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METHODS AND TOOLS FOR ORGANISATIONAL SELF-ASSESSMENTS

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Summary: This report summarises the LearnSafe project with respects to findings and recommendations related to the use of self-assessments as a method for identification of areas, where possible improvements could bring better organisational performance. Self-assessments are an important tool for any organisation to improve its performance. The most important part of a self-assessment is to define good performance and to find indicators to measure actual performance. There are many methods and tools available to do self-assessments and there are also many reports that can provide guidance for the process. Self-assessments can only be effective if the organisation is mature enough to do an honest search for areas of improvements. If issues cannot be lifted up at the table and discussed as issues, it may be necessary to start with creating an organisational climate that is supporting open and honest self-assessments. This report supplements earlier work in the Workpackages WP3 and WP4 of the LearnSafe project.

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1 INTRODUCTION

The LearnSafe project[1] was divided into two major phases of theoretical and empirical investigations. The first phase was devoted to *management of change* in the belief that the adaptation to changed environmental conditions provides one of the major challenges to nuclear power plants today. The second phase was devoted to *organisational learning,* which is seen as an important process in the pursuit of continued improvement of performance measured in terms of both safety and efficiency. Self-assessments are important both in the management of change and in organisational learning. A working paper with this subject was therefore included in the early plans of the LearnSafe project.

Models of safety have changed over the years. From having had a primary focus on technology, the safety area is today also incorporating such things as organisational factors, safety culture and learning. This broadening of issues considered of importance for safety, evokes a need for developing new methodologies for risk assessment and tools for learning from incidents and events. Such methods must have the capacity and richness to mirror the complexity found in theoretical models of human and organisational behaviour. For instance risk analysis should optimally incorporate influences on risk from human and organisational factors and learning strategies should be broad enough to reflect experiences in the whole spectrum of technology, people and organisational/cultural issues.

This report summarises the two phases of LearnSafe with respects to findings and recommendations related to the use of self-assessments as a method for identification of areas, where possible improvements could bring a better organisational performance. The intention is that this report can support the nuclear power plants in their processes of performance evaluation and goals setting. This report supplements earlier work in the Workpackages WP3 and WP4 of the LearnSafe project.

2 THE USE OF SELF-ASSESSMENTS AT NUCLEAR POWER PLANTS

The use of self-assessments has become a common practice for major industries today. The methods and tools vary, but the general methodology follows largely the same patterns. A self-assessment is initiated either as a part of some continuing activity or when there have been signals of a deteriorating performance. A self-assessment is typically carried out as an internal activity, although external experts may be called in as moderators in the process.

2.1 Reasons for using self-assessments

There are obvious reasons for using self-assessments at the nuclear power plants to collect and use operational experience. The first and most important is that only a systematic exercise can ensure that important experience is collected, assessed, categorised and feed back in a cycle of improvements. The second reason is that only the organisation itself has the full background knowledge to be able to catalogue and prioritise various pieces of information coming from different sources within the organisation. When the organisation itself is carrying out the self-assessment there are at least in principle no danger that confidential information comes out in the open.

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[1] The project FIKS-CT-2001-00162 "Learning organisations for nuclear safety" funded by 5th Euratom Framework Programme 1998-2002, Key Action: Nuclear Fission by the European Commission. For additional information see the web-site http://proxnet.vtt.fi/learnsafe/, which is open for the LearnSafe partners. The project has also established an open web-site at the address http://www.vtt.fi/virtual/learnsafe/.

This said it is important to understand that there are certain dangers that may diminish the usability of the results from a self-assessment. If there for example are taboos in the organisation, they may prevent important information to reach the senior management. It is also important that self-assessments are done in an open a trustful atmosphere, not to introduce fears that information revealed by single persons may be used against them.

2.2 Self-assessments in cycles of planning and implementation

There are several planning cycles of goal setting, planning, implementation and assessments used at the nuclear power plants. One of these cycles is connected to the strategic and annual planning, which is following well established phases within a year. The last phase of this cycle of strategic and annual planning is an assessment of the previous cycle results to build the basis of a new cycle. For this purpose there is a range of tools from formal collection of operational data to a more informal assessment of performance of individuals, groups, sections and departments. This assessment is carried out in relation to stated goals as defined in the beginning of the planning cycle.

