Example 4.
- Ideal situation: The Team subjectively considered the communications that should occur within the selected processes. The evaluation was accomplished in accordance with the Table I, Example 4, as in the previous case.

Comparison of the two situations showed that of the 133 communications involved in the 11 processes studies, 70 **complied with** and 53 **did not comply** with the characteristics for requirements of ideal communications. On the basis of these facts an indicator was defined: the number of communications involved in safety-related processes that meet the requirements for ideal communications.

47.3% of the communications involved in safety-related processes did not meet the requirements of ideal communications, this percentage should actually be zero. The team considers it to be a reasonable expectation that the target of 100 effective communications out of 133 could be exceeded, and consequently established the objective to be met as follows:

- Objective: To achieve a situation in which 80% of the communications carried out in safety-related processes meet the requirements of ideal communications.

- Matrix of corrective actions: In order to achieve the aforementioned objective a "Root-Cause" analysis was made by the team to identify communications problems - causes and to develop the corresponding corrective actions (See Table II, Example 4).

- Matrix plan: Finally, once the corrective actions were weighted and prioritised, according to importance, by the steering team, an action plan was established with the schedules for its implementation (see Table III, Example 4).

- Follow-up: The steering team will verify achievements against the action plan and also regularly report on progress against the specified performance indicator.

TABLE I, EXAMPLE 4 (SPAIN) - COMMUNICATION EVALUATION

CLIENT	MESSAGE				CHANNEL					FEEDBACK								
										MESSAGE					CHANNEL			
	OBJECTIVE	CLEAR	CONCRETE	SPECIFIC	Indicate RESPONS	Docum WRITTEN	VERBAL	TELEPHONE	COMPUTER	OBJECTIVE	CLEAR	CONCRETE	SPECIFIC	Indicate RESPONS	Docum WRITTEN	VERBAL	TELEPHONE	COMPUTER
Control Room Sup.	4	5	3	3	3	4	5	3		4	5	3	3	3	4	5	3	
Aux. Oper.	5	5	5	5	0	3	5	3		5	5	5	5	0	3	5	3	
Aux. Workman	4	5	4	3	3	5	2	2		4	5	4	3	3	5	2	2	
Aux. Workman	4	5	5	4	3	4	4	3		4	5	5	4	3	4	4	3	
Aux. Workman	5	5	5	4	2	5	4	4		5	5	5	4	2	5	4	4	
Aux. Workman	5	5	3	4	5	4	3	4		5	5	3	4	5	4	3	4	
Aux. Workman	3	4	4	4	3	5	2	2		3	4	4	4	3	5	2	2	
Instr.	5	4	3	3	3	5	2	2		5	4	3	3	3	5	2	2	
Instr.	5	5	5	4	3	5	2	2		5	5	5	4	3	5	2	2	
Oper.	5	4	4	3	2	5	4	3		5	4	4	3	2	5	4	3	
Shift Chief	4	5	3	3	2	2	4	4		4	5	3	3	2	2	4	4	
Me Supervisor	5	5	5	5	5	5	3	3		5	5	5	5	5	5	3	3	
Me Supervisor	5	5	4	4	5	5	3	3		5	5	4	4	5	5	3	3	
Mech.	5	4	3	3	5	4	3	2		5	4	3	3	5	4	3	2	
Mech.	4	3	2	4	5	5	3	2		4	3	2	4	5	5	3	2	
Eq. Maintenance	5	4	2	4	2	4	3	2	4	5	4	2	4	2	4	3	2	4
Eq. Maintenance	5	5	3	3	5	5	4	3	4	5	5	3	3	5	5	4	3	4
Eq. Maintenance	5	4	2	2	5	5	3	2	4	5	4	2	2	5	5	3	2	4
Eq. Maintenance	4	3	3	2	5	5	3	2	4	4	3	3	2	5	5	3	2	4
Eq. Maintenance	5	4	3	3	4	3	4	3	4	5	4	3	3	4	3	4	3	4
AVERAGE	4,6	4,5	3,6	3,5	3,5	4,4	3,3	2,7	4	4,6	4,5	3,6	3,5	3,5	4,4	3,3	2,7	4

EVALUATIONS PERFORMED BY PEOPLE COMMUNICATING DURING SAFETY-RELATED PROCESS PERFORMANCE, ON AN ASCENDING SCALE OF 0 TO 5

TABLE II, EXAMPLE 4 (SPAIN) - COMMUNICATION - MATRIX OF CORRECTIVE ACTIONS

PROBLEM	CAUSE	CORRECTIVE ACTION	PRACTICAL METHODS	EFFICIENCY	FEASIBILITY	TOTAL	PERFORMANCE	REMARKS
	Ignorance of administrative standards (OTS/OSDCM)	Ensure that the people involved in safety related processes know the administrative stan-dards.	Deliver courses on chapter 6.9.2 of the OTS s and procedure 0-13.	20	15	300	YES	
47 3% of communic-ations in safety-related processes do not meet the requirements of ideal communication, when this figure should be 0.	Lack of awareness.	Increase personnel awareness	Implement an information campaign through posters in the plant and personalized leaflets	20	20	400	YES	
	No importance given to communications.	Underline the importance of good communilcations.	Install posters showing the charac-teristics of efficient communications at telephones	25	15	375	YES	
		Inform on the quality of communications at Cofrentes NPP.	Value communi-cation and publish data.	20	15	300	YES	
	None of the personnel has received communi-cations training	Train the personnel in efficient communications	Deliver courses on efficient communications.	20	15	300	YES	
	No recycling of people who have received communications training.	Maintain the personnel up-dated in efficient communi-cations	Deliver brief periodic recycling courses on efficient communication, these should be impacting and practical	20	15	300	YES	
	Procedures incomplete	Complete the procedures.	Revision of procedures, including required communications.	15	20	300	YES	

