SAFETY SCIENCE Monitor

ISSUE 3 1997 VOL 1

Article 1

# THE SAFETY ELEMENT METHOD -A USER DEVELOPED TOOL FOR IMPROVEMENT OF SAFETY MANAGEMENT

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## ABSTRACT

The article presents the Safety Element Method and the process of developing the method. The method is an assessment and development tool for improvement of the safety, health and environment (SHE) management, tailored for application in the Norwegian mining industry. Development of the tool has been carried out through a structured group problem solving process. The participants were resource persons representing different parties in the industry. The Safety Element Method (SEM) is designed for being used by the practitioners themselves. The method identifies the current SHE performance and the desired future of the organisation. The tool also gives aid to find improvement measures. SEM emphasises consensus decisions through internal group discussions. The method is designed as a matrix, where the columns represent five phases of development. The rows define the safety elements considered. The content is devided in six main elements that ought to be considered by the organisation; Goals/ambitions, Management, Feedback systems/learning, Safety culture, Documentation and Result Indicators. Though the method has been developed for mining enterprises, the basic principles of the approach are relevant for other high risk industries.

Key terms: Occupational health and safety; Quality management; Organisational development; Management assessment; Mining industry; Problem solving; Accident prevention

## 1 INTRODUCTION

The Norwegian mining industry has a high injury frequency rate and a high severity rate, i.e. reports to the Norwegian authorities reveal that this industrial sector has the most personnel injuries of all sectors in Norway (Arbeidstilsynet, 1995; Alteren, 1995a). The safety results of 1993 and 1994 represent the typical safety performance; an injuries frequency of respectively 32,5 and 28,5 lost time injuries per one million working hours, and a severity rate of respectively 473 and 545 lost days per one million working hours.

The Norwegian internal control regulation, that entered into force 1 January 1992, has the intention to implement new approaches to cope with the challenges of the management of SHE. Compared to the traditional control regime, the internal control reform gives more requirements on the obligations of the management of the enterprise, on systematic and documented actions based on principles for the quality assurance area and on system audits as a tool for control (Hovden, 1996). According to safety results in mining enterprises, the implementation of the reform had not given the intended effect. Through the Norwegian mining development program, NORMIN, representatives from mining enterprises have stressed

the need for a structured and adapted tool for internal assessment, control and improvements. Also the internal control regulations require such assessments. Using a formal audit tool makes the assessment approach more objective, systematic and effective, as well as ensuring that important factors are handled (Kjellén et. al., 1987). Reviews of several methods showed that they had been developed for different purposes and varied in scope and approaches (Kjellén and Sklet, 1995; Kjellén and Larsson, 1981; Alteren, 1995b). In agreement with the mining industry it was decided to develop an improvement tool specially tailored to meet the needs of the branch. The idea was to develop a participative tool for internal assessments, to be used by a group of employees from different organisational levels and layers. The mining industry itself played a central and active role throughout this development work.

The purposes of this article are; 1) to discuss an approach for developing an improvement tool that satisfies the needs of the users, and 2) to present and discuss the tool, the Safety Element Method (SEM). Questions representing the first purpose are: What approach should be chosen for development of an organisational improvement tool? Who should participate in the development process? What main subjects should be discussed by the participants during the development of the tool? Questions considering the second purpose are: What traditions in organisational theory should be emphasised, i.e. how does SEM relate to the nature of organisations? What are the main factors and aspects of safety management to be covered by SEM? These questions are penetrated by linking the general organisational frames to the development and content of SEM.

Evaluation of the use of SEM will be documented in later articles.

### 1.1 Aims for the Tool

Safety management is not an exceptional exercise of management, it represents an aspect system similar to systems and principles applied in other areas of management. An objective of the tool has been to integrate and co-ordinate the efforts from the different parts of the mining enterprises. The aim is to attain better safety for personnel, property and external environment. The mechanisms and general management factors that influence such damage are the same factors that influence the results in other business areas (Bird and Germain, 1990; Tinmannsvik, 1991; National Research Council, 1982). A holistic perspective of the organisation should therefore be considered. By visualising development potentials the tool can provide motivation for higher ambitions, encourage continuous improvements and implement the ideas of total quality management into SHE management.

The main purpose of the tool is to motivate the companies to develop their organisations through a process that gives commitment and involvement. Employee participation, which is a part of Norwegian labour traditions, is an essential factor. To quote Bolman and Deal (1993, p.136): «Participating is a means to enhance work morality and productivity at the same time». This suggests group methods of analysis and dialogue, to broaden the perspectives in order to identify common ground, shaping the ideals and to lead to committed action (Weisbord, 1993). The organisational members shall think of the future as a condition they create intentionally out of values, visions and what is technically and socially feasible. The desirable future reality shall become the basis for action, based on mutual interest across the boundaries of levels and competence.

The tool has to be flexible enough to cover all branches of the industry with all aspects of production, as well as the various safety stages and local conditions affecting different enterprises within the industry. The aim is also to make the tool fit for small and medium sized enterprises, which generally have scarce resources, to help them to approach SHE improvement commitment and action. The close co-operation with users through the development of the tool should ensure that it fits the purpose.

### 1.2 General Model for the SEM

A general diagnosis model that had proven useful through recent studies (Alteren, 1995a, Jersin and Sten, 1996), was chosen as a basis for the development work. The principle of the model is shown in figure 1[1]. The model is founded on the principles of safety management and quality assurance. Management remedial options and potential for further improvement of quality and safety are revealed by defined stages of

1 Figure 1 is not representing the general model as it initially was proposed, it shows the general model adjusted to the result of the development presented in this article.

performance within defined safety elements. The stages in the matrix tell how each of the safety element achievement develop from lower to higher ambitions.

The main idea of the model is that groups shall assess their own organisation within each safety element, based on the criteria explaining the performance on each stage. They shall decide what are the current conditions of SHE (profile A) and what conditions do they want, i.e. what condition will serve the enterprise best (profile B). The step following involves development of a strategy to achieve the desired output and design of the tasks needed to execute that strategy. A similar model is the basis when Narayanan and Nath (1993, p. 423) consider Likert's four systems assessment (Likert, 1975) in the light of stream analysis. The current state of the organisation is compared with the ideal state, and deviations assessed. The greater the deviation is, the less effective is the organisation.

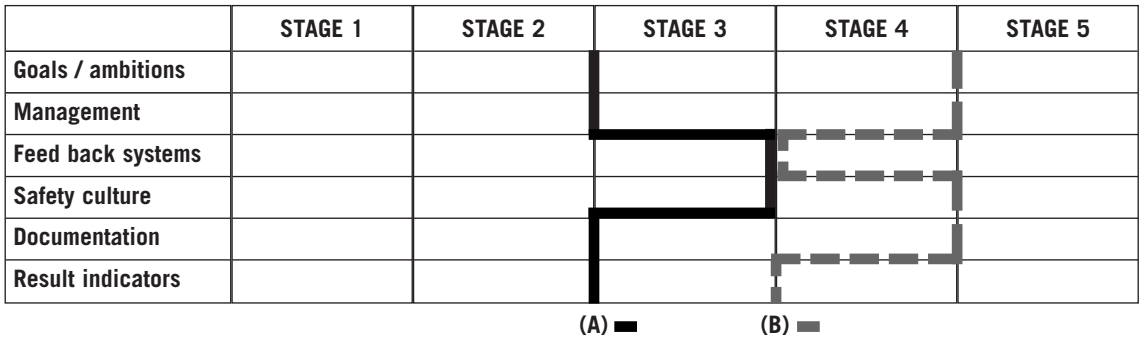


**Figure 1** Presentation of current state of organisation (profile A) and the desired future state (profile B) by, the general model of the Safety Element Method.