Similar planning and implementation cycles are set for example by the annual refuelling and large development or modification projects. The assessments for these typically use the same methods and tools, which are used in the strategic and annual planning.

One observation from the planning and implementation cycles is that goal setting and goal follow up sometimes present difficulties. One remedy has been to introduce the so called Balanced Score Card approach (BSC).[2] This approach helps in defining goals and priorities for several major areas, which are broken down in sub-areas and indicators. At those plants, where the BSC-approach is used, it a common practice to use the same method to bring goals and performance indicators down in the organisation.

2.3 Quality audits and revisions

The quality systems are introducing their own audits and reviews.[3] These can be seen as a specialised form of self-assessments. Quality audits are executed with a clear norm defined in the procedures. Interviews and document reviews are used to identify discrepancies. Discrepancies are usually categorised into deviations and observations to indicate the seriousness of the identified discrepancy. Quality audits are usually performed on a rotating basis within the organisation, with which organisational units and activities are audited with a period of for example three years.

The audits are typically carried out by a small group consisting of one to four persons depending on the scope of the audit. When several persons are participating, there is typically a division of roles and areas of expertise. The deviations and observations are fed back to the activity or organisational unit audited in a closing session to inform about the results and to give an opportunity to clear up possible misunderstandings. Further handling of the deviations and observations include the preparation of an action plan for improvements.

[2] Robert S. Kaplan, David P. Norton (1996). Translating strategy into action: The balanced score card, Harvard Business School Press, Boston, Mass. 322p.
[3] IAEA (1996). Quality assurance for safety in nuclear power plants and other nuclear installations, SS No. 50-C/SG-Q.

2.4 Periodic safety reviews

Nuclear power plants go through a comprehensive safety review with an approximate interval of ten years. This requirement is typically included in national regulation. IAEA has also created guidance for such reviews.[4] The review is divided into the following main parts: Plant; Safety analyses; Performance and feedback of experience; Management; Environment. It is concluded in a global assessment, which is based on the review and agreed corrective actions.

The management part of the review takes a look on organisation and administration, procedures, the human factor and emergency planning. These areas are further broken down in separate elements to be considered and assessed.

2.5 Benchmarking

Benchmarking is not necessarily a self-assessment in a strict sense, because they are usually carried out as a co-operation between two or several partners. In a benchmarking exercise a certain comparable functions or activities are selected at the participating organisations to be compared. Depending on the scope of the exercise, it could go down into a large amount of details for example connected to the use of resources and time. The benefit of benchmarking exercises is that they do not require a specific norm against which the assessment is done, because this norm is provided by the practices of the participating organisations. In the LearnSafe project one such benchmarking exercise has been carried out.[5]

2.6 Preparation for external reviews

A tradition has been created within the nuclear industry that external reviews are carried out at a regular interval. IAEA is for example offering OSART reviews, which most plants have gone through. WANO is offering peer reviews to its members and in a few years time it is expected that all plants in the world have gone through a peer review at least once.[6]

A common practice at the nuclear power plants before an external review is to do a self-assessment using the same methodology. This has the multiple benefits of preparing for the review to get the largest benefit of it and to engage a large group of people in a discussion on preconditions for safety.

3 METHODS AND TOOLS FOR SELF-ASSESSMENTS

There are several methods and tools that can be used for self-assessments. Regardless of the used methods and tools they can usually be divided into the following general phases, preparations, data collection, analysis, interpretations and suggestions for improvements. When a new method and tool is taken into operation it is a good policy to do a pilot investigation to check that asked questions are understood and that relevant data is obtained.