TABLE III, EXAMPLE 4 (SPAIN) - COMMUNICATION ACTION PLAN

CORRECTIVE ACTIONS	PRACTICAL METHODS	ACTION SEQUENCE	1995				1996						RESPONSIBLE PARTY
			SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	
°Increase personnel awareness	Perform a communications campaign by means of posters distributed around the plant and a personalized leaflet	- Campaign study											
		- Contracting Placing of posters and distribution of leaflets											TEAM/GIC
Underline the importance of good communications	Install posters at telephones showing the characteristics of efficient communications	- Poster design											
		- Placing and/or distribution of posters											TEAM/GIC
Inform of the quality of communications at Cofrentes NPP	Evaluate communications and publish results	- Study, evaluation and publication of data on communications for the selected processes											TEAM
Train people in efficient communications Entire knowledge of administrative standards governing Reportable Events	Deliver training courses on efficient communications, chapter 6 9 2 of the OTS and procedure 0-13	- Course preparation and scheduling											
		- Course delivery											TRAINING/TEAM
Keep personnel updated on efficient communications	Deliver brief periodic recycling courses	- Course preparation and scheduling											
		- Course delivery											TRAINING/TEAM
Complete procedures	Procedure revision including required communications	- Preliminary study of communications in procedures											
		- Revise or draw up procedures											TEAM/ORGANIZATION

The **Maintenance Plan Optimization Team** was a Task Force set up by the Steering Team to study the Cofrentes Maintenance programme, equipment and systems reliability and outages programming, so as to obtain a simplify and flexible process, adapted to available resources, to limit important to safety systems unavailability and to get outage programmes on time.

The team was made up of maintenance managers and supervisors. The Maintenance Work Performance Planning was considered the Process "Client" for the Valid Requirements.

The team compile the information affecting the current programme coming from the following activities:

- Reliability Centered Maintenance
- Maintenance Rule
- Outages Optimization
- Present Preventive Maintenance
- On-line Maintenance
- Design Modifications Planning
- Radiological Protection Constraints

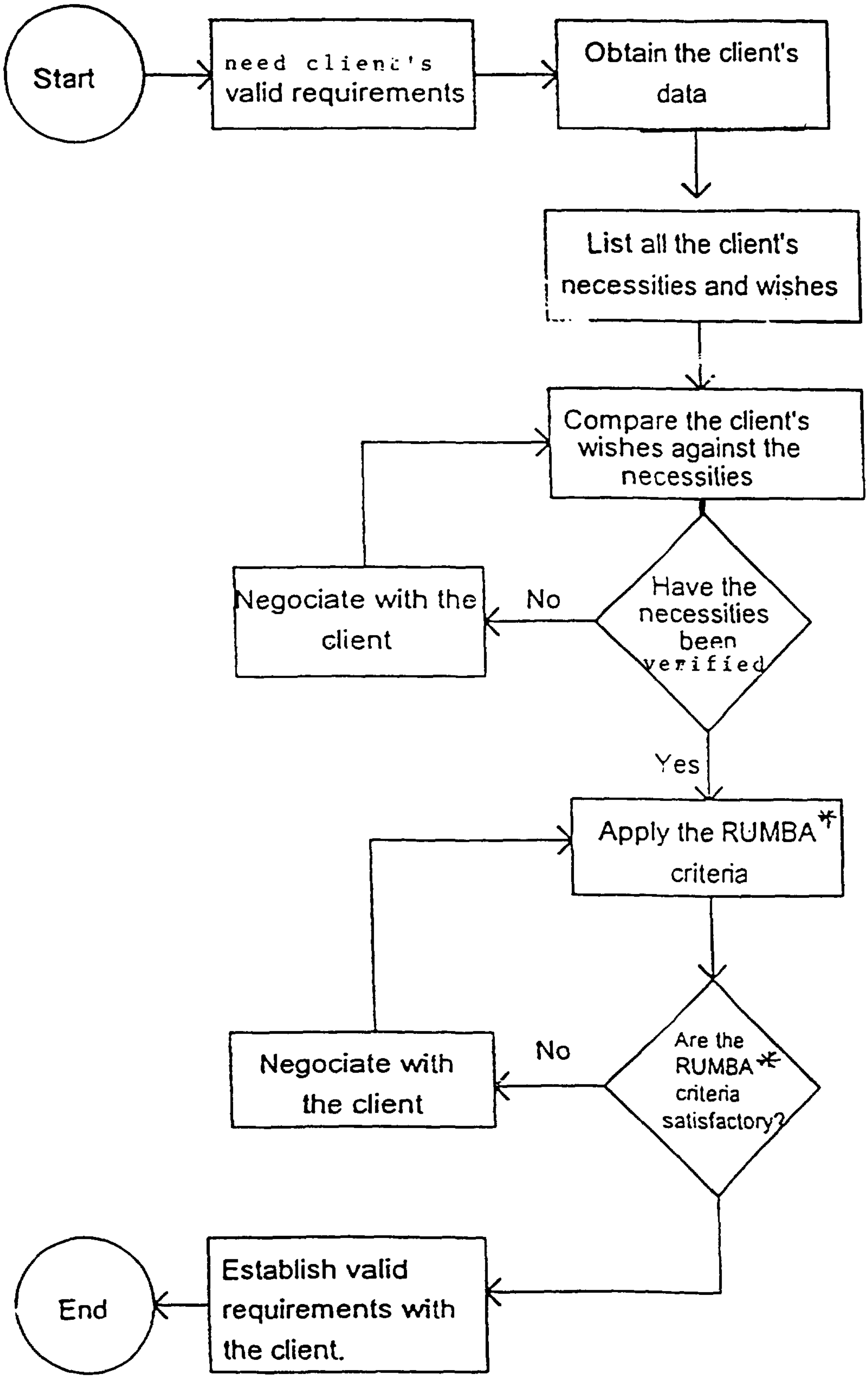
The Team was previously trained in the dynamics of Cofrentes Continuous Improvement Path Methodology which includes the steps stated heredown:

- Project Planning
- Reasons for Task Improvement
- Knowledge of Present situation
- Task Analysis - Indicators Development
- Corrective Actions Matrix and Short Actions Planning
- Project Results
- Standardization if applicable
- Long Term Actions Planning

The Team followed the Process Management Guidelines presented in Fig. 1 and 2 as developed for the Cofrentes Continuous Improvement Programme - Phase II: Process Focused.

The results of the process analysis drove into a: (1) Process Simplification and Optimization Programme, (2) Development of Performance and Quality Indicators and (3) Specification of Sections Responsibilities for Programme Surveillance and Follow-up.

The Process Flowchart, Indicators, Responsibilities and Important to Safety Systems Availability Charts are presented in Figures 1 through 5, Example 4.



