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Self-assessment of operational safety for nuclear power plants

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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. This report will be used in IAEA sponsored workshops and seminars on operational safety that include the topic of self-assessment.

The IAEA wishes to thank all participants for their valuable contributions. The IAEA officer responsible for this publication is H. Eichenholz of the Division of Nuclear Installation Safety.

EDITORIAL NOTE

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1. INTRODUCTION

The efforts of the IAEA to date regarding self-assessment have strongly focused on operational safety. It is now recognised that strong economic performance of nuclear power plants (NPPs) must be driven by excellence in nuclear operations and uncompromising safety [1]. In the area of safety management, the role of self-assessment is to provide an effective tool to establish, maintain, and improve safety management systems.

This TECDOC reflects the broader safety perspective communicated above and provides the continued focus on operational safety. However, it is important to recognise that the processes and practices advocated potentially have a much wider application to the overall operating performance of NPPs. While it is difficult at times to separate the operational performance and safety issues of NPP performance, it is important to maintain the focus on operational safety during the performance of self-assessment activities.

Encouraging a broader application of the self-assessment processes and practices described in this TECDOC to all facets of NPP operational performance serves to strengthen the safety culture that will result in both excellence in nuclear operations and uncompromising safety.

1.1. BACKGROUND

As part of the nuclear industry's response to TMI and Chernobyl nuclear power plant (NPP) accidents, 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 UK, Canada and France also initiated peer review programmes with similar objectives. On a broader international scale, the IAEA initiated the Operational Safety Review Team (OSART) [2] programme for voluntary review of safety performance at power plants world wide. The IAEA also initiated other voluntary programmes, such as Assessment of Safety Significant Events Team (ASSET) [3] and Assessment of Safety Culture in Organization Team (ASCOT) [4], 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 Convention on Nuclear Safety. This convention has established, 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 have to report periodically to their peers on the measures taken to meet their obligations under the Convention. During the preparation of the report, 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 are 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 increased and the feeling of ownership for achieving them is significantly enhanced.

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 the self-assessment process and perhaps more effectively meet their obligations under the Convention on Nuclear Safety, the Operational Safety Section called a consultants meeting in August 1995 and 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, and resulted in the August 1997 issuance of IAEA-TECDOC-954, *Procedures for Self-Assessment of Operational Safety.* That report represented the general approach used by industry in the 1995–1996 time frame, with a focus of providing methods of self-assessment and examples of self-assessment processes. The current publication is the result of a Technical Committee meeting in December 1998 and a consultants meeting in February 1999 that discussed and evaluated self-assessment practices that reflect industry best practices and experiences. The focus was to: (1) describe the development, implementation and maintenance of the self-assessment process; and (2) incorporate examples of self-assessment processes that are considered practical implementation of the concepts found in the report.

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 a self-assessment process. The concepts developed in the report are intended to be sufficiently generic to encapsulate the wide variety of programmes noted by the IAEA. However assessments conducted by organizations external to the utility or the operator of the nuclear power plant are not intended to be covered by these guidelines although they are occasionally referenced.

In this report the definition of the terms 'internal' and 'external' is dependent on the position of the person viewing the process of assessment, if this person is within or outside the organization or utility performing the assessment (see Fig. 1).

The basic concepts and the methodology of self-assessment have proven to be applicable to other areas such as efficiency, reliability and overall economic performance. This report is primarily focused on the improvement that can be made in the area of operational safety.

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

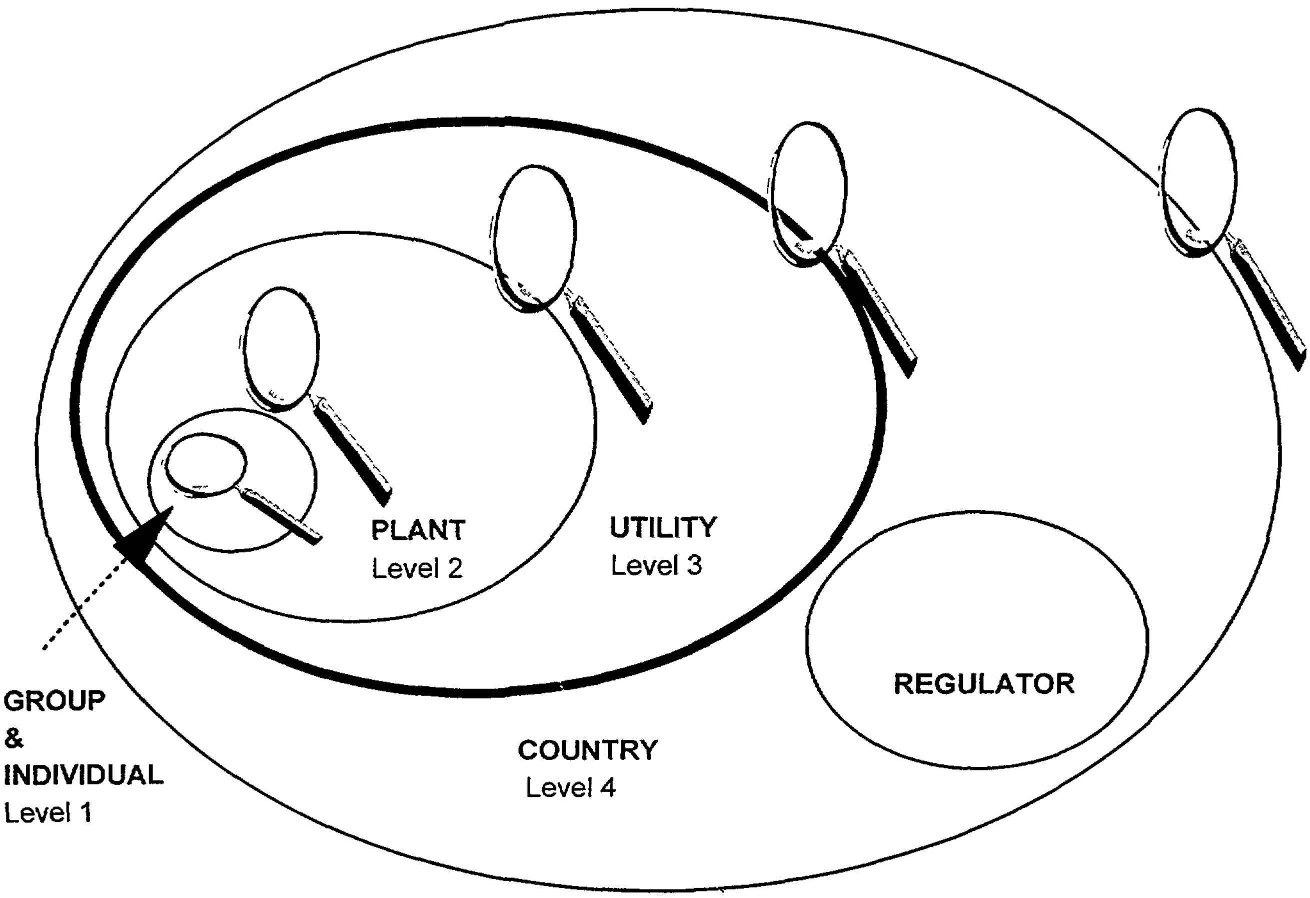

FIG. 1. Self-assessment depending on the position of the viewer.

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 [5].

Operational safety is an obligation of 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 [5]. 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 process whereby individuals, groups and management within an operating organization evaluate the effectiveness of their own operational safety against pre-determined performance expectations. A self-assessment programme or self-assessment loop is only complete when the corrective actions have been implemented and their adequacy confirmed.

Performance expectations are the set of goals, targets and objectives that are to be followed and achieved by the staff as a whole and may include performance expectations other than safety.

2. 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 that hinder 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, 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 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-assessment 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 process is applied effectively.

3. 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 broad company perspective or 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 self-assess their individual or group performance against a set of mutually agreed performance expectations.

Examples of different self-assessment processes are given in Table I (see Section 4.1.5).

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 report. 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.

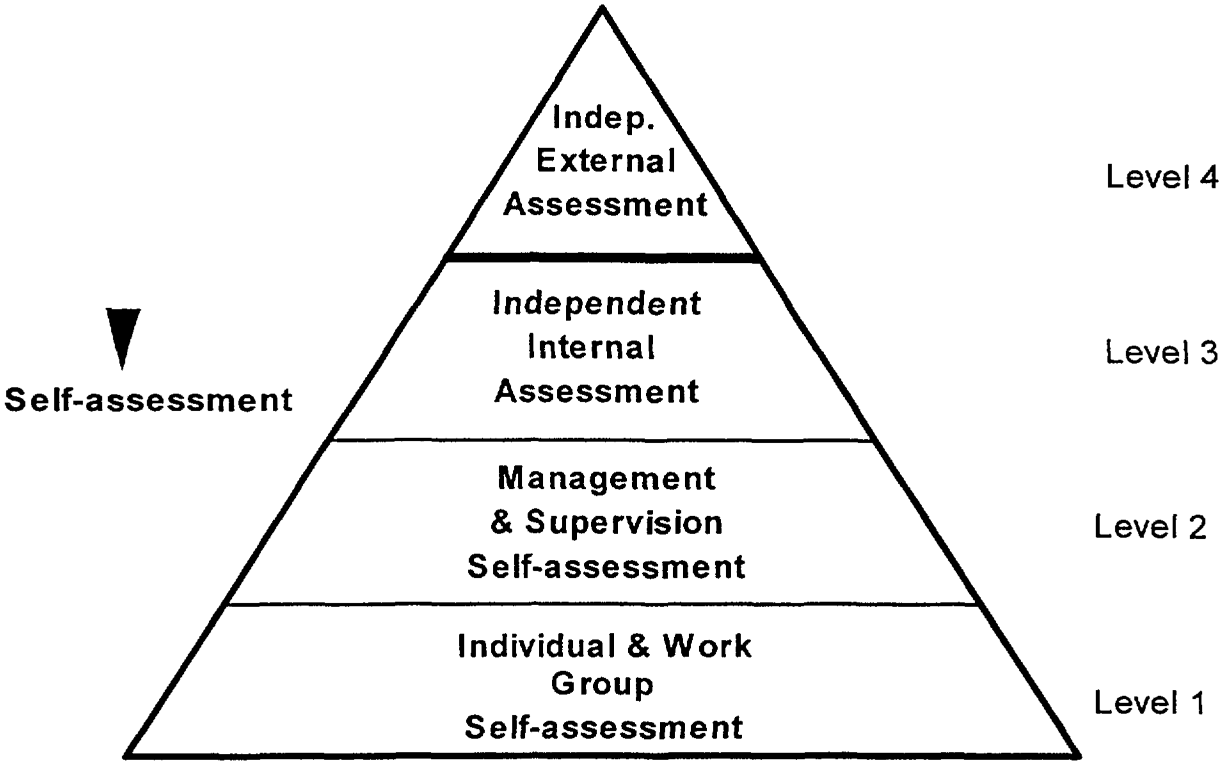

FIG. 2. Triangle of the assessment process.

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.

4. DEVELOPING, IMPLEMENTING, AND MAINTAINING A SELF-ASSESSMENT PROCESS

4.1. DEVELOPING A SELF-ASSESSMENT PROCESS

4.1.1. Management role

Self-assessment should be a continuous process initiated by management to enhance plant safety, evaluate the effectiveness of safety management and strengthen safety culture. 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 overall management system.

From a management perspective, development of the self-assessment process within an organisation is fundamentally linked with the development of its safety culture, since it has a vital role in ensuring that safety is given the priority attention it deserves. The safety management system should provide the framework within which self-assessment activities can be pursued.

International experience gained by utilities which have successfully developed, implemented and maintained self-assessment has shown that the following management roles are vital:

- Definition of an overall self-assessment plan that effectively and efficiently achieves the stated goals of the NPP.

- Definition of performance expectations taking account of the business plan, public expectations, owner (utility) requirements and the development of safety standards.

- Definition of the general process and schedule for conducting self-assessment, including providing resources for its implementation.

- Encouraging commitment from individuals at the team-level to the self-assessment process as a way of enhancing operational safety; this necessitates visible and positive actions at all levels of management in support of documented plans/performance expectations.

These key management roles are discussed in more detail in Section 4.2 (Implementing a Self-Assessment Process).

4.1.2. Creating a self-assessment culture

Management commitment to self-assessment is essential in assuring that personnel at all levels support and endorse the self-assessment process. In addition, management should help establish a culture which encourages self-assessment as a process for improving performance. In this respect, a culture which encourages self-assessment is an important element of a good safety culture. Consequently, the practices described in this section may be viewed as common cultural attributes, although particular emphasis is given to actions related to self-assessment activities.

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

- Promulgating management expectations and to 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 improved methods to enhance 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.

- 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.

- Facilitating ownership and understanding of the self-assessment process by encouraging staff to have control of appropriate elements of their self-assessment activities and results.

- 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.

If new problems are identified through means other than self-assessment, a review should be conducted to determine what changes are needed in the self-assessment programme so that this situation does not reoccur.

Management of some utilities who have successfully implemented a self-assessment process 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.

4.1.3. 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 activities might be improved. The acceptance of individuals' suggestions by management (possibly combined with some form of recognition or reward) serves to enhance the commitment of the individual to both the desired performance level and the striving for continuous improvement.

Management expectations and individuals' suggestions should be discussed and agreed. Objectives and criteria should be publicised 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.

4.1.4. Communication of the self-assessment process

The performance expectations, purpose and results of aspects of the self-assessment process should be visible to all plant staff, and they should be directly of use by 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 that needs to be carried out at an early stage.

Although the primary beneficiary will be the plant and operating organization, the results of the self-assessments could be used to positively influence external stakeholders, 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.

4.1.5. Examples of self-assessment programmes

A number of self-assessment programmes have been developed by utilities, nuclear organizations, and NPPs using a variety of different types of tools and mechanisms, as described in this TECDOC. These programmes have greatly assisted organizations in their development of a self-assessment culture, although it should be noted that in many instances, the primary motivation for initiating the programme may not have been explicitly defined as ‘self-assessment’ and that other overriding requirements may have been relevant.

Some utilities have utilized OSART, ASSET and safety culture methodologies in formulating a check list as a practical self-assessment tool and have incorporated these principles into their self-assessment process (ASCO and Kozloduy have used OSART checklists for self-assessment; Forsmark and Olkiluoto have used ASSET).

Examples are given in Table I and in the Annex, to facilitate understanding of practical steps that may be taken by an organization to encourage the development of a self-assessment culture. Programmes related to the self-assessment process typically consist of:

- Operating experience feedback (OEF) analysis;
- Quality assurance (QA) surveillance and audits;
- Safety system functional evaluations (SSFEs);
- Management visibility and involvement;
- Self-verification programmes;
- Safety committee periodic meetings; and
- 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". Figure 1 clearly illustrates that "self" changes depending on the reference point of the observer. Since this report is oriented toward "line" organizations involved with the operation and support of nuclear facilities, it is most appropriate that the 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 to in this section and included in the Annex 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 I). 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 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.

TABLE I. ASSESSMENT MATRIX

Assessment type and frequency	Continuous	Periodic	
		Preventive	Corrective
Independent external assessment		Not covered in this report	
Independent internal assessment	**A** Tokyo Electric Power Company (Example 8 of Annex)	**B** EDF-Corporate (Example 1 of Annex) UK – Peer evaluation (Example 2 of Annex) British Energy – Management of change (Example 9 of Annex)	**C** UK – Peer evaluation (Example 2 of Annex) British Energy – Management of change (Example 9 of Annex)
Management and supervision	**D** Virginia Power – Windows (Example 3 of Annex) DE&S/VY (Example 10 of Annex) Cofrentes – Safety Culture Enhancement (Example 4 of Annex)	**E** EDF – Station assessments (Example 1 of Annex) Magnox Generation - Station evaluation (Example 2 of Annex)	**F** Forsmark – MTO (Example 5 of Annex) Olkiluoto NPP – ASSET (Example 6 of Annex)
Individual and work group self-assessment	**G** Virginia Power – Windows (Example 3 of Annex) DE&S/VY (Example 10 of Annex) Cofrentes – Safety culture enhancement (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–I, as indicated in the text, represent the group of processes in the organization related to that position in the table.

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 safety programmes;
- Independent reviews of changes to plant design or method of operation;
- Independent reviews of operational practices; and
- Independent reviews of plant performance to verify that safety functions are maintained.

C. Periodic – Corrective

- Independent review of root cause evaluations and corrective actions taken in response to identified plant problems;
- Independent review of performance expectations.

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, e.g. the observation of work to verify procedure adequacy and use; and
- Management observations of training, e.g. 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, e.g. 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;
- Integrated performance trends by monitoring key performance indicators in areas important to safety; and
- Collection and evaluation of individual suggestions.

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 inter-departmental interfaces based on identified programme implementation; and
- Stand-down days where methods for improving work performance are collectively used.

Individual and work team

G. Continuous

- Individual self-checking, e.g. STAR (Stop, Think, Act, Review);
- Inter-departmental team pre 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; and Review of procedure adequacy during their implementation.

H. Periodic – Preventive

- Equipment surveillance tests, calibrations, etc., used to demonstrate acceptable performance;
- Periodic training evaluations; and
- Evaluation of suggestions and performance expectations.

I. Periodic – Corrective

- Conduct of trouble shooting activities;
- Working group review of interface problems; and
- Post-maintenance testing to verify the effectiveness of the maintenance.

4.2. IMPLEMENTING A SELF-ASSESSMENT PROCESS

4.2.1. Process considerations

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

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

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

In the development of the programme, serious consideration should be given to the use of benchmarking activities. As described here, the term benchmarking is intended to mean the use of a process where the organization developing the self-assessment programme compares their existing internal experience with those of external organisations. The object is to identify existing programmes or processes that have demonstrated effectiveness and are considered to reflect international best practices in achieving the benefits of self-assessment, while ensuring that they are appropriate for use within the evaluation organisation. The information described in this TECDOC can be a valuable tool in determining the potential benefits, effectiveness, or appropriateness for use within the evaluating organisation.

While the overall programme described in this section is comprehensive, an implementation plan to be effective it must recognize the existing levels of performance and resources of the organization. The results of different assessment types, or levels of self-assessment, is an input to the considerations for the need to conduct additional assessments that are to be included in the implementation of the programme. As such, the programme should be periodically reviewed and revised based on operational safety performance and feedback from the self-assessment process.

4.2.1.1. 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;
- Radioactive material disposal;
- Plant modification process;
- Plant configuration control;
- Corrective action programme;
- Organization and administration;
- Conduct of operations;
- Engineering support;
- Operational experience feedback;
- Control of contractors; and
- Reliability of plant equipment.

4.2.1.2. Extent of the assessment

Once the key functions and processes have been identified the conditions that must be met to assure 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, including calibration of instrumentation;
- Adequate procedures and training for operations that are important to the safety and reliable operation of the plant; and
- 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 assuring the safety function or the reliability of operations;
- 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.