The intention of the stages of the model is to direct the evaluators to make more nuanced assessments than «Satisfactory» or «Not satisfactory», as in for instance the diagnosis tools MORT (Johnson, 1980) and ISOBAR (Tinmannsvik and Mostue, 1993). The purpose is to attain a more dynamic improvement philosophy instead of a static «good enough» thinking.

The structure used in this general model is applicable and may be utilised in several areas. It has been used for external evaluations of safety in mining enterprises (Alteren, 1995a), then based on three defined stages. Jersin and Sten (1996) arranged it for internal assessment of quality and safety in a helicopter transportation company. They defined four stages of performance. A parallel way of thinking is demonstrated by Lillestøl (1994, p.198) when he defines five stages of quality assurance (QA);

1) No formal QA system - lots of deviations, no follow-up

2) QA system is worked out, but is not functioning - deviations get sporadic follow-up

3) QA system for handling deviations is working - follow-up of deviations, mostly reactive

4) QA system for deviations and improvement is working - causes of failures are not repeated

5) QA system puts weight on prevention of potential failures - deviations are rare

Phillips Petroleum Company in an official brochure «Safety Excellence», presents a method for internal assessments, in line with the SEM model. They are judging 13 elements and have 10 stages for assessment. This shows that a similar idea for assessment has arised independently at different places at the same time.

The experiences from the studies of Alteren (1995a) and Jersin and Sten (1996) were very promising. The feed back about the evaluation model showed that the companies appreciated it and found this way of judgement educational. The general model was found to be simple and comprehensible, and representing a dynamic and adaptable development perspective. It functioned well as support for the diagnosis process and was easily communicated. It also produced enthusiasm, engagement and increased insight into the

challenges of their own organisation. Considering the positive experiences the model had a concept worth further development and testing, and we proposed the model as a foundation for a development tool for the mining industry as described in this article.

## 2 THEORETICAL FRAMEWORK FOR THE DEVELOPMENT OF THE TOOL

### 2.1 Action Research

Action research is one of the cornerstones of organisational development literature (French and Bell, 1995). This research approach seemed to fit the needs for the development of SEM. The action research model focuses on planned change as a cyclical process of research and action, which involves collaboration between practitioners and researchers. It places emphasis on data gathering and diagnosis prior to action planning and implementation, as well as careful evaluation of results after action is taken. Thus action research is aimed both at helping specific organisations to implement planned change and at developing more general knowledge that can be applied in other settings (Cummings and Huse, 1989).

Two action research models presented by French and Bell (1995, p.139-140) have been combined and illustrated in one comprehensive model, as shown in figure 2. The wheel illustrates the work for planned change as a continuous process. The model also illustrates the collaboration between organisational members and researchers.

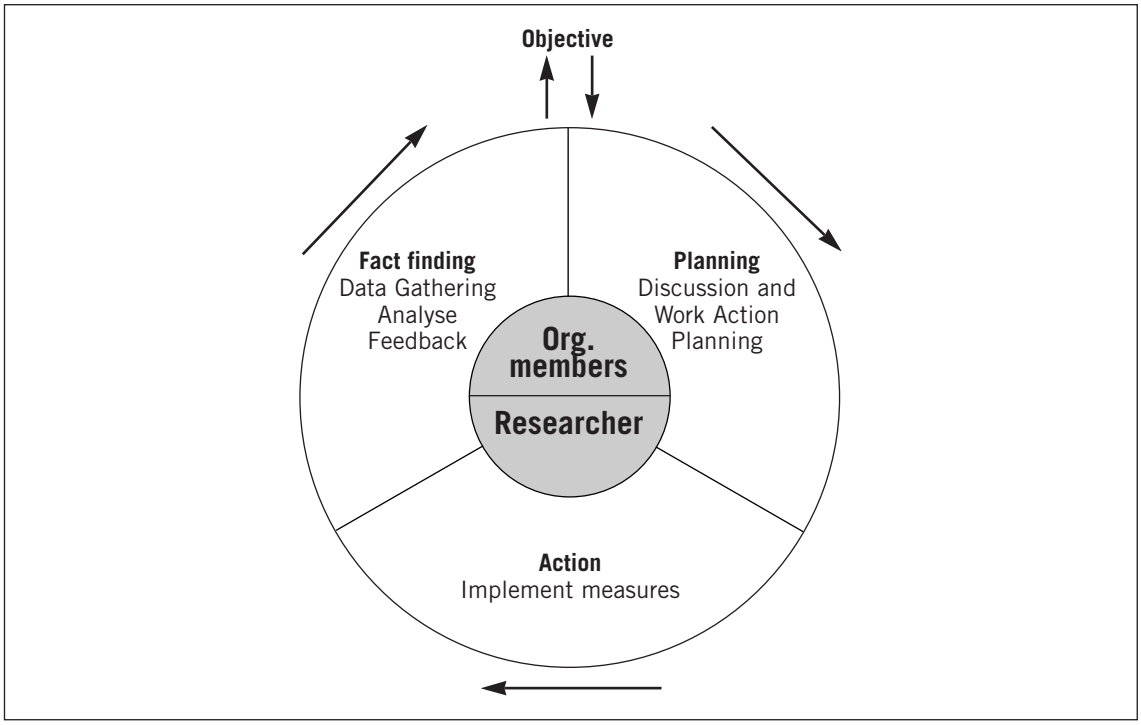


**Figure 2** The action research model is made to look like a wheel to enchace the impression of the planned change as a continuous process.

The action research wheel presents the whole process of the planned organisational improvement project of the Norwegian mining enterprises. The first «Fact finding» part, covering data collection, analysing data and giving feedback to the mining industry, was carried out in a study made by Alteren (1995a, 1995b). It was this study that revealed the unsatisfactory safety results. Through this the «Objective», to obtain better safety results through improved SHE management at the mining sites, was decided.

In this article the «Planning» stage of the total project is presented. It describes the development of the assessment and improvement tool.

The results from the next steps of the project, «Action», which is the implementation of the tool at the enterprises, and «Fact finding», that is the evaluation of the tool and the results of it, will be presented in separate articles.

The action research model in figure 2 can be compared to the Deming cycle used by quality management professionals. The Deming cycle is also known as the PDSA cycle, which refers to the initial letters Plan - Do - Study - Act (Dean and Evans, 1994). The first three components of the Deming cycle, Plan - Do - Study, corresponds to the three sectors of the action research wheel. The fourth component, Act, is designed to ensure that the improvements will be standardised and practised continuously. Standardising and follow-up of the improvements of the production process is essential. That is however regarded as the responsibility of the enterprises, and will not be a part of this research project. It is not a part of the action research model either.

## 2.2 Organisational Development

A simple, but illustrating, model presented by French, Bell and Zawacki (1989) demonstrates organisational development and change, see figure 3. They emphasise the need to assess the current state (A) and to design the future state (B), a model that corresponds entirely to the general model of the Safety Element Method. The period between A and B can be thought of as the transition state (C), where changes are implemented.

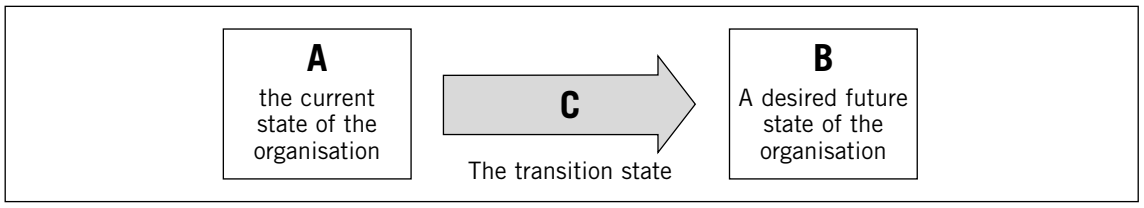


**Figure 3** Organisational change (adapted from French, Bell and Zawacki, 1989).

French and Bell (1995) express organisational development as a never-ending journey of continuous change, where an initiative moves the organisation to a higher plateau, and another initiative or program moves it to a yet higher stage — a metaphor evident in the general model of SEM.

