INSAG-15

Key Practical Issues in Strengthening Safety Culture

INSAG-15

A REPORT BY THE
INTERNATIONAL NUCLEAR SAFETY ADVISORY GROUP

INSAG

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INTERNATIONAL ATOMIC ENERGY AGENCY
VIENNA, 2002

The International Nuclear Safety Advisory Group (INSAG) is an advisory group to the Director General of the International Atomic Energy Agency, whose main functions are:

(1) To provide a forum for the exchange of information on generic nuclear safety issues of international significance;
(2) To identify important current nuclear safety issues and to draw conclusions on the basis of the results of nuclear safety activities within the IAEA and of other information;
(3) To give advice on nuclear safety issues in which an exchange of information and/or additional efforts may be required;
(4) To formulate, where possible, commonly shared safety concepts.

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FOREWORD

by Mohamed ElBaradei
Director General

Over the last decade, the concept of safety culture has been a vital element in discussions about safety in many industries. This reflects a recognition that, while having engineered safeguards and formal management systems to control risks is essential, it is equally important to win the commitment of the workforce to treat safety as a priority through a genuine corporate commitment to achieve high levels of safety.

INSAG-4, published in 1991, made one of the first attempts to define what is meant by safety culture and to turn the concept into practical language. INSAG-13 built on this by considering the organizational issues which underpin an excellent safety culture. The present publication extends this discussion further. It is an eminently practical report, written to translate the concept into everyday language, so that operators and regulators not only have a framework for understanding the subject but can measure performance — both personally and organizationally — against clearly stated and universally applicable criteria. The present report not only discusses the key issues underlying the establishment of safety excellence, but goes on to provide a series of simple prompts or questions which are aimed at all concerned, from the boardroom to the shop floor.

I am pleased to release this report to a wider audience. In particular, I hope that it will provoke wide discussion, and will be used as a basis for all 'stakeholders' involved in seeking improvements in safety culture to consider their corporate and personal responsibilities and to work actively together to promote changes leading from good performance to excellence.

EDITORIAL NOTE

Although great care has been taken to maintain the accuracy of information contained in this publication, neither the IAEA nor its Member States assume any responsibility for consequences which may arise from its use.

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1. INTRODUCTION

This report describes the essential practical issues to be considered by organizations aiming to strengthen safety culture. It is intended for senior executives, managers and first line supervisors in operating organizations. Although safety culture cannot be directly regulated, it is important that members of regulatory bodies understand how their actions affect the development of attempts to strengthen safety culture and are sympathetic to the need to improve the less formal human related aspects of safety. The report is therefore of relevance to regulators, although not intended primarily for them.

The International Nuclear Safety Advisory Group (INSAG) introduced the concept of safety culture in its INSAG-4 report in 1991 [1]. Since then, many papers have been written on safety culture, as it relates to organizations and individuals, its improvement and its underpinning prerequisites [2]. Variations in national cultures mean that what constitutes a good approach to enhancing safety culture in one country may not be the best approach in another. However, INSAG seeks to provide pragmatic and practical advice of wide applicability in the principles and issues presented in this report.

Nuclear and radiological safety are the prime concerns of this report, but the topics discussed are so general that successful application of the principles should lead to improvements in other important areas, such as industrial safety, environmental performance and, in some respects, wider business performance. This is because many of the attitudes and practices necessary to achieve good performance in nuclear safety, including visible commitment by management, openness, care and thoroughness in completing tasks, good communication and clarity in recognizing major issues and dealing with them as a priority, have wide applicability.

2. DEFINITION AND PRINCIPLES OF SAFETY CULTURE

In INSAG-4 [1] safety culture was defined as:

> "that assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding priority, nuclear plant safety issues receive the attention warranted by their significance."

Figure 1, reproduced from INSAG-4, shows the desired responses at the organizational levels of policy, management and the individual. The policy level establishes the necessary framework for the organization. Management shapes the working

