A risk management framework designed for Trelleborg AB

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Abstract
The aim of the thesis is to present a framework for risk management at Trelleborg AB. In doing that a literature study concerning what constitutes good risk management has been performed. Several useful guidelines for how good risk management should be conducted were identified. Risk management documents at Trelleborg were evaluated using these guidelines. Furthermore, complementary interviews with employees were also conducted. It was concluded that Trelleborg AB has a well communicated policy regarding risk management, but lacks routines for many of the risk management activities. Considering these deficiencies a framework for risk management was suggested and implemented in a computer program at Trelleborg AB.

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Foreword

There are several people that have contributed to this thesis. I would like to thank these people for all the support.

I want to thank the personnel at Trelleborg AB for the opportunity and for answering the question that was asked during interviews. I would especially want to thank Bertil Nilsson for all his support.

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Summary

Corporations are faced with a variety of regulations and standards that they have to follow. An important part of the regulations concerns the management of risk, which is something that the authorities demand that companies actively do. Furthermore, other companies with which a corporation collaborates might also demand that risks are managed in an appropriate manner.

The focus of the thesis is to determine how a large company can handle its risks in practice. Trelleborg AB has been used as an example to illustrate the difficulties that can be encountered concerning risk management in a large company. Studies have been made to determine if there are needs for improvements of risk management activities at Trelleborg and suggestions of improvements have been presented. A framework which contains features that can facilitate risk management activities at Trelleborg has also been presented in the thesis. The framework contains a computer based method for risk analysis that can generate basic data for decision-making. It has also been determined which risk analysis methods that are most appropriate to use to generate basic data for decision-making in the present context.

To be able to design the framework the thesis sheds light on several questions. The first question is: What is good risk management and how can the quality of risk management be determined in a company? The First question was answered by literature studies. Several suitable guidelines for what good risk management is, such as the International Electro technical Commissions (IEC) guidelines and the International Nuclear Safety Advisory Group's guidelines, were identified. Some very important issues that were found in the literature were the positive aspects of having a well developed safety culture and a commitment to continuously improve safety.

The answer to the first question was then used to provide a point of departure for answering the second question of the thesis: In what areas within risk management does Trelleborg need improvements? To answer this question information about the risk management organisation at Trelleborg was gathered. This information was analysed using the results from the first literature study and the analysis that was mentioned above. During the analyses, areas within risk management that didn't seem to have sufficient routines were identified. These areas were analysed more thoroughly by interviewing employees. One important question that could not be answered by analysing documents was whether Trelleborg's risk management policy, and routines for risk management, were known and practiced by the employees. Therefore, interviews were performed with key personnel within the organisation. The conclusions from the interviews were that the policy is well communicated within the company, and the personnel are well aware of the purpose of risk management at Trelleborg. This is shown by the employees' commitment to the policy and that they know that risk management is important for the company. However, during the interviews it was discovered that there are no established routines for analysis, feedback and follow ups within the company. This is shown by the employees knowing that they should analyse the risks that they are in charge of, but they lack directions and have different ways to analyse risks in different parts of the company. Trelleborg AB´s weakness lies in that there isn't any system for controlling and following up on the analysis that has been done and there isn't any global system for incident reporting. It is crucial for the top management in a large organisation to have insight of risk management on a local level.

Another issue that was discovered during the interviews was that some of the key risk management activities within the company are dependent on the engagement of a small group of employees. This makes Trelleborg vulnerable to loosing competent risk management personnel.

The features in the framework for risk management, which is the focus in the thesis, will help Trelleborg AB to facilitate the changes that are recommended in this thesis. The recommendations are:

- Create more defined routines for risk management.
- Use a management system to make risk management more effective.
- Simplify the process of incidents reporting.
- Give employees feedback regarding risk analysis.

These recommendations were then used as a point of departure when creating the framework for risk management which is suggested in the thesis. The framework should include suggestions of which methods for risk analysis that should be used. Therefore, the following set of questions has been answered: Which criteria should the risk analysis methods that are included in the framework comply with? Which information is needed to establish the criteria? Which risk analysis methods comply with the criteria in the best manner? To answer the questions a thorough literature study was made. The literature study resulted in a set of criteria by which different risk analysis methods could be evaluated. The criteria were then ranked according to their importance by the personnel at Trelleborg. The top 5 criteria were: overview analysis, possible to rank the risks, thorough analysis, possible to analyse course of events and simplicity to generate statistics. This shows that the model had to consist of more than one analysis method since the employees found it important to have the possibility to both have a thorough analysis and an overview analysis. The employees also thought that it should be simple to generate statistics from the analysis. The analysis methods that were chosen to be included in the framework were checklists, preliminary risk analysis and Quantitative Risk Analysis (QRA) which will constitute a good mix of risk analysis methods that fill different needs. Checklists will make it possible to do non time consuming analysis and control of predefined risks. Preliminary risk analysis will make it possible to do overview risk analysis that could be used to identify areas that need more thorough analysis. QRA will make it possible to quantify the size on specific risks. Finally, the risk management framework, including the risk analysis methods, was implemented in a computer program. With the help of this thesis and the computer program there are opportunities for improvement of the risk management activities with Trelleborg AB even with small means.

Sammanfattning

Dagens företag möts av en mängd olika standader och regler som de måste följa. Antingen är det myndigheter eller företag de sammarbetar med som kräver att de följer vissa rutiner. I de flesta fall innebär både standaderna och reglerna att företagen måste analysera och hantera sina risker.

I detta examensarbete presenteras förslag på hur ett stort företag kan hantera sina risker i praktiken. Trelleborg AB har använts som ett exempel på de svårigheter med riskhantering som kan påträffas i ett stort företag. Det har identifierats ett behov av förbättringar rörande riskhantering inom Trelleborg. Det har även identifierats hur ett ramverk som innefattar detta kan möjliggöra och förbättra riskhanteringen inom Trelleborg. Ramverket innefattar en datorbaserad metod för riskanalys som är avsedd att kunna användas för att generera beslutsunderlag. Det har också fastställts vilka riskanalysmetoder som är mest lämpade för att skapa beslutsunderlaget.

För att kunna designa ramverket belyser detta examensarbete ett antal mer specifika frågor. Den första frågan är: Vad innefattar bra riskhantering och hur kan kvaliteten på riskhantering mätas? Denna fråga har besvarats genom litteraturstudier. En av de teorier som valts ut genom litteraturstudierna är IES:s riskhanteringsprocess och en annan är Cost Benefit Analys (CBA). Under sammanställningen av detta examensarbete har det även identifierats att bra riskhantering även innefattar organisatoriska aspekter som säkerhetskultur och engagemang gentemot säkerhet. Det har även identifierats att företaget behöver ha riskanalysmetoder som är anpassade till deras organisation.

Svaret på den första frågan har används som utgångspunkt för att svara på den andra: Inom vilka områden behöver Trelleborg förbättras? För att besvara denna frågan har den information om riskhantering inom Trelleborg analyserats med stöd av litteraturen från litteraturstudien som beskrivs ovan. Under analysen har det identifierats olika områden som behöver förbättras. Dessa områden har analyserats mer ingående genom intervjuer med anställda på Trelleborg. Bland annat var det nödvändigt att undersöka hur väl de anställda kände till policys och rutiner för riskhantering. Slutsatsen som kunde dras efter intervjuerna var att Trelleborg har en välskriven riskhanteringspolicy och riktlinjer för riskhantering. Det kunde även fastställas att policyn är väl kommunicerad inom företaget och att personalen är väl medvetna om syftet med policyn. De anställda var engagerade i att hantera sina risker och att de var medvetna om att riskhantering är viktigt för företaget. Trots detta framkom att det inte finns några etablerade rutiner för riskanalys, återkoppling och uppföljning av risk hantering. Detta illustreras av att de anställda vet att de ska hantera riskerna men saknar verktyg och rutiner för att analysera riskerna och att ledningen inte följer upp och återkopplar riskhanteringen.

Trelleborgs svaghet ligger i att det inte finns något system för att kontrollera och följa upp de analyser som gjorts, av bl.a. inhyrda konsulter, och att det inte finns något globalt system för incidentrapportering. Det är avgörande för den översta ledningen i en stor organisation att ha insikt i riskhantering på lokal nivå. Om insynen i den egna verksamheten är bristande kan det resultera i att företaget blir sårbart vid förlust av personal som är kunnig inom riskhantering.

Ramverket som är det centrala i detta examensarbete kommer att hjälpa Trelleborg att

driva igenom de förändringar som detta examensarbete föreslår. Rekommendationerna är följande:

- Skapa mer väldefinierade rutiner för riskhantering.
- Använd ett ledningssystwm för att göra riskhanteringen mer effektiv.
- Underlätta incidentrapporteringsprocessen.
- Ge feedback angående riskanalyserna.

Rekommendationerna har använts som utgångspunkt vid skapandet av ramverket för riskhantering. Ramverket innehåller förslag på metoder för riskanalys som kan användas av Trelleborg för att analysera risker. För att kunna välja de metoder som passar Trelleborg bäst utvärderades de efter specifika kriterier. Frågorna som besvarades var: Vilka kriterier ska riskanalysmetoderna överensstämma med? Vilken information behövs för att kunna etablera kriterierna? Vilka metoder överensstämmer bäst med kriterierna? För att besvara dessa frågor genomfördes en noggrann litteratursökning. Genom litteraturstudier etablerades kriterierna och därefter rankades de av personalen. De fem som rankades högst var översiktlig analys, möjlighet att ranka riskerna sinsemellan, möjlighet till att göra ingående analyser, möjlighet att analysera händelseförlopp och enkelhet att generera statistik.