* **RUMBA** means Reasonable, Understandable, Measurable, Believable and Assessable

FIG.1. Example 4 (Spain) - Process management - Identify the client's and supplier's requirements

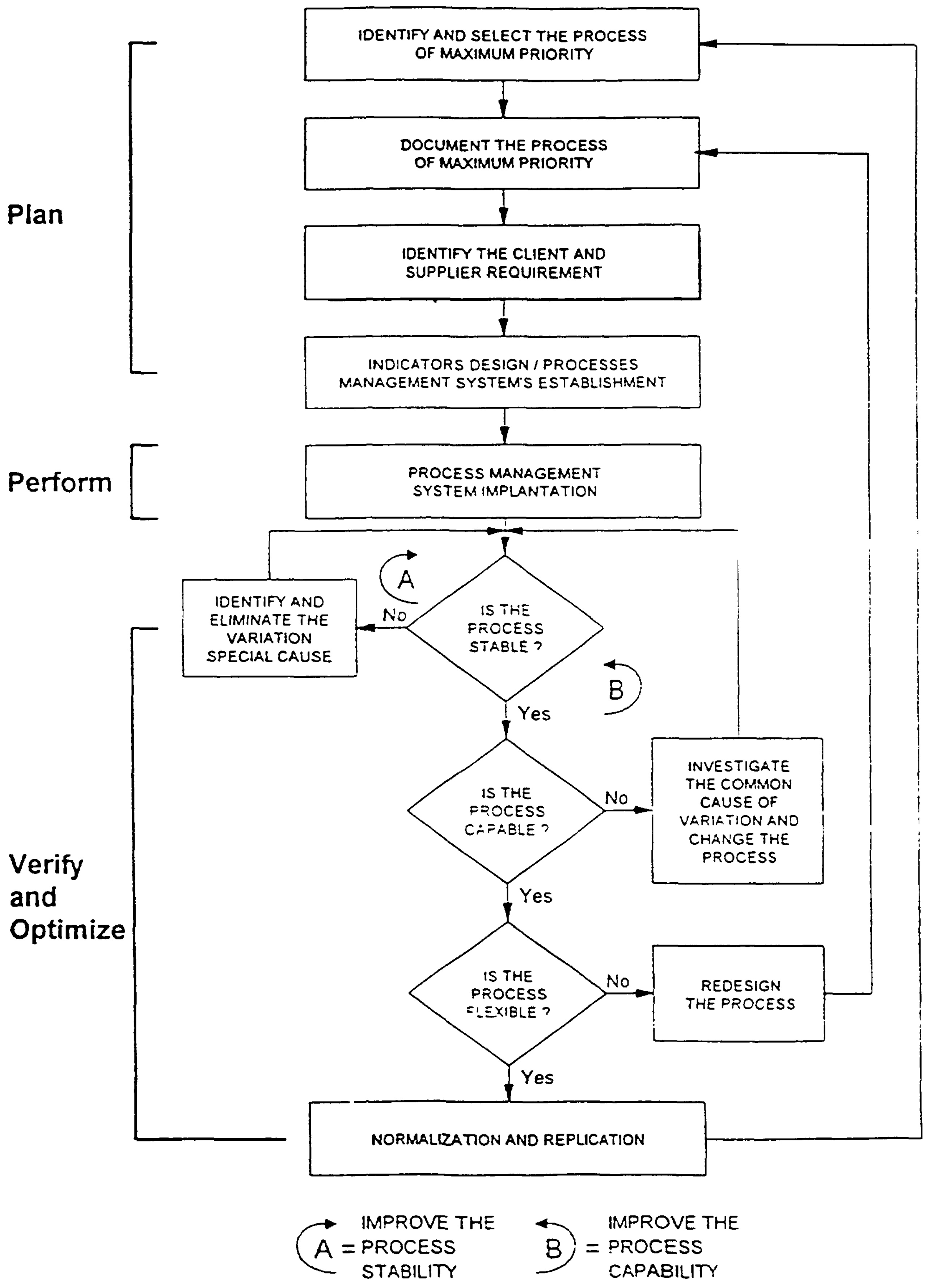


FIG. 2. Example 4 (Spain) - process management process documentation of maximum priority

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IBERDROLA

PROCESS MAN

PROCESS DESCRIPTION	PROCESS OBJECTIVE	PROCESS CLIENT·
MAINTENANCE PLAN	ELABORATE MAINTENANCE PLANS ALLOWING EASY AND FLEXIBLE WORKS PERFORMANCE	MAINTENANCE WORK P

PROCESS FLOWCHART

	SECTION / ACTIVITY		PLANT ENGINEERING	MAINTENANCE TECHNICAL OFFICE	OPERATIONS / OTHERS	PERFORMANCE	
1	CURRENT PROGRAM OF PREVENTIVE MAINTENANCE						
2	GENERIC APPLICATION PPA's - OCP's						
3	DETECTION OF FAILURE STUDY						
4	JOBS TO PERFORM						
5	OUTAGE?						
6	GATHER EQUIPMENT AND UNAVAILABILITIES						
7	ON-LINE MAINTENANCE PLAN						
8	DOES IT REQUIRE THE PLANT SHUTDOWN?						
9	STUDY AND PLANNING						
10	VERY URGENT?						
11	STUDY AND PLANNING						
12	IMMEDIATE CORRECTIVE MAINTENANCE						
13	PERFORM SHUTDOWN						
14	NON-SCHEDULED SHUTDOWN						
15 A	VALVES						
15 B	ROTATIVE EQUIPMENT						
15 C	TURBO GENERATOR						
15 D	REACTOR						
15 E	ISI						
15 F	OTHERS						
16	OUTAGE PROGRAM						
17	MAINTENANCE PROGRAM						

