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# Self-assessment of safety culture in nuclear installations

## Highlights and good practices

INTERNATIONAL ATOMIC ENERGY AGENCY

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# FOREWORD

This report summarizes the findings of two IAEA Technical Committee Meetings on Safety Culture Self-Assessment Highlights and Good Practices. The meetings took place on 3–5 June 1998 and 23–25 October 2000 in Vienna, and involved an international cross-section of representatives who participated both in plenary discussions and working groups. The purpose of the meetings was to discuss the practical implications of evolutionary changes in the development of safety culture, and to share international experience, particularly on the methods used for the assessment of safety culture and good practices for its enhancement in an organization.

The working groups were allocated specific topics for discussion, which included the following:

- organizational factors influencing the implementation of actions to improve safety culture;
- how to measure, effectively, progress in implementing solutions to safety culture problems;
- the symptoms of a weakening safety culture;
- the suitability of different methods for assessing safety culture;
- the achievement of sustainable improvements in safety culture using the results of assessment;
- the potential threats to the continuation of a strong safety culture in an organization from the many challenges facing the nuclear industry.

The working groups, when appropriate, considered issues from both the utility's and the regulator's perspectives.

This report will be of interest to all organizations who wish to assess and achieve a strong and sustainable safety culture. This includes not only nuclear power plants, but also other sectors of the nuclear industry such as uranium mines and mills, nuclear fuel fabrication facilities, nuclear waste repositories, research reactors, accelerators, radiography facilities, etc. The report specifically supplements other IAEA publications on this subject.

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# 1. INTRODUCTION

## 1.1. BACKGROUND

A review of incidents indicates that safety culture problems affect both highly developed and developing countries. Safety culture issues can arise at all stages of organizational life, and even in organizations previously recognized for their safety performance. About two thirds of the causes of accidental radiation exposure is attributed to human error and not technical or procedural causes. Currently the majority of effort to improve safety culture has focused on nuclear power plants.

An international cross-section of representatives met on two occasions under the auspices of the IAEA to discuss issues associated with the development and maintenance of safety culture in organizations. The discussions recognized the dynamic nature of the evolution of safety culture, and the need to understand how best to support the evolution by appropriate actions or practices; and how best to measure progress. The importance of detecting at an early stage, any weakening of safety culture was also recognized, and symptoms of potential weakening were identified. Consideration was also given to how the many challenges facing the nuclear industry worldwide may impact on the maintenance of a strong and enduring safety culture in an organization.

Representatives met both in plenary sessions and in working groups, to discuss the above issues. This report summarizes the findings of their discussions. The information in this report will be a useful supplement to other IAEA publications on safety culture, and extend understanding of how to deal with its dynamic and evolutionary nature, and of the potential impact on safety culture of the many challenges facing the nuclear industry. The information will be of practical value to organizations that are trying to improve their safety culture and will enhance the effectiveness of their efforts.

Initiatives to improve safety culture need to be sensitive to the influences of national and organizational cultures; the diversity of cultures will require a variety of approaches to apply the principles of safety culture. The range of approaches is expanding as countries participate in the international sharing of experience in the development of safety culture. Some countries, have organized regional safety culture workshops or forums to share information. The IAEA has also been instrumental in encouraging the sharing of experience and good practices. This will assist and accelerate the development of safety culture internationally, and help gain greater public acceptance and trust of the nuclear industry.

## 1.2. OTHER RELEVANT IAEA PUBLICATIONS ON SAFETY CULTURE

The IAEA has published the following publications that give guidance on the principles and practices that support the development of safety culture:

*75-INSAG-4 entitled "Safety Culture"*

This report by the International Nuclear Safety Advisory Group (INSAG) is aimed at promoting safety culture by defining the concept as it relates to organizations and individuals engaged in nuclear power activities. It provides a useful reference for judging the effectiveness of safety culture in an organization so that potential improvements can be identified. INSAG-4 was instrumental in giving practical value to the theoretical concept of safety culture.

*Safety Reports Series No. 1 entitled "Examples of Safety Culture Practices"*

This report comprises an international selection of examples of practices that illustrate specific attributes of safety culture as given in INSAG-4. The examples are those commonly observed at nuclear facilities; or if not in widespread use, to represent practices of fundamental importance to safety culture development.

*Safety Reports Series No. 11 entitled "Developing Safety Culture in Nuclear Activities"*

This report contains practical suggestions on how to develop, improve and evaluate safety culture. The report recognizes its evolutionary nature and will be of value to all organizations irrespective of which stage of development safety culture is at. The report recognizes that the approach to developing a progressive safety culture has much in common with that needed to develop an effective organizational culture, particularly one seeking to become a "learning organization". The report includes a list of symptoms of a weakening safety culture.

*IAEA-TECDOC-743 entitled "ASCOT Guidelines — Guidelines for Organizational Self-Assessment of Safety Culture and for Reviews by the Assessment of Safety Culture in Organizations Team"*

75-INSAG-4 includes an appendix of safety culture indicators in the form of questions worthy of examination when the state of safety culture in an organization is being assessed. The ASCOT Guidelines also include a list of supplementary guide questions for each question listed in the appendix. It thus provides a comprehensive practical basis for assessing organizational safety culture against the principles specified in INSAG-4. The Guidelines do not differentiate between the different stages of evolution of safety culture.

1.3. IAEA SAFETY CULTURE SERVICES

The IAEA has developed a programme of services that can support Member States in their efforts to develop a sound safety culture in organizations under their regulation. This support can be provided in various ways — as a continued support during a long term safety culture enhancement process, or as intermittent support to specific steps of that process.

## 2. SELF-ASSESSMENT OF SAFETY CULTURE

In this section, the relative advantages and disadvantages of various methods of assessing safety culture are discussed. The major points from presentations made by participants at the meetings are also summarized.

2.1. METHODS OF ASSESSING SAFETY CULTURE

The purpose of an assessment of safety culture can be to increase the awareness of the present culture, to serve as a basis for improvement and to keep track of the effects of change or improvement over a longer period of time. There is, however, no single approach that is suitable for all purposes and which can measure, simultaneously, all the intangible aspects of safety culture, i.e. the norms, values, beliefs, attitudes or the behaviours reflecting the culture. The various methods all have their strengths and weaknesses. It is therefore recommended that a "triangulated" approach be used, where a combination of different methods is applied to

measure the same phenomenon. Usually a combination of the following methods is used to gain an understanding of the culture of an organization.

### 2.1.1. Interviews

An advantage of the interview is that the respondent can use his or her own words and expressions. It also allows for a greater flexibility in questioning, with the possibility for follow-up questions, making it easier to get to the deeper meanings and to clarify ambiguities in meaning. A difficulty with interviews is that they are not directly comparable with one another. They are also relatively time consuming, usually based on only a limited sample. This can make it difficult to generalize results for the whole organization.

### 2.1.2. Questionnaires

By using questionnaires, you can obtain information that is representative of the whole or parts of an organization. The information can be quantified and results compared between groups, and over time. Questionnaires ensure a greater degree of anonymity, and create a less stressful situation for the respondent. They are also relatively easy to administer. However, answers to questions represent the more apparent and conscious values and attitudes of the respondent, and may not reveal the full depth of unconscious assumptions that underpin beliefs, values and attitudes. How the questions are formulated is important to avoid the risk of misunderstanding, or inadvertently prompting the more socially acceptable answer. With questions generally limited to certain categories, it is also difficult to obtain information about the various aspects of a situation. This can make ambiguities difficult to deal with. The response rate by the employees of an organization can increase if the questionnaire design is attractive and if time during working hours is allowed to complete it.