## 2.3 Organisational Perspectives

Organisations can be viewed as open systems and analysed using systems theory (Narayanan and Nath, 1993; Hale et. al., 1994). Viewing organisations from multi-perspectives is used by authors like Morgan, in his images of organisations (1986) and Bolman and Deal (1984) who introduced four organisational frames. Cummings and Huse (1989, p. 69) combine these two approaches in their model for diagnosing organisations by integrating the different dimensions and components in the systems model. The organisational perspective in figure 4, showing how design components form the total picture of an organisation, is based on these authors.

Aims for the tool are to co-ordinate the efforts from different parts of the company and to integrate safety management into the management performance of other areas. To achieve this the tool must cover the richness of perspectives and aspects provided by Bolman and Deal (1984) and Cummings and Huse (1989), as shown in figure 4.

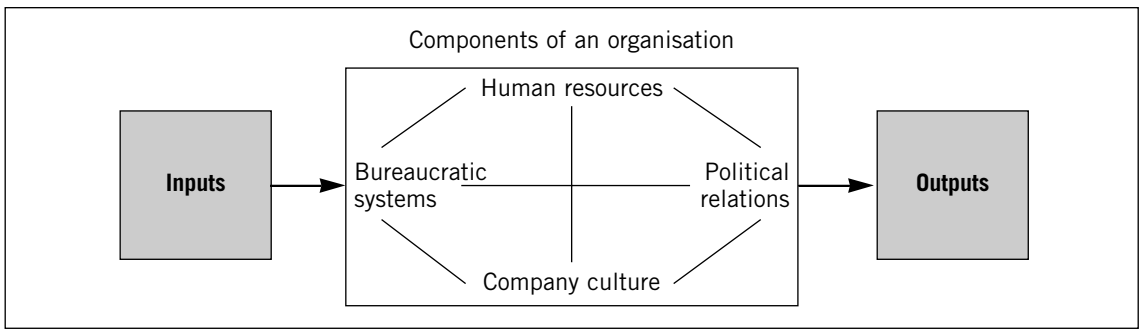


**Figure 4** Model for diagnosing organisations (adapted from Cummings and Huse, 1989).

The four perspectives in figure 4, bureaucratic systems, human resources, political relations and company culture, correspond to the structural, human resources, political and symbolic frames of Bolman and Deal.

### 2.4 Local Reality

Organisations consist of individuals and groups, and their realities are socially constructed through the joint actions of all the organisational actors. Every organisational member has a local way of making sense out of actions and events (Gjersvik, 1993). Every member also has different experiences and relationships at work, in their departments, with their fellow workers, customers, machines, routines and jobs. They are enacting a local everyday reality. At the same time, the actors in the organisation are products of the organisation. Through actions the organisational institutions, objects and language are created. This is the organisational reality. The words «local» reality and «organisational» reality can be replaced by the words «subjective» and «objective» reality, which are used by Berger and Luckmann (1966).

Not all groups of actors have the same power to influence the processes of reality construction, and the management way of thinking may easily become dominant in the organisation. The result is that the management's way of viewing the organisation is perceived as the organisational reality, favouring actions and objectives in accordance with this reality (Gjersvik, 1993).

A tool for organisational improvement should be developed with respect to the local knowledge of the users. Also the tool developed should enable actors of organisational assessment to express their local reality.

## 3 THE DEVELOPMENT PROCESS

An important aim has been how to develop a tool that satisfies the needs defined by the users. It is essential to make a tool that corresponds to the local reality of the mining enterprises. Based on the assumption that the most useful and best adaptable tool for the mining industry can only be developed in co-operation with the industry itself, representatives from the industry have been involved in the development work. Collaboration is also a foundation of the action research model.

Alternative ways of carrying through the development work were considered;

1) Development of a tool derived from theoretical considerations, with a network of resource persons to present their opinions about the work and reply to questions and inquiries.

2) Establishment of groups of employees at several mining sites to develop a tool based on suggestions and ideas from these groups. The groups would consist of employees from different levels of the organisations.

3) Establishment of one common mining group consisting of members from different mining enterprises. The members would represent different levels of the organisations. The tool would be developed according to decisions made by this group.

The third alternative was preferred by the researchers based on the comparison of advantages and disadvantages enlightened in table 1.

**Table 1** *Advantages and disadvantages of three alternative ways of the development process.*

| Alternatives | Advantages | Disadvantages |
|---|---|---|
| Theoretical considerations | - Scientific and empirical results should determine the tool. This basis promises a high validity and reliability. | - The users would be given a passive role. The result could be an office product with few impulses from the working reality. |
| Separate working groups at each enterprise | - More people from each enterprise would be involved at the first stage of the process. This might give a better feeling of ownership of the tool.<br>- The participants would be on their home ground. They may more easily focus on their own interests and express their own everyday reality. | - There is a risk of ending up with completely different directions. Wishes, ideas and suggestions would have to be followed up, otherwise the meetings would be meaningless and destructive.<br>- There is a risk that specific interests like dust, ventilation, cleaning of hanging wall (checking for loose stone blocks in roof) etc. will dominate, so that a more general tool may be difficult to reach. |
| One common working group | - The resource persons are actively involved.<br>- The participants would give and receive impulses from other enterprises and other organisational cultures. This may lead to a wider range of ideas and more open thoughts.<br>- A common tool for the mining industry would be more easily agreed upon if the participants were involved in the process through common meetings. | - The tool would not be introduced to the employees of the companies at such an early stage. This can be expected to give a poorer commitment to the tool.<br>- The tool would be less specially adapted and tailored to each enterprise, since the aim would be to find a tool that can satisfy more users. |

### 3.1 Problem Solving by Groups

Development of the improvement tool was carried out as a planned and conscious search process through a prepared series of seminars. The technique has frequently been used for problem solving purposes, e.g. on technical and ergonomic issues (Andersson, 1990). The seminar series, composed of four seminars, is described in figure 5 (adapted from Andersson and Rollenhagen, 1993). The approach is similar to the traditional method for "search conferences" in the organisational development literature (see e.g. Weisbord, 1993). The method also corresponds to the principles of development work expressed by Hale by his problem solving cycle (1992). The first three seminars were arranged over two days, the fourth seminar was carried out six weeks later and lasted for one day. One of the researchers functioned as the change agent, in terms of the literature. Large flip-charts were used for the registration and discussion of ideas and suggestions.