3.1 Data collection instruments

Self-assessments typically use several data collection instruments. These could include interviews, questionnaires, observations and document reviews. The selection of some specific

[4] IAEA (2003). Periodic Safety Review of Nuclear Power Plants, NS-G-2.10.
[5] Björn Wahlström, Olle Andersson, Olli-Pekka Luhta (2003). Quality activities, operations management and process orientation; Experience from a benchmarking exercise, PLEM – LearnSafe – W004.
[6] Björn Wahlström, Bernhard Wilpert, Carl Rollenhagen (2003). Reflections on the WANO peer review process, PLEM – LearnSafe – W003.

instruments always relies on a compromise between resources needed and the quality of data obtained. The different instruments could be utilised in a variety of ways, which means that a selection and adaptation of used data collection instruments should be the target for a deliberate design effort.

Interviews could be structured, semi-structured or unstructured. In the structured interviews the intent is to ensure that the respondents are asked same questions. In unstructured interviews the respondents are asked to associate freely around a selected theme. Interviews are time consuming and resource demanding if their full potential is to be used.

Questionnaires have the benefit that they can be targeted to a large number of respondents and that the data collection and analysis can be done using computerised methods. On the other hand the questionnaires are restricted to a predetermined set of question and there is no assurance that the questions are understood and that the questionnaires are filled in honestly.

Observations can be done either during the execution of real tasks or during various kinds of simulations. The observation of real tasks may be very time consuming, because the studied work activities may comprise of only a small part of the total observation period. On the other hand simulations always introduce the risk of deviations between actual and simulated ways to carry out the work.

3.2 Quantitative data collection instruments

Qualitative results are often sufficient, but sometimes there is a wish to obtain also data that can be used for trending purposes. Many of the physical and economic variables are available in a numeric form, but assessments of human and organisational performance are more difficult to bring in this format. One possibility is to use simple quantifications for example by giving the characterisations of poor, tolerable, good, very good and excellent for the assessed conditions. If this simple quantification scheme is used it may be advisable to give descriptions of what is meant with the characterisations to anchor respondents to use comparable scales.

Questionnaires, which are using the so called Likert scales with for example seven response alternatives ranging from "Not at all of the same opinion" to "Very much of the same opinion", have the benefit of giving quantitative values simply by averaging the responses over the whole material. In this case a further analysis can be done by statistical methods either to identify factors that determine components of variation or cluster analysis to find groups of similar answers in the material.

3.3 Safety climate assessments

Many of the nuclear utilities in Europe are using questionnaires for self-assessments of safety climate/culture. The questions are focusing on issues such as: Personal perception of upper management commitment to safety; Communication practices inside and between organisational units; Perceived availability of resources; Perceived compliance with rules; Change management routines; etc. It is typical that these questionnaires are administered annually. The questionnaires are usually implemented via the Intranet and full anonymity is guaranteed for the respondents. Various practices are used to suggest remedial actions from the data obtained, such as for example to use the data to identify themes that are perceived as candidates for improvement across several departments and/or to identify specific areas in need of development for specific functions. There have been discussions among the utilities to eventually update and modify the instrument to incorporate the lessons learned from several years of ap-

plication and in light of the research in safety science conducted after the instrument was designed.

The LearnSafe project has, as one of its spin-off activities, used data from such safety climate assessments and together with data collected in the context of LearnSafe, elaborated on organisational learning strategies.[7] Vice versa the LearnSafe project models have been found useful to shed new light on the data obtained in the safety climate data collection.

Safety climate assessments of this kind can be useful to stimulate a discussion of safety issues in a broader context than what usually is found in the technical safety tradition. One should be careful, however, to not use such data as the sole quantitative indicators of safety culture. Good practice is instead to use these methods as input for discussions of safety, for example, as suggestions of themes that perhaps need a deeper evaluation so that potential safety problems can be relieved.

3.4 Systematic analysis of events

The analysis of events is one important activity through which learning from experience is ensured. The analysis of events can be seen as self-assessments, because they are usually done within the plant organisation. The analysis is typically precluded by a categorisation of the importance of the event, which governs forthcoming analysis steps. IAEA has published a brief review of used methodologies.[8]

Learning from the analysis of events has been systematized at many nuclear plats.[9] One commonly used framework is the so-called MTO-concept (Man, Technology, Organisation). In Sweden for example, plants have implemented MTO-teams at their production units to ensure that an integrated view of safety is applied in event investigations. In the LearnSafe project such a strategy has been identified as an interesting example of good practices to support a *system view* of nuclear safety. A comprehensive analysis of events is most likely one fruitful route to support a system view of safety – i.e. a view that elaborates on the complex interactions among human, technology and the organisational context. The focus of event for supporting systemic views of safety has many advantages, such as for example, that complex interactions are easier to map and understand when the investigators use this approach. The abstract systemic models are easier to exemplify using some to communicate the systems thinking. Another advantage is a broader participation in the analysis supplies training in event investigations.