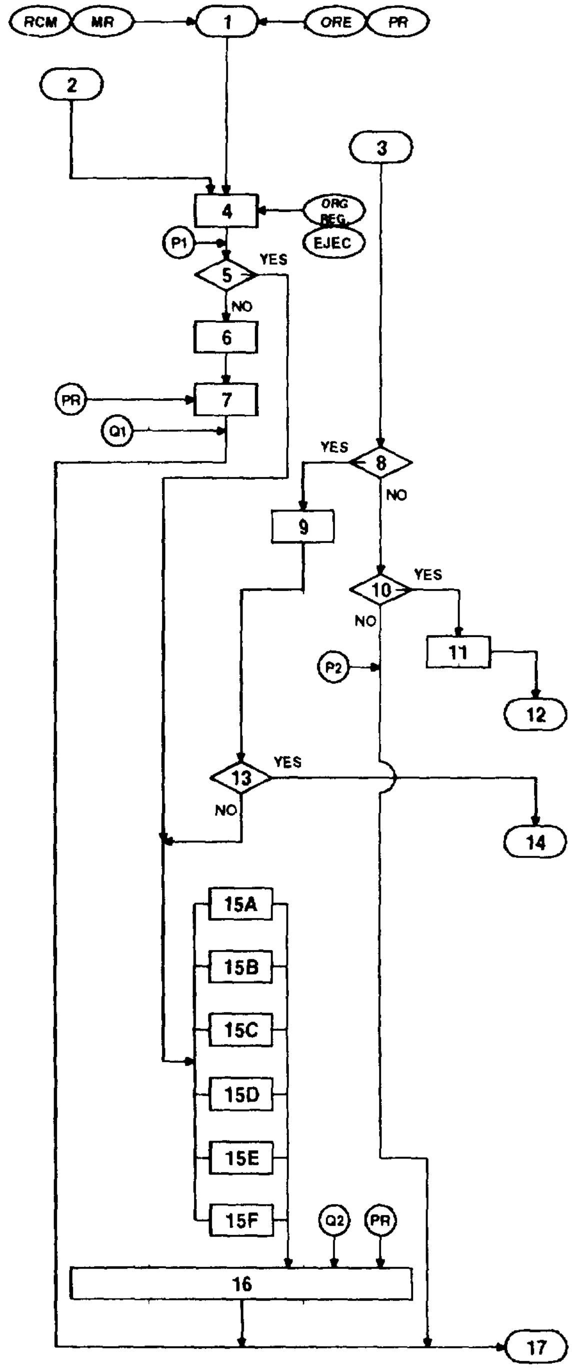

FIG. 3 Example 4 (Spain) - process management system)

PMC-090H07(INGLÉS) rev 0

SECTION 1

IAGEMENT SYSTEM

COFRENTES
CENTRAL NUCLEAR

PERFORMANCE.	CLIENT's VALID REQUIREMENT (S): - DISTRIBUTE PREVENTIVE MAINTENANCE ACCORDING TO RESOURCES. - LIMIT UNAVALABILITIES. - HAVE AN OUTAGE PROGRAM ON TIME.	RESULT OR QUALITY INDICATORS: Q1 = INOPERACTIVE FACTOR<0,004 ECCS AND GD's<0,008 RHR Q2 = HAVE AN OUTAGE PROGRAM 5 MONTHS BEFORE STARTING DATE.

QUALITY (AND/OR) PROCESS INDICATORS		SURVEILLANCE				VARIUS INFORMATION
INDICATORS DESCRIPTION	CONTROL LIMITS	CONCEPT	FREQUENCY	RESPONSIBILITY	CONTINGENCIES	INCLUDES: - Abbreviations - Procedures - Notes, etc...
GRAPHICS	SPECIFICATION OF OBJETIVES	"WHAT"	"WHEN"	"WHO"	ACTION	
P1: Graphics in % of of number of pending preventive maintenance jobs	<15 %	Number of pending jobs	End of the month	T.M.O. (JRV) T.M.O. (LAM)	Reestructure preventive maintenance	Months of July and August 50 % September 70 % Outage 0 (feasible, preventive maintenance working)
P2: Graphics in % of number of pending, working and feasible corrective jobs.	< 15 %	Number of pending jobs and causes	End on the month	T.M.O. (JRV) T.M.O. (LAM)	Reestructure resources	
Q1. Unavailability Factor charts ECCS, G/D's	< 0,004 HPCS / RCIC and G/D's. <0,008 RHR	Number of hours non-available with regard to required operability trains and hours	End on the month	T.O.O. (JAGL) T.M.O (JRV)	Reestructure preventive maintenance. Analyse root causes of faults	
Q2: Date Have the outage developped program available Rev. 0	5 months before outage starting date	△ Issue date with regard to outage date	6 months before outage	T.M.O. (JCR)	Cause Analysis	

EDITION	DATE	EDITED BY	PREP	Vº Bº	
1	27-08-95	OPERATING	J.C.R J.A.G.L J.R.V		MC

SECTION 2

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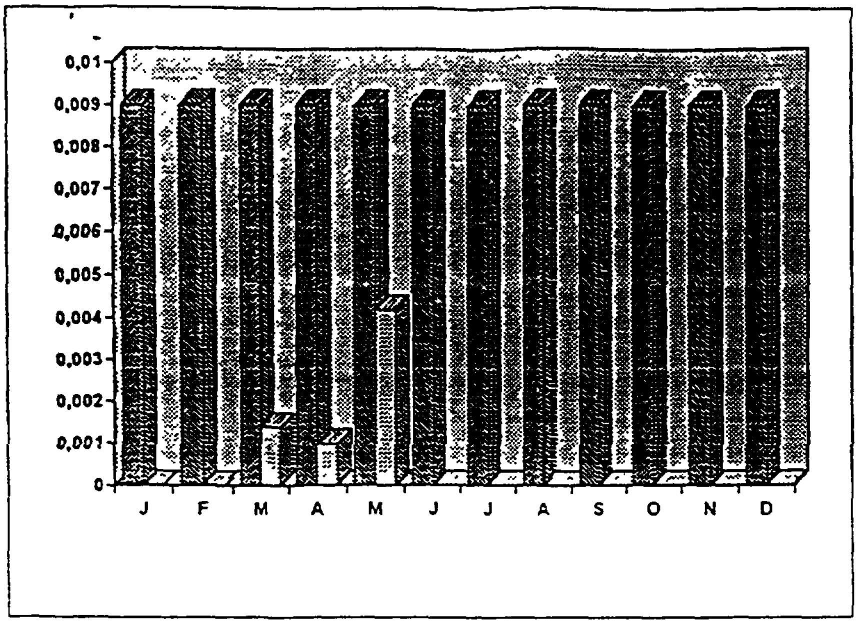


1996	Anticipated	Real
JANUARY	009	0
FEBRUARY	009	0
MARCH	009	00114
APRIL	009	.00099
MAY	009	.0042
JUNE	009	
JULY	009	
AUGUST	009	
SEPTEMBER	.009	
OCTOBER	009	
NOVEMBER	009	
DECEMBER	009	

