

INSAG-18

Managing Change in the Nuclear Industry: The Effects on Safety

INSAG-18

A REPORT BY THE
INTERNATIONAL NUCLEAR SAFETY ADVISORY GROUP

INSAG



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International Atomic Energy Agency

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**MANAGING CHANGE IN THE NUCLEAR INDUSTRY:
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A report by the
International Nuclear Safety Advisory Group

INTERNATIONAL ATOMIC ENERGY AGENCY
VIENNA, 2003

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

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

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FOREWORD

**by Mohamed ElBaradei
Director General**

The nuclear industry is going through a period of unprecedented change. The changes arise from the political and business environment in which the industry must operate — notably the re-structuring of the wider electricity industry, with deregulation and the introduction of competitive electricity markets - and from within the industry itself as it strives to become more competitive. These pressures have already resulted in significant changes to how nuclear enterprises are organized. The changes can be expected to continue.

Those responsible for the safety of nuclear installations — ultimately, the board of directors - must ensure that the potential impacts on safety are carefully analysed when organizational changes are proposed, and that throughout the period of time that organizational changes are taking place, and after the changes have occurred, very high standards of safety are maintained. Changes can be made effectively and safely, and gains in efficiency and competitiveness, as well as safety, can be realized if changes are introduced carefully and managed well. Failure to manage change well can significantly affect the likelihood of an accident, the degree to which the assets of the company are put at risk, and the company's reputation, must ensure that and that the change is managed so as to avoid adverse impacts on safety.

This INSAG report is written for members of boards of directors and senior executives who are responsible for the overall safety of an installation, who make decisions for change, and who implement those decisions. It is also written for senior regulators who, on behalf of the public, ensure that Boards of Directors and executives meet their responsibilities for safety. The report discusses how and why change can challenge the maintenance of a high level of safety, and what can be done to control that challenge and hence reap all the benefits of change. It draws an analogy between the well established principles for managing engineering changes safely, and the need to put in place similar approaches to manage organizational changes. The report also identifies issues that regulators should review when licensees propose changes to the organization and management of their enterprise

I am pleased to release this report to a wider audience. In particular, I hope that it will increase awareness of this important issue and help to ensure that it is adequately addressed at all nuclear installations.

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1. INTRODUCTION

1. The nuclear industry is going through a period of unprecedented change. The changes arise from the political and business environment in which the industry must operate, and from within the industry itself as it strives to become more competitive. These pressures have already led to significant changes in how nuclear enterprises are organized. The changes can be expected to continue.

2. It is absolutely essential that throughout the period of time that organizational changes are taking place, and after the changes have occurred, very high standards of safety are maintained by all the elements that make up the industry. Changes can be made effectively and safely, and gains in efficiency and competitiveness, as well as safety, can be realized if changes are introduced carefully and managed well. Experience has shown that this is not a simple matter to achieve. Nuclear installations are complex, and it is inherently demanding to foresee all the implications that a change may have on safety. However, experience has shown very clearly that many changes have a strong potential to affect both the safety that has been built into a design and in the safety culture of an organization. Hence failure to manage change well can significantly affect the likelihood of an accident, the degree to which the assets of the company are put at risk and the company's reputation.

3. This INSAG report is directed at members of boards of directors and senior executives who are responsible for the overall safety of an installation, who make decisions for change and who implement these decisions. It is also written for senior regulators who, on behalf of the public, ensure that boards of directors and executives meet their responsibilities for safety.

4. This report discusses how and why change can challenge the maintenance of a high level of safety, and what can be done to control that challenge and hence reap all the benefits of change. It draws an analogy between the well established principles for managing engineering changes safely and the need to put in place similar approaches to manage organizational changes. It also identifies issues that regulators need to review when licensees propose changes to the organization and management of their enterprise.