4.2.1.3. Self-assessment frequency

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/year;
- The proper alignment of system valves and power supplies should be evaluated prior to unit start-up, following maintenance activities and at other appropriate times; and
- 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.

4.2.1.4. Self-assessment plan documentation

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 the whole process. It should be readily apparent to management and staff how the several components of the overall assessment programme (see Figure 2) are organized and applied, how the results are obtained, compiled in reports, and how the results generate actions to improve operational safety performance.

4.2.2. Performance expectations

4.2.2.1. Overview

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. Some examples of performance expectations are:

- Demonstration of a strong safety culture;
- Unavailability of safety systems;
- Radiation exposure;
- Completion of safety plant modifications;
- Industrial safety accident frequency rate; and
- Communications improvement.

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; and
- Looking at best practices published by international organizations and institutions.

In order to ensure that performance expectations will be achieved, it is desirable that they 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. Where targets are surpassed, should be recognized as a successful outcome and as a foundation for the achievement of even higher levels of performance.

4.2.2.2. Objectives and criteria for 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 ommissions 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 therefore relatively simple.

4.2.2.3. 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 those 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; and
- Number of field changes to plant design modifications.

Numerical indicators to monitor operational safety performance of nuclear power plants are used by operators and some regulators worldwide. During the last few years, the IAEA, through Technical Committee meetings and consultants meetings, has worked in this area [6].

4.2.2.4. 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.

4.2.3. Personnel, resource, and scheduler aspects for effective self-assessment

Important consideration for conducting effective self-assessments includes the need to define the general process and schedule for conducting self-assessments, and for providing personnel and other resources for its implementation. These considerations should assure an adequate and timely evaluation of key safety functions and important operational safety performance factors while minimizing the impact on routine activities.

Additionally, it is important to recognize that the self-assessment process benefits from the integration of an assessment activity into the lower level layers of the self-assessment process. The general principles described below, should wherever possible, attempt to involve the individual and group levels during the self-assessment activities.

General principles for assuring 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 operational log trends 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.

4.2.4. Performance comparison

4.2.4.1. Purpose of performance comparison

Self-assessment is essentially a critical comparison of existing activities and results against a pre-determined 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.

4.2.4.2. Methods of performance comparison

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

Self evaluation includes individual self-checking against planned performance of activities and critical review of the results of routine activities, such as, logkeeping.

Data review includes the comparison of previous data to establish performance expectations. This may include simple comparisons against performance indicators (see Section 4.2.2.3) 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 programs 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 4.1.5. Examples of key performance indicators which have been utilized for performance comparisons at differing levels of self-assessment within organizations are given in Section 4.2.2.3.

4.2.5. Completing performance assessment

4.2.5.1. Purpose of the performance assessment phase

A key objective of the performance assessment phase is to characterzse 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.

4.2.5.2. 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.

4.2.5.3. 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 analyzed.

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

4.2.5.4. Identification of corrective actions

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

4.2.5.5. 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.

4.2.6. 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 or programme.

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

4.2.7. 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.

4.3. MAINTAINING A SELF-ASSESSMENT PROCESS

Experience has shown that the establishment and implementation of a self-assessment programme are not sufficient steps in themselves to ensure its success. Success depends on the continued application of well established principles. Improving operational safety performance is a relatively slow process with no short cuts.

The key points for maintaining a self-assessment programme are:

- Visible commitment and leadership from the top
  (Management is personally involved in assessing performance: line management routinely carries out self-assessments such as: walking around the plant and observing work, listening to employee suggestions and complaints, examining trends and indicators, reviewing the results of independent assessments against self-assessments);

- Applauding and rewarding instances of self-assessment and self identification of problems;

- Ownership of safety and operational performance by line management at all levels;

- Making continuous improvement an everyday occurrence. (increase standards annually to ensure continuous improvement);

- Identifying issues needed to ensure cultural change;

- Individual commitment based on effective two way communication, and the use of peer pressure as a motivating factor; and

- The corrective action process must be seen by all to effective (demotivation will occur quickly if people see that the items that they have identified are not being corrected).

Seeking opportunities to learn from world class performers reinforces lessons learned from analysis of incidents and near misses. Experience shows that most occurrences result from day to day attitudinal and behavioural shortcomings, rather than major deficiencies in systems and processes. This indicates the need to reach the hearts and minds of personnel in order to maintain the highest levels of operational safety performance.

An overt demonstration that an organization has a adopted a culture of self-assessment is the extent to which it learns from others and itself. There are opportunities to learn from a reactive and proactive approach to events, near misses and successes. Events can be both internal and external to the organization and a systematic approach to root cause analysis to search for the lessons to be learned is essential. A culture that focuses on continuous system improvements, rather than punishing individuals for errors will help promote the reporting of near misses. These are important because they can reveal successful barriers which can then be reinforced, extended or consolidated into the affected plant or system or the lessons to be learned can be implemented elsewhere, as appropriate.

In incident analysis it is important to identify not only what needs to be improved but also what worked and was a success. This is so that any remedial action does not detract from the successes. Furthermore, just as lessons can be learned from incidents they can also be found in successes. A proactive approach is needed to single out examples of things which have worked well in order to examine them and understand what factors contributed to the successes. Continuous improvement and development is a feature of a learning organization.

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Annex

EXAMPLES OF PROCESSES OF SELF-ASSESSMENT OF OPERATIONAL SAFETY

EXAMPLE 1: FRANCE (EDF)

France - Electricite de 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.

1. The EGS (Evaluation Globale de Sûretè/Global Safety Assessment)

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 top 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 on 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 (EGS- Global Safety Assessment) 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 of the individual in their activities;
- Analysis with root causes and consequences of deviations of the information is performed at the Nuclear Inspection office. Draft reports with recommendations and suggestions 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; and
- The results are distributed to the site by corporate management. The site then has to perform the appropriate corrective actions which are followed.

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.

- Evaluation for each area of the degree of fulfillment of the objectives in comparison to the references. That is made by evaluating the performances on the results but also by the confidence in the degree of fulfillment of the results (see Figure 1, Example 1).

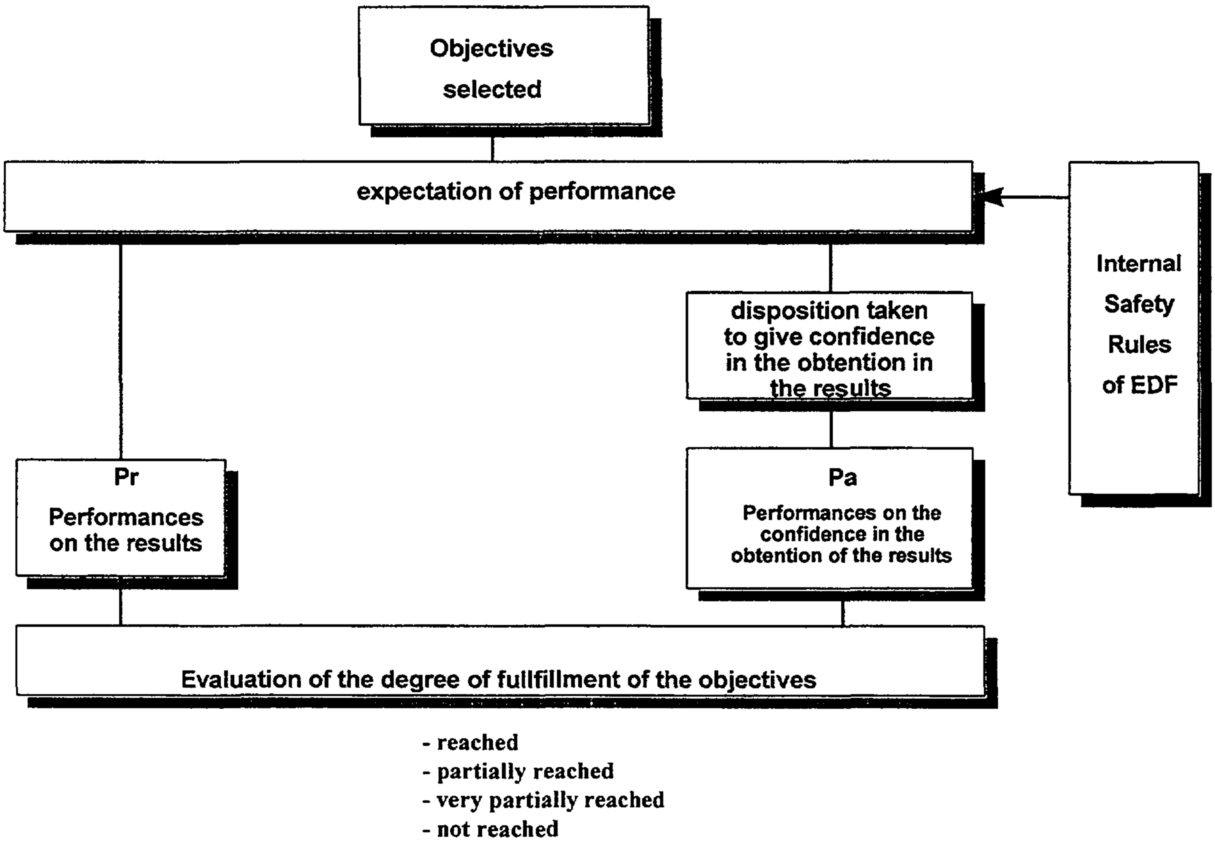


Figure 1. Example 1 (France/EDF)
EGS - Evaluation of the degree of fulfillment of the objectives

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; and
- The management controls the activities of the operator.

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 Figure 2, 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.

These assessment also take into account human factors by questioning and evaluating the existence and effectiveness of specific 'lines of defence' 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:

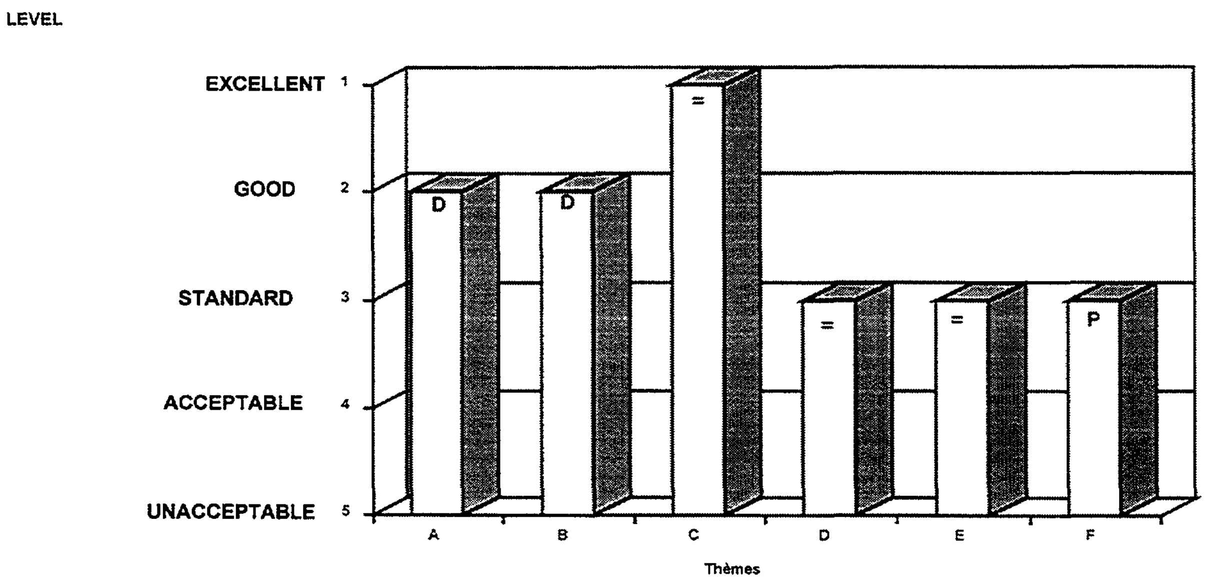
- Evaluation of the individual and collective participation in the different phases of the work;
- Assess the logic of personnel through observation of work practices through the use of (and adherence to) procedures, standards and regulations; and
- Verify the existence of preventive measures such as 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 (EGS, 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.

2. Self Assessment on EDF-NPP

In addition to the assessment process described above and to the assessment implemented on each NPP by QA Department with a formal plan, EDF promotes self-



Thèmes :

A	: People, management and organisation	
B	: Training	
C	: Surveillance and control of the equipment	
D	: Operation of the plant	
E	: Performance, program and analyses	
F	: Procedure and documentation	

Monitoring

P	: Progression	
=	: No change.	
D	: Degrading.	
PNE	: Progression not evaluated	

Figure 2. Example 1 (France/EDF) - Performance Scale for Operations Area

assessment (SA) at each of their sites inside operation departments. 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 (EGS)- the self-assessments 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-assessment 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-assessment 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-assessment process is to learn by doing. In the EDF environment self-assessment 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-assessment activities and develop a progressive strategy.

  - After some years of experience, EDF believes that a rigorous process must be applied in order to have an efficient self-assessment. The key elements in the success of the process are:

    - Preparation by the management of the manners to implement the process inside the teams;
    - Involvement of the first line managers with an assistance to help them during the process;
    - Plan training for those involved (as required). Training can be carried out by the Quality department. Enhanced communications are supported by management;
    - Perform the self-assessment by collecting data -on different methods analyze the results and define corrective actions;
    - Establish an action plan - corrective actions are prioritized, limited in number 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-assessment 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 (BNFL Magnox Generation, British Energy)

Two examples from the UK are given here, concerning self/plant evaluations, benchmarking and striving to achieve world-class safety standards.

(a) Self/Plant Evaluations

The first example from the UK is a 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. British Nuclear Fuels (BNFL) Magnox Generation and British Energy 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 Generation, and includes seconded members from other utilities. The UK Peer Evaluation programme was modelled 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 Figure 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. This is accomplished in the following manner:

- 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; and

- 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 whilst 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; and
- Self-evaluation complements and supports a quality improvement programme.

(b) World-Class Safety Standards

An important part of Magnox Generation's drive for world-class safety has been the utilization of self-assessment methodology in which improved safety performance is promoted through the direct involvement of personnel in the assessment and improvement of their own work activities and processes.

In addition to the well established management systems for peer reviews, self-evaluations and safety audits, Magnox Generation has recently implemented a safety improvement initiative with the objective of defining and delivering a self-assessment programme designed to achieve world-class safety performance.

The approach adopted to define world-class safety standards has involved two elements, namely, the identification of well-understood quantitative performance indicators and qualitative criteria based upon operational experience and practice. The development of these elements was facilitated by extensive consultation with operational personnel within Magnox Generation and taking account recent progress in the monitoring and reporting of safety performance indicators within the international nuclear community. The qualitative and quantitative indicators, taken together, constitute the definition of 'world class' standards for NPP.

Quantitative Performance Indicators

Despite the difficulties of defining all-embracing quantitative performance indicators, data from the World Association of Nuclear Operators (WANO) were analyzed and seven performance indicators were selected for detailed analysis. These include: collective radiation exposure, volume of low level solid radioactive waste, thermal performance index, unplanned automatic scrams, unplanned capability factor, unplanned capability loss factor, and industrial safety accident rate. Analysis of the data enabled lower quartile, median, and upper quartile values to be identified for each performance indicator and world-class performance was defined as upper quartile achievement.

The primary objective was to provide NPP with a useful and relatively simple numeric self-assessment tool for benchmarking and judging their safety performance against world-class standards. Hence, the performance of individual NPP in these areas were assessed against the foregoing numeric criteria and the results presented in a colour coded format. An example for illustrative purposes and one specific time period is shown Figure 2, where green represents upper quartile (world-class) performance, orange represents mid-range performance, and red represents poor (lower quartile) performance.

Experience has shown that presentation of the information in this format permits overall safety performance for a NPP, in numeric terms, to be readily assessed and understood by staff at all levels. However, it should be noted that the quantitative approach outlined above should be viewed as one element of the initiative to define world-class safety standards.

Qualitative Criteria

Operational staff at NPP, together with safety specialists, were consulted in order to propose criteria by which they make judgements about standards. The qualitative criteria arising from the consultation process could be grouped into six key areas, as follows:

- Pride in plant; intolerance of low standards;
- Learning, self-critical, open organization;
- Demonstrable care for Environment;
- Effective and used safety management system;
- Corporate unity of purpose; and
- Strong commitment to safety with clarity about goals and expectations.

To facilitate the involvement of staff at NPP, the qualitative indicators were further simplified and put into the form of a brief questionnaire, an example of which is shown in Figure 3. The questionnaire has been used to initiate debate at NPP within Magnox Generation about current performance standards and what needs to be achieved at the NPP in specific areas of the plant to strive for world-class performance.

The questionnaire contains a series of simple statements with some examples as a guide and then invites operational staff to give their assessment of current performance on a simple 'traffic light' indicator and propose improvements. The intention of the document is not primarily to measure current performance of the NPP, but to raise the profile of safety, stimulate awareness and generate the debate on striving for world-class performance.

Experience has shown that the initiative has provided an effective forum to raise safety awareness and promote staff ownership of safety improvements. To gain maximum benefit, output from the activity must be integrated into the improvement strategy for the NPP to ensure that issues raised can be progressed appropriately. Within Magnox Generation, one of the main vehicles for managing safety enhancements at the plant level is the NPP's Safety Enhancement Plan.

In practice, the questionnaire has been provided as a self-assessment tool to NPP and is owned and driven by staff on the plant. It is used as a basis for discussion among management teams, as part of team briefings, and by specific safety focus groups. It is also intended to use the tool as a basis for stimulating debate with external groups, such as the safety authorities or regulators, who may be judged able to provide an external perspective.