ANTICIPATED
REAL

OBJECTIVE
Maintain the operating indicator of HPCS/RCIC (INPO) due to failures and maintenance tests <0,009

INDICATOR
Unavaiability hours (HPCS + RCIC) per failures or maintenance tests/2 x required hours

REFERENCE
Reference INPO's objective 0,025

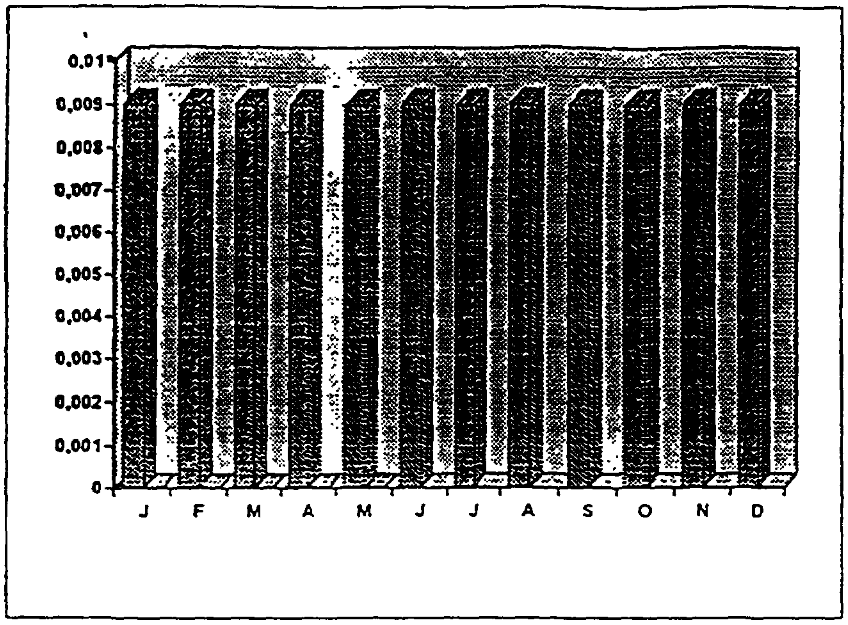
CONCEPT
Unavailability (accumulated from 1/1)

COMMENTS AND ACTIONS

COORDINATED BY
Jeronimo Roldan Vilches

CONTROLLED BY
Technical Operations Office (O T O.)

FIG. 4. Example 4 (Spain) - hpcs/rcic availability



1996	Anticipated	Real
JANUARY	009	0
FEBRUARY	.009	0
MARCH	.009	0
APRIL	.009	0
MAY	.009	0
JUNE	.009	
JULY	.009	
AUGUST	.009	
SEPTEMBER	.009	
OCTOBER	.009	
NOVEMBER	009	
DECEMBER	009	

ANTICIPATED

REAL

OBJECTIVE

Maintain the operating indicator of RHR (INPO) due to failures and maintenance tests <0.009.

INDICATOR

Unavalability hours (RHR) per failures or tests/2 x total n° of hours.

REFERENCE

Reference INPO's objective 0,020

CONCEPT

Unavailability
(accumulated from 1/1)

COMMENTS AND ACTIONS

COORDINATED BY

Jeronimo Roldan Vilches

CONTROLLED BY

Technical Operations Office (O.T.O.)

FIG. 5. Example 4 (Spain) - rhr availability

EXAMPLE 5: SWEDEN (Forsmark Nuclear Power Plant)

The Man, Technology, and Organization (MTO) approach used by Forsmark is based on events and incorporates the "people" impact on a self-assessment process. The methodology is based on the INPO Human Performance Enhancement System (HPES), modified to be more user friendly and more aligned with the Swedish culture. The key factor in the MTO process from a self-assessment perspective lies primarily in the fact that the MTO results are used to identify and address adverse performance trends.

Experience from the MTO and ASSET Self Assessment Programmes at the Forsmark Nuclear Power Plant

ABSTRACT

Within the nuclear industry there are two events which have had a significant impact on the way of thinking and attitudes to safety, although in different ways.

The TMI accident at Harrisburg, USA put the focus on Man-Machine interface, the way of working and attitudes to safety.

The accident at Chernobyl focused on Safety Management and Safety Culture.

After the Chernobyl accident, safety culture (IAEA INSAG-4) became a commonly used concept which included an overall perspective on safety and an understanding of the interaction between Man, Technology and Organizational matters (MTO). Another important result of the two accidents was the initiation of programmes to evaluate operational safety performance.

As a result of this understanding, the MTO concept was introduced at the Forsmark Nuclear Power Plant already in 1988 and is today a conceptual way of thinking which is well integrated in the line organization. The MTO concept include traditional Man-Machine issues as well as self-assessment programmes to evaluate safety performance.

1. INTRODUCTION

The concept of "root-cause" is not unambiguous. It is up to the investigator to decide how deep to go. Several different techniques exist for performing event investigations, all with the aim of identifying "root-causes" and they all share the ambition of going beyond the surface of the event. An event investigation should consequently reveal the deep structure of all the matters causing the event. One may argue that a root-cause analysis should attempt to investigate all the layers of defence - from technical barriers to management practice. In order to accomplish this, one may use some kind of structured check-list, such as is the case in the IAEA ASSET methodology or some more open method such as the INPO HPES methodology.

The latter has been preferred by Forsmark in the past, partly because it is simple and straightforward. Forsmarks Kraftgrupp AB together with Vattenfall AB has however modified the HPES-method in order to make it more user friendly and more adapted to Swedish culture. The methodology used today is called: "The MTO Analysis Methodology". This paper describes how the MTO Analysis Methodology is utilised at Forsmark. The paper also include a brief description and a short summary of the ASSET Peer Review performed at Forsmark NPP 1995 - 1995.

2. THE MTO CONCEPT

2.1. IMPLEMENTATION OF THE MTO CONCEPT

The MTO concept was introduced at Forsmark in 1988. One of the first measures which was adopted was to form an MTO group. The terms of reference of the group is described in greater detail below. In order to ensure that the analysis activity would be well-adapted to the purpose, some of the power plant personnel took part in the courses which were held by INPO at an earlier stage. In subsequent years, the MTO work was developed. The work comprises several different activities besides the analysis of events which have occurred. The development of methods etc. has been carried out in close co-operation with the technical personnel of the nuclear power plant and behavioural scientists within the Group (Vattenfall AB).