2. CHANGES IN THE NUCLEAR INDUSTRY

5. Many of the changes that are occurring in the nuclear industry stem from structural changes in the electrical supply industry as a result of deregulation, privatization and the need to improve the competitive position of the nuclear industry. These pressures can lead to major organizational changes to an electrical utility and to its suppliers, such as mergers, the breakup of monopolies, the sale of nuclear plants to new companies and decisions on the survival or demise of a nuclear activity. The decision to close a nuclear power station, for example, has significant implications for the safety of its remaining life, particularly if the closure is earlier than anticipated or arises owing to non-technical reasons.

6. The drive to improve efficiency and reduce costs can also result in organizational changes that can have significant safety implications. Examples of these are:

- a drive for harmonized standards and procedures, for example after corporate mergers;
- changes in the arrangements for providing central support services such as engineering support, procurement and human resources;
- relocation of offices that have the potential to lose expertise in critical areas;
- increases in the time periods between maintenance or inspection outages to improve capacity factors;
- shortening maintenance and refuelling outage time to improve capacity factors;
- changes in the policies for recruitment and training of staff;
- reduction in the layers of management.

7. The drive to reduce costs can also result in engineering modifications or changes to the operating modes of a plant that can affect safety. Examples of these are:

- changing from a base load to a more flexible operating mode;
- modifications of the plant, for example to increase power output;
- changes to fuel type and enrichment to achieve higher burnup or load factors;
- changes to operating policies and principles;
- changes to technical specifications.

3. POTENTIAL IMPACTS OF CHANGE ON SAFETY

3.1. EFFECTS ON ORGANIZATIONAL SAFETY

8. INSAG wishes to emphasize that many changes have been carried out successfully with proper concern for the maintenance or improvement of safety. When changes have been well managed, they have resulted in significant improvements in operating efficiencies, and in overall safety, in many nuclear installations. This section provides some brief illustrations of how these types of change can affect safety in a detrimental way when they are not managed well, on the basis of actual experience gained in industry. Some of these effects have been substantial. Section 5 of this report discusses practical steps to manage such changes in order to reap the benefits that were expected and to avoid these detrimental effects.

9. Cases exist where the drive to reduce costs has resulted in inadequate resources being made available to maintain all the components of the plant at a high level of reliability. Although these decisions led to short term improvements in the financial state of the company, long term safety and profitability suffered dramatically. The cost of recovering from the deteriorating state of the plant far exceeded the financial savings made earlier in the life of the plant.

10. Some mergers and takeovers have led to a loss of nuclear related expertise at board and executive level. New directors and executives will bring fresh ideas and reinvigoration to a company. However, knowledge of the nuclear business and an understanding of the principles that must be satisfied to ensure safety are still vital at this level. Decisions on allocation of resources have been made without an understanding of what is required to maintain the defence in depth which is essential to the achievement of very high levels of safety. Regulators have taken corrective action in these circumstances, with consequent losses to the company in terms of both reputation and revenue.

11. Downsizing and 're-engineering' have resulted in understaffing and lack of competence of staff. Outsourcing has led to difficulties in maintaining the availability of the necessary expertise in contractors and to an overreliance on external sources of expertise, which cannot be guaranteed in the long term. Reduction of the number of layers of management can result in inadequate supervision or oversight of staff work.

12. Cost reduction programmes have led to reduced resources being made available for training and retraining staff. This has led to instances where the qualifications of staff needed to assess the significance of design changes and to maintain key pieces of equipment have been inadequate.

13. Reduction of spare parts inventory arising from changes in procurement and stock policies have resulted in short cuts being taken in maintenance, particularly where there is significant pressure to keep outage times short. These issues also occur where the actions of the board and senior executives appear to staff to give precedence to commercial considerations over safety, in spite of stated company policies.

14. None of these examples are specific to the nuclear industry. They are, however, more of a concern than in other industries, given that nuclear installations are complex and are required to maintain a continuous, unbroken, high level of safety over many decades, through commissioning, operation and decommissioning. They illustrate that it is vital that vigilance is maintained in any change process to ensure that the benefits from change, which other experience has shown to be realizable, do in fact occur

3.2. EFFECTS OF CHANGE ON THE INDIVIDUAL

15. The safety of a plant also depends on the values and safety culture of the individuals in the organization. The highest level of safety culture is defined in IAEA Safety Series 11 [1], and discussed further in INSAG-15 [2], as a continuing process of improvement to which all the individuals in the company contribute. It is recognized by individuals as “how we do things around here”.