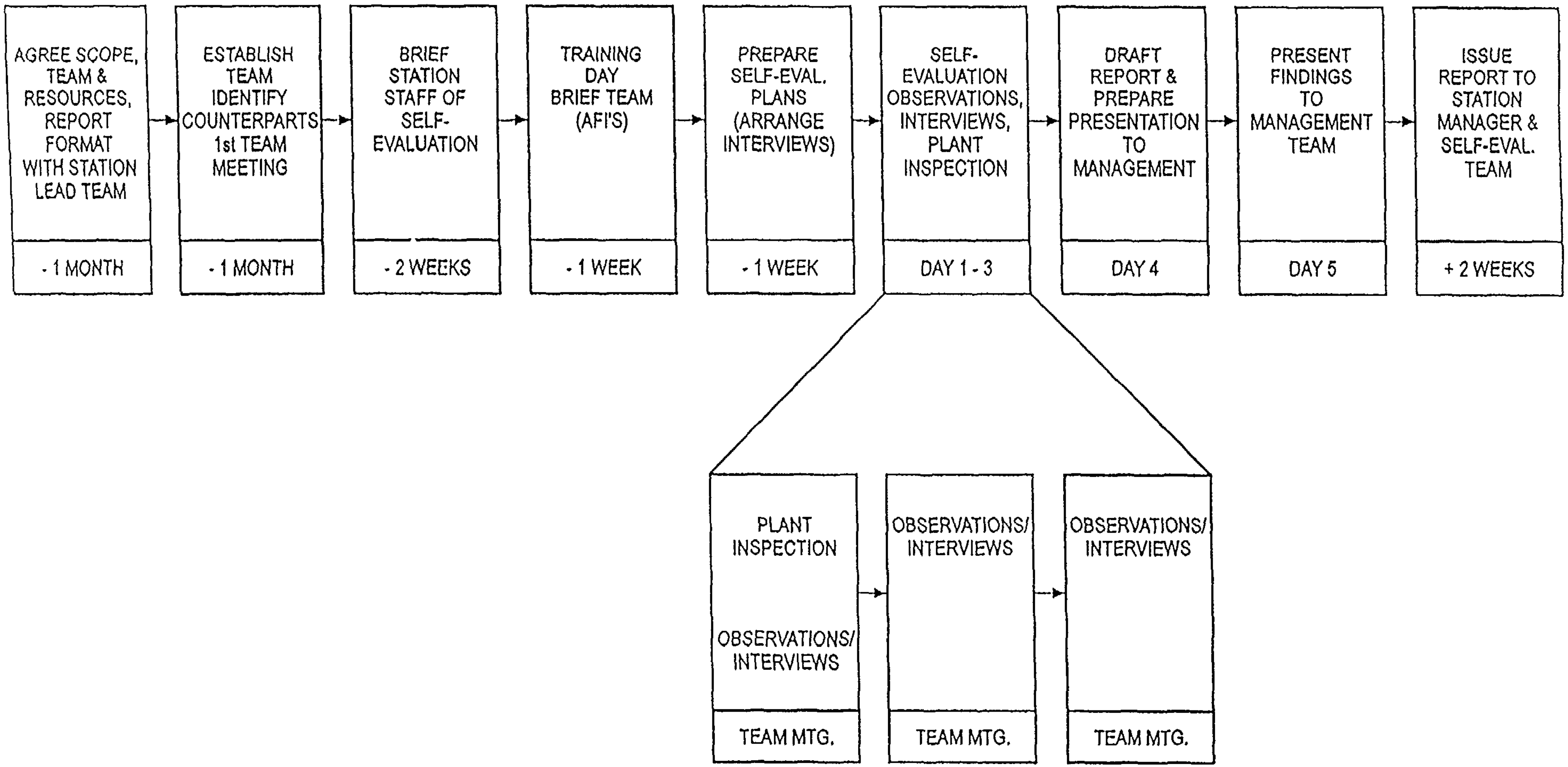


FIG. 1. Example 2 (UK/BNFL Magnox) - Model self-evaluation programme

Indicator	COLLECTIVE RADIATION EXPOSURE 3 YEAR CRE (Man-Rem)	VOLUME OF RADIOACTIVE SOLID LLW 3 YEAR RWW	THERMAL PERFORMANCE 1 YEAR TPI	UNPLANNED AUTOMATIC SCRAMS 3 YEAR UA7	UNIT CAPABILITY FACTOR 3 YEAR UCF	UNPLANNED CAPABILITY LOSS FACTOR 3 YEAR UCL	INDUSTRIAL SAFETY ACCIDENT RATE ISA per 200,000 man-hours worked
25%ile	10 15	10 67	92 11	0 00	73 00	1 21	0 09
Median	22 56	23 80	98 69	0 64	81 69	3 89	0 41
75%ile	46 54	41 29	99 56	1 33	86 28	8 12	0 88
Worldclass	<10.15	<10.67	>99.56	0.00	>86.28	<1 21	<0.09
Mid-range	10.15 - 46.54	10.67 - 41.29	99.56 - 92.11	0.01 - 1.33	86.28 - 73.00	1.21 - 8.12	0.09 - 0.88
Lower quartile	>46.54	>41.29	<92.11	>1.33	<73.00	>8.12	>0.88
PLANT MEDIAN	22.56	28.03	96.20	0.45	80.39	10.37	0.90
NPP 1	33.13	97.90	95.30	1.39	70.28	18.51	0.90
NPP 2	33.13	97.90	90.45	0.77	62.14	23.15	0.90
NPP 3	22.56	28.03	98.70	0.00	86.84	9.54	0.58
NPP 4	22.56	28.03	96.05	0.32	80.44	12.61	0.58
NPP 5	46.54	40.43	96.66	1.82	78.43	10.61	0.55
NPP 6	46.54	40.43	96.35	1.52	78.64	13.68	0.55
NPP 7	6.86	10.23	93.42	0.28	86.30	1.06	1.00
NPP 8	6.86	10.23	94.63	0.00	93.87	1.71	1.00
NPP 9	11.71	22.53	97.82	0.00	80.35	10.12	1.27
NPP 10	11.77	22.53	97.37	0.57	87.51	3.14	1.27

FIG 2 Example 2 (UK/BNFL Magnox) - Benchmarking of NPP Utilizing WANO Performance Indicators

Intolerance of Low Standards?

1 The general standards of 'housekeeping" on the site are high

Example

We all play our part in keeping the site clean and tidy and there is little litter on the site All areas are at the same high standard with an absence of "scruffy" areas for which nobody assumes responsibility

POOR						GOOD

If there was one thing we could do to make further improvement in this area it would be!

----

2 The plant is kept in good material condition

Example

Bearing in mind the age of the plant it is well maintained oil/water leaks are remedied promptly and there is good labelling and lighting etc

POOR						GOOD

If there was one thing we could do to make further improvement in this area it would be!

----

3 Work is carried out competently and professionally

Example

There is the necessary attention to detail pride in doing a good job and a questioning attitude on matters of safety e g when something does not happen as expected we stop to think why this might be and ask if necessary

POOR						GOOD

If there was one thing we could do to make further improvement in this area it would be!

----

13 There is strong commitment to Improving Safety?

Example

They have high visibility on safety matters around the plant and expectations standards are made very clear by them on a personal basis They respond to concerns from staff and give feedback where helpful

POOR						GOOD

If there was one thing we could do to make further improvement in this area it would be!

FIG 3 Example 3 (UK/BNFL Magnox) - World-Class Standards - Questionnaire

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-Assesment Programme	- Daily Statusing - Dept. Performance - Housekeeping Inspections - Supv. Monitoring and 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

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

First Quarter 1999

EQUIPMENT PERFORMANCE

Generation	Reactor Trips	RCS Integrity	Fuel Reliability	Chemistry Performance	Maintenance Rule Equipment

NON-EQUIPMENT PERFORMANCE

Operations	Maintenance	Engineering	Radiological Protection	Nuclear Site Services	Planning
Emergency Preparedness	Training	Materials	Security	Station Safety, Licensing, & Procedures	Nuclear Information Technology

CROSS FUNCTIONAL PERFORMANCE

Safety Culture	Self-Evaluation	Human Performance	Training	Work Management	Plant Status & Config Controls
Equipt. Perf. & Materiel Condition	Complacency Avoidance	Regulatory Performance	Corrective Action	Maintenance Rule	Safety & Loss Prevention
Cost Management					

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

LEGEND

2Q/98	3Q/98	4Q/98

First Quarter
1999

Surry Performance Annunciator Panel

VIRGINIA POWER

Panel Operations

First Quarter 1999

Shift Logs and Rounds	Operator Work-Arounds	Ops Status and Configuration Controls	Reactivity Management
Labeling	Tagging	Human Performance	Self-Assessments
Personnel Exposure	Industrial Safety	Temporary Modifications	Operator Distractions

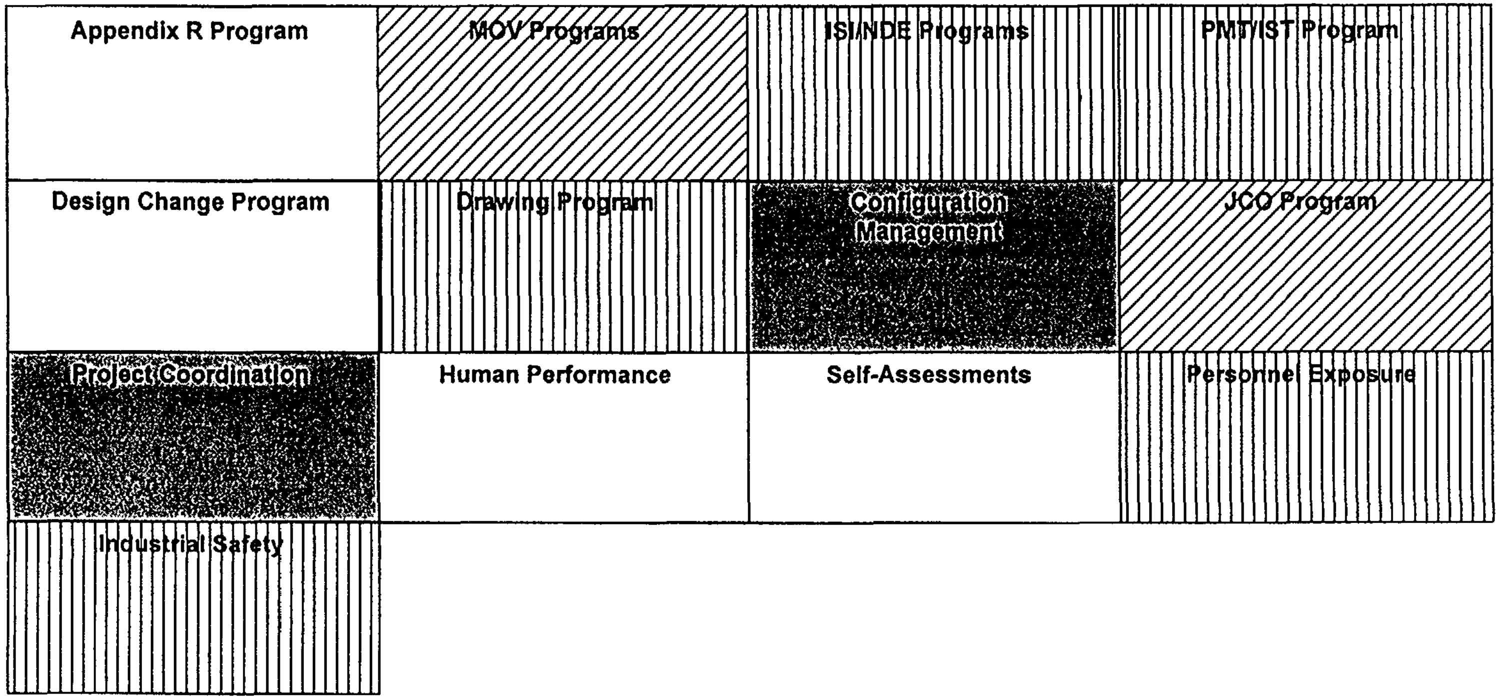
RED		- SIGNIFICANT WEAKNESS
YELLOW		- IMPROVEMENT NEEDED
WHITE		- SATISFACTORY
GREEN		- SIGNIFICANT STRENGTH
		- UNASSESSED

VIRGINIA POWER

Surry Performance Annunciator Panel

Panel Engineering

First Quarter 1999



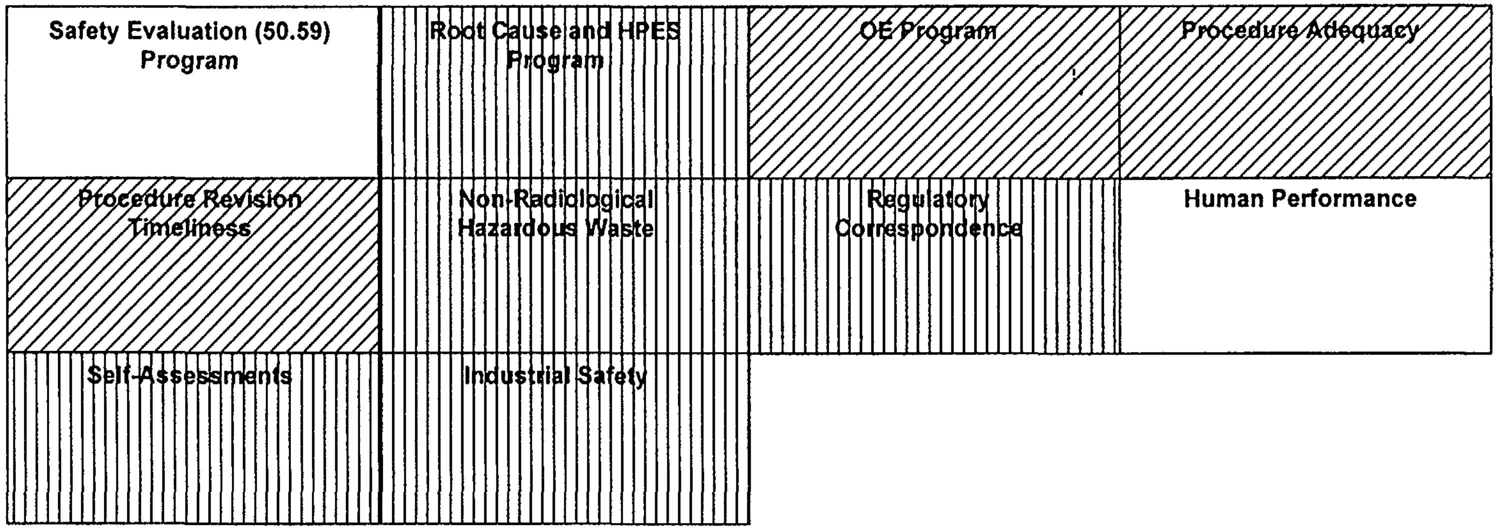
RED - SIGNIFICANT WEAKNESS
YELLOW - IMPROVEMENT NEEDED
WHITE - SATISFACTORY
GREEN - SIGNIFICANT STRENGTH
- UNASSESSED

Surry Performance Annunciator Panel

VIRGINIA POWER

Panel Station Safety, Licensing, & Procedures

First Quarter 1999



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

VIRGINIA POWER

Surry Power Station
Performance Annunciator Panel Reporting System

QUARTER: 1
YEAR: 1999

Area Non-Equipment Performance **Panel** Operations

Reactivity Management

		Last Three Quarters	
	Fourth Quarter 1998	Third Quarter 1998	Second Quarter 1998
Color: GREEN	WHITE	GREEN	GREEN

Justification

First quarter 1999 update.

Significant RM Events: None
RM Incidents: None

Events/Incidents = 0/0

Window should be green.

Documentation

Operations input; SS&L IR/LER/DR Databases; NRC/INPO/SNS/ Nuclear Oversight Reports

Criteria

```
No. of VPAP-1410 Reactivity Management Events  // No. of VPAP-1410 Reactivity Management Incidents:
GREEN   = None for 2 qtrs  // <= 1
WHITE   = None for 2 qtrs  // <= 2
YELLOW  = None             // <= 3
RED     >= 1 current qtr.  //  > 3
```

Note: NRC/INPO/Pre-INPO/ N/Oversight Findings and program-related Deviation Reports count as RM Incidents

[Revised 2Q/98]

VIRGINIA POWER

Surry Power Station
Performance Annunciator Panel Reporting System

QUARTER: 1
YEAR: 1999

Area Non-Equipment Performance Panel Engineering

Design Change Program

		Last Three Quarters	
	Fourth Quarter 1998	Third Quarter 1998	Second Quarter 1998
Color: **WHITE**	WHITE	WHITE	RED

Justification

Number of IPRs/Field Changes per active DCP - 1.6
Issues identified - 0

The First Quarter 1999 Nuclear Oversight Report indicated that weaknesses exist in the Design Control Program with the closeout of Design Change Packages not being controlled.

In Inspection Report 99-01, the NRC provided two examples of a non-cited violation for inadequate design controls. In the first example, the design reviews for Unit 2 low head safety injection pump minimum flow requirements were inadequate. This issue originated in 1988, when it was incorrectly assumed that the Unit 2 LHSI pumps were evenly matched, when they were not. The second example involved a calculation for Number 3 EDG battery not recognizing a transfer switch that allowed additional loads on the battery.

The Windows Coordinator considers these examples as weaknesses of the Design Change Program and lowered the grading of this panel from Green, as recommended by Engineering Management, to White.

Documentation

Design Control Reports

Criteria

Number of Design Change issues identified // Number of IPRs/Field Changes per active DCP:
Green - None // <= 5
White - <= 2 // <= 10
Yellow - <= 4 // <= 15
Red - >4 // > 15
[Revised 2Q/98]

Surry Power Station
Performance Annunciator Panel Reporting System

VIRGINIA POWER

QUARTER: 1
YEAR: 1999

Area: Non-Equipment Performance

Panel: Station Safety, Licensing, & Procedures

OE Program

Color		Fourth Quarter 1998	Third Quarter 1998	Second Quarter 1998
		Last Three Quarters		
Color	YELLOW	RED	RED	RED

Justification

First Quarter 1999 update:

1. Backlog of OER evaluations - 0

2. OER recommended action items that are overdue - 1 overdue of 28 open = 4%

3. Actions initiated by other departments that are overdue - 2 overdue of 13 open = 15%

The Pre-INPO Team identified three areas involving the OE Program needing improvement, including:

Communication of OE expectations
SOER timeliness and effectiveness
Threshold of putting OE on the INPO Nuclear Network may be too high

The 1999 INPO Evaluation identified that some important OE has not been shared with the industry.

Many initatives have recently been implemented to improve the OE Program. Training has been provided to 350 individuals on how to use the INPO database, to perform searches, and to answer questions. A generic password has been implemented to allow all station personnel access to the database.

SOER timeliness and effectiveness has been improved through the use of multi-discipline teams to evaluate new SOERs compared to the old way of assigning one person to perform the review. In the past, it took months to perform the review, but with the team, a recent SOER took a week to evaluate. Use of the team also improved acceptance of the actions.

Since two of the overdue OE items were completed in mid April, and due to all the OE initatives being implemented to improve the program, Management is using discretion to grade the OE program from Red to Yellow.

Based on the above, this panel is being graded Yellow.

Documentation

The backlog of OER Program analysis reports are the initial detailed evaluation by an OER reviewer (as a percentage of IOER open documents that are overdue), and may not be Station specific. The OER recommended action items that affect the station that are overdue includes corporate actions that affect the station.