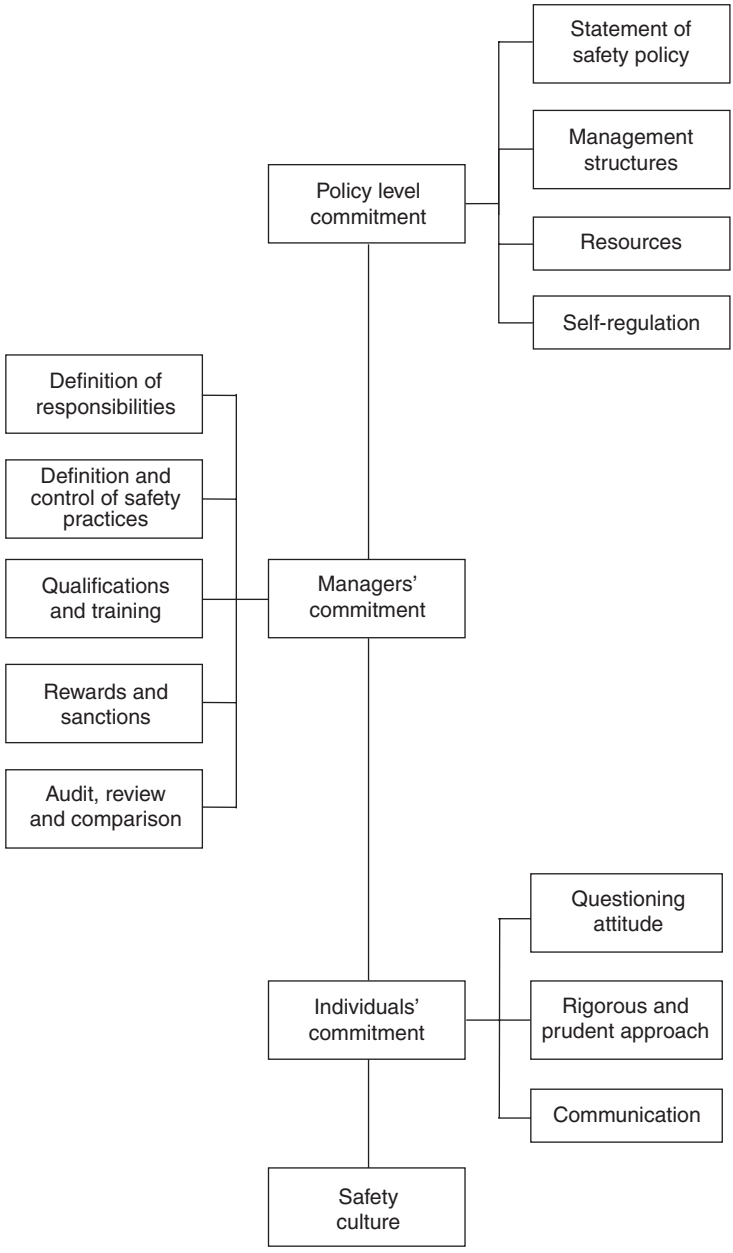

FIG. 1. Illustration of the presentation of safety culture. (Reproduced from INSAG-4 [1].)

environment and fosters attitudes conducive to achieving good safety performance. At the individual level, a questioning attitude, a rigorous and prudent approach, and good communication are emphasized.

IAEA Safety Reports Series No. 11 [3] makes it clear that safety culture is itself a subset of the culture of the whole organization, whereby the latter comprises the mix of shared values, attitudes and patterns of behaviour that give the organization its particular character. Put simply, it is 'the way we do things around here'.

Organizations typically go through a number of phases in developing and strengthening safety culture. IAEA Safety Report Series No. 11 identifies three stages:

(1) Safety is compliance driven and is based mainly on rules and regulations. At this stage, safety is seen as a technical issue, whereby compliance with externally imposed rules and regulations is considered adequate for safety.
(2) Good safety performance becomes an organizational goal and is dealt with primarily in terms of safety targets or goals.
(3) Safety is seen as a continuing process of improvement to which everyone can contribute.

The foregoing discussion is a simple and idealized representation of what is, in practice, a complex process. In reality, the three phases are not distinct and any organization may have some parts that are ahead of others in the process of strengthening safety culture.

In the first stage, improvements are often gained primarily by improving the engineered safeguards of the plant in line with, for example, the principles contained in INSAG-12 [4] (the revised version of INSAG-3), and introducing basic systems and procedures to control hazards. These improvements are often driven by the need to meet regulatory requirements and are usually achieved by means of management edict, using professional safety staff to deliver improvements. Staff tend to believe that safety is the responsibility of management and is largely imposed upon them by others.

The second stage of development involves the use of a framework such as that presented in INSAG-13 [2]. The organization will have developed a safety related vision or mission statement with clarity about its values and goals, and will have established clear processes and procedures for achieving its goals. At this stage, individual employees will notice that work is better planned, with prior consideration of safety hazards together with rules and procedures to govern what can and cannot be done that are systematically documented. However, in many organizations, this stage of safety is still often 'imposed' on the individual worker with little involvement or consultation, and is administered and monitored by safety

professionals. Although this phase of improvement can raise consciousness about the need to work in a safe environment, it does not of itself gain commitment to and identification with safety at the individual level and the team level.

The third stage of development is the ideal that many organizations are striving to attain. Achieving it is a continuing process. It requires a safety related vision and values that are fully shared. A large proportion of the individual employees in the organization need to be sufficiently committed that they are personally and actively involved in enhancing safety. As appropriate, contractors and others with an influence on safety will also be fully involved. Everyone will have a clear understanding of requirements and aspirations and, individually or particularly through teams, will show a commitment to achieving and sustaining enhancements to safety in all that they do.

At this stage safety is 'in the bloodstream' of the organization. Poor conditions and practices are viewed by all to be unacceptable and are openly challenged. Events and incidents, whether related to industrial safety, environmental issues, or radiological or nuclear safety, are seen not as part of normal working life but as exceptional and unacceptable occurrences that are avoidable. At this point a learning organization has been created with a self-sustaining safety culture.

It is important that any organization striving to move into the third stage of development does not neglect the earlier stages and the importance of going through them before proceeding to the last stage. Achieving good safety performance requires a rule based compliance culture and high quality engineering as prerequisites, and these need to be strongly maintained even while developing the elements more strongly related to human issues discussed in this report.