3.5 Use of safety performance indicators

Many important aspects of performance are difficult to measure objectively. One alternative is to find indicators that correlate with interesting aspects of performance. Using several indicators at the same time it is often possible to get quite reliable assessment of the interesting aspects of performance. IAEA has been active in giving guidance for safety performance indicators.[10]

To fulfil requirements on usefulness, safety performance indicators should have a close relationship to risks and/or safety. It is advantageous if the necessary data is readily available. In-

[7] Björn Wahlström, Carl Rollenhagen (2004). Organisational controllability, PLEM – LearnSafe – W011.
[8] IAEA (2002). Review of methodologies for analysis of safety incidents at NPPs, TECDOC-1278.
[9] Björn Wahlström, Hans Maimer, Bethan Jones, Carl Rollenhagen (2003). Feedback and Analysis of Operational Experience in the Nuclear Industry, PLEM – LearnSafe – W203.
[10] IAEA (2000). Operational safety performance indicators for nuclear power plants, TECDOC-1141.

dicators that are quantitative to show a range of performance are more useful than others. Safety performance indicators should be unambiguous and unlikely to cause undesirable actions. It is important that the significance of the indicators is understood, i.e. they should to the largest extent be objective and fair. Indicators that have an industry wide applicability, makes it possible to do benchmarking. Indicators should not be susceptible to manipulation, which implies that close relationships to measurable physical results is an asset. It is essential that several independent indicators are used to ensure that a consistent assessment can be reached. It is important that the indicators followed is a manageable set, to ensure that cost of following the indicators are in balance with the benefits they give.

In using performance indicators it is important to understand that they may become ends in themselves. A too large emphasis should thus not be put on some specific performance indicator, because priorities may shift. In specifying a set of performance indicators it is important to be prepared to change them at regular intervals. This need is also connected to the need of performing regular reviews of operational practices.

3.6 Assessment of organisational performance

Assessments of organisational performance always presuppose some definition of relevant performance. It is also important to understand that assessments have a certain goal and that the used assessment process should be adapted to that goal. IAEA has created two partly overlapping documents gives a comprehensive overview of the whole self-assessment process together with examples of practices from eight different countries.[11]

Typically an assessment process would be started in response to a certain need. This has to be spelled out and the suggested self-assessment process has to be adapted to this need. Setting up a specific self-assessment project would typically start by defining scope, time schedule and resources. One responsible person would typically be appointed for the task and the necessary resources would be allocated. In addition a steering group is usually appointed to support the self-assessment project.

There are additional benefits of successful self-assessments that may be taken into account already in the planning phase. One of these additional benefits is the transfer of knowledge from people with a long experience at the plant to people with a shorter experience. Sometimes a self-assessment process can bring in a better understanding of performance expectations and crucial components of safety

3.7 Self-assessment of safety culture

Safety culture has been one of the buzzwords especially within a regulatory frame. The nuclear power plants have had more difficulties in bringing the concept into the normal day-to-day operation.[12] The main difficulty in the self-assessments of safety culture is connected to the need for defining the concept and finding good indicators for its measurement. IAEA has been active in finding indicators for safety culture and tools for their assessment.[13] A comprehensive overview of methods and tools for self-assessment of safety culture has been re-

[11] IAEA (1997). Procedures for self-assessment of operational safety, TECDOC-954. IAEA (1999). Self-assessment of operational safety for nuclear power plants, TECDOC-1125.
[12] Björn Wahlström, Carl Rollenhagen (2004). Issues of safety culture; reflections from the LearnSafe project, Forth American Nuclear Society International Topical Meeting on Nuclear Plant Instrumentation, Controls and Human-Machine Interface Technologies, Columbus, Ohio, September, 2004.
[13] IAEA (2002). Safety culture in nuclear installations; guidance for use in the enhancement of safety culture, TECDOC-1329.

leased.[14] Proposed questions to be asked when assessing personal contribution to the enhancement of safety culture can be found in still another document.[15]

One theme in the IAEA documents is that safety culture goes through certain stages of development.[16] In the first stage there is a belief that safety is based on rules and regulation. In the second stage a focus on safety is placed as an organisational goal. Finally a mature organisation is characterised by its awareness and understanding that safety always can be improved.