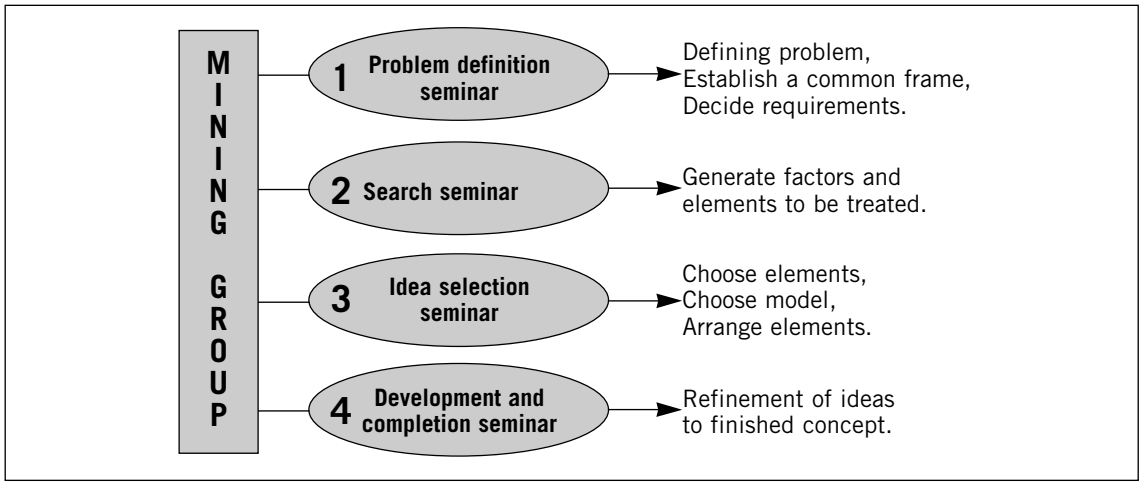


**Figure 5** The seminar series

The background and aims of the development process were defined at a problem definition seminar. What requirements the assessment tool should meet were also agreed upon. The proposition to model was also presented by the researchers.

At the search seminar, themes, elements and factors that could be included in the tool were generated. All proposals were listed without criticism.

At the idea selection seminar the group decided which of the ideas from the search seminar that should be further developed. The model that would be the basis of the tool (figure 1) was also chosen at the idea selection seminar. The preferred elements were arranged and defined according to the model.

The results from the idea selection seminar were processed by the change agent and submitted to academic resource persons. Comments about the content were received and taken into account. Then the sketch of the tool was distributed to the group members in advance of the development and completion seminar. At the fourth seminar the sketch was criticised, formulations were discussed and suggestions of improvements were proposed. How to use the tool was also discussed.

### 3.2 The Participants in the Process, Establishing a Common Frame

The participants in the seminars were seven experienced persons representing the Norwegian mines, plus one academic resource person and the researchers. The group represented different interests; employees, staff safety personnel and line management, each of them holding pieces of the complex puzzle of the entire system. The researchers made the preparations for the seminars, as well as documenting the work after each seminar. The academic resource person took part in the seminars as observer and back up throughout the process.

The selected mining group represented a wide range of practical and theoretical knowledge within mining and SHE challenges of mining. Getting a balanced composition of the group with respect to positions in organisation was a principle followed. There were two main personnel safety representatives, one safety manager, one safety- and quality manager, one middle manager from production, one managing director (earlier quality manager and process engineer) and one mining engineer, working on a doctoral thesis about quality improvements in mining (earlier production manager and quality manager). The two last-mentioned were the only ones that had taken part in processes using similar methods earlier.

The group members were invited because of their personal ability and experiences. Some of the members knew each other in advance, but mainly they were introduced to each other at the first seminar. Their theoretical knowledge within safety differed, and to establish a common base an introductory guidance was initially presented to the group. They were given a short review of main approaches to SHE management and organisational development, and also introduced to the principles of quality assurance. Theoretical studies that were presented to the work group were based on several authors (among others Rosness, 1992; Hovden, 1991; Reason, 1991; Bolman and Deal, 1984; Tinmannsvik, 1991; Bird and Germain, 1990; Heinrich, 1936 and Likert, 1975). At the beginning of the fourth seminar some SHE management principles were repeated.

The participants were motivated for the development process. All invited group members accepted the invitation, and together they formed a committed group. Concluding the development process the members of the group stated that the participation had been valuable for them, which also was «proven» through the long travels they had to make (and their own company had to pay) to take part in the development process. They received no personal compensation for participating.

### 3.3 Pre-test of the Safety Element Method

Subsequent to the seminars the developed tool, the Safety Element Method (SEM), was submitted to professors at the Norwegian University of Science and Technology and to researchers at SINTEF Safety and Reliability, for comments and proposals. No fundamental changes were found necessary, though the comments did result in addition of two factors to the method (presented in part 4.2) and in some minor modifications.

The last step in the development process was pre-testing SEM at the Norwegian Public Road Administration, at the local county road office. Pre-testing at the road office was considered realistic, since their activities and their SHE management challenges are similar to the mining industry. The pre-test was carried out as a real internal review using SEM. The method was afterwards discussed in order to identify weaknesses or important elements that were missing in the tool. The tool received a positive response at the road office, and only small modifications were made afterwards.

## 4 DECISIONS AND RESULTS FROM THE SEMINARS

### 4.1 Requirements to the Tool

Quality criteria of the tool need to be chosen according to the purpose of a tool, and at the first seminar, i.e. the problem definition seminar, the requirements for SEM were discussed. Proposals for criteria were in advance prepared by the researchers, on the basis of theoretical studies in earlier research (Kjellén and Menckel, 1986; Tarrants 1980; Slote, 1987; Yin, 1994; Sanders and McCormick, 1992; Meister, 1985; Tinmannsvik, 1991; Nytrø et. al., 1994; French and Bell, 1995; Cummings and Worley, 1993; Cummings and Huse, 1989), but they were not shown to the group. The requirements decided by the group corresponded well with the «concealed» criteria defined by the researchers. The criteria preferred by the mining group are presented in criteria 1-5 below. However, as a part of an action research program the researchers also have included the scientific requirement validity, which is presented in criteria 6.

The fulfilment of the six criteria will be tested through the use of the tool at mining enterprises, but the evaluation will not be reported in this article. The selected criteria are presented here to show what the group decided to emphasise during development of SEM.

1 ***Understandable and acceptable:*** The tool must be simple to use, understandable and acceptable. This includes being efficient, which means that costs of using the tool must be consistent with the benefits to be gained.

2 ***Trustworthiness:*** or credibility, focuses on correspondence between the constructed realities of the organisational members and how the tool presents these realities. The results must give recognition for the users and cover the factors people consider as important (= face validity).

3 ***Motivate for development and change:*** The tool shall point out improvement potential and visualise development perspectives. It must give aid to decide the current situation, to establish goals and create dialogue.

4 ***Generate action/activities:*** The information obtained from using the tool must be relevant as a basis for working out measures.

5 ***Produce change:*** The intention of internal assessment is improvement and better SHE results.

6 ***Validity:*** The measurements must be valid and correspond to the real safety performance of the organisation.

### 4.2 Choosing Model and Defining Stages

Previous to the seminars, examples from use of the general model (Alteren, 1995a; Jersin and Sten, 1996) had been distributed to the members of the group, to introduce them to the suggested general model. These examples were also presented during the problem definition seminar. Still the decision to use them as a basis for the tool was not made before the second day of the search conference.

The examples submitted to the participants in advance, were deviating from the general model in figure 1 (part 1.2) by having different number of stages and containing other elements. It was underlined that this was only a proposition to a model. It was also stated that if this kind of model was to be used, the tool would still have to be built up from scratch by them, i.e. they would have to make the decisions about

what factors to treat, how to divide in stages and to decide the specific content of the boxes in the matrix.

The proposed model in figure 1 was chosen. The members of the mining group confirmed that it made intuitive sense and they believed that it would make a good structure for the assessment and development tool. The group decided to define five stages of management performance. According to figure 1 the main focus of management changes as a company moves up the stages, and the focus within each stage was described by the mining group.