Analysmetoderna som valdes var checklistor, grovanalys och kvantitativ riskanalys. Dessa analysmetoder kommer att utgöra en bra mix för riskanalys som fyller de olika behov som finns på Trelleborg. Checklistorna kommer göra det möjligt att göra analyser på kortare tid. Grovanalysen kommer att förenkla översiktliga analyser och kan även användas för att identifiera områden som behöver analyseras ytterligare. Den kvantitativa riskanalysen (QRA) kommer att göra det möjligt att kvantifiera storleken på en specifik risk. Som ett sista steg i examensarbetet implementerades ramverket i ett datorprogram på Trelleborg. Med hjälp av ramverket och datorprogrammet finns det stora möjligheter att förbättra riskhanteringsarbetet inom Trelleborg AB även med små medel.

Innehållsförteckning

1 Introduction

1.1 Background

Corporations are faced by a variety of regulations and standards that they have to follow. Either it is the authorities or it is the corporations which they collaborate with demanding that they follow certain procedures. In many cases it's both and the standards and regulations demand that corporations identify their risks. Many companies put lot of resources in identifying different types of risks and often have different systems for identifying the different types of risks and sometimes there aren't enough resources to handle the identified risks.

There are several different ways to handle the risks that have been identified during risk analysis. What is important is to manage the risks in order to make the risk analysis a benefit for the company. Is it enough to give employees orders to make risk assessments without asking what the result was and without making changes to lower the risks? If that is the case the risk analysis can be useless. Even if there are several ways to handle risks it seems as if the best way for a large corporation which is located in several countries and continents is to use a computer based system. This is the background for the first hypothesis which is the background of this thesis:

To be able to handle the risks that are identified a company needs a system for risk management support which includes both routines and a computer based system which enables handling of the risks that are identified.

Trelleborg AB will constitute an example of a large company. Presently Trelleborg AB has a management system which handles environmental risks and also works with proactive risk management on a central level and has a well written risk management policy. The company deals with risk management in many different ways. They turn to risk management consultants to analyze risks at request from supervisory authority and other consultants to lower insurance costs. They are also certified according to ISO 14001 which obligates them to analyse their environmental risks. To be able to get full use of the risk analysis being done they need an overview of all risks and they need a risk management framework to handle the risks more effectively.

1.2 Aim

There are three aims with this thesis. The first aim is to determine how a large company can handle its risks in a practical manner. Trelleborg AB will be used as an example of the difficulties that can be encountered in a large company.

The second aim is to determine if there is a need for improvements within risk management at Trelleborg and what kind of improvements. The third aim is to design a framework that contains features that can facilitate risk management at Trelleborg. The framework will contain a computer based method for risk analysis and that can generate basic data for decision-making.

1.3 Limitations

As mentioned in section 1.1 Trelleborg AB has a management system which handles environmental issues [1]. Since the management system is mainly focused on Environmental

issues it will not be discussed in this thesis. The framework suggested in the thesis could constitute a part of a management system for Trelleborg if they were to expand their central management system to all areas within the company.

The framework developed in this thesis is designed for Trelleborg AB. The methodology can be used for other companies but one should bear in mind that some of the special circumstances that applies to Trelleborg AB might not be applicable to other companies. The framework is designed so that it can be used together with Trelleborg AB's other risk management features. Especially Willis blue scoring system because of a request from Lars G Stenblom who is Vice president risk management at Trelleborg AB.

1.4 Problem formulation

The aim of this thesis is to design a framework for risk management for Trelleborg AB. To be able to design the framework the thesis sheds light on the following more specific questions:

- What is good risk management and how can the quality of risk management be determined in a company?

The answer to the first question can then be used to provide a point of departure for answering the second question of the thesis:

- In what areas within risk management does Trelleborg need improvements?

The framework for risk management which is the focus in the thesis should include some methods for risk analysis. In order to choose the most appropriate risk analysis methods, an evaluation of the methods according to certain criteria are needed. Therefore, the following set of questions needs to be answered:

- Which criteria should the risk analysis methods that are included in the framework comply with?
- Which information is needed to establish the criteria?
- Which risk analysis methods comply with the criteria in the best way?

The answers to all the questions above will provide sufficient information for the suggestion of a framework for risk management for Trelleborg AB.

2 Method

In this section the method that was used to reach the result in this thesis is presented. The method is built on the questions that were presented in the previous chapter and it is illustrated in figure 2.1.

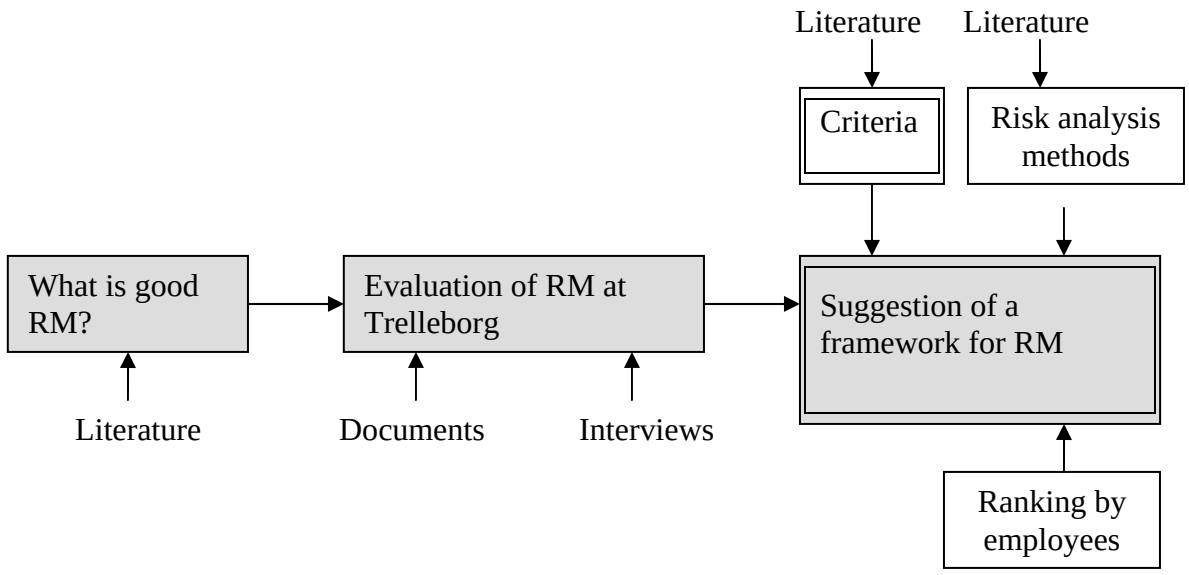

Figure 2.1. Illustration of the method used in the thesis.

The first question that was asked is: What is good risk management and how can the quality of risk management be determined in a company? To answer the first question a thorough literature search of the available literature in this area was performed by using the databases Elin@Lund and Lovisa (at the Lund University Libraries). The search was done by using the search words: risk management, risk analysis and risk analysis + method. The search resulted in many articles and books and the most relevant books and articles were chosen as a basis for this thesis.
The reason for looking for literature on risk analysis methods is that within the framework for risk management there was a need for risk analysis methods. To determine which methods that should be included in the framework literature studies were done and available methods were identified. The literature on risk analysis and risk management that was found was analysed and the most suiting was summarized and discussed in chapter 4.

The second question was: in what areas within risk management does Trelleborg AB need improvements? To answer this question information on the risk management organisation at Trelleborg was gathered by downloading information that was available on Trelleborg AB intranet. The information that was available was risk management policy with information on risk management strategy and routines, Blue risk scoring board, and documents that should be used to report incidents. These documents were analysed by using the results from the first literature study and the analysis that was mentioned above. The analysis was done by using criteria for good risk management, from the 4 c´s and INSAG, and comparing Trelleborg´s routines against

them. During the analyses risk management areas that didn't seem to have sufficient routines, were identified. These areas were analysed more thoroughly using interviews with employees. To get more structure in the interviews one hypothesis was made: "Trelleborg AB´s risk management policy is not thoroughly communicated within the company". To be able to falsify or verify the hypothesis several interviews with managers responsible for a specific production or safety mangers were conducted. During the interviews the hypothesis was tested and general risk management issues were discussed in an open interview. The hypothesis was tested by testing knowledge about the policy.

To determine how a method for risk analysis can be designed to constitute general data for decision-making three questions were to be answered: Which criteria should the chosen risk analysis method comply with? Which information is needed to establish the criteria? Which methods comply with the criteria in the best way? To answer the questions a thorough literature search on the available studies was made. The search was done by using the databases Elin@Lund and Lovisa (at the Lund University Libraries). The search was done by using these search words: risk management + criteria, risk management + tool, risk management + software and risk analysis. The search resulted in many articles and books and the most relevant books and articles were chosen and analysed. Articles that contained information on tools for risk management and criteria for risk management tools are summarized in chapter 4 and constitute the basic for the criteria for this framework. After identifying criteria, employees, general managers and safety/environmental managers at Trelleborg ranked criteria according to their preference. The results from the employees ranking can be found in chapter 5. After the criteria were chosen it was used to analyse the methods and other criteria that were identified earlier in this thesis. A framework for risk management was designed according to Trelleborg risk management documents, good risk management according to literature and opinions from employees.