### 2.1.3. Observations

This method is central to the anthropological study of cultures, and is often a useful complement to interviews when studying organizational cultures. One advantage of this method is that you can watch the culture as it enacts itself, thus it is possible for the observer to confirm results obtained from interviews and/or questionnaires. Observations can also provide new information on cultural phenomena, but they cannot be quantified and used for statistical purposes. There are other limitations. It may be difficult for the observer to interpret cultural phenomena in the right way. There is also the risk of over-generalization from too few observations.

### 2.1.4. Review of documentation

Organizations within the nuclear industry generally possess an extensive hierarchy of documentation. A review of these in a particular organization can provide some insight into aspects of its safety culture. For example, two important components of a sound safety culture in an organization are a systematic approach to safety and the definition of clear roles and responsibilities for its employees. A review of documents will give some indication of whether these requirements are satisfactory. How often documentation is reviewed will reflect the organization's attention to maintaining up-to-date information, and this in turn can reflect the priority that is given to safety. Employees may have been involved in the preparation of certain documents that are relevant to their work. This demonstrates that the organization recognizes

that employee involvement is desirable in achieving better performance at work, and in achieving better safety at work. Safety culture cannot be assessed by only reviewing documentation however the evidence gained from a review can reinforce information gained from other methods of assessment.

### 2.1.5. Methods applied

It was apparent from representatives at the meetings that all the above methods for assessing safety culture were being used internationally. It was also apparent that selected methods had to be adjusted to the particular organizational, and sometimes national, context before use. Thus, in order to develop a suitable questionnaire, information was collected from interviews or focus groups to identify the safety concerns of organizational employees or other relevant groups. This information, together with a model of safety culture, was used to develop questions for a questionnaire. The questionnaire was then tested in a pilot study before being finalized and administered to the intended sample population, which can be the organization on any part thereof. Independently of the method adopted, the results of the assessment were then generally used as the basis for preparing a safety culture improvement plan.

## 2.2. INTERNATIONAL EXPERIENCE OF SAFETY CULTURE ASSESSMENT

Representatives attending the meetings shared their knowledge and experience of assessing and developing safety culture in their organizations. There was widespread agreement on the set of characteristics that describe a positive safety culture but there was some variation in how safety culture was modelled. Some models were particularly useful for assessing sub-cultural variations within an organization, whilst others were based on cultural norms. No single model yet exists that has the flexibility to cover all aspects of safety culture, i.e. beliefs, attitudes, norms, behaviours, etc. At one of the meetings participants were asked to select individually a small number of key characteristics of safety culture from a longer list of characteristics. Three characteristics that received wide support as priority characteristics were top management commitment to safety, the availability of sufficient and competent staff, and openness and communication.

Some of the interesting information presented to the meetings is summarized below. Because of the considerable similarity of approach to safety culture assessment by different countries and organizations, the national source of the information is not specified as this would give a false impression of exclusivity and unfairly give prominence to a particular source.

### 2.2.1. Co-operative approach to the assessment of safety culture

In many instances the assessment and development of safety culture involves the co-operation between utility, government organizations and psychological research institutes. Some projects involve co-operation between countries and this is particularly beneficial when one of the countries involved is still at the early stages of safety culture development. The involvement of psychological research institutes helps ensure the theoretical soundness of assessment techniques and the correct interpretation of results. It is helpful to involve the nuclear energy policy makers and regulators of a country in any project aimed at developing safety culture. This will ensure the political and technical support necessary for the successful accomplishment of the project. In some countries the views of members of the local community in which a plant is located, are sought when developing safety culture improvement plans.

### 2.2.2. Safety culture definitions and models

Four different definitions of safety culture were reviewed in relation to different methods of assessing safety culture. The review concluded that:

- Differences in definition lead to different assessment methods;
- The use of a mix of methods is generally appropriate for the assessment of safety culture;
- Indicators of safety culture do not always relate to safety culture models;
- There is a need to develop a common model of safety culture and identify safety culture indicators.

Organizations are not always culturally homogeneous and it is important to consider sub-cultures when assessing safety culture. The characteristics of the different sub-cultures may differ. A model has been developed that helps identify the dimensional structure of safety culture, and it can also be used to assess sub-cultural differences, e.g. maintenance, technical support, etc. The model involves an assessment of how an organization (or sub-unit) rates on two dimensions; integration/unity and order/direction. A healthy safety culture requires positive ratings on both dimensions. The first dimension is relevant to communication and functional co-operation, and the second to the pursuit of common goals. The model can be used to assist with the preparation of a questionnaire or the interpretation of interview results if it is considered that sub-cultural variation is a possibility.

### 2.2.3. Safety culture guides

Some organizations have produced guides to assist with the assessment of safety culture. Some guides are language translations of IAEA reports, e.g. 75-INSAG-4, whilst others have been created for particular national environments. Generally the guides help in providing an interpretation of INSAG-4 requirements. The guides also are useful references for the preparation of safety culture questionnaires. During recent years with the increasing use of modern computer communication some organizations have created internal web sites devoted to safety culture for the benefit of their employees. Some organizations in the nuclear industry have created web sites for public access and this provides a channel for communicating educational safety culture information to a wide range of people.

### 2.2.4. Safety culture assessment process

Internationally there is great similarity in the process used to assess safety culture. Typically the first step of the process is to identify the important safety norms or safety aspects of working at a plant by using focus groups. These groups consist of a mixture of employees from different parts of the plant. The results from the focus groups are used to compile a questionnaire. The focus group is given the opportunity to review the questionnaire. The next important stage is to test the questionnaire on a small sample population. The questionnaire is then refined before being administered to the whole or a significant part of an organization. The analysis and interpretation of the results of a questionnaire survey normally require the assistance of specialists. An important step is the timely feedback of results to participants. The final stage is the preparation of a safety culture improvement plan based on the results of the assessment. The implementation of the plan should be pursued with the same effort as other key business plans.

Some explicit information on how two different organizations in the nuclear industry implemented an assessment of safety culture may better illustrate the key stages of the assessment process. In each organization the reason for the assessment differed, although the objective of gaining a better understanding of their safety cultures was the same.

In the first organization the reason for the safety culture assessment was a proposed merger between two companies who differed in terms of history, geographic location, business priority and even in the origin of the approach to regulation. The top management of the company formed from the merger initiated a company-wide assessment of the safety culture to gain an appreciation of strengths and potential weaknesses. In preparation for the assessment the top managers of the company participated in a safety culture seminar to improve their understanding of safety culture issues. The seminar was organized by the IAEA. A multi-disciplinary team was created from staff of the organization. The team included operational and technical staff, a statistics expert, several psychologists and a sociologist. This team received training in a workshop organized by the IAEA. A product of the workshop was a questionnaire comprising 70 questions and a list of questions for use in interviews. The questionnaire survey covered the organization's employees and contractors. The response rate was 73% reflecting the fact that time was allowed employees during work hours to complete the questionnaire. The results of the assessment provided a basis for an action plan to improve the safety culture. The organization considered that the involvement of the IAEA in a supportive role added credibility to the safety culture assessment.

In the second organization various types of survey had been carried out over several years. These surveys had concentrated on assessing safety attitudes, and the general safety climate rather than specifically safety culture. Improvement plans had been developed using the results of these surveys but implementation had not always been effective. A number of barriers to the effective use of survey results were identified. These included the length of time before employees received feedback on survey results, managers lack of practical understanding of results, lack of ownership of survey results, and an inability to prioritize improvement action.