Root-cause analysis is never successful if the management does not support this type of work and allocate the necessary resources. Management must:

- provide a policy regarding when, how and by whom the analysis shall be performed
- provide adequate training to perform such an analysis
- create a culture of "non-blame".

The introduction of MTO and the subsequent development of an integrated MTO approach has been steered by the fact that Forsmarks Kraftgrupp AB, as the licensee, has full responsibility for safety. To a large extent, work is characterised by an awareness of this. The following statement is included in the company's policy statement:

Reactor safety is considered to be an integral part of the primary production activity and, as such, always has the highest priority.

The overall ambition of the company is to maintain a high performance level in terms of production, safety, low costs and confidence. The basis of a high level of long-term performance is a developed corporate culture consisting of norms, attitudes, policy, ideas and strategies.

On the basis of the particular corporate culture, efficiency with regard to organization, competences, structure, methods and systems are the means of achieving the desired level of performance. Together, these attributes comprise the "M and O" of the MTO concept.

The MTO seminars which have been carried out at all three production units have had a particularly large significance for widely establishing the MTO approach. All categories of personnel have participated in these seminars, including managers from the production manager level downwards.

2.2. DESCRIPTION OF THE SELF-ASSESSMENT METHODOLOGY

In short, the technique works as follows: A first step is to build a sequence of events, one by one. It is convenient to think of these steps as film sequences which, in reasonably objective terms, depict WHAT took place. In reality this is represented by a sequence of related squares (X-axis). To understand WHY the events took place, a diagram is developed which gives in Fig. 1. Example 5, information on the underlying causes and circumstances that led up to identified events in the main sequence (Y-axis).

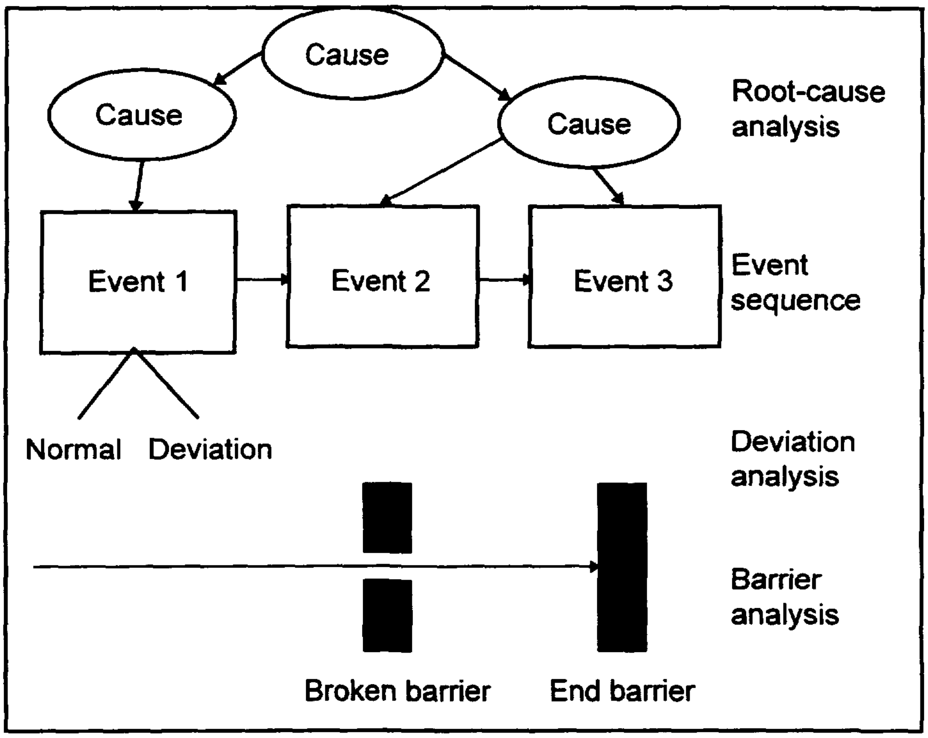


FIG. 1. Example 5 (Forsmark) - Illustration of the analysis and root-cause method, MTO. Event sequence, deviation analysis, barrier analysis and analysis of underlying causes

A third step, and the most important step in the analysis, is the investigation of barrier functions. Barriers found to be weak or missing are identified. The basic question to answer is '*Why was it not prevented*'?

In many case, the analysis is complemented with a deviation analysis and a consequence analysis.

The MTO analysis method is simple to use and underlying causes are easily identified, provided that the analysts have a basic knowledge of human factors and interviewing techniques. A further development of the method would be to "force" the analysts to investigate all the layers of the defence-in-depth. Today it is possible to stop the analyses too early. Such method developments are planned at Forsmark. The ASSET methodology is a good inspiration for such developments.

Since 1988, a total of 33 analyses have been carried out. It is the unit manager or the company's safety committee who decides whether to carry out analyses. Analysis methods corresponding to those which are used for events can also be used in connection with plant modifications. In the latter case, it is mainly the barrier analysis which can be used. Special instructions have been prepared for those carrying out the analyses. The instructions are included in the company's MTO manual.

2.3. Self-Assessment Review Groups

Due to limited resources, it is not possible to analyse all events in depth. For that reason there is a need for a simpler type of analysis. The main goal for such a method is to detect trends in causes. Methods already exist and one of these methods has been put into practice at Forsmark since 1992. In our experience an important factor for the successful use of such methods is that the method should not be too complicated. A second important factor is that the review group, which categorises the causes, should include representatives from different areas. The review group must also contain some "key person" which represents the "memory" of the group.

The joint nuclear power plant MTO group was formed in 1988. In June 30, 1995, the group had held 40 meetings for which minutes have been kept. Furthermore, local MTO groups for each production unit were set up a few years ago.

The joint group includes a representative from each production unit. This is usually the same person who leads the local group as well as a representative from the technical unit and an external behavioural scientist. The chairmen and secretaries have been appointed by the staff unit for Safety and Environment. The group consists of a total of about 5 people.

The working group is mainly responsible for carrying out the following tasks:

- To examine all of the LERs (Licensee Event and Scram Reports) occurring at the three production units (a total of about 100 per year) which have been reported to the regulatory authorities as well as to evaluate whether they are MTO-related or not.

- To report in minutes of meetings any comments and views concerning the events which the group has evaluated as being MTO-related.

- To categorize MTO-related events according to cause and to analyse trends for the different categories.(See below MTO Categorization of Events).