The following questions may help organizations to understand where they are within this hierarchy:

(a) To what extent is safety being achieved primarily by high standards of engineering control?
(b) Has the organization developed clear safety goals and a comprehensive system for the management of safety?
(c) Are most people, at all levels in the organization, actively and routinely involved in enhancing safety?

Although most organizations in the nuclear industry should be able to give generally positive answers to the first two of these questions, experience shows that fewer would be able to respond entirely positively to the third question. The purpose of the next section is to provide practical and pragmatic guidelines on the developments necessary for this challenging third phase and to provide some simple diagnostic questions which might aid progress on the route to improvements in safety performance. In the Appendix, simple diagnostic questions are elaborated upon and

directed at specific groups in any organization, from the board of directors to supervisors and operators. It is hoped that these questions will be used as a prompt for organizations and individuals to consider openly and honestly how they can increase, on a practical everyday basis, their contribution to developing a stronger safety culture.

3. KEY ISSUES IN SAFETY CULTURE

3.1. COMMITMENT

Commitment to safety and to the strengthening of safety culture at the top of an organization is the first and vital ingredient in achieving excellent safety performance. This means that safety (and particularly nuclear safety) is put clearly and unequivocally in first place in requirements from the top of the organization, and there is absolute clarity about the organization's safety philosophy. However, true commitment to the enhancement of safety means more than writing a policy statement and mentioning the importance of safety in speeches by senior staff. Although these are vital steps, most people are adept at spotting mismatches between fine words and reality. Commitment means not only providing leadership but also developing, in partnership with staff and their representatives, the means of translating the safety goals of the organization into day to day reality. This latter step provides the visible evidence that aspirations are really held. It means genuinely devoting time and resources to safety and requires that senior managers are trained and, in particular, have the necessary competence in matters relating to nuclear safety.

Questions which might test the real commitment of an organization to safety include the following:

(a) Has the organization developed with its staff a shared vision that achieves clarity about its expectations and goals that will both maintain safety and seek opportunities for improvement? Most importantly, can staff remember and relate to the key points?

(b) Are senior staff seen to be fulfilling these expectations themselves? For example, is safety the first item on the agenda at their meetings? Do they attend sites wearing appropriate personal protective equipment? Are managers seen to be devoting time and resources to safety, for example, spending a substantial proportion of their time at the plant looking specifically at the level of safety actually being achieved, and to challenging and praising different practices?

Have they taken the time to become sufficiently competent in nuclear safety issues?

(c) When difficulties arise, are expectations still fulfilled? For example, if maintenance is running behind schedule, are procedures still used effectively with no tendency to take shortcuts?

3.2. USE OF PROCEDURES

Management systems require clearly written procedures that are fit for their purpose to control all aspects of nuclear and radiological safety. However, there is a great difference between having excellent procedures on paper and having procedures that are understood and applied consistently and conscientiously by all staff. There is a need for balance in the number and extent of procedures. They should identify and address the main risks and be intelligible and of relevance to those who will use them. In particular, the rules and procedures, reinforced by training, need to bring out clearly to the workforce the reasons for particular requirements, since only then will the procedures pass the test of relevance required by the operator if he or she is to be fully committed to their use.

In other words, it is essential that employees' perceptions of risk are such that the requirements placed upon them are seen to be necessary and relevant. If procedures are not valued, shortcuts or 'work-arounds' will begin to be practised. This could lead to further degradation of safety standards, since working around a requirement which is not a prime safety requirement can quickly lead to a culture in which even vital and fundamental safety procedures are no longer viewed as sacrosanct. The important conclusion from this is that simple intelligible procedures should be in place for work which needs to be controlled. These procedures ought to be in a form that can be used directly at the place of work. The issue of how to respond to genuine errors and to violations of procedures is discussed in Section 3.4.

This discussion raises several diagnostic questions, which those responsible at operating organizations (and regulators) should consider:

(a) Have procedures been written in collaboration with the employees who will use them? Are they fit for their purpose and written clearly so that they are simple to understand and to use in practice?

(b) Do employees understand and accept the need for the rules and, in particular, do they understand the potential consequences, in terms of effects on safety and the environment, arising from non-compliance?

(c) Are the application and the accuracy of rules and procedures monitored, and are shortcomings quickly corrected with the involvement of the users? Has a

system of work-arounds, with or without the tacit approval of managers, begun to develop?

3.3. CONSERVATIVE DECISION MAKING

INSAG-4 [1] referred to a questioning attitude and a rigorous and prudent approach. Well tested systems relying on defence in depth and supported by procedural requirements will protect employees and the public from radiation hazards. It is easy, therefore, for the workforce to develop the attitude that safe conditions are provided for them by others, and that events at other plants are exceptional and isolated and could not occur at their plant. It is therefore essential that everyone connected with nuclear safety be constantly reminded of the potential consequences of failing to give safety absolute priority. Most incidents and accidents in the nuclear industry have occurred because someone has failed to take the relevant precautions or has failed to consider or question in a conservative way decisions that they have made or the steps which were taken to implement them.