A decision was taken to perform a new survey using a questionnaire that had been developed outside the organization but which was familiar to the organization's safety culture experts. These experts had contributed to its development Another advantage of using this particular questionnaire was that it was familiar to the regulators responsible for the licensing of the organization. As in the first organization a multi-disciplinary team was formed. The team comprised managers from various functions, safety specialists and employee representatives. The response rate to the survey was similar to the first organization at 72%. Again the opportunity was given employees to complete the questionnaire during work hours. Employees returned their completed questionnaires to an independent data-handling agency to safeguard anonymity. The results of the survey were evaluated to identify strengths, weaknesses and significant group differences in response. The results of the survey formed the basis of a safety culture improvement plan. The wide involvement of employees in the analysis and identification of improvement action was encouraged to gain better commitment in implementing the improvement plan. This had been a difficulty with previous attempts to implement plans successfully. One additional advantage of using the externally developed survey instrument was that it had been used to carry out surveys in other organizations hence results could be compared between different organizations.

### 2.2.5. Overcoming barriers to the development of safety culture

Assessment allows the strong and weak aspects of safety culture in an organization to be identified. Improvement plans to address the weaknesses can be prepared. An essential part of the improvement process may be to train employees in skills to enhance safety culture. The following describes an approach one organization found helpful in pursuing their safety culture improvement aspirations.

Residential workshops were used to train staff. One workshop was specifically designed for senior managers to help them improve their interpersonal skills. Two psychologists conducted the workshop. The maximum number of persons attending a workshop at any one time was 15. Other workshops were used to train middle managers in team building. Each workshop had 25 participants and considerable attention was placed on improving communication skills.

It was important to give specific training to senior managers as these individuals were generally from the older age range and considered more resistant to change. Their commitment to safety culture improvement was essential if progress was to be made.

The training included the use of attitude improving techniques traditional to the local culture; an example of how safety culture training can be enriched by application of practices native to a particular national culture.

### 2.2.6. Situational approach to the assessment of safety culture

Many assessments of safety culture are based on questions that attempt to gain information on norms, and then assume that behaviour will be consistent with these norms. The difficulty is that there is a complexity of norms, some of which may be competing. It is therefore difficult to know which norm will prevail in a particular situation. To overcome this difficulty a situational approach to the assessment of safety culture has been developed. The method is based on obtaining information on an individual's reaction to a particular scenario. The scenario has been developed from real events as described by those involved in them. The response of an individual to the dilemmas presented in the scenario can reveal what the underlying norms are, and provide a more confident basis for predicting behaviour. This situational approach to assessing safety culture is a useful complement to other assessment techniques.

### 2.2.7. Lessons learned from experience with questionnaire surveys

It is helpful to those thinking of conducting a questionnaire survey to be aware of some of the problems encountered by others that have experience of surveys. Typical problems encountered include:

- poor response to survey because survey was carried out at same time as major plant outage when people were very busy;
- questionnaire comprised too many questions;
- questions were poorly formulated and open to misinterpretation;
- instructions for completing the questionnaire were inadequate;

- people did not feel that their anonymity was protected (this is a particular problem with sample groups when gender, age and skill information is requested);
- the purpose of the questionnaire is not explained;
- feedback of results takes too long;
- no pilot survey carried out to confirm that proposed questionnaire is suitable before full survey undertaken.

It is recommended that advice be sought from people with expertise in developing questionnaires before embarking on a survey to avoid or minimize problems such as those listed above. A poorly constructed survey will fail to deliver reliable results and undermine confidence of people in the benefit to be gained from the use of such methods.

### 2.2.8. Sustaining safety culture during decommissioning

Each nuclear facility will eventually face decommissioning. Decommissioning may take prolonged periods of time to complete. The maintenance of a good safety culture during this phase of a nuclear facility's lifetime will be a challenge as the motivation of those involved in decommissioning may be tested. People may be involved in tasks that will not be completed in their working lifetime. It is true that the nuclear-related risks may be lower because the majority of nuclear material will have been removed in the post-operational cleaning of plant but there will be continuing conventional and radiation safety risks that have to be addressed. Particular attention will have to be given to ensuring that employees perceive a positive purpose to their work and that there is not a decline in the attitude towards continuous improvement.

### 2.2.9. Increasing interest of regulators in safety culture

The regulators in some countries are establishing groups within their organization that have expertise in human and organizational factors. The existence of this expertise enables the regulators to assess better the safety cultures of the external organizations for which they are responsible. This greater knowledge of safety culture also helps ensure that the regulator's interaction with an external organization reinforces the development of safety culture in that organization and does not impede it. In one country the regulators undertook a self-assessment of their own organization's safety and organizational culture. This not only provided them with valuable knowledge about themselves and their attitudes and values but it also gave them direct experience of a safety culture assessment project. This will prove helpful when they evaluate the safety culture assessments done by organizations in their jurisdiction.

## 3. ORGANIZATIONAL FACTORS THAT ARE IMPORTANT FOR IMPLEMENTING SOLUTIONS TO SAFETY CULTURE PROBLEMS

After assessing the safety culture of an organization, the next important step is to identify solutions to problems detected by the assessment. Proposed solutions need to be realistic in taking account of organizational capabilities and circumstances, both internal and external. Solutions to specific safety culture problems may vary from country to country because of differences in how nuclear power developed historically, and differences in national cultures. A subgroup of representatives attending the meeting discussed this issue. The subgroup comprised people from a variety of countries and organizations.

There are certain organizational factors that are considered when proposing solutions to safety culture problems. The importance of a particular factor will vary with the nature of the problem. Some organizational factors are wide-ranging in their potential effect.

## 3.1. ORGANIZATIONAL FACTORS TO BE CONSIDERED

The following organizational factors were identified by representatives participating in the working group discussing this issue, as being particularly important when considering solutions to safety culture problems.

### 3.1.1. Continuous improvement attitude

No matter how well an organization is currently performing, it always needs to consider how it could improve further. This will involve searching for improvements in organizational systems and processes, and how more effective advantage can be taken of changes in technology or changes in the external environment. The absence of a continuous improvement attitude reveals itself in the form of organizational inertia. Performance is superficially checked against targets with little attention to the real health of the organization as reflected in employee capabilities and the quality of the organizational culture. The lack of a continuous improvement attitude will impede the evolution of a learning organization and encourage the complacency that is so harmful to the development of a progressive safety culture.

This particular organizational factor is wide-ranging in its potential impact. It must be introduced into the organizational culture before serious attempts are made to develop safety culture. There has to be a genuine corporate concern for safety. The development of a continuous improvement attitude is strongly dependent on the leadership and commitment of top management, and the involvement of employees in the learning and improvement process.

### 3.1.2. Effective communication channels

An organization intent on developing and improving its safety culture must ensure that information is effectively communicated throughout the organization, and to external stakeholders including regulators. Knowledge and experience needs to be shared among organizational groups if learning is to be encouraged. Good communication channels are vital in this respect. Computer-based information systems have an important role to play in improving communications within an organization, and also with external groups, e.g. regulators.

Information transmitted up and down the hierarchy is susceptible to ambiguity and distortion. This is also true of horizontal communications. It is particularly important that communication channels exist to allow employees to share their safety concerns with top management. Inter-group collaboration is adversely affected when communication is poor. Distorted or ambiguous information can be the source of conflict in an organization. When communication channels are ineffective, it may be necessary to introduce formalized communication processes to ensure that communication actually takes place, and that consistent messages are being transmitted. The effectiveness of communications should be monitored.

### 3.1.3. Management commitment

A good safety culture will not be developed without management commitment. It is particularly important that corporate management demonstrates this commitment. The

development should not be left to junior managers or safety specialists if positive safety attitudes and behaviours are to be integrated into employees' working practices and habits. Actions to improve safety culture should be channelled through managers who, by showing a visible interest in safety, can motivate their employees to become personally committed to the improvement of safety. Some organizations provide specific training for managers as part of activities to improve safety culture. The scope of the training is matched to the particular competence needed by the various managerial groups, e.g. senior management, middle management, etc.

