

IAEA-TECDOC-1329

# ***Safety culture in nuclear installations***

*Guidance for use in the enhancement of safety culture*



INTERNATIONAL ATOMIC ENERGY AGENCY

IAEA

December 2002

The originating Section of this publication in the IAEA was:

Operation Safety Section  
International Atomic Energy Agency  
Wagramer Strasse 5  
P.O. Box 100  
A-1400 Vienna, Austria

SAFETY CULTURE IN NUCLEAR INSTALLATIONS: GUIDANCE FOR USE IN THE  
ENHANCEMENT OF SAFETY CULTURE

IAEA, VIENNA, 2002  
IAEA-TECDOC-1329  
ISBN 92-0-119102-2  
ISSN 1011-4289

© IAEA, 2002

Printed by the IAEA in Austria  
December 2002

## FOREWORD

This guidance has been developed for use in the IAEA's Safety Culture Services, which provides support to Member States in their efforts to develop a sound safety culture of their organizations. It will be of particular use in seminars and training workshops that are part of these services. Much of the information in this publication reflects the approach the IAEA has adopted to assist nuclear organizations in Member States in improving their safety culture.

This guidance covers topics such as: what is culture, and in particular what is safety culture; what are the stages of development of safety culture, and how you can assess its development using employee surveys; what practices can be used to develop safety culture, and what indicators will help monitor progress. The symptoms of a weakening safety culture are described, as well as the lessons learned from organizations who have experienced safety culture problems. This guide also contains information on how to undertake the process of transforming the existing safety culture, and develop a learning culture in an organization that is based on continuous improvement. The relationship between quality and safety is discussed. The safety culture services offered by the IAEA are also described.

The IAEA's perspective of safety culture has expanded with time as its understanding of the complexities of the concept developed. The concept of safety culture was first introduced by the International Nuclear Safety Advisory Group formed by the IAEA. In their report (INSAG-4, 1991) they maintained that the establishment of a safety culture within an organization is one of the fundamental management principles necessary for the safe operation of a nuclear facility. The definition recognized that safety culture is both structural and attitudinal in nature and relates to the organization and its style, as well as to attitudes, approaches and the commitment of individuals at all levels in the organization. In the framework of the IAEA Assessment of the Safety Culture in Organizations Team (ASCOT) activities, significant work has been done with respect to indicators to determine the effectiveness of safety culture. IAEA-TECDOC-860, ASCOT Guidelines, issued in 1996, proposed key indicators for the different areas that need to be considered when assessing safety culture. A number of other INSAG reports and Safety Series reports have been published by the IAEA to provide information that will be helpful to organizations that are interested in developing or enhancing their safety culture.

Recently the IAEA's perspective on safety culture has broadened even further with attention focused on obtaining a deeper understanding of the actual concept of culture and particularly organizational culture. The approach supplements the IAEA's previous efforts to promote a better understanding of safety culture, but does not replace them. It can be argued that the IAEA's perspective of safety culture has evolved in stages. The first stage was associated with the definition of safety culture; the second stage with how to assess it; the third stage on how to enhance it; and the fourth and current stage on obtaining a deeper understanding of the actual concept of culture. The hope is that the more sophisticated understanding obtained in the fourth stage will lead to improved ways of assessing safety culture, and also increase our ability to detect changes in safety culture at an early point in time. This ability will enable corrective actions to be taken to avoid the consequences of a deteriorating safety culture.

The IAEA is very grateful to M. Merry of the United Kingdom, who compiled the present publication. The IAEA officer responsible for this publication was K. Dahlgren Persson of the Division of Nuclear Installation Safety.

### *EDITORIAL NOTE*

*The use of particular designations of countries or territories does not imply any judgement by the publisher, the IAEA, as to the legal status of such countries or territories, of their authorities and institutions or of the delimitation of their boundaries.*

*The mention of names of specific companies or products (whether or not indicated as registered) does not imply any intention to infringe proprietary rights, nor should it be construed as an endorsement or recommendation on the part of the IAEA.*

## CONTENTS

|  |    |
|--|----|
| 1. INTRODUCTION.....   | 1  |
| 2. WHAT IS CULTURE? .....  | 3  |
| 2.1. Introduction .....  | 3  |
| 2.2. Three levels of culture .....   | 3  |
| 2.2.1. Level one: Artefacts .....  | 4  |
| 2.2.2. Level two: Espoused values .....  | 4  |
| 2.2.3. Level three: Basic assumptions .....  | 4  |
| 2.3. Definition of culture .....   | 5  |
| 2.4. Diversity of culture .....  | 6  |
| 2.5. Is there a right or wrong culture?.....   | 7  |
| 2.6. Relation of climate to culture .....  | 7  |
| 3. WHAT IS SAFETY CULTURE.....   | 8  |
| 3.1. Foundation for operational safety.....  | 8  |
| 3.2. Three level model of safety culture .....   | 9  |
| 3.3. Characteristics of safety culture .....   | 10 |
| 3.3.1. Characteristics at artefact and/or espoused value level .....                                     | 10 |
| 3.3.2. Characteristics at espoused value level .....   | 13 |
| 3.3.3. Characteristics at basic assumption level .....   | 13 |
| 3.4. Definitions of safety culture .....   | 14 |
| 4. STAGES OF DEVELOPMENT OF SAFETY CULTURE .....   | 16 |
| 4.1. Evolution of view on what influences safety culture .....   | 16 |
| 4.2. Stages of development of safety culture.....  | 17 |
| 4.2.1. Stage 1 — Safety based on rules and regulation .....  | 17 |
| 4.2.2. Stage 2 — Safety becomes an organizational goal .....   | 18 |
| 4.2.3. Stage 3 — Safety can always be improved .....   | 19 |
| 4.3. Assessing the stage of development of safety culture .....  | 19 |
| 5. EMPLOYEE SURVEYS .....  | 22 |
| 5.1. Characteristics of various survey methods .....   | 23 |
| 5.1.1. Quantitative written questionnaire .....  | 23 |
| 5.1.2. Written questionnaire with narrative element .....  | 23 |
| 5.1.3. Face-to-face interviews .....   | 23 |
| 5.1.4. Focus group interviews.....   | 24 |
| 5.2. The survey process .....  | 25 |
| 5.2.1. Key objectives .....  | 25 |
| 5.2.2. Assessing survey costs and benefits .....   | 26 |
| 6. SELF-ASSESSMENT OF SAFETY CULTURE.....  | 32 |
| 6.1. Using the three level model .....   | 32 |
| 6.1.1. Identify artefacts.....   | 32 |
| 6.1.2. Identify espoused values.....   | 33 |
| 6.1.3. Compare espoused values with artefacts.....   | 33 |
| 6.1.4. Eliciting the basic assumptions .....   | 33 |
| 6.2. Linking artefacts, espoused values and basic assumptions to safety culture<br>characteristics ..... | 34 |
| 6.3. Designing a safety culture questionnaire.....   | 34 |

|   |    |
|---|----|
| 6.3.1. Ambiguity or uncertainty about language and terminology..... | 35 |
| 6.3.2. Lack of clarity about the information required.....          | 35 |
| 6.3.3. Combining multiple questions into one question.....          | 35 |
| 6.3.4. Making unjustified assumptions.....                          | 36 |
| 6.3.5. “Don’t know” and “Not applicable”.....                       | 36 |
| 6.3.6. Leading questions.....                                       | 36 |
| 6.4. Format of questions.....                                       | 36 |
| 6.5. Building the safety culture questionnaire.....                 | 37 |
| 6.6. Sample population.....   | 38 |
| 6.7. General points.....  | 38 |
| 6.8. Interviews.....  | 38 |
| 7. PRACTICES TO DEVELOP SAFETY CULTURE.....                         | 40 |
| 8. SAFETY CULTURE INDICATORS.....                                   | 46 |
| 8.1. Types of performance indicator.....                            | 46 |
| 8.2. Measurability.....   | 47 |
| 8.3. Consequences of measuring.....                                 | 48 |
| 8.4. Examples of safety culture indicators.....                     | 48 |
| 8.5. Safety culture index.....                                      | 49 |
| 9. SYMPTOMS OF A WEAKENING SAFETY CULTURE.....                      | 51 |
| 9.1. Stages of organizational decline.....                          | 51 |
| 9.2. List of symptoms of a weakening safety culture.....            | 52 |
| 9.2.1. Organization’s perspective.....                              | 52 |
| 9.2.2. Regulator perspective.....                                   | 54 |
| 10. LESSONS LEARNED.....  | 57 |
| 10.1. Common symptoms and causes of safety problems.....            | 57 |
| 10.2. Recovery processes.....                                       | 58 |
| 11. CHANGING THE SAFETY CULTURE.....                                | 60 |
| 11.1. Simple model of transformational change.....                  | 60 |
| 11.1.1. Disconfirmation.....  | 60 |
| 11.1.2. Survival anxiety or guilt.....                              | 61 |
| 11.1.3. Psychological safety.....                                   | 61 |
| 11.1.4. Cognitive redefinition.....                                 | 62 |
| 11.1.5. Methods for learning new concepts.....                      | 62 |
| 11.1.6. Internalizing new concepts and meanings.....                | 63 |
| 11.2. Enhancing the safety culture.....                             | 63 |
| 12. THE LEARNING CULTURE.....                                       | 65 |
| 12.1. Types of learning.....  | 65 |
| 12.2. Mistakes and the learning organization.....                   | 66 |
| 12.3. Characteristics of a learning culture.....                    | 67 |
| 13. KEY POINTS ABOUT CULTURE.....                                   | 72 |
| 13.1. Key points to remember about culture.....                     | 72 |
| 13.2. Key attributes for leading change.....                        | 73 |
| 13.3. Power and change.....   | 74 |
| 14. QUALITY MANAGEMENT AND SAFETY.....                              | 76 |

|   |    |
|---|----|
| 14.1. Quality management system.....      | 76 |
| 14.2. Quality management and safety ..... | 78 |
| 15. WHAT MAKES A GREAT WORKPLACE?.....    | 80 |
| 16. IAEA SAFETY CULTURE SERVICES.....     | 83 |
| BIBLIOGRAPHY .....                        | 87 |
| CONTRIBUTORS TO DRAFTING AND REVIEW ..... | 89 |





# 1. INTRODUCTION

This guidance is for training purposes. It is directed at organizations that operate NPPs, nuclear facilities or nuclear installations and are interested in developing their understanding of the concept of safety culture and how safety culture can be enhanced. The information will be particularly useful for persons in charge of raising employee awareness of safety culture in order to improve organizational safety performance. Each section of this guidance deals with an important aspect of safety culture, including how to assess and transform the existing safety culture.

The contents of the sections are briefly summarized below so that the user can decide which modules need to be included in any particular stage of a safety culture improvement programme.

*Section 1:* Culture is a complex concept and before any effort is devoted to improving the safety culture, it is necessary that people get a basic understanding of what “culture” is. This section describes a model of culture that is based on multiple levels that cover both the visible and less visible aspects of culture. Culture is defined in this section.

*Section 2:* This section describes the foundations for operational safety and also how the multilevel model of culture can be applied to safety culture. The various characteristics of safety culture are described, and several definitions of safety culture given.

*Section 3:* Safety culture evolves and this section discusses the three stages through which it can evolve in an organization. These stages reflect, to some extent, how the view has changed of what is the dominant underpinning basis for safety in an organization. The characteristics of each stage are described as well as a method for determining which stage an organization has reached.

*Section 4:* The characteristics of various survey methods are discussed, in particular the relative advantages and disadvantages of questionnaires and interviews. Both these methods are commonly used in the assessment of safety culture. The information in this and the next section will be of interest to persons involved in the self-assessment of safety culture in their organization. A general model of the survey process is described.

*Section 5:* This section contains more detailed information on how to assess safety culture in an organization. The design of an effective safety culture questionnaire is discussed in sufficient detail to allow an organization develop its own customized questionnaire.

*Section 6:* This section describes practices that can help an organization develop its safety culture.

*Section 7:* The use of indicators to monitor the state of safety culture in an organization is discussed. The advantages and disadvantages of using indicators are considered. The possibility of using a safety culture index to reflect the aggregate performance of a number of safety culture indicators is discussed.

*Section 8:* This section describes the symptoms of a weakening safety culture. The symptoms are grouped into two categories: those that are readily detectable by the organization itself, and those that are more easily detected by a person external to the

organization. Detecting symptoms at an early stage is important if safety culture problems are to be avoided.

*Section 9:* Several organizations located in different parts of the world have experienced significant safety culture problems that have threatened their survival. This section is a summary of the lessons learned from the experience of these organizations. The role of the regulator in any recovery process is discussed.

*Section 10:* The challenges faced by an organization in changing its safety culture are discussed. A simple model of transformational change is described.

*Section 11:* The characteristics of a learning culture are described. Single and double loop learning are defined.

*Section 12:* This section summarizes some of the key points about culture and describes key attributes for leading change in an organization. The importance of considering power relationships in an organization during the change process is discussed.

*Section 13:* The role of quality management in the improvement of safety performance is discussed. The relationship between quality management, safety management, safety culture and leadership is illustrated.

*Section 14:* The characteristics of a vibrant workplace are described. A vibrant workplace is one where employees are fully engaged and motivated. A list of questions is given that will allow a person to determine what stage has been reached in becoming an organization that is a great place to work.

*Section 15:* This section describes the range of services offered by the IAEA to help Member States improve their safety culture.

## 2. WHAT IS CULTURE?

### 2.1. INTRODUCTION

In order to understand safety culture, it is necessary to have an insight into the concept of culture. The first step is to obtain an appreciation of culture in its broadest sense.

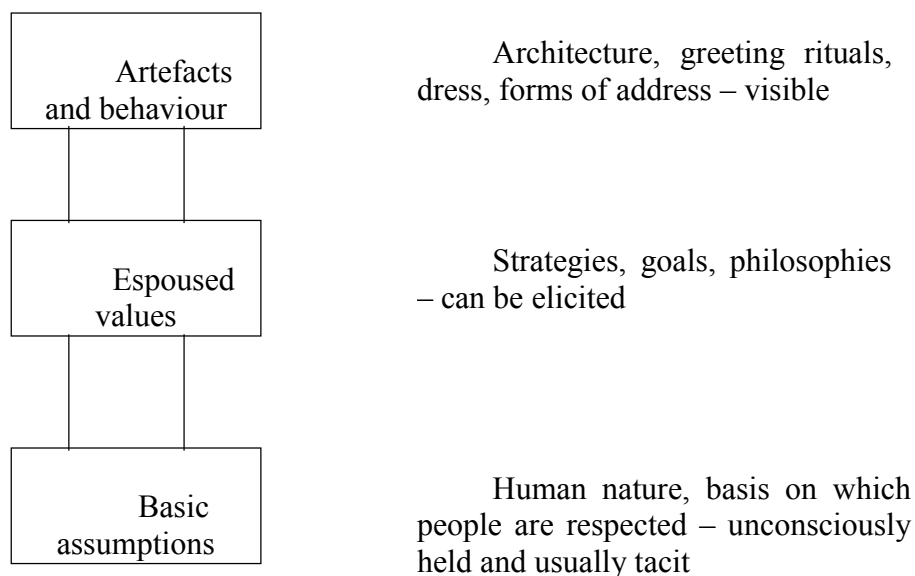
If you were asked to describe your own culture, what would you say? Describing one's own culture is not an easy task. We only begin to perceive our culture when we are out of it, confronted by another. Or in the words of the French philosopher, Jean Baudrillard, "To open our eyes to the absurdity of our own customs is the charm and benefit of travel". Culture serves as a lens through which we perceive the world. Culture distorts how we see the world and how the world sees us. We tend to use our own culture as a reference point to evaluate others.

Culture is to society what memory is to individuals. Culture includes traditions that reflect "What has worked in the past". It also encompasses the way people have learned to look at their environment and themselves, and their unstated assumptions about the way the world is and the way people should act.

The biggest danger in trying to understand culture is to oversimplify it in our minds. It is tempting to say that culture is just "the way we do things around here", or "our basic values", or "our rituals", and so on. These are all manifestations of the culture, but none is the culture at the level that culture matters. A better way to think about culture is to realize that it exists at several "levels" and that we must endeavour to understand the different levels, but especially the deeper levels.

### 2.2. THREE LEVELS OF CULTURE

The levels of culture go from the very visible to the tacit and invisible. The following diagram shows a multilevel model of culture that was developed by Edgar Schein, a distinguished management consultant and organizational psychologist.



### **2.2.1. Level One: Artefacts**

The easiest level to observe is that of artefacts: what you see, hear and feel. Entering an organization, the most obvious artefact is the architecture and design of the building.

Is the space where people work open, partitioned by half walls or in private offices? Other aspects of layout, such as the number of executive dining rooms, washrooms, or reserved parking spaces also indicate the importance attached to hierarchy and status. These may be reinforced by artefacts such as cars, and office furniture that send clear messages regarding ranking order.

At the level of artefacts, culture is very clear and has immediate emotional impact. But you do not really know why each organization is constructed as it is, or why people are behaving as they are. It is difficult to decipher what is going on. You have to move to the next level of culture.

### **2.2.2. Level Two: Espoused values**

Espoused values are those values that are adopted and supported by a person or organization. Information about espoused values can be obtained by asking questions about the things that you observe or feel. Espoused values are those values that people say that they support. Values are preferred states about the way things should be. Examples of espoused values often quoted in organizations are, equality of opportunity, teamwork, empowering employees, safety is a priority etc. These values are not uncommon in organizations, even those having completely different physical layouts and working styles. Should you spend a longer time in an organization you will often become aware of inconsistencies between some of the espoused values and the visible behaviour. For example, an organization may espouse “teamwork” as a value but has a reward system that is highly competitive and individualistic. It may espouse that “safety is a priority” but employees take risks to meet production targets. What these inconsistencies tell you is that a deeper level of thought and perception is driving the behaviour. The deeper levels may or may not be consistent with the values espoused by the organization. If you are to understand the culture, you must decipher what is going on at the deeper level, and establish what are the basic assumptions.

### **2.2.3. Level Three: Basic assumptions**

These lie at the deepest level of culture. They are fundamental beliefs that are so taken for granted that most people in a cultural group subscribe to them but not in a conscious way. To understand any culture you must unearth these basic assumptions that are operating. These basic assumptions will reflect many of the deeper assumptions of the national culture but are not exclusively determined by the national culture. In the case of an organization they will also reflect its history, the values, beliefs and assumptions of the founders and the key leaders who have made it successful.

An example of a basic assumption is the underlying assumption about human nature. Are people basically good or evil? Some religions take as their point of departure the idea that people are basically evil (original sin) and can only be redeemed through certain acts of religious faith. People are expected to sin, to confess, to ask forgiveness, and to repent. Other assume that people are basically good, and that they live and work to fulfil their human potential. Hard work and perseverance are seen as ways of achieving these ends. In management this translates into beliefs about workers: Theory X and Theory Y. In Theory X, workers are assumed to be lazy, to need constant direction and supervision because they will

try to get away with as much as possible. In Theory Y, workers are assumed to be self-directed, to be willing to take initiatives and to do what has to be done without external control. Thus assumptions about human nature determine the willingness to delegate and the nature of control systems. The popular idea of empowerment depends very much on the assumption that people are self-directed and self-controlled.

Other basic assumptions deal with fundamental aspects of life—the nature of time and space; human activities; the nature of truth and how one discovers it; the correct way for the individual and the group to relate to each other; the relative importance of work, family and self-development; the proper role of men and women; and the nature of the family.

Basic assumptions are rarely discussed or confronted and hence are extremely difficult to change. To learn something new in the realm of basic assumptions requires us to consciously resurrect, re-examine and possibly change some of the more stable parts of our cognitive structure, a process involving double-loop learning. Such learning is intrinsically difficult because the re-examination of basic assumptions temporarily destabilizes our cognitive and interpersonal world releasing large quantities of anxiety. Rather than tolerating such anxiety, we tend to want to interpret the events around us as consistent with our basic assumptions, even if we have to distort our interpretation. It is in this psychological process that culture has its ultimate power.

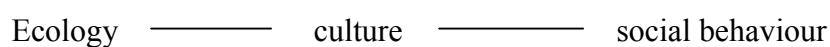
Any group culture can be studied at these three levels—the level of artefacts, the level of espoused values, and the level of basic assumptions. If one does not decipher the pattern of basic assumptions that may be operating, one will not know how to interpret the artefacts correctly or how much credence to give to the articulated values. In other words, the essence of a culture lies in the pattern of basic assumptions, and once one understands these, one can understand the other more surface levels of culture, and deal appropriately with them.

### 2.3. DEFINITION OF CULTURE

Many people use the word “culture” to explain a variety of phenomena, but as each tends to adopt a slightly different perspective, there is no unanimously accepted definition. Perspectives differ because culture is studied by several different disciplines, all of which have their distinctive approach. These disciplines include anthropology, sociology and social psychology. Economics has some interest in the subject, but this seldom results in studying culture itself.

Definitions of culture vary in complexity. One of the simplest is: “The way that we do things around here”. Although simple, this definition is not of much practical use to anyone interested in analysing culture. Perhaps the most inclusive definition is:

“Culture is the human-made part of the environment.” This definition reminds us that the ecology shapes the cultures that emerge in it, and in turn culture shapes particular kinds of behaviours. A simplified way of thinking about culture is to place it between ecology and social behaviour as follows:



Ecology consists of the objects, the resources, and the geography of the environment, and the ways one can make a living and survive.

Currently one of the most widely accepted definitions of culture is that given by Edgar Schein. This is the definition adopted by the author.

“Culture is a pattern of basic assumptions—invented, discovered or developed by a given group as it learns to cope with its problem of external adaptation (how to survive) and internal integration (how to stay together)—which have evolved over time and are handed down from one generation to the next.”

Schein’s definition includes the key characteristics of culture. First, culture emerges in adaptive interactions. Second, culture consists of shared elements (shared language, and the opportunity to interact). Third, culture is transmitted across time periods and generations (modern communications results in cultural diffusion in films and television). Culture is a complex concept that must be analyzed at every level before it can be understood. The biggest risk in working with culture is to oversimplify it and ignore several aspects that matter. These are:

- (1) Culture is deep. If you treat it as a superficial phenomenon, if you assume that you can manipulate it and change it at will, you are sure to fail. Culture controls you more than you control culture. As you learn what works, you develop beliefs and assumptions that eventually drop out of awareness and become tacit rules on how to do things, how to think about things, and how to feel.
- (2) Culture is broad. As a group learns to survive in its environment, it learns about all aspects of its external and internal relationships. Deciphering culture can be an endless task. If you do not have a specific focus or reason for wanting to understand culture, you will find it frustrating.
- (3) Culture is stable. People want to hold on to their cultural assumptions because culture provides meaning, and makes life predictable. Humans do not like chaotic, unpredictable situations. Any prospective cultural change creates great anxiety and resistance to change. If you want to change some elements of your culture, you must recognize that you are tackling some of the most stable parts of your life.

#### 2.4. DIVERSITY OF CULTURE

People in modern society experience a diversity of cultures. There may be a dominant culture that shapes their values and basic assumptions but the influences of the other less dominant cultures, referred to as sub-cultures, will also have an important effect on their lives.

Culture is a property of a group. Whenever a group has enough common experience, a culture begins to form. One finds culture at the level of small teams, families and workgroups. Cultures are also found at the level of departments, functional groups and other organizational units. Cultures are found at the level of the whole organization if there is sufficient shared history. It is even found at the level of a whole industry because of the shared occupational backgrounds of the people in the industry and the requirements of the technology. Finally culture exists at the level of regions and nations because of common language, ethnic background, religion and shared experience. Each individual is a multicultural entity who displays different cultural behaviours depending on what is required in a particular situation. If you spend most of your life in a certain occupation or organization, you take on many of the cultural characteristics that others in the occupation or organization share. Thus the key to understanding whether a culture exists or not is to look for common experiences or backgrounds.