In practice, it is important that there should be a requirement for each individual or team to stop and review safety before starting a piece of work or beginning to carry out a procedure. Various techniques have been developed, including the STAR (stop, think, act, review) principle. They all have one feature in common: the need to be conservative in safety related matters by staff checking their understanding of a situation (and if necessary seeking more information or advice) and by assuming that the worst could happen. To take a conservative course of action is not always easy, particularly when there are operational pressures, and this is when an organization's priorities have to be clear and genuinely accepted. To develop and reinforce this culture, employees should be praised if they stop work or do not approve modifications because there is a reasonable doubt about the safety implications.

The following questions may help to clarify whether such conservative decision making is genuinely encouraged and consistently applied:

(a) Is there a simple, well understood process to promote conservative decisions? For example, in appropriate circumstances, are staff encouraged to put in writing the basis for their course of action? Are they encouraged to consult experts about unexpected developments?
(b) Are personnel encouraged to take advice or to seek more information when they have doubts about safety? Can evidence be cited that this happens in practice?
(c) When conservative decisions are appropriately taken (such as stopping work for good safety reasons), is this visibly supported by senior managers?

3.4. A REPORTING CULTURE

Failures and 'near misses' are considered by organizations with good safety cultures as lessons which can be used to avoid more serious events. There is thus a strong drive to ensure that all events which have the potential to be instructive are reported and investigated to discover the root causes, and that timely feedback is given on the findings and remedial actions, both to the work groups involved and to others in the organization or industry who might experience the same problem. This 'horizontal' communication is particularly important. Near misses are also very important because they usually present a greater variety and volume of information for learning.

To achieve this, all employees need to be encouraged to report even minor concerns. This raises the important question of 'blame free' reporting. If employees are to report near misses, they must believe that these reports are valued and that they and their colleagues will not be penalized or disciplined as a result of coming forward to make them. There will, of course, be situations in which some action needs to be taken in relation to an individual as a result of an incident. One example would be a wilful act; another, the deliberate contravention of a procedure which is known to be workable, intelligible and correct. Sometimes retraining may be necessary. A more difficult issue arises when a conscientious worker makes repeated mistakes which cannot be corrected by coaching and retraining. However, in a good reporting culture, it is accepted that it is the failure to report any issue that may adversely affect safety which is unacceptable. A good reporting culture will be regarded by staff as 'just' and will be built on an atmosphere of trust.

This open and responsive approach to reporting and following up also has implications for regulators. For example, they may become aware of a greater number of 'failures' reported by the operating organization as such a system is developed and may be tempted to take action as a result. It is vital that a balanced view be taken, however, since overreaction could stifle developments which in the longer term will lead to real and sustainable enhancements in safety.

The following are pointers to consider in moving towards a strengthened safety culture:

(a) Are employees encouraged to report all events and near misses? Given that research has shown that the number of near misses usually exceeds the number of actual events by at least an order of magnitude, is the ratio of reports of near misses to events with real consequences sufficiently high?
(b) Are reports investigated and dealt with on a prioritized basis and is feedback given both to those who report the issue and to others who may benefit from the learning opportunity?
(c) Has a 'just' reporting culture been established in consultation with the workforce, so that there is an understood and accepted balance between 'no blame'

incidents and culpable ones such as malicious acts, deliberate violations or significant and repeated shortcomings in competence?

3.5. CHALLENGING UNSAFE ACTS AND CONDITIONS

Nearly all events, ranging from industrial and radiological accidents, incidents and near misses to failures affecting nuclear safety, start with an unintentionally unsafe act or an unacceptable plant condition or process. These have often been latent and have gone undetected or been treated as 'custom and practice' and therefore been ignored. Then, in combination with another challenge to the system, a further more significant failure occurs. Minimizing existing latent shortcomings in working practices or plant conditions is therefore vital in avoiding more serious events.

Minimizing latent shortcomings requires knowledge on the part of plant employees and contractors about why specific safety systems and requirements are in place, and about the importance of each item of plant in contributing to safety. Not only should they be suitably qualified and experienced for their particular areas of specialization, but they must be encouraged to challenge potentially unsafe practices and identify deficiencies wherever and whenever they encounter them. In addition to knowledge about the safety significance of plant, systems and procedures, they must be helped to develop the confidence to challenge others if they observe shortcomings in safety performance. This needs to be done in a constructive way and combined with praise for good safety performance.

Regulators, also, should be aware of why safety systems and requirements defined by plant management are in place, and why they are important. Regulators must also be particularly careful to ensure regulatory actions taken to correct deficiencies do not impede continued improvements in safety culture. For example, employees must still 'own' their procedures and the procedures must continue to be seen by employees as being fit for their purpose.

Failure to challenge, particularly by managers and supervisors, not only fails to eliminate the particular shortcoming in performance which has been observed, but also creates a culture in which failures, oversights and shortcuts become the norm. This is well captured by the phrase 'to tolerate is to validate'. This raises the following issues:

(a) Is there a process for identifying, reporting and correcting shortcomings in safety and unsafe acts in the workplace?
(b) Are employees fully involved in this process and are they trained to know how to challenge and praise in a constructive way? Can they readily distinguish between good and bad practices, and safe and unsafe acts? Is it acceptable for staff to challenge unsafe practices in the workplace?

(c) Are issues identified and dealt with promptly so that staff can see the improvements that have resulted from their commitment to enhancing safety?