### 3.1.4. Effective planning system

A systematic approach is necessary when developing safety culture; indeed the lack of such an approach is a symptom of a weakening safety culture. The existence of an effective planning system in which scope of work, accountability for implementation, and implementation milestones are specified, is essential. Solutions to safety culture problems generally require multi-group co-ordination and this will only be effective if there is an adequate planning system.

### 3.1.5. Resource adequacy

The mismatch of resource to task has already been identified as a symptom of a weakening safety culture. The adequacy of resource must be considered in a broad context. It extends beyond mere quantity and must include skill, knowledge, and experience. Solutions to safety culture problems may have to be prioritized in terms of potential benefit to the organization. Where resources are inadequate to implement solutions to priority problems, further training may have to be given to employees, additional recruitment undertaken or external resources employed.

### 3.1.6. Skills and competencies

Work having a potential impact on safety only has to be performed by suitably qualified and experienced persons. This is particularly important in the nuclear industry. Generally skills and competencies are specified in job profiles covering organizational roles. The job profiles are based on task analysis of work undertaken by a person in a particular role. The lack of adequate job profiles indicates the absence of a systematic approach within an organization, and this would need to be remedied before solutions to safety culture problems were implemented. Skills and competencies extend beyond the technical domain and include communication, leadership and other interpersonal skills.

### 3.1.7. External influences

The external influences may be social, political, economic or legal. Many organizations face external pressures that call into question their long-term future. This is certainly the case in the nuclear industry. Employees of organizations faced with these external pressures may perceive that the future is hopeless, and become demoralized. Demoralized people are less inclined to change or attempt improvements as they think that their fate is sealed. It is important that top management counter this tendency by providing their employees with a positive vision for the future despite external pressures. Improving the safety culture can be part of that positive vision.

## 3.2. RELATIVE IMPORTANCE OF ORGANIZATIONAL FACTORS

Whilst all the organizational factors are important, the subgroup discussing this topic took the view that some factors were of greater relative importance. This is because some factors have a wide-ranging impact on an organization and its capability to implement, successfully, solutions to safety culture problems. The various organizational factors discussed in the previous section were rated on a scale of 1 to 10, with 10 representing what the subgroup regarded as the most important. The results are shown as follows:

| Organizational factor | Rating |
|---|---|
| Continuous improvement attitude | 10 |
| Management commitment | 9 |
| Resource adequacy | 5 |
| Effective communications channels | 4 |
| Effective planning system | 3 |
| Skills and competencies | 3 |
| External influences | 1 |

The two highest rated factors — continuous improvement attitude and management commitment — are key in that they are catalysts for the creation of many of the other organizational factors. Even in the case of external influences, these two factors can play an important role in helping create a positive vision of the future. The item external influences was rated low, not because it is considered unimportant, but because an organization should not allow itself to be deterred from improvement action because of unfavourable external circumstances. To do otherwise, and adopt a passive response, would demoralize employees and risk the organization's survival.

## 3.3. RELEVANCE OF ORGANIZATIONAL FACTORS TO COMMON PROBLEMS INHIBITING THE DEVELOPMENT OF SAFETY CULTURE

The subgroup, based on the experience of its members, identified a list of common problems that can hinder the development of safety culture. The list, which should not be regarded as comprehensive, is shown in Appendix I. The relevance of the various organizational factors to each problem is also shown. The utility and the regulator may have different perspectives of a problem (this merely reflects their different responsibilities and interests). The appendix includes information showing how the different perspectives may influence the relevance of an organizational factor on the resolution of a particular safety culture problem.

A review of Appendix I reveals that the most frequent difficulties that organizations face, when attempting to implement solutions to safety culture problems, are lack of adequate resources and skills. For regulators, the difficulty encountered is often ineffective communications. Problems whose successful solution depends on the satisfactory state of many

organizational factors are likely to be more challenging. Appendix I indicates that the following problems may be particularly challenging, as they depend on 3 or more factors being satisfactory.

- Lack of future prospects
- Lack of learning from near misses
- Inappropriate documents
- Lack of employee ownership of change.

The above are examples of problems that may require some time to resolve if the organizational factors are not favourable. When preparing a plan to solve such problems, it is helpful to split actions that will take a long time to complete, into a series of shorter duration stages. Employees will then likely be more aware that progress is being made, and be more motivated to continue their efforts in the longer term.


# 4. ACTION AFTER COMPLETION OF ASSESSMENT

## 4.1. INITIAL ACTION

The results of the assessment are subjected to a root cause analysis to try and identify the reasons why weaknesses in safety culture exist in the organization. Employees are normally consulted in this process, perhaps using a small number of focus groups. This approach allows a discussion of the need for improvement and enables employees to make practical suggestions on how improvements may be achieved. Employees are more likely to be committed to the implementation of improvements if they have been intimately involved in generating ideas for that improvement.

After the identification of improvement actions it is important that these actions be given a priority and incorporated into a coherent improvement strategy. For some strategies it may be sensible to test that they produce the desired results by means of a trial in a particular part of the organization. The strategy can then be extended to the remaining parts of the organization with more confidence.

It is important to prepare people for change by making the results of the assessment known to all employees in the organization and presenting the results in an understandable and interesting way. The motivation for making the changes necessary to improve the safety culture needs to be made explicit. It is important that employees perceive the improvement plan as realistic; plans may be challenging but not so challenging that they lower employees expectations of successful achievement.

In evaluating the results of the safety culture assessment it is important to identify organizational and safety culture strengths, and not focus exclusively on weaknesses. Improvement strategies should utilize these strengths. Employees need to be given a balanced picture of the situation to avoid demoralization.

The successful implementation of improvement plans is more likely if there are tangible benefits to individuals or groups from the change. These benefits need not necessarily be

financial but could be increased opportunity to gain skills, increased recognition or greater decision-making powers.

### 4.1.1. Time to realize benefits from improvement action

Safety culture is a complex concept with many facets. Considerable time may be needed before the desired changes in safety culture are realized. Individuals and organizations need time to adapt. Consideration needs to be given to this time factor when agreeing improvement actions and preparing strategic improvement plans. When a long period of time is needed for the desired benefit to be obtained, identifying a series of milestones where some tangible progress may be evident is desirable. Achieving these milestones will help motivate employees.

The working group that discussed this topic recognized the difficulty of accurately forecasting the time needed to implement change. They did offer the following suggestion on likely times needed to detect some tangible evidence of successful improvement.

- Individual change where specific change goals exist      1 year or longer
- Group or single site change where change goals exist      2 years or longer
- Multi-group or multi-site change      3 years or longer

It must be emphasized that the above estimates are solely for guidance and much will depend on specific circumstances, and that the times are not for total completion of the change but merely the time that is needed to realize some benefit from the change.

### 4.1.2. What is needed to achieve successful and enduring improvement in safety culture

Before embarking on an improvement programme to achieve the desired change in safety culture it is important to establish that there is management commitment at all levels for the programme, and that sufficient resources will be available. Regulators should be made aware of the programme and its goals. It is sensible to ensure that the regulator understands that the estimated time for implementation of the significant actions contained in the programme are subject to a greater uncertainty than they may be accustomed to, when dealing with conventional engineering projects.