When you think of culture, try to avoid thinking of nationality, religion, race or occupation as the only criterion that defines culture. Culture is a complex whole and it is best to use many criteria to discriminate one culture from another. Most modern states consist of many cultures; most organizations have unique cultures; most occupations have some aspects of distinct cultures.

Is the existence of sub-cultures likely to be harmful? One viewpoint is that, unless the different sub-cultures all contain something that results in a common sense of purpose, different priorities and agendas can arise and this can create serious problems. The counter-argument is that different sub-cultures give different perspectives and this is advantageous. The sub-culture of a marketing department is very different to the sub-culture of the accounting department.

## 2.5. IS THERE A RIGHT OR WRONG CULTURE?

It is important to realize that there is no right or wrong culture, no better or worse culture, except in relation to what a group or organization is trying to do, and what the environment in which it is operating allows. An organization with a strong culture (organizational members have the same core values and a high degree of commitment to these values) may be capable of superior performance in the short term, but the strong culture may become highly inappropriate if the environment of the organization changes.

## 2.6. RELATION OF CLIMATE TO CULTURE

"Climate is the characteristic atmosphere within an organisation at a given point in time which is reflected in the way its members perceive, experience and react to their surroundings."

There are certain similarities and differences between climate and culture. While both are phenomena that are felt or experienced by people, climate tends to be something of which they are more consciously aware. In addition, although both have effects on behaviour, this occurs in different ways. Culture provides a code of conduct that tells people the expected and appropriate ways to behave, whereas climate tends to result in a set of conditions to which people react. Culture is also more permanent and deeply ingrained, whereas climate is usually considered to be more short term. Another way in which culture and climate are similar is that they are both linked to the value system of organisational members. Values are a fundamental part of a culture, and to some extent, culture itself gives people their values. Climate, however, is more often a reflection of whether current organisational conditions are in accord with the values that people hold. Therefore culture is often a significant background to a particular set of climatic conditions.

### OPTIONAL EXERCISES

- (1) Think about the organization in which you work, and try to identify some of its espoused values and basic assumptions. Start by thinking of the artefacts around you at work, and think of why they are that way. Try to see the culture as an outsider might.
- (2) What is the fundamental mission of your organization? What is its reason for being? Is there a hierarchy of purposes?
- (3) List the groups or communities that you belong to, and identify with. For each group list some of the values and basic assumptions that are held.

### 3. WHAT IS SAFETY CULTURE

The culture of any organization in the international nuclear industry is centred on safety. This reflects human awareness of the significant destructive capability of nuclear power when control is lost, and the recognition that strict attention to safety is essential if the benefits of this form of power are to be obtained. For a nuclear organization, safety culture is the dominant aspect of the organizational culture.

Many people, even those who work in the field of safety, do not know what “safety culture” is. People need to have a better understanding of what a safety culture looks like in a practical sense. Before considering a multilevel view of safety culture, let us consider what are the elements that constitute a good foundation for safety in an organization. These are the elements that you would look for when scrutinizing safety in an organization, to assure yourself that the approach to safety is coherent and comprehensive.

#### 3.1. FOUNDATION FOR OPERATIONAL SAFETY

The first element to look for is whether strategic plans and action plans exist that integrate safety into all aspects of an organization’s activities. Are there measurable short, medium and long term safety objectives in these plans, and is there regular monitoring of progress in implementing the plans. Monitoring of progress by the senior management team demonstrates a vital aspect of good safety leadership. There should be regular reviews of the plans to confirm that they remain valid. Information about progress and the outcome of reviews should be communicated to all employees. Thus the existence of plans, objectives, monitoring, reviews, and the involvement of senior management are tangible evidence of safety leadership, which is important for developing a positive safety culture.

Another key element of a solid foundation for safety is the presence and quality of the organization’s risk control systems. If risk assessments have been conducted on all the organization’s activities, and the appropriate control measures have been fully implemented, it is probable that safety is being actively controlled at the operational level. However, the extent to which risk assessments have been conducted can only be determined if such assessments and the appropriate control measures have been properly recorded. Thus, the presence and quality of recorded risk assessments that cover all the organization’s activities provides an indication of a positive safety culture. The presence of a planned review schedule that fully involves the persons who actually undertake the operational activities also provides an indication of a positive approach to safety.

Another element of a good foundation for safety is the presence and quality of an organization’s safety management information system. This provides the means by which the organization can evaluate its ongoing safety activities. It also helps the organization measure its effectiveness at controlling safety, as well as producing the information required to enable errors or weaknesses to be corrected.

The extent to which an organization’s safety management systems are reviewed is also a key element. This can only be achieved by conducting regular, planned safety management system audits throughout the whole organization. The frequency with which these are done provides an indication of a positive approach to safety. Conducting audits is one thing, the organization also has to act upon and implement any recommendations in the audit report. Thus, the extent to which an organization provides the necessary resources to deal with the



findings of audits of processes or the safety management system also provides an indication that there is a solid foundation for safety.

Another key element is the extent to which every employee receives high quality integrated job and safety training. Exposing people to infrequent safety lectures in classrooms is insufficient. The evidence required is that a planned integrated series of safety training events (relevant to the participants) are being conducted on a rolling basis for all employees. In addition, the extent to which an organization actually changes its systems and management practices to support the safety training provides further evidence of a positive approach.

One of the better indications that safety is well based in an organization is the existence of a good attitude to safety among its employees. Safety attitude can be measured using psychometric surveys that cover various characteristics thought to be important to safety. The survey will give an indication of how employees perceive the organization's safety efforts. The fact that an organization is willing to consult its members and act on their views is a strong indication of a positive approach to safety.

Probably the most important indication of a good safety foundation in an organization is the extent to which employees are actively involved in safety on a daily basis. If there is little involvement, with safety solely dependent on managers and safety specialists, it can be said that the organization has failed to win people over to the safety effort. Conversely, when safety issues are identified and acted on by all employees as part of their normal working routine, the organization can be said to have won over people's hearts and minds to the safety cause.

The position of senior safety staff in an organization's hierarchy gives a visible indication of the importance attached to safety. If the senior safety staff have direct and unimpeded access to the head of the organization, it can be said that the organization actively recognizes the important contribution that the safety function makes to the organization.

All the above elements play an important role in establishing a good foundation for safety in an organization. These elements, individually or in totality do not constitute a safety culture, although they are an important part of it. The elements can be observed; hence they lie at the highest level (i.e. artefact level) of the "Three Level" model of culture. In the next section we will give a practical example of how the Three Level model can be used to help understand the safety culture in an organization.

### 3.2. THREE LEVEL MODEL OF SAFETY CULTURE

To understand safety culture in its entirety, we must identify the artefacts, espoused values and basic assumptions that form the totality of the concept of culture as it applies to safety. Examples will be given for each of the three levels. The examples are illustrative only as the application of the Three Level model to a specific organization would reflect the uniqueness of that organization, and allow logical links to be made between the artefacts, espoused values and basic assumptions. Logical links will not be apparent in the illustrative examples shown below, as it is not derived from any particular organization.

Artefacts are the easiest to observe, but are the most difficult to interpret the meaning of. Knowledge of espoused values will help with the meaning, but it is only when the basic assumptions are understood, that the meaning of the components at the artefact level will become apparent.

| Level             | Example   |
|-------------------|---|
| Artefacts         |   |
| – objects         | Safety policy statement   |
| – language        | Zero lost time accidents  |
| – stories         | The day the boss broke his ankle  |
| – rituals         | Safety award presentations  |
| – behaviour       | Use of safety equipment   |
| Espoused values   | Safety is the top priority<br>Zero tolerance for safety deficiencies<br>Blame-free work environment<br>Errors are learning opportunities  |
| Basic assumptions | Accidents are caused by carelessness<br>Some people are accident-prone<br>Risks have to be taken to achieve targets.<br>Safety can always be improved<br>Accidents are avoidable<br>Properly designed plant is inherently safe. |

### 3.3. CHARACTERISTICS OF SAFETY CULTURE

Broad agreement on what are the main characteristics of safety culture has gradually emerged in recent years based on research findings, lessons learned from organizational failures in safety management and safety culture and from the international collaboration of safety experts under the auspices of the IAEA. Most of the characteristics can be assigned to the artefact level and/or the espoused level of the Three Level model, with only a small number more appropriately associated with the level of basic assumptions. This reflects the relative ease in identifying artefacts that can be observed. In the future as we become more skilled in analysing safety culture, we shall probably identify more basic assumptions, and be able to add to the list of components at the deeper levels of the model. In the meantime, safety culture characteristics have been listed below, under the appropriate level, artefact and/or espoused value and basic assumption. The characteristics are not listed in any order of importance.

#### 3.3.1. Characteristics at artefact and/or espoused value level

*Top management commitment to safety:* this is a very important characteristic, which, if not present, will seriously inhibit the development of a positive safety culture. Top managers must demonstrate their commitment in their behaviour, attitude to safety, and in the allocation of resources, including the time spent on safety issues particularly in the time spent on efforts to improve safety.

*Visible leadership:* this is related to the previous characteristic in that top managers' behaviour in support of safety must be visible to their colleagues and other employees. Top managers can promote the cause of safety by serving as role models.

*Systematic approach to safety:* this will be apparent in the quality of the safety management system safety procedures and safety documentation. Safety priorities will be

identifiable with information provided on accountabilities. An important area where a systematic approach is particularly important is risk assessment and control of risks.

*Self-assessment:* the purpose of self-assessment is to promote improved safety performance through the direct involvement of people in the critical examination and improvement of their own work activities and work results. Potential weaknesses can be detected and often resolved well before they reduce any margin of safe operation. A strong commitment to the self-assessment process can motivate employees to seek continuous improvement in safety performance.

*Strategic business importance of safety:* the importance given to safety will be apparent in an organization's strategic and other action plans. The importance will be further emphasized if there are proper monitoring arrangements to check that safety goals are being achieved, and that progress is communicated to employees.

*Absence of safety versus production conflict:* there should be no conflict if safety is a true priority. When a safety issues arises during work, the work should temporarily stop to allow assessment and resolution of any problems. Workers should not improvise without risk assessment, and take risks to save time or achieve some production target.

*Relationship to regulators and other external groups:* there should be mutual respect between members of an organization and regulators or other external groups. Sharing of longer term plans with regulators can help increase confidence and allow the regulator to prepare more effectively for future work demands. The relationship should be characterized by mutual trust and openness in communication.

*Proactive and long term perspective:* this will be apparent when future plans are scrutinized. These plans should contain short, medium and long term goals to demonstrate that the organization is actively preparing for the future. It may be that future resource needs will change, or perhaps a need for new skills among employees. Plans should contain contingency arrangements to allow for change.

*Management of change:* an awareness of the challenges associated with organizational change and their particular relevance for safety is important. The existence of an organizational process for implementing change will be significant evidence that this issue is being addressed.

*Quality of documentation and procedures:* documentation should be comprehensive and easy to understand. The responsibility for preparing documentation and its review should be clear. Documentation should be used in both training and work. It is important that safety documentation is accessible to employees, and in a form that is convenient for use at work.

*Compliance with regulations and procedures:* this is of obvious importance for safety. Procedures should state what to do in the event of the unexpected, which may not be covered by the existing regulations or procedures. Violation of regulations and procedures is a clear sign that safety culture is weak.

*Sufficient and competent staff:* employees face additional risks if they are of insufficient number for the task in hand, or if they lack the necessary skills for the task. Both quantity and quality of staff are important.

*Employees have a questioning attitude:* employees have a low threshold for identifying deficiencies and do not just blindly follow procedures.

*Man, technology and organization knowledge:* understanding of the complex interactions between humans, technology and organization is important if safety problems are to be avoided. This means that there must be an understanding of human behaviour and what influences it. Safety should not be viewed mechanistically and a more human systems approach is better. The presence of people with specialist knowledge of human factors in the organization signifies that attention is being paid to this characteristic.

*Clear roles, responsibilities and accountabilities:* it is important from the safety viewpoint that there is no confusion over safety roles or responsibilities. Charts and job descriptions should define roles and responsibilities clearly. Accountability implies that objectives are specified, targets for achievement stated, progress evaluated and there are consequences for achievement or non-achievement.

*Motivation and job satisfaction:* the behaviour of employees will be strongly influenced by their motivation and job satisfaction. These will reflect the quality of leadership, and the attention to job design in an organization. Motivational issues can be complex and specialist assistance may be required by the organization.

*Involvement of all employees:* employees will not have a sense of ownership of safety if they are not involved in the identification of safety problems and their solution. Safety is an area in an organization where everyone can contribute. The organization should have processes for involving employees in safety matters.

*Good working conditions with regard to time pressure, workload and stress:* safety can be compromised if employees are overloaded with work. Their morale and alertness to safety problems will decrease. Managers need to anticipate the impact of unusual events or organizational restructuring on employees to avoid problems. Employees have a responsibility to be fit for duty when they report for work.

*Measurement of safety performance:* it is important that an organization measures its safety performance and communicates the results and trends to all its employees. Measures of activities designed to improve safety are particularly important, as there should not be reliance only on event statistics. The latter approach is too reactive.

*Proper resource allocation:* attention should be given in planning to the resource requirements of routine and non-routine work. Engineering shutdowns for maintenance often have higher resource requirements than anticipated. It is not just a question of numbers of people, but also the specific skills needed.

*Collaboration and teamwork:* it is essential that employees are able to work effectively in teams. This is particularly important when the teams are cross functional, if conflicts are to be avoided. Effective teams should be recognized by the organization's reward system.

*Handling of conflict:* an organization needs to have adequate processes for handling conflict otherwise the conflict will either escalate, or be suppressed only to reveal itself in some other way. The ease with which employees can raise problems with others is the sign of a confident workforce. Conflicts in safety-related areas are particularly damaging, as it can degenerate into mutual blame and mistrust.

*Relationship between managers and employees:* there should be an open and mutually respectful relationship between managers and employees. Both should be confident in being able to approach one another, and to raise matters of concern. Some organizations may be more hierarchical than others, but hierarchy should not prevent mutual respect.

*Awareness of work process:* employees should have a good understanding not only of their own work processes, but also how these processes interact with other processes. There should be good documentation of the processes in an organization. Both the human, technological and organizational parts of the process should be covered.

*Good housekeeping:* where housekeeping is poor, there is likely to be low morale among employees, and a lack of interest among their managers. This combination is a recipe for poor safety. Housekeeping includes the material condition of the plant.

### **3.3.2. Characteristics at espoused value level**

*High priority to safety:* many organizations state that safety is the top priority, but actions and behaviours do not always confirm this espoused value in practice. The credibility of the organization is diminished if the reality is inconsistent with the value espoused.

*Safety can always be improved:* organizations do not become satisfied with their safety performance and always seek ways of improving. This espoused value will be reflected in the wide application of self-assessment.

*Openness and communications:* good communications are necessary in an organization if employees are to perform effectively. Employees must be confident that they can be trusted with knowledge, and also have the opportunity to communicate their concerns, either as a group or individually. Organizations can use a multiplicity of communication channels to reach their employees. An organization will continually encourage openness among its employees if it subscribes to this value.

*Organizational learning:* this can almost be regarded as an organizational philosophy whereby the approach to any problem is regarded as an opportunity to learn. There is a willingness to learn from others, and share your own experiences with them. The organization continually re-evaluates the environment and adapts in anticipation of environmental changes. Commitment to organizational learning is very important in learning from safety problems, and identifying their true root causes.

### **3.3.3. Characteristics at basic assumption level**

*Time focus:* there needs to be a balance between the past, present and future. Excessive focus on anyone of these to the exclusion of others can create problems. The balance should be found in planning activities, but it also needs to be present in employees' work. Time focus will be influenced by the broader social and national cultures.

*View of mistakes:* mistakes can be regarded as opportunities for learning or for punishment. The choice depends on the broader social culture. Organizations can influence the view of mistakes among their employees. It is very important for safety that employees feel able to draw attention to safety mistakes without fear of punishment otherwise the knowledge will be suppressed. Some other employee may then be subjected to the same mistake in the future.

*View of safety:* the responsibility for safety falls on every employee and rests not just with managers or the regulator. In a nuclear facility safety includes industrial safety and environmental safety, as well as nuclear safety.

*Systems thinking:* the world is recognized as being complex and its understanding requires more than simple linear causal logic. More complex mental models are used to analyse the mutual interaction of forces. This is best done using a systems approach.

*Role of managers:* managers in some organizations adopt a more authoritarian approach than in other organizations. This does not prevent a manager from investing time and effort in coaching their employees directly, or in arranging coaching by others. Managers must have sufficient safety knowledge to feel confident in discussing safety issues with employees. Hierarchy must not inhibit any manager from giving visible support to safety improvement.

*View of people:* the view of people can greatly influence how they are treated in an organization. If the view is that people are undisciplined and self-interested, there will be many controls placed upon them. Their activities will be highly supervised. On the other hand, if people are regarded as interested in realizing their potential through development, and trustworthy, they may be managed in a more flexible way that empowers them to undertake greater responsibility. Both views have a role to play in improving safety, but the majority view is that the latter perspective will realize more benefits in the long run.

### 3.4. DEFINITIONS OF SAFETY CULTURE

The concept of safety culture is defined in INSAG-4 as follows:

“Safety culture is 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.”

This definition was emerged from discussions of the Chernobyl Accident, and understandably has a strong nuclear connotation. Another definition by the ACSNI Human Factors Study Group in the UK that is similar in spirit, but which also describes more explicitly the characteristics of an organization that has a positive safety culture is:

“Safety culture is the product of individual and group values, attitudes, competencies and patterns of behaviour that determine the commitment to, and the style and proficiency of an organization’s health and safety programmes.

Organizations with a positive safety culture are characterized by communications founded on mutual trust, by shared perceptions of the importance of safety and by confidence in the efficacy of preventive measures.”

The Nuclear Regulatory Commission defined safety culture in a somewhat similar but more succinct way:

“A good safety culture in a nuclear installation is a reflection of the values, which are shared throughout all levels of the organization and which are based on the belief that safety is important and that it is everyone's responsibility.”

Anyone interested in analysing safety culture can refer to these definitions or apply the Three Level model.

## OPTIONAL EXERCISES

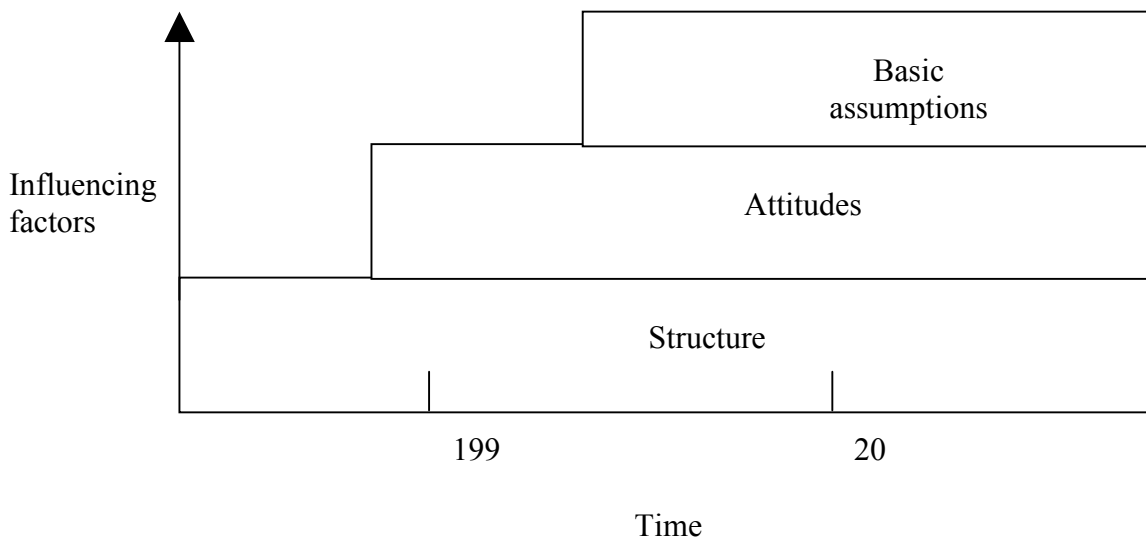
- (1) Use the Three Level model to analyse the safety culture of your organization. Begin by listing artefacts, and then list the espoused values. Examine some of the artefacts to see whether they are consistent with the espoused values. When there is an inconsistency, think what basic assumptions may be operating in your organization that would explain this inconsistency. Do not be over-elaborate, as the purpose of the exercise is to allow you to apply the model.
- (2) Using the information provided in the section on “Foundations for Organizational Safety”, check whether your organization possesses all the key elements required for a good foundation. Try and rate each key element on a scale ranging from: non-existent; early development; well developed.
- (3) Assess if there is any relationship between the findings of Exercise No. 1 and No. 2 above.

## 4. STAGES OF DEVELOPMENT OF SAFETY CULTURE

### 4.1. EVOLUTION OF VIEW ON WHAT INFLUENCES SAFETY CULTURE

Organizations vary in their understanding of the concept of safety culture, and the actions necessary to influence it in a positive way. This variation may reflect different levels of awareness, especially in highly technical organizations, of the safety impact of human behaviour and attitudes. Organizations may eventually evolve and develop this understanding. Over time there has been a changing emphasis on what organizations think is important for success, as can be seen in the diagram below.

Evolution of perception of what influences safety



In the 1980s and before, the dominant influence on safety was considered to be structural with the emphasis on procedures, practices and organization. This view gradually changed in the late 1980s in the aftermath of the Chernobyl accident and also because of the increasing interest in the business world in how to develop a strong organizational culture. The INSAG-4 definition of safety culture recognized that it was attitudinal as well as structural. The definition related safety culture to personal attitudes and habits of thought and to the style of organizations. It was recognized that whilst attitudes are generally intangible they do lead to tangible manifestations. In the late 1990s people became more aware of the complexities of culture and that it was a multilevel concept. It was realized that to understand culture it was necessary to delve beyond the tangible manifestations and attitudes to explore the values and basic assumptions that ultimately underpin behaviours and attitudes. This was a more sophisticated view of culture and it offered the prospect of more reliable assessments of safety culture in organizations. The more modern view also enabled the link to be established between important attributes of a positive safety culture such as “a questioning attitude” and some of the more basic cultural assumptions that human beings have, e.g. a properly designed nuclear plant is inherently safe.



The preceding model of the evolution of what are the dominant factors influencing safety allows us to understand better how safety culture may develop. Three stages of development seem to occur. Each stage involves a different awareness of the effect on safety of human behaviour and attitude. The characteristics of each stage are described in the next section. The characteristics may be used by an organization to diagnose which stage reflects its current state most accurately.

## 4.2. STAGES OF DEVELOPMENT OF SAFETY CULTURE

The three stages are:

| Stage | Focus                                       |
|-------|---|
| 1     | Safety is based on rules and regulations    |
| 2     | Safety is considered an organizational goal |
| 3     | Safety can always be improved               |

When an organization's emphasis is on procedures, as typically was the case in the 1980s and before, Stage 1 is likely to be the preferred choice. Stage 2 would be the choice if the emphasis were more on planning and achieving safety goals. This was the common position in the late 1980s and the 1990s when there was a move to broaden the participation of employees in safety matters, in the belief that this would encourage the development of positive safety attitudes. Employees were encouraged to develop safety improvement plans and set goals, and monitor progress in achieving them. The third stage corresponds to an organizational emphasis on continuous improvement and achieving excellence. In pursuit of excellence, organizations have attempted to develop cultures that can cope with frequent change. To do this, they have tried to gain a better understanding of how to change their culture, and this in turn, has encouraged them to explore the concept of culture. This interest has made organizations receptive to ideas on how to improve their safety performance by enhancing their safety culture. Managers are becoming more comfortable with the concept of culture and the need to consider the softer issues. Stage 3 is associated with the late 1990s and beyond.

The evolution described above has influenced organizations in how they view safety culture. There are three stages of evolution but the three stages should not be considered as totally distinct. It is possible for an organization, at any one time, to exhibit characteristics associated with several, or all, of the stages.