3.6. THE LEARNING ORGANIZATION

If an organization stops searching for improvements and new ideas by means of benchmarking and seeking out best practice, there is a danger that it will slip backwards. A learning organization is able to tap into the ideas, energy and concerns of those at all levels in the organization. Enhancements in safety are sustained by ensuring that the benefits obtained from improvements are widely recognized by individuals and teams, and this in turn leads to even greater commitment and identification with the process of improving safety culture. Ideally, all employees are involved in proactively contributing ideas for improvement, and are encouraged to become aware of what world class performance in terms of safety means in their jobs. They contribute not because they are *told* to do so but because they *want* to do so. To do this, staff need to be given the opportunity to compare how they do things with how other workers do, so that they are aware of what constitutes excellence in their field of work. To generate a sense of achievement, they need to be enabled themselves to carry out, wherever it is safe and sensible for them to do so, the improvements which they have identified, and to do so with the evident encouragement and the full backing of management.

It is necessary to provide mechanisms to enable experience and ideas to be transferred within the organization. It is also necessary to have formal systems for monitoring and providing feedback to management so that they know the effectiveness of the improvements that have been carried out and for ensuring that the organization retains 'corporate memory' of why and how improvements have been made.

Although employees often concentrate initially on industrial safety and issues relating to plant conditions, involvement in and commitment to the improvement process is likely to lead to a wider appreciation of issues of nuclear safety and environmental issues, and to have broader benefits for the business in promoting a culture of active involvement and teamwork.

Schemes which encourage staff to provide ideas for improvement are valuable. Sometimes they can lead to either a team being rewarded or donations being made to good causes. However, experience shows that such schemes tend to lose momentum and to become less effective with time. More sustainable approaches involve encouraging staff to work as teams and continually to seek improvements by identifying prioritized actions to enhance safety in their own work areas.

Various indicators have been developed which allow some assessment to be made of the quality of particular aspects of safety culture in any organization. These are difficult to measure reliably and should not be given undue weight. Nonetheless,

they can provide a useful indication of the progress being made and of areas where further attention is required.

The process of safety performance declining through failure to encourage the adoption of new ideas and practices is insidious. Organizations rarely recognize the early signs of deterioration. Table I (based on INSAG-13 [2], para. 90) attempts to capture the stages of decline and their consequences, and illustrates the fact that complacency can be costly.

The following questions might be considered in relation to an organization's commitment to learning:

(a) Are there mechanisms which fully involve staff and relevant contractors in contributing ideas for improvement? Are they encouraged to implement these measures themselves whenever it is safe and beneficial for them to do so?
(b) Are employees, as individuals and in teams, given the opportunity to look outside their organization in order to learn from best practice and are they given time to effect improvements? Are they encouraged to share ideas with their peers, and to carry out evaluations of their own working practices and performance?
(c) Are the results of the learning process fed back into the system of management and training for safety, and are mechanisms in place to ensure that a 'corporate memory' of events is retained?
(d) Are there systems in place to allow safety performance to be critically appraised, both by line managers and by others independent of line managers, in order to try to identify whether the organization's safety standards are falling or whether complacency is developing?

3.7. UNDERPINNING ISSUES: COMMUNICATION, CLEAR PRIORITIES AND ORGANIZATION

In addition to the specific issues discussed earlier, there are three prerequisites which underpin all of these questions.

The first is that of establishing good communication about safety issues. This involves the three elements of communication: transmission, reception and verification. Various methods can be valuable, from oral team briefings to dedicated written safety communications, but there is little doubt that face to face communication, achieved with high visibility of managers and supervisors at the place of work, has the greatest effect. It is sometimes found that, even when managers are able to provide evidence that they have transmitted a message concerning safety, it is the perception of employees that they have not received adequate information or that they do not recognize its significance to them. This means that the form of transmission is inappropriate, that there is insufficient clarity or that the message is not being

TABLE I. TYPICAL PATTERN OF DECLINING SAFETY PERFORMANCE *(after INSAG-13 [2], para. 90)*

Stage 1: Overconfidence	This is brought about as a result of good past performance, praise from independent evaluations and unjustified self-satisfaction.
Stage 2: Complacency	In this phase, minor events begin to occur at the plant and self-assessments that are inadequate are performed to understand their significance singly or in total. Oversight activities begin to be weakened and self-satisfaction leads to delay or cancellation of some improvement programmes.
Stage 3: Denial	Denial is often visible when the number of minor events increases further and more significant events begin to occur. However, there is a prevailing belief that these are still isolated cases. Negative findings by internal audit organizations or self-assessments tend to be rejected as invalid and the programmes to evaluate root causes are not applied or are weakened. Corrective actions are not systematically carried out and improvement programmes are incomplete or are terminated early.
Stage 4: Danger	Danger sets in when a few potentially severe events occur but management and staff tend consistently to reject criticisms coming from internal audits, regulators or other external organizations. The belief develops that the results are biased and that there is unjust criticism of the plant. As a consequence, oversight organizations are often silent and afraid to make negative assessments and/or to confront the management.
Stage 5: Collapse	Collapse can be recognized most easily. This is the phase where problems have become clear to all parties and the regulator and other external organizations need to make special diagnostic and augmented evaluations. Management is overwhelmed and usually needs to be replaced. A major and very costly improvement programme usually has to be implemented.

