



**THAI - CANADIAN
NUCLEAR HUMAN RESOURCES DEVELOPMENT
TRAINING PROGRAM**

**EFFECTIVE TECHNIQUES
IN
SELF ASSESSMENT
OF
NUCLEAR POWER PLANTS**

**LECTURE NOTES FOR THE COURSE ON

PEER EVALUATION TECHNIQUES**

BY: R.B.TAYLOR
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SELF ASSESSMENT

1.0 OBJECTIVE OF PRESENTATION

Self-assessment of operational safety has been identified as an important mechanism that organisations can use to improve safety. The purpose of this paper is to present the basic approach to self-assessment. Assessments conducted by organisations external to the utility or the operator of the nuclear power plant are not intended to be covered by this paper although they are occasionally referenced.

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

2.0 GENERAL

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

Processes of self-assessment 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 and results of process as an effective way for improving safety performance. These processes involve the use of different types of tools and mechanisms to assist the organizations to assess their own safety performance against given standards. When performance comparison is objectively made against standards of excellence, it enhances the understanding of the need for improvements, the feeling of ownership for achieving them and safety culture as a whole.

Although the primary beneficiary of the self-assessment process is be the plant and operating organization, the result of the self-assessment is also used, for example, to increase the confidence of the regulator in the safe operation of an installation.

3. PERFORMANCE EXPECTATIONS

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

The full set of performance expectations can be the set of goals, targets and objectives, including those set by the organization management, that are to be followed and achieved by the staff as a whole and may include performance expectations other than safety. The performance expectations may exist in different forms, such as qualitative executive management policy statements as well as quantitative performance measures, with their associated mutually agreed

targets. The performance expectations must be visible and made public to all staff. They must be constructed in such a way as to ensure that relevant staff can recognize how they contribute to their achievement. Performance expectations concern, for example:

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

The performance expectations should be set by:

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

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

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

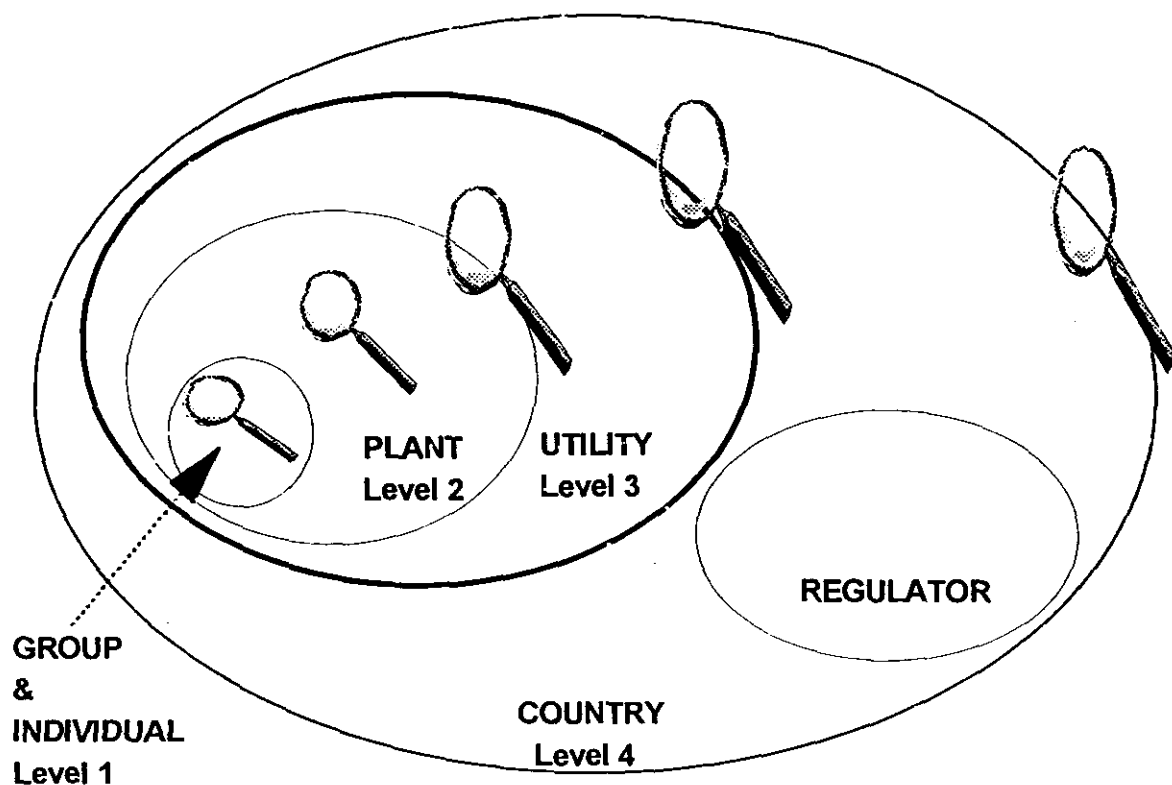


FIG.1. Self-assessment depending on the position of the viewer

4. PURPOSE AND BENEFITS OF SELF-ASSESSMENT

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

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

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

- It maintains a continuous assessment of safety throughout the whole of the organization; this allows improvements to be made based on up-to-date factual knowledge and the objectives to be achieved.
- Staff awareness of the self-assessment process can result in a better understanding of the performance expectations and can broaden staff knowledge of the objectives to be achieved, and how they can be reached. Training of staff in the self-assessment processes can also result in enhancement of their individual skills.
- A strong commitment to the self-assessment process can motivate staff to seek improvements in safety performance. The involvement of individuals in examining the effectiveness of activities for which they are responsible, or in which they are involved, can help them to understand the need for improvement, and should lead them to identify improvement actions, thus encouraging problem solving at the working level. This will assist in developing a greater sense of ownership and openness in which staff feel confident in bringing problems forward and in suggesting improvements.
- The self-assessment process, in conjunction with other forms of internal and external assessments, is a major factor in reaching the desired overall performance expectations and maintaining and enhancing safety culture.
- Although the primary beneficiary of strong self-assessments will be the plant and operating organization, the results of the self-assessments could be used, for example, to increase the confidence of the regulator in the safe operation of an installation or to assist the meeting of obligations under the Convention on Nuclear Safety. Such considerations may influence the form of assessment as well as the type and detail of the results.
- Self-assessments can help to improve communication and working relationship across all levels of the organization.

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

5. SCOPE OF SELF-ASSESSMENT

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

- Independent internal assessment, where a group, within the utility but independent of the line organization being assessed, carries out the evaluation. Viewed from the outside of the utility, this is regarded as a self-assessment process.
- Management and supervision self-assessment, where the plant management on an ongoing process evaluates the effectiveness of performance in their respective areas of responsibility.
- Individual and work group self-assessment, where individuals and/or teams each assess their individual or group performance against a set of mutually agreed performance expectations.

Examples of different self-assessment processes are given in Table 2.