VIRGINIA POWER

Surry Power Station Performance Annunciator Panel Reporting System

QUARTER: 1
YEAR: 1999

Area: Non-Equipment Performance

Panel: Station Safety, Licensing, & Procedures

OE Program

Criteria

The backlog of OER Program Analysis Reports // The OER recommended action items and/or Actions initiated by other departments that are overdue // Actions tracked in the IOER Database that were initiated by other departments that are required as a result of an OE document that are overdue:

GREEN - 0% // 0% for 2 Qtrs // None for 2 Qtrs
WHITE - <= 5% // 0% // None
YELLOW - <= 10%// <= 5% // <= 5% of total documents
RED - > 10% // > 5% // > 5% of total documents
[Revised 2Q/98]

Action

Actions for OE documents IN 92-69, OE 8593, and OE 8769 were overdue at the end of the quarter. Implementation the revision to VPAP-1403 which includes the actions needed to close OE 8593 and 8769 was completed in mid April.

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**

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 731065(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	
	3a Type ☐ MRule Equipment	☐ Other Equipment	☐ Non-equipment	☐ RMI -___	3b ☐ Repeat

Corrective Action Assignments ■ N/A

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

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

6 Assigned Actions/Response Details ☐ Other ______
☐ Category 1 RCE
☐ Category 2 RCE
☐ Category 3 RCE
☐ MRule Evaluation
☐ Trend - Basis ☐ Initial Action Acceptable ☐ Close to WO ☐ Normal Processes to Resolve

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

Corrective Action Plan Response ■ N/A

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

9b MRule Evaluation (Engineering Use Only)	MRFF? ☐ Yes ☐ No ☐ N/A	MPFF? ☐ Yes ☐ No ☐ N/A	MRule Function(s)

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

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, Sec.-Security, NEP-Nuclear Emergency Preparedness, Eng.-Engineering, Ops -Operations, Maint.-Maintenance, RP-Radiation Protection, NSS-Nuclear Site Services, SNS-Station Nuclear Safety, MRule-Maintenance Rule, RCE-Root Cause Evaluation, RMI-Reactivity Management Issues, 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(Sep 97) (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.

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(Back)

ATTACHMENT 3

(Page 1 of 1)

Threshold Screening Categories

SIGNIFICANT	POTENTIALLY SIGNIFICANT	ROUTINE
Fatality, Severe Personal Injury, or Significant Industrial Hazard Reactor Trips Severe or Unusual Plant Transients A Significant Degradation in the Ability of a Safety System to Perform its Function during a Test or Plant Transient An Event Involving Plant Safety or Reliability that had a Strong Potential to be more Severe if Different Conditions that could be Reasonably Expected had been Present Exceeding a Safety Limit as defined in Tech Specs Radiation overexposure that exceeds NRC limits Offsite Radioactive Release in excess of regulatory limits Entry into Emergency Plan as Site Area Emergency or General Emergency Fuel Handling or storage events that involve a significant release of radioactivity, challenge to Spent Fuel cooling or spent fuel radioactivity control Reactivity Management Events Events of the same level of significance based on management review	An event that is reportable under 10CFR50.72 or 10CFR50.73 or for which a Notice of Violation is received Unplanned Plant Transients such as Forced Power Reductions or Transients and Unplanned ESF Actuations due to Equipment, Personnel, Human Performance or Regulatory/Safety issues Unplanned reduction in Nuclear Safety Margin: • 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 • Unplanned entry into a TS LCO of 24 hours or less • Reactivity Management Incident • Unplanned entry into a ORANGE or RED PSA On-line Maintenance Risk Category 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 Entry into Emergency Plan as NOUE or ALERT Any significant defect in any spent fuel storage cask structure, system, or component, which is important to safety Lost Time Accident 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	Events not classified as either Significant or Potentially Significant

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
2.17 ET NAF 97-0055, PSA Evaluation of On-Line Maintenance Special Configuration Matrix
2.18 ET NAF 97-0086, PSA a(3) Maintenance Rule Risk Significant Equipment
2.19 VPAP-1410, Reactivity Management

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 revised to 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, Reference 2.18 has been issued to identify risk significant equipment. References 2.16 and 2.17 provide mechanisms to determine the increased risks associated with on-line maintenance activities. Criteria have been added to the "ESF Systems," "Heat Sink," "Electrical Power Supplies," and "Secondary Systems,"critical parameter windows, as well as in the Top Level Block discussions in Sections 4.5 through 4.9, to account for the effects of on-line maintenance on overall station risk.

3.5 Reference 2.18 provides a detailed listing of FEG listings for Surry Units 1 and 2. The listing provides a reference of Risk Significant Equipment and the applicable risk significant failure mode(s) which must be considered for each FEG.

3.6 Reference 2.18 provides a list of risk significant equipment sorted by FEG and also sorted by component mark number.

3.7 Reference 2.17 provides specific PSA evaluations of various equipment combinations not previously evaluated, and provides the results for these special configurations with respect to the allowed out of service hours for the analyzed combination.

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:

(white)	Fully Operable Condition Green
(light shading)	Acceptable but degraded/LCO of > 6 hrs to HSD may be in effect Condition Yellow
(dark shading)	Degraded Condition/HSD required within 6 hrs Condition Orange - Contingency actions may be required
(black)	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:

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** •OC-52(53) has been implemented due to an INCREASE in Unidentified RCS leakage of more than 0.2 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** •Total Primary to Secondary Leakage rate increase is >/=60 GPD/hour, or Total Primary to Secondary Leakage exceeds 150 GPD in any S/G, **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-off 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 Product 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 Instrument s

DATE: 06/18/1999

TIME: 0600

☐	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/Unanalyzed Condition. CONDITION RED

Surry Unit 2 Operating Critical Parameters

Number	Equipment/Mark Number	Explanation
3	❖ 2-BS-PAH-1	• 7 day Personnel Hatch clock in effect.
15	❖ TB IA X-TIED	• TB IA cross tied to support 1-IA-D-1 maintenance.

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. Fifteen 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 four 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 micro processes 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 ground rules must be established to create the norms of behaviour and the environment needed for people to accomplish the safety and production objectives.

IBERDROLA 5 Nuclear Management understood the crucial importance of culture factors such as: personnel accountability and empowerment, team-work, vertical and horizontal integration, quality of training, company 5 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 on this matter, since the only available information was the general guidance expressed in the INSAGA 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 to:

- 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

- present the action plan 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 is 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 Table I, Example 4, as in the previous case.

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- modify attitudes and create an enhanced safety culture, increasing awareness of the importance of good communications among the personnel

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- 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.

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 compiled 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 below:

- 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

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 communiications.	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	

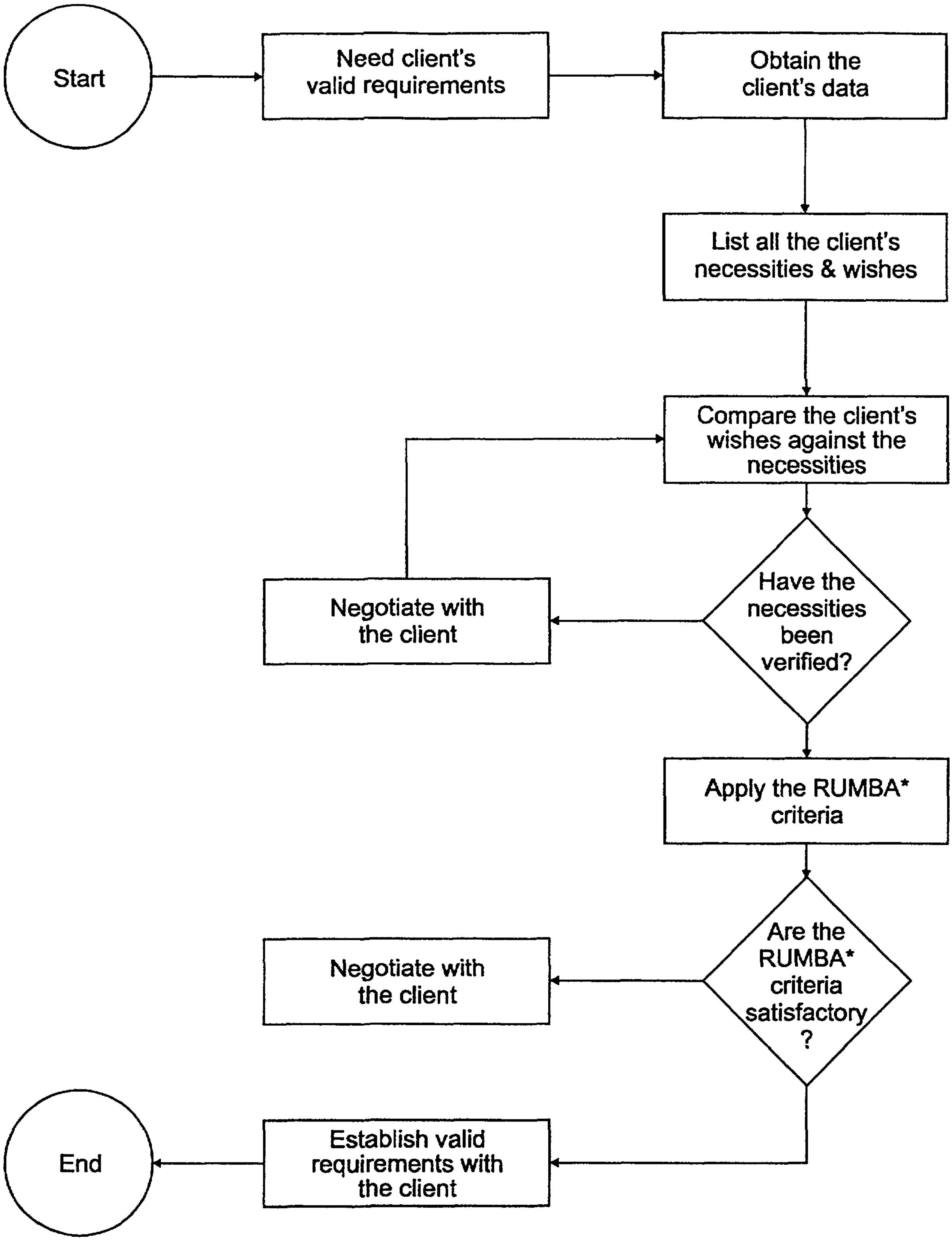
TABLE III, EXAMPLE 4 (SPAIN) - COMMUNICATION ACTION PLAN

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 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, Mensurable, Believable and Assessable

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

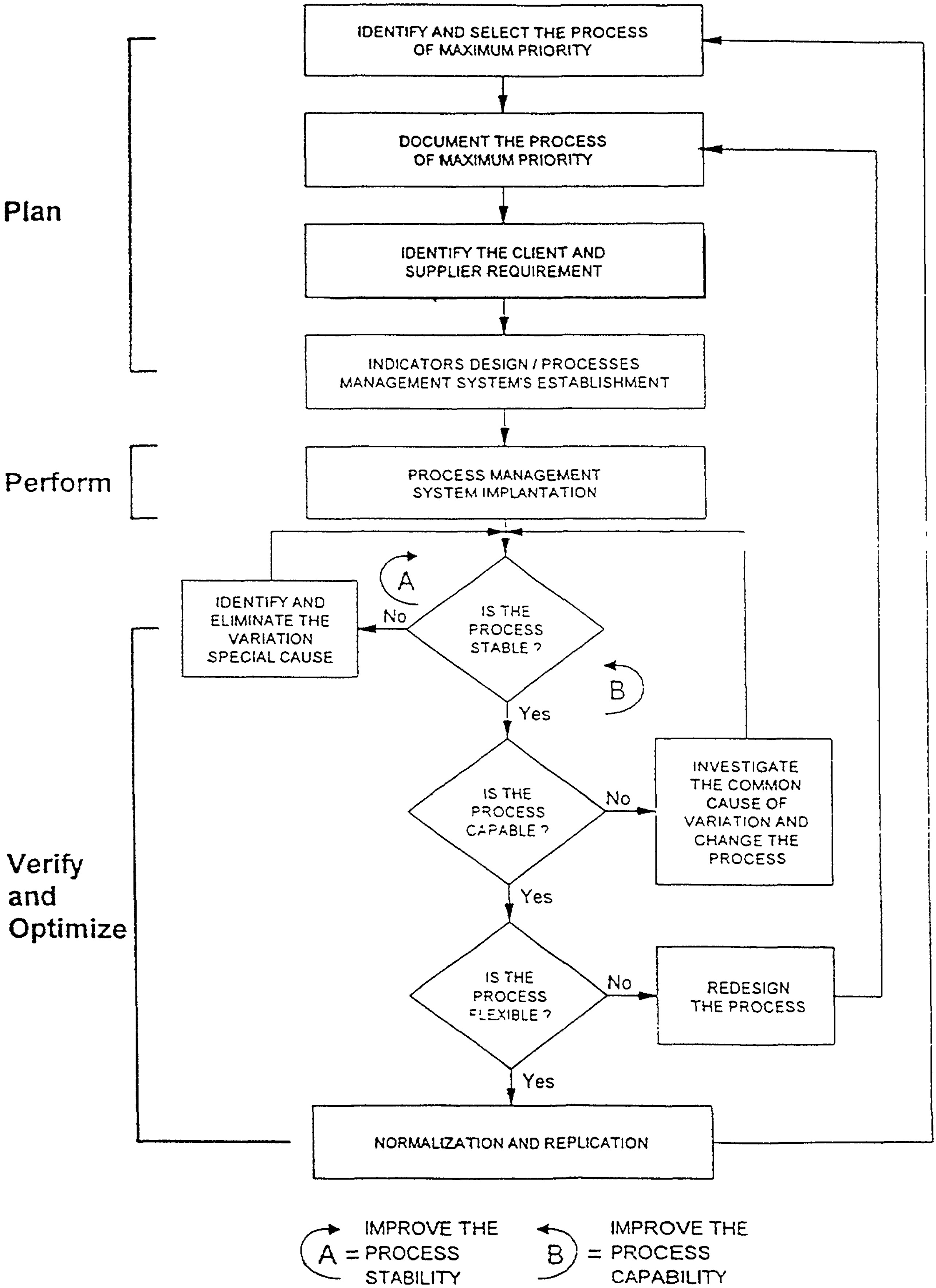


FIG. 2. Example 4 (Spain) - process management process documentation of maximum priority

IBERDROLA

PROCESS MANAGEMENT SYSTEM

COFRENTES
CENTRAL NUCLEAR

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

PROCESS FLOWCHART

SECTION: PLANT ENGINEERING | MAINTENANCE TECHNICAL OFFICE | OPERATIONS / OTHERS | PERFORMANCE

	ACTIVITY
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

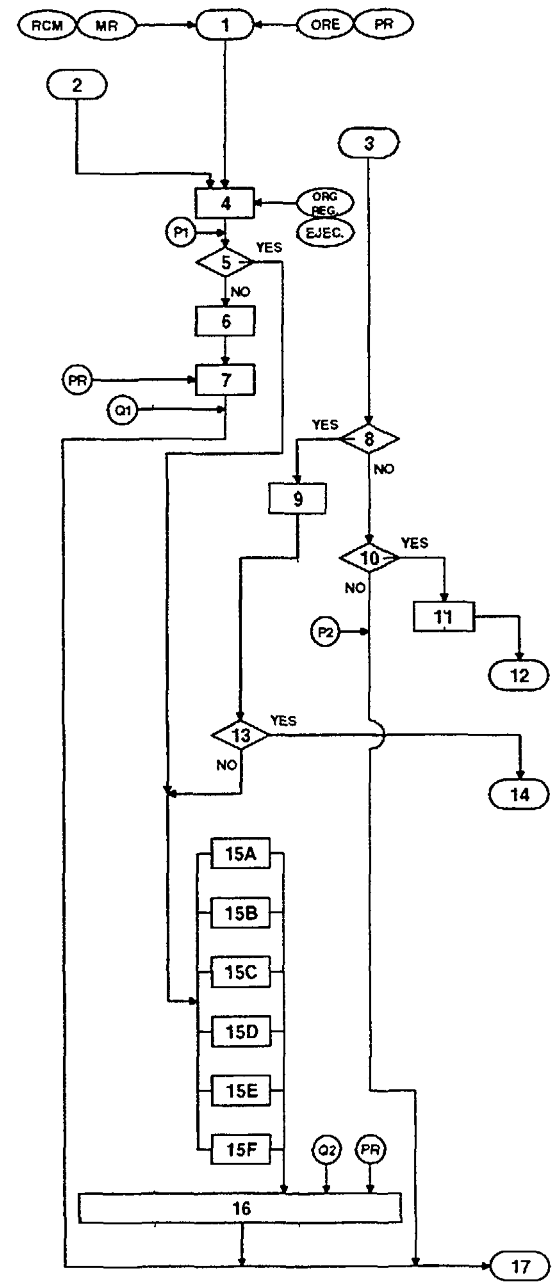


FIG. 3. Example 4 (Spain) - process management system)

QUALITY (AND/OR) PROCESS INDICATORS: INDICATORS DESCRIPTION / GRAPHICS	CONTROL LIMITS / SPECIFICATION OF OBJETIVES	SURVEILLANCE: CONCEPT "WHAT"	FREQUENCY "WHEN"	RESPONSIBILITY "WHO"	CONTINGENCIES / ACTION	VARIUS INFORMATION: INCLUDES: - Abbreviations - Procedures - Notes, etc...
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.	