Note: It is important that declining performance be recognized in the first two stages and at the latest by early in Stage 3.

welcomed by those receiving it. It is thus important to check that messages not only have been sent but also have been received and understood, and are being acted upon. It is also important to ensure that communication with regulatory bodies is carried out using the same principles.

The second issue is that of ensuring that a sense of reality is retained about what can be achieved and on what timescales. Many programmes of safety enhancement have faltered because of a failure to deliver agreed objectives. The key prerequisite here seems to be one of prioritization. Providing 'wish lists' of improvements, which are not delivered or are only partly implemented because clear priorities have not been agreed, not only fails to deliver real improvement but also encourages cynicism and a feeling of initiative overload, and ultimately results in a loss of momentum in the process of safety enhancement. In discussions with staff and contractors, it is important that realistic objectives and timescales are set, and that efforts to achieve these are then properly resourced. Plans for enhancement or improvement need to be prioritized, with feedback to regulatory bodies and employees on why certain activities have been selected for implementation while others have not been given the same priority. One important way of signalling intent and providing a vehicle for change is the deployment of a plan to improve safety. To be effective this must be prioritized, reflect any changes in priority (i.e. be a living document) and, very importantly, be developed and widely shared with the workforce. It is also vital that such a plan should identify measures of success and be clear about timescales and accountabilities.

The third underlying issue is that of achieving and maintaining clarity about the organizational structure and accountability for what is to be done. People need to know what their task is in the organization, and how their skills and knowledge are to be used in achieving and maintaining its goals. All team members need to know and respect the inputs expected of the other members, and of those, such as contractors, who are working alongside them. This is particularly important in periods of rapid organizational change.

This discussion prompts the following diagnostic questions:

(a) Does there exist an effective system for communication on safety issues in the organization? Has this system been tested to check that messages are both being received and being understood by the workforce at all levels?
(b) Is there clarity about the key agreed objectives for safety enhancement? Are these objectives prioritized and achievable, and are people accountable for their delivery?
(c) Are these priorities understood by the workforce and by regulatory bodies, and are the workforce and the regulators involved in the process?
(d) Is there clarity about who is responsible and accountable for carrying out work, particularly in periods of rapid change?

4. CONCLUSIONS

Organizations go through a number of phases in developing and strengthening their safety cultures. While continuing to maintain and improve engineered safeguards and operating in a well developed system for managing safety, organizations need to strive for a culture in which there is real commitment from the top of the organization to a safety vision, a set of values and ways of working that are developed with and identified with by the workforce. In organizations with a strong safety culture, a large proportion of the workforce, often working in teams, will be committed to and actively involved in a continuous process of safety enhancement as part of a learning organization. These attitudes and the ways of thinking and working to which they lead can give rise to wider benefits to the industry, including, for example, improvements in terms of quality and environmental standards.

The first step in promoting a strong safety culture is vital: to obtain visible commitment from the top of the organization. This means that senior managers are seen to devote time and resources to safety, and to act as role models for their own staff, with their actions clearly matching their words.

Procedures to control work should be clearly expressed, simple and usable on a day to day basis. In particular, staff (and, where appropriate, contractors) need to be involved in the development and improvement of procedures, and to understand clearly the consequences in terms of effects on health, safety and the environment of not following them. Managers and supervisors need to be vigilant so that 'workarounds' are not allowed to develop. Shortcuts or failures to follow requirements should not be condoned, even when there are strong operational pressures to do so. Complacency and denial help to establish an unsatisfactory culture which is difficult to rectify later.

It is important that the workforce be encouraged to have a questioning attitude and to take conservative actions in matters relating to health, safety and the environment. Reviewing actions using such approaches as STAR (stop, think, act, review) and seeking help where there is any doubt about safety should be strongly supported, even if this leads to delays or some loss of production. All staff members and relevant contractors need to be reminded frequently that failures in the nuclear industry can have serious consequences for themselves, their colleagues and the public, and that complacency is not acceptable.

Near misses constitute a rich source of information for the learning process, and reporting them by means of a well defined system is very important. Such reporting needs to be encouraged in an atmosphere of trust, the lessons learned need to be made widely available to those who might benefit, and problems that are identified need to be corrected quickly and visibly. Unsafe practices and deficiencies in systems and procedures should be the subject of challenge by everyone in the organization. It is important to give people the confidence and skills to challenge unsafe practices

constructively and to praise good performance. Small deviations from safe practice or from the correct plant configuration can remain latent until another, often unrelated, deviation occurs. Taken in combination, these deviations might then lead to a much more substantial incident or accident. This is an important reason for actively seeking to eliminate shortcomings which on their own may not seem to be of major significance.

Improvement is a continuous process. It requires self-critical, open and constructive comparison with others and 'benchmarking' against them. Involvement of the workforce is vital if areas for improvement are to be recognized, and then owned and sustained. Line management must also be seen to welcome scrutiny from peers and to be open to such scrutiny, as part of the process of actively promoting a learning organization.