Another theme of the IAEA documents is that a deterioration of the safety culture typically exhibits a common pattern with the following stages: Over-confidence; Complacency; Denial; Danger; Collapse.[17] WANO has also used a set of warning signals that should initiate concerns and actions for improvements. Not going into the details of these warning signals, it cannot be stressed too much that the senior management should have a very good situational awareness of the organisational climate and applied practices. The real dilemma emerges if the senior management is not enlightened enough to understand the business risk of a non-safe plant.

4 SOME REFLECTIONS

Organisational self-assessments should not be seen as an end in itself, but as a one important component in a set of management tools that are used on a continuing basis for ensuring good performance. There are many different instruments that can be used for self-assessments and it is therefore important that pros and cons are understood to select a battery of instruments that can give the best result.

4.1 Self-assessments as compared with external reviews

Self-assessments should always be complemented with external reviews, because it is always easy to be blind to defects in one's own work. When external reviews are carried out they should be given free hands, because any hidden agenda tends to diminish the usability of the results. External reviews have to be anchored high up in the senior management to give them credibility and to ensure that there is a willingness to reveal sensitive things.

Self-assessments can often benefit from the use of an external moderator. Especially in group discussions there is often a need to do interpretations of the statements given by asking new questions. Sometimes it may be a need for releasing tensions through an intervention of the moderator. Self-assessments can also take steps towards the methodology of peer reviews by involving a few persons from similar positions as the persons, who commissions the self-assessment.

4.2 Implicit models of performance

All method or tool for self-assessments relies on some more or less explicit model of performance. If this model has not been made explicit, it may be difficult to assess the relevance of results and interpretations. Unfortunately many methods used by consultants rely more on ad hoc considerations than on a consistent structure of concepts and validated models.

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[14] IAEA (2002). Self-assessment of safety culture in nuclear installations, TECDOC-1321.
[15] IAEA (2002) Key practical issues in strengthening safety culture, INSAG-15.
[16] IAEA (1998). Developing safety culture in nuclear activities; practical suggestions to assist progress, Safety Report Series No.11.
[17] IAEA (1999). Management of Operational Safety in Nuclear Power Plants, INSAG-13.

All assessment methods rely on the use of norms and criteria on what can be considered as acceptable and what cannot. In practice there is often a grey zone between those two areas, which is important to specify. If for example some practice cannot be considered to be a direct threat to safety, but it still appears somewhat dubious, it can sometimes be used as an example to clarify important components in the construction of safety.

In the definition of norms and criteria there is sometimes a wish to categorise observations with respect to their importance. In practice this is usually done by assigning verbally described categories to the observations. To ensure a consistency in these categorisations it is usual to provide examples or other guidance for the categorisations.

4.3 Collection of multiple views

All methods and tools that are use for self-assessments have their blind spots. This means that it is always a good policy to use at least two methods to validate main conclusions of the self-assessment. There is a benefit if the used methods rely on the same underlying assumptions and models, because it is then easier to ensure that results are consistent. A simple and inexpensive method for this kind of validation is to use some major method for the bulk of the data collection and interviews or group discussions to assess the validity and meaning of the results.

The need for multiple views can also stretch over time, because it is often more important to see trends over time than absolute values in some variable. To ensure consistency in the trending it is important to repeat the assessments at regular points of time in the same way. This may on the other hand freeze the self-assessment to outdated practices.