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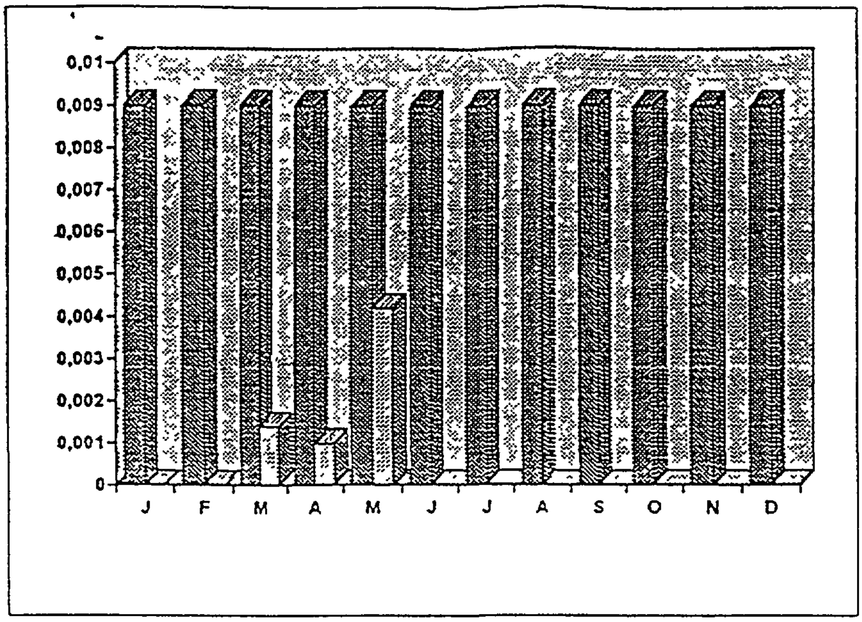


1996	Anticipated	Real
JANUARY	009	0
FEBRUARY	009	0
MARCH	009	00114
APRIL	009	00099
MAY	009	0042
JUNE	009	
JULY	009	
AUGUST	009	
SEPTEMBER	009	
OCTOBER	009	
NOVEMBER	009	
DECEMBER	009	

ANTICIPATED

REAL

OBJECTIVE

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

INDICATOR

Unavailability 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

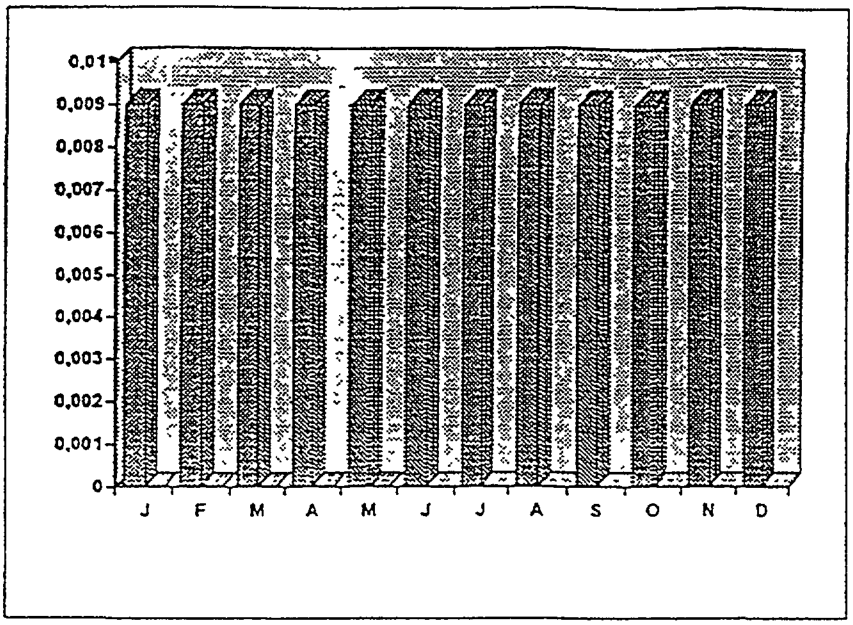
COORDINATED BY

Jeronimo Roldan Vilches

CONTROLLED BY

Technical Operations Office (O T O)

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



1994	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

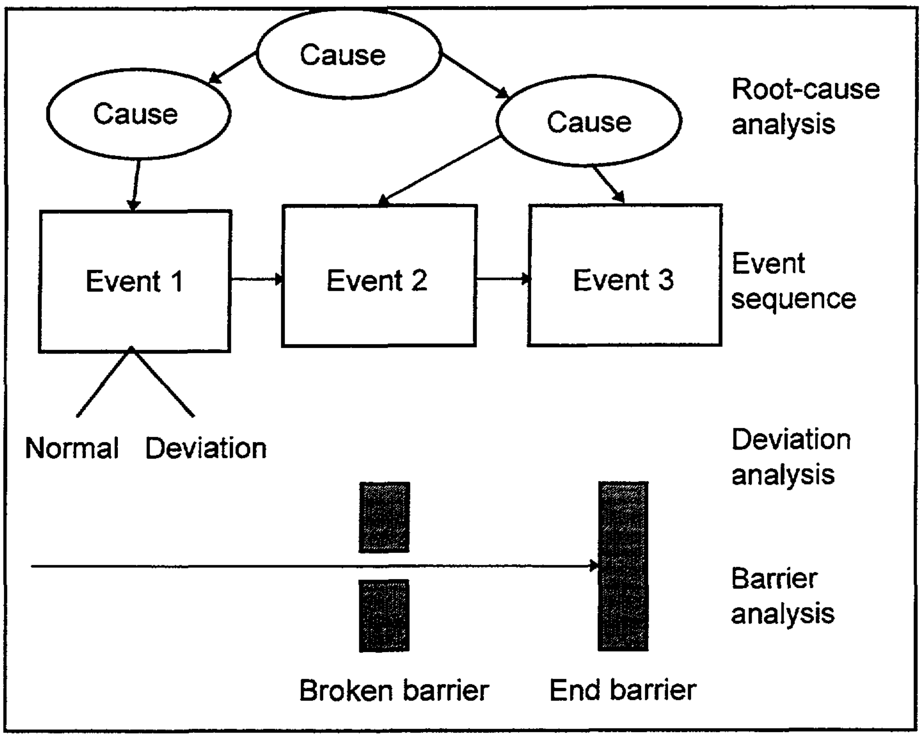


FIG. 1. Example 5 (Forsmark) - Illustration of the analysis and root-cause method, MTO. Event sequence, deviation analysis, barrier analysis and analysis of underlying causes

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).

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.

Deficiencies in Plant Modification Procedures - 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.

Deficiencies in Work Praxis - 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: FINLAND (Olkiluoto Nuclear Power Plant)

The decision to carry out a self assessment using the ASSET method in Olkiluoto NPP owned by Tedlisuunden Voimen Oy (TVO) was made after the ASSET Self Assessment seminar which was held in November 1996. The self assessment included the operational events experienced during years 1993 - 1997 by two units of Olkiluoto NPP.

The selection of the events was based on reporting criteria to the regulator. The analysis included 132 events which had resulted in special report, scram report, disturbance report or immediate limitation of operation according to the Technical Specifications.

The self assessment was carried out by a team of 14 experts from the operating and safety organisations. The conduct of the plant self assessment represented an effort of 9 man/months between October 1997 and September 1998. The self assessment can be described to be on level 3 in the triangle of the assessment process discussed in the TECDOC (Figure 2).

The analysis of the events was documented in a computer program ERCATD, Event Root Cause Analysis Tool and Database. The ERCATD program makes it possible to present and print out statistics and trends of events, their significance and recurrence. It also assists in establishing the action plan for corrective actions.

The plant self assessment of safety performance, safety problems and safety culture using ASSET method revealed some safety problems which were considered to be pending because the corrective actions were either not comprehensive and/or not fully implemented.

The deficiencies identified happened primarily due to weaknesses that were not addressed by the plant preventive maintenance program which failed to prevent the degradation of the reliability of equipment and proficiency of operation personnel. In the area of quality of procedures the weakness occurred in the quality control process which failed to ensure that the instructions met the required acceptance criteria prior to operation.

In the majority of cases the pending safety problem was not prevented because the dominant factor was the limited plant capability to timely detect the latent weaknesses. In the case of reliability of the diesel generators the dominant factor was the restoration capability. That means that the failures were detected by the testing and surveillance program, but they were not analysed deep enough to prevent them from recurring.

The plant self assessment report was reviewed by an international ASSET Peer Review Team from 4 to 10 November 1998.

The ASSET Peer Review brought an international and broader perspective to plant self assessment. The ASSET team could highlight some additional lessons that can be learned from the pending safety problems, for example:
A systematic root cause analysis of all degradations identified as a result of operational failures or periodic surveillance testing can lead to further comprehensive measures in order to further enhancing the plant safety culture.

TVO has decided to continue with the ASSET method to analyse the operational events. For the coming WANO Peer Review in September/October 1999 the operational events from 1997 and 1998 will be analysed.

The aim is to get the simple three questions analysis (what failed, why did it fail, why was it not prevented) as part of handling of all failures and deviations, including near-misses.

Self assessment work using ASSET method turned out to be useful in revealing the pending safety problems and in future focusing the efforts of the plant management in identifying plant safety issues, assessing their significance and learning the lessons to further enhance failure prevention.

EXAMPLE 7: LITHUANIA (Ignalina NPP)

The Ignalina nuclear power plant still has not developed a comprehensive self-assessment procedure; however, several existing activities, which were developed during the many years of operation, provide a base for creation 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 one example of self assessment activities, in which not all of the power plant is encompassed but good interaction between several divisions takes place, the concept of the monthly "maintenance day" can be highlighted. Maintenance days were developed as a means of periodic review for many aspects of on-going 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 safety surveillance service.

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.

Internal safety audits of all safety related departments, introduced in 1997, are another example of expanding safety assessment practices. In parallel with preparation of a comprehensive yearly report of Nuclear Safety Audit, required by national regulatory practice, during 1998 the schedule and internal requirements to conduct internal safety audits of all relevant departments of Ignalina NPP were developed. Service of Safety Surveillance and Quality Assurance was made responsible for the audits and the audits themselves are performed by representatives of said service together with peer review members of departments undergoing the audit. The peer reviewers are encompassing the scope of individual and department self assessment. All safety related activities are checked, inconsistencies and irregularities documented. Further corrective measures are proposed by involved department and their implementation is checked by service of safety surveillance. During 1997, 11 internal audits and 22 suppliers audits were performed.

An active feedback from self-assessment activities is more evident during internal safety culture workshops. In 1996 an ambitious safety culture enhancement programme was adopted. During 1997, 42 internal one-day self-assessment workshops on safety culture were conducted in various divisions and during these workshops a total of 140 proposals for safety improvement in different areas were received from participants. About 10% of proposals were implemented on plant-wide scale, many others were taken into consideration by the heads of corresponding divisions. In 1998 a special form for safety improvement proposals was created and clear procedure of proposal consideration was developed. Eighteen more small safety culture self-assessment oriented workshops were held during 1998.

During development of large scale Safety Improvement Programme (SIP-2) in 1997 corresponding findings by the plant staff were used together with recommendations from external assessment.

This experience shows that a self-assessment culture is growing although Ignalina NPP still has no formal separate safety self-assessment procedure. The programme of self-assessment is becoming more regular, more formalised and more comprehensive, providing the possibility for every staff member to be involved. It is also providing tangible results as interaction of staff members from top to bottom as well as from bottom to top is increasing.

In the absence of utility level process most of the self-assessment activities are initiated by the plant itself and supported by the formal founder of the NPP - Ministry of Economy.

EXAMPLE 8: JAPAN (Tokyo Electric Power Company)

TEPCO is implementing self-assessment at the respective levels in the triangle of the assessment process as shown in the TECDOC, Figure 2. Self-assessment activities are being carried out as an integral part of the normal work process in individual departments where possible. Outlines of the main activities are indicated below which shows assessment at all levels of the organisation.

1. Independent Internal Assessment

1.1. Thermal and Nuclear Power Audit Group of Audit & Operational Development Department (Head Office)

The Thermal and Nuclear Power Audit Group is responsible for assisting the senior management and making audits chiefly on nuclear power plants as an independent organisation separated from the nuclear division. The Group was set up as the Special Assistants to the President for Nuclear Power in 1991 when an accident occurred at Mihama Unit 2 of Kansai Electric Power Company. The Group consists of 6 senior staff members (above senior manager level of the head office). Main activities of this Group are as follows:

To ensure the safety of nuclear power generation and improve reliability, the Group examines matters concerning quality assurance, operating and management activities of the Nuclear Division. It provides guidance, suggestions and adjustments as necessary. Audits are made twice a year for about three days at the Head Office and each power station, and these results are reported to the top executives twice a year.

Auditing covers the following general matters concerning nuclear safety:

- General subjects on quality assurance activity (organizational management, planning, education and training, etc.);
- Collection and use of information about events, and measures to prevent a recurrence of the similar events;
  Adoption of critical new designs and new technologies and critical design changes;
- Establishment and modification of important rules and manuals;
- Other matters necessary for nuclear safety.

And, to contribute its share to the auditing process, the Group meets regularly (once a week) with the Head Office Nuclear Power Plant Management Department to obtain information about performance, operations and events at nuclear power plants. And further, the Group exchanges information with independent audit groups of other electric power companies to enhance our self-assessment activities and continue bench-marking.

1.2 Nuclear Safety Promotion Centre (each power station)

The Nuclear Safety Promotion Centres were established in 1990 when Unit 3 of the Fukushima Daini Nuclear Power Station suffered from an incident. The Centre has been set up at each nuclear power station as an auditing section on all the aspects of nuclear safety. The Centre functions independently of the line department. The staff of the Centre is composed of seven to eight members at each nuclear power station. It is headed by the plant deputy superintendent (Nuclear Safety Promotion). Main activities of the centre are as follows:

(1) Regular Auditing (Audit of Quality Assurance Activities)

Audits are made regularly at each engineering-related department of the nuclear power station in the following areas (note: the audit is performed on each department once every two years):

- QA program, organiZation, documentation control, design control, procurement control, materials and supplies control, manufacturing control, installation control, inspection and testing, operation and maintenance, non-conformance control, QC record control, information control, education control, etc.;
- Findings and corrective actions of comprehensive safety management surveys conducted by the regulatory authorities and voluntary safety management surveys by the Head Office.

Members of the Centre attend some in-site meetings for acquiring necessary information for their audits.

The results of the audits are reported to the plant superintendent.

(2) Start-up Integrity Evaluations

A start-up integrity evaluation is conducted in association with a comprehensive preventive maintenance program being implemented during annual inspection.

In the first stage, the operation department manager and the chief nuclear engineer confirm the checklists and those evidences which are executed by each group prior to start-up. The checklist and those evidences (reaching several hundreds pages) cover essential items for start-up and reliable safety operation with reference to the proper completion of maintenance, modification work, inspection, testing, and systems line-up, and compliance with safety codes.

The second stage is performed by the audit team consisting of members of The Nuclear Safety Promotion Group joined by members of groups other than those covered by the audit, with the manager of the Nuclear Safety Promotion Group as chief of the team. Mainly, audit team assesses the following items :

- Implementation of design change management;
- Implementation of voluntary in-house inspection;
- Implementation of works execution management;
- Others (e.g. verification of those specified values, etc., which may affect the plant).

(3) Participation in Troubleshooting Committee

The staff members of the Centre participate in the Troubleshooting Committee (see 2.2(8)), provide guidance and advice on safety promotion and check the measures performed by the line group to prevent recurrence.

2. Management and Supervisory Level Self-Assessment

2.1. Head Office Activities

(1) Continuous monitoring of key plant operating parameters

The Nuclear Power Plant Management Department monitors key plant operating parameters (operating records, schedules and topical matters) of each nuclear power station continuously and submits a report to the executives.

(2) Survey of Voluntary Safety Management

The Nuclear Power Plant Management Department conducts a survey once a year at each nuclear power station to assess the compliance with the safety code, the implementation of safety management, and quality assurance activities for operation and maintenance.

(3) Study Meeting on Performance Indicators

At the beginning of each fiscal year, a meeting concerning the plant performance is held to assess the results of the last fiscal year, review the propriety of indicators, and adjust target values and work out goals in that fiscal year between each plant and the Head Office management section.

(4) Wide Implementation of Measures to Prevent Recurrence of Incidents and Failures

Company-wide measures are considered to prevent a recurrence of the incidents or failures experienced by the power stations of TEPCO and other electric power companies. Instructions are given to each power station to take such measures and a follow-up survey is conducted twice a year on the status of those measures.

2.2. NPP Activities

(1) Reviews by Chief Nuclear Engineer on Daily Operation Log and Surveillance Reports

The chief nuclear engineer reviews the daily operation log and surveillance reports.

(2) Field Observations and Coaching

People in managerial positions including the plant superintendent, make observations of work through each plant every month.

(3) Management Programme

Based on our medium-term executive management policy (a five-year program) which is renewed approximately at three-year intervals, our head office departments and nuclear power stations establish a medium-term (three year) management program to among other things, enhance nuclear safety culture, improve the capacity factor and control power generation costs. They conduct a top level hearing once every year. Under the medium term(three-year) programme, all corporate divisions involved control the progress of their activities for each fiscal year at regular intervals in order to correct any undesirable deviation from the predetermined expectations. In addition, they are required to present the results of a self-assessment at the end of each fiscal year to senior management.

The rating programme was launched in 1997 to assess the performance of nuclear power stations. Based on a merit-mark system, higher ratings are given to those stations which set targets higher than those of the Head Office at the beginning of each fiscal year. The Head Office assesses the sites performance and gives the rating based on comparison between expectations and achievements at the end of each fiscal year when these two ratings are added. There are thirteen assessment items including the capacity factor, unit costs of power generation, radiation exposures and so on. Some of these items are related to qualitative aspects which are difficult to evaluate numerically. These include enhancement of safety culture, regional coexistence and public acceptance activities. The ratings in these areas are being done on the basis of the results of a questionnaire to plant personnel and subjective evaluation of their own performances. Specific items of assessment are summarized below:

- Unit costs of power generation;
- Unit cost of repairs;
- Unit cost of general improvements;
- Capacity factor;
- Capacity factor excluding maintenance outages;
- Reduction of the annual inspection period in the number of days;
- Number of radioactive emission events outside the control area (only actual results to be assessed);
- Frequency of fires (only actual results);
- Dose equivalent;
- Monitoring of low level radioactive waste in the number of drums;
- Troubleshooting activities;
- Safety culture;
- Regional coexistence and public acceptance activities (only actual results to be covered by the self-assessment of the power stations).

(4) Management Observation of Training

The chief nuclear engineer and executives make regular observations of simulator training for operators to verify that the performance of the operators technical levels meet expected standards.

(5) Design Review Committee

The important changes of plant systems and equipment are deliberated and approved by the Design Review Committee chaired by the plant superintendent.

(6) Superintendent's Guidance Meeting

The activities pertaining to the major items of the management program are reported to the superintendent's guidance meeting held about three times a year to receive necessary guidance and advice. One of these meetings is held in the presence of outside experts of Total Quality Control (TQC). Representatives of all power stations operated by TEPCO gather together at the company's Head Office once a year to exchange opinions on common topics with outside TQC experts and the corporate executive management.

(7) Periodic Safety Review (PSR)

A Periodic Safety Review (PSR) is conducted to comprehensively check the safety of nuclear power plants approximately every ten years based on operational experience and technical knowledge and to make further improvements in the safety and reliability of the existing nuclear plants as part of voluntary safety activities. The PSR program started in 1993. At this time a PSR has been completed on five plants in order of age. The results of the PSR are made public.

(8) Troubleshooting Committee

A committee made up of the plant deputy superintendent, senior engineers and section managers meets to ensure that in the event of a problem or a precursor of a problem at the plant a set of actions such as an investigation of the causes, formulation and implementation of preventive or remedial measures can be taken immediately and correctly. The committee holds sessions continuously until the causes of a problem have been identified and cease to exist.

Discussion in these meetings are followed by the head office management using a television conference system so that relevant information can be shared quickly with other NPPs in the industry as a whole.

(9) Preventive Maintenance Assessment Committee

The Preventive Maintenance Assessment Committee is held every month to examine information on incidents and faults at the nuclear power plants of TEPCO and other electric utilities in Japan and abroad. This committee incorporates lessons learned into repair, maintenance and improvement plans for each plant and makes a follow-up of the status of these plans thereby ensuring complete preventive maintenance of equipment. The committee is composed of the plant deputy superintendent and staff members higher in position than the manager of the engineering division.