### 4.2.1. Stage 1 — Safety based on rules and regulation

At this stage an organization sees safety as an external requirement, and not as an aspect of conduct that will allow it to succeed. The external requirements are those of government, the legal framework and the regulatory bodies. There is little awareness of the behavioural and attitudinal aspects of safety. Safety is seen as a technical issue, to be achieved by compliance with rules and regulations. Some characteristics of an organization in Stage 1 are:

- (1) Problems are not anticipated, and the organization reacts to each one as it occurs.
- (2) Communications between departments and functions is poor.

- (3) Collaboration and shared decision-making is limited.
- (4) People who make mistakes are blamed for their failure to comply with the rules.
- (5) The role of management is seen as enforcing the rules.
- (6) There is not much listening or learning inside or outside the organization, which generally adopts a defensive position when criticized.
- (7) People are viewed as components of the system—the mechanistic view.
- (8) There is an adversarial relationship between managers and other employees.
- (9) People are rewarded for obedience and results, regardless of long term consequences.

#### **4.2.2. Stage 2 — Safety becomes an organizational goal**

An organization at this stage considers safety to be an important organizational goal, even in the absence of external requirements. Although there is growing awareness of behavioural issues, this aspect is largely missing from safety management, which generally concentrates on technical and procedural solutions. Safety is dealt with in terms of targets or goals, with accountabilities for achieving the goals specified. Organizations at this stage often discover that after a period of time, when safety trends have improved, a plateau is reached. Some characteristics of an organization in Stage 2 are:

- (1) There is growing awareness of the impact of cultural issues in the workplace, although it is not understood why added controls and training have not yielded the expected safety improvements.
- (2) Management encourages interdepartmental and inter-functional communications.
- (3) Management's response to mistakes is to introduce more controls and procedures, and to provide more retraining.
- (4) The role of management is to make sure that goals are achieved and that work objectives are clear to employees.
- (5) The organization is willing to learn from external groups, especially new techniques and best practices.
- (6) The relationship between employees and management is adversarial, although there may be more opportunities to discuss common goals.
- (7) People are rewarded for exceeding goals regardless of long term consequences.
- (8) The interaction of people and technology is considered, but more from the viewpoint of increasing the efficiency of the technology.
- (9) There is more teamwork.
- (10) The organization remains reactive in relation to problems, although there may be more anticipation of potential problems in planning.

### 4.2.3. Stage 3 — Safety can always be improved

An organization in this stage has adopted the idea of continuous improvement and applied the concept to safety. There is a strong emphasis on communications, training, management style and improving efficiency and effectiveness. People within the organization understand the impact of cultural issues on safety. Some characteristics of an organization in Stage 3 are:

- (1) Problems are anticipated and dealt with before they occur.
- (2) Collaboration between departments and functions is good.
- (3) There is no goal conflict between safety and production.
- (4) Almost all mistakes are viewed in terms of process variability with the emphasis placed on understanding what has happened, rather than finding someone to blame.
- (5) Management's role is seen as coaching people to improve performance.
- (6) Learning from others, both inside and outside the organization, is valued.
- (7) People are respected and valued for their contribution.
- (8) The relationship between management and employees is mutually supportive.
- (9) People are aware of the impact of cultural issues, and these are considered in decision making.
- (10) People are rewarded for improving processes, as well as results.
- (11) People are considered to be an important part of organizational systems with attention given to satisfying their needs, and not just to achieve technical efficiency.

The time-scale required to pass through the various stages cannot be predicted. Much will depend upon the circumstances of an individual organization, and the commitment and effort that it is prepared to make in order to bring about change. Sufficient time must be taken at each stage to allow the benefits from changed practices to be realized and to mature. It should be remembered that an organization might possess characteristics associated with each of the three stages. Change in an organization is rarely simultaneous or uniform. A rule-based approach should not be viewed negatively. There will be activities or circumstances in organizational life where strict compliance with rules is essential, e.g. emergency response, or operating with sufficient margin for safety. Cultural awareness is not incompatible with having strict rules; after all, much of culture is about complying or conforming to norms.

### 4.3. ASSESSING THE STAGE OF DEVELOPMENT OF SAFETY CULTURE

The stage of development of safety culture in an organization can be assessed using the following simple method. Individuals can use the method separately or in groups. The method is based on how the organization being assessed views certain factors such as mistakes, time, role of managers, handling of conflict and the nature of people. Each of these factors is viewed in a slightly different way in each of the three stages of development of safety culture. The approach is to consider which stage is most reflective of the factor being considered. When this is done for all five factors, it will generally be found that one specific stage has

been selected more than the others. The stage with the majority of selections is considered to be the stage to which the organization, under consideration, has developed its safety culture. Different stages may be selected for the various factors. Individuals from the same organization may exhibit differences in their selections. This is not uncommon for representatives from different levels in the organization or different functions.

The information from the assessment can be used to develop future improvement plans.

In the following, the characteristics of each stage that are relevant to the five factors used in the assessment method are described.

*View of mistakes*

| <b>Stage</b>      | <b>Characteristic</b>  |
|-------------------|--|
| Rule-based        | People are blamed for non-compliance with rules.<br>Organizations react defensively to criticism rather than listening and learning. |
| Goal-based        | Mistakes result in more controls and training.   |
| Improvement-based | Mistakes are an opportunity to understand and improve.   |

*Time focus*

| <b>Stage</b>      | <b>Characteristic</b>  |
|-------------------|--|
| Rule-based        | Short term is all-important  |
| Goal-based        | People are rewarded for exceeding goals, regardless of long term consequences.<br>Numerical targets are specified for safety.  |
| Improvement-based | Short term performance is analysed to improve longer term performance.<br>Longer term focus with anticipation of consequences. |

*Role of managers*

| <b>Stage</b>      | <b>Characteristic</b>   |
|-------------------|---|
| Rule-based        | Managers enforce rules and pressure employees for results.                            |
| Goal-based        | Managers use techniques such as management by objectives.                             |
| Improvement-based | Managers coach people to improve performance.<br>Managers support collaborative work. |

*Handling of conflict*

| <b>Stage</b>      | <b>Characteristic</b>  |
|-------------------|--|
| Rule-based        | Conflicts are rarely resolved and groups continue to compete with one another. |
| Goal-based        | Conflict is discouraged in the name of teamwork.                               |
| Improvement-based | Conflict is resolved by means of mutually beneficial solutions.                |

*View of people*

| <b>Stage</b>      | <b>Characteristic</b>  |
|-------------------|--|
| Rule-based        | People are components in a system .                                    |
| Goal-based        | Growing awareness that people’s attitudes influence their performance. |
| Improvement-based | People are respected and valued for their contribution.                |

For each of the five factors, select the stage that most reflects the organization.

Indicate your selection by placing an “X” in the appropriate box.

*Name of factor (e.g. view of mistakes)*

| Rule-based | Goal-based | Improvement-based |
|------------|------------|-------------------|
|            |            |                   |

The stage of development of the safety culture is that stage with the majority of selections. When a group consensus is used to make the selection, it may be possible that no one stage has a majority. In this case, place the “X” on the boundary between stages, or use an arrow to link the first and third stage if they are equal.

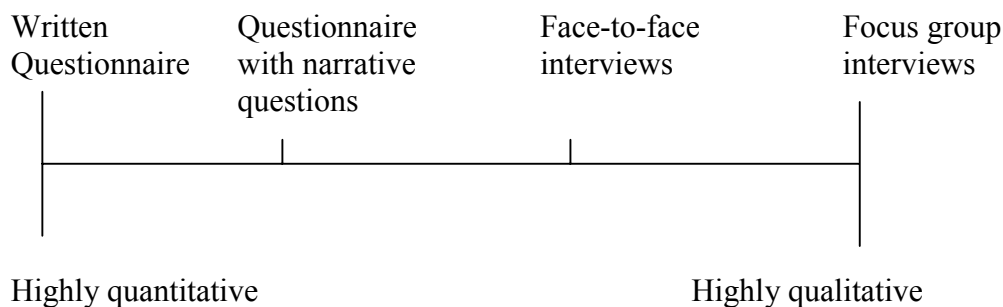
**OPTIONAL EXERCISES**

- (1) As an individual, or as a member of a group, assess to which stage the safety culture of your organization has evolved using the method described. Was there consistency in the results for the five factors, or was there variation in the stage selected? What could account for differences?
- (2) Form groups comprising people from different organizational levels or functions (i.e. all senior managers or all engineers) and repeat the assessment. Do the results differ? Why was there a difference if any?

## 5. EMPLOYEE SURVEYS

The first two sections considered the concept of culture and its application to safety culture. The third section described how safety culture could evolve in stages. One of the greatest challenges associated with safety culture is the question of how it can be assessed. We know from the multilevel model of culture that many aspects are not visible, and indeed, in the case of basic assumptions, may not even be consciously held. Nonetheless, there are methods that can be used to gain greater information about the state of safety culture. Most of these methods involve using some form of survey technique that can be applied to a group of employees in an organization. This section will describe the general survey process, and the next section will specifically consider how safety culture can be assessed.

In considering the potential use of an employee survey, managers need to look at the range of possible survey options in order to decide which is likely to be most appropriate for both their objectives for the survey, and the organizational context. Broadly speaking, information on employee attitudes, opinions or perceptions can be collected in one of two ways: either by means of a written questionnaire, or an oral interview. In practice, these two general categories encompass a wide range of approaches. At one extreme, this may include questionnaires sent to a very large sample; at the other, it may include unstructured interviews conducted with a small number of key individuals. Between these two extremes, a further range of options is available—questionnaires that collect narrative as well as purely quantitative information; structured, semi-structured or unstructured interviews with individuals or groups. The following diagram illustrates the range of survey types that range from qualitative to quantitative.



Valid methods of data collection exist at all parts of this spectrum, but each survey method will provide the user with different information. A multiple-choice questionnaire will provide very precise data that can be assumed with a high degree of confidence, reflects the views of the population. However, this type of questionnaire will not, in itself, provide a detailed in-depth understanding of the attitudes, motivations or concerns that underlie particular responses. At the other end of the spectrum, an unstructured interview of a focus group will generally not provide statistically reliable information, but will often provide a critical insight into major concerns or issues. In conducting a survey, it is essential that managers understand clearly the type of information that they can expect to collect using a particular survey method. Even more importantly, they must understand the potential benefits and shortcomings of whatever method they have selected.

## 5.1. CHARACTERISTICS OF VARIOUS SURVEY METHODS

### 5.1.1. Quantitative written questionnaire

The written questionnaire is probably the most commonly used method of collecting data for employee surveys. The exclusively quantitative questionnaire—that is, one that comprises only “tick box”, scale-based or other questions, where the respondents are asked to select one of a number of specified options—can provide a number of benefits. It is usually quick and easy to complete, which may be helpful in minimizing work disruption and encouraging a high response rate. It can provide clear data, which can be rapidly analysed. It allows respondents to remain anonymous so encouraging them to express critical views without fear of adverse consequences. Provided the questionnaire has been completed by a representative sample, it can provide a precise and reliable reflection of the total population, and so provide an authoritative basis for future decision making.

However, the perceived authority of the quantitative questionnaire can also be a major weakness. Managers are often strongly influenced by apparently authoritative statistics that—particularly if the design, application or interpretation of the questionnaire is unsatisfactory—can be misleading. Even when properly used, the questionnaire is a relatively blunt instrument. It is a less effective tool for exploring more complicated or ambiguous issues. To deal with complexities, the questionnaire would have to be increasingly lengthy and detailed, and even then it would probably fail to accommodate many subtleties of response. The questionnaire would become longer, less user-friendly and more difficult to interpret.

### 5.1.2. Written questionnaire with narrative element

To help overcome the weaknesses of the purely quantitative questionnaire, employee surveys can be a mixture of closed multiple-choice questions, and questions that seek a narrative response from the respondent. To take a simple example, the questionnaire may ask the respondent to evaluate a training course on a scale that ranges from “excellent” to “very poor”. This could then be followed up by an open question seeking a narrative response—for example “Why do you say this?” The advantage of this approach is that it maintains many of the benefits of the quantitative questionnaire, while also providing a means of explaining more complicated issues. The major weaknesses are that there is less control over the form and content of the information provided, as respondents will use different language in their narrative responses. The questionnaire will be more difficult to complete and analyse. The difficulties may discourage respondents.

### 5.1.3. Face-to-face interviews

Although the majority of employee surveys are based on the use of written questionnaires, more open forms of data collection such as face-to-face interviews have a significant role to play. They are commonly used as part of a survey that is mainly based on questionnaires, as a means of providing data that will assist the process of questionnaire design, or to explore qualitatively the issues emerging from the written survey.

The primary advantage of face-to-face interviews is that they provide a relatively efficient means of collecting highly complicated information relating to individual attitude or perception. Interviews are most likely to be used to collect highly detailed information from a relatively small group of respondents. The major weakness of the interview is that the content of the responses does not lend itself to precise quantifiable analysis, except at a crude level. Other weaknesses of the interview are its relative inefficiency as a tool for collecting

information from larger populations, and the loss of respondent anonymity. Respondents may be less willing to talk openly even when the interview is conducted by a third party who is independent of the organization for whom the respondent works.

Interviews may involve varying degrees of structure. The fully structured interview, where respondents are asked a series of closed multiple-choice questions is uncommon, as this is essentially a quantitative questionnaire completed orally. It has few benefits except ensuring a response in situations where self-completion may be unpopular. More commonly, surveys will be based on semi-structured interviews, where the interviewer has a defined schedule of open questions that they use consistently for each respondent. This approach provides the opportunity to explore individual attitudes and opinions in detail, but also provides a basis for comparison between responses, and for some collective analysis. Totally unstructured interviews are less commonly used but may be appropriate when an organization wishes to explore a broad issue such as "morale" or "motivation". Care needs to be taken that the resulting information is not so diverse as to be effectively useless to the organization. At the practical level, most people find it easier to respond to questions or statements than to engage in open-ended discussion.

#### **5.1.4. Focus group interviews**

If an organization does wish to explore a broad issue, it may well be more effective to collect information in a group session rather than in individual face-to-face interviews. Group sessions have the advantage in that the interaction of the group can often prompt and sustain discussions without a high level of input from the interviewer. Members of the group will share their experiences, views and attitudes about the topic in question, prompting responses from each other. The interviewer's role is to facilitate discussion, and to record the key points that emerge from the discussion.

The primary purpose of a focus group discussion is to encourage genuine open discussion of an issue. It provides a means of collecting data that is not constrained or limited by the preconceptions of those conducting the survey. By contrast, other types of surveys are inevitably influenced by such preconceptions. The fact that we choose to ask certain questions rather than others will, to some degree, reflect our own assumptions and restrict participants from responding in ways that lie outside these assumptions. Open-ended group discussions are likely to be particularly valuable during the early stages of a survey process to ensure that the user of the survey has an accurate and comprehensive understanding of the relevant issues. Group discussions are also valuable when held subsequent to the written survey. Group sessions can ensure that no additional topics have emerged that were not covered by the questionnaire.

The strength of the focus group interview is also its weakness. In conducting the session, the interviewer relinquishes virtually all control over its form, content and development. Because of this, the output of the session is unlikely to be susceptible to collective analysis. At a more practical level a group session, like the face-to-face interview, is inevitably a less anonymous process than a written survey. Participants may be concerned about expressing critical views. This can be partially overcome by using an external third party to conduct the sessions, and analyse the output.

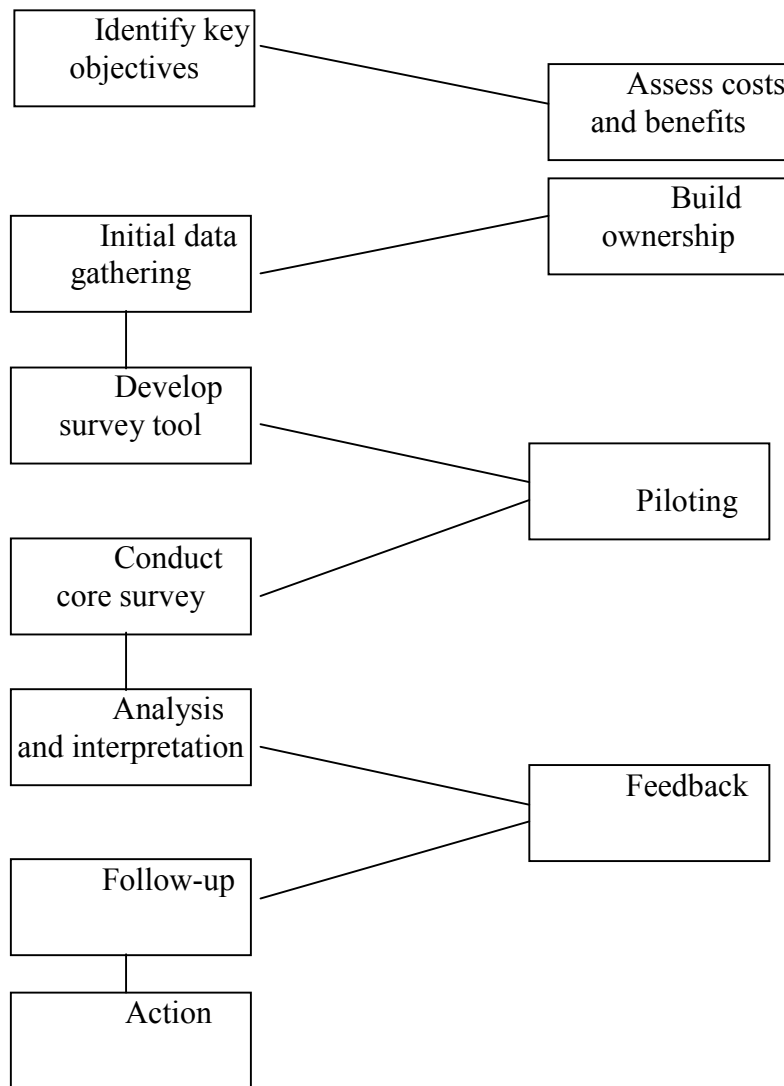
Summarizing, employee surveys come in all shapes and sizes, and there is no ideal method of data collection. Each survey method has different strengths and weaknesses, and is likely to be useful in specific situations, and at specific point in time in the overall survey process. In selecting a particular method, managers need to understand the nature and quality



of information that they are likely to obtain from the process and, even more importantly, the information that they will not be able to obtain. Precise and reliable quantitative information can be obtained, but often at the expense of information about the detail and complexity of the issue being explored.

## 5.2. THE SURVEY PROCESS

The value of a survey needs to be judged in rigorous terms. Surveys can be expensive to conduct—in terms of both direct costs and employee time—but they are capable of producing substantial organizational benefits. To ensure the success of a survey, it is helpful to consider the various stages of the survey process. A general model of the survey process is shown below.



Each step in the process is described in more detail in the following. The key to a successful survey is effective preparation.

### 5.2.1. Key objectives

The first step in conducting an effective survey is to determine its intended objectives. You need a broad understanding of why you wish to conduct the survey, and what benefits

the organization should obtain as a result of the process. A list of questions that you might ask yourself to ensure clear thinking at this stage is the following:

- (1) Why do you want to conduct an employee survey?
- (2) In broad terms, what employee information do you want to obtain from the survey?
- (3) Why do you think this information is not currently available in the organization?
- (4) Why do you think this information, if available, will help the organization operate more effectively?
- (5) What kind of survey do you wish to conduct?
- (6) What do you see as the potential positive impact of the survey in the organization?
- (7) What do you see as the potential negative impact of the survey on the organization?

If you are unable to provide concise responses to any of the above questions, this may well mean that you should pause and think about whether an employee survey is the appropriate tool for your purposes.

### **5.2.2. Assessing survey costs and benefits**

Your calculation of costs does not need to be highly detailed at this stage, and it is unlikely that you will be able to produce a precise account of either side of the cost/benefit equation. Nevertheless, it is important to address this issue for two reasons. First, if the potential cost clearly outweighs the potential benefits—then you may simply decide not to proceed with the survey. Second, even when the benefits outweigh the costs, it is important to have an idea of the expected costs and benefits so that you can adjust the process along the way if your expectations are not met.

The costs of conducting a survey can be divided into three broad categories:

#### *Direct costs*

- (1) Cost of consultancy support (if used);
- (2) Cost of printing questionnaires;
- (3) Costs of printing related information;
- (4) Costs of mailing and return of questionnaires (if required);
- (5) Costs of computer analysis of survey results.

It should be possible to estimate the above costs with some precision. Although direct costs are easy to calculate, they are also easy to underestimate.

#### *Indirect costs*

- (1) Time of managers involved in managing the process, and in developing the survey instrument;

- (2) Time of employees taking part in the initial data collection, and in piloting the survey instrument;
- (3) Time of employees actually participating in the survey;
- (4) Time of employees involved in focus groups or in survey follow-up;
- (5) Time of managers and employees in feeding back the survey results;
- (6) Time of administrative staff producing the survey materials;

The indirect costs involved in the survey process are much less easy to define.

#### *Potential costs*

The third area of costs is the most difficult to assess. It is concerned with the costs that the organization might be expected to incur as a result of the survey findings. The survey findings may suggest that you need to restructure some of your organization. To do this may be very costly—probably in excess of the direct and indirect costs of the survey. Yet, if the organization fails to respond effectively to the survey findings, this may negate any potential benefits emerging from the survey. The lack of organizational response may damage morale, motivation and organizational effectiveness. It is important that the organization considers its willingness to accept costs that may be incurred as a result of the survey before undertaking it.

#### *Potential benefits*

It is more difficult to assess the potential benefits from a survey, and there is a danger that the cost side of the cost/benefit equation gets over-emphasized. In determining the expected benefits, it is helpful to return to the objectives of the survey that were defined at the start of the process. Examples of benefits that can be produced as a result of a survey are:

- (1) Improved understanding of organizational culture;
- (2) Improved understanding of employee concerns, needs, aspirations and motivation;
- (3) Identification of barriers to, or motivations for, performance improvement;
- (4) Identification of barriers to, or motivations for, change;
- (5) Clarification of employee opinions about key topics;
- (6) Ability to assess the organization's state, either in time, or against other comparable organizations, in order to monitor progress;
- (7) Identification of organizational strengths and weaknesses in areas such as communications and human resource management.

A question to ask about potential benefits is, assuming that the survey process produces the information that we hope for, how will this information be used by managers and by the organization in general.

### *Building ownership*

An important step before starting to prepare the survey instrument and conducting the survey is to invest time in building commitment to the survey among people in the organization. This is often a crucial step. It is very common for a survey to run into problems, not because there is anything wrong with the survey process itself, but because influential individuals or groups within the organization undermine it. It is important to recognize that, however positive the motives for conducting a survey, it may still be perceived as threatening by many individuals. Senior managers may feel threatened by potential revelations about organizational attitudes or morale. Line managers may fear that the survey will reveal their managerial shortcomings. Employees may be concerned about the uses that may be made of the findings.

The building of ownership involves a number of steps. The first, and probably the most important, is to ensure ownership at the top. To be effective, an employee survey must be seen to have the support of senior management. If such support is not evident, this will encourage opposition from those who feel threatened by the survey process or the potential findings. The second step is to encourage ownership among line managers who may be affected by the process or its results. You need to ensure that there is an understanding of the survey objectives, and how the results may address their concerns. The third and final step is to encourage some commitment by the workforce and its representatives. If trade unions are present, it is worth involving trade union representatives at this early stage, to ensure that they understand what is the purpose of the survey.

You should make an effort to communicate formally about the purpose and objectives of the survey as early as possible. The most effective approach is often a letter from the Head of the organization to each employee, stating the purpose of the survey, and briefly describing the procedures that will apply, and aiming to allay any concerns.