At the ***first stage*** companies' management are mostly unilaterally concentrating on production, with little commitment to safety work and documentation. At the ***second stage*** the company is rule oriented, ambitions are mainly to meet the minimum requirements of the authorities. Management is mostly reactive, in the sense of reacting when they have to, often following authorities' demands. At the ***third stage*** company ambitions are above the authorities' minimum requirements. More extensive plans and safety activities are main issues at this stage. Companies at this stage will often pay attention to quality assurance according to a suitable ISO-standard and view quality assurance and safety management within a common framework. At the ***fourth stage*** the management wants safety to become a competitive advantage, and safety management is equal to the best companies. Emphasis is on continuous improvement of processes, and on co-ordination of processes and management systems to attain advantageous synergy effects. At the ***fifth stage*** large resources are made use of for safety purposes. The company perceives itself as the leading company within safety. As a consequence of this position, the company participates in committees that work to improve authority regulations. A company at this stage will usually apply a Total Quality Management model as a basis for its development, e.g. the European Foundation for Quality Management (EFQM) or the USA's Malcolm Baldrige National Quality Award.

### 4.3 Elements to be Treated by the Tool

A specially tailored development tool should place emphasis on the factors that is appraised important by the users. The mining group agreed in an early phase that the tool had to be relevant to all risk exposed parts of the enterprises, not only the mining operations. At the search seminar proposals for elements to be included in the tool were generated through brainstorming. The researchers had in advance prepared a list of elements based on the content of the ISRS (Bird and Germain, 1990), SMORT (Kjellén et. al, 1987) and ISOBAR (Tinmannsvik and Mostue, 1993) to compare with, to find whether the mining group left out factors that were considered essential in these auditing tools. This list was unknown to the participants. The elements proposed by the resource persons, derived from their experience and knowledge, corresponded entirely to the content of the pre-established list, which implies that the suggestions to the content of the tool can be reckoned as comprehensive.

Developing further all the factors generated would make the tool more extensive than was the intention of the group. The proposed factors were grouped into eleven main groups and prioritised. The meaning of each element was discussed parallel to the grouping of the factors, at the end of the search seminar. The prioritising of the groups of safety elements was accomplished the next day, at the idea selection seminar. Six main groups of safety elements were chosen to be treated through the assessment and development tool, see table 2. The members retained the parts they found most crucial for the safety performance, based on their own experience. Element groups that were eliminated at this stage were planning, resources / maintenance, incentives, emergency plans and local opinion about the enterprise.

However, comments from safety experts made the researchers decide to work out emergency preparedness and resources as a part of the tool, for discussion at the development and completion seminar. At that seminar these elements were included subordinate to the main elements documentation and management, as presented in table 2. Some of the other omitted factors, for instance maintenance and planning, were also included by the mining group at this seminar, but as minor items mentioned as a part of subordinated elements.

**Table 2** *Main and subordinate elements to be considered by the diagnosis and development tool.*

| Main elements | Subordinate elements |
|---|---|
| 1. Goals / ambitions | 1.a) The process of working out internal goals<br>1.b) Conflicts between goals of SHE and profitability |
| 2. Management | 2.a) Resources |
| 3. Feed back systems / learning | 3.a) Use of methods for learning<br>3.b) More methods (continuation)<br>3.c) Training |
| 4. Safety culture | 4.a) How is it, being the workers safety representative<br>4.b) General communication |
| 5. Documentation | 5.a) Relations to suppliers and contractors<br>5.b) Emergency preparedness |
| 6. Result indicators | 6.a) Result indicators in use<br>6.b) Number of recorded near accidents versus number of accidents |

### 4.4 The Development Result - the Safety Element Method

The main safety elements and subordinated elements were arranged and specified according to the five defined stages. Table 3 shows the matrix that is containing the main elements, called the main matrix. Each of the six safety elements of the main matrix has a sub matrix connected, containing the subordinated elements. The main matrix is summarising general and superior considerations, while the sub matrices are covering more details and proposing concrete measures. The intention of the structure is that the main matrix may be used separately or as a broad filtering to identify problem areas for deeper study, while the sub matrices are optional complementary assessments. The sub matrices may also be used separately, if subjects there is found to be of special current interest. By focusing only the main matrix or by choosing between separate elements SEM can be adapted to the purpose of the assessment and the present challenges of each organisation. The reason for the structure is thus to increase efficiency of the assessment and make the tool dynamic and flexible. This final architecture of the method was decided by the mining group at the development and completion seminar. The main matrix is presented in table 3. The sub matrices are presented in appendix 1.

The content and formulations of each element are mainly a result of direct proposals and decisions made by the mining group, but they are also strongly influenced by the literature that was presented to the group initially. Example of the latter is the subordinate element 1a) (appendix 1), which is similar to Likert's four systems approach about goals (Likert, 1975). The sub element 5b) (appendix 1) is worked out merely based on literature (Dynes, 1989; Kjellén et. al., 1987; Tinmannsvik and Mostue, 1993). Some formulations were basically copied from the methods of Alteren (1995a) and Jersin and Sten (1996), for instance the formulations that form sub matrix 1b) (appendix 1).

The stage of development in an enterprise will usually vary within the different safety elements of the model. The development to higher stages is a step by step process, and commitment at one stage presupposes that systems and activities at lower stages are already established and functioning. What will be the optimal stage for a company shall be defined by the internal group that conducts the SEM assessment. The method is not similar to ISRS (Bird and Germain, 1990) and must not be confused with the five star rating of that method. It is no matter of course that all companies ought to be best served by reaching the fifth stage for the safety elements. For instance, within safety element 1 (see table 3) being on stage 2 may be the right ambition for many small and medium sized companies.

**Table 3** *Internal analysis by the Safety Element Method, main matrix. Current status should be marked by ✗ and the desired situation by ✓ in the windows (❑). For every stage, fulfilment of the previous stages is presumed. Sub matrices connected to each element are presented in appendix 1.*

| | STAGE 1 | STAGE 2 | STAGE 3 | STAGE 4 | STAGE 5 |
|---|---|---|---|---|---|
| **1. Goals / ambitions** | ❑ Goals are missing. | ❑ Ambitions are to satisfy regulations. | ❑ Goals and ambitions go beyond regulations. | ❑ Goals beyond regulations. Company matches the best. | ❑ Working to influence and improve regulations. |
| **2. Management** | ❑ Modest obligations to safety work from manage-ment. | ❑ Follow-up of accidents.<br>❑ Weak SHE management gives small consequences for line managers.<br>❑ Mainly local treatment of risks. | ❑ Management actively engaged in safety work.<br>❑ Breach of SHE instructions brings reactions for everyone.<br>❑ Systematic safety work.<br>❑ Focus on technical and human failures. | ❑ Safety is equally prioritised and followed-up as production and quality.<br>❑ Comprehensive views and systematic approaches characterise safety work.<br>❑ Strong focus on organisational and management factors. | ❑ Strong management commitment and obligations to improve safety culture. No self-satisfaction.<br>❑ Line management are good models. |
| **3. Feedback systems / learning** | ❑ Casual transfer of experience. | ❑ Simple statistics.<br>❑ Mainly short term corrective actions. | ❑ Thorough statistics.<br>❑ Deviation control.<br>❑ Action plans and measures are worked out.<br>❑ Time schedules are kept. | ❑ Proactive search for improvement, continuous preventive measures.<br>❑ Thorough process when working out action plans. | ❑ Extensive and systematic exchange of experience with other enterprises. |
| **4. Safety culture** | ❑ Mastering risky challenges is the ideal. | ❑ Little *extra* done to work safely. It is more essential to finish fast. | ❑ Mainly seeking safe behaviour, sometimes chances are taken. | ❑ Safe behaviour is a matter of course.<br>❑ The employees are actively seeking each other's experience. | ❑ Always safe working methods, never breach of routines.<br>❑ All employees work actively to obtain a working environment without losses. |
| **5. Documen-tation** | ❑ Small amount of formal routines. | ❑ Satisfies minimum requirements. | ❑ Comprehensive documentation.<br>❑ Improvements following revisions. | ❑ Plain and practical documentation.<br>❑ Procedures are accepted, and followed by most employees. | ❑ Documentation is well known, always up to date, and followed. |
| **6. Result indicators** | ❑ No result indicators (except economic ones). | ❑ Absenteeism and accident statistics are the only result indicators. | ❑ Extensive use of SHE-results as result indicators. | ❑ Co-ordinated and integrated goals. Relations between personnel damage and other losses are visualised through result indicators. | ❑ Has received international awards for the SHE and quality management. |

During the development of SEM the researchers accepted some inconsistent suggestions from the mining group about the content of the safety elements. As an example, within the sixth safety element the definition of stage five says «receiving international awards» (table 3). This statement may be viewed as a performance achievement instead of a result indicator. The mining group insisted though on seeing it as an indicator of success, and the formulation was kept due to the opinion of the group.