3 Presentation of Trelleborg AB

This chapter is a brief presentation of Trelleborg's history, organisation, its different business areas and risk management at Trelleborg.

3.1 History

In October 1905 when Trelleborg was registered it was with the name Trelleborgs Gummifabrik. They then manufactured industrial rubber and tires. The company grew from having 100 employees in 1905 to 1000 employees in 1935. After rapidly internationalising the company and setting up factories abroad Trelleborg was listed on the Stockholm Stock Exchange in 1964 by the name Trelleborg AB. [1]

3.2 Business areas today

Trelleborg AB consists of five business areas:

- Trelleborg Automotive
- Trelleborg Wheel Systems
- Trelleborg Engineered Systems
- Trelleborg Building Systems
- Trelleborg Sealing Solutions

Trelleborg Automotive develops and manufacture polymer-based components and systems used for noise and vibration damping for passenger cars, light and heavy trucks, and for rail, marine and industrial applications. [1]

Trelleborg Wheel Systems supplies tires and complete wheel systems for farm and forest machines, lift trucks and other materials-handling vehicles. [1]

Trelleborg Engineered Systems supplies industrial fluid systems and engineered solutions for the protection and safety of investments, processes and individuals in demanding environments. The area consists of two parts: Industrial Fluid Systems and Engineered Solutions. [1]

Trelleborg Building Systems supplies polymer and bitumen-based building products for sealing and waterproofing applications in industrial and consumer markets. The area consists of three parts: Sealing Profiles, Waterproofing Systems and Pipe Seals. [1]

Trelleborg Sealing Solutions supplies precision seals for the industrial, automotive and aerospace markets. The area consists of three parts: Industrial applications, Automotive and Aerospace. [1]

3.3 Risk management at Trelleborg AB

It is the General Manager at each Trelleborg facility that has the final responsibility to carry out risk management in agreement with the policy. In the following sections the different aspects of risk management at Trelleborg AB will described. The overall policy for risk management is described and how the coordination of risk management issues is conducted. Trelleborg corporate

risk management involves the following: risk analysis, risk handling, risk financing and follow-up. These activities will be more thoroughly described in chapter 4.

3.3.1 Risk management Policy

The objectives of The Trelleborg Group risk management policy is that they “shall make every reasonable effort to ensure safety and reliability in its operations by protecting personnel and other persons concerned, property, know-how, goodwill, environment and other assets against accidents, damages, losses or other undesirable events.“ [2] The policy also states that all risk management should meet the requirements from society, the employees and the owners. It should even meet the requirements and expectations of the customers as to safe and reliable deliveries, quality and service. [2] Risks that might result in considerable damages should be identified, assessed and handled or financed. The total long-term cost of risk shall be optimized. And costs mean the cost for damages as well as for protective measures including insurances. [2]

3.3.2 Risk management co-ordination within Trelleborg AB

Trelleborg central risk management (TCRM) function is a part of the legal department. TCRM has responsibility for co-ordination of risk management matters and also for development and consultative service of risk and insurance matters. [2]

The corporate risk manager is responsible for all the group common global insurance company. In accordance to legislation there should be a country coordinator that reports to the group’s corporate risk manager who in case of major concern should report to risk management risk management committee. The risk management committee consists of representatives from every Business area and also the legal department. [2]

4 Good Risk Management

The purpose of this chapter is to determine what defines good risk management and to describe the theory that will constitute the basis of this thesis. First different theories and standards will be described and discussed.

A thorough literature study was conducted to answer the question “What is good risk management and how the quality of risk management can be determined in a company?”. The literature study on available literature in this area was performed using the databases Elin@Lund and Lovisa (at the Lund University Libraries). The search was done by using the search words: risk management, risk analysis and risk analysis + method. The search resulted in many articles and books and the most relevant books and articles were chosen as a basis for this chapter. The reason for looking for literature on risk analysis methods is that within the framework for risk management there is a need for risk analysis methods. To determine which methods that should be included in the framework literature studies were done and available methods were identified. The analysis methods that was found most fitting to analyze from the literature search was: Preliminary risk analysis, Checklists, What if -analysis, Index method, HazOp analysis, Event tree analysis, FMEA, QRA and PRA

The risk management theory’s that was found most fitting to analyze from the literature search was: The IEC characteristics for risk management, methods for decision analysis (including such criteria as technology based criteria, rights based criteria, expected value based criteria), International Nuclear Safety group definition on safety culture (INSAG) and Engineering council risk management guidelines (The 4 c´s).

4.1 The IEC

In this section different characteristic of risk management will be defined in the way they will be used throughout this thesis. IEC’s (International Electro technical Commission) risk management definitions will be used. The reason for choosing IEC is that IEC is a well known and accepted organisation for standardization. There are several different risk management frame work and theories available. The argument for choosing IEC is that a well known standard comes before other theories. “The object of the IEC is to promote international cooperation on all questions concerning standardization in the electrical and electronic fields” [3].The IEC collaborates with the International Organization for standardization (ISO) [3]. In table 4.1 different concepts included in the IEC standard are defined. The use of the concepts in the present thesis is in agreement with these definitions.

Table 4.1 The IEC definitions

Risk	"Combination of frequency, or probability, of occurrence and the consequence of a specified hazardous event."
Risk analysis	"Systematic use of available information to identify hazards and to estimate the risk to individuals or populations, property or environment."
Risk assessment	"overall process of risk analysis and risk evaluation"
Risk control	process of decision- making for managing and/ or reducing risk; its implementation, enforcement and re-evaluation from time to time, using the results of risk assessment as one input"
Risk estimation	"Process used to produce a measure of the level of risks being analysed. risk estimation consists of the following steps: frequency analysis, consequence analysis and their integration."

[3]

4.2 Decision analysis

In this section various criteria used in decision analysis are described. The reason for including this section in the thesis is that after a risk analysis is done some kind of decision must be made and there are different theories that can be used to make the decision. There are several decision criteria available but in this thesis only a few will be described and discussed. The theories that will be described and discussed are [4]:

- Technology based criteria
- Rights based criteria
- Expected value criteria

Technology based criteria and Rights based criteria have been studied and mentioned without being included in this framework. The reason for not choosing technology based criteria is because it is built on decreasing a specific risk by the best technology. According to literature that was used [5] technology based criteria can lead to a waste of recourses and therefore it is not applicable on a profitable organisation. The reason for not choosing rights based criteria is that rights based criteria weighs in the entire society's rights not to be exposed to a specific risk [5] and according to the author of this thesis that is not possible for a profitable organisation.

An expected value criterion is a criterion that can be used when having to choose from two or more alternatives. The values are calculated by multiplying probability of outcome with the monetary value of outcome. Cost benefit analysis (CBA) and Cost effectiveness (CEA) are two ways of using expected value criteria.

Cost benefit analysis (CBA) have been chosen as the most appropriate for Trelleborg because cost benefit analysis is done by weighing the different alternatives against each other in monetary units [5]. Monetary units are easier to take into account with the rest of the analysis within the company. A CBA analysis is done by doing the following and it is the structure in the analysis that is most useful for Trelleborg:

1. Identify the set of alternative projects.
2. Decide whose benefits and costs count.
3. List the impacts and decide on measurement indicators.
4. Predict the impacts quantitatively over the life of the project.
5. Attach money values to all impacts.
6. Determine which costs originate from which year and calculate present values.
7. Compute the net present value (NPV) of each alternative.
8. Perform sensitivity analysis.
9. Make a recommendation based on the NPV and sensitivity analysis. [6]

The first step in the list above is identification of the sets of alternatives which will make it possible for Trelleborg to get an overview of the possibilities after a risk analysis is done. The second step is to decide whose benefits should count. Should it be the employees, stock owners or the environments benefits that counts? This is a question the corporation should be able to answer. Step 3 and 4 gives CBA has an additional advantage which makes it possible to list the impact and predict the impact of investing in risk management or not. These steps will make it possible to get a picture of what will happen or what could happen if we don't take measures to lower the risks that has been identified. Step 5 to attach money values to the impacts gives the company a way to compare the risk decreasing investments to other investments. Step 6-9 are steps to assure that the analysis has been conducted in a correct manor.

Cost effectiveness is, as mentioned above, also an expected value based criteria but the difference lays in the fact that in cost effectiveness analysis (CEA) goals are set up and the responsible tries to reach them with as low cost as possible [5]. According to the author of thesis CEA doesn't suit Trelleborg in the same way as CBA because it doesn't help Trelleborg in the same way when they are going to choose what measurers that are needed to be taken. If Trelleborg uses CBA it will make it easier for them to compare different investments benefits. It will also make it possible to compare benefits from making investments and not making investments [5].