### *Initial data gathering*

The first step in any survey, regardless of its size and scope, is to collect some initial data. Initial data collection has a number of purposes:

- (1) To ensure that the survey objectives really are appropriate to the organization's wider needs.
- (2) To ensure that you fully understand the context within which the survey will be conducted.
- (3) To help understand the potential implications of the survey's objectives.
- (4) To confirm the intended scope and range of the survey.
- (5) To ensure that the survey deals comprehensively with all aspects of the issues under review.

During this phase, you should aim to be as unconstrained as possible by any preconceptions and assumptions that you might have about the issues under review. The collection of initial data should open up the subject as much as possible, allowing you to gain a full understanding of the factors that may be relevant. For this reason, it is best conducted by means of loosely structured interviews or group sessions. For any kind of substantial survey,

group sessions are preferable. The groups should comprise a broad representation of the population to be surveyed, although at this stage there is no need to have a statistically representative sample. Each group should comprise about 10–12 individuals. Some thought should be given as to how you combine different employee groups within the organization, e.g. managers and non-managers, people from different functions, experienced employees and newcomers etc. There is often some benefit in including in the group, individuals who are likely to have a different perspective on key topics. The role of the data collector in these groups is to introduce the purpose of the survey, to seek the group's views on the issues, and to act as a facilitator for the discussions. Group sessions to collect initial data add significant value to the survey process. Even in the case of a small survey where it may be difficult to justify a group session, you should ensure that, at the very least, you have conducted some exploratory interviews with key people to confirm that you have fully understood and appreciated the issues.

Some organizations employ external consultants to assist with group sessions as they may have a high level of skill in facilitation and group work. When consultants are used, it is important to avoid loss of organizational ownership for the survey.

#### *Developing the survey instrument*

Once you have clarified the issues to be explored in the survey, you are then in a position to begin designing the instruments that you will use to collect the survey data. The survey instrument may take many forms, ranging from highly quantitative questionnaires through to a semi-structured, primarily qualitative interview. The choice of instrument will depend on the focus and objectives of the survey.

The design of a survey instrument is a skilled process. A survey instrument must be consistent, i.e. they must be applied in identical form to each participant in the survey. This is not usually a problem with written questionnaires, but can be more of a problem with semi-structured interviews where it is important that participants are asked the same range of questions in the same format. A survey instrument's findings must be capable of some level of quantification even in the case of interview-based surveys. Some notion of scale is necessary in interpreting and communicating the survey's findings. The survey instrument should be capable of providing valid information about the issues under review. Questions should not be so vague to support the detailed conclusions that are needed, or conflate several issues, preventing you from drawing clear conclusions about any one issue.

The survey instrument must not only be well designed, but also appropriate to the climate and culture within which it will be used. Do the intended participants have previous experience of dealing openly and honestly with their views of the organization; are participants familiar with survey techniques; is the organization highly status conscious?

Whatever survey instrument is used, it is important that senior managers and line managers maintain their commitment to the survey. It is important that they are involved in the design or selection of the survey instrument. Testing a draft instrument among these key people at an early stage may be useful in that you can respond to any remaining concerns.

#### *Piloting*

Whatever kind of questionnaire or interview you are planning, whatever the size and scope of the survey you plan on undertaking, you should always make time to conduct a pilot survey. Piloting need not be an extensive exercise. Even with a major survey, you will

probably receive sufficient feedback from a comparatively small pilot survey of about 12 to 15 individuals. The pilot group should ideally be representative of the population that will eventually participate in the survey.

Pilots are valuable in that no matter how much effort has been spent on the design of a survey instrument, a new pair of eyes will always identify some weaknesses or scope for improvement. Furthermore, at this stage of the survey process, no person who may ultimately have to complete the survey instrument will have tested it. Piloting will reveal unclear or confusing terminology, ambiguity in question design, or the unjustified assumption that employees will be aware of some issue. To pilot a self-completion questionnaire, the pilot group can be assembled in one room. You may wish to separate managers and non-managers to avoid people from feeling constrained in expressing their views. You should emphasize that the intention is not to survey them at this moment, but to enlist their help in improving the design of the questionnaire.

The piloting of structured, or semi-structured interviews, tends to be less participative, and is often a straightforward testing exercise. You simulate the survey process with a group of “dummy” interviewees. In testing interviews, it is generally preferable not to inform the interviewee that they are taking part in a pilot, as it is difficult for an interviewee to behave naturally if they are aware that the process is not genuine.

### *Conducting the core survey*

Once piloting is complete, you are ready to begin the core survey process whether it is interview or question-based. The survey may be of the total population or a selected sample. In the case of a sample, consideration needs to be given to the size of the sample. The size should be sufficient to provide results that are statistically significant, but also more importantly, the size of the sample must be such that the findings have credibility with employees.

Consideration needs to be given as to how the survey questionnaire is to be distributed, whether it will be completed in working time, and how it will be returned. Questionnaires that have to be completed outside work, and returned by mail, generally have a low return rate of 10% or less. Distributing the questionnaire by the internal mail system of an organization, and asking participants to complete it in working time, results in a much higher response rate—probably at least 50%. Providing an allotted period of time at work for completion of the questionnaire can result in response rates in excess of 85%.

Where the survey is based on semi-structured interviews, you need to consider who will be selected for interview, where the interviews will be held, and how much time will be required.

Effective preparation is the key to ensuring that there is a high level of response. A clear return date should be specified. Experience suggests that there is little benefit in setting too long a deadline, usually 2 to 3 weeks is usually plenty.

### *Feedback*

Whatever the results of the survey, you should always feed back the results to employees as quickly as practicable. Failure to feed back survey results is not only discourteous, but can be damaging to the organization. The form of the feedback will depend on the nature of the survey, the culture of the organization, and the expectations of employees.

In general, you will probably wish feedback the headline findings of the survey to participants and, where appropriate the wider population. You will not usually need to provide detailed breakdowns—for instance breakdown according to response group—at this stage unless they are indicative of some highly significant finding. The most common approach is to produce a simple summary report that can be distributed to all employees. In some cases you may wish to provide more detailed information, either to whole populations or specific parts. You may wish to feed back to individual divisions or functions their results, with some indication of how they compare with the aggregate response. Feedback is important in ensuring that participants understand the results of the survey, and in demonstrating that their responses have contributed to the overall process.

### *Follow-up*

All too often, organizations assume that the completion of the survey, with the production and feedback of results, marks the end of the survey process. It is often worthwhile spending some time conducting follow-up research. This is particularly the case in questionnaire-based surveys. You may find that the statistics that you have collected only give you part of the picture; you may not understand why a particular response was high or low. You may not understand why the response from part of the organization is different to the rest. In these circumstances, it is often helpful to collect some more qualitative information. The follow-up stage is most commonly conducted by means of focus groups. This can be done with a small sample of respondents—either from the total response group, or from specific areas—to explore the issues in question. In this way, the focus group allows you to pick apart the survey findings to ensure that you fully understand them. The follow-up can also be a very effective mechanism for looking at potential responses to survey findings. The focus group will not only help the organization understand the significance of findings, but also begin to identify and develop possible initiatives or actions to help deal with the issues.

If the survey has been based on focus groups or interviews, you will already have a high level of qualitative information, and it may not be necessary to conduct a follow-up to clarify issues.

### *Action*

Many issues may be covered by a survey, and these may need to be addressed by various actions. It is important that a plan is prepared, incorporating these actions, and a process put in place to monitor the implementation. Senior managers should regularly review progress and communicate the extent of progress to employees.

## OPTIONAL EXERCISES

- (1) Review the section on “Key Objectives” and answer the list of questions that are designed to clarify your objectives in a proposed survey of safety culture in an organization that you are familiar with.
- (2) What are the advantages and disadvantages of the various survey methods (i.e. questionnaires, interviews) for obtaining information about the safety culture in an organization?

## 6. SELF-ASSESSMENT OF SAFETY CULTURE

To assess the safety culture of an organization is not easy. We must remember that the safety culture will be influenced by the organizational culture, and possibly other cultures. Culture is a complex concept involving multiple levels with some levels such as basic cultural assumptions being tacit and out of awareness. There are no commercially available safety culture questionnaires that will satisfactorily assess the safety culture of an organization. This should not be surprising as each organization is unique in terms of its history, its organizational culture and its employees. In view of the uniqueness, many organizations choose to undertake their own self-assessment of their safety culture. The assessment can be based on the Three Level model developed by Schein, and combining this with knowledge of the characteristics of safety culture, and knowledge of how to design and conduct an employee survey. Knowledge of these three areas can be used to develop a method for assessing the safety culture in an organization.

### 6.1. USING THE THREE LEVEL MODEL

Schein's Three Level model is a useful way to develop an understanding of safety culture in an organization. Recall that the model is based on three levels of culture: artefacts which are visible; espoused values which can be determined; and basic assumptions which are tacit and out of awareness. The best way to use the model is to assemble a group comprising representatives from the key areas of the organization. This may be the group that ultimately will be involved in the project to assess the safety culture. If this is the case, the individuals in the group should have the appropriate skills, for example, at least one person should be familiar with statistics, and also there should be a person having some knowledge of psychology. Having formed the group, the next steps are outlined below.

#### 6.1.1. Identify artefacts

Start by identifying many of the artefacts that characterize the organization. Ask people to recall what they noticed when they first joined the organization, and whether what they noticed is still present. Write down all the items that are identified. The following list can serve as a prompt to make sure that you cover all the areas in which cultural artefacts are visible:

- (1) Dress code;
- (2) Level of formality in authority relationships;
- (3) Working hours;
- (4) Meetings (how often, how run, timing);
- (5) How decisions are made;
- (6) Communications: how are people informed;
- (7) Jargon, uniforms, identity symbols;
- (8) Ceremonies and rituals;



- (9) Disagreement and conflict: how handled;
- (10) Policies and procedures;
- (11) Plans: what do they cover;
- (12) Visibility of senior managers.

Do not restrict the identification of artefacts at this stage to safety-related artefacts, although you may wish to place an asterisk against any in this category to facilitate later identification.

### **6.1.2. Identify espoused values**

Ask the group to identify some of the espoused values that the organization holds. Some may already have been mentioned when identifying artefacts. When this happens, list them under espoused values. Espoused values are often stated in formal documents such as strategic plans where they may be included when vision and mission statements are given. Again at this stage do not restrict contributions to safety-related espoused values, but you can highlight any that are in this category.

### **6.1.3. Compare espoused values with artefacts**

Identify how the espoused values may be linked to the various artefacts that have been listed. For example, teamwork may be an espoused value, but at the artefact level the reward system is based on competition between individuals. When there is an inconsistency between what is observed at the artefact level and espoused values, you have probably identified an area where a deeper tacit assumption is operating. You now have to search for that deeper assumption. By identifying the inconsistencies and conflicts between overt behaviour, policies, rules, practices and the espoused values, you will gradually identify the deeper levels of the organizational culture. You may begin to see patterns among the basic assumptions that are driving the system, and which explain the presence of most of the artefacts that you have listed.

If you think that there may be cultural sub-groups that have their own basic assumptions, you can test this by forming groups that will reflect possible differences.

### **6.1.4. Eliciting the basic assumptions**

Assess the pattern of basic assumptions that you have identified in terms of how they help or hinder you in accomplishing safety goals. Since culture is very difficult to change, concentrate on identifying the assumptions that can help you. Try to see your culture as a positive force to be used rather than a constraint to be overcome. If you identify particular assumptions that you consider to be real constraints on improving safety, note them as requiring future action to change these elements of culture.

The above four-part exercise will provide useful data on the overall organizational culture and the influence of that culture on safety. The exercise is best conducted with the assistance of a facilitator who understands the concept of culture, and who is not a member of the organization that is undertaking the cultural self-assessment.

The next step is to identify specifically those artefacts, espoused values and basic assumptions that have a relevance to the various characteristics of a positive safety culture.

## 6.2. LINKING ARTEFACTS, ESPOUSED VALUES AND BASIC ASSUMPTIONS TO SAFETY CULTURE CHARACTERISTICS

In an organization in which safety is central to the culture, we have already identified some of the artefacts, espoused values and basic assumptions associated with safety. We shall now try to link each of the component levels of culture with the safety culture characteristics. To do this, take each safety culture characteristic in turn, and identify the particular artefacts, espoused values and basic assumptions that are relevant to the that characteristic. Some artefacts, espoused values and basic assumptions will be associated with more than one safety culture characteristic. An example will illustrate what is required.

Characteristic: *involvement of all employees*

Artefacts:                Safety improvement teams  
                             Employee involvement in safety inspections  
                             Surveys of employee safety attitudes  
                             Employees contribute to safety plans

Espoused values:    Teamwork  
                             Everybody is responsible for safety  
                             Empowerment of people

Basic assumptions: People have a right to be involved in activities that affect their lives  
                             People will contribute positively if given the opportunity  
                             People can be trusted to do what is right

This above list is not comprehensive and could be expanded. The benefit of the exercise is twofold: firstly, it demonstrates that safety culture is embedded in the organizational culture as you are able to show the link between the individual safety culture characteristics and the artefacts, espoused values and basic assumptions of the organizational culture; secondly, it identifies the safety culture characteristics that may be missing in that no artefacts can be found that reflect the characteristic's presence. This information is useful when considering future improvements to the safety culture of the organization.

## 6.3. DESIGNING A SAFETY CULTURE QUESTIONNAIRE

Where survey findings are suspect, this is most commonly caused by fundamental flaws in the design of a survey instrument such as a questionnaire. This section will deal with the key issues involved in designing an effective safety culture questionnaire. There is an extensive literature available on the complexities of questionnaire design. Much of the literature deals with the design of questionnaires for psychometric and other experimental purposes where a particularly high level of rigour and precision is required. Although the principles are relevant to the design of employee surveys, the rigour required for managerial or organizational purposes is generally rather less. In the organizational context, you will usually be interested in exploring at a relatively straightforward level, opinions or attitudes relating to specific issues. Nevertheless, even though employee surveys are exploring more straightforward issues, the precision of the survey instrument is still important.

As with many aspects of good survey practice, many of the principles reflect simple common sense, even though they are too often disregarded. The key principles are:

- (1) Decide precisely what information you wish to obtain from each individual question.
- (2) Ensure that the question gives you this information as precisely as possible.
- (3) Ensure that there is no possibility of misunderstanding or ambiguity about the question or its answer.

Expressed in these terms, the principles seem obvious, yet in many surveys they are disregarded. There are a number of common pitfalls that are worth highlighting.

### **6.3.1. Ambiguity or uncertainty about language and terminology**

In framing a question, people will often assume a common understanding of words or phrases where no such commonality exists. For example, a questionnaire might ask, “Is the quality of safety in your workgroup excellent/good/fair/poor?” This may be a useful question if it is followed by others that explore the respondent’s understanding of the term “quality of safety” and its application in the workgroup. Frequently, this question is allowed to stand alone with no explanation or follow-up. In such cases, what is meant by “quality”? Without a common understanding of the term, the responses that we receive are likely to be meaningless.

### **6.3.2. Lack of clarity about the information required**

Questionnaires are frequently weakened by the lack of clarity about the nature and detail of the information they are intended to collect. You should always stop to ask yourself: Why am I asking this question? What exactly do I want to know? Will this question give me the information that I need? These questions are often not asked, with the result that the wrong question is asked in the questionnaire.

An example illustrating the benefit of asking these questions is the following: The question was contained in an employee safety survey. The question asked respondents to express their degree of agreement with the following statement: “My manager is committed to safety: strongly disagree/disagree/neither agree or disagree/agree/strongly agree”. Most respondents expressed agreement with the statement which, whilst welcome, actually provided little useful information about how the commitment was demonstrated. The information would fail to distinguish between managers who just talked about safety, and those who translated words into actions. An alternative and improved statement is: “My manager devotes time each week to meeting employees to discuss safety improvements”. This statement includes the key words “devotes time”; “meeting”; “safety improvements”.

### **6.3.3. Combining multiple questions into one question**

One of the most common causes of confusion in questionnaire design is the entangling of several issues within one question, so that it is unclear what information is being provided by the respondent. An example is when respondents are asked to express their degree of agreement with the statement “Work and safety performance are regularly reviewed by managers: strongly disagree/disagree/neither agree or disagree/agree/strongly agree”. The assumption behind the question is that both work and safety performance are regularly

reviewed. How does a respondent answer if only work performance is reviewed? Another criticism of the above statement is what is meant by “regularly”.

#### **6.3.4. Making unjustified assumptions**

Problems can arise when the phrasing of the question implies an assumption that is not justified by the evidence available to you. An example is the statement “When I carry out a safety inspection, I use a checklist: yes/no/sometimes”. The assumption is that the respondent carries out a safety inspection.

#### **6.3.5. “Don’t know” and “Not applicable”**

These categories of responses are often omitted. You should allow for the possibility that the respondent does not know. It has been argued that a “don't know” response gives respondents an opportunity to avoid committing themselves, but on the other hand do we want to obtain “forced response” that are virtually meaningless?

#### **6.3.6. Leading questions**

Even when a question has been very carefully and precisely phrased, it may still provide misleading information if it appears to be leading the respondent towards a particular answer. Employees often experience some anxiety when completing surveys, and may be very keen to give the “right” answer—the answer they believe the organization wants to hear. It is difficult to avoid this problem entirely as some employees will always instinctively seek what they believe to be the “socially acceptable” response (just as a few employees may react in the opposite direction). This problem occurs most often when respondents are asked to indicate their level of agreement or disagreement with a particular statement. There is a danger that the preferences or prejudices of the questionnaire designer influence the formulation of the statement, leading the respondent to make a particular choice. A series of positive statements about a particular aspect of an organization may suggest to a respondent that a positive attitude to this issue is preferred. It is prudent to include a mixture of positive and negative statements, which do not suggest any particular preference.

An example of a potentially leading statement is “The quality of safety in my department is generally excellent: strongly disagree/disagree/neither agree or disagree/agree/strongly agree”. The statement is heavily biased to the positive. A respondent who thought that safety was satisfactory, but with room for improvement, would probably agree with the statement.

### **6.4. FORMAT OF QUESTIONS**

There are various ways to structure survey questions apart from the agree/disagree format. Survey questions can be divided into two broad categories: those exploring attitudes or opinions, and those seeking some form of factual information. The first category would include the agree/disagree format, an example being “Safety is always a primary concern for the organization; agree/disagree”. In the second category might fall questions about the frequency of safety briefings, for example. Within these two broad categories a number of formats can be applied. Questions on attitude or opinion generally ask the respondent to indicate both the direction and strength of feeling—for example “strongly agree” to “strongly disagree”. Alternatively, you may ask for a range of opinion about a given topic with a question like “Do you think the safety planning of work in your department is generally excellent/good/fair/poor?” In such cases, where you are asking respondents to commit

themselves to a specific opinion, you need to be aware of the “error of central tendency”—where respondents are reluctant to give extreme responses, and prefer to select the middle ground. If you have an odd number of possible choices in your scale, you may find respondents disproportionately opting for the middle one.

In collecting factual information, you may wish to use scales where the required information lies on a continuum. For example “How many days have you spent on safety training in the past 12 months? Fewer than 3 days/ 4–6 days/ 7–10 days/more than 10 days”.

The format of questions throughout the questionnaire need not always be the same. There are benefits in having some variety to discourage “automatic” responses to questions. This can result in respondents consistently hovering around the midpoint of a repetitive series of scales. By varying the format of questions, it is possible to encourage respondents to pause momentarily before addressing each question. Each specific question will then be better considered on its individual merits. You should aim to strike a balance between encouraging respondents to view each question independently and avoiding an overall format that appears unduly disruptive or confusing. Sometimes it is helpful to phrase questions about a topic in a form that a “disagree” response would be considered positive. Including some questions of this form will help identify respondents who complete the questionnaire in a mechanical and unthinking way.

## 6.5. BUILDING THE SAFETY CULTURE QUESTIONNAIRE

A decision has to be made on the length of the questionnaire. There is generally a relationship between the length of the questionnaire and the level of response. The longer and more detailed the questionnaire, the more likely you are to encounter resistance from potential respondents. Ultimately, you need to balance the two factors. In the case of safety culture questionnaires, it is usually recommended that the number of questions be in the range 60 to 80. With less than 60 questions it is difficult to capture the detail necessary to obtain a picture of the safety culture, and with more than 80 you may encounter resistance.

Some personal information about the respondent may be required to assist with the analysis. The information may be about a department, to which the respondent belongs, grade, age gender, length of service. Care must be taken to avoid collecting information that will reveal the respondent’s identity, e.g. there may be one female engineer aged 25 in a department. The relative importance of personal information will depend on the issues under consideration.

Some 31 characteristics of a positive safety culture were identified. A series of questions in an appropriate format can be developed for each characteristic. To avoid creating a lengthy questionnaire, it is suggested that about 15–20 characteristics are selected, and four questions or statements generated for each selected characteristic. The group sessions used to identify the organization’s cultural components (artefacts, espoused values and basic assumptions) could be used to select the subset of characteristics that will be used to generate questions. Some safety culture characteristics may already have been identified as missing. These could be excluded from the questionnaire, although they should be highlighted as requiring future action to develop them.

The suggested approach is illustrated by the following example:

Safety culture characteristic: *Absence of safety versus production conflicts*

Possible statements for inclusion in a questionnaire are:

- (1) Work stops immediately when a safety problem is identified: strongly agree/agree/ neither agree or disagree/ disagree/strongly disagree.
- (2) Production would be higher if it were not for safety requirements: strongly agree/agree/ neither agree or disagree/ disagree/strongly disagree.
- (3) Workers sometimes take safety risks to complete their work: strongly agree/agree/ neither agree or disagree/ disagree/strongly disagree.
- (4) Safety needs are addressed when planning work: strongly agree/agree/ neither agree or disagree/ disagree/strongly disagree.

Note that a “disagree” response to statements No. 2 and 3 would be indicative that safety is not considered to be secondary to production.

It is recommended that more than four statements be generated for each characteristic so that there is a pool of statements from which a final selection can be made. This will help if some selected statements need to be replaced as a result of the pilot survey.

## 6.6. SAMPLE POPULATION

The size of the sample will often be dictated by the need to ensure that employees accept the findings of the survey as a valid reflection of the aggregate views. A sample, which only satisfied statistical confidence requirements, would be too small generally. Most organizations when they decide to conduct a survey of their safety culture, survey all of their employees. Should you decide to use a smaller size sample, you need to be aware of the need for a reasonably sized sample in the smallest sub-group that you wish to investigate. Generally, you need at least 30 respondents in the smallest sized sample. The basic rule is that the more finely you wish to slice the survey findings, the larger the sample that you will require.

## 6.7. GENERAL POINTS

Some other general points about surveys are worth stressing. First, make sure that you provide clear instructions that indicate how the questionnaire is to be completed. It is also a good idea to provide some specific examples of how a question should be completed. The most effective questionnaire are those where respondents are able to proceed easily through the questionnaire from the first question to the last, and are not required to skip a number of questions. Finally, do try and lay out the questionnaire as attractively as possible. It is often possible, for a relatively small cost, to make dramatic improvements to the design that may, in turn, have a very significant impact on the level of response.

## 6.8. INTERVIEWS

Care also needs to be taken when preparing questions for use in interviews. Interview questions are generally open in that a simple agree/disagree response is not required. In preparing for an interview, a series of questions should be prepared for each topic. The order in which the questions will be asked should be considered. Follow-up questions should be

prepared for use after the respondent has given a first answer to the main question. These follow-up questions can be general or specific.

The most important requirement in an interview survey is that each respondent should have an adequate understanding of every question, and that the question is asked in a non-directive manner.

#### OPTIONAL EXERCISES

- (1) From the 31 characteristics of a positive safety culture, select 15 that are important, in your view, to improving the safety culture in your organization. List the artefacts observable in your organization that are relevant to the selected characteristic.
- (2) Using the 15 selected characteristics, prepare a simple questionnaire comprising a series of statements in the agree/disagree (including strength of agreement or disagreement) format. Generate four statements for each characteristic, including some to which a “disagree” response would be considered positive.
- (3) Invite another person who has not been involved in preparing the questionnaire, to read it and ask questions about any items that are ambiguous, or difficult to interpret. Amend your questionnaire to take account of their comments.
- (4) Prepare a series of questions to be used in an interview survey on what an interviewee understands by the term “safety culture”.