16. Change is frequently seen as a threat by individuals in an organization and can have a significant effect on their state of mind, their commitment to the organization and to their contribution to safety culture in particular. Those attributes of a good safety culture such as the reporting of near misses, maintaining a challenging and questioning attitude, and working in teams to identify and achieve improvement opportunities are likely to be (and have been) early casualties if individuals feel that their values are no longer congruent with those of the organization. For example, safety engineers may be less inclined to press for a fully acceptable safety case for a design change, as they have traditionally done, if a company's actions lead to a perception that cost reduction is more highly valued than safety, even though company policies may clearly state otherwise.

17. Furthermore, poorly managed changes may create unnecessarily large and prolonged uncertainties about future responsibilities and even job security among key technical staff. Such large and prolonged uncertainties may divert attention from safety matters and, at worst, lead to key staff members leaving the organization.

18. For the management of a company to achieve the commitment of their staff to the highest level of safety, on a continuing basis, is a difficult task even during periods of relative organizational stability. Periods of major organizational change, particularly if it is driven by the need to improve competitiveness, provide an even more challenging environment in which to demonstrate that safety is being maintained as a very high priority. It is thus vital that there is an even greater focus on maintaining and demonstrating a corporate commitment to safety and safety culture during periods of change, and that a careful look is taken at the effects of change on the perceptions of individuals in terms of the key elements necessary for the maintenance of a good safety culture.

4. ROLE OF THE REGULATOR

19. Just as it is difficult to manage the effects of organizational change on safety there are also real challenges for the regulator in understanding the pressures driving the change, and in dealing with the safety implications that can arise from it. However, the regulator has a responsibility to the public to ensure that operating organizations can operate safely, and hence a degree of involvement is inevitable and appropriate. The level of involvement will depend on the extent to which the organization can show its understanding of the issues involved and the robustness of its procedures for dealing with them. It is important for regulators not to impede or unnecessarily slow down changes which are beneficial, neutral or minor in their safety significance, and to limit their involvement to the impact of change on safety. Systems to monitor and assess the safety impact must not be bureaucratic and it is important that regulators remain open-minded and do not take on responsibilities for decision making on managerial issues which properly rest with the operator. As discussed above, the impact of change is felt frequently at the individual level. Significant delays in making necessary changes can have very negative effects on the state of mind of individuals and contribute to a reduction in overall safety culture. A balance has to be struck between allowing time for due

process and removing uncertainty. Close liaison between the organization and the regulator at senior levels will be important in managing this difficult balance. It being recognized that the prime responsibility for safety rests with the licensee, the basic function of the regulator will be to ensure that the licensee makes an appropriate self-assessment of the safety implications of planned changes and takes account of the results of the self-assessment when implementing the changes.

5. PRACTICAL STEPS

20. Many utilities have faced major organizational changes over the past few years and have developed systems and procedures to manage these changes. In some cases regulators have laid down requirements that utilities must follow. Detailed advice and experience about making changes using well thought out, managed processes are documented in the IAEA publication *Managing Change in Nuclear Utilities* [3]. The implications and processes for dealing with major engineering changes are also well documented. Several INSAG reports have previously laid down requirements for this activity. This report focuses explicitly on some basic principles which should be followed for those changes that are likely to affect safety, and in particular, where the safety culture of both the organization and the individual could be significantly affected. The experience gained in developing systematic methods to manage engineering changes can be used to develop equivalent methods to deal with organizational change.

21. INSAG recommends that companies have a formal, systematic approach to review proposed changes, as they do for engineering changes. For major changes, and those with significant potential to affect safety, boards of directors and executive management need to satisfy themselves that the safety implications of changes have been fully and satisfactorily addressed. These issues are to be discussed regularly at board meetings.