Safety experts have commented that the heading «safety culture» is somewhat misleading for safety element 4, since the content concentrates on describing safety behaviour of the members of an organisation. According to literature (Booth and Lee, 1995; ACSNI, 1993) this is thus not a wrong way of expressing the safety culture. They describe safety culture as "the way we do things round here", and emphasise that the patterns of behaviour are the visible expression of the culture.

### 4.5 How to Accomplish the Internal Assessment

The way of accomplishing the SEM assessment is regarded as an important part of the tool. The details about the practical use of SEM were decided at the development and completion seminar, and modified after the pre-test. A basic assumption of SEM is that a common realisation about the situation of today and about future goals are a necessary basis for organisational change. Thus the intention is to make knowledge and common sense from different organisational levels interact in creating the shared visions of the organisation (Weisbord, 1993).

The enterprises' internal improvement activity will be carried out in two parts, where the first part is the assessment of the current situation and the desired state (profile A and B in figure 1), and the second part is the compilation of measures. The tool has been constructed for promoting internal discussions, and both these parts will happen through group processes. The mutual definition of the states A and B ensure that the local experiences of the participants are brought forward. The members of the internal SEM group will have an equal chance to express their views. The group assessments will be introduced by an individual evaluation of the current and desired state of the organisation. The individual judgements, which are made to reduce the risk of dominant participants controlling the common assessment, form the basis for the group discussions.

Participants in the assessment should come from different places and levels of the organisation. Equal number of participants from the line management and from the employees is essential. The safety supervisor of the enterprise takes part as an independent representative. Recommended size of a working group is five to seven persons (Andersson and Rollenhagen, 1993), as to optimise efficiency and creativity. Composition of the group, depending on what part of the company are going to be represented, must be decided beforehand. The group may represent a single department, two (or more) tight coupled departments, or a whole enterprise.

The internal assessment will normally be initiated by the working environment committee of the enterprise, and the results of the assessment should be submitted the committee.

The next step of the internal improvement is to work out what improvement measures shall be implemented in the company. SEM also contains a check list of safety measures to help during this part (Mostue and Rosness, 1996; Alteren, 1996), as a supplement to the measures directly introduced through the sub matrices of SEM.

## 5 DISCUSSION

### 5.1 The Development Method Chosen

The resource persons from mining enterprises were given a strong position in the development of SEM. The approach is based on the action research model (part 2.1) and the theories of local reality (part 2.4). The development method is also rooted in the theory of Schön (1983), who expresses that competent practitioners hold and exhibit tacit knowledge without being consciously aware of and sharing it. The intention of the search conference was to reveal and share the mental models, experiences and dilemmas of the practitioners.

Introductory during the first seminar, a short review of SHE management, organisational development and quality management literature was presented by the researchers. The choice of literature that was presented probably had an influence on the result. This input may have influenced the attention of the participants and also it revealed the stand of the researchers. It may have distracted the participants from their local reality and tacit knowledge. On the other hand, in order to develop an effective health and safety management tool, the developers needed to have a clear idea of what constitutes an effective health and safety management system. Thus an initial review of literature was a necessary part of the seminars. Also the group members described this process as valuable, and the initial review did not disturb the common sense judgement of the participants.

Altogether, the choices made by the mining group seemed to be strongly influenced by the material distributed in advance, although the process was inviting critical comments and alternative ideas. The model that was used for development of the tool had also been presented to the group as a proposition in advance. The mining group found that the way of structuring the elements made sense, i.e. a validation of the model. The general model also functioned well as a basis for the development, otherwise the process would soon have stopped. The engagement of the group members confirmed that the concept was applicable. Anyway, the result shows that the group process was dependent of the starting point, a result that is known from the decision making literature. Tversky and Kahneman (1982, p.14) call this phenomenon anchoring.

When the users are invited to be as active participants as in this project, it follows that their wishes, ideas and suggestions have to be seriously considered and followed up. Otherwise the meetings may have a more destructive than constructive effect. Involving the users actively also means that the researchers may have to make a balance between what the practitioners insist on and what is theoretically correct. During the development of SEM the researchers chose to compromise, and accepted some suggestions about the content of the method, that were not quite consistent with respect to theoretical terms in safety literature (see part 4.4). These cases do however not represent any serious dissimilarities, and they are not expected to make any confusions or problems for the users. These minor irregularities seem to bother safety experts that have commented on the tool, but have not been noticed by practitioners. In any case, the content are open for individual interpretations.

Involving several persons in a development process may also lead to an extensive, huge tool. This may have made SEM more time consuming than was the initial intention, but probably also more appropriate and valuable for the mining enterprises, in its contents.

The positive response and the constructive participation of the mining group members are a token of support for the development method chosen and the process planned. If the process had not functioned well, the development work would have come to a stop. An advantage of the method is that it combines content and process in a constructive way by being structured and by emphasising the common goals of the group members. Potential conflicts between group members are deemphasised by focusing on the shared assumptions and appreciations. To use the words of Weisbord (1993, p.10): The method “combines content and process in a way that is more structural than interpersonal”. This helped the process getting off and continuing in a positive way.

### 5.2 Organisational View Reflected in the Method for Accomplishing a SEM Assessment

If organisations view local realities and interests as valid, they should stimulate and support the explication of the local perspectives (Gjersvik, 1993). One benefit of SEM is the way it stimulates the articulation of the local knowledge and the local reality of the organisation through the method for executing the assessment. This makes it possible to gain knowledge about what various resource allocations mean. Gjersvik points out that the differentiation in the organisation can be a space of possibility when there is an arena, a language and interpersonal relations where the opinions of the holders of local knowledge can be expressed. SEM introduces such an arena and a language. Awareness of the possible frames for roles and problems is necessary to be able to choose among them (Schön, 1983). SEM invites to take notes of the values and norms to which organisational members would give priority and of those they would regard less important.

By using SEM several groups of actors are invited to influence the construction of the reality, the planning of the future state and the decisions about improvement measures, which harmonises with the organisational development theory in part 2.2. Weisbord (1993) emphasises the importance of the common ground, of shifting the gaze from past problems to ideal futures, from differences to shared visions, in order to learn and act from a mutual base. The method of accomplishing a SEM assessment satisfies this by bringing together people who each have different pieces of a the puzzle, to find shared views. They shall define what is going well, what is not, and what to do about it.

SEM presupposes interpersonal relations at the enterprise that motivate constructive dialogues. In a working environment with many conflicts and labour disputes, the prime function of SEM might not be performed. Anyway, in a conflict environment SEM may fulfil another mission, that is to visualise the disagreements and the different opinions of the actors.

### 5.3 Organisational Perspectives and Factors Considered in SEM

The four theoretical frames, bureaucratic systems, human resources, political relations and company culture (part 2.3), which give different images of the enterprise and its organisation, are helpful in order to discuss the perspectives of SEM. The four frames do not subdivide the organisation into exclusive parts, but accentuate different aspects of an organisation.