## 7. PRACTICES TO DEVELOP SAFETY CULTURE

There are a number of practices that can help an organization develop its safety culture. Many of the practices could also benefit the organization in areas other than safety. The introduction of these practices into an organization will provide the tangible evidence of its intention to improve safety, and demonstrate its appreciation that safety culture development requires a broad range of action. In the following, the specific practices are described, but are not dealt with in any priority, as they are all important, although some may be more important than others.

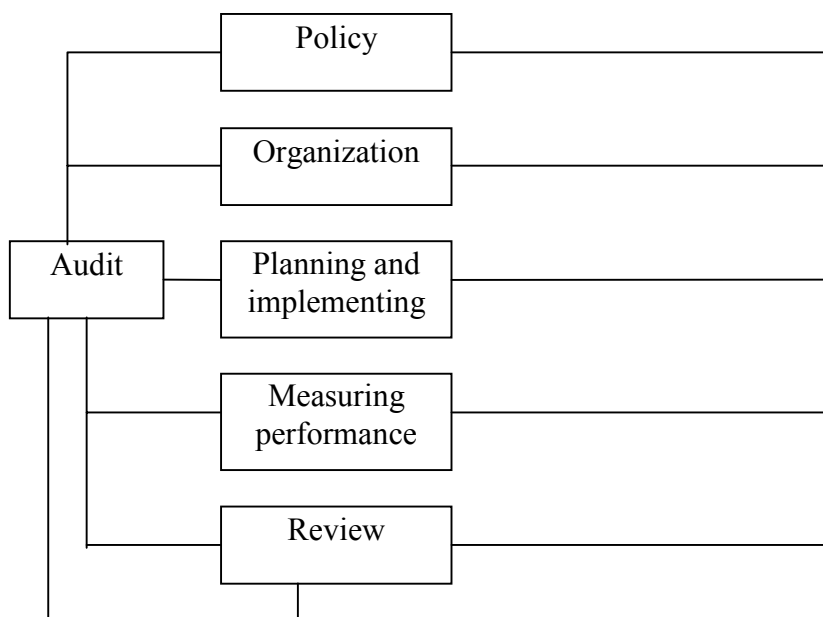
### *Practices for senior managers*

The involvement of senior managers in pursuing high standards of safety is one of the more important practices, as most employees will judge what is important in an organization by the words and behaviour of senior managers. This is particularly true of middle and junior managers who will take the lead from their senior colleagues.

Senior managers must support the development of safety culture by:

- (1) Gaining an understanding of safety culture as a concept;
- (2) Being visibly interested in safety and integrating it into their other activities;
- (3) Encouraging employees to have a questioning attitude on safety;
- (4) Ensuring that safety is included in planning activities;
- (5) Regularly reviewing safety to ensure its adequacy for current and future circumstances;
- (6) Monitoring safety trends to ensure that safety objectives are being achieved;
- (7) Recognizing those who improve safety.

Senior managers should also ensure that the organization has an effective safety management system for maintaining a high standard of safety. The main elements of such a system are shown in the diagram below [21].



Senior managers must not restrict their interest to safety problems such as accidents or other events. Doing this is a reactive approach. To develop a positive safety culture, senior



managers should take an interest in what is being done to prevent accidents and events, and in so doing demonstrate that prevention is better than cure.

### *Risk assessment*

The analysis of risk and its consequences is an important activity in improving safety. Organizations with a keen interest in safety will perform risk assessments for all their significant activities, and it will be an integral part of pre-work activity. When the risks have been assessed, control measures can be identified to eliminate or reduce the risk. Risk assessment is most effective when conducted by a multi-disciplinary team, as this will ensure that risk is addressed from many perspectives. The multi-disciplinary approach encourages better understanding and communications between functional groups. Risk assessment is most effective when employees believe that they can impose some control over the outcome of events. This will be the case when one of the basic cultural assumptions is that humans can exert some control over nature. A fatalistic approach to life is not conducive to risk assessment.

### *Errors as a learning opportunity*

It is important that employees be encouraged to treat errors as a learning opportunity, and that managers give employees the confidence to report errors without fear of blame. It is only by treating errors as a learning opportunity that processes can be improved. One consequence of this approach is that the number of events reported can actually increase. This is a result of higher safety awareness, and having the confidence to report errors; it is not a sign that safety is deteriorating. Only in the longer term will the number of events decrease, as the benefits of learning takes effect. It is important that managers are not misled by indicators that show a short term increase in the number of events. Organizational disciplinary measures can still apply if there has been wilful neglect by an employee that caused an event. Near misses (events that had no tangible consequence) should also be regarded as a valuable source of learning.

### *In-depth analysis of events*

To derive benefit from events, a systematic in-depth analysis of their causes is of fundamental importance. The analysis should include human factors and not be restricted to technical matters. The analysis should attempt to identify the direct and indirect causes of an event in order to establish the root causes. The causes may be one or several of the following: technical, human behaviour, organizational culture, process, procedure, equipment, environment, or latent weaknesses in defences. There should also be a thorough analysis of the actual or potential consequences, and a consideration of the robustness of the remaining lines of defence. Root cause analysis recognizes the multi-causal nature of events. There is rarely a single cause and effect. The involvement of a person with human factors skills is recommended when undertaking a root cause analysis, particularly when human error is part of the cause. Root cause analysis can only be effective when errors or events are reported openly and honestly.

### *Organizational learning*

Many organizations have adopted an approach, which involves a constant re-evaluation of the environment, together with the creative adaptation that enables anticipation of environmental changes, and development of appropriate responses. Such organizations are often called “learning organizations”. This proactive approach is ideal for improving safety.

In a learning organization there is a willingness to learn from others, and also to reciprocate by sharing information with other external groups. The ability to recognize, and diagnose problems, and to identify solutions, improves when there is a learning philosophy in an organization. A learning organization is unlikely to underestimate the influence of organizational culture on safety performance, and is more likely to use cultural strengths to achieve improvements in safety.

#### *Role of training in promoting safety culture*

Training can make an important contribution to developing safety awareness and skills. Training needs should be identified using job and task analysis, and by referring to other sources such as risk assessments. Although safety training increases knowledge and skills, it may not alter employee attitudes, values or behaviour. Trainers can counter this difficulty by promoting a positive safety culture in their training activities. This can be helped if trainers regularly visit plants and work areas to observe work in order to improve their understanding of specific training needs. Training managers in the basic concepts of organizational culture, and in the characteristics of a positive safety culture will be beneficial if they are to demonstrate leadership in developing safety culture.

#### *Employee contribution to improving safety performance*

All employees have a responsibility to contribute to their personal safety and to that of their colleagues. This contribution is best achieved if employees are encouraged to become actively involved in safety by inviting them to participate in safety improvement teams—the teams may comprise representatives from various functions. Many organizations have regular safety meetings at the departmental or group level. Safety committees usually comprise representatives from both management and the workforce. Some organizations hold an annual safety conference or exhibition, which serve as a forum for representatives from all levels and parts of the organization to meet, and discuss safety issues. The conference may have a particular safety theme. External speakers may be invited to share their experiences. An annual conference often combines presentations with group work aimed at producing action plans for improving safety. Employees can then return to their normal work after the conference, and implement the safety improvement plans.

#### *Involvement of contractors*

Contractors are a key resource in many organizations and should not be excluded from efforts to improve safety. It is helpful if contractors receive the same attention and training in safety culture as the employees of the organization. This can be mutually beneficial in improving safety performance, and encouraging a similar view among contractors that safety culture is important. It should be recognized that contractors may have a different organizational culture to the organization that they work for. The best way forward may be to focus on the key characteristics of a positive safety culture, and allow some flexibility in how those characteristics are embedded in the contractor organization.

#### *Communication of safety issues to the public*

It is important to maintain public confidence in safety, particularly nuclear safety. Communication of information on safety performance to external groups can assist in developing this confidence. However, information must be communicated in a way that minimizes the possibility of misinterpretation. Some organizations hold regular meetings, often referred to as “local liaison meetings” with representatives of the local community and

local government to share information about activities and performance. The meetings sometimes include representatives of the regulatory bodies to assure the local community that there is an independent perspective. In addition to local liaison meetings, some organizations publish regular newsletters containing information on various matters, including safety. Sometimes a newsletter is used as a channel of communication with the wider media, which refer to the newsletter for a convenient summary of information. This can help limit distortion of the facts, especially those associated with a safety-related incident. The larger organizations can offer tours of their facilities to members of the public. This creates a sense of openness, and offers an opportunity to provide visitors with factual information. Very large organizations may build exhibition buildings that house models demonstrating the processes that they use. Interactive models are particularly popular among young people.

### *Self-assessment processes*

Organizations committed to the achievement of high standards of safety use self-assessment to maintain and develop the ability to manage safety effectively. Self-assessment allows organizations to evaluate their safety performance by reference to internal indicators, or by comparison with the performance of other organizations.

Self-assessment may involve self-evaluation, self-inspection, or self-audit. Competent people should undertake the self-assessment. Where an audit is involved, the people performing the audit should be independent of the area or activity being audited. This can be done by using either external consultants or staff from different departments or groups, or even sites, to audit their colleagues. Those with auditing responsibilities will generally require specific training in auditing techniques. Audits that concentrate solely on compliance can create a negative image in the eyes of employees, and can create difficulties for auditors in their work. Some organizations have extended the role of audits from one exclusively dealing with compliance issues, to one that includes the identification of improvement opportunities based on best practice. Auditors, by the nature of their work, have the opportunity to observe best practice in an organization or in many organizations if they are external auditors. Audit reports can be used to disseminate information about best practices.

### *Integrated safety evaluations*

Safety issues need a multi-disciplinary approach with the involvement of different specialists. This will require the work to be organized in a way that allows an integrated approach, for example in the planning and implementation of a major plant modification or in the investigation of an event. These usually require consideration to be given to a variety of issues: technical, human factors and organizational aspects, in a co-ordinated and integrated manner. The integration of knowledge of human factors into routine work may also provide a useful way of improving safety performance.

### *Safety performance indicators*

Traditionally, many organizations record the number of accidents and safety-related events. Whilst providing useful information, these indicators are of a passive nature. Many organizations use indicators of a more positive nature to complement the traditional passive indicators. Positive indicators, in the safety context, measure what is being done to improve safety and prevent incidents. Examples of positive indicators are:

- (1) Percentage of safety improvement proposals implemented during the previous month or quarter;

- (2) Number of safety inspections conducted by senior managers during the past month;
- (3) Number of employees who have received refresher safety training during the past month;
- (4) Number of safety audit recommendations implemented during the past month.

The above list is not comprehensive and is illustrative only. The value of positive indicators is that they serve as a means for recognizing the efforts of people who are trying to improve safety. Recognition is a powerful motivating force to encourage continued improvement. Safety performance trends should be communicated to all employees to make them aware of progress.

#### *Regulatory approach and implications for safety culture*

There is considerable diversity in the regulatory approach to safety with regards to where emphasis is placed. One option is a compliance-based approach in which very explicit standards and requirements are applied. This approach may be less effective when considering how best to develop safety culture. Another option is to focus on outcomes—to establish indicators and devote regulatory effort to tracking them, and investigating adverse trends. The problem with this approach is the difficulty of identifying predictive indicators. Indicators are often too easy to manipulate or not sensitive enough to highlight developing problems. Another option is to adopt a process-based approach to regulation that takes account of the fact that the safe operation of a facility depends on the effectiveness of its organizational processes. This latter approach focuses on the organizational systems that have been developed to ensure continuous safe operation. Process-based regulation recognizes that the design of organizational processes must remain flexible to allow the organization to adapt to a changing environment. The organization must demonstrate to the regulator that there is an on-going evaluation of key processes, and that the organization is alert to opportunities to improve its systems. The three approaches can be combined as they are not mutually exclusive.

The advantage of process-based regulation for organizational and safety cultures is that assessments based on the effectiveness of key processes allow a degree of flexibility but retain an in-depth rigour that is no less than mere compliance-based approaches. Irrespective of which regulatory approach is adopted, organizations committed to continuous safety improvements will benefit from open and frank dialogue with their regulatory bodies, especially when the dialogue concerns safety objectives. Experience has shown that such dialogue will promote an inquiring and learning attitude that is so vital to enhancing safety culture.

#### *Influence of the regulatory body*

It is important that the regulatory body promotes safety culture development in those organizations under its jurisdiction. Regulatory inspectors should be trained in all aspects of safety management, safety culture and on how to undertake change in an organization. Without this understanding, regulators may incorrectly concentrate their efforts and slow down or impede the development of safety culture. For example if regulatory inspectors only show interest in compliance with procedures, the organization may gradually begin to view safety from only a technical perspective and treat the human component mechanistically. The complexity of safety culture would be ignored.

Organizations find it helpful if there is a degree of predictability and stability in the regulatory process. It is important that regulators routinely meet representatives of organizations to share forward thinking.

#### *Interaction with regulators*

The statutory duties of a regulator necessitate frequent contact with an organization. Also in addition to this formal interface, some organizations hold regular meetings of a more informal nature to discuss general plans for the future or to share information about an emerging problem. These informal meetings keep the regulator informed of progress in work areas that may be of interest. It allows the regulator to obtain a broader perspective of the organization's activities. Questions relating to safety culture can often be discussed at these informal meetings, thus allowing both the regulator and the organization to develop their awareness of safety culture in tandem. It may be that several regulators have jurisdiction over an organization. In this case the informal meetings also can provide an opportunity for regulators to interact with each other and with the organization. Any incompatibilities in regulatory strategies will become apparent.

### OPTIONAL EXERCISES

- (1) Consider your own organization, and from the list of practices given, identify those practices that you believe are already used in your organization, and those that you believe could beneficially be introduced.
- (2) Consider each practice in turn, and give your view on which espoused values and basic cultural assumptions would be required to ensure the effectiveness of the practice in developing safety culture. Are there any espoused values or basic assumptions present in your organizational culture that would make difficult the introduction of a specific practice?

## 8. SAFETY CULTURE INDICATORS

Safety culture is a complex concept and there is no simple indicator that measures its state. The multilevel nature of culture, and the tacit nature of some of the levels (basic assumptions), increases the difficulty of measurement. Some of the potential advantages and disadvantages of using indicators to measure safety culture are shown below.

### Advantages

- The use of indicators allows trends to be detected.
- Managers pay greater attention to what is being measured and the use of safety culture indicators will increase their interest in the concept.
- Safety culture is an important aspect of organizational life hence it should be treated like other important aspects and measured.

### Disadvantages

- Safety culture is complex and no obviously satisfactory measures exist, thus any attempt at measurement must be indirect.
- Some elements of safety culture such as basic assumptions may be unconsciously held and present great difficulties for measurement.
- Managers may feel that they have little influence over trends in safety culture indicators when they have limited understanding of the concept of safety culture and the period of time needed to effect a change in safety culture.

Despite the difficulties faced in attempting to measure safety culture and any potential limitations, it is recommended that an effort be made to identify suitable indicators.

Before considering safety culture indicators in more detail, it will be helpful to review the subject of performance indicators in general.

### 8.1. TYPES OF PERFORMANCE INDICATOR

Two types of performance indicator are in wide use today. One type relates to results, and the other is associated with activities, and compliance with processes and procedures.

*Type 1:* Results oriented indicators identify measurable results, including individual and organizational contributions.

*Type 2:* Implementation oriented indicators measure the fidelity of actions, and compliance in the application of methods, resources and approaches to tasks.

Type 1 indicators are generally the most commonly used, but Type 2 indicators are also used, and have an important role in certain areas including safety. The two types of indicators cover “ends” and “means”.

## 8.2. MEASURABILITY

Sometimes we know more about some results than others. For example: in some instances we can only name something as being in a certain category; in other cases, we can only know that an item is greater than, less than or equal to another. At other times, we can measure something with great precision. There are four scales of measurement that reflect the above possibilities.

*Nominal scale:* used when referring to data that can only be classified into categories, for example,

| <b>Function</b>   | <b>Number of persons</b> |
|-------------------|--------------------------|
| Operations        | 550                      |
| Engineering       | 370                      |
| Safety            | 150                      |
| Administration    | 300                      |
| Technical support | 150                      |

The categories are mutually exclusive, and each object appears in one of the categories.

*Ordinal scale:* used when data can be defined as greater than, less than or equal to another, for example:

| <b>Safety rating</b> | <b>Number of ratings</b> |
|----------------------|--------------------------|
| Excellent            | 2                        |
| Good                 | 4                        |
| Average              | 4                        |
| Poor                 | 3                        |
| Very poor            | 1                        |

The ratings follow a ranking with “excellent” regarded as greater than “good” etc. However, there may be unequal distances between the categories, for example, a safety rating of “good” cannot be considered to be twice as competent safety-wise as a rating of “average”. Many safety surveys ask employees to indicate the direction and strength of agreement on a question or statement about safety.

*Interval scale:* used when data can be expressed on a scale beginning at an arbitrary zero, and having equal intervals, for example:

| <b>Length of service</b> | <b>Number of persons</b> |
|--------------------------|--------------------------|
| 4–6 years                | 50                       |
| 7–9 years                | 100                      |
| 10–12 years              | 20                       |

*Ratio scale:* used when data can be expressed on a scale having a meaningful zero point, and also when the ratio between two numbers is meaningful, for example: money is a good illustration. Having zero money has meaning—you have none! We also can state that a person with \$ 4 has four times the amount of money that a person with \$ 1 has.

It is important to be aware of the different scales when considering indicators for measuring the state of safety culture in an organization. Most people are accustomed to using interval and ratio scales in their work, and we have become accustomed to their meaning. When we embark on measuring something as complex as safety culture, we need to be aware of the other types of scale.

### 8.3. CONSEQUENCES OF MEASURING

It is often said that only those things that get measured, get done; and that, since only certain things can be measured, it is hardly a surprise when managers or organizations are assessed on short term criteria. Short term measures may be of production or the number of accidents. The consequences of not being able to easily measure things like “commitment to safety” or “relationship with the regulator” means that we are forced back to measures of “numbers of accidents” or “numbers of training courses”. These become important indicators in the organization for measuring safety. Consequentially, when we learn more about the multilevel complexity of safety culture, we become frustrated at not being able to identify meaningful measures. When we do agree, a possible measure such as the findings of an employee attitude survey, it seems so different and fuzzy compared with our usual measures that managers are uncomfortable, and downplay its importance relative to the other more traditional measures in use. However, if managerial discomfort were a reason to avoid anything, then we would probably not be looking at a very effective organization. Managers may be concerned about the subjectivities of a performance measurement system, but on one thing we can be certain, once managers have been measured and possibly rewarded on a particular activity, it soon becomes an important part of their performance. It is often assumed that it is the measurement itself that stimulates a change in activity and its relative success, but it may actually be the process that people go through to achieve a goal that is considered a success. In the case of safety, it is not that managers respond to mechanical stimuli in a Pavlovian way (10% reduction in the number of safety incidents equates to a pay bonus, thus pay attention to safety), but rather that to get to the agreement that improved safety is an essential part of the organization’s objectives, requires people to discuss what exactly the organization is trying to achieve and why. Once agreement has been reached, it should then be clearer to all what the objectives are, and managers can begin to pull in the same direction. The introduction of safety culture indicators will help because it forces managers to reflect upon safety culture far more than they normally would. Another important consequence of introducing measures is not only to bring under greater control what exists by influencing managers’ and employees’ behaviour, but also to expand their awareness of the area being measured. This is particularly relevant for the measurement of safety culture, as many organizations have traditionally held a narrow view of what is involved in achieving safety. Some organizations regard safety as a predominantly technical issue with little attention paid to the importance of attitude and other cultural factors on safety performance. Safety culture indicators can help broaden people’s range of thinking of what constitutes a good foundation for safety.

Care needs to be taken in selecting safety culture indicators to avoid over-emphasizing any particular aspect. The multilevel nature of safety culture means that a broad range of indicators, some of which may be more subjective in form than others, is necessary to gain useful information about the state of safety culture in an organization.

### 8.4. EXAMPLES OF SAFETY CULTURE INDICATORS

It is recognized that there is no one indicator of safety culture that reflects the complexity of the concept. The only practical way forward is to identify a portfolio of indicators that measure the important characteristics of a positive safety culture. Some traditional safety performance measures will still be relevant, but additional indicators will be needed. Some examples of indicators that may be useful, when grouped in a portfolio of indicators, in measuring the overall state of safety culture are shown below. The examples are listed under the different levels of culture in line with the Three Level model of culture



developed by Edgar Schein. The relevant safety culture characteristic is shown in brackets along side the example.

#### Artefacts

- (1) Percentage of corrective actions not completed within planned time-scale (a measure of proper resource allocation, top management commitment to safety).
- (2) Safety audit scores (a measure of safety performance, self-assessment).
- (3) Safety attitude scores (a measure of employee involvement, motivation and job satisfaction).
- (4) Percentage of tasks having risk assessment in pre-work planning (a measure of a systematic approach to safety).

#### Espoused values

- (1) Frequency of senior manager plant tours (demonstrates high priority to safety).
- (2) Number of safety inspections (demonstrates high priority to safety).
- (3) Percentage of managers trained in root cause analysis (organizational learning).

#### Basic assumptions

- (1) Frequency of reporting of near misses (view of mistakes).
- (2) Number of safety improvement teams (view of people).
- (3) Percentage of employees who have a basic understanding of the safety culture concept and its importance (properly designed plant is inherently safe).

Other examples could be given but the important point to note is that a portfolio of indicators is needed to describe the state of the safety culture in an organization.

### 8.5. SAFETY CULTURE INDEX

The question is often asked whether it is possible to create a safety culture index that is representative of the aggregate trends of a number of different safety culture indicators (such as the examples listed in the previous section). It is possible with one way being to allocate weightings to each individual indicator and sum the weighted results. The value of the weighting factors could be the same or vary with a greater weighting allocated to individual indicators that were measuring some particularly important safety culture characteristic. The sum of the weighted indicators could be normalized to 100. The safety culture index created by adopting the above approach would give a very general indication of trends in the state of the safety culture in an organization. There are difficulties with the approach in that the index could be very insensitive to changes in any particular indicator that contributed to the index. This is more likely to be the case when the weighting factors are equal. When the weighting factors vary to emphasize the importance of some of the contributing indicators the difficulty faced is that the index could be overly sensitive to changes in a single contributing indicator.

An alternative approach to developing an index is to agree criteria for rating the performance as shown by individual indicators. For example criteria could be provided to judge whether the percentage of corrective actions not completed within the planned time-scale was rated poor, satisfactory, good or very good. Numerical scores could then be allocated to each rating with a negative score given to any poor rating. For example a poor rating could be allocated a score of -5, a satisfactory rating 3, a good rating 5 and a very good rating 7. The scores of all the contributing indicators are summed to obtain the value of the index. The index may be normalized to 100. The advantage of this approach, compared to the previous method using weighting factors, is that poor performance is penalized because it attracts a negative score.

The number of indicators that contribute to the index needs to be limited to about ten in total otherwise the index becomes too insensitive to detect changes in individual indicators.

### OPTIONAL EXERCISES

- (1) Review your organization's current safety performance indicators, and categorize them as "ends" or "means" oriented. How do the numbers in each category compare?
- (2) What performance measures apply to managers in your organization? Do they get rewarded for performance in activities that are measured?
- (3) Suggest some additional indicators that may be useful for measuring the safety culture in your organization. How are these indicators associated with the different levels of culture: artefacts, espoused values and basic assumptions?
- (4) From the perspective of your organization, suggest three indicators that could be introduced to help expand employee awareness of the influence of safety culture on safety performance.