(10) Radiation Safety Management Meeting

A monthly meeting is held with the participation of the deputy superintendents and other members of NPS personnel concerned to assess the radiation exposure of plant personnel , the production of radioactive wastes and the trend of water chemistry and other relevant data and to discuss such topics as radiation control and water chemistry.

An example of data used at these meetings is shown in the diagram (Fig.1. Example 8). The exposure dose rate during each annual inspection or major improvement work is estimated in detail by the group in charge based on the record of similar work carried out in the past, an analysis of the particulars and environment of this work and other relevant data. The results of such predictions are routinely compared with the past record.

In addition, arrangements are provided to immediately study deviations if any, and to make necessary corrections. Data accumulated through these activities serve as performance expectation in respect of dose projections and make it possible for the personnel at the working level to recognize them as a reasonable and achievable target.

(11) Expertise and Skill Certification System

Internal qualification and certification tests, which consist of a written examination, practical skill test and oral test are conducted to assess the knowledge of work and expertise and skills required for employees to discharge their duties according to their length of experience. Those employees who have been in service for one year, for five years and for ten years are given opportunities to receive these qualifying tests.

3. Individual and Work Group Self-Assessment

(1) TQC (Total Quality Control) Activity

Quality improvement activity is promoted on the PDCA (Plan, Do, Check and Action) method. A small voluntary circle of group members is engaged in this activity to improve the quality of duties being discharged at their respective workplaces. A large variety of subjects are covered by this activity from safety improvement to streamlining of operation and maintenance. The findings are reported to the superintendent at a regular meeting. Cases of excellent performance are awarded commendation with a symbolic amount of money at the meeting to give incentives to the employees and these activities help create a continuously improving self-assessment culture.

TQC activities are carried on by small groups with the participation of almost all plant personnel at the individual level. Members of these groups(Quality Circles) always look for problems in their respective task areas and take measures for necessary improvements.

Through these activities, the plant personnel are motivated to continually take steps toward "KAIZEN" (or improvement) of their jobs and consequently of their plant. This is of great significance in that it promotes their sense of "ownership" and contributes to the development of safety culture.

(2) Condition Monitoring of Major Systems and Equipment

The operation support group and the engineering group conducts condition monitoring of major systems and equipment. The number of monitoring parameters comes up to approximately 120 per plant and they are measured about once every two weeks.

(3) Check-up on Maintenance Request Forms(MRF) Processing

An assessment is made every month to see if maintenance request forms (MRFs) issued from the operation section are processed by the maintenance division in a timely and proper manner. The result is reported to the chief nuclear engineer and the operation department manager.

(4) Plant Field Patrol

The maintenance department personnel make plant patrols to review procedure adequacy and adherence during contractor activities and work.

(5) Surveillance Tests

Surveillance tests of the major systems and equipment are performed regularly to demonstrate acceptable performance.

(6) Work Schedule Co-ordination Meeting During Annual Inspection

A work schedule co-ordination meeting is held every week during annual inspection to check up on the progress of operations and co-ordinate schedules.

(7) Post Maintenance Testing

Equipment and systems which have been overhauled or repaired are test-operated to check on their integrity.

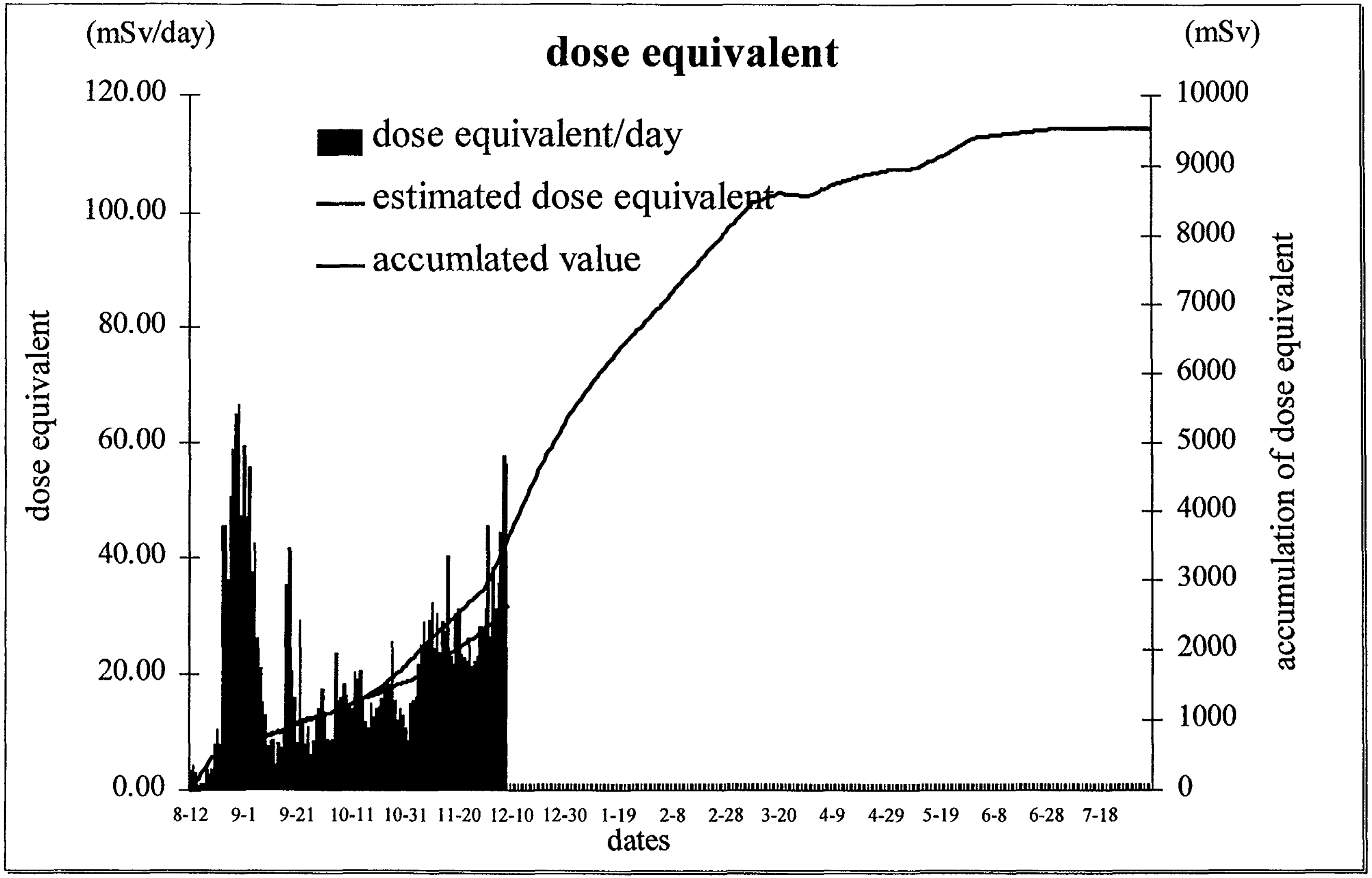


Fig. 1 Example of dose equivalent trend related to a major plant modification

EXAMPLE 9: UNITED KINGDOM (British Energy)

Due to changes occurring within the utility industries in the UK and around the world, Nuclear Electric decided that processes needed to be developed to provide a method for self assessing their " soft " change controls. All UK nuclear utilities had well developed processes for developing and implementing " hard " changes in the form of modifications to plant and safety cases. However, there was a realisation that organisational changes to structures and staffing policies could impact nuclear safety and business effectiveness as well.

Nuclear Electric Ltd decided to develop a Management of Change Standard to define a process and associated controls for managing " significant" changes in the company. The Standard was prepared in 1996 (NEL/CS/BUS/002) and subsequently revised in 1999 (as the Standard Practice SP 07) and ensures that :

(a) any change achieves its objectives and any associated risk is minimised;

and

(b) due consideration is given to the continuance of meeting Company policies and standards.

and

(c) compliance with a condition of the licence

The Standard makes it the responsibility of all management staff to ensure that the potential impact of any proposed change that does not affect changes to existing plant, major new changes, normal planned business improvements or the management of major non-recurring expenditures is considered and assessed.

Senior management must then ensure that the critical area of their responsibility produces a baseline where their managers can validate any change proposals.

The attached Standard provides a structure by which the company provides the tool for the self assessment of these changes and ensures that the proper measures are in place to move forward with any significant change in the Company .

Each station upon deciding that the Change Standard must be implemented will then prepare a Local Instruction that will define the process and controls to safely implement their designated change at their site. One example of a local instruction being developed was at Sizewell B implementing an organisational change at the site.

SEE ATTACHED SP 07 and SZB/LI/10/002

STANDARD PRACTICE	SP 07	British Energy Generation (UK) Ltd
TITLE: Management of Change	ISSUE B5/A1	
APPROVAL FOR ISSUE: SEE APPENDIX A	July 1999	

1 PURPOSE

To set out the procedures and controls for managing change such that all changes are properly justified and auditable and that:

(a) any change achieves its objectives and any associated risks are minimised;
(b) due consideration is given to the continuance of meeting Company policies and standards.
(c) compliance with Licence Condition 36

2 SCOPE

This procedure outlines the requirements for controlling changes to organisation structures, roles, processes, or staff levels within British Energy Generation (UK) Ltd (BEG(UK)L), including:

- Changes to company organisation structures and staff numbers;
- Changes to the overall balance of work, or significant accountabilities within Divisions and Departments;
- Changes and appointments to Director level posts;
- Changes to the duties and responsibilities of staff within Divisions and Departments relating to critical areas as identified in Section 6, Table 1;
- Introduction of new working methods and systems, which relate to critical areas as identified in Section 6, Table 1

The application of the controls within the procedure is **graded according to the significance** of the change (see section 4.2)

The procedure will **not** apply to modifications to plant (SP 04), or to replacement of staff due to normal promotion, retirement or other natural loss of staff (SQP 11 & PER/D010).

3 RESPONSIBILITIES

Proposers propose changes and must ensure that the potential impact of any change is considered. Managers also allocate a change grading and arrange for assessment of the change.

Directors and Head of Function identified in Table 1 are responsible for all changes and maintaining Baseline Criteria (see Appendix B), against which managers can consider change proposals. In addition, they are the Assessors for Grade 1 changes (see Section 4.2).

Approvers must ensure that the overall business case objectives are clearly set out and that appropriate resources and responsibilities are allocated to manage the change. Monitor and review the implementation through the Accountability Process and conduct a post-completion review.

Assessors are responsible for evaluating the change proposal against the risk areas identified in Table 1.

The **Quality Manager** is responsible for the review and revision of this standard and the monitoring of its application.

HSED is responsible for providing an independent assessment of all safety related changes, retrospectively reviewing grades of changes and carrying out post-completion reviews.

4 PROCEDURE

The process map for Management of Change is shown in figure 1.

4.1 Change Proposal - Responsibility : Managers

The Change Proposal must include:

Proposal
- Reference to the business case objectives;
- The organisation or overall working arrangements proposed at the completion of the change;

Validation Statement
- The risks to areas identified in Section 6, Table 1 associated with the proposed new organisation / working arrangements;
- The countermeasures proposed against each of the risks identified;
- Reference to enablers from other internal or external sources (dependencies);
- Identification of assessors;
- Identification of the Approver;
- The proposed grade of the change;

Implementation Plan
- Strategy for implementing the change;
- Performance measures (monitoring risk, benefits and results of change);
- Implementation programme (enabler programme).

The staff release process shown in flowchart format in Appendix C must be used for severance or transfers outside Divisions or Departments, which result in the loss of a post or secondments over 6 months. (See Appendix D & E for the appropriate Staff Release Form and Pre-release Directors Review Form respectively).

4.2 Change Grading - Responsibility : Managers

Changes should be graded such that controls are proportional to the significance of the proposed change, i.e. its potential to create uncertainty in, or jeopardise arrangements for management of the critical areas. Grading criteria are:

Grade 1

- Company change programmes and/or changes that affect more than one Business Unit.

Changes that have the potential to significantly impact Nuclear Site Licence or key Health, Safety and Environmental Requirements. (see Appendix B, or the Critical Areas see Section 6, Table 1).**Grade 2**

- Changes that have the potential to significantly impact the Critical Areas other than Nuclear Site Licence or health and safety, and are changes within a Business Unit .

All other changes should be managed as normal business.

4.3 Assessment - Responsibility : Directors and Managers identified in Section 6, Table 1.

Grade 1 changes will be assessed by the Director(s) identified in Section 6, Table 1

Grade 2 changes will be assessed by the third parties nominated in the change proposal

4.4 Approval - Responsibility : Managing Director, Directors, Heads of Function

Grade 1 changes will be approved by the Managing Director.

Grade 2 changes will be approved by the Directors or Heads of Function responsible for the Managers involved in the change.

The **Approver** will assure that the relevant assessors have been involved, the process has been followed and the implementation of the change is likely to deliver the objectives set out in the business case.

5 REVIEW

Review of implementation plans shall be carried out periodically (as specified in the Implementation Plan) as part of the review of accountabilities within the business planning process.

The **Approver** will conduct a post-completion review to confirm that the objectives of the change have been met and that subsequently, performance indicators are satisfactory.

The Change Proposal will be subject to reassessment if there is a change to the proposed final arrangements, or programme of enablers.

The HSED Director briefs the NII at regular intervals.

6 TABLE 1 - CRITICAL AREAS

Critical Area	Assessor (Grade 1 changes)
The safety or health of staff, contractors and the public	Director, Health Safety and Environment
The environment	Director, Health Safety and Environment
Operational performance & Plant Operation	Executive Director of Operations Director, Health Safety and Environment
Safety case and design constraints other than those covered by the modifications process	Executive Director of Engineering
Staff motivation	Head of Human Resources
Customer satisfaction (External to BEG(UK)L i.e. Direct Sales Customers.)	Managing Director
Market Compliance	Managing Director
Commercial performance	Director of Finance
Technical capability	Executive Director of Engineering
Public perception	Head of External Relations
Legal compliance	Company Secretary

7 DEFINITIONS

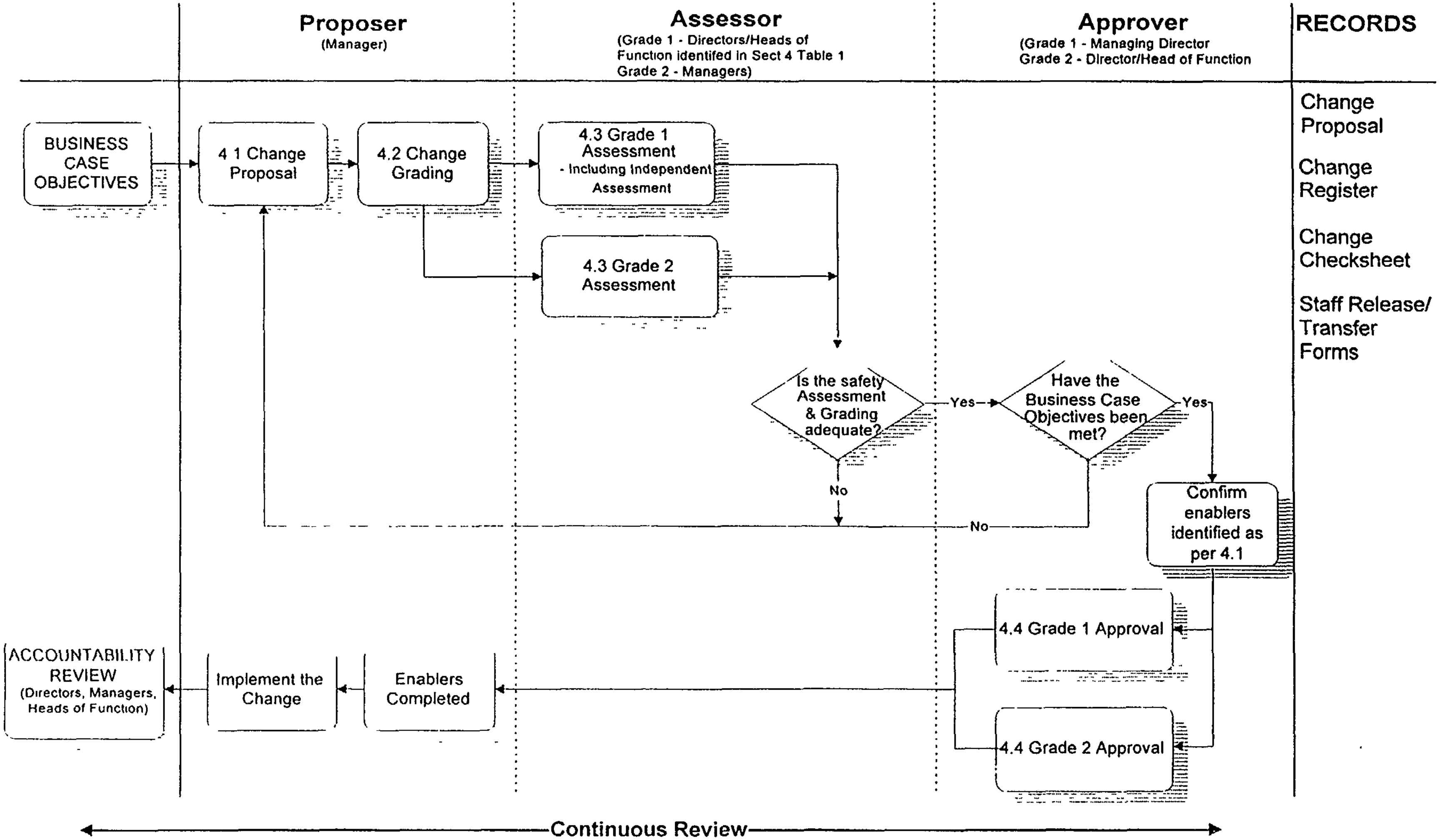
None.

8 RECORDS

Change Proposals, Staff Release forms and Pre-Release Directors Review forms involving only one Business Unit will be maintained by the originating Station orBusiness Unit in the form of a Change Register containing the master documents.

A copy of Records of Grade 1 Changes will also be maintained by the Quality Manager and copied to the HSED Director.

FIGURE 1 Management of Change Process



Appendix A

STANDARD PRACTICE APPROVAL RECORD SHEET

This sheet is the formal record of approval of the undernoted SP.

Standard Practice number: **SP 07** Issue: **B5/A1**

Title: **Management of Change**

The document Referenced above is hereby approved for issue and implementation in all parts of Scottish Nuclear.

Signed:

.... Date: ....
Executive Director of Engineering

.... Date ....
Executive Director of Operations

.... Date ....
Director of Finance

.... Date ....
Director, Health, Safety & Environment

.... Date ....
Head of Human Resources

.... Date ....
Company Secretary

APPENDIX B – BASELINE CRITERIA

The following aspects should be considered when conducting the risk assessment.