4.4 Methods and tools used in the LearnSafe project

The LearnSafe project has used many methods and tools for the collection of data during its two phases of research.[18] Simply relying on the experience from these exercises it is apparent that the same methods and tools with small adaptations can be used also as parts in self-assessments. The group discussions and the Metaplan sessions proved especially useful in the data collection within the LearnSafe project.

The Metaplan technique is a technique that encourages individual involvement by participants.[19] It also facilitates group interactions and discussion. Metaplan is a data collection technique during which a moderator controls the data collection process. The moderator would typically begin the session by introducing a question to be answered. Each member of the group is then asked to produce 3-5 simple statements as answers to the question and record their answers on cards provided. The cards are then collected and stuck to a board in random order. The group is then asked to sort the cards by content and to create clusters with the same or similar meanings. Finally clusters are given names and the clusters and statements are ranked by their priority.

[18] LearnSafe (2003). Deliverable 3: Methods and Tools for Data Collection during Phase 1, PLEM – LearnSafe – D3. B. Wilpert, H. Maimer, J. Jung (2003). Phase II - Organisational learning, PLEM – LearnSafe – WP401.
[19] Bethan Jones, Sue Cox (2003). Metaplan: a technique to facilitate management learning within the nuclear industry, PLEM – LearnSafe – W009.

4.5 Organisational self-assessments as a tool for learning

Organisational self-assessments can be used as a tool for learning.[20] This can be done for example by composing the self-assessment team with a mix of old-timers and new-comers. To enhance the learning value of a self-assessment it may however be necessary to be more systematic. This would for example be possible by writing suitable reports and arranging small seminars and training courses.

The praxis with the periodic safety reviews provides a good opportunity to step back and to assess organisational performance over a longer time period. Properly handled these reviews give opportunities for the whole organisation to reflect back over a time period long enough to assess what has changed for better and what for worse. Used in this way, these reviews can provide valuable indications and information to govern the choice of strategies for future operation.

5 CONCLUSIONS

Self-assessments should be seen as an important tool for any organisation to improve its performance. The most important part of a self-assessment is to define performance and to find good indicators to measure that performance. There are many methods and tools available to do self-assessments and there are also many reports that can provide guidance in the details.

One of the questions that have emerged from LearnSafe concerns how *system thinking* can be implemented in organisations that are highly specialised. The request for methods reflects a pragmatic and understandable need but may also evoke false and dangerous beliefs that methods can be used more or less automatically. This is not correct, because any method has its underlying assumptions, which should be understood before the method is used. As a consequence, one should be careful when introducing methods that are assumed to reflect systemic or global aspects of safety. To achieve insight into the complex relations among man, technology and the cultural and organisational context, the LearnSafe project recommends a strategy that stimulates an open discussion of *safety issues* and from that local solutions must be obtained.

Self-assessments can be effective only in a mature organisation. If issues cannot be lifted up to the table and discussed as issues, it may be necessary to start with creating an organisational climate that is supporting self-assessments.

[20] Björn Wahlström, Carl Rollenhagen (2003). Merging of two organisational cultures, PLEM – LearnSafe – W011.

APPENDIX. EXAMPLES OF DIMENSIONS USED IN SELF-ASSESSMENTS

The following list of question areas has been proposed to be used in the self-assessment of safety culture.[21]

government	commitment to safety	legislation budgets of regulatory agencies international communication
	regulatory agencies	clear safety objectives regulatory requirements a process for dealing with issues problems with regulation consistent regulatory practices education and training programmes international cooperation regular reports on safety problems balance between formality and professionalism contacts between regulator and operators information exchange on experience reliance on international safety processes presence at plants
operator	corporate level	safety policy issued familiarity with safety policy availability of expertise in nuclear safety a safety committee responsible senior manager resources for safety functions reviewed
	plant level	meetings devoted to safety issues peer reviews carried out reporting directly to plant manager reward systems include safety performance clear assignments of safety responsibilities documents kept up to date the importance of attitude to safety understood performance appraisals include safety influence of safety attitudes on promotions open and adequately formal relationships regular reviews of safety performance timely actions on safety reviews awareness of how plant compares to others regular assimilation of operating experience awareness of trends of safety indicators formal reporting of safety related events safety review group trend on outstanding deficiencies training end in a formal assessment resources allocated to training