## 9. SYMPTOMS OF A WEAKENING SAFETY CULTURE

There is often a delay between the development of weaknesses in safety culture and the occurrence of an event involving a significant safety consequence. The weaknesses can interact to create a potentially unstable safety state that makes an organization vulnerable to safety incidents. Within the nuclear industry, there have been a number of high profile cases in different parts of the world that have been linked to a weakened safety culture. By being alert to the early warning signs, corrective action can be taken in sufficient time to avoid adverse safety consequences. Both the organization (which could be a specific plant or utility) and its regulators must pay attention to signs of potential weakness. Some organizations that have encountered difficulties with their safety culture have previously been regarded as good performers by their industry peers. Good past performance is sometimes the first stage in the process of decline.

### 9.1. STAGES OF ORGANIZATIONAL DECLINE

The following model has five stages of decline, with each stage being more severe in consequence than the previous stage. The model is more reflective of an organization in secular decline rather than an organization suddenly faced with a catastrophic event that could not be reasonably anticipated.

| <i>Stage</i> | <i>Name of stage</i> | <i>Characteristic of stage</i>   |
|--------------|----------------------|--|
| 1            | Over-confidence      | Good past performance leading to self-satisfaction.  |
| 2            | Complacency          | Occurrence of minor events that are subjected to minimum self-assessment, and delay in improvement programmes.   |
| 3            | Denial               | Number of minor events increases, with possibly a more significant event. These are treated as isolated events. Findings from audits are considered invalid. Root cause analysis not used.                   |
| 4            | Danger               | Several potentially serious events occur but management and employees reject criticism from audits or regulator, by considering their views biased. The oversight function is afraid to confront management. |
| 5            | Collapse             | Regulator intervenes to implement special evaluations. Management is overwhelmed and may need to be replaced. Major and very costly improvement needs to be implemented.                                     |

The above sequence of stages can be avoided if the organization conducts critical self-assessments and establishes prioritized action plans that address the root causes of difficulties. These plans must be implemented with vigour.

## 9.2. LIST OF SYMPTOMS OF A WEAKENING SAFETY CULTURE

Symptoms can be considered from both the organization's and the regulator's perspective.

### 9.2.1. Organization's perspective

The following symptoms are particularly relevant from the internal perspective of the organization. Any self-assessment of safety culture should check for their presence. For some of the symptoms, it may be possible to develop indicators that will be of value in detecting adverse trends.

*Lack of systematic approach:* this deficiency can affect all aspects of an organization's activities. It makes an organization prone to repeated crises, and some of these may have serious safety consequences. The presence of this deficiency is evidenced by unclear accountabilities, poor decision making processes, and lack of reliable information and general limited understanding of process. From the safety perspective, it is revealed in the weakness of risk assessment processes. Organizations that adopt a systematic approach do not assess their effectiveness solely on attaining goals, but also judge effectiveness on its ability to acquire inputs, process the inputs, channel the outputs, and maintain stability and balance. In the case of safety culture, a systematic approach would be indicated by the existence of improvement plans, clear goals and accountabilities, monitoring of progress and allocation of adequate resources. Another indication of a lack of a systematic approach is the absence of a process to manage change.

*Procedures not properly serviced:* procedures that are not regularly reviewed and updated can become invalid, and possibly result in safety consequences. The preparation, issue and updating of procedures should be subject to quality control. Responsibilities for review should be clear. A positive sign is having people who have to use the procedures involved in the review.

*Incidents not analysed in-depth and lessons not learned:* repetition of a problem usually indicates that the fundamental cause (or causes) of a problem has not been properly identified. A systematic in-depth analysis of incidents is necessary if lessons are to be learned and the root causes identified. Root cause analysis requires that both the direct and indirect causes of incidents be identified. The causes may be technical, human factor, organizational culture, process, procedure, equipment or environment. Past experience has shown that human factors and safety culture issues play a large part in many events that have safety consequences. A root cause analysis allows the complexity of events to be better understood. Repetition of events may also indicate that the organization does not have a learning culture. A positive sign that attention is being given to the systematic analysis of events is that training is given to those employees who may have to use this skill.

*Resource mismatch:* resource mismatch may reveal itself in the form of excessive project slippage, excessive overtime 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. No allowance is made in the planning process for unanticipated problems, with the consequent lack of margins for completing work. When considering resource mismatch, attention must be given to both the quantity and quality of resource, and whether the mismatch is short or long term. Resource mismatch is often present after a period of organizational downsizing.

*Number of violations increasing:* violations (conscious deviations from rules, e.g. short cuts) provide an insight into the safety culture. All violations should be thoroughly investigated to establish the root causes. Where violations are increasing, it may be a sign of an indifferent management environment, or of some organizational stress. Violations should not be confused with errors caused by slips or lapses. The latter are unintended deviations of action from intention.

*Increasing backlog of corrective actions:* a significant increase in the number of corrective actions that have not been implemented within their planned time-scale is a sign that safety may not be given the priority that it warrants. The extent of the backlog is a good indicator of managerial effectiveness in planning, resource allocation, prioritizing and monitoring of work. Attention should be given to both the number of corrective actions that have exceeded their target date for implementation, and the magnitude of the delay.

*Verification of readiness for operation or maintenance:* incidents often occur at the startup of plant after a shutdown for maintenance, or when the plant is not properly prepared by operators for planned maintenance work. Incidents may be caused by a variety of factors: poor pre-work planning, inadequate risk assessment, poor communications or permit-to-work systems, inadequate training, or lack of suitably qualified and experienced staff. 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. Both operations and maintenance staff should be involved in any verification.

*Employee safety concerns not dealt with promptly:* employees will become frustrated and de-motivated if they perceive that their safety concerns are ignored, or if they have repeatedly had to raise these concerns before action is taken. They will gain the impression that safety is not important—a poor basis for developing a positive safety culture. The absence of communications between employees and senior managers can prevent safety concerns from being brought to the attention of those who have the authority to initiate remedial action. Senior managers who regularly visit plant are more likely to be aware of safety concerns. There should be a system to allow or encourage employees to raise safety concerns, and which progresses corrective actions.

*Disproportionate focus on technical issues:* this weakness would be revealed by insufficient attention to the human factors aspect of work. Problems would only be perceived as technical challenges with solutions designed to engineer out any human weaknesses. A positive indication that this weakness does not exist is the inclusion of human factors and cultural issues in employee training, particularly in the training of managers. Human factors should be an integral part of risk assessment.

*Near miss reporting:* the absence of a near miss reporting system does not necessarily indicate a weakening safety culture, but rather that the organization does not recognize the valuable information that can be obtained from this type of event. It may be that the organization is in the early stages of developing a learning culture, or that employees still have the basic cultural assumption that those who commit errors will be punished. The existence of a near miss reporting system is a sign that an organization has achieved a higher level of sophistication in its approach to safety.

*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 behaviour, and will be ignorant of the root

causes of many events. An organization is unlikely to adopt a philosophy of “continuous improvement” if it does not undertake self-assessment.

*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 culture. Housekeeping standards have proved to be a good indicator of the general ethos of an organization.

### **9.2.2. Regulator perspective**

People who come from outside the organization more readily detect some symptoms. The regulator is a very important observer of an organization, and has a key role to play in detecting early signs of a declining safety culture. The following is a list of some symptoms that are best identified from an external perspective. This does not mean that people within an organization are incapable of detecting these symptoms; it merely means that their involvement in the organization may make them less conscious of the symptoms.

*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 pressures may try to reduce their costs by downsizing their workforce and eliminating systems or overly simplifying them. This can result in a loss of skill, experience and historical data. The existence of an effective change management process is a protection against this consequence. The importance of retaining corporate memory is especially important in the nuclear industry which will face decommissioning work extending over many decades, and which will involve a new generation of employees. An indication of this weakness is a lack of adequate records, and a disproportionate number of experienced people leaving the organization. The re-hiring of some of these people as consultants is possible evidence that the corporate memory is weak, especially if they are repeatedly needed to cope with problems.

*Low status of Quality Assurance (QA) function:* a common finding of investigations into organizations that have encountered serious safety problems is the low status of the QA function. QA employees 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 function can be obtained from employee surveys, and also by examining how QA findings are addressed.

*Role of Headquarters (HQ):* often the operational sites of an organization are geographically separate from their HQ. This separateness can result in different organizational sub-cultures developing with consequences for communications and relationships. At the sites, corporate goals may be subordinate to local goals, and policies and standards not uniformly applied. Relationships can become disharmonious, and it is unlikely that a sound safety culture can develop in such a climate. There may be a lack of awareness of safety issues at the corporate level, and they may be ignored when making business decisions. It is important that people from both the sites and the HQ interact on a frequent basis to share information about all issues that are affecting their work. Senior managers located at HQ should regularly visit the sites, and whilst visiting ensure that they meet a wide range of employee.

*Lack of ownership:* a responsible attitude to safety is unlikely to develop when there is a lack of ownership of safety. Lack of ownership usually indicates a lack of commitment. This is particularly serious when the lack of ownership is among senior managers, as this

disinterest will percolate down the management chain in the organization. At the operational level, it will be revealed by an abdication of safety responsibilities to safety specialists.

*Isolationism:* organizations or parts of organizations can become isolated because of geography or from the way an organization is structured. In an isolated organization, safety standards can become unrelated to modern standards, and the organization increasingly operates in a self-referencing mode. Insularity can also be internal to an organization if many sub-cultures exist and they do not communicate with each other. This inhibits learning from shared information and experience.

*Lack of learning:* an organization seeking to develop its safety culture should be willing to share knowledge and experience with others, as well as using the experience of others to improve its own safety. A learning organization will adopt this approach. The nuclear industry is an industry that has been keen to share experience internationally. Problems can arise when organizations become complacent and focus on the successes of the past, and are reluctant to invest in building new skills for the future.

*Unwillingness to share or co-operate:* this symptom is closely associated to the previous two weaknesses. The existence of sub-cultures can result in a strongly shared purpose that motivates employees in their local groups, but which creates communication barriers between groups. Co-operation can be inhibited as groups seek to protect their status, or competitive position. Safety culture requires openness in communications and co-operative relationships. It is unlikely to develop positively when these requirements are absent.

*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 were not developed internally. This would indicate a potentially weak safety culture. A positive indication would be the existence of a process to monitor progress in implementing the findings of reviews. Information on progress would be shared with those responsible for carrying out the review.

*Deficiencies in regulatory body:* regulators have an important role to play in assisting organizations develop a positive safety culture. Representatives of the regulatory body should be trained in safety culture issues, so that they are better able to evaluate the safety culture of an organization. The existence of such training is an indication that the regulator is adopting a broad perspective in their regulatory duties. This will assist them in the development of soundly based regulatory strategies. Regulators will only be able to detect symptoms of a declining safety culture if they have the knowledge to do so.

The presence of a small number of the above symptoms should not be construed as indicating that an organization has a poor safety culture. Not all characteristics of a positive safety culture will develop at the same rate; some characteristics will be more challenging than others to develop. However, the presence of many of the symptoms should be a cause for concern, as they would indicate that the organization's safety state is vulnerable to destabilisation. The destabilizing trigger may be what appears to be a relatively minor event. Many of the symptoms can interact in a synergistic way, increasing the overall impact of their combined effect. For example, where there is a resource mismatch, there may be inadequate verification of readiness for startup, or maintenance of plant; the pressure of inadequate resources may result in a lack of a systematic approach with shortcuts taken, and procedures modified without proper consideration. The pressure on resources may result in a lack of co-operation between groups as they give priority to their own goals. It may also result in a

disproportionate focus on technical issues, as there is no time available to consider the human factor aspects.

An organization that has developed a positive safety culture, and which has a good safety management system, will be less vulnerable to destabilisation when unanticipated events occur. A positive safety culture and sound safety management system cannot eliminate the occurrence of unanticipated events, although it can significantly reduce the frequency of their occurrence. What a positive safety culture creates, is resilience to any destabilizing force.

#### OPTIONAL EXERCISES

- (1) Consider your own organization, and list those symptoms of a weakening safety culture that you believe may warrant attention in order to avoid future problems.
- (2) Illustrate the potential synergistic effect of the symptoms of a declining safety culture by constructing a network diagram that illustrates the mutual interaction of the symptoms. Are there any symptoms that appear particularly potent in their influence?
- (3) Consider each symptom of decline in turn, and list those characteristics of a positive safety culture that would reduce the likelihood that the symptom would occur. Are there any safety culture characteristics that are frequently identified as being influential?



## 10. LESSONS LEARNED

Good performance in the nuclear business must be driven by excellence in nuclear operations and uncompromising safety. If this does not occur the ability of a nuclear organization to manage nuclear technology safely can be jeopardized. Despite increased awareness worldwide of the major role played by safety management and safety culture in the safety performance of nuclear installations, many nuclear organizations have, in recent years, experienced serious declines in these aspects. This has, in turn, led to extensive and costly improvement programmes and intensified regulatory supervision. The magnitude and difficulty of the effort required to recover performance are such that the continued viability of the organization comes into question.

One of the major challenges for the future is for both the nuclear industry and regulators to achieve a more proactive approach to safety management and safety culture so that problems are detected and acted upon at an early stage, in order to prevent a significant degradation of safety. Another important step in this effort is to carefully review the lessons learned from some of the reported problems and recoveries in safety management and safety culture. The examples of lessons learned in the following resulted from experience in North America and Europe.

### 10.1. COMMON SYMPTOMS AND CAUSES OF SAFETY PROBLEMS

One factor common to all the organizations that experienced safety management and safety culture problems was that during their early years of operation they belonged in the league of best performing plants as measured by the means available at the time. They had, however, failed to adequately manage the transition from the design and construction stage to a stage where the focus needed to be excellence in operation and maintenance of the plant. Common obstacles to a smooth transition were:

- Inadequate corporate support;
- Poor leadership and managerial skills focused more on technical competence than people skills;
- Lack of recognition of the need to develop a good safety culture;
- Insularity with lack of learning from the experience of others;
- No benchmarking of themselves against others;
- Lack of resources;
- Reorganizations and/or downsizing including the loss of experienced staff and corporate memory;
- Increased backlogs in maintenance and updating of procedures;
- Low status of the QA department as well as poor follow-up of QA findings;

- Relatively high threshold to impending safety management and cultural problems before action was taken by the organization and also by the regulators.

A common feature in the above was the failure of corporate and plant management to appreciate or recognize these symptoms or their significance, coupled with a failure to take effective corrective action at an early stage despite overtures from regulators and others. A lack of an appropriate questioning attitude by senior management up to the Board of Directors, and the absence of an effective corporate oversight to bring attention to the significance of issues were contributing factors. The absence of a strong senior management reaction to safety lapses by the plant, or declining safety performance, led to the acceptance of standards that were less than the industry norm.

A working group convened by the IAEA to review lessons learned from the various international experience of declining safety performance concluded that the following features were relevant:

- (1) Lack of senior manager (in some cases, the Board of Directors) leadership with the necessary insight, knowledge and ability to manage the unique interaction between the technology, economics, human factors and safety in a changing nuclear environment.
- (2) Lack of criteria for when regulatory action should be taken to curtail degradations in safety management or safety culture.
- (3) Inability of some regulators to influence at the senior management level when detecting gradual degradation in safety management.

## 10.2. RECOVERY PROCESSES

An essential first element in the recovery process is the development of a comprehensive plan that identifies the issues and resolves the causes. The issues will depend on the organization involved but may include leadership, communications, the corrective action programme, procedures, work planning and control, effective QA oversight, self-assessment programmes and safety culture improvements. Extensive leadership training may need to be provided at all levels of management and supervision.

Generally, a successful recovery process involves a change of the management team to actually drive the recovery changes and sustain the recovery. Reasons for changing the management team were loss of corporate trust in their ability to effect change; loss of credibility with the national regulator and/or workforce; the need for a new work culture to bring about the change; and possibly because the previous management team were exhausted by their fruitless efforts to improve safety management performance. The management team should not be changed for the sake of change, but only after proper analysis is performed that supports the need for change.

The regulator often has to develop new and different regulatory approaches to cope with the recovery situation. The regulator has to work closely with the management of the organization in a highly interactive process. This is necessary to deal with the complex issues and the lack of confidence in the organization's assurances that they will deal effectively with the issues.

After every significant failure of safety management that becomes obvious to the public, there is a need to re-establish public trust in the regulator and in the corporate and plant

management. Both the regulator and the organization may provide information or hold public meetings to explain the current situation and describe progress along the recovery route.

The sustainability of safety related changes must be demonstrated. This requires that an assessment be performed at an early stage as to whether a recovery plan is going to be successful. There is a need to carefully monitor the change in safety culture as other changes are taking place. This is necessary to ensure that the safety management changes are influencing the safety culture in the right direction, i.e. towards becoming a learning organization.

Some lessons learned from experience with recovery processes were:

- (1) Ensure complete analysis of the effect of a change prior to its implementation.
- (2) Regulator needs to have expertise in safety culture in order to review the effectiveness of any cultural change in improving safety.
- (3) Regulator has to rapidly develop new processes to effectively deal with the complex technical, human and public confidence issues, and this requires considerable resources and new skills to manage.
- (4) For a successful recovery, the relationship of the regulator and the organization must be one of mutual trust whilst maintaining a businesslike regulator/organization interface.
- (5) Public participation in the regulatory process, in some cases, helped restore public confidence in the regulatory process and in the organization.

The recovery process outlined above has proved successful in rehabilitating organizations that have been affected by degradations in safety management and safety culture. Organizations that have been fortunate enough not to experience such degradations must take advantage of the lessons learned in order to sustain and possibly improve their current safety performance.

#### OPTIONAL EXERCISES

- (1) Review the obstacles that can adversely affect the smooth transition from the design and construction stage to the operation and maintenance stage, and list for each obstacle those characteristics of a positive safety culture that would prevent the obstacle occurring.
- (2) Suggest some criteria that regulators could use to prompt regulatory action when there is a gradual decline in safety culture and associated safety management performance.

## 11. CHANGING THE SAFETY CULTURE

The current organizational and safety cultures of an organization will have evolved over its life, and will have been influenced by the beliefs and values of the founders, their basic cultural assumptions and the experience of the organization to the present point in time. During this evolution, the main cultural components will have become embedded in the organization. Once the cultural elements have stabilized, further change becomes more complicated. It now involves having to unlearn beliefs, attitudes, values and basic assumptions, as well as learning new ones. People resist change because such unlearning is uncomfortable and anxiety producing. People can be coerced into changing their overt behaviour, but such behavioural change is not stable unless the deeper levels of culture undergo some kind of transformation. To change the organizational culture or the safety culture, we have to learn about change processes that are transformational.

### 11.1. SIMPLE MODEL OF TRANSFORMATIONAL CHANGE

The simple model described involves three main stages with each stage containing sub-stages. Without understanding the psychological and sociological dynamics that are involved, it is difficult to really grasp why cultural change is so difficult, or why it takes so long to implement.

*Stage 1: unfreezing – creating the motivation to change*

- (1) Disconfirmation
- (2) Creation of survival anxiety or guilt
- (3) Creation of psychological safety to overcome learning anxiety

*Stage 2: learning new concepts and new meanings for old concepts*

- (1) Imitation of, and identification with, role models
- (2) Scanning for solutions, and trial and error learning

*Stage 3: internalizing new concepts and meanings*

- (1) Incorporation into self-concept and identity
- (2) Incorporation into relationships

#### 11.1.1. Disconfirmation

Can a successful organization make major changes, or does there have to be some threat, or sense of failure or crisis, before people are motivated to make changes? Successful organizations can be endangered by complacency that leads to more serious problems. The general experience is that some kind of dissatisfaction or threat has to be present in a mature organization before it is willing to embark on change. Kurt Lewin, a distinguished social psychologist, thought of this as a process of “unfreezing.”

Human systems tend to try and maintain a stable equilibrium. If change is to occur, some new forces must upset the equilibrium; recognizing and managing these forces creates the motivation to change. Any change begins with some disconfirmation.

Disconfirming information can involve any or all of the following:

- (1) Economic threat
- (2) Political threat
- (3) Technological threat
- (4) Legal threat
- (5) Scandal or accident
- (6) Merger or joint venture
- (7) Charismatic leadership
- (8) Education and training

Focusing on disconfirming events means that you address the business problem before you start to think about culture. Disconfirming data may not be the problem, but only the symptoms, which should trigger some diagnostic work. You must identify what the underlying problem might be. Problems can have multiple causes.

### **11.1.2. Survival anxiety or guilt**

If the disconfirming data penetrates your defensiveness, anxiety or guilt may be felt. You recognize the need to change and adopt new ways of thinking. Once you accept the need to change, you also begin to experience learning anxiety. Learning anxiety is a combination of several specific fears, all of which may be active at any time as you contemplate change. The specific fears are:

- (1) Fear of temporary incompetence
- (2) Fear of punishment for incompetence
- (3) Fear of loss of personal identity
- (4) Fear of loss of group membership

The last fear is the most difficult to overcome because it requires the whole group to change how it thinks.

If you are the target of change, and confronted with the need to unlearn and learn new ways, you may resist in order to protect your position, your identity, and your group membership even if it means experiencing survival anxiety or guilt. Your resistance is based on your learning anxiety. To bring about transformational change in this situation, two principles come into play:

Principle 1: survival anxiety or guilt must be greater than learning anxiety.

Principle 2: learning anxiety must be reduced rather than increasing survival anxiety.

Learning anxiety can be reduced by increasing the learner's sense of psychological safety.

### **11.1.3. Psychological safety**

Creating psychological safety for organizational members who are undergoing transformational change involves a number of steps. These steps need to be taken almost simultaneously. They are:

- (1) Provide a compelling positive vision so that employees believe that they and the organization will be better off if they adopt the new way of thinking and working. Senior management must be committed to the vision and communicate it to others.
- (2) Give employees formal training in the new ways of thinking and working.
- (3) Involve employees in designing their own optimal learning processes, thus recognizing that everyone learns slightly differently.
- (4) Provide opportunities to practice the new ways and give feedback, so that people can make mistakes and learn from them without disrupting the organization.
- (5) Give informal training to groups so that new norms and assumptions can be built collectively. A person should not feel deviant in engaging in the new learning.
- (6) Provide positive role models so that people can see the new behaviour and attitudes in others with whom they can identify.
- (7) Form support groups so that problems associated with the new learning can be discussed, and so that people can speak openly about difficulties with others who may be experiencing similar difficulties.
- (8) Ensure that systems and structures are consistent with the new way of thinking, e.g. reward and discipline systems.

Most transformational change programmes fail because they do not satisfy the above eight conditions. When you consider the effort and difficulty of achieving all eight conditions, it is little wonder that change is so difficult.

#### **11.1.4. Cognitive redefinition**

The best way to characterize what actually happens in a learner is to call it cognitive redefinition. The essence of the new learning is usually some cognitive redefinition of some of the core concepts in the set of basic assumptions. Most change processes emphasize the need for behavioural change. Such change is important for laying the groundwork for cognitive redefinition, but is not sufficient unless redefinition at the assumption level takes place. An example to illustrate cognitive redefinition is the approach to safety. The nature and origins of the nuclear industry have led to great emphasis being placed on technical safety with less emphasis on the human element. In any attempt to change the safety culture, people will need to redefine their understanding of what creates safety from a purely technical view to a socio-technical and cultural view. Cognitive redefinition allows you to think in a different way. Such cognitive shifts are possible if an organization manages to create enough psychological safety for the change to take place.

#### **11.1.5. Methods for learning new concepts**

There are basically two mechanisms by which you can learn new concepts, new meaning for old concepts, and new standards of evaluation. You can learn by imitating a role model, and psychologically identifying with that person; or you can keep inventing your own solutions until something works for you. You have a choice which mechanism to encourage. As part of the training programme, you can invite people who have successfully adopted the new way of thinking and behaving and encourage others to find out how they did it. This

approach works best if it is clear what the new way of working is to be and if the concepts to be taught are themselves clear. However, we sometimes learn things through imitation only to find out that they do not fit our personality or the environment in which we work and live. Once we are on our own and the role models are no longer available, we revert to our old behaviour. Alternatively, if you want the learners to learn things that really fit their personalities, then you might decide to encourage learners to scan their environment and develop their own solutions.