Health, Safety and Environmental Requirement	Current Arrangements to meet Requirements
Company Policy and its implementation through HS&E targets and objectives met at all times	Health and Safety Policy, Safety Management Prospectus, Environment Policy, Quality Policy.
Lines of accountability for HS&E well defined and documented throughout the process	Company Quality Programme, SN QP1 and Division / Department Procedures Manuals.
Legal requirements for HS&E met directly or as defined by Company policies and standards under self-regulation	Site Licence conditions and compliance principles, RSA authorisations, Company Standards (e.g., Safety Rules, Mental Health Standard, Medical and Safety Codes of Practice, etc.)
Regulatory commitments met or renegotiated	Safety Management Prospectus and supporting re-licensing documents, correspondence with NII
Necessary workload defined and adequate and competent resources in place or contractually available to meet it.	Business Plans, Post and competence profiles, contract specifications, Training and Development plans
Sufficient health, safety and environmental protection expertise provided or secured to ensure: a) the production, peer review, independent assessment of nuclear safety cases, b) the general health and safety of staff and contractors, c) the inspection and audit of health, safety and environmental performance	Safety Management Prospectus defines the areas considered important to licencing, i.e. the key technical competencies available either at stations or centrally. Division/ Department Procedures Manuals The Company audit and inspection programmes
Arrangements for obtaining and reacting to operational experience from BEG stations and those of other UK and overseas nuclear operators.	Operational Experience Feedback arrangements (NUPER, CFU. HSE and WANO)
Effective emergency arrangements maintained at each site and centrally	Stations' Emergency Plan and Handbook, CESC arrangements, training plans, demonstrations
Benchmarking of the Company organisation and level of HS&E resource against International standards or expectations	IAEA Safety Standards, WANO objectives and criteria (these define a minimum set of activities, such as health physics control, appropriate for the safe running of a nuclear installation)
Changes to arrangements for liabilities or decommissioning under Nuclear Installations Act agreed with HSE prior to implementation	Re-licensing submissions on scope of segregated decommissioning fund and decommissioning strategy

Appendix B – cont'd

Operational Performance

- Operate the plant within the site licence conditions design constraints and the safety case with particular focus on·
  - suitably qualified and experienced people
  - the maintenance schedule
  - QA arrangements
- Observe the conservative decision making principle
- Minimise the likelihood of trips.
- Operate to meet the required Energy profile

Market Compliance

Maintain compliance with

- Generation and Supply Licence obligations
- Any other regulatory or contractual requirement
- Scottish Grid Codes
- N E.A
- Associated Connection Agreements

Customer Satisfaction

- To meet, and maintain the capability to meet, the commitments made through our contracts with
  - Wholesale (Contracts for Difference) customers
  - Direct Sales customers

Commercial Performance and Shareholder Confidence

- Ability to produce timely statutory, regulatory and management control reports
- Achievement of financial targets
- Ability to sustain transactions with staff, suppliers, customers, tax authorities and BE

Technical Capability

To operate and maintain our plant we must have the ability to -

- Ensure consistency of design with safety case and operability requirements
- Discharge technical obligations under LCAs
- Investigate, analyse and implement solutions for plant problems
- Retain and understand the history of the plant
- Maintain essential nuclear technology

Staff Motivation

- Conditions for staff are maintained at safe and satisfactory levels
- Two-way communication with staff is maintained
- Staff have clear objectives and accountability
- Staff are given tasks appropriate to their level of competence and qualifications

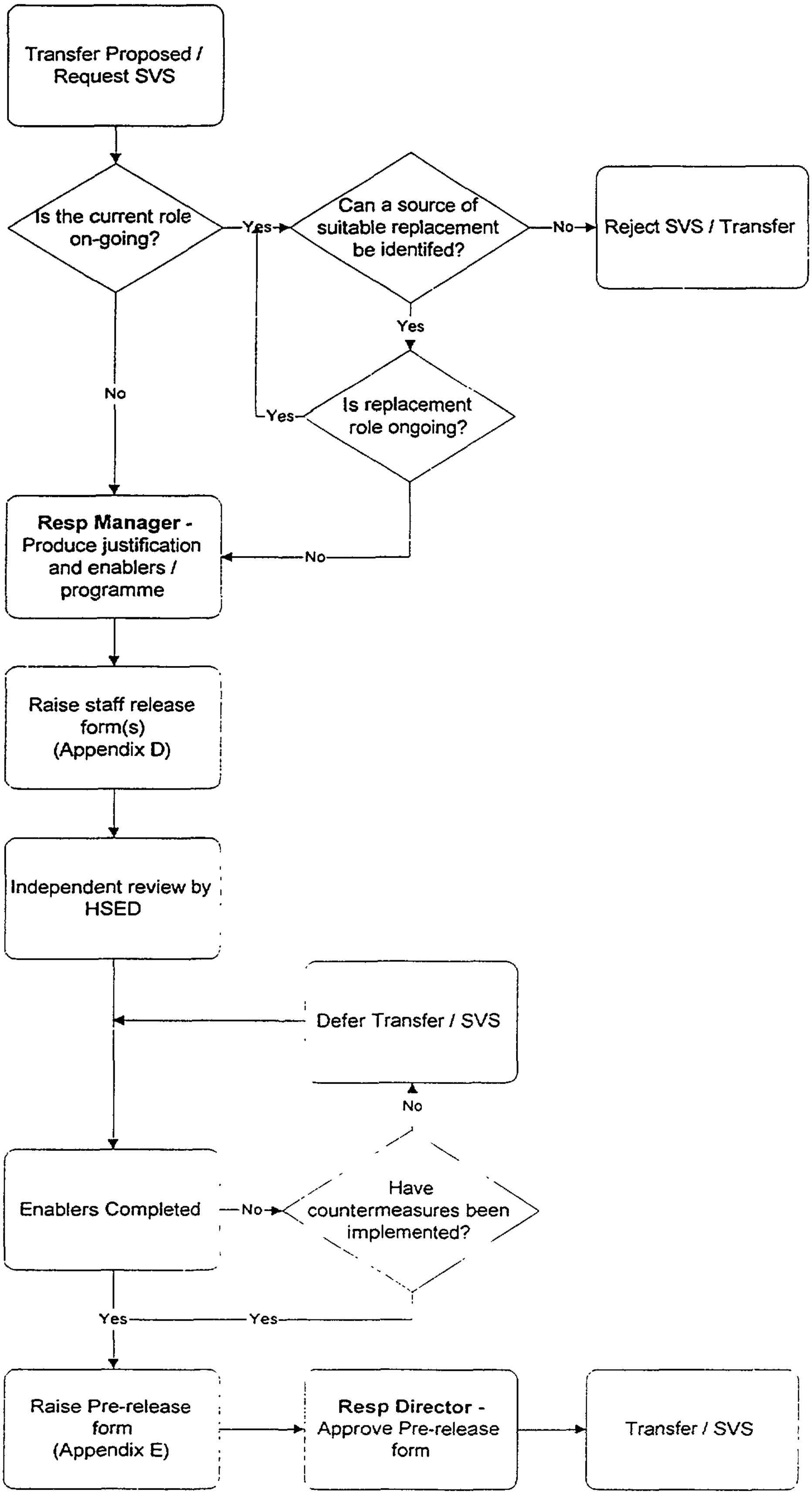
Public Perception

- Maintain an open door relationship with the public in order to avoid significant adverse and critical exposure in the media or the local community

Legal Compliance

- All legal requirements placed upon the Company either by statute or contract will be met

APPENDIX C – Staff release process



APPENDIX D – Staff Release Form

Staff Release Form

PERSONAL DETAILS

Name: ______________________ **Post:** ______________________

Length of Service: ______________________ **Ref:** ______________________

RELEASE DATE ______________________

POST EVALUATION STATEMENT (Justification for loss of post – reference Change Proposal as relevant)

____

____

____

____

____

____

Signed: ______________________ Date: ______________________

Responsible Manager

HSED / Site Inspector Review **(Mandatory for Grade 1 Safety Significant changes only)**

____

____

Signed: ______________________ Date: ______________________

DIRECTOR APPROVAL

____

____

Signed: ______________________ Date: ______________________

Director

APPENDIX E - Pre-release Director's Review Form

Pre-release Director's review

EMPLOYEE NAME: ____________ **EMPLOYEE NUMBER:** ____________

DEPARTMENT: ____________ **OCCUPATION:** ____________

RELEASE DATE: ____________ **REF No:** ____________

CHANGE REF No. ____________

PRE-RELEASE ACTIONS (use an additional sheet if required)
COMPLETED Y / N

1. ……………………………………………………………………………………

2. ……………………………………………………………………………………

3. ……………………………………………………………………………………

4. ……………………………………………………………………………………

5. ……………………………………………………………………………………

IF ANY ACTIONS ARE OUTSTANDING, PLEASE QUOTE ALTERNATIVE ARRANGMENTS HERE:

……………………………………………………………………………………

……………………………………………………………………………………

……………………………………………………………………………………

……………………………………………………………………………………

……………………………………………………………………………………

……………………………………………………………………………………

I have conducted a review and can confirm that the conditions for release of the above named individual are satisfactory and conform with the Management of Change Process:

SIGNED
MANAGER ………………………………… **Date:** ……………

APPROVED
DIRECTOR ………………………………………………… **Date:** ……………

SIZEWELL B POWER STATION

LOCAL INSTRUCTION

SZB/LI/10/002

MANAGEMENT OF CHANGE AT SIZEWELL B

Prepared by:	....	QM Section Head	Date 11/4/97
Reviewed by:		B Shift Charge Engineer	
		Training Engineer	
		Personnel Officer	
		Maintenance Section Head	
		Safety Support Section Head	
		Systems Group Head 5	
Agreed by:	....	HR Manager	Date 11/4/97
	....	T&SS Manager	Date 22-4-97
	....	Commercial Manager	Date 22/4/97
Approved & Authorised for Issue:	....	Station Director:	Date 25/4/97

Revision Details:			
Issue No:	DAAF No:	Reasons for Change	Sections Affected
1	DCF 9700933	Local arrangements for compliance with company standard on management of change	All

1 PURPOSE

To define the process and controls necessary to safely implement organisational change at Sizewell B, including the release, transfer and severance of staff.

2 SCOPE

Organisational changes at Sizewell B, irrespective of significance or commercial and safety risk.

Note, the Management of Change Standard (NEL/CS/BUS/002) defines the process and controls necessary for significant changes. While some change proposals may not be significant enough to warrant the adoption of the above standard, all changes need to be assessed, authorised and implemented as appropriate according to their significance.

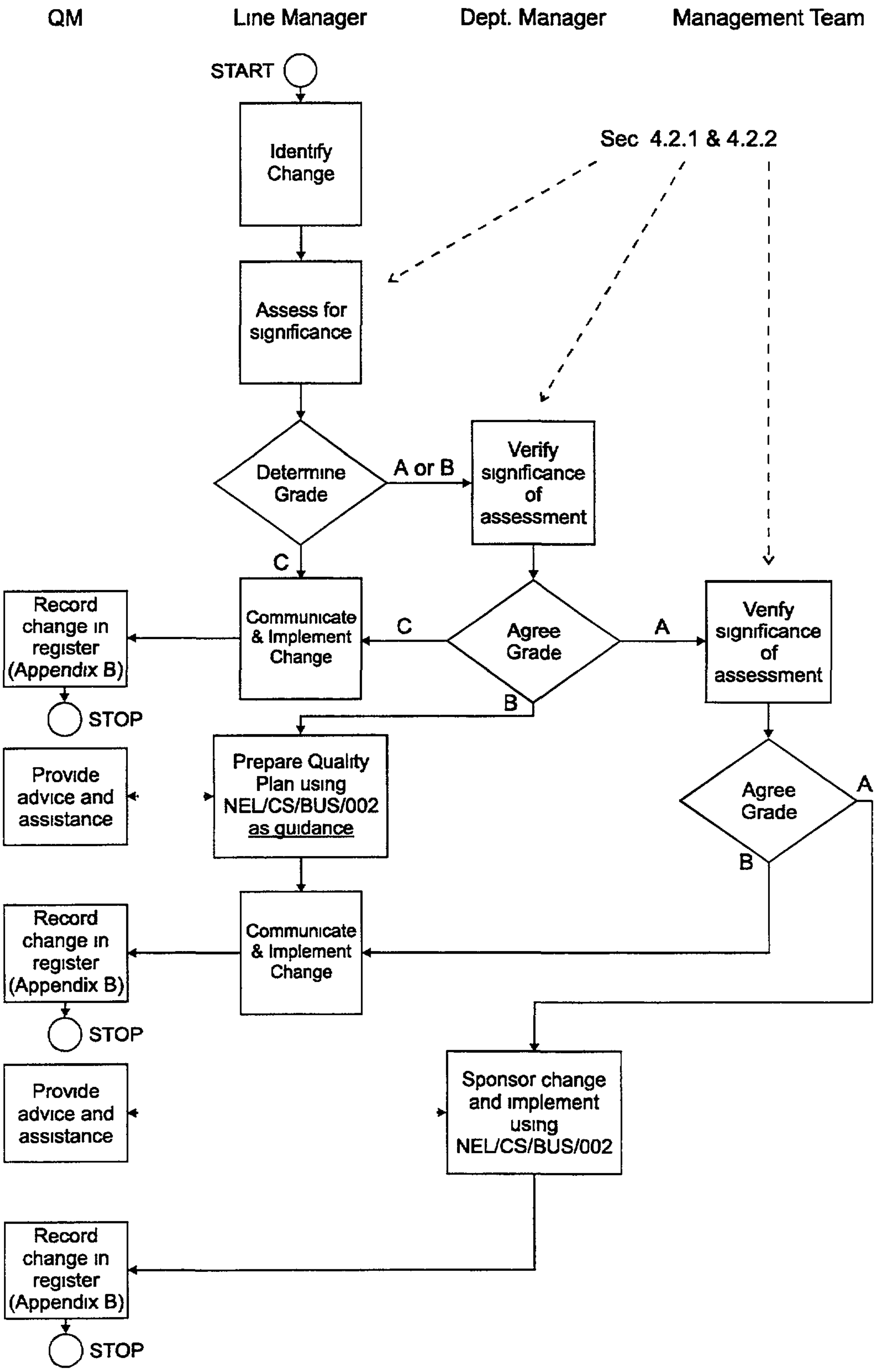
3 RESPONSIBILITIES

3.1 The Quality Management Section Head is the Nominated Person for this instruction and is responsible for its review and implementation. He is accountable for the overall effectiveness of the process.

3.2 Line Managers, eg Section Heads, Departmental Maangers and the Station Director are responsible for proposing, assessing and authorising changes in accordance with this instruction and the Change Management Policy (22).