*Bureaucratic systems* focus on goals, internal control, procedures, documentation, safety information systems and other rational techniques of co-ordinating efforts into common directions. Responsibility and structure are the main approaches. In the *human resource* frame a basic issue is to integrate individual and organisational needs. Leadership style, training, competence, communication, working conditions and preventive health services are central. *Political relations* in an organisation may be expressed by the key words industrial democracy, participation, negotiation and power. The political relations frame views organisations as coalitions between groups with different values and realities, where decisions are about allocating scarce resources, and goals are evolved from bargaining. The *company culture* approach implies the basic assumptions that are taken for granted, often unconsciously and without visible manifestations. They might be observable through the values and norms typical for the firm and for the behaviour of the employees. Symbols and artefacts may be visible manifestations of the culture (Schein, 1985).

The picture is four-dimensional, and SEM should preferably handle all the four accentuated perspectives. Table 4 shows the covering of the four perspectives in SEM.

As table 4 shows, SEM takes care of all four dimensions that ought to be considered. Apparently most emphasis has been put on the structural bureaucratic systems orientation, as in for instance the main element 3) Feed back systems / learning. The elements can, however, be interpreted through several frames. In fact, all elements may have a strain of all four perspectives. Though the structural approach is dominant for main element 3) Feed back systems / learning, the element may also be viewed in different ways through other frames. By introducing the human resource perspective, communication and competence may be highlighted. By introducing the political perspective to main element 3, the power of information may be treated. The culture approach to main element 3 may give a discussion about what kind of information systems that are acceptable or appropriate for the organisational members. Another example is sub element 6 b). The sub element is also primarily reckoned as a rational technique of bureaucratic systems, but it may still also be considered as a cultural artefact.

It also appears from table 4 that it is not only the direct descriptions of the safety performances that ought to be regarded. The vertical divided stages and the way of accomplishing the diagnosing activities are also important for the total performance of SEM. By viewing both the direct and the indirect aspects of SEM it can be asserted that the four approaches to organisations are given an appropriate consideration through the tool.

**Table 4** *Treatment of four organisational perspectives in SEM.*

| | Main element | Sub element | Also |
|---|---|---|---|
| **Bureaucratic systems** | **1, 3, 5, 6** | 3a, 3b, 5a, 5b, 6a, 6b | - SEM is constructed with different demands to structure in the different stages. Stage 1 represents no formalities, stage 2 is satisfying the minimum requirements of the authorities, and from stage 3 on the enterprise is reaching further than the legal demands. |
| **Human resource** | **2** | 3c, 4b | - Several elements can be viewed through different frames. Element 2a (discussing competence) and 3b (including working conditions) are examples of elements that are placed under another category, but that can be viewed also through the human resource frame.<br><br>- All organisational members are regarded as valuable resources with applicable knowledge. This is reflected in the way an assesment is accomplished. |
| **Political relations** | | 1a, 1b, 2a | - Strong indirect political commitment through the way of accomplishing the assessment.<br><br>- Special claims to participating processes are expressed vertically on stages 3 and 4, as in the elements 3, 3a and 3b. |
| **Company culture** | **4** | 4a | - High expectations to the safety culture of an organisation are defined vertically on stage 4 and specially on stage 5.<br><br>- Sub elements 6a and 6b might be interpreted as cultural artefacts. |

The possibility of understanding the elements of SEM in several ways, means that the results of the internal assessments may be marked by the local interpretation and current interests. The intention of this is to invite for dynamic and flexible assessments, where challenges present can and will be introduced and discussed.

## 6 EVALUATION OF SEM

The next steps of the process are to continue work as described through the action research wheel, that is the implementation and the fact finding part of the project. The tool will be implemented at four mining enterprises of different size and with different kind of production, and evaluated according to the requirements presented in part 4.1 in co-operation with these enterprises. «The proof of the pudding is in the eating», and further theorising about the method before testing makes little sense. Still, all participants from the development of SEM insisted on their companies being a part of the evaluation of the tool, which indicates that they believe in the method and consider it appropriate.

The next phases of the project will be presented in two separate scientific articles; 1) the immediate results and opinions at the implementation of SEM, i.e. testing requirements 1, 2 and 6 (from part 4.1), and 2) the follow-up when the process has progressed, to reveal whether the use of SEM has resulted in any actions and changes, that means testing requirements 3, 4 and 5.

## 7 CONCLUSION

A search process carried out as a series of seminars have been chosen as the strategy to develop an improvement tool for safety management in the mining industry. The project is based on an action research model, which implies that the results can not be regarded as universal proof. Still the project has resulted in some experiences of general relevance:

- It has shown that the approach for developing the tool functioned well and resulted in a meaningful process.

- The results show that the initial introduction to theory that the researchers presented to the mining group, made a foundation and a path that the group followed, in spite of a process inviting objections and alternative ideas.

When introducing the tool at mining enterprises, the development process is a strength. The active participation of resource persons contributes to confidence in the method. Thus SEM is regarded as a useful tool made by experienced persons. The development method also seems to have created a positive feeling of ownership of and belief in SEM. All the resource persons of the development process insisted on their company participating in the evaluation of the tool.

Some advantages of the Safety Element Method would be that:

- it offers a good general view regarding the potential for further development of the management of safety, through giving a clear framework for internal improvement achievements;

- it seems to be useful and adaptable to organisations with different kind of production and which are on different stages within safety;

- it facilitates communication and gives an arena for discussion;

- it visualises how management concepts and control systems applied within the organisation should take the knowledge of the different organisational levels into account.

The framework of the model is not restricted to managing health and safety, but can be applied to other areas which need to be managed, e.g. quality or production.

So far SEM has received positive response from the industry. The primary objective is to give a basis to make good choices, to initiate activities and to attain positive synergy effects between safety, quality and production. Applied studies at mining sites will be undertaken to evaluate the use of SEM.

## ACKNOWLEDGEMENTS

Besides the members of the mining group, special acknowledgements are given to professor Tom Myran at NTNU (the Norwegian University of Science and Technology) for initiating the project as a part of the NORMIN program, and to professor Urban Kjellén at NTNU and senior scientist Erik Jersin at SINTEF, for their contribution to the development of the general model of the Safety Element Method.

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**Appendix 1**

**SUB MATRIX 1; Goals / ambitions**

*Internal analysis by SEM, sub matrix 1. Current status should be marked by ✗ and the desired situation by ✓ in the windows (❑). Fulfilment of the previous stages is presumed.*

| | STAGE 1 | STAGE 2 | STAGE 3 | STAGE 4 | STAGE 5 |
|---|---|---|---|---|---|
| **1.a) Working out internal goals** | ❑ Goals are not worked out. | ❑ Concrete goals for the departments.<br><br>❑ Suggestions of goals and action plans mainly from the management.<br><br>❑ Goals are not well known through the organisation. | ❑ Concrete, long term goals.<br><br>❑ Goals and action plans are worked out through co-operation. Proposals from all levels.<br><br>❑ Goals are known and accepted. | ❑ Goals and action plans are worked out through group processes. | ❑ Everyone has the same goals, and works to reach them. |
| **1.b) Goal conflicts; SHE and profitability** | ❑ Conflicting goals are suppressed. | ❑ Conflicting goals are treated occasionally. | ❑ Procedures for managing conflicting goals are worked out and agreed upon. | ❑ Systematic prevention of goal conflicts. If occur, managed by procedures. | ❑ Goal conflicts hardly occur. |