The general principle is that there must be clarity about the ultimate goals to be achieved, and the new way of working that is to be adopted. But this does not necessarily imply that everyone achieves the goal in the same way.

#### **11.1.6. Internalizing new concepts and meanings**

The final step in any transformational change process is to internalize the new concepts that will result in new behaviours. If the behaviour fits the rest of the personality, and is consistent with the expectations of important others in the learner's work and social environment, it becomes a stable part of the person and eventually of the group. If the new concepts are not consistent with the expectations of your work or social group, you will either revert to your old concepts and behaviour if you value the group, or leave the group if you now value the new concepts and behaviour more. Lewin referred to this final stage of transformational change as "refreezing."

### **11.2. ENHANCING THE SAFETY CULTURE**

The model of transformational change just described is useful when considering how to change the safety culture. An organization will already have a safety culture in some form that will have been influenced by the organizational culture, the organization's history and experience, and other cultural forces (e.g. national culture). The challenge is to transform the safety culture to a state that is more appropriate to that required for the organization's future success. Changing the safety culture is not a stand-alone goal; it is a way to contribute to the achievement of some major organizational goal. Paradoxically, the best way to clearly understand how your safety culture is implicated in any change is not to start with the idea of changing the culture. Instead concentrate on what the new way of working is to be. Be as detailed as you can in specifying the new behaviour and thinking. The list of characteristics of a positive safety culture, and the practices that assist in developing such a culture, may help you identify the desired future state of the organization's safety culture. Once the desired future state is well understood, you must now assess the present state of the safety culture to determine the gap between the desired future state and the present. The assessment will provide you with information on how the existing safety culture can help you achieve the desired new way of working and thinking. It will also identify safety culture issues that may hinder the achievement of your goals. You can then design a specific programme of safety culture change to deal with these issues. Remember that you are not changing the entire safety culture, only elements of it that hinder the achievement of your desired goal. As the gaps between the present and the desired future state are identified, consideration needs to be given to what kind of actual change process is needed. For this stage, there are no standard solutions, and an organization has to design its own approach. The approach may involve training, creation of task groups, system changes, team building and coaching of senior managers and other employees.

The final point to note is, do not launch major change initiatives prematurely. The temptation to launch into action is great, but where culture is involved, it is better to go slowly initially and make sure that you understand what the new way of thinking and working is, and consider how the existing culture can help or hinder you. It is especially important to build on the existing culture to accomplish the desired changes. Remember the need for psychological safety: how to make the people who are the targets for change, sufficiently motivated to want to change, but not so anxious about learning new things as to resist change. Consider how the existing culture can help the learning process and make people feel secure.

#### OPTIONAL EXERCISES

- (1) What could create the motivation in your organization to change the existing safety culture? Refer to the information on disconfirmation in Stage 1 of the change process for ideas.
- (2) In what way would you like the people in your organization to start thinking differently about safety? Are there any practices for developing safety culture that could help with this?
- (3) From your knowledge of the transformational change process, critically review a previous organizational change that you have experienced, and identify how the change process that was used, could be improved.



## 12. THE LEARNING CULTURE

One of the greatest challenges in changing a culture is to develop a learning organization that will be able to make its own continual diagnosis, and self-manage whatever transformations are needed as the environment changes. An organization of this type is likely to be far more resilient and successful in today's dynamic, fast-moving environmental conditions. A fundamental assumption underpinning the development of a learning organization is that people can change by increasing their knowledge and skills. The question is whether an organization can develop a set of assumptions that can become stable, and thus function as a culture, and yet encourage and allow for continual learning and change. In a sense, these appear to be contradictory requirements in that culture, by definition, is a stabilizing conservative force. Examples of fully developed learning organizations are rare, and so it is essentially a view of "what might be", rather than "what is". The journey from a conventional way of operating to becoming a fully developed learning organization can be a long one. The journey can take place in four distinct stages.

### *Stage 1: the knowing organization*

This is an organization that fully understands its current environment. It aims to be highly efficient and in control of events by making small adaptive, incremental changes. Moreover, if the environment remains stable and predictable, there is little need for the organization to change, and so long as the need to learn does not rise, the organization is perfectly capable of being successful.

### *Stage 2: the understanding organization*

In this stage, the organization seeks to understand more clearly what is happening in its environment and relies on its strong cohesive culture to pull it through any changes.

### *Stage 3: the thinking organization*

The organization recognizes the problematic nature of environmental changes. However, its actions tend to be reactive, and while it constantly scans the environment, its focus is on identifying potential problems and developing a fast reaction.

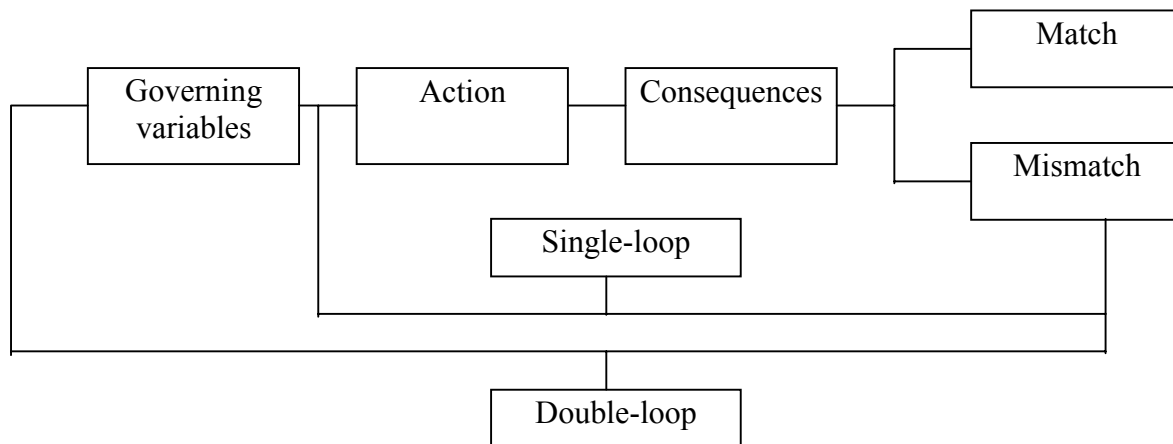
### *Stage 4: the learning organization*

In the fourth stage change is viewed as a way of life, and there is some emphasis on being anticipatory and proactive. Every experience is regarded as a learning opportunity, and anything that stands in the way of improvement is open to challenge. Experimentation or trying new methods is encouraged.

## 12.1. TYPES OF LEARNING

Learning is defined as occurring under two conditions. First, learning occurs when an organization achieves what it intended; that is, there is a match between its action in pursuit of a desired goal, and the actual outcome. Second, learning occurs when a mismatch between intentions and outcomes is identified, and it is corrected; that is, a mismatch is turned into a match. Whenever an error is detected and corrected without questioning or altering the underlying assumptions of the system, the learning is described as "single-loop". "Double-

loop” learning occurs when there is a style of learning that goes beyond learning how to achieve existing goals, and that involves questioning whether the goals and assumptions that underpin them are appropriate. Single-loop and double-loop learning are shown in the diagram below:

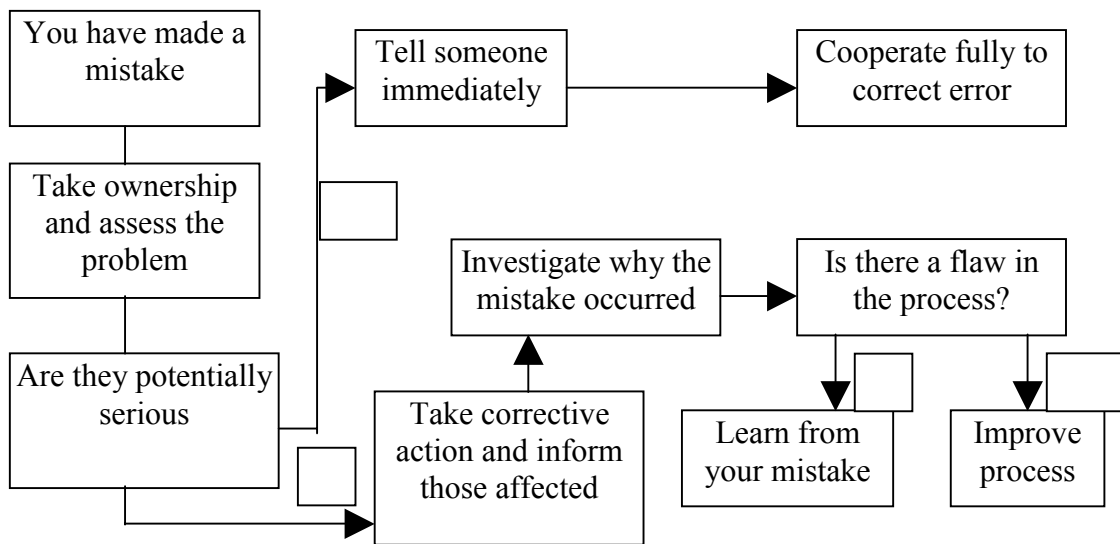


The term “single-loop” is borrowed from electrical engineering, where for example a thermostat is defined as a single-loop learner. The thermostat is programmed to detect states of “too hot” or “too cold”, and to correct the situation by turning the heat off or on. If the thermostat asked itself such questions as why it was set at 68 degrees, or why it was programmed as it was, it would be a double-loop learner. Senge has elaborated on these ideas to distinguish between two types of learning: adaptive and generative which are analogous to single and double-loop learning.

Most of an organization’s activities involve single-loop changes. The emphasis on organizational single-loop learning may be partially due to the fact that organizations usually decompose complex tasks into simpler tasks that produce the correct result when correctly carried out. Although single-loop actions are the most numerous, they are not necessarily the most powerful. Double-loop actions ultimately control the long term effectiveness of an organization. When considering culture, whether organizational or safety culture, double-loop learning is essential.

## 12.2. MISTAKES AND THE LEARNING ORGANIZATION

A learning organization learns from the individual mistakes of its members. An individual who restricts the learning to that from his or her own mistakes is not satisfactory as others are not given the opportunity to learn from the individual’s experience. Sharing your experiences with others is essential in a learning organization. There must be no fear of punishment in admitting a mistake. The learning process in response to a mistake should be as follows:



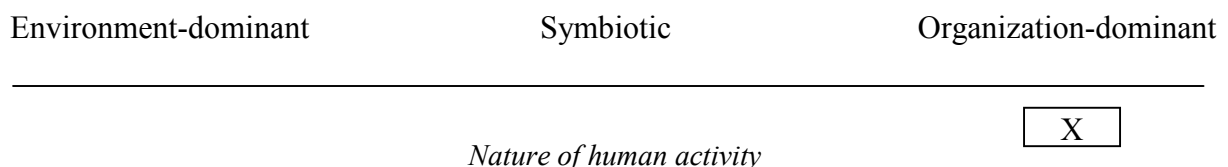
The non-learning approach is to sweep mistakes under the carpet and hope that the problem goes away, or blame someone else or the special circumstances. It would be very difficult to persuade employees to report near misses in a non-learning culture. The potentially valuable learning from such events will be lost.

### 12.3. CHARACTERISTICS OF A LEARNING CULTURE

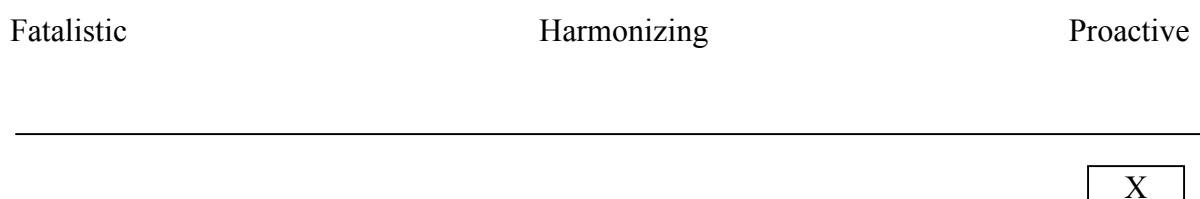
Schein has attempted to describe the characteristics of a learning culture by considering a number of dimensions as described below. An “X” indicates the position of an organization with a learning culture on the dimensional scales.

#### *Organization – Environment relationship*

A learning culture must contain the basic assumption that the environmental context in which the organization exists is, to some degree, manageable. The organization is not a passive captive of its environment, although in some cases there may be very close links, in which case the relationship is symbiotic.



A learning culture must contain the basic assumption that the appropriate way for humans to behave is to be proactive problem solvers and learners, and that people can change. If the culture is based on fatalistic assumptions of passive acceptance, learning will be very difficult as the environment changes.



### *Nature of reality and truth*

A learning culture must contain the basic assumption that solutions to problems derive from a pragmatic search for truth, and that truth can be found anywhere. What must be avoided in a learning culture is the automatic assumption that wisdom and truth reside in one source. This can be a potential problem for senior managers who traditionally are expected to be the source of knowledge. Sometimes those in senior positions must teach others to accept that senior management do not always know, and that the learning task is a shared responsibility.

Authoritative

Pragmatic

---

X

### *Human nature*

A learning culture assumes that ultimately human nature is basically good, and that you can put your trust in people. It also assumes that people are interested in developing their potential. If it is assumed that people are lazy and passive, and that people only have self-interest, organizations will become cynical. Their mistrust of people will be reflected in their structures and processes. In such an organization the learning process will be totally undermined.

Humans basically bad

Humans basically good

---

X

### *Nature of human relationships*

Should the learning culture be based on assumptions of individualism or collectivism? It may be that an individualistic culture is more favourable to creativity and innovation, and a collective culture more suitable for implementation of complex interdependent solutions. Learning organizations tend to have a blend of both individualism and collectivism. Neither extreme on this dimension is favourable to learning.

Collectivism

Individualism

---

X

In terms of assumptions about authority, is it better for a learning culture to be authoritarian/paternalistic or collegial/participative? The answer is complex. The participative organization is more likely to generate creative solutions because it will tap a wider range of resources. However, once the solution has been found, whether the participative organization is better at implementation seems to depend on the nature of the solution. If it is easily communicated and understood, then an authoritarian approach will be more efficient; if the solution is complex and requires the co-operation of different parts of the organization, then a participative approach works better. A learning culture will assume the legitimacy of both approaches, and the managerial style will vary according to task.

X

*Nature of time*

The optimal time orientation for learning appears to be somewhere between the far future and near future. One must think far enough ahead to be able to assess the consequences of different courses of action, but must also think in terms of the near future to assess whether the solutions are working. The assumption that the best orientation is to live in the past, or the present, is dysfunctional if the environment is becoming more turbulent.

Past-oriented

Present-oriented

Near future-oriented

X

A similar argument can be made about assumptions of what is a correct unit of time in terms of which to think—minutes, hours, days, months, years, or decades? This will depend on the task and the kind of learning. The optimal assumption is that a “medium-length” of time should be selected for assessment, so that enough time is allowed to test a proposed solution, but not so much time that one persists with a proposed solution that is not working. A judgement on what is a “medium-length” of time will have to be made for a specific task. “Medium-length” for cultural change will be much longer than “medium-length” for changing an organization’s strategic goals.

Short time units

Medium time units

Long time units

X

*Information and communication*

A learning culture is based on the assumption that communications and information are central to the organization’s well being. There should be a multi-channel communication system that allows people to interconnect. It means that everybody assumes that telling the truth, as best as one is able, is positive and desirable. This does not mean that people suspend all cultural rules and try and achieve extreme interpersonal openness across hierarchical boundaries. It does mean that people become sensitive to task relevant information, and as far as possible share it. Managers can assist by clarifying what kind of information is critical to effective problem solving and learning. A fully connected network can only work if there is trust among all the participants in the network.

Low connectivity

Fully connected

X

*Uniformity versus diversity*

The more turbulent the environment, the more likely it is that a diverse organization will have the resource to cope with unpredicted events. A learning culture will be based on the assumption that diversity is desirable at the individual and group level. Such diversity may create sub-cultures. For diversity to be an asset, the sub-cultures must communicate and learn to value each other.

High uniformity

High diversity

---

|   |
|---|
| X |
|---|

*Task versus relationship*

The assumption that seems to be most appropriate for a learning culture is that both orientations are equally important. In a stable environment, it is acceptable to be task oriented. In a more turbulent, complex environment, one needs to value relationships to achieve the level of trust and communications that will make joint problem solving possible. This is a dimension that can be strongly influenced by one's national culture.

Task-oriented

Task and relationship oriented

Relationship-oriented

---

|   |
|---|
| X |
|---|

*Linear versus systemic logic*

As the world becomes more complex and interdependent, the ability to think systematically, to analyse forces and understand their mutual causal effects, and to abandon simple linear causal logic, will become more critical to learning. A learning culture must be built on the assumption that the world is intrinsically complex and non-linear. This will encourage people to think about their mental models, and test them against reality. This will improve one's ability to cope with complexity.

Linear thinking

Systemic thinking

---

|   |
|---|
| X |
|---|

The role of learning-oriented leadership in a turbulent world is to promote the above characteristics in their organizations. Leaders must, themselves, hold these assumptions, and then be able to recognize and reward behaviour in others, based on these assumptions. Learning leaders must be careful to look inside themselves, and to identify their own mental models and assumptions before they leap into action.

## OPTIONAL EXERCISES

- (1) Consider your own organization, and judge where it is currently located on the bi-polar dimensional scales that reflect the characteristics of a learning culture.
- (2) Compare the characteristics of a positive safety culture with the characteristics of a learning culture. For each safety culture characteristic, identify which learning culture characteristic supports it.

### 13. KEY POINTS ABOUT CULTURE

If you are serious about managing culture in your organization, the biggest danger that you face is that you do not appreciate the depth and power of culture. Culture is deep, extensive and stable. If you do not manage culture, it manages you, and you may not even be aware of the extent to which this is happening.

#### 13.1. KEY POINTS TO REMEMBER ABOUT CULTURE

The following points encapsulate the realities of culture and cultural change:

- (1) Culture is the shared tacit assumptions of a group that it has learned in coping with external tasks, and dealing with internal relationships. Culture is a product of social learning. Ways of thinking and behaving that are shared, and that work, become the elements of culture.
- (2) You facilitate a change in the culture rather than creating a new culture. You can demand or stimulate new ways of thinking and working; you can monitor it to make sure that it is done; but members of the organization will not internalize it, and make it part of the new culture unless, over time, it actually works better.
- (3) Culture evolves with the fluid circumstances of an organization. As the external and internal conditions of an organization change, so does the rightness of given cultural assumptions change. The criterion of a right culture is the pragmatic one of what enables the organization to succeed in its primary task.
- (4) Culture influences all aspects of organizational functioning: the mission, the strategy, the means used, measurement systems, norms, reward systems, views on human nature and time. These are all reflected in the culture.
- (5) To better understand your own cultural biases, it is helpful to work with people from other organizations (cultures) to reflect on your own tacit, taken-for-granted assumptions.
- (6) Any cultural change is transformational because you have to unlearn something before you can learn something new. It is the unlearning that causes anxiety and resistance to change. The motivation to unlearn, and learn something new comes from a realization that if you continue in the present way, you will not achieve your goals; you will experience “survival anxiety”. The realization of what may be involved in learning something new causes “learning anxiety”. For change to occur, survival anxiety must be greater than learning anxiety. This is best achieved by lowering learning anxiety by creating psychological safety for the learner.
- (7) Never start with the idea of changing culture. Always start with the issues that the organization is facing. Only when these issues are clear, should you ask yourself whether the culture aids or hinders the resolution of the issues.
- (8) Always think initially of the culture as your source of strength. It is the residue of your past successes. Even if some elements of the culture look dysfunctional, remember that they are probably only a few among a large set of others that continue to be strengths. If change needs to be made, try to build on existing cultural strengths, rather than concentrating on changing elements that may be weaknesses.



- (9) Learning about culture requires effort. You have to enlarge your perception and examine your own thought processes. You have to accept that there are other ways to think and do things.

### 13.2. KEY ATTRIBUTES FOR LEADING CHANGE

The behaviour of leaders in an organization—that is, what they say and do—throughout the change process has a tremendous impact on whether employees place a high value on making change work. If leaders fail to do things that support change (for example, make presentations, attend training sessions, hold participative meetings, provide and listen to feedback, and reward and recognize employees for their change efforts), they send a strong negative message to their organization. The message is “Change is only good for other people” or “The changes are not important enough to warrant an investment of management time”. Leaders can send positive messages about change. Listed below are six leadership attributes that managers at any level in an organization can embody to promote the process of change. These attributes should be adopted to ensure the success of a change effort.

- (1) Creativity, including openness to the creativity of others. Critical to the success of a change programme is a leader’s openness to considering, and trying new ideas. Openness to the creativity of others provides strong motivation for employees to make a change initiative work.
- (2) Team orientation demonstrates a leader’s reliance on the help of others to make change happen. Leaders, alone, cannot make change happen. They must enlist others, often by forming teams. Leaders often demonstrate the importance they place on teamwork by attending team meetings and regularly recognizing the efforts of the team.
- (3) Listening is the attribute that communicates to others that their opinions are valued. Often during a change process, communications concentrate on a top-down flow of information from leaders to employees. To be effective during change, communications must be two-way. People need to know that what they say is heard and valued. Accepting input from employees does not mean abdicating decision making responsibility. It means that employees can voice their opinions.
- (4) Coaching may be one of the most powerful attributes for effecting change. Coaching for performance is based on the goals and measures that have to be established for the change effort, is essential for successful change at all levels of the organization. Coaching helps influence “the people variable” in the change process. This is the variable that will have the most impact on the success or failure of change.
- (5) Accountability in the context of change means taking personal ownership for the success of the change effort. Leaders often take one of two basic approaches in their efforts to bring about change. When confronted by change, leaders can stand back and observe the changes taking place. This approach places change in the context of something done by others. By standing back and observing, and often criticizing the changes, leaders become role models for this kind of behaviour. This helps create an organization of onlookers rather than participants. This approach helps reinforce an organizational culture of stagnation, a culture in which people wait for others to make change happen. The other approach leaders can take is to participate in, and support the change process—take ownership of it. Leaders who own the change, participate, and support change with positive input. This helps create and reinforce a learning culture in the organization.

- (6) Appreciation allows leaders to recognize and reward employee efforts to make change successful. Simply offering thanks for a job well done can mean the difference between ongoing success of organizational change, and lack of support for future efforts. Leaders should not wait until the change has occurred before expressing their appreciation. They must thank employees frequently as progress is being made. Appreciation lets employees know that the organization values them.

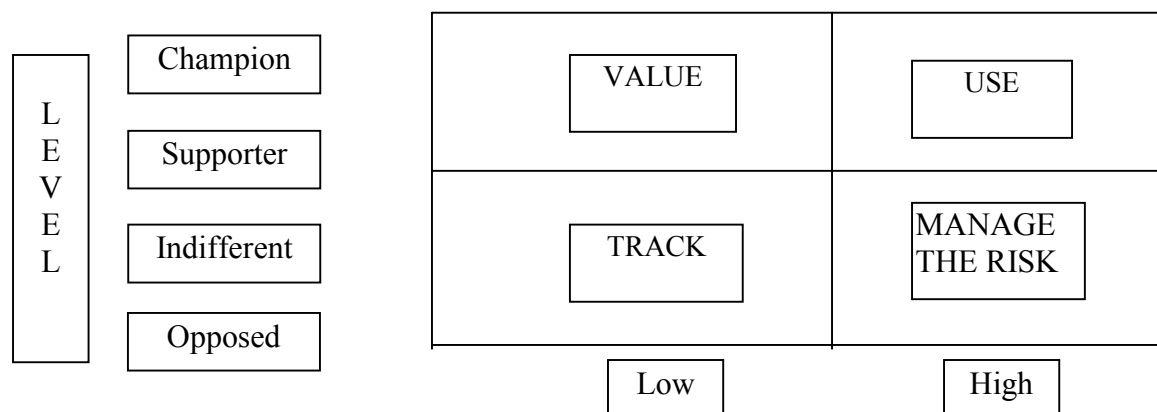
Leaders should understand that it is part of the normal process that a change effort will experience difficulty. Accepting that there will be difficulties is paramount to undertaking and continuing a change effort. Otherwise, we either give up when difficulties arise, or we are paralysed before we start. Managing the soft side of change often does not yield immediate observable results. Human differences must be taken into account during a change initiative, if an effective and lasting transformation is to be achieved.