4.3 The characteristics for good risk management

In this section characteristic for good risk management is presented. The reason for including it in this thesis is to get a basis for the evaluation of Trelleborg risk management organisation. Harms-Ringdahl has in his book about risk management and management systems [7] described what characterises good risk management. It is because he has based his theories on so many different well known sources that his literature has been chosen. He has used and compared risk management guidelines from “Kemikontoret”, guidelines from the European council, International Nuclear Safety Advisory Group (INSAG) report on safety culture with other surveys and summarized them into recommendations on how to handle risk management issues within an enterprise. In his results he states that in all documents and analyses he refers to have indicated that organisational aspects are important for risk management. These aspects will be looked into more thoroughly in the next section. [7]

4.3.1 Safety culture

One organisational aspect is safety culture. International Nuclear Safety Advisory Group (INSAG) has defined safety culture as: “that assembly of characteristics and attitudes in organizations and individuals which establishes that as an overriding priority, nuclear plant safety issues receive the attention warranted by their significance.” [8] In figure 4.1 the connection between policy, management commitment, individuals´ commitment and safety culture is shown. [8]

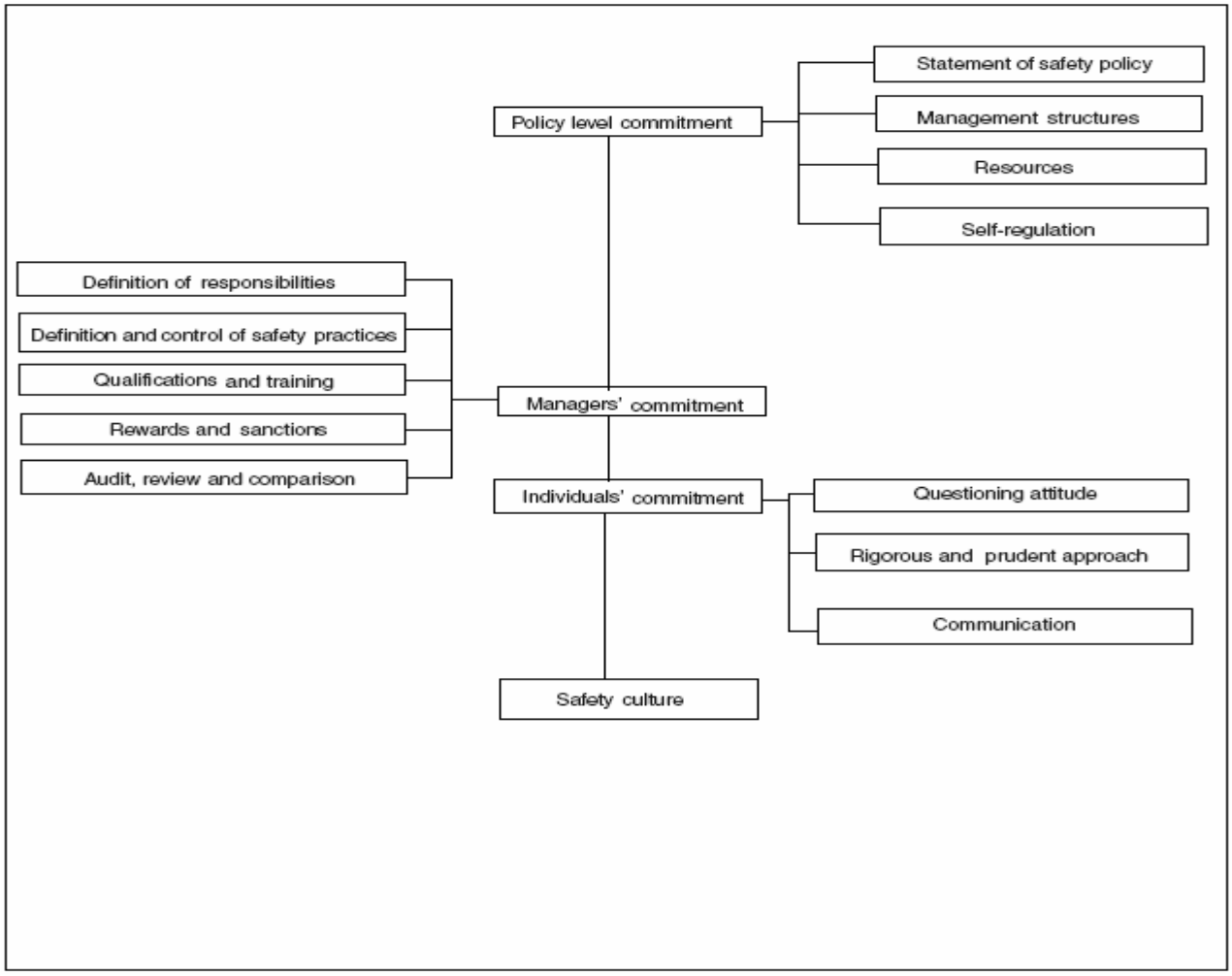

Figure 4.1 The connection between policy, management commitment, individuals´ commitment and safety culture [8].

4.3.1.1 Commitment

The report from INSAG further proclaims that it is crucial that the top of an organisation is committed to safety and to improving the safety culture to achieve first-rate safety performance. [7] They also proclaim that it isn't enough to have a policy and to mention safety in speeches even if those things are also important. Commitment is according to the report about integration of the organisations safety goals in the every day work. To be able to test the commitment in an organization questions have been designed and they are summarized below:

1. Has the organization developed a common outlook on the goals and how to achieve them and can the employees relate to them?
2. Does the management set a good example? For example is safety first on the agenda for meetings and does management take necessary protective measures when they are seen in the production?
3. Do the employees tend to take shortcuts when they are behind schedule? [8]

4.3.1.2 Use of procedures

In the report the authors emphasize the importance of having written procedures and that the procedures are fitted for the tasks that should be performed. But according to the authors it is not enough to have them on paper. They also have to be understood and accepted by the staff. It is also important to monitor the procedures and make sure that weaknesses in the organisation are corrected. [8]

4.3.1.3 Reporting culture

A reporting culture is an important ingredient in a good safety culture. In a reporting culture it is important to report both incidents and “near misses”. By near misses INSAG means incidents that could have led to severe consequences but didn’t. According to the report the information required from reporting personnel is important learning information. By reporting incidents the company could learn from their mistakes or near misses. To be able to learn from the information collected it must be distributed within the company so that all personnel can learn from each others mistakes. To motivate the employees it is important that no one is penalized for doing so or that any of the reporting persons co-workers are. [8]

4.3.1.4 Learning organization

The report from INSAG further proclaims that if an organization doesn’t search for ways to improve there is a risk that they will slip backwards instead. A learning organization learns from employees experiences from all levels of the organization. When the company is a learning organization the employees contribute to the development not because they are told to contribute but because they want to. To get the employees to want to contribute they need to feel that they have the backing of the management and that they are given opportunity to make the improvements they have suggested. It is essential to provide instrument to facilitate knowledge and ideas to be transmitted within the organization. They also state that it is necessary to have a system for feedback to management so that they can get knowledge about the company’s progress. [8]

4.3.2 The 4 Cs´

Harms-Ringdahl also refers [8] to the 4 Cs´ guidelines from the engineering council [9] where they have put together a list of management practises for effective risk management. The guidelines have been put together from lessons learned from incidents [9]. Below in table 4.1 the guidelines are presented.

Table 4.1 4 Cs´ guidelines from the engineering council

	Approach
Commitment	Recognition by top management that effective risk management is essential to success: • Risk management is a key business objective, integral with business management. • Regular board level review of risk management performance. • Policy of compliance as a minimum requirement, positive interface with regulators. • Formal staff reporting system. • Operation of quality assurance (QA) program to all activities.
Culture	Reinforces commitment to quality and success through organization: • Individual responsibilities and performance targets clearly allocated. • System for monitoring risk management performance. • Employee/trade union involvement. • Risk reduction in conceptual design. • Positive employee health programs. • Emergency preparedness.
Communications	Strong formal and informal networks throughout the organization: • Policy well-communicated and reinforced. • Confidential blame free accident reporting. • Effective interfaces with customers, suppliers and contractors. • Identification and enforcement of critical procedures. • Use of multi-disciplinary teams (designers, operators, planners, risk specialists).
Continuing professional development	Systematic approach to updating by education and training on risk issues: • Knowledge of : codes and standards, organizational interfaces and legal and financial matters. • Registration of engineers encouraged. • Feedback system from customers and lessons learnt back to design, procedures and staff education/ training.

[9]

4.4 Available risk analysis methods

The framework for risk management will also include methods for risk analysis that comply with the good risk management described in the sections before this. There are many different risk analysis methods. But to determine which method that is most appropriate for use at Trelleborg AB only the most common methods has been analyzed. The methods mentioned in this section can be used to analyze technical, environmental and organizational aspects. The following is a brief review of the most common risk analysis methods that will be analyzed in this thesis.