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

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

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

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

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

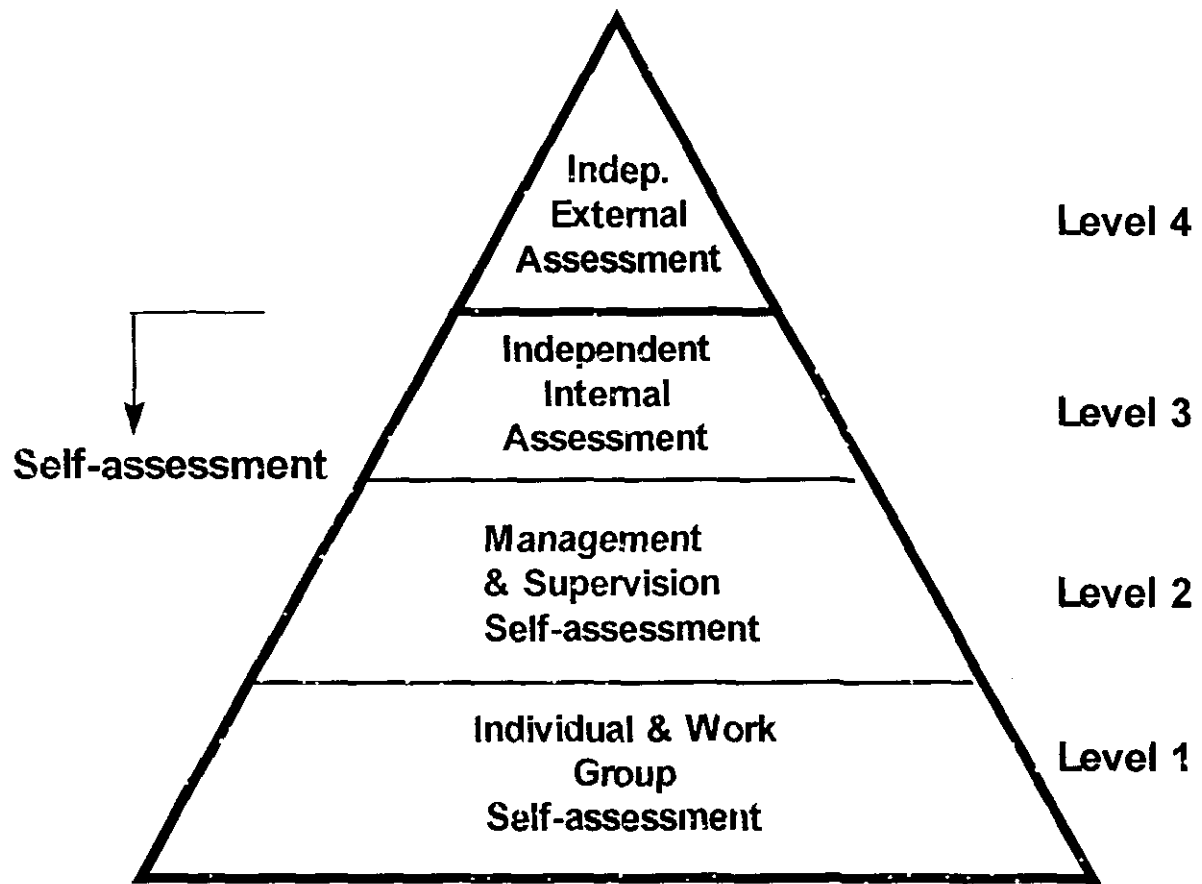


FIG. 2. Triangle of the assessment process

5. METHODS FOR SELF-ASSESSMENT

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

Safety culture requires that the plant identifies, assesses and effectively resolves its own problems. The more efficient the plant is at dealing with low level issues before they get to the threshold of significance, the better it will be able to perform.

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

- Promulgating management expectations and scheduling self-assessment. This could include an explanation of the motivation and involvement of management and may considerably diminish the impact of the expected lack of time by managers and staff.
- Establishing a programme for technical exchange with other compatible industries/organizations, including other nuclear installations. This could balance internal lack of awareness of better ways to improve performance.
- Setting examples of encouraging and accepting constructive criticism as a method for improving performance. This could eliminate the unwillingness to accept criticism.
- Establishing data and information systems (surveillance, maintenance, operational data, etc.) to facilitate the systematic analysis of results. The provision of sufficient and consistent data and information will enhance the process of self-assessment.
- Establishing a comprehensive training programme, which could include assessment techniques, root cause analysis, team training, and use of databases. Achieving common purpose and teamwork, and an accurate estimation of training necessary to carry out the self-assessment process will assist the development of self-assessment within an organization.
- Anticipating ways to effectively deal with the possible large number of suggestions that will emerge as a consequence of an open environment for questions and new ideas. The implementation of an effective communication plan will encourage and facilitate constructive two-way communication of the issues.
- Reviewing existing processes, tools and techniques to identify those which already have the attributes of self-assessment. Any such processes that are considered to be effective could form the basis for the broader development of the self-assessment process.

- Encouraging participation in self-assessments by recognizing individual contributions, scheduling time for participation and including self-assessment experience in career development programmes.
- Maintaining a flexible process to accommodate specific needs. The self-assessment process should avoid complex procedures, wherever practicable, and be carefully managed to retain its simplicity and efficiency.
- Evaluating the effectiveness of the overall self-assessment programme periodically. Items that may be considered in this evaluation include : the rate of voluntary participation of plant staff in the self-assessment processes; number of ideas for improvement; results of staff appraisal feedback; reductions in the maintenance work backlog; reductions in the number of non-conformances arising from external audits; reduction of repeated events; and improvements of plant performance targets.

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

The performance expectations, purpose and results of the self-assessment process should be visible to all plant staff, and they should be directly useful to management and staff at all levels. Maximum benefit will be gained when the needs of the various groups within the organization, for which the self-assessment process is being developed, are considered. The identification of the customers, those who will be expected to make decisions on the basis of the results, is an essential step.

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

6.0 SELF-ASSESSMENT PROCESS

The following general steps may be used to conduct self-assessments at several levels.

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

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

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

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

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

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:

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

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

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

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

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

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

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

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

- the collective effect of safety equipment that is not available should be evaluated on a continuous basis;
- the performance of operators responding to simulated plan transients should be evaluated a few times per year;
- the proper alignment of safety system valves and power supplies should be evaluated prior to unit start-up, following maintenance activities and at other appropriate times;
- the adequacy of calibration procedures for safety related instrumentation may not require evaluation for several years if no changes to equipment or technician experience occur.

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

The self-assessment process performance comparison 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.

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

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

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

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

Obtaining an insight into the comparison will be permitted by the prior identification of goals and objectives which are measurable. It may not always be possible to identify quantitative information for a process, although experience has shown that this is the situation for only a

minority of processes. The exact nature of the comparison will of course be governed by the explicit characteristics of the process under scrutiny.

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.

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

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

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

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.

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

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

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

REFERENCES

- [1] INTERNATIONAL ATOMIC ENERGY AGENCY, OSART Guidelines, IAEA-TECDOC-744, Vienna (1994)
- [2] INTERNATIONAL ATOMIC ENERGY AGENCY, ASSET Guidance for Plant Self-Assessment (Operational Safety Performance)
INTERNATIONAL ATOMIC ENERGY AGENCY, ASSET Guidance for Peer-Review of Plant Self-Assessment
- [3] INTERNATIONAL ATOMIC ENERGY AGENCY, ASCOT Guidelines, IAEA-TECDOC-743, Vienna (1995)
- [4] INTERNATIONAL ATOMIC ENERGY AGENCY, The Safety of Nuclear Installations, IAEA Safety Series No. 110, Vienna (1993)