### 13.3. POWER AND CHANGE

Power plays an extremely important role in the workings of an organization, through its effect on the ways employees relate to each other. Any change, but especially a cultural change, may alter existing power relations so the success of any transformation depends, in part, on change leaders being able to handle the power issues. The topic of power is a sensitive area because it goes to the heart of individual identity and self-perception. Employees must feel that they are involved in change without feeling that they are simply submitting to management power.

The aim in handling power issues is to gain the support for the change process of those who wield power in the organization. Handling power issues begins with an assessment of the level of support for change, using personal interviews, not only with key people, but also with a cross-section of employees. The significance of the key people and others for the success of the change is assessed. The results of the assessment can be shown on a diagram like the one below.

#### *Level of support for change*



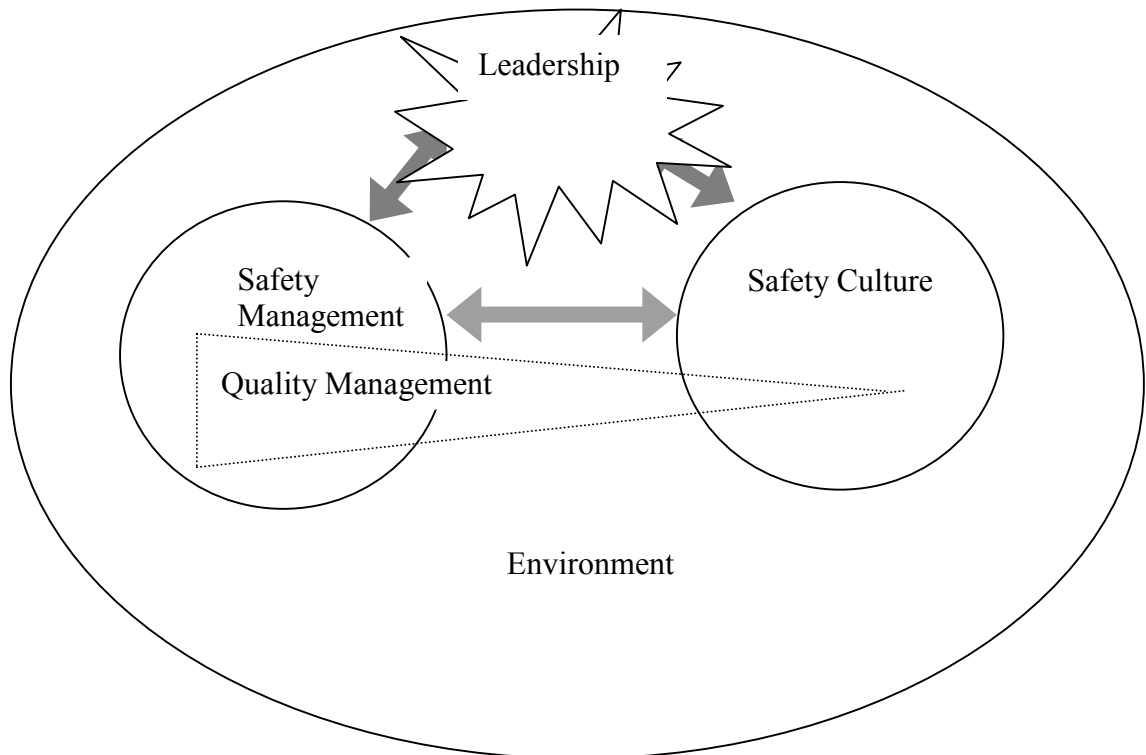
The level of support of key people for the change process can change with time, so there should be regular monitoring of their attitudes. A supportive attitude for change can be assisted by appropriate communications, providing effective training, and organizing regular meetings with key people throughout the duration of the change process. The aim is to ensure that all key people understand the change process, and that they have the opportunity to share ideas and take part in important decisions. All these factors will help strengthen their support.

## OPTIONAL EXERCISES

- (1) What are the main safety-related issues that your organization faces, and what aspects of your present organizational culture can be considered to be a strength in dealing with these issues? What elements of the present culture may inhibit success in dealing with the safety-related issues?
- (2) How will you start putting into practice some of your newly gained theoretical knowledge on how to develop an improved safety culture in your organization?
- (3) Make a list of points that you would refer to when trying to persuade an opponent of safety culture change that it would be beneficial for your organization.

## 14. QUALITY MANAGEMENT AND SAFETY

Is quality management part of safety or is safety part of quality management? This is a frequently asked question with the answer varying depending on which function a person works in, or is most familiar with. In this section, information is provided that will clarify the role of quality management in the safe operation of a nuclear facility. When we refer to safety, we will be referring to both safety management and safety culture. Leadership is vital if both quality management and safety are to flourish in an organization. The diagram below shows how leadership, safety management, safety culture and quality management relate to each other.



Leadership is essential if the employees of an organization are to be persuaded that each individual must own both safety and quality. Safety and quality are complementary and mutually supporting. The safety culture of an organization will influence the type of safety management system that it develops; and in turn, the safety management system will influence the safety culture. The safety management system comprises those arrangements made by an organization for the management of safety in order to promote a strong safety culture and achieve good safety performance. Both the safety management and the safety culture are influenced by leadership, particularly leadership by senior managers, but also by other managers and supervisor throughout the organization.

### 14.1. QUALITY MANAGEMENT SYSTEM

The quality management system is a specific set of processes designed to help an organization systematically plan for and achieve desired levels of performance. The processes of the quality management system can be used to assure desired levels of performance for all organizational activities including safety performance.

An effective quality management system contains three basic components:

- (1) a set of methods to identify problems;
- (2) a set of method to solve problems;
- (3) a set of methods to standardize solutions.

Effective quality management systems have processes in place to identify problems in their early stages as well as methods for recognizing and responding to problems as they happen or after they occur. These processes should ensure that all employees are encouraged to identify and report problems in addition to providing for specific jobs whose major responsibilities include finding and resolving problems.

An effective quality management system ensures that the following five steps of the problem solving process are included:

- (1) Analysing problems;
- (2) Developing alternate solutions;
- (3) Selecting appropriate solutions;
- (4) Piloting implementation of selected solutions;
- (5) Evaluating impact of solutions.

Being able to select the most appropriate solution requires that the criteria for selection are clear and include all important considerations (e.g. impact on safety).

Evaluating the impacts of the implemented solution identifies unexpected consequences in a timely fashion so that adjustments can be made or backup solutions implemented.

Standardizing solutions refers to implementing and integrating solutions that have been tested and found successful into daily work processes. These solutions become part of the standard operations of the organization. Assuring that solution have been tried out, evaluated and refined before adopting them as standard practices avoids potentially costly and time-consuming changes to solutions that are not adequate.

Taken together, these components form the quality management system. All three components must be in place and working together for the quality management system as a whole to be effective. If an organization's response is to correct discrete, immediate precursors to incidents without undertaking a systematic analysis process, links between separate events are unlikely to be discovered, and similar incidents may occur in the future. The iterative cycle of identifying and solving problems, and standardizing solutions provides a basis for achieving systematic, continual improvement across the entire organization.

The effectiveness of an organization's quality management system can be judged using the following criteria:

- (1) Having processes for all three components of a quality management system (identifying problems, solving problems, and standardizing solutions);
- (2) A prevention-based approach;

- (3) Integration across functional units and levels of management;
- (4) A focus on process as well as outcomes.

A prevention-based approach is at the heart of a quality management system that is geared towards safe operations, which is the primary goal of a nuclear organization. Prevention-based quality management systems rely mainly on methods to anticipate potential problems and develop and implement solutions before these problems occur. While these systems also have methods for addressing existing problems and mitigating the consequences of unexpected problems when they occur, they do not rely on event response and after-the-fact analysis as the major method for safety improvement. An example of a prevention-based method is the self-assessment of safety culture.

Integration refers to considering and coordinating decisions and actions not only in terms of the individual unit most affected by the change, but also in terms of the effects on the entire organization. If each unit tries to create its own separate set of quality assurance processes, problem identification and problem solving are likely to be limited by a narrow view of the issues and potential options for corrective action and improvement. An integrated quality management system provides sufficient authority and resources to fully implement decisions for change across the organization.

A focus on process explores and identifies the connection between actions and the outcomes of those actions (actions which result in problems or actions to solve problems). Many performance indicators used by organizations focus on results achieved. Whilst important indicators of performance, knowing the information by itself does not provide a basis for improving performance. These types of indicators measure the results of processes; they do not provide information on the processes that led to the results. Focusing on process refers to the specific methods for assuring quality. Evaluation of a process focus is based on evidence of an organization's ability to both determine how processes lead to specific outcomes and to use this knowledge for solving problems to improve performance.

## 14.2. QUALITY MANAGEMENT AND SAFETY

The primary goal of a nuclear organization is safe operation. This requires the existence of both a sound safety management system and a good safety culture. The organization's quality management system has a key role to play in ensuring that the safety management system is effective, and that the safety culture is reinforced and strengthened. The components of an effective quality management system are relevant to the safety management system and the safety culture of an organization. In practice, quality management principles may be more frequently applied to safety management issues rather than safety culture, partly because the latter is a relatively new and developing concept, and also because quality assurance has tended to dominate people's view of quality management. Quality assurance tends to be associated with more tangible issues in an organization. This limits its perceived applicability to issues that have less of the human dimension. Safety culture has a very large human dimension so most people would not think of applying quality assurance methods to it. The earlier diagram showing the relationship between leadership, safety management, safety culture and quality management illustrates this point by having a smaller overlap of quality management with safety culture than with safety management. This may change in the future as a better understanding of how an effective quality management system can help develop a positive safety culture in an organization. The regulator has a role to play in encouraging this contribution by the quality management system.

## OPTIONAL EXERCISES

- (1) List some of the methods used in your organization to identify safety problems. Which methods help identify problems in their early stages?
- (2) Consider a task which you are familiar with, and which has a safety implication. What is the process used to assure the safety of the task? Can you think of ways to improve the process?

## 15. WHAT MAKES A GREAT WORKPLACE?

Over the past 25 years the Gallup organization has interviewed more than one million employees to ask them hundreds of different questions on every conceivable aspect of the workplace. Gallup analysed the data statistically in order to identify what the key elements of a strong workplace were. They were not particularly interested in those questions that everyone strongly agreed or disagreed with. Rather they were searching for those special questions where the most engaged employees—those who were fully committed to the goals of the organization and who also contributed significantly—answered positively, and everyone else answered neutrally or negatively. Gallup finally discovered that the strength of a workplace could be simplified to twelve questions. These twelve questions do not capture everything you may want to know about your workplace, but they do capture the most important information that measures the core elements needed in order to attract, focus and retain the most talented employees.

The twelve questions are:

- (1) Do I know what is expected of me at work?
- (2) Do I have the material and equipment that I need to do my work right?
- (3) At work, do I have the opportunity to do what I do best every day?
- (4) In the last seven days, have I received recognition or praise for my work?
- (5) Does my supervisor, or someone at work, seem to care about me as a person?
- (6) Is there someone at work who encourages my development?
- (7) At work, do my opinions seem to count?
- (8) Does the mission/purpose of my organization make me feel that my work is important?
- (9) Are my co-workers committed to doing quality work?
- (10) Do I have a best friend at work?
- (11) In the last six months, have I talked with someone about my progress?
- (12) At work, have I had opportunities to learn and grow?

These twelve questions are the simplest and most accurate way to measure the strength of the workplace. If you can create the kind of environment where employees answer positively to all twelve questions, then you will have built a great place to work.

You may be wondering why there are no questions dealing with pay, benefits, senior management or organizational structure. There were initially, but they disappeared in the analysis. This does not mean that they are unimportant. It simply means that they are equally important to every employee, good, bad and indifferent.



Imagine the twelve questions to represent stages in the psychological climb of a mountain. It is the psychological climb that you make from the moment you take on a new role to the moment you feel fully engaged in that role. At the base of the mountain, perhaps you are joining a new company, or have just been promoted to a new role within the same company. At the summit of this mountain you are good at what you do, you know the fundamental purpose of your work, and you are always looking for better ways to do your work. You are fully engaged.

The key stages are:

*Base Camp:* “What do I get?”

When you first start a new role, your needs are basic. You want to know what is expected of you. How much you are going to earn. Will you have an office or a phone? At this stage you are asking “What do I get?” from the role. Of the twelve questions, No. 1 and 2 measure Base Camp.

*Camp 1:* “What do I give?”

At this stage, you want to know whether you are any good at the job. Are you in a role where you can excel? Do other people think that you are excelling? If not, what do they think about you? Will they help you? At this stage your questions centre on “What do I give?” You are focused on your individual contribution and other people’s perception of it. Questions No. 3–6 measure Camp 1.

*Camp 2:* “Do I belong here?”

At this stage, your perspective widens and you ask “Do I belong here?” Are you working with people who have the same value system? Questions No. 7–10 measure Camp 2.

*Camp 3:* “How can we all grow?”

This is the most advanced stage of the climb. At this stage, you want to make things better, to learn, to grow, to innovate. Questions No. 11 and 12 measure Camp 3.

*The Summit*

If you can answer positively all twelve questions, then you have reached the summit. Your focus is clear. You feel a recurring sense of achievement, as though the best of you is being called on, and the best of you responds every single day. You look around and see others excited by the challenge of their work. You look forward to the challenges of the future.

Base Camp and Camp 1 are the foundations. Spend time focusing on the needs of these stages and you will have the strength necessary for the long climb to the summit. Ignore these needs and you may psychologically disengage from your work even if, on the surface, everything seems fine.

The metaphorical mountain reveals that the key to building a strong vibrant workplace lies in meeting employees’ needs at Base Camp and Camp 1. This is where you should focus your time and energy. If your employees’ lower level needs are not satisfied, then everything that you do for them further along the journey is almost irrelevant. But if you can satisfy these

needs successfully, then the rest—the team building and the innovating to improve performance—is so much easier.

#### OPTIONAL EXERCISE

- (1) Consider each of the twelve questions and rate your response to each on a scale of 1 to 5 (1 – strongly disagree to 5 – strongly agree). Respond from the perspective of your own job in your organization. Which stage of the mountain climb do the results indicate that you have reached? Have the needs of Base Camp and Camp 1 been satisfied before the more advanced stages have been tackled?

## 16. IAEA SAFETY CULTURE SERVICES

The IAEA safety culture services have evolved gradually over a period of time. Initially, ASCOT seminars were used to explain the meaning of safety culture. ASCOT guidelines and technical committee meetings were employed to explain how safety culture might be assessed. The safety culture services have been expanded. The IAEA now offers a number of services to Member States to increase their understanding of safety culture, and to assist in enhancing it. Member States are becoming increasingly aware of the importance of developing a strong safety culture for successful safety performance. The support of the IAEA can be given in various ways—as a continued support during a long term safety culture enhancement process, or as support to parts of this process.

The safety culture enhancement process contains the following steps:

- (1) Top management commitment to launch a safety culture enhancement programme;
- (2) A self-assessment of the present safety culture;
- (3) Formation of an assessment team to perform the self-assessment;
- (4) Gaining a common understanding and frame of reference of safety culture through training of both the senior management team, and the appointed assessment team;
- (5) Development of the assessment tools;
- (6) Performing the self-assessment, analysing the results and presentation of findings;
- (7) Development of an improvement programme based on the results of the self-assessment;
- (8) Implementation of the improvement programme;
- (9) A follow-up of the effects of the improvement programme after about 18 months through a new self-assessment of safety culture;
- (10) Peer review of the organization's safety culture by an external team.

The IAEA can support Member States in all, or some, of the steps listed above. A typical time-scale for the safety culture enhancement effort is about two years.

Diagrammatically, the enhancement process can be summarized as follows:

| No. | Nuclear installation                  |   | IAEA support           |
|-----|---------------------------------------|---|------------------------|
| 1   | Corporate commitment                  | ← | Assistance visit       |
| 2   | Baseline assessment                   |   |                        |
| 3   | Appointment of assessment team        |   |                        |
| 4   | Common understanding                  | ← | Safety Culture seminar |
| 5   | Assessment tools                      | ← | Training               |
| 6   | Assessment completed                  | ← | Peer review            |
| 7   | Action plan                           | ← |                        |
| 8   | Implementation                        | ← | Workshops              |
| 9   | Follow-up assessment                  |   |                        |
| 10  | Safety Culture assessment review team | ← | IAEA team              |

### *Safety culture seminars*

The purpose of the seminars is to increase the understanding of the concept of safety culture, to present information on the stages of development of safety culture and on the different approaches that can be used to assess safety culture. Various practices for improving safety culture are described. The important role of management, particularly senior management, in developing a positive safety culture is emphasized. The duration of a seminar is three days at least. It is recommended that the first seminar involve the senior management team of the organization.

### *Training*

Usually a team is formed within the organization to be responsible for performing the self-assessment of the safety culture. The IAEA can assist the appointed team in developing the assessment tools, and in how to perform the complete assessment process. The training includes team building, a review of methods that can be used to assess safety culture, practical exercises in how to apply the methods, and the development of an initial version of the assessment tools to be used. Information is given on the application of the tools, the analysis of results, and on the development of an action plan for the improvement of safety culture. A minimum of one week is needed for this training, with the length of time needed varying upon the level of understanding of safety culture issues.

### *Peer review*

To successfully improve the safety culture of an organization through self-assessment, the assessment methodology and the process used, has to be valid and reliable. The IAEA can assist in evaluating the quality of the self-assessment methodology and process by means of a peer review by a team of international experts. This support is particularly important when the self-assessment is applied for the first time. It can also be useful when unexpected signs of a weakening safety culture appear, indicating that the self-assessment process needs to be scrutinized and strengthened. The duration of the peer review is a minimum of three days, but it requires preparation before the visit of the expert team.

### *Workshops*

The results of the self-assessment of safety culture will reveal to what extent the various formal systems and processes used to manage safety, have created the desired outcome in employee perception and behaviour. The results of the self-assessment of safety culture may highlight the need for improvements to be made in the management of safety. Difficulties may arise in identifying the most appropriate solutions. Information on successful management strategies and approaches to resolve any difficulties can be provided. This is done by means of workshops where participants include representatives from Member States, who share information on best practices. The duration of a workshop is about three days.

### *IAEA Review Team*

The purpose of the review team is to review the ongoing safety improvement programme. This review usually takes place about 18 months after the initiation of the safety culture enhancement programme. The review team will use questionnaires, interviews, and observations to gain an appreciation of the state of the safety culture in an organization. Key processes will be reviewed. The review team comprises about 4–5 experts, and the duration of the review is a minimum of ten days. The results of the review will allow an organization to benchmark its safety culture and provide a basis for further improvement. This encourages the organization to undertake continuous improvement—the essential feature of a learning organization.

Finally, the process of enhancing safety culture is complex. The temptation to rush through the planning process to get to the action stage must be avoided. The management and other employees of an organization must gain a basic understanding of the concept of safety culture, how it can be assessed, and the practices that will encourage its positive development. The IAEA provides a safety culture service that involves sequential stages that will provide this understanding.



## BIBLIOGRAPHY

- ACSNI Study Group on Human Factors, 3<sup>rd</sup> Report: Organising for Safety, HSE Books (1993).
- ARGYRIS, C., On Organizational Learning, Blackwell (1992).
- COOPER, D., Improving Safety Culture, John Wiley and Sons (1998).
- DAVIDSON, M., The Transformation of Management, Butterworth-Heinemann (1996).
- GALPIN, T., The Human Side of Change, Jossey-Bass (1996).
- GRINT, K., Fuzzy Management, Oxford University Press (1997).
- INTERNATIONAL NUCLEAR SAFETY ADVISORY GROUP, Summary Report on the Post-Accident Review Meeting on the Chernobyl Accident, Safety Series No. 75-INSAG-1, IAEA, Vienna (1986).
- INTERNATIONAL NUCLEAR SAFETY ADVISORY GROUP, Safety Culture, Safety Series No. 75-INSAG-4, IAEA, Vienna (1991).
- INTERNATIONAL ATOMIC ENERGY AGENCY, Developing Safety Culture in Nuclear Activities, Practical Suggestions to Assist Progress, Safety Reports Series No. 11, IAEA, Vienna (1998).
- INTERNATIONAL NUCLEAR SAFETY ADVISORY GROUP, Management of Operational Safety in Nuclear Power Plants, INSAG-13, IAEA, Vienna (1999).
- INTERNATIONAL ATOMIC ENERGY AGENCY, Examples of Safety Culture Practices, Safety Reports Series No.1, IAEA, Vienna (1997).
- INTERNATIONAL ATOMIC ENERGY AGENCY, Self-Assessment of Operational Safety for Nuclear Power Plants, IAEA-TECDOC-1125, Vienna (1999).
- INTERNATIONAL ATOMIC ENERGY AGENCY, Risk Management: A Tool for Improving Nuclear Power Plant Performance, IAEA-TECDOC-1209, Vienna (2001).
- INTERNATIONAL ATOMIC ENERGY AGENCY, ASCOT Guidelines, IAEA-TECDOC-743, Vienna (1994).
- INTERNATIONAL ATOMIC ENERGY AGENCY, Self-Assessment of Safety Culture in Nuclear Installations, Highlights and Good Practices, IAEA-TECDOC-1321, Vienna (2002).
- KAUFMAN, R., Strategic Planning Plus, Sage Publications (1992).
- MELBER, B., DURBIN, N., LACH, D., BLOM, J., Quality Systems Evaluation Method: Development and implementation. Swedish Nuclear Power Inspectorate: SKI-Report 95:62, ISSN-1104-1374.
- MORGAN, G., Images of Organization. Sage Publications (1997).
- PENDLEBURY, J., GROUARD, B., MESTON, F., Successful Change Management, John Wiley and Sons (1998).
- ROBBINS, S., Organization Theory, Prentice Hall (1990).
- ROLLINSON, D., BROADFIELD, A., EDWARDS, D., Organizational Behaviour and Analysis, Addison Wesley Longman (1998).
- SCHNEIDER, S., BARSOUX, J., Managing Across Cultures, Prentice Hall (1997).

SCHEIN, E., *Organizational Culture and Leadership*. Jossey-Bass Inc. (1992).

SCHEIN, E., *Corporate Culture Survival Guide*, Jossey-Bass Inc (1999).

SENGE, P.M., *The Fifth Discipline*, Doubleday Currency (1990).

TRIANDIS, H., *Culture and Social Behaviour*, McGraw-Hill (1994).

WALTERS, M., *Building the Responsive Organization*, McGraw-Hill International (1994).

WARING, A., *Safety Management Systems*, Chapman and Hall (1996).



## **CONTRIBUTORS TO DRAFTING AND REVIEW**

|                      |   |
|----------------------|---|
| Clark, C.R.          | International Atomic Energy Agency            |
| Dahlgren Persson, K. | International Atomic Energy Agency            |
| Eichenholz, H.       | International Atomic Energy Agency            |
| Feik, K.             | Mochovce Nuclear Power Plant, Slovak republic |
| Ignatov, M.          | International Atomic Energy Agency            |
| Lange, D.            | International Atomic Energy Agency            |
| Lipar, M.            | International Atomic Energy Agency            |
| Merry, M.            | Safety Culture Consultant, United Kingdom     |
| Rivas Lagunes, L.    | Laguna Verde Nuclear Power Plant, Mexico      |
| Taylor, T.           | CNSC, Canada                                  |
| Zhong, W.            | International Atomic Energy Agency            |

### **Consultants Meeting**

Vienna, Austria: 21-24 May 2001