4.4.1 Preliminary risk analysis

Preliminary risk analysis is a method which is used to get a rough overall picture of the facility or system. It is a method that brings up the most critical risk to the surface so that they can be analysed more thoroughly with a more detailed risk analysis method. The person or persons that carry out the analysis should be a person with experience of similar conditions and they should rank the risk's probability and consequence. Preliminary risk analysis then generates a list containing qualitative data with or without internal ranking. It should then be a person with experience of similar conditions that rank the risk's probability and consequence. The risks should be ranked according to a scale of five (table 4.2). [10]

Table 4.2 Example of frequency- and consequence classes of accidents

Class	Frequency	Consequence
1	Unlikely < 1 time /1000 year	Neglectable (none or small damage)
2	1/ 1000 year	Dangerous (minor person- and property damage)
3	Likely 1 time / (10- 100) year	Severe (significant person- and property damage)
4	1 time / 10 year	
5	Very likely > 1 time / year	

A preliminary risk analysis is done by doing the following:

1. Choose a process or part of process.
2. Identify and list possible events that could damage the process.
3. Identify possible causes to the events.
4. Identify consequences of the events.
5. Value the probability for the events according to a scale (table 4.2).
6. Value the consequences for the events according to a scale (table 4.2)
7. Give suggestions to measures. [10]

4.4.2 Check lists

Check lists can be used to make sure that activities meet the requirements. Check lists should be established by a person or several persons that have sufficient knowledge about the facility and they should be based on their previous experiences. If the lists are detailed they often consist of requirements on the equipments technical design and how it should be operated. The general check lists can consist of questions concerning characteristic of handled substances, occurrence of risk increasing methods, effects of external disturbance, deficiency in support functions like electricity, pressure and security equipment. Check lists are one of the most time- and cost effective methods for risk analysis. [10] The reason that checklists are time- and cost effective is that the analysis is done by following a list. Because a list with clear instruction is followed

decisions concerning what to include in the analysis are minimized and therefore time effective and since it is time effective it is also cost effective.

4.4.3 "What if"- analysis

"What if" – analysis is a method which is used to identify risk sources by analysing series of unplanned events in a system. By asking "what if" possible deviation from the systems planned functions are analysed. The questions are usually generated from previous experience and assumes from drafts over the process. The results are presented in a table with possible damage sequence, its consequence and the suggested proactive measures. The results when using "what if"- analysis is qualitative and no internal ranking is done and no quantitative appraisals are done. [10]

A "What if" analysis is done by doing the following:

1. Ask the question: what if…
2. Estimate the probability (low, medium or high).
3. Identify the consequence.
4. Give suggestions to measures.
5. Ask a new question. [10]

It is a simple method to use but it is easy to overlook some significant problems and should therefore only be used in combination with other analysis. [10]

4.4.4 Index – method

There are two index-methods, the Dow index and the Mond index, that has similar calculations. The methods are used within chemical process industry to identify and measure risks, the analyst performing the analysis goes through these steps:"

1. Divide the facility into appropriate units.
2. Define the substance with the highest risk in each unit and then calculate the material factor based on which reaction that liberates most energy.
3. Appraise the contributing risk factors according to the directive in the method manual.
4. Calculate the risk index.
5. Classify the unit's risks.
6. Calculate bonus factors (optional).
7. Put together a summation of the risk analysis for example: maximal damage on facility.
8. Repeat step 2 to 6 for every unit."

[10]

4.4.5 HazOp – analysis

HazOp-analysis ("Hazard and operability studies") is a method which is used to identify risk sources and also other relationships in the process that can reduce the facility's ability to fulfil its goals. HazOp – analysis is a form of controlled brainstorming with the purpose to find possible deviations from planed production conducted by a group with various competences. To be able to perform the analysis check lists and leading words are used. There are seven leading words and they can be found in table 4.3. [10]

Table 4.3 Leading words for Hazop analysis

	Leading words	Description
1	No, not, none	Intended function fail to come completely
2	More, higher	Quantitative increase
3	Less, lower	Quantitative decrease
4	As well	Qualitative increase
5	Partly	Qualitative decrease
6	Opposite	Reversed function
7	Instead of	Replaced function

A HazOp-analysis is done by doing the following:

1. Choose a part to analyse.
2. Define normal or intended function of the part chosen.
3. Choose a parameter in the process.
4. Derive deviations by combining the process parameter with a leading word.
5. Find out possible causes to the deviation.
6. Estimate the consequences.
7. Give suggestions to measures.
8. Derive a new deviation (go to 4).
9. Choose a new parameter in the process (go to 3).
10. Choose a new part to analyse (go to 1). [10]

4.4.6 Event Tree Analysis (ETA)

ETA is a technique which is used to identify the possible outcomes of an event [3]. An event tree starts with the initiating event and depending on what happen afterwards, different scenarios is formed. In most cases it is assumed that an event is either a success or a failure [1]. The technique is suitable for systems with safety systems and emergency routines [10]. When performing an ETA analysis the question "what happens if" is asked and it results in a event tree [7]. When the scenarios are identified probability and consequence is calculated and different risk measures are identified for each part of the scenario [10]. The event tree shows the relationship between functioning and failure of different systems [9], an example of an event tree can be found in figure 4.2.

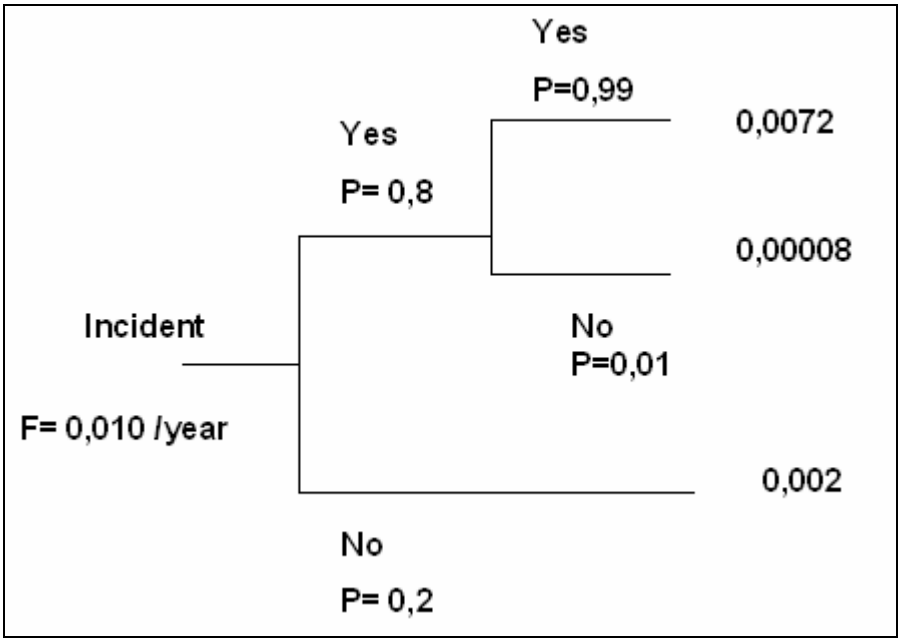

Figure 4.2. Example of an event tree

4.4.7 FMEA

FMEA (Fault Modes and Effects Analysis) is a method which is used to identify and assess risks. It is a qualitative method at first hand but can also be quantified by internal ranking in between the risks. FMEA analysis results in descriptions on possible malfunctions that could lead to severe consequences. The method can also be used for identifying needs for further risk analysis. [11] The analysis is done by identifying effects or consequences of a specific component's different fault modes [3]. The results can be shown in a table with two columns containing: Component/function and Malfunction/effect an example of the table is shown in table 4.4.

Table 4.4 example of results from FMEA analysis

Component/function	Malfunction/effect
Pump, feeding/into operation	- Doesn't stop when it should/emanate - Stops/feeding declines - Break in gasket /leakage - Breakdown in pump house /leakage feeding declines

[11]

4.4.8 QRA-Quantitative Risk Analysis

QRA (Quantitative Risk Analysis) is a quantitative method which answers the three following questions: What can go wrong? How likely is it? What are the consequences? [12] The analysis is done by doing the following:

1. Undesirable endpoints is identified
2. The events that can lead to the endpoints are identified
3. Scenarios are identified by using fault and event trees
4. The probability for the scenarios identified is determined by using previous experience and records.
5. The scenarios are then ranked according to their expected frequency. [12]

1 **Identification:** The first stage of a QRA analysis is the identification stage during this stage the system is described and possible events and scenarios are identified [13]. The main purpose of this stage is to create a list over possible starting events and even the priority of the events [13].

2 **Frequency estimation**

2.1. **Historical record:** By using a historical record with past event frequencies the future frequencies can be estimated. It is although important to recognise the insecurities it can bring about to the calculations if the data isn't applicable to the specific incident [13].

2.2. **Fault and event tree analysis**: Fault trees and event trees can be used to evaluate out comes from different scenarios. The parameters that are used in fault trees are likelihood and consequence these parameters are often historical data. The uncertainty in fault lays in the uncertainty of the parameters. [13].

3 **Consequence estimation**: There are various models for calculation of consequences for different incidents depending on which incident or risk. The consequences for example can be injury or death on human beings, damage on physical property or loss in monetary value [13]. When dealing with chemicals there are several uncertainties especially when dealing with human beings because most data comes from extrapolating results from animal tests [13].

4 **Estimation of risk**: Estimating the risk is usually done by combining probability and consequence of a certain outcome [13]. There are many ways to measure risk but the two main risk measures that can be found in literature are individual risk and societal risk [13]. Individual risk is the risk a person at a specific location is exposed to by a certain hazard. Societal risk is a measure of how many people that would be exposed to the hazard in case of on incident [13].

4.4.9 PRA

PRA (Probabilistic risk assessment) is a quantitative method that the nuclear industry relies on when it comes to facility analysis [14]. When performing a PRA using the “classical approach” the analyst goes through these steps:”

- Event-Tree sequences are transformed into Boolean (true or false) formula
- Minimal cutsets of these formula are determined
- Probabilistic measures are assessed from the cutsets (including probabilities and/or frequencies of sequences, importance factors, and sensitivity analyses)” [14].