To achieve sustained improvement over what may be prolonged time periods the following will be of help:

- Continued management commitment and support for the improvement programme;
- Providing refresher training and seminars on safety culture to ensure that employees do not forget what the improvement programme is trying to achieve;
- Including safety culture issues in the audit programme;
- Ensuring that newcomers to the organization are aware of the safety culture aspects of their role in the organization;
- Include safety culture attributes in the selection criteria for new recruits or promotion of employees;
- Ensure that the safety management system supports safety culture and that its requirements are compatible with safety culture principles;

- Include safety performance and safety culture attributes in the criteria used to evaluate employees, particularly managers;
- Be aware of safety culture developments in other organizations and exchange information on practices;
- Integrate safety culture issues in the business planning process to emphasize the business importance of the concept.

### 4.1.3. Role of the regulator in promoting the development of safety culture

It is important that regulators have a good understanding of the concept of safety culture and its complexity. Any lack of understanding could impair the effectiveness of the regulator in his or her interaction with an organization under their jurisdiction. Regulators receive adequate training in safety culture. It will be helpful if the regulatory and utility staff have a comparable understanding of safety culture issues to avoid any difficulties that may arise from mismatches in knowledge. Possessing a comparable understanding will be more likely to ensure a constructive dialogue between regulator and utility. It would be sensible for regulators to consider formulating guidelines on safety culture that will assist them in their duties.

## 5. ASSESSING THE PROGRESS OF IMPROVEMENT EFFORTS

A subgroup of representatives from different countries and organizations met to discuss this topic. The information in this section is not meant to be comprehensive; it will, hopefully, show the importance of selecting the appropriate methods for assessing progress in improvement efforts. Efforts to improve safety culture generally involve action plans. Specific improvement actions will have been identified from the assessment of safety culture, perhaps using questionnaires, interviews or other methods. Progress in implementing actions needs to be measured so that feedback can be given to those persons accountable for the implementation, and to confirm that the implementation is being effective.

The common methods of evaluating progress in implementing actions are:

- audit
- key performance indicators
- peer review
- observation
- employee surveys (e.g. questionnaires, etc.)

Each of these methods has relative advantages and disadvantages, which are summarized in Appendix II.

## 5.1. SUITABILITY OF EVALUATION METHODS FOR MEASURING PROGRESS

Each of the above evaluation methods was reviewed to determine its suitability for measuring the progress of a variety of specific safety culture improvement actions identified by the subgroup. The list of improvement actions should not be regarded as comprehensive. The results of the review are shown in Appendix III.

Employee survey was judged to be the evaluation method having the most wide-ranging suitability; whilst observation, particularly that carried out in routine inspections, was considered to be of limited value in measuring the progress of safety culture improvement actions. Audits and peer reviews were of moderate value but were considered to have limited value for measuring progress in behaviourally related improvements. Key performance indicators as currently used were similarly limited.

It is interesting to note that the evaluation methods most commonly used in organizations are key performance indicators and observations during inspections; the two methods that are considered to have limited value for assessing safety culture improvements. Within the nuclear industry, audits and peer reviews are routinely used. They generally involve persons who are independent of the organization. Employee surveys are increasing in use, as organizations take an interest in obtaining information about employee attitudes as part of programmes to change behaviour.

The consensus of the subgroup was that too much use is made of performance indicators that measure the negative rather than the positive aspects of safety. It is especially important to make use of positive performance indicators in a safety culture improvement programme. Positive indicators are those that measure actions taken proactively to improve safety, or to prevent safety being degraded, rather than measuring deficiencies retrospectively. An example of a positive indicator is the performance in implementing agreed employee safety improvement suggestions within a specified time. Another positive indicator is the frequency of visits to a plant by senior managers to meet and speak with employees about their concerns, including safety.

Appendix III provides useful guidance on which evaluation methods to use for measuring progress of specific actions to improve safety culture.

## 6. SYMPTOMS OF A WEAKENING SAFETY CULTURE

### 6.1. IMPORTANCE OF DETECTING SYMPTOMS

There is often a delay between the development of weaknesses and the occurrence of an event involving a significant safety consequence. Weaknesses can interact synergistically to create a potentially unstable safety state that makes an organization vulnerable to safety incidents being triggered by one, or a series, of relatively harmless safety lapses. By being alert to the early warning signs, corrective action can be taken in sufficient time to avoid adverse safety consequences. Both the management and regulators must pay attention to signs of potential weakness.

The subgroup that discussed this topic identified a list of symptoms of a weakening safety culture. The subgroup considered symptoms from both the utility and regulator's perspectives.

### 6.2. UTILITY PERSPECTIVE

The following symptoms are particularly relevant from the utility perspective, and any self-assessment of safety culture should include checks for their presence. For some of the symptoms it may be possible to develop performance indicators that will be of practical value in detecting adverse trends.

### 6.2.1. Lack of systematic approach

This deficiency can adversely affect all aspects of an organization's activities. Its presence would prevent accountabilities and decision-making processes from being transparent. The consequent lack of reliable information, and limited logical understanding of processes, would seriously hinder any assessment of safety culture. Any organization lacking a systematic approach would be prone to repeated crises and organizational stress. A positive indication that an organization is conscious of the need for a systematic approach is the use of a formal process to manage change. The process usually includes some type of risk assessment. The existence of handbooks that describe organizational and technical processes, and plans that have been developed by means of a systematic process are also indicators of a systematic approach.

A systematic approach to training is particularly important. Organizations need to devote sufficient resources to training to ensure effective safety performance. Training needs for job-roles and tasks are identified and criteria of competence specified. Training should be given throughout an employee's working life, and be a combination of classroom and on-the-job training. Training records are regularly updated and reviewed. The status of training hours and the results of training tests are also routinely reviewed.

### 6.2.2. Procedures not properly serviced

Procedures that are not regularly updated and subjected to review can become invalid, and possibly result in safety consequences. The preparation, issue and updating of procedures should be subject to quality control. Formats should be consistent where practicable, and checks undertaken to confirm that the procedures are understandable to those persons who have to refer to them. Indicators of this weakness are the lack of a systematic process to review procedures regularly, and lack of clarity over responsibility for review. Another indicator may be an increasing trend in procedurally related incidents.

### 6.2.3. Incidents not analysed in depth and lessons not learned

Repetition of a problem usually indicates that the fundamental cause or causes of the problem has not been properly identified. A systematic in-depth analysis of incidents is necessary if lessons are to be learned and the fundamental, or root causes, identified. Root cause analysis requires that both the direct and indirect cause of incidents be determined. The causes may be technical, human behaviour, organizational culture, process, procedure, equipment, environment, etc. A potential indicator of this weakness is the absence of training in the systematic and in-depth analysis of incidents.

Repetition of events may also indicate that the organization does not have a learning culture. A learning culture will only develop where there is good organizational communications with provision for feedback and sharing of information, in addition to in-depth analysis of incidents.

Systematic in-depth analysis of incidents enables the complexity of such events to be understood. Being able to deal with complex events is a positive sign from the perspective of safety culture. Some utilities have formed dedicated review and analysis groups in their organizations, with high levels of skill and experience. The existence of such groups can provide confidence in the quality of analysis. Analysis should include human factors as well as

technical issues to ensure that there is an integrated evaluation. Often it is changes in the human systems that are more likely to have consequences for safety than technical changes. Past experience has shown that human factors and safety culture issues play a significant part in complex events.

### 6.2.4. Resource mismatch

Resource mismatch may reveal itself in the form of excessive project slippage, excessive hours worked by employees, lack of suitably qualified and experienced persons, increased use of contractors in key organizational roles for long periods of time, and repeated requests to regulators for dispensations to regulatory requirements. Another indicator is the absence in the planning process of any allowance for unanticipated problems, and the consequent lack of margins for completing work. When considering resource mismatch attention must be given to both quantity and quality of resource, and whether the mismatch is short or long term.