Several additional factors underpin excellence in safety. Firstly, it is important that there be clarity in the organization about responsibilities and accountabilities (particularly in periods of rapid organizational change). Secondly, communication needs to be a continuous high priority process, with checks to see that messages have been both received and understood. Finally, the temptation to provide unattainable wish lists of potential improvements, possibly leading to initiative overload, needs to be resisted. Stakeholders such as the workforce and regulators should be consulted on priorities, and should contribute to an adequately resourced, continuously developed and realistic plan for improvements, in which accountabilities are clear and progress is continuously monitored.

Appendix

EXAMPLES OF QUESTIONS FOR ASSESSING PERSONAL CONTRIBUTIONS TO THE ENHANCEMENT OF SAFETY CULTURE

This Appendix contains a series of questions, arising from the discussion in the main part of the report, which might be used by members of an organization — from the boardroom to the shop floor — to help them consider their personal contributions to safety culture. The questions are not intended to be exhaustive. INSAG encourages operating organizations to use these questions as a basis for discussion and to consider developing them further as 'prompts' which might be made available to encourage everyone in the organization to review critically their actions and behaviour and to consider how they personally can contribute to enhancing safety. This process can itself be a useful contributor to improving safety culture. It is also recommended that regulatory bodies establish a parallel set of questions for use in their own organizations. Included in this set would be questions that relate to the potential for the regulator to influence the safety culture of the operating organization, both positively and negatively.

A.1. QUESTIONS FOR MEMBERS OF BOARDS OF DIRECTORS

(1) Do I have a clear picture of what is needed in the organization to strengthen safety culture and to achieve a high level of safety?
(2) Have we published an agreed clear statement of our expectations for safety?
(3) Is safety on the agenda of the next Board Meeting?
(4) Do I know what the current safety issues are?
(5) Do I have the necessary experience and knowledge of safety, and nuclear safety in particular, in order to make sound judgements and take action on the issues before us?
(6) Do I visit my plants regularly and give attention to safety issues?

A.2. QUESTIONS FOR CHIEF NUCLEAR OFFICERS AND EXECUTIVE OFFICERS

(1) Do I have a clear picture of what is needed in the organization in order to strengthen safety culture and achieve a high level of safety?

(2) Have we published an agreed clear statement of our expectations for safety?
(3) Have I checked whether my staff understand these expectations?
(4) How do I know that my managers are really committed to the view that a 'safety first' plant is also a well run plant?
(5) Was safety the first item discussed in our last management meeting?
(6) Do I make myself visible to staff and demonstrate my personal commitment to safety by means of my actions as well as my words?
(7) What did I do last week to demonstrate my commitment to safety?
(8) Do I consistently praise good practices and challenge poor ones?
(9) The last time that we were behind schedule, did I allow shortcuts to be taken?
(10) Did I visibly support my staff the last time that they stopped operations for safety reasons?
(11) Following an unexpected outage, did I ask first about the safety implications or did I ask first when the plant would be back online?
(12) Do I have the systems to ensure that the correct information about safety issues is before me so that I can make sound decisions?
(13) Am I making adequate resources available to implement the improvements we agreed on?
(14) Am I confident that near misses and a larger number of minor events are really being reported?
(15) Do I have a means of independently checking that my management processes and systems are working properly?
(16) How do I know that we are not becoming complacent? Am I confident that I really know?
(17) Do I know how my organization compares with others in terms of safety culture?
(18) When did we last have a peer review?
(19) What evidence do I have that we really are a 'learning organization'?
(20) Do we have a clear, prioritized programme for safety enhancement to which everyone is committed?

A.3. QUESTIONS FOR THE STATION DIRECTOR AND SENIOR MANAGERS

(1) Have we published an agreed clear statement of our expectations for safety?
(2) When I ask my staff what our expectations for safety are, can they tell me?
(3) How do I know that my managers are really committed to the view that a 'safety first' plant is also a well run plant?
(4) Was safety the first item discussed in our last management meeting?

(5) When was I last in the plant visibly making my commitment to safety apparent through my actions?
(6) What did I do last week to demonstrate my commitment to safety?
(7) Do I consistently praise good practices and challenge poor ones?
(8) The last time that we were behind schedule, did I allow shortcuts to be taken?
(9) Do my staff understand what could happen to the plant or to people if a procedure is not followed?
(10) Am I aware which 'work-arounds' exist — and am I still allowing them?
(11) Was our last decision on plant maintenance or plant operation a conservative one?
(12) Following an unexpected outage, did I ask first about the safety implications or did I ask first when the plant would be back online?
(13) Am I sure that our system to implement findings from event reports and peer reviews is working?
(14) Do I deal promptly with unsafe acts and/or conditions when I see them or when they are pointed out to me?
(15) Do I know what the real safety issues in my plant are?
(16) Do all my staff fully understand the potential safety consequences of mistakes which they may make?
(17) Do we systematically look at other organizations and other parts of our own organizations to see what we can learn from them?
(18) Do I encourage my staff, working in teams, to think about how we can enhance safety?
(19) How do I know that we are not becoming complacent? Am I confident that I really know?
(20) Do I really know whether our procedures and management processes are working properly?
(21) What evidence do I have that we really are a 'learning organization'?
(22) Do we have a clear prioritized programme for the enhancement of safety which my staff have been involved in developing?