4.5 Categorization of risk analysis methods

It is important to categorize risk analysis methods in quantitative and qualitative methods to be able to understand what kind of results the methods will give. Because of this the methods mentioned in section 4.4 are categorized in this section (figure 4.5). Before the categorization is done the different categories are described.

4.5.1 Qualitative methods

Qualitative methods often result in a description of possible sequence of incidents. These methods are often more simple to use because they are less complex. Some examples of qualitative methods are: HazOp, What-If and check lists. These methods are mostly used to identify the risks and not to quantify them. [10]

4.5.2 Semi Quantitative methods

These methods can be used to both identify and quantify risks. The results when using these methods contains in consequence and probability for an incident. One example of Semi quantitative methods is index methods. The results can be used to rank risks in regard to how likely they are and the size of the consequence. [10]

4.5.3 Quantitative methods

Quantitative methods generate probability for an unwanted consequence or expected causality in a year for a certain activity. The methods do not have to result in consequence and probability for an incident to be a quantitative method. It can also result in a deterministic result. The deterministic result can be separate values that show the present risk level. One example of quantitative methods is QRA (Quantitative Risk Analysis). [10]

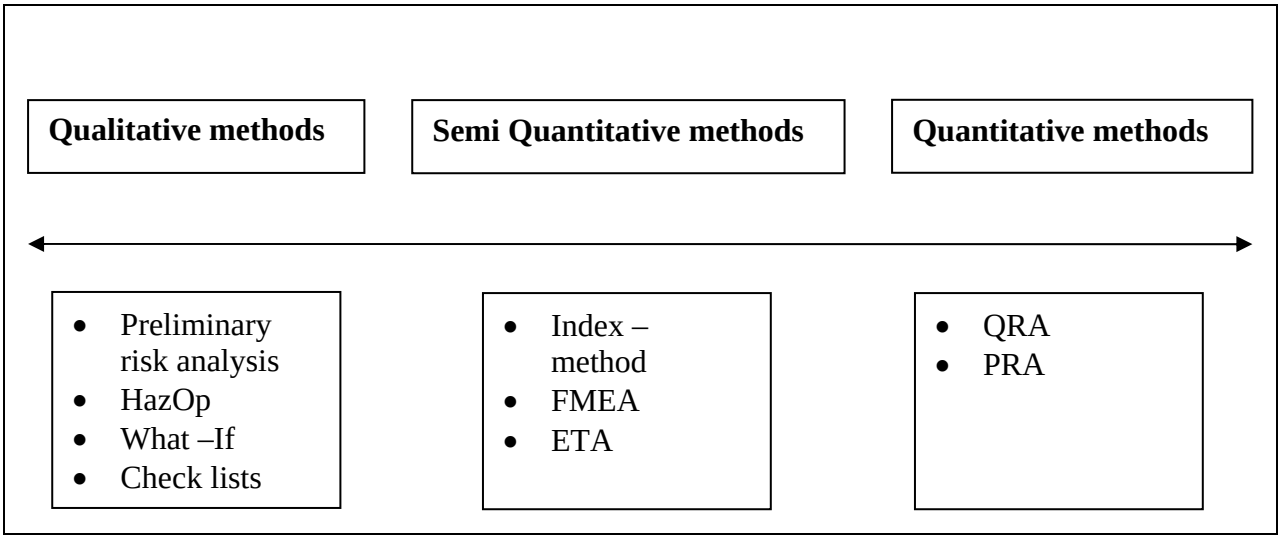

Figure 4.5 Categorization of risk analysis methods [3] [10] [11] [15] [16]

5 Trelleborg AB and risk Management

In this chapter Trelleborg's central risk management routines will be presented and analysed. The analysis will be based on the theory from chapter 4. As described in chapter 3 Trelleborg works on risk management issues on a central level and has a well written risk management policy a well defined guidelines for risk management.

5.1 Risk management documents

Amongst Trelleborg risk management documents there were only limited information on how risk management should be conducted on Trelleborg intranet and the employees didn't have more information. There were documented routines and their risk scoring model. These are described in the following sections.

5.1.1 Risk management routines and guidelines

The central risk management documents, at Trelleborg AB, are overview routines for risk management. The documents that specifies the routines are short and leaves much room for own speculations. The tables contain routines that should be the basis for all risk management at Trelleborg. Trelleborg doesn't have specific central risk management routines for all tasks. But the individual subsidiaries have routines for handling different risk management aspects. The subsidiaries routines have been created on demands from top management and because the responsibility for the risks have been delegated to the subsidiaries. The overview guidelines for those in charge of risk management can be seen below.

The overview guidelines are to continuously identify risks and to continuously evaluate identified risks, especially the risk for catastrophe. When the employees handle risks they should continuously do follow ups when it is effective and economically justified. They should also take protective measures for control of identified risks. They should also work to raise the risk awareness of the employees and other persons concerned by information and training. Another aspect that they should ensure is good working environment and good order at the work place. The employees should protect property against fire, explosion etc as well as against foreseeable changes in climate and the forces of nature, establish relevant protection plans and protection instruction, introduce maintaining routines for the manufacturing processes and prevent risks for business interruption. Another part of handling risks is to establish relevant contingency plan systems which are sensitive to interruption. One part of the contingency plan is to prevent those risks of damage which could be caused by the delivered products (products liability). Another part is to protect technical know-how and business concepts against unauthorized access, protect operations against trespassing, sabotage and fraud. [2] The employees should also continuously let external inspectors repeat loss prevention analysis [2].

5.1.2 Trelleborg Blue risk scoring model

This section explains Trelleborg Blue risk scoring model which is Trelleborg´s risk management ranking system that has been designed with their insurance brokers Willis. The reason for including it in this thesis is because of a request from Trelleborg´s vice risk manager Lars G Stenblom. The request was that the framework would be aligned with the scoring model.

The general purpose of the risk scoring model is to provide ranking of the agreement with Group risk management manual [17]. At a site inspection different grades will be given which relate to the site risk picture. This makes it possible for different plants to compare grades. Special analysis can be done in areas were there are deviations from risk management manual. In Table 5.8 the different grades can be seen. The grades below are used to grade the different categories in the checklist that the insurance company uses when doing revisions on the facilities. There are several different aspects in the facilities that are graded such as structures of buildings, fire protection and electrical equipment. These aspects are summarized for each part of the company and each part is graded.

Table 5.8 Grading of Trelleborg Blue risk scoring model [17]

Grades		
***	Blue	Fully complies/better than the Trelleborg risk management Manual, where applicable, and no improvement is required.
**	Green	Does not fully comply with the Trelleborg risk management manual and need minor alterations/improvements.
*	Yellow	Does not comply with the Trelleborg risk management manual and requires substantial improvement.
☹	Red	Major deviations from the Trelleborg risk management manual and requires high attention or urgent action either to eliminate a dangerous situation or to prevent a future loss.

5.1.3 Analysis of risk management documents

In chapter 4.3 the characteristics for good risk management is described with the 4 Cs´ as guidelines for effective risk management and with INSAGs rapport on safety culture [8] [9]. In this section the risk management documents from Trelleborg will be analysed and the theory from chapter 4 will serve as the basis of a discussion. The analyses will only consider the information given in Trelleborg's formal risk management documents.

5.1.3.1 Compliance with the 4 Cs´

According to the engineering councils 4 Cs´ there are several aspects that are fundamental for risk management. [9] The author of this thesis has analysed Trelleborg's risk management documents according to these aspects. According to the policy documents the corporation recognises that risk management is essential for the company [2]. It isn't enough to look at the documents to determine this and it will therefore be investigated more thoroughly. They do on the other hand not mention any formal staff reporting system, incident reporting system that the staff should use when they encounter an incident or an almost incident, something which the 4Cs´ also recommend [2] [9]. The author of this thesis therefore assumes that there are none. As the engineering council recommends, Trelleborg has according to the policy, clear delegation of risks to the manager at each facility, employee health programme and emergency preparedness [2] [9]. They don't have any system for monitoring risk management performance which is one of the recommendations in the 4 Cs´ [2] [9]. The engineering council recommends that the company should have a policy that is well-communicated and reinforced as well as identification and enforcement of critical procedures [8]. These two aspects are not possible to assess from risk management documents and will need further analysis. But there is an available risk management policy in the risk management document [2]. There isn't any information about any reporting or

feedback system. [2] In the risk management document it is stated that Trelleborg should "raise the risk awareness of the employees and other persons concerned, by information and training" [2]. There isn't mentioned any routines for doing so. Therefore it is hard to decide if there is any "Systematic approach to updating by education and training on risk issues" which is recommended by the engineering council [9]. In table 5.4 the compliance with the 4 Cs report is summarized and listed. In the last column there are aspects that need further analysis. This is done by interviewing the personnel, se section 5.5.