22. It is INSAG's view that a safety assessment should be developed for any change that could affect safety. INSAG recommends that:

- the safety assessment be independently reviewed within the organization;
- the organization have a formal process in place that considers the safety implications of the change in the light of the assessment results;

- for the more significant changes, advice be sought from a nuclear safety committee, possibly with external members;
- for the more significant changes, the regulator form an independent view prior to final approval by the company's board.

23. It is important that this process be supported and well understood throughout the company, particularly when new management structures are being implemented. In INSAG's view, some of the principles for handling engineering changes that are also useful for assessing the implications and controlling the impact of organizational change are as follows:

- Changes are to be classified by operating organizations against agreed criteria as to their safety significance.
- All proposed changes above a certain agreed level or significance are to be notified to the regulator.
- A case is to be made by the operator as to how the planned changes will continue to maintain acceptable levels of safety. This includes both the final position and the arrangements during the transition from the old organizational arrangement to the new. Where this is of sufficient significance, it needs to be agreed by the regulatory body.
- A review mechanism needs to be agreed to ensure that cumulative small changes do not impair safety.
- A system to monitor progress against the planned introduction of significant change is to be developed and any shortfalls rapidly identified so that remedial action can be taken.

24. Underpinning the process is the need to communicate with staff and other stakeholders honestly and openly, addressing the safety implications of the changes, explaining the steps being taken and setting up the appropriate mechanisms for feedback of information to monitor the effects of implemented changes.

25. The interaction of different changes also needs careful consideration. Changes which on their own may have only a limited effect on safety may compound to produce a much more significant effect. Where possible, INSAG recommends that the number of different change initiatives which may have an impact on safety being pursued at any one time be minimized, although for the more profound externally determined changes this may not always be possible. In addition, the total workload imposed on the operating organization to implement the changes in parallel with continued operation needs to be considered very carefully.

26. Despite all precautions and attention to the principles set out above, some changes will, inevitably, have an unexpected negative impact on safety. It is therefore vital that adequate monitoring is in place to provide early warning of such trends and allow time to take remedial action before minimum acceptable safety levels are challenged. Wherever possible, such remedial action has to be planned in advance. Care should be taken in choosing the measures to be monitored and in assessing their effectiveness in providing early warning of any deteriorating trend. Changes with the potential for major effects on safety levels will require more extensive monitoring to detect adverse trends earlier. Their likely effectiveness must also be considered and the speed with which a situation can be retrieved must be assessed.

27. It is important that boards of directors and executive management be presented with, and discuss, regular reports on the results of such monitoring programmes.

6. CONCLUSIONS

28. The nuclear industry presents particular challenges when change is required of it. Nuclear installations are complex and require a highly skilled and motivated workforce to run them safely and efficiently. A very high level of safety is expected of the industry for the many decades that plants are likely to run. Reductions in the level of safety achieved are not acceptable, even for short periods of time. Effective and immediate action is expected if this occurs.

29. The level of safety and efficiency achieved in nuclear installations has, in fact, been steadily improving over the last few years. It is essential that changes beneficial to the development of nuclear power can be taken advantage of whenever they do not prejudice the standards achieved or the potential for future improvements. However, it is also vital that when major changes are planned, not only the systems for assuring the safety of engineering modifications but also organizational systems should be rigorously and independently scrutinized. The boards of operating companies must remain aware that they have the responsibility for safe operations and that both they and the regulators must be convinced that safety considerations have been given priority commensurate with their significance during any process of major change.

30. In times of change, there is significant pressure on the approach to safety and on the safety culture of both organizations and individuals. The key mission for the leaders of an organization should therefore be to hold as their top priority the need to remain focused on maintaining and enhancing the overall safety culture of the organization. An appreciation of the key elements which support a strong safety culture and, in particular, the need to visibly reinforce the corporate commitment to safety in a way which is credible to the workforce and to continue to communicate honestly and openly about safety matters is vital. The effect of change on the individual's commitment and the impact that this can have on the maintenance of a good safety culture must be recognized. Thus, all actions taken by the leaders in planning and implementing change are to be tested in terms of the effect they will have on the perceptions of individuals about these key elements as beacons of stability within periods of inevitable uncertainty.

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