### 6.2.5. Violations increasing in number

Violations (conscious deviations from rules, e.g. short-cuts) provide an insight into the safety culture of an organization. All violations should be thoroughly investigated to establish the root causes. Where violations are increasing in number it may be an indicator of an indifferent management environment (i.e. one that rarely punishes violations or rewards observance). Violations should not be confused with errors caused by slips or lapses (unintended deviation of action from intention). The significance of violations is the deliberates of the deviation from practices deemed necessary for safety.

### 6.2.6. Increasing backlog of corrective actions

Any significant increase in the number of corrective actions that have not been implemented within their planned time-scale, is one of the more obvious signs that safety culture may be weakening. It is a sign that safety is not being given the priority that it warrants. Attention should be given to both the number of corrective actions that have exceeded their original implementation date, and the magnitude of the delay. The extent of the backlog is also a good indicator of managerial effectiveness in planning, organization of resources, prioritising and monitoring the progress of work.

### 6.2.7. Insufficient verification of readiness for operation or maintenance

Incidents often occur at the startup of plant after shutdown for maintenance, or when the plant is not properly prepared by operators for planned maintenance work.

Incidents may be caused by poor pre-work planning and risk assessment, lack of interdisciplinary communication, poor permit-to-work systems, inadequate training or lack of suitably qualified and experienced people. The existence of a systematic process for preparing plant for startup, or for maintenance, is an indicator that attention is being paid to this important aspect of operations. The process should include pre- and post-maintenance checks by operators and maintenance staff. The effectiveness of these checks is an indicator of the quality of the relationship between operations and maintenance personnel.

### 6.2.8. Employee safety concerns not dealt with promptly

Employees will become frustrated and de-motivated if they perceived that their safety concerns are ignored, or if they have to repeatedly raise them before action is taken. They will have the impression that safety is unimportant— a poor basis for developing a positive safety culture. The absence of adequate communication channels between employees and senior management can prevent safety concerns being brought to the attention of those persons who have the authority to initiate remedial action. Senior managers who regularly visit plants and speak with employees are likely to be aware of safety concerns, and be in a position to reinforce the importance of safety. An indicator of a weakness in this area is the lack of a system that enables employees to raise safety concerns, together with effective progressing of corrective action. Another indicator is that only trivial concerns are addressed.

### 6.2.9. Disproportionate focus on technical issues

A weakness would be revealed by insufficient attention to the human factors aspects of work. Problems would be perceived as technical challenges with solutions designed to engineer out human weaknesses. A positive indicator that this weakness does not exist is the inclusion of human factor issues in employee training, particularly managers training. Evidence that human factors are being considered in risk assessments that underpin the safety basis of plant operations needs to be demonstrated. Human factors may also be considered in employee selection processes.

### 6.2.10. Lack of near miss reporting

The absence of a near miss reporting system does not necessarily indicate a weakening safety culture, but rather an organization that, perhaps, has still to recognize the valuable information that can be obtained from this type of event. It may be an organization in the early stages of developing a learning culture. The existence of a near miss reporting system is more a sign that an organization has achieved a higher level of sophistication in its approach to safety.

### 6.2.11. Lack of self-assessment processes

The lack of self-assessment processes is a significant indicator of potential weakness in safety culture. Lacking such processes, an organization will be blind to deficiencies in safety attitudes and behaviours. This report contains useful guidance for organizations wishing to strengthen their capability in this area.

### 6.2.12. Housekeeping

Poor standards in housekeeping generally indicate a disinterested management and a poorly motivated workforce who have little pride in their environment. These weaknesses usually extend into the safety domain and damage the safety culture. Housekeeping standards have proved by experience to be a remarkably reliable indicator of the ethos of an organization.

### 6.3. REGULATOR PERSPECTIVE

Regulators will also be interested in the symptoms listed in the previous section, but in addition will also pay attention to the following symptoms that often can only be identified from an external perspective.

### 6.3.1. Failure of corporate memory

Significant corporate change must be carefully managed to ensure that the principles of good safety are not jeopardized. Organizations facing economic and market pressures may try to reduce their costs by downsizing their workforce and eliminate systems. This may result in a loss of skill and experience or historic data. The existence of effective change management processes is a protection against this consequence. The importance of retaining corporate memory will increase as organizations in the nuclear industry embark on future decommissioning of facilities. Decommissioning will generally have to be undertaken by a new generation of employees who may only have an indirect appreciation of plant details, and do not have the intimate knowledge of plant that is obtained by personal involvement in design and commissioning. Indicators of potential weakness in corporate memory are lack of adequate records and a disproportionate number of experienced people leaving the organization. The re-hiring of these experienced people as consultants to assist with problems is possible evidence that the corporate memory is weak.

### 6.3.2. Low status of Quality Assurance Department

A common finding of investigations into organizations that have encountered serious safety problems is the low status of the QA Department. QA staff are viewed in a negative light and perceived by other employees to be undertaking a policing role. QA findings are often ignored, or not addressed in a timely manner. An indication of the status of the QA role can be obtained from employee interviews or questionnaires, and by examining how QA findings are addressed.

### 6.3.3. Role of utility headquarters (HQ)

Often the operational sites of organizations are geographically separate from their utility HQ. This separateness can result in different organizational sub-cultures developing, with consequences for communications and relationships. Corporate goals become less important than local goals. Policy and standards are not uniformly applied. Hostile relationships between parts of an organization and its HQ result in erosion of corporate identity, and ultimately corporate values. It is unlikely that a sound safety culture can develop in a climate of corporate disharmony. Indicators of this weakness are a lack of awareness of the corporate HQ's role throughout an organization, and poor communications between HQ and other parts of the organization. There also may be a lack of corporate concern and awareness of safety issues. A positive indicator that safety is considered to be important corporately, is the allocation of a special responsibility for safety oversight to a member of the organization's Board of Management. Safety issues are considered when making economic decisions in organizations where there is a corporate awareness of safety.

### 6.3.4. Lack of ownership

A responsible attitude to safety is unlikely to develop when there is a lack of ownership of safety issues in an organization. Lack of ownership usually indicates a lack of commitment. This weakness occurs when there is a lack of ownership among the senior managers of an organization. At the operational level it will be revealed by an abdication of safety responsibilities to safety specialists, and poor cross-functional co-ordination with blame for problems continually directed at certain groups.

### 6.3.5. Isolationism

Organizations or parts of an organization can become isolated because of geography or from the way that an organization is structured. Structure can help or hinder communication. Organizational isolation can cause safety culture to deteriorate because employees come to believe that safety performance is satisfactory. Safety standards become unrelated to external benchmarks or modern standards, and the organization operates in a self-referencing mode. It is important that organizations should have a policy and a process for reviewing standards. Insularity can also be internal to an organization, especially if many sub-cultures exist with poor interdisciplinary communication that inhibits learning through sharing of information. Managers can become isolated from the workforce if they do not visit work areas.

### 6.3.6. Lack of learning

An organization striving to improve and develop its safety culture is willing to share its knowledge and experience with others, as well as using the experience of others to improve its own safety. Within the nuclear industry there are great benefits to be gained by sharing information and experience internationally. The practice of not sharing information on commercial grounds should not be allowed to escalate to the extent that it becomes a barrier to improving safety. Effective problem resolution generally requires experience and knowledge to be shared. The maturity of the learning culture can be determined by checking whether learning is valued, and how, practically, the organization supports learning, e.g. training included when planning change. The organization may focus on the successes of the past and be reluctant to invest effort in building new skills for the future. The training programme is reviewed to determine whether new elements of training are being included on a regular frequency.