Table 5.4 Trelleborg compliance with the 4 Cs´

Insufficient compliance	4 cs´	Sufficient compliance	Further analysis needed
• Formal staff reporting system	**Commitment**		• Recognition by top management that effective risk management is essential to success.
• System for monitoring risk management performance	**Culture**	• Individual responsibilities and performance targets clearly allocated • Employee health programmes • Emergency preparedness	
• Confidential blame free accident reporting	**Communications**		• Policy well-communicated and reinforced • Identification and enforcement of critical procedures
	Continuing professional Development		• Feedback system from customers and lessons learnt back to design, procedures and staff education/ training • Systematic approach to updating by education and training on risk issues

5.1.3.2 Compliance with INSAG´s report on safety culture

In INSAG's report, which is described in chapter 4, four headlines has been used and these will be the basis for this analysis. The headlines are: commitment, use of procedures, reporting culture

and learning organization. [8] In the first chapter about commitment it is stated that it is crucial that the top of an organisation is committed to safety and that the organisations safety goals are integrated into the every day work [8]. The organisation has, according to the policy clear safety goals. But it isn't enough to have policy. The policy needs to be communicated to the employees as well [2]. In the second chapter on use of procedures it is said that a corporation should have written procedures that are fitting for the tasks that should be performed. On an overview level there are routines for risk management and how it should be conducted [8]. But they lack specific routines for specific tasks. This needs to be analysed more thoroughly. There isn't any system, for monitoring the procedures and make sure that weaknesses in the organisation are corrected, described in the official risk management documents [2]. In the third chapter the concept of a reporting culture is described as one of the most important ingredients for a safety culture and it can't be found anywhere in any of the risk management documents. But to determine this further analysis need to be done [2] [8]. The fourth chapter describe a learning organization as an organization which learns from all employees experiences and since Trelleborg doesn't have a reporting culture a learning organisation is not applicable [2] [8]. In table 5.5 the compliance with INSAGS report is summarized and listed. In the last column there are aspects that need further analysis. This is done by interviews with personnel. This is found in section 5.2.

Table 5.5 Trelleborg compliance with INSAGs rapport

Insufficient compliance		**Sufficient compliance**	**Further analysis needed**
-	**Commitment**	-	• The organisation has according to the policy clear safety goals.
• System for monitoring the procedures and make sure that weaknesses in the organisation are corrected	**Use of procedures**	-	• The organization has written procedures that are fitting for the tasks that should be performed.
-	**Reporting culture**	-	• Report both incidents and near misses. • Distribution within the company so that all personnel can learn from each others mistakes
• Learns from employees experiences from all levels of the organization. • Provides an instrument to facilitate knowledge and ideas to be transmitted within the organization. • System for feedback to management	**Learning organization**	-	-

5.2 Interviews to evaluate acceptance of risk management policy and routines

The risk management documents that were evaluated (see the previous section) didn't contain enough information to determine if Trelleborg conduct risk management in a suitable manor. In this section it will be explained how interviews are used to answer the questions that was brought to light in the section before this. When analyzing Trelleborg's compliance with the 4 Cs´ there were several areas that were difficult to analyze by studying official documents. The first area that needed more analysis was if the top management at Trelleborg recognized that effective risk management is essential to success. It is necessary to question the personnel to establish whether if risk management is essential. The author also believes that if it is recognized as critical for the top management the employees are certainly aware of it. The next question is closely connected to the first the question: is the policy well-communicated and reinforced? These two aspects are connected by the fact that even if top management recognizes risk management as essential, but has failed in communicating the policy there will still be insufficient risk management. During interviews with employees it will be determined if this is the case. There are three more areas that have been brought up to light by the 4 cs': is there any identification and enforcement of critical procedures within Trelleborg? Is there any feedback system from customers and lessons learnt back to design, procedures and staff education/training. Is there any systematic approach for updating by education and training on risk issues? These three questions will be answered during interviews with employees.

When analyzing Trelleborg compliance with INSAGs report on safety culture there were some aspects that needed further analysis. The first aspect is if the organization has clear safety goals. The second aspect is reporting culture. It wasn't possible to establish if the organization report both incidents and near misses and if there are any distribution within the company so that all personnel can learn from each others mistakes. The last aspect that needed further analysis was if the organization has procedures that are fitting for the tasks that should be performed.

To answer the questions that have been brought up five interviews were conducted with employees from different business areas within Trelleborg AB. The personnel that were interviewed were either general managers or safety/environment managers. At every Trelleborg facility there is at least one of each kind and they are responsible for the risk management activities in the facility. The personnel that were interviewed can therefore be considered representative for Trelleborg facilities.

5.2.1 Questions

In table 5.4 and 5.5 aspects that are not possible to asset from risk management documents are listed. These aspects were used to put together the questions that were used in the interviews. The reason for choosing the questions that were used in the interviews was that they were general questions. The reason for choosing general questions is that it could give the interviewer an understanding of the employees' knowledge of Trelleborg´s risk management policy. It was also important not to alienating the personnel by asking them questions that can make them feel like they are being accused of not knowing what Trelleborg risk management policy consists of. The questions that were asked were the following:

Table 5.9 Questions to evaluate acceptance of risk management policy.

1	What is risk management and how do you practise it on a daily basis?
2	What is the purpose of Trelleborg risk management?
3	What does risk management means?
4	What sorts of risk are most important to identify?
5	Can you mention some activities to manage risk?
6	What does Trelleborg mean with follow-ups of risks?
7	Who is responsible of the risks at this unit?

5.2.2 Results from interviews

The answers from the interviews have been put in a table and are ranked according to occurrence. The tables contain the questions followed by the answers.

Table 5.10

Question: What is risk management and how do you practise it on a daily basis?
Risk management is something that is done when a new machine has been purchased or an old machines use has been altered. *
Trelleborg turn to consultants to manage its risks. *
Risk management is when we use our management system to control the risks. Parts of the company are certified according to ISO standards which means they have to analyse the facility's risks.
Risk management is practised in our meetings where problems and risks are lifted to the surface.
An example of risk management is that employees can rapport risks and things they want to improve.
Risk analysis is something that is done after an incident to improve the continuing work.
Risk management is when we draw up emergency and contingency plans to prepare for future incidents.
Risk management is something that is done subconsciously.
An example of risk management is when we measure the noise level in the production and in the neighbourhood.

* this answer were given by more than one person

Table 5.11

Question: What is the purpose of Trelleborg risk management?
The purpose is to protect people, environment, goodwill, the company's survival and clients.*
The purpose is to protect people, the environment and to prevent fires.
The purpose is to live up to governmental demands.

* this answer were given by more than one person

Table 5.12

Question: What does it mean to manage risks?
To take actions to minimize or eliminate risks.
To make plans to improve the operations after an incident.
To turn to consultants to manage risks.

To get resources to manage the risks that has been discovered.
To bring risks to the surface and produce plans to lower the risks.

* this answer were given by more than one person

Table 5.13

Question: What sorts of risk are most important to identify?
Risks that have high consequence or high probability are the most important to identify.*
Risks that could affect peoples health or the environment are the most important.*
Risks that have the largest consequences like catastrophes are the most important to identify.

* this answer were given by more than one person

Table 5.14

Question: Can you mention some activities to manage risk?
The risks are managed by putting someone responsible for each risk and a time plan is made for reducing the risks. The person responsible is given resources (both financial and personnel) to manage the task.
We manage risk by identifying them as they are today then we define what our goal is than we determine how to get there.
We get resources to manage the risks
We use a computer based system to administrate progress and to keep ones involved up to date.

* this answer were given by more than one person

Table 5.15

Question: What does Trelleborg mean with follow-ups of risks?
Trelleborg management doesn't follow up risks. It is up to every unit to do so.
That there are routines for how often risk analysis should be done.
There isn't done any follow up on the analysis that has been done. On our management system and the risks that it covers there is done an annual audit.
The insurance company does risk analysis and a representative from management is present during the analysis.
Have a computer based system for follow ups on rapports and analysis?

* this answer were given by more than one person

Table 5.16

Question: Who is responsible of the risks at this unit?
The production manager*

* this answer were given by more than one person

5.2.3 Analysis of the results from interviews

The interviews that were conducted had two purposes. The first was to get answers to the specific questions and the other was to get a general outlook of risk management at Trelleborg. The questions led to discussions that gave the author a sense of risk management at Trelleborg.

When asking the question: "What is risk management and how do you practice it on a daily basis? " The employees explained thoroughly what risk management was for them and how they practiced it on a daily basis. The answers differed much and also the degree of knowledge about

how risk management should be conducted according to guidelines varied much. In table 5.10 a summary of the different answers can be found. One employee answered that “risk management is when we use our management system to control the risks. Parts of the company are certified according to ISO standards which means they have to analyse the facility’s risks.” One other employee said that “An example of risk management is that employees can report risks and things they want to improve.” Both of these answers are signs of good risk management but from very different perspectives. There are several ways to interpret the result. One way is that if there had been sufficient routines and guidelines available for personnel managing the risks there wouldn’t be so much variation in what they think risk management is. One other way to interpret the result is that it is the employees’ ability to receive the information that is the problem that causes the different answers. One additional interpretation can be that there are sufficient routines but the employees haven’t been informed about them. But all of the interpretations indicate the same thing that there either is a lack of information or routines.

When the author spoke generally about risk management to the employees it became clear that there isn’t any systematic approach for update by education and training on risk issues. This conclusion was drawn from the fact that the employees haven’t been given any training on risk management and that they weren’t updated when new risks were identified. This is one of the areas were Trelleborg needs improvement. The impression that was given during the interviews was that there weren’t any feedback system from customers which could be used to report accidents, lessons learnt back to design, procedures and staff education/training. Since there aren’t any feedbacks or reporting system it will be difficult for the organization to report both incidents and near misses. The lack of system for reporting incidents also leads to lack of distribution within the company since there isn’t any information to distribute. This prohibits the personnel to learn from each others mistakes which were identified in chapter 5.1.3.1 as an important part of good risk management.