- To report trends and analysis results in an annual report and to the company's safety committee.

- The working group also recommend and encourage MTO analyses to be carried out as well as evaluate analyses which have been carried out, both with regard to the application of the analysis method and the results.

The activities of the group are dictated by a joint nuclear power plant procedure which is a part of the company's MTO manual.

The experience of the work of the group is very good. Comments submitted by the group carry a considerable weight and reporting to the safety committee means that MTO-related issues have been raised to a high level of safety within the company. Furthermore, work within the group has been characterised by continuity and a similar approach during the time that the group has been in effect.

MTO Categorisation of Events (Licensee Event Reports)

Experience has shown that it is difficult to maintain clear categories of causes when classifying MTO factors. Often there is a difficult balance between having too many categories, on the one hand, and having too few, on the other hand. The definitions provided below are, to a large extent, considered to be of practical use. However, in certain cases, they are also considered to be difficult to manage which is justification for continuous supervision.

<u>Deficiencies in Plant Modification Procedures</u> - Concerns the contents of the administrative procedures and the application of these procedures in connection with plant modification activities. Plant modification work covers all stages - from conception to completion.

<u>Deficiencies in Work Praxis</u> - A general category of comment for cases where the work methods of the individual deviate from what is considered to be good praxis. This comment is only made when none of the other categories have managed to detect deficient work praxis. Good work praxis means well-known and established methods which have been found to lead to the desired quality of work. The fact that a work method deviates from good praxis says nothing about the basic causes of the deviations and is only an observation which often requires further follow-up work.

Deficiencies in Leadership - This comment is made when the event has been caused or is affected by deficient work praxis at the management level (group level and higher).

Deficiencies in Ergonomics - This comment is made when the course of action adopted by the individual is negatively affected by a deficient man-machine interface. This category also includes deficiencies in the working environment such as light, noise, temperature etc.

Deficiencies in Technology - This comment is made when deficiencies in technology have contributed to putting the individual in such a situation that the probability of human error and administrative difficulties has increased and when it would have been possible to prevent this with technology of a better design. When events are categorised as "deficiencies in technology", this does not necessarily mean an increase in the probability of human error. The fact that a component does not perform as specified or does not fulfil the environmental requirements may be enough to categorize the event, in combination with "O" or "M", categorize the event as caused by deficiencies in technology. Note that this category is different from the above (ergonomics), even if the difference, in certain cases, may be difficult to maintain. This category has been found to be meaningful and has been added to the original list.

Deficiencies in Administrative Procedures - Concerns the design of the administrative procedures, e.g. their completeness and ergonomic design. Examples of administrative procedures include: Notifications of Equipment Malfunction, Work Permits, Operating Orders, Log Book, Control Room Work.

Deficiencies in Communication - Concerns deficiencies in communication between one or several parties. The communication may be written or oral. There may be deficiencies in the sending as well as the receiving of a message or order. However, normally, it is always the sender who is responsible for ensuring that the message (information) is correctly understood.

Deficiencies in Procedures - This comment is made to designate a deficiency in either work praxis and/or a deficiency in terms of an administratively unsuitable design of a procedure. Comments concerning a lack of procedures are also made in this category where this is the cause of or a contributing factor to deficient behaviour.

Deficiencies in Training - This comment is made when the individual lacks the knowledge required to carry out the work with an adequate level of quality. This category covers the training system (its design and follow-up)

Deficiencies in Operational Readiness Verification - This category comprises deficiencies in systems and/or work praxis which aims at verifying that a system, after work has been carried out on it, is ready for operation.

Recurrence - Concerns events for which comments have previously been made but which, for different reasons have not led to sufficiently strong measures to prevent their recurrence.

Deficiencies in Experience Feedback - Concerns information which has been available but which has not been used to such an extent so as to prevent the event from recurring. The information may have originated within the unit, at another unit within the plant, or at another nuclear power plant.

Breach of Procedures - Concerns a deliberate breach of a procedure, routine or other rule. An unconscious breach of a procedure may, e.g. be caused by a deficiency in work praxis or deficiency in training.

Unclear Definition of Responsibilities - The event is caused by or affected by the fact that the responsibilities have been inadequately defined (in writing or verbally) in connection with the work.

3. ASSET

3.1. PEER REVIEW OF THE FORSMARK SELF-ASSESSMENT ASSET

ASSET stands for the Assessment of Safety Significant Events Team. Analyses according to the ASSET method have been carried out under the auspices of the IAEA since the end of the 1980s. In 1994, FKA decided to carry out a self assessment of the safety situation and to let an expert team, under the leadership of specialists from the IAEA, evaluate the results. Previously, the entire ASSET analyses were carried out by an international team of experts under the leadership of IAEA's specialists. The role of the nuclear power plants, in such cases, was to compile and prepare the documents for the evaluation as well as to answer the questions of the team. Since a complete analysis in accordance with previous models is both costly and time consuming, the IAEA was interested in testing a method which involved a large degree of self-assessment by the plant.

For FKA, the decision to carry out the ASSET was motivated by the potential benefits for the safe generation of electricity and the international perspective provided by peer review. *An additional motive was the evaluation of potential advantages using new methodology for* safety evaluation and assessment.

FKA conducted its self-assessment of operational safety performance during the period of June to December 1995 and the ASSET peer review mission of the conclusions for the Forsmark plant took place at Forsmark from 12 to 15 February 1995. The peer review was conducted by the ASSET team according to the procedures provided in the outline of the ASSET Peer Review report.

In order to carry out the self-assessment, a working group was trained by the IAEA, on site at Forsmark. The work started with the classifying and systematizing of all LERs which had occurred during the period from 1990 to 1994. A number of safety-related problems which had not been definitively solved were identified, and analyses of greater depth were performed (root cause analyses). In its assessment work, the group aimed at finding the answer to the following questions:

- What happened? Event tree
- Why did it happen? Direct cause
- Why was it not prevented? Root cause

The last question was the most difficult to answer. However, the work was facilitated by the structured analysis method described in the ASSET manual.

When FKA's self-assessment was completed, it was evaluated over a period of five days by the IAEA's expert team. The team considered FKA's self-assessment to be well prepared and recommended that each unit should be required to compile an annual self-assessment of plant performance to be reviewed on site by the internal department of nuclear safety.