### 6.3.7. Unwillingness to share or co-operate

This symptom is closely linked to the previous two weaknesses. The existence of sub-cultures can promote a strong shared-purpose and comradeship that motivates employees in their local groups, but results in communication barriers between groups. These barriers can have a bad influence on the development of safety culture. Senior managers must avoid over-competitiveness developing among employees as they try to improve their safety performance, as this can inhibit co-operation.

### 6.3.8. Failure to deal with the findings of independent external safety reviews

Regulators or other external groups may carry out safety reviews. Ignoring the findings of these reviews could indicate that safety is not considered a priority issue, or that there is a reluctance to accept proposals for change that have not been developed internally. These explanations would be significant indicators of a potentially weak safety culture. Repeated slippage in the implementation of accepted findings of a review would also indicate weakness. A positive indicator would be the existence of an organizational process for reviewing the progress of implementing actions, and for sharing information about progress with those responsible for the external review.

**6.3.9. Deficiencies in regulatory bodies**

Regulators have an important role to play in assisting organizations to develop positive safety cultures. It is important that the regulator have a soundly based regulatory strategy and communicates this strategy to organizations under their jurisdiction. It is possible that the strategy will change as organizations successfully establish good safety cultures that gain the confidence of the regulator. Organizations clearly understand the criteria by which they will be assessed by the regulator. Representatives of regulatory bodies are trained in safety cultural issues so that they are better able to evaluate the safety-state of an organization. The existence of such training would be a positive indicator that the regulator is adopting a broad perspective in their oversight duties. The quality of the relationship between the regulator and the regulated organization is also an indicator of potential deficiencies in both groups.

# 7. FUTURE CHALLENGES IN DEVELOPING AND SUSTAINING SAFETY CULTURE

## 7.1. POTENTIAL THREATS TO SUSTAINING A STRONG SAFETY CULTURE

The nuclear industry throughout the world is facing many challenges today, as are other industries. What differentiates the nuclear industry from others is that nuclear safety problems in one part of the world cannot be insulated from people in other regions or continents. There is a potential global pool of adverse safety events that can influence people's perceptions of the nuclear industry in their own country. In addition to safety issues the nuclear industry must also cope with economic and political influences. Globalization of business has increased both opportunities and threats. Examples of some of the challenges facing the nuclear industry include environmental acceptability, international security concerns, an increase in privatization with all its attendant pressures for cost reduction, and innovations in technology. The nuclear industry will be faced with ageing plant and associated decommissioning work that will extend over long periods of time raising questions about the maintenance of nuclear knowledge and skills.

Many of these challenges have the potential to influence the safety culture in an organization. Economic and other business pressures have the potential to distract the managers in an organization from their visible commitment to safety culture. This reduction in visible support for safety culture coupled with a workforce who may be demoralized by perceived job insecurity associated with the business pressures, can have a detrimental impact on the motivation of workers to work safely and maintain their alertness through a questioning attitude. None of this is unique to the nuclear industry but as has already been noted, the nuclear industry is judged by its global safety performance and this aggravates the consequences of any safety failure.

## 7.2. INFLUENCE OF OTHER CULTURES ON SAFETY CULTURE DEVELOPMENT

The main components of a strong safety culture are recognized and there is a considerable international consensus on how safety culture can be assessed. The frequent contact and communication which takes place between people working in the nuclear industry worldwide will have contributed to this position. The tradition of sharing technical experience and knowledge has been continued in the sharing of safety culture experience. It is evident however

that the practices adopted to develop safety culture in different organization need to take account of both the existing organizational and national culture. This need not to be considered a problem but merely a reflection of the diversity of cultures that enrich human existence. Those interested in assisting others to develop their safety culture need to be sensitive to this diversity and be flexible in the practices selected to achieve a particular safety culture goal.


# 8. CONCLUDING REMARKS

Maintaining and improving safety culture requires continuous evaluation. There are a variety of methods for assessing safety culture, and each method has its own relative strengths and weaknesses. A combination of methods may be used in a "triangulated" approach to provide greater confidence in the result.

International experience in assessing safety culture is a valuable source of information, particularly when it demonstrates how the challenge is met in developing a positive safety culture in different national and organizational environments. Despite the different environments, international experience proves that there is much in common with the approach to assessing safety culture.

Before selecting and implementing a solution to a safety culture problem, it is important to consider the circumstances in which an organization finds itself, and its capability to implement the proposed solution. There are a number of organizational factors that need to be considered before finally deciding on the appropriateness of a solution. Two important factors are whether a continuous improvement attitude exists in the organization; and whether management is committed to the improvement of safety culture. These two key factors are characteristic of a learning organization. An important stage is when the safety culture assessment has been completed and the results have to be evaluated and improvement actions identified. Advice was given on how to manage this stage effectively. The important role that the regulator plays in promoting safety culture was discussed.

There are a number of methods for evaluating progress in improving safety culture. Depending on the improvement action, some methods are more appropriate. Employee survey, based on interview or questionnaire, is the method having general suitability.

It is important to detect signs of a weakening safety culture at an early stage so that remedial action can be taken. A variety of symptoms characterizing a potentially weak safety culture were described, and indicators suggested for their detection. Symptoms were considered from both the utility and regulator's perspectives

There are several IAEA publications available to help organizations develop a progressive safety culture. This report is a useful supplement to these publications. The IAEA also provides a range of safety culture services to Member States. The information in this report will extend the understanding of how to respond to the evolutionary nature of safety culture, and be of practical value to both utilities and regulators when considering the assessment of safety culture.

**RELEVANCE OF ORGANIZATIONAL FACTORS TO
COMMON PROBLEMS THAT MAY INHIBIT THE
SUCCESSFUL DEVELOPMENT OF SAFETY CULTURE**

The following is a list of common problems showing the relevance of the various organizational factors to each problem. The problems were identified by the subgroup and are not to be assumed as comprehensive.

**Organizational factor**

| No. | Problem | A | B | C | D | E | F | G |
|-----|---------|---|---|---|---|---|---|---|
| 1 | Ineffective feedback system | | R | | | U | | |
| 2 | Lack of management commitment | | | U | | | | |
| 3 | Bad housekeeping | | | U | | U | | |
| 4 | Management visibility | | | U | | U | | |
| 5 | Too theoretical approach to safety culture | | | | | | U | |
| 6 | Inappropriate membership of safety committees | | | | | U | U | |
| 7 | Regulatory difficulties in assessing safety | | | | | | R | R |
| 8 | Inappropriate documents | R | R | | | R | | |
| 9 | Lack of adequate review | | | | U | U | | |
| 10 | Lack of future prospects | U | | | | U | U | U |
| 11 | Inadequate QA procedures | R | | | U | | | |
| 12 | Adverse impact of subcultures | | | | | | U | U |
| 13 | Inadequate guidance for developing safety | | | | U | | | U |
| 14 | Deviation from procedure | | | U | | | U | |
| 15 | Employee ownership of change | U | | U | | | U | |
| 16 | Loopholes in procedures and systems | | | R | | | | |
| 17 | Safety culture confused with safety systems | | | | | | U | |
| 18 | Poor communication with regulator | | R | | R | | | |
| 19 | Inadequate learning from near misses | U | U | | U | U | | |

A – continuous improvement attitude
B – effective communication channels
C – management commitment
D – effective planning system
E – resource adequacy
F – skills and competencies
G – external influences