**SUB MATRIX 2; Management**

*Internal analysis by SEM, sub matrix 2. Current status should be marked by ✗ and the desired situation by ✗ in the windows (❑). Fulfilment of the previous stages is presumed.*

| | STAGE 1 | STAGE 2 | STAGE 3 | STAGE 4 | STAGE 5 |
|---|---|---|---|---|---|
| **2.a) Resources (time, personnel, competence, material)** | ❑ Small efforts are made to evaluate the needs of resources. | ❑ Resource matters are occasionally discussed.<br><br>❑ Resources are not well proportioned to tasks. | ❑ Systematic planning of exploitation of resources according to tasks. | ❑ Use of resources a frequent subject at the works councils, which result in improvements.<br><br>❑ Time, personnel, competence and material are well adjusted to the needs of the organisation. | ❑ As previous stage. |

**SUB MATRIX 3; Feedback systems / learning**

*Internal analysis by SEM, sub matrix 3. Current status should be marked by ✗ and the desired situation by ✓ in the windows (❑). Fulfilment of the previous stages is presumed.*

| | STAGE 1 | STAGE 2 | STAGE 3 | STAGE 4 | STAGE 5 |
|---|---|---|---|---|---|
| **3.a) Methods used for learning** | ❑ Accidents are reported to the social security office. | ❑ Accidents and serious near accidents are reported.<br>❑ Investigations of serious incidents.<br>❑ Safety inspections. | ❑ Systematic treatment of incidents, the safety system is functioning well.<br>❑ Safety inspections are well prepared and followed up.<br>❑ Measures are executed as scheduled.<br>❑ Analysing safety inspection records.<br>❑ Handling of deviations. | ❑ Thorough investigation and follow-up of incidents and deviations.<br>❑ Long term measures.<br>❑ Creative measures.<br>❑ Use of loss costs. | ❑ Accomplished and planned measures show inventiveness and ingenuity. |
| **3.b) More methods** | | | ❑ Have revisions of internal control.<br>❑ The revisions lead to improvements of the internal control system.<br>❑ Safety programs in projects.<br>❑ Risk analysis for the most essential processes.<br>❑ Incidents and deviations of mechanical equipment are investigated and followed-up.<br>❑ Have maintenance programs.<br>❑ Frequent assessment of maintenance systems, by mechanical and process personnel together.<br>❑ Appraisal interviews.<br>❑ Functioning system for rehabilitation and reintegrating of employees. | ❑ Benchmarking tests.<br>❑ Job safety analysis.<br>❑ Thorough risk analysis for all parts of enterprise.<br>❑ Reliability of equipment is maximised through systematising programs.<br>❑ Follow-up of former employees to find any long term health effects. | ❑ The enterprise shows how to obtain the very good safety results, and shares the experiences with others. |
| **3.c) Training** | ❑ Informal training, mainly occasionally. | ❑ Training as a routine for new and transferred personnel. Safety included.<br>❑ Line managers and some employees have training with focus on SHE. | ❑ Enterprise has training programs for most tasks.<br>❑ All employees have special training for their job, responsibility of SHE included.<br>❑ Employees from all levels participate in working out the training programs. | ❑ Training programs include follow up, repetition, and updating<br>❑ Plans for competence building for all employees.<br>❑ Joint revisions of standard of training. | ❑ Everyone has thorough training and performs their job correct.<br>❑ Everyone works actively to improve training. |

**SUB MATRIX 4; Safety culture**

*Internal analysis by SEM, sub matrix 4. Current status should be marked by ✗ and the desired situation by ✓ in the windows (❑). Fulfilment of the previous stages is presumed.*

| | STAGE 1 | STAGE 2 | STAGE 3 | STAGE 4 | STAGE 5 |
|---|---|---|---|---|---|
| **4.a) How is it, being the workers' safety representative (SR)** | ❑ Safety representative (SR) has no special function. | ❑ SR has an ungrateful job, and is often "between two chairs". | ❑ Being the SR gives no problems in relation to fellow workers and supervisors / managers. | ❑ It is positive and attractive being the SR. | ❑ The work of the SR is appreciated by all parties. |
| **4.b) General communication** | ❑ Internal communication is mainly unstructured. | ❑ Unsatisfying communication sometimes causes mistakes. | ❑ Internal communication usually functions well, but in certain areas it ought to be improved. | ❑ Internal communication is very good. It rarely leads to misunder-standings. | ❑ Internal communication never causes mistakes. |

**SUB MATRIX 5; Documentation**

*Internal analysis by SEM, sub matrix 5. Current status should be marked by ✗ and the desired situation by ✓ in the windows (❑). Fulfilment of the previous stages is presumed.*

| | STAGE 1 | STAGE 2 | STAGE 3 | STAGE 4 | STAGE 5 |
|---|---|---|---|---|---|
| **5.a) Relations to suppliers and contractors** | ❑ Co-operation agreements are mainly unformalised . | ❑ Have formal contracts, SHE demands are of subordinated importance. | ❑ Routines and procedures include SHE requirements to second part:<br>❑ Affect choice of partners.<br>❑ Enviro nmental considerations are counting in purchasing. | ❑ External parties are integrated in SHE work:<br>❑ Common activities and common improvement goals.<br>❑ Common incident investigations, common safety meetings. | ❑ Suppliers and contractors bring in improvements to SHE work. |
| **5.b) Emergency preparedness** | ❑ There are no formalised emergency plans. | ❑ Formal emergency plans.<br><br>❑ Training pre-scribed by law are carried through.<br><br>❑ Emergency plans and use of damage reducing equipment are well worked in.<br><br>❑ Loss limiting equipment (incl. first aid) are easily available. | ❑ Emergency plans and training are comprehensive for all actual incidents.<br><br>❑ Emergency plans are up to date, incl. maps, escape routes, responsibility etc..<br><br>❑ Personnel with emergency training are always available.<br><br>❑ Connections to mass media are well prepared. | ❑ No extraordinary crisis organisation. Ordinary alert routines and organising are continued through crises.<br><br>❑ Training and exercising till overtraining. Loss limiting activities can be carried through blindly. | ❑ As previous stage. |

**SUB MATRIX 6; Result indicators**

*Internal analysis by SEM, sub matrix 6. Current status should be marked by ✗ and the desired situation by ✓ in the windows (❑). Fulfilment of the previous stages is presumed.*

| | STAGE 1 | STAGE 2 | STAGE 3 | STAGE 4 | STAGE 5 |
|---|---|---|---|---|---|
| **6.a) Result indicators in use** | ❑ Conditions are not measured by result indicators. | ❑ Simple accident statistics are used as result indicators. | ❑ Extensive use of SHE-results as indicators.<br>❑ Work to reach expected number of near accidents.<br>❑ Measure psycho - social working environment.<br>❑ Recording internal and external complaints.<br><br>❑ Work to reduce environmental damages. Keep simple external environmental accounts for control and improvements. | ❑ Deviation costs are used as indicators (e.g. costs for repairs, deviations / delay of production, complaints, absence.)<br><br>❑ Committed to the European environmental control and revision system EMAS* or ISO 14000. | ❑ High motivations of the employees are proven through measures.<br>❑ Work to be of use to society, and measure it.<br>❑ Have gained international acknowledgement for the management of safety and quality.<br>❑ Have received international awards.<br>❑ Have benchmarking visitors.<br>❑ Accident statistics are only secondary indicators. |
| **6.b) Number of recorded near accidents versus accidents** | ❑ Near accidents are not recorded. | ❑ Recorded fewer near accidents than accidents. | ❑ The number of recorded near accidents are at least the same as number of accidents. | ❑ Recorded near accidents are five times higher than the number of accidents. | ❑ At least 30 times more near accidents than accidents are recorded. |

*Eco-Management and Audit Scheme