A.4. QUESTIONS FOR MIDDLE MANAGERS

(1) Was safety the first item discussed in our last management meeting and team briefing?
(2) When was I last in the plant and visibly taking an interest in safety matters?
(3) What did I do last week to demonstrate my commitment to safety?
(4) Do I consistently praise good practices and challenge poor ones?
(5) The last time that we were behind schedule, did I allow shortcuts to be taken?
(6) Did the staff who are going to use our procedures help to write them?

(7) Are our procedures simple to understand and to follow?
(8) Do my staff understand what could happen to the plant or to people if a procedure is not followed?
(9) Have my staff told me about poor procedures recently and have I taken any action?
(10) Am I aware which 'work-arounds' exist — and am I still allowing them?
(11) What specifically did we do the last time a workable procedure was ignored or not followed?
(12) Was the last decision I made on a safety related issue a conservative one?
(13) Did my staff actually 'stop, think, act and review' the last time that they carried out a safety related task? How do I know?
(14) How do I know that my supervisors are really committed to the view that a 'safety first' plant is also a well run plant?
(15) Do my staff seek advice when they have any doubts about safety?
(16) Did I visibly support my staff the last time that they stopped operations for safety reasons?
(17) How do I know that my staff understand my expectations on safety?
(18) Did I deal promptly with the last unsafe act reported to me? Did I thank and give feedback to the person who reported it to me?
(19) Do my staff fully understand the potential safety consequences of mistakes which they may make?
(20) What does the ratio of near misses to accidents reported tell me about our reporting system?
(21) Was I clear about who is responsible for implementing the last safety enhancement that we agreed on? Do the workers on the shop floor know?
(22) What evidence do I have that we really are a 'learning organization'?
(23) Do I explain to my staff and involve them in discussions about what our real safety priorities are?

A.5. QUESTIONS FOR FIRST LINE SUPERVISORS

(1) Was safety the first item discussed in our last team briefing?
(2) What did I do last week to demonstrate my commitment to safety?
(3) Did the staff who are going to use our procedures help to write them?
(4) Are our procedures simple to understand and to follow?
(5) Do my staff understand what could happen to the plant or to people if a procedure is not followed?
(6) Have my staff told me about poor procedures and have I done anything about it?
(7) Am I aware which 'work-arounds' exist — and am I still allowing them?

(8) What specifically did we do the last time a workable procedure was ignored or not followed?
(9) Did my staff actually 'stop, think, act and review' the last time that they carried out a safety related task? How do I know?
(10) Did my staff seek advice when they had doubts about safety?
(11) Did I visibly support my staff the last time that they stopped operations for safety reasons?
(12) What did I do when a staff member did not report 'mistakes' or near misses?
(13) How do I know that my staff challenge unsafe acts and/or conditions when they observe them?
(14) Do I challenge unsafe acts and/or conditions when I see them and deal with them promptly?
(15) Do I encourage my staff to give me ideas for improvement? Do I act on them?
(16) How do I know that my staff understand our safety message?
(17) Did I take a demonstrably prudent approach when I supervised my staff's work last week?
(18) Do my staff really understand how what they do could lead to serious consequences? How do I know?

A.6. QUESTIONS FOR THE SHOP FLOOR

(1) Do I always understand a task before carrying it out?
(2) Do I know what my responsibilities are?
(3) Do I understand what could go wrong and what could happen if I do not carry out this job properly?
(4) Do I have the necessary knowledge to proceed?
(5) Do I know everyone who is jointly responsible for this task?
(6) Are there any unusual circumstances about this job?
(7) Do I need any assistance and do I know where to obtain this from?
(8) Do I know what to do if something goes wrong?
(9) Do I understand what the procedures are and the reasons for them?
(10) Would my instructions be easier to understand and to follow if I was involved in producing them? What could I do to improve them?
(11) Have I followed the appropriate procedures?
(12) Am I prepared for the unexpected?
(13) Do I stop and think when a problem arises?
(14) Am I taking shortcuts?
(15) Am I being clean and tidy in carrying out my work?
(16) Did I report the last problem that I saw?

(17) Do I point out to others when I see them doing something unsafe or say ‘well done’ when they are doing something in a very safe way?
(18) Do I really understand how what I do could have serious consequences?
(19) Do I ensure that the workers on the next shift are fully informed about safety issues when they take over the job in hand?

REFERENCES

[1] INTERNATIONAL NUCLEAR SAFETY ADVISORY GROUP, Safety Culture, Safety Series No. 75-INSAG-4, IAEA, Vienna (1991).

[2] INTERNATIONAL NUCLEAR SAFETY ADVISORY GROUP, Management of Operational Safety in Nuclear Power Plants, INSAG Series No. 13, IAEA, Vienna (1999).

[3] INTERNATIONAL ATOMIC ENERGY AGENCY, Developing Safety Culture in Nuclear Activities: Practical Suggestions to Assist Progress, Safety Reports Series No. 11, IAEA, Vienna (1998).

[4] INTERNATIONAL NUCLEAR SAFETY ADVISORY GROUP, Basic Safety Principles for Nuclear Power Plants (75-INSAG-3 Rev. 1), INSAG Series No. 12, IAEA, Vienna (1999).

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