R – relevant to regulator
U – relevant to utility

**Appendix II**

**RELATIVE ADVANTAGES AND DISADVANTAGES OF DIFFERENT MEASURING METHODS**

| Method | Advantage | Disadvantage |
|---|---|---|
| Audit | ▪ Good for reviewing action plan elements<br>▪ Holistic approach<br>▪ Good for comparison of achievement with time<br>▪ Can bring in a new viewpoint<br>▪ Useful for regulators<br>▪ Diagnostic | ▪ Does not evaluate quality of elements<br>▪ Biased by people providing input<br>▪ Can be expensive or time consuming<br>▪ Can be affected by mind- set<br>▪ Can be associated with blame cultures<br>▪ External people may misunderstand cultural differences |
| Key performance indicators | ▪ Quantifiable<br>▪ Can give comparison of achievement over time<br>▪ Can cover a range of parameters<br>▪ Allows comparison between facilities<br>▪ Easy to communicate<br>▪ Useful for inclusion in reports | ▪ Limited in scope<br>▪ Non-diagnostic<br>▪ Mainly plant oriented<br>▪ Difficult to validate<br>▪ Long time lags<br>▪ Tend to be negative<br>▪ Influenced by random events |
| Peer review | ▪ Good for reviewing action plan elements<br>▪ Holistic approach<br>▪ Good for comparison of achievement over time<br>▪ Can bring in a new viewpoint<br>▪ Can bring in new practices<br>▪ Good for comparison with external benchmarks<br>▪ Systematic<br>▪ Encourages open communication<br>▪ Allows expert evaluation | ▪ Biased by people providing input<br>▪ Can be expensive or time consuming<br>▪ Can be affected by mind-set<br>▪ External people may misconstrue cultural differences<br>▪ Lack of independence |

| Method | Advantage | Disadvantage |
|---|---|---|
| Observation | ▪ Low cost<br>▪ Convenient and easy to do<br>▪ Flexible<br>▪ Can involve employee representatives<br>▪ Visible<br>▪ Can be routine or non-routine<br>▪ Results available quickly<br>▪ Good for internal or external use | ▪ Not systematic<br>▪ Comparisons can be difficult<br>▪ Limited value for assessing safety culture issues<br>▪ May be perceived as emphasizing the negative<br>▪ Reactive |
| Employee survey | ▪ Suitable for assessing psychological factors<br>▪ Valuable for assessing safety culture elements<br>▪ Provides knowledge about behaviour<br>▪ Good for qualitative analysis<br>▪ Useful for comparisons<br>▪ Wide-ranging application | ▪ Requires the involvement of specialists for best results<br>▪ Lack of acceptance and familiarity<br>▪ Difficult for non-specialists to interpret<br>▪ Danger of misuse<br>▪ Can be viewed as overly academic and unpractical |

**Appendix III**

**REVIEW OF SUITABILITY OF EVALUATION METHODS FOR SPECIFIC SAFETY CULTURE IMPROVEMENT ACTIONS**

Improvement action

| Method | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Audit | 0.5 | 1 | 0.5 | 1 | 0.5 | 0 | 0 | 1 | 0.5 | 1 | 1 | 1 | 1 | 1 | 0 | 0.5 | 1 | 1 | 1 | 0 | 12.5 |
| Key performance indicators | 0 | 0 | 0 | 1 | 0.5 | 1 | 1 | 0 | 0.5 | 0.5 | 1 | 1 | 1 | 0.5 | 0.5 | 0.5 | 0 | 0 | 0 | 0 | 8.5 |
| Peer review | 0.5 | 0.5 | 0.5 | 1 | 0.5 | 1 | 0 | 1 | 0.5 | 0.5 | 1 | 1 | 1 | 1 | 0 | 0.5 | 0.5 | 0.5 | 0.5 | 0 | 12 |
| Observation | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2.5 |
| Employee survey | 1 | 1 | 1 | 0.5 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0.5 | 0.5 | 1 | 1 | 1 | 1 | 0.5 | 1 | 17 |

0 not suitable; 0.5 partially suitable; 1 suitable.

*List of improvement actions identified by subgroup:*

1. Training
2. Restructuring organizations
3. Setting up safety culture task groups
4. Appointing facilitator or oversight group
5. Special initiatives, e.g. STOP, STAR
6. Adopting risk assessments for routine tasks
7. Behaviour modification programmes

8. Safety suggestion schemes
9. Incentives
10. Communication feedback
11. Allocation of safety budget
12. Near miss reporting
13. Housekeeping
14. Procedure revision

15. Programmed management visibility
16. Safety indicators in appraisals
17. Contractor selection, training
18. Benchmarking
19. Improve recruitment
20. Delegation of responsibilities

# RELATED IAEA PUBLICATIONS

**SAFETY SERIES**

| 85 | Safe Management of Wastes from the Mining and Milling of Uranium and Thorium Ores: A Safety Practice | 1987 |
|---|---|---|
| 35-S2 | Code on the Safety of Nuclear Research Reactors: Operation | 1992 |
| 110 | The Safety of Nuclear Installations: A Safety Fundamental | 1992 |

**NUSS (Nuclear Safety Standards) PROGRAMME — Operation**

| 50-SG-O1 (Rev. 1) | Staffing of Nuclear Power Plants and the Recruitment, Training and Authorization of Operating Personnel: A Safety Guide | 1991 |
|---|---|---|
| 50-SG-O11 | Operational Management for Radioactive Effluents and Wastes Arising in Nuclear Power Plants: A Safety Guide | 1986 |

**SAFETY STANDARDS SERIES**

**Nuclear Safety**

| NS-G-2.4 | The Operating Organization for Nuclear Power Plants: Safety Guide | 2001 |
|---|---|---|
| NS-G-3.1 | External Human Induced Events in Site Evaluation for Nuclear Power Plants: Safety Guide | 2002 |

**Operation of Nuclear Power Plants**

| NS-R-2 | Safety of Nuclear Power Plants: Operation (Safety Requirements) | 2000 |
|---|---|---|

**Radiation Safety**

| RS-G-1.1 | Occupational Radiation Protection: Safety Guide | 1999 |
|---|---|---|
| RS-G-1.4 | Building Competence in Radiation Protection and the Safe Use of Radiation Sources: Safety Guide | 2001 |

**SAFETY REPORTS SERIES**

| 1 | Examples of Safety Culture Practices | 1997 |
|---|---|---|
| 11 | Developing Safety Culture in Nuclear Activities, Practical Suggestions to Assist Progress | 1998 |

**INSAG SERIES**

| 75-INSAG-1 | Summary Report on the Post-Accident Review Meeting on the Chernobyl Accident | 1986 |
|---|---|---|
| 75-INSAG-4 | Safety Culture | 1991 |
| INSAG-13 | Management of Operational Safety in Nuclear Power Plants | 1999 |

**TECDOC SERIES**

| 743 | ASCOT Guidelines — Guidelines for Organizational Self-assessment of Safety Culture and for Reviews by the Assessment of Safety Culture in Organizations Team | 1994 |
|---|---|---|
| 1125 | Self-assessment of Operational Safety for Nuclear Power Plants | 1999 |
| 1209 | Risk Management: A Tool for Improving Nuclear Power Plant Performance | 2001 |
| 1226 | Managing Change in Nuclear Utilities | 2001 |

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| Parvez, T. | Directorate of Nuclear Safety and Radiation Protection, Pakistan |
| Qamrul Hoda, M. | Karachi Nuclear Power complex, Pakistan |
| Rollenhagen, C. | Vattenfall Energisystem AB, Sweden |
| Rycraft, H. S. | British Nuclear Fuels, United Kingdom |
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**Technical Committee Meetings**
Vienna, Austria: 3–5 June 1998; 23–25 October 2000
**Consultants Meeting**
Vienna, Austria: 26–29 January 1999