[21] IAEA (1994). ASCOT Guidelines: Guidelines for organisational self-assessment of safety culture and for reviews by the Assessment of Safety Culture in Organisations Team, TECDOC-743.

		assessment of training programmes periodic review of training programmes production requirements interfere with training understanding of operating limits compliance with procedures individualized training appropriate use of training tools training programmes do address safety culture initiatives for safety records easily retrievable work by supporting organisations working style of senior supervisors middle managers make inspections policy on overtime conflicts between safety and economy safety review of annual shut downs actual illustrations that safety comes first discussions of commitment to safety dissemination of lessons learned system for suggesting improvements attitudes to safety reviews and audits regular personnel performance reviews responses to safety infringements appraisal of managers safety performance participation in safety courses inspection of safety related work attention to the working environment awareness of commitment to safety an understanding of acts influencing safety an understanding of own responsibilities an understanding of recent incidents procedural compliance attentiveness to quality of records actions when safety threats are observed actions an perceived errors in procedures reporting of safety shortcomings alertness of control room staff use of training opportunities efficiency of communication attitudes to reviews and audits
research or-ganisations		understanding the use of results reporting misuse of results efficiency of channels for new data mechanisms for pursuing relevant research promptness of utilization of results
design or-ganisations		processes for V&V of computer codes participation in international exercises outside expertise supplementing own competency design review teams auditing of the design review

The following list of twenty organisational dimensions was created based on research sponsored by the US Nuclear Regulatory Commission.[22] It is supported by various questionnaires and assessment tools to carry out more detailed evaluations of the dimensions.[23]

CULTURE

1. Organisational culture
2. Ownership
3. Safety culture
4. Time urgency

COMMUNICATIONS

5. External communication
6. Interdepartmental communication
7. Intradepartmental communication

DECISION-MAKING

8. Centralisation
9. Goal setting
10. Organisational learning
11. Problem identification
12. Resource allocation

ADMINISTRATIVE KNOWLEDGE

13. Coordination of work
14. Formalisation
15. Organisational knowledge
16. Roles and responsibilities

HUMAN RESOURCE ADMINSTRATION

17. Performance evaluation
18. Personnel selection
19. Technical knowledge
20. Training

The following list of dimensions was used in the assessment and review of Ontario Hydro nuclear power plants, which resulted in extended shut downs of several plants.[24]

1. Managerial leadership
   - inadequate definition of employee accountabilities
   - poorly defined lateral working relationships
   - inadequate managerial practices
   - failure to support low level management
   - inefficient oversight
2. Culture and standards
   - culture

[22] Haber, S.B., O'Brien, J.N., Metlay, D.S., Crouch, D.A. (1991). Influences of organisational factors on performance reliability, NUREG/CR-5538.

[23] Rick Jacobs, Sonja Haber (1994). Organisational processes and nuclear power plant safety, Reliability Engineering and System Safety, Vol.45, pp.75-83.

[24] Andognini, G. C. (1999): Lessons from plant management for achieving economic competitiveness for evolutionary reactors, pp.330-337 in Evolutionary water cooled reactors: Strategic issues, technologies and economic viability, IAEA-TECDOC-1117. A more detailed account of the assessment report has been available at the site http://www.hydro.on.ca/OHNewSit.nsf/Public/ConsInforNewsIIPARReport.

- non-conservative decision making
- standards

3. People and performance
    - people
    - performance
4. Processes and procedures
    - inadequate performance monitoring
    - inadequate procedural compliance
    - inadequate quality assurance
    - inadequate work protection
    - root cause not identified
    - security program needs
    - incomplete or flawed processes
5. Plant (hardware) and design
    - operability determinations
    - design basis documentation and change control
    - systems engineering and programs
    - safety system functional inspection results
    - plant status and configuration control
6. Organisation and resources
    - resources
7. Labour relations
    - collective agreement issues affecting performance
8. Site specific and corporate reviews
    - operations
    - maintenance
    - training
    - engineering
    - quality
    - radiation protection
    - chemistry
    - emergency preparedness
    - security