4 PROCEDURE

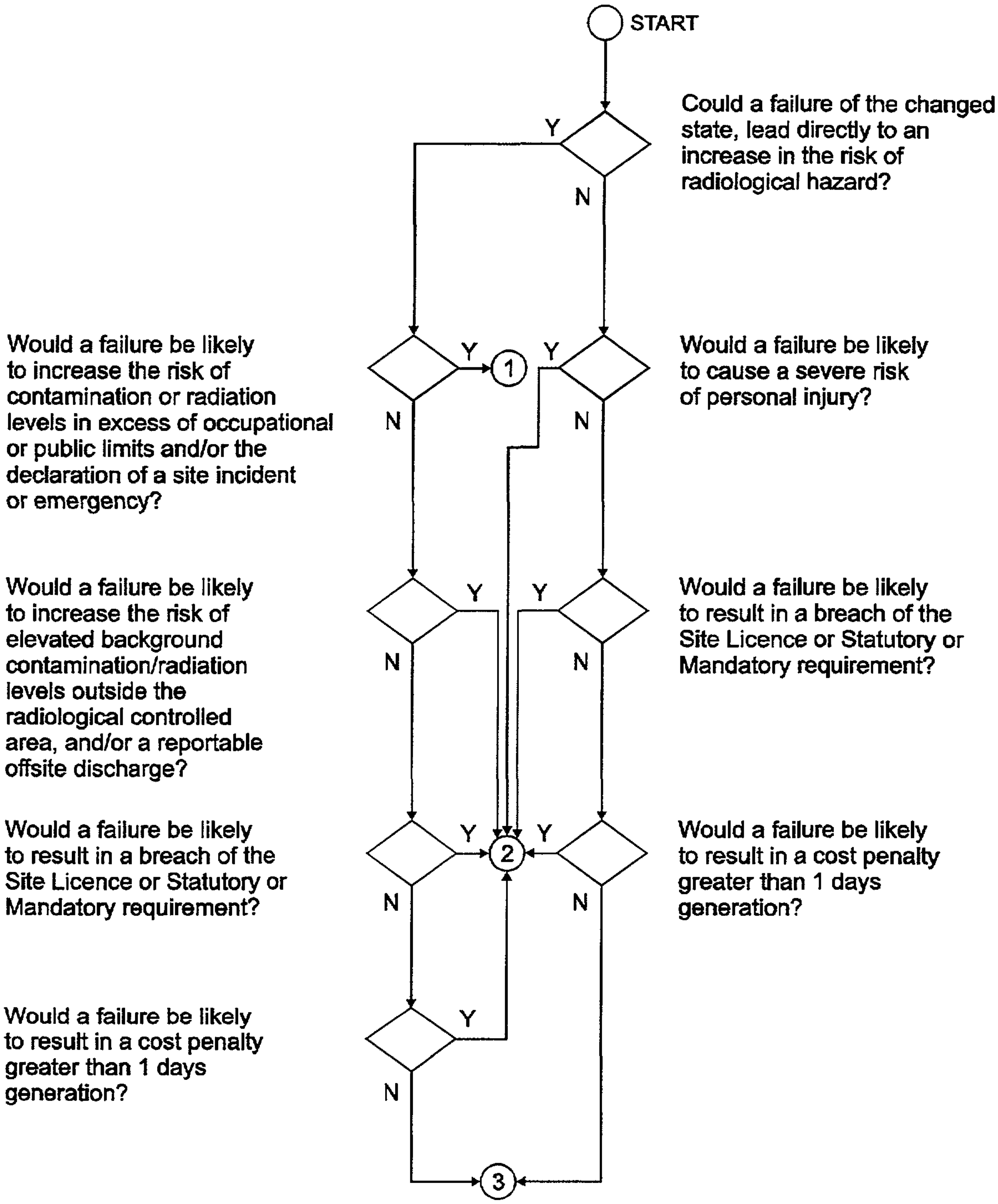
4 1 Overview & Link to Company Standard



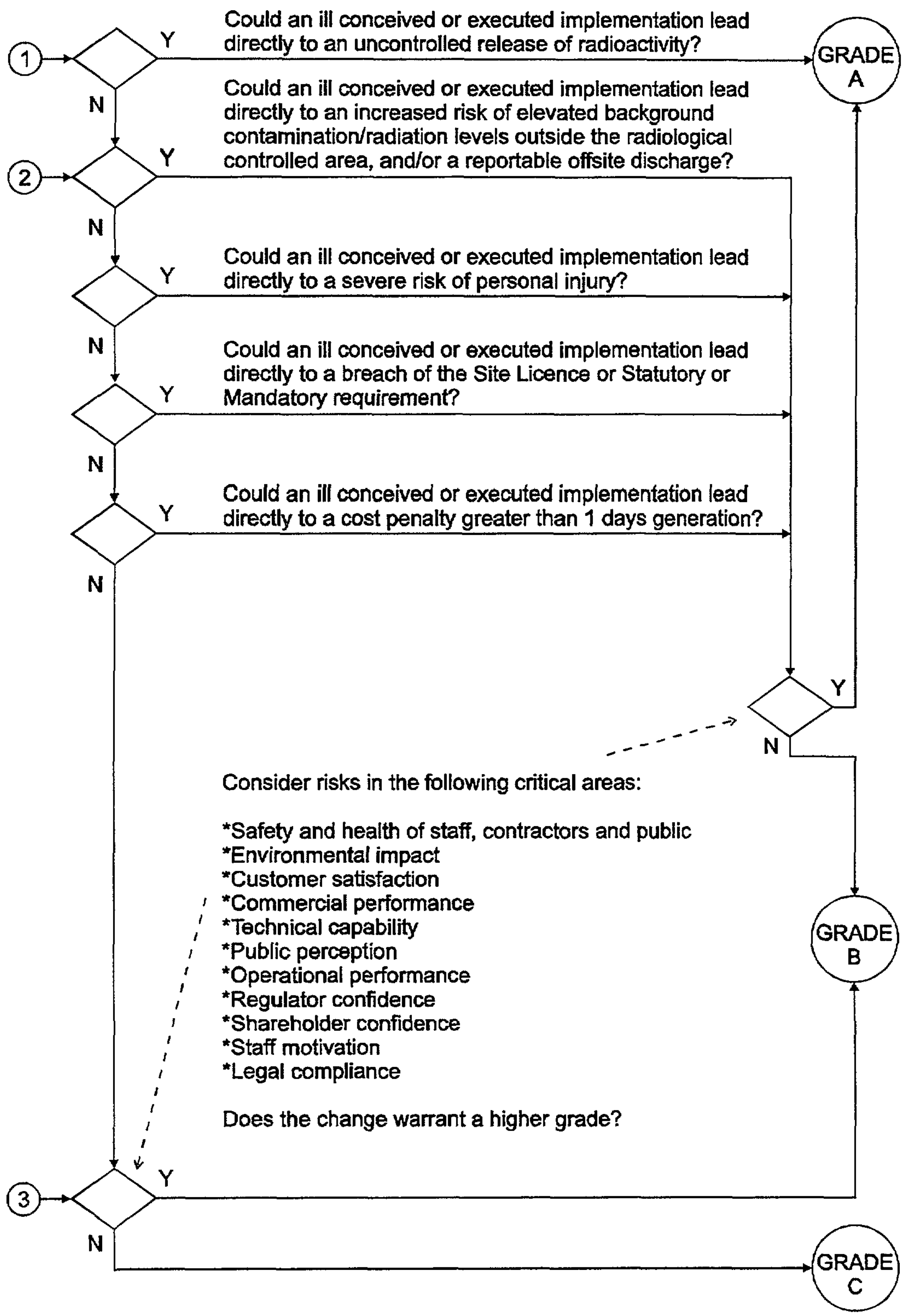
SZB/LI/10/002
Issue 1
Page 3

4.2 Assessment of Significance

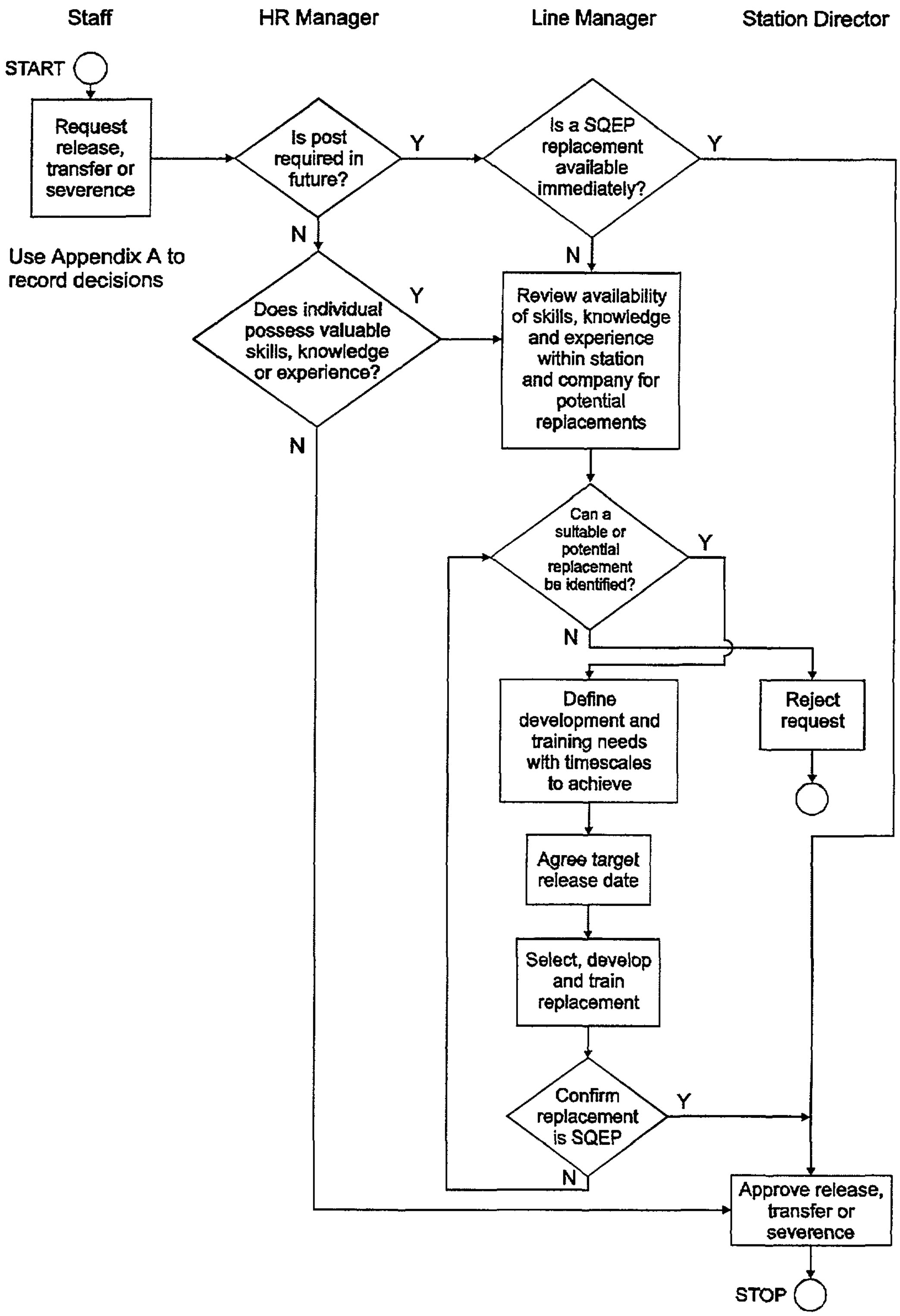
4.2.1 Consideration of Consequence of Failure in the Changed State



4.2.2 Consideration of Consequence of Inadequate Implementation



4.3 Staff Release, Transfer or Severance



5 DEFINITIONS

5.1 There are no definitions concerned with this procedure.

6 REFERENCES

6.1 Change Management Policy 22 (SZB/POLICY/CHANGE MANAGEMENT).

6.2 The Management of Change Standard (NEL/CS/BUS/002).

7 RECORDS

7.1 Approved change proposals, validation statements and post completion records for Grade A changes.

7.2 Quality Plans for Grade B changes.

7.3 Register of Changes maintained by QM Section Head.

7.4 Staff Release/Transfer/Severance Forms maintained by Personnel Officer

APPENDIX A

Sizewell B Staff Release/Transfer/Severance Form				SZB/HPF/130
Applicant's Details				
Name	Post	Section	Department.	Payroll #
Replacement's Details if Applicable				
Name	Post	Section	Department.	Payroll #
Development & Training Needs				
What			When	Progress
Justification				
Target Release Date	Agreed * Departmental Manager	Date	Approved *- Station Director	Date
* Subject to satisfactory completion of above				

SPECIMEN

APPENDIX B

Sizewell B - Management of Change Register							SZB/HQF/014
Ref	Title	Proposer	Assessor	Approver	Grade	Start	Finish

LAST PAGE OF DOCUMENT

EXAMPLE 10: UNITED STATES OF AMERICA (Vermont Yankee Nuclear Power Corporation and Duke Engineering and Services)

Establishment of a self-assessment programme is an essential part of any management programme. Duke Engineering and Services, in conjunction with Vermont Yankee Nuclear Power Corporation in the United States, has developed a process to use self identified information to develop a Functional Area Assessment (FAA) at the Vermont Yankee Nuclear Power Station and at the Vermont Yankee Corporate Headquarters.

A vital ingredient in the safe operation of Vermont Yankee is the continuous measurement of performance and the pursuit of improvement opportunities. The aim of each assessment may be improvement of a process, portion of a process or verifying conformance with existing requirements or benchmarking of performance against that of other departments and organisations. The FAA is an assessment of the performance within a defined department.

This assessment identifies the specific responsibilities within the functional area, assesses the performance of each based on available data and performance indicators, identifies ongoing activities aimed at improving performance and establishes future improvement activities. These future activities would include self assessment activities for departments, quality assurance activities and possible external assessment activities via assist visits which were recommended to improve performance.

The Functional Area Assessment Programme is owned by the management team. The Quality Assurance Programme is used by the management team to provide independent assessment of the self assessment process. All departments perform an assessment in their area of expertise that includes data from their own self assessment programme, Quality Assurance findings, internal corrective action findings, industry events and operating experience feedback and external independent recommendations, i.e. Nuclear Regulatory Commission, INPO, IAEA, WANO and any other site specific information.

Once the information and data have been gathered together it is evaluated and formed into the Functional Area Assessment. The completed department FAA is presented to the other managers for evaluation and input from their peers. The final report is prepared by the site manager to be used in forming the strengths and improvement opportunities for the station. The improvement opportunities should be the focus areas for the next year and will provide direction for self-assessment and other assessment activities. Each focus area evaluated is rated and classified into superior, good or poor performance and whether the trend is improving or declining. The FAA is considered a "living" document and is used as such as a management tool to ensure continuous improvement starting at the group/individual level, plant, utility, regulator and other outside organizations. (See TECDOC Figure 1).

The attached diagrams provide information of data flow and use within the system that will support issuance of the FAA by the company during each cycle. The flow charts also show the relationship of the of the Functional Area Assessment and the levels of assessment activities at the site.

SEE ATTACHED EXAMPLE 10: Figs 1 and 2.

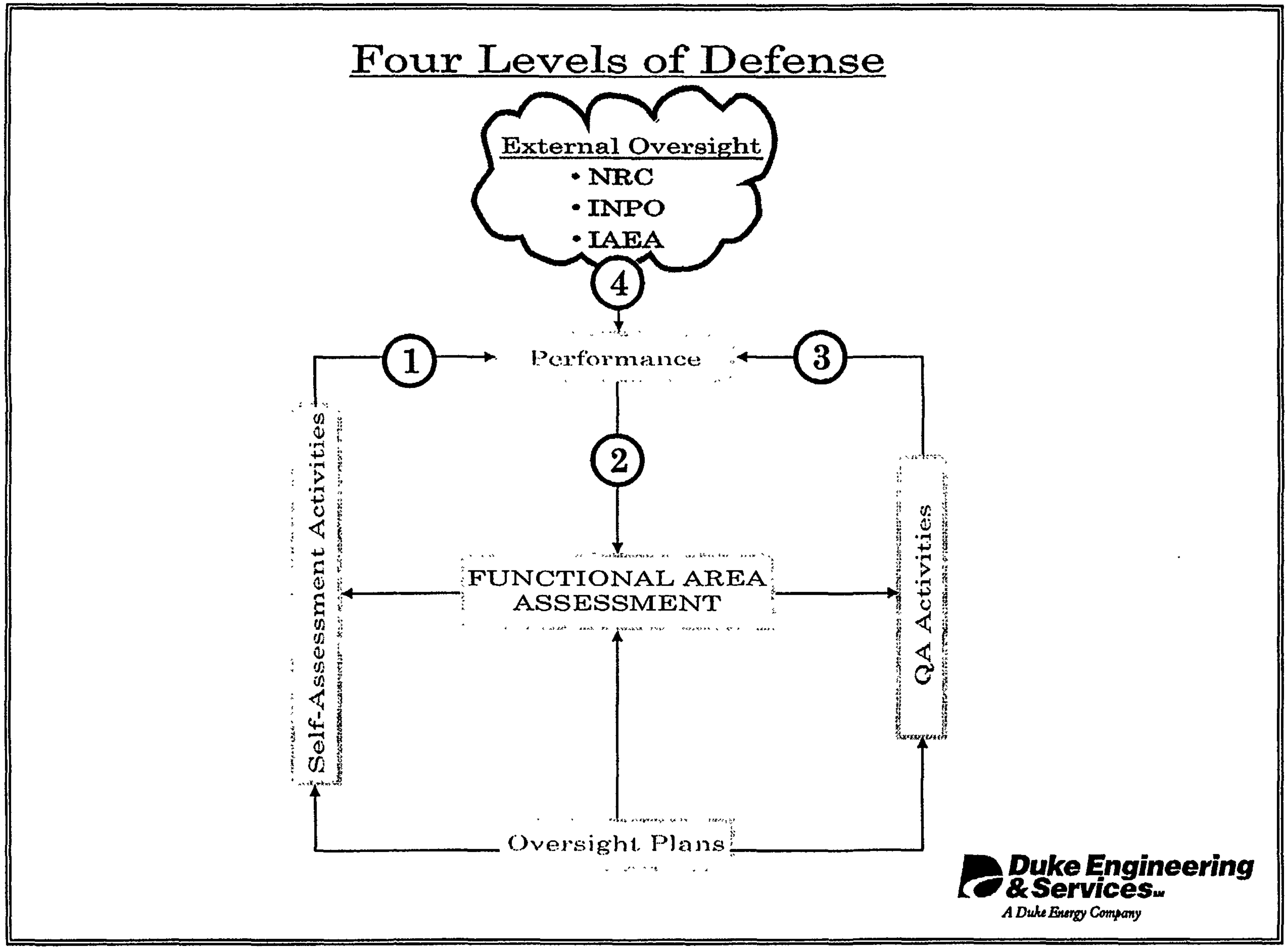


FIG. 1. Example 10

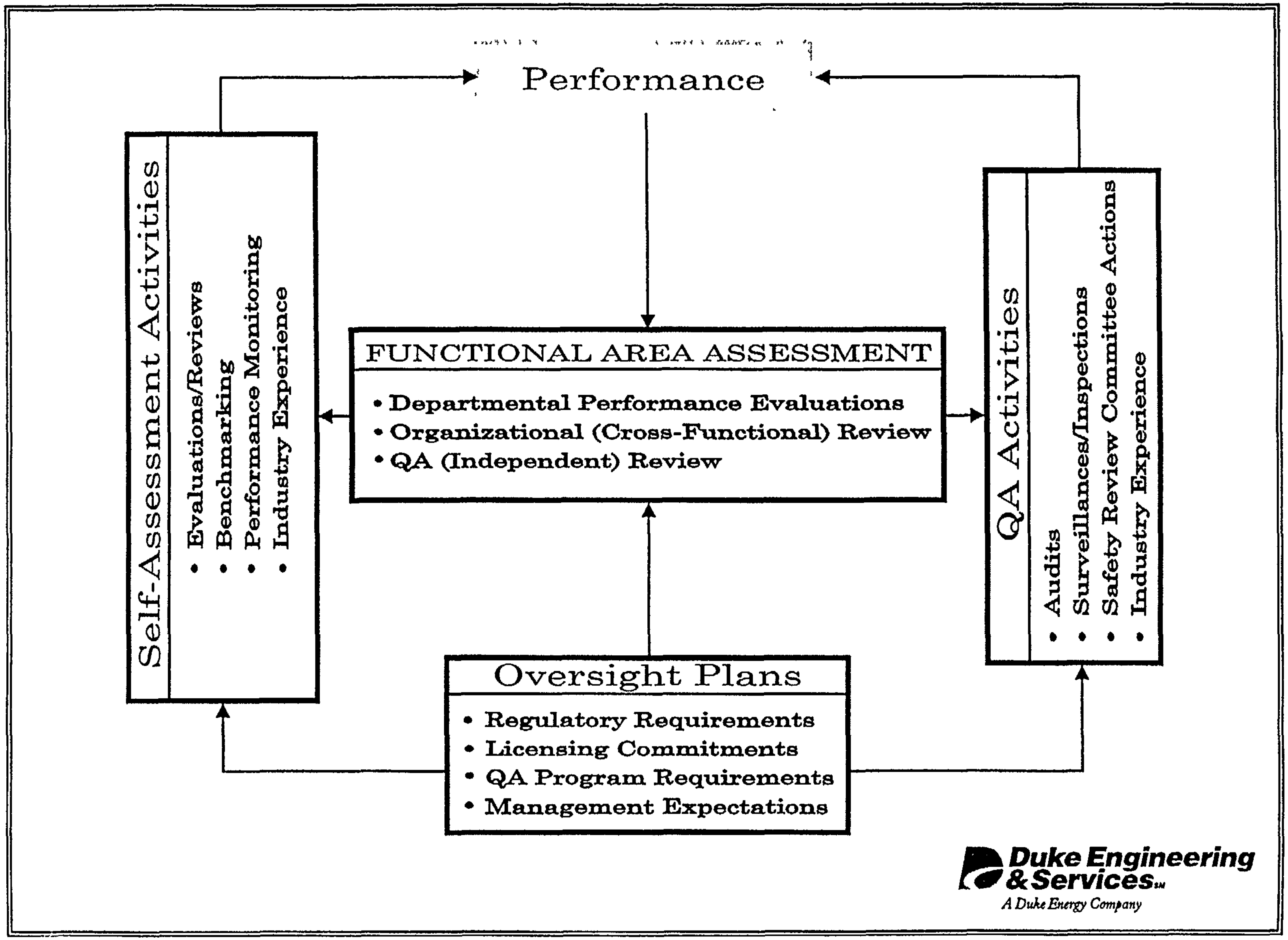


FIG. 2: Example 10

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