FKA's own evaluation is that several components of the ASSET method can favourably supplement and deepen the MTO event analysis method which has already been implemented. A project for the expansion and deepening of the MTO analyses with a root cause analysis in accordance with ASSET methods has already been started.

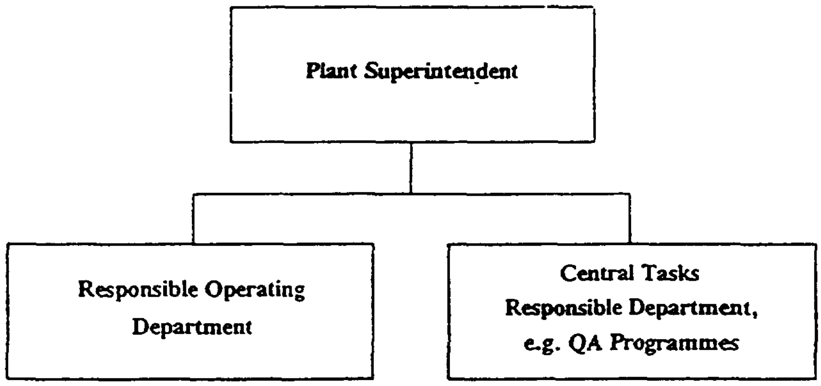
EXAMPLE 6: GERMANY (Gundremmingen Nuclear Power Plant)

The Gundremmingen approach to self-assessment differs significantly from the principles contained in the body of the TECDOC in that it is an integral part of the quality assurance programme. The unique characteristics which make the example relevant to this effort are: (1) individuals can initiate a review of applicable internal performance expectations, and (2) the feeling of ownership associated with the results.

The overall quality policy is based on a single principle, the department which is responsible for the implementation and surveillance of the quality assurance system is independent from the operating group.

The (self)-assessment programme, is a basic part of the quality assurance programme and therefore, the methods and the necessary (self)-assessment are co-ordinated/initiated by a department, which is independent of the operating departments of the organization.

In case of Gundremmingen the organizational structure is the following:



Self-assessment is a continuous process for all levels of management and staff. The initiative is taken by the staff or the responsible department. The purpose and methods of self-assessment are an established part of the training of plant personnel.

Self-assessment in Gundremmingen is based on the following basic rules:

- Plant internal: The basic necessary actions are the published goals of the organization, which take the following steps:
  - Discussion and declaration of the goals for a department (e.g. reduced outage length; less reliance on contractors, reduction of waste).
  - Working towards achieving these goals by the responsible department/team.
  - Measurement methods (in case of Gundremmingen Audit).
  - Discussion and acceptance of a report detailing actual against the goals.

- Taking “corrective actions” towards achieving the goals.

- Plant external: Initiated by the company with almost the same procedures as described in 3.1.

- External: Initiated by the company or the local authorities. For example: OSART; ASCOT and ASSET.

- Self-assessment in Gundremmingen is seen as a tool that the management can utilise to initiate necessary changes in organization; procedures (e.g. operating manual); and self-regulation.

- Any individual can initiate an Audit as a means of checking his own standard against the standard of the audit team. (The decision to carry out an audit is taken by the plant superintendent after the initial question from the head of the central task, see point 1).

- The signed report of the audit team is the start of the Corrective Action phase. The corrective action also specifies the target end date to the responsible department.

- Plant - Internal Self-assessment

  - The education and training necessary for any member of the “Audit” team is described in the organization manual.

  - The methodology of audits cover the following ideas:

    - checking the real situation against written standards

    - information interchange and discussion about indicated problems, root cause.

  The second point is much closer to Peer Reviews than to the classic definition of Auditing.

The audit team may also contain specialists from other plants and/or other departments. These specialists are not actual members of the team but they are seen as a base for “good practice” transfer between different plants or department.

SUMMARY

- this approach of self-assessment was initiated in 1988/89
- auditors were seen as internal “policemen“
- this changed completely because:
  - anyone can initiate an Audit
  - anyone can see the result (the report is not confidential “plant internal”)
  - this method has resulted in increasing the “feeling of ownership” among the staff, because anyone is now able to initiate changes.

EXAMPLE 7: LITHUANIA (Ignalina Nuclear Power Plant)

The Ignalina nuclear power plant does not currently have a comprehensive self-assessment programme; however, it has initiated elements of a self-assessment process in the area of maintenance entitled "maintenance days." As a point of interest the maintenance organization at Ignalina contains approximately 2500 people; for a two unit station, 1500 MW(e) per unit.

Several existing activities, which were developed during the many years of operation, provide a base for development of a system and this approach may be more effective than attempts to import ready for use models of self-assessment systems from outside.

As an example of self-assessment activities - the concept of the monthly "maintenance day" can be highlighted. Maintenance days were developed as a means of periodic review for many aspects of ongoing and planned maintenance activities (e.g. nuclear safety, industrial safety quality assurance, economics, etc.) in separate divisions of a large maintenance department. Maintenance days have a lot of elements of internal self-assessment in one specific functional area. Here members of the Maintenance Department perform self-assessment together with staff members of their "clients" and the surveillance division.

Assessment is performed in the following areas:

- Equipment and materials
  - general plant (shop) conditions
  - maintenance procedures and documentation
  - inclusion of new technology
  - materials and spare parts.

- Organizational measures
  - general organization and management; interaction with other departments
  - maintenance personnel training
  - planning
  - conduct of maintenance work
  - testing and control
  - records.

The following are examples of self-assessment in different areas.

- availability of equipment lists, placement plans and transportation charts within the plant are checked to minimize loads movement near safety related equipment

- availability of work procedures and personnel training concerning foreign material exclusion is checked

- the opinion of work team members on possible quality improvement means is sought

- attention is paid to the yearly plan for implementation at maintenance techniques to minimize radiation exposure of the staff

- the quality control of purchased materials and spare parts is evaluated

- implementation of training and qualification measures for all levels of maintenance personnel is assessed.

Maintenance days at Ignalina NPP have many of the attributes of self-assessment. It is continuous and the assessment is appropriately structured and objective. It can provide a good base for development of a comprehensive station self-assessment system.

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Consultants' Meeting on *Plant Self-Assessment Programme, A Tool to Enhance Nuclear Safety*
Vienna, 14 - 18 August 1995

Technical Committee Meeting on *Development of Technical Document on Self-Assessment of Operational Safety - Principles and Examples*
Vienna, 25 - 30 August 1996