When the employees were asked the question: “What is the purpose of Trelleborg risk management?” There were a majority that said that “The purpose is to protect people, environment, goodwill, the company’s survival and clients”. These answers were very much aligned with Trelleborg risk management policy which says that Trelleborg “shall make every reasonable effort to ensure safety and reliability in its operations by protecting personnel and other persons concerned, property, know-how, goodwill, environment and other assets against accidents, damages, losses or other undesirable events “[2]. When asking the question: “What does it mean to manage risks?” there weren’t a single answer that was the same. One of the answers was: To make plans to improve the operations after an incident. Another answer was: To turn to consultants to manage risks. This indicates that the employees were given different information or has interpreted the information in different ways. This also indicates that the employee doesn’t know the difference between business continuity planning and risk management. Which indicates that there aren’t any well established routines and that the employees haven’t sufficient knowledge about how risk management should be conducted.

When asking the question: “What sorts of risk are most important to identify?” The employees were well aware that the importance of risk depended on probability or consequences or the combination of them both. According to the risk management routines at Trelleborg AB the risk that is the most important to identify is risks for catastrophe. Catastrophe is an event with high consequence but often with low probability. But since the consequence often is high the product

of consequence and probability will still be high even if the probability is low. Therefore the employees were right even though they didn't give the exact same answer.

When asking the question: "Can you mention some activities to manage risk?" there weren't a single answer that was the same. This indicates that there aren't any well established routines for managing risks. When asking the question: "What does Trelleborg mean with follow-ups of risks?" the answers still deviate from each other. When asking the question: "Who is responsible of the risks at this unit?" there wasn't anyone who didn't know that it was the general manager of each facility [2]. After having conducted interviews and studying risk management documents it is possible to answer the first question from the previous section: has Trelleborg recognized that effective risk management is essential to success? The answer is yes but they haven't managed to communicate this to a full extent to the employees.

5.2.4 Conclusions and recommendations after analyzing documents and interviews

In this section conclusions on risk management at Trelleborg and a short set of recommendations will be presented.

Trelleborg is in the starting up phase of conducting risk management, and since they are such a large organization there will be difficulties in reaching the personnel. The management has completed the first step and decided what they want to accomplish with risk management risk management and how to do it. Trelleborg AB has a good risk management policy and routines but they haven't spread all the information to all of the employees. The personnel are well aware of the general goals of risk management at Trelleborg AB but don't know how to accomplish it. The knowledge of how to conduct risk management is relative low amongst the employees. The next step for Trelleborg should be to communicate how risk management should be conducted, to the employees. Trelleborg AB also needs to guide and encourage the personnel into conducting risk management in a correct manor. This conclusion is drawn from the fact that the employees knows that they should analyse the risks that they are in charge of but they lack directions and have different ways to analyse risks in all parts of the company. During the interviews it became clear that the reason that risk management at Trelleborg AB has such a high level as it does depends on the employees that are the driving forces within the organisation. Driving forces within Trelleborg means employees who take initiatives without support from specified routines or encouragement from management. It is the driving forces at Trelleborg which makes the risk management routines functional even if there isn't any system to support them.

After conducting interviews and looking at risk management documents the author of this thesis has decided on a few recommendations for Trelleborg. The first recommendation is to create better defined routines for risk management. To be able to implement the routines in an effective manor use a computerized management system. Create a system to follow up on the analysis so that the analysis can come to use. Make it easier to report incidents and near misses. To make the employees to want to report incidents give them feedback and show the progress that has been made because of the reports. These recommendations are summarized in table 5.16.

Tabel 5.16 Recommendations

Create more defined routines for risk management.
Use a management system to make risk management more effective.
Simplify the process of incidents reporting.
Give employees feedback regarding risk analysis.

6 Establishing the content of the framework

In this chapter the contents of the framework for risk management at Trelleborg will be established. To be able to establish what should be included in the framework the framework was divided into two parts. The first part was the design of the framework and how the different parts would be integrated with each other. The second part was to choose which risk analysis methods that were going to be used in the framework. To be able to decide how the framework should be designed and how to evaluate different methods interviews and literature studies were conducted.

Since the framework includes different methods for risk analysis a process for suggesting such methods had to be constructed. The basis for this process is a set of criteria that are used to evaluate different risk analysis methods (section 6.1.1.). The importance of the different criteria for evaluating risk analysis methods were then assessed by a group of employees (section 6.2.1). Finally, the methods suitable for Trelleborg were determined by combining the employees' assessments of the importance of the different criteria and an evaluation of the different risk analysis methods according to the different criteria (section 6.3). The process is illustrated in figure 6.1.

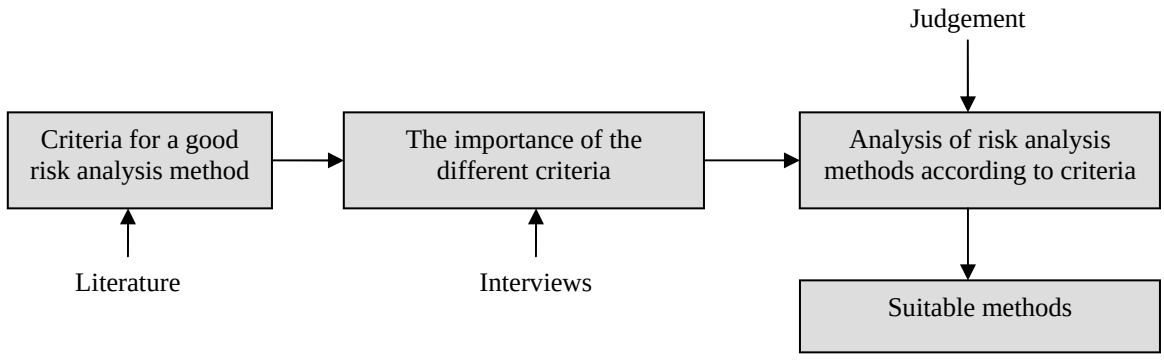

Figure 6.1. Illustration of the process of suggesting suitable risk analysis methods for the framework.

6.1 Theory on models for risk analysis

Much literature on risk management support systems was found in the literature study. However, there was only one model that could handle both quantitative and qualitative data which was needed at Trelleborg. The model that was chosen has been used as a basis for the framework. One additional article has been chosen to be the basis for the evaluation of risk analysis methods. The article is an example of how to evaluate methods by using decision analysis.

6.1.1 Theory on how to evaluate methodologies

In this section an article with the title: "*Evaluating* methodologies*: A Procedure and application to nuclear power plan siting methodologies"* is described. In the article the authors discuss the problems of deciding which technique to use when evaluating methods for decision analysis [18] regarding the location of nuclear power plants. Since one of the questions of this thesis is "what kind of criteria should the risk analysis methods comply with?" there was a need for procedures to evaluate risk analysis methods in a scientific way. The author of this thesis found many similarities between her own problem of evaluating risk analysis methods and the problems discussed by Coleen, et al. [18]. Therefore the technique used by Coleen, et al. for evaluating decision analysis methods is used as a starting point for the present study. Using the technique, which is based on decision analysis, makes it easy to see on what grounds the selection of risk analysis methods is based on. This is more scientific than to base the analysis on one person's subjective opinion.

The general approach employed when analysing the risk analysis methods is based on five steps [18]:

1. Identifying the alternative methodologies available
2. Specifying the objectives to be met by the methodology selected
3. Constructing attributes to measure the degree of attainment of the objectives
4. Describing each methodology in terms of the attributes
5. Evaluating how well each methodology achieves the overall objectives using Neumann-Morgenstern utility theory

In table 6.1 the hierarchical structure of the criteria for evaluation of the methods in reference [18] can be found. The areas of the top level in the hierarchy are: Quality of analysis, public perception, and practicality. There are many sub levels that are specific for nuclear siting methodologies and there are a few that are more general and can be used when evaluating many types of methodologies. Some of the criteria described in the sub levels will be employed evaluating risk analysis methods in the present context.

Table 6.1 Hierarchical structure of analysis methodologies [18].

1. Quality of analysis
1.1 Multiple concerns adequately considered
1.2 Comparable analysis of candidate sites
1.3 Sufficient rationale provided
1.4 Uncertainties adequately considered
1.5 Long term impacts adequately considered
1.6 Sensitivity analysis possible
1.7 Sufficient data used
2. Public Perception
2.1 Methodology understandable
2.2 Perceived public input to the selection
3. Practicality
3.1 Only commonly available expertise required
3.2 Methodology inexpensive to use

6.1.2 An example of an existing tool for risk management support

This section of the thesis is a description of a risk analysis tool proposed by Martin et al. in the article "*Combining the best attributes of Qualitative and Quantitative Risk Management Tool Support*" [19]. The tool involves a tool for qualitative identification of risks in the earlier stages of a project followed by a tool for quantitative handling for the later part of the project. The combination of the qualitative and the quantitative risk analysis methods makes it possible to fully utilize the advantages of each of the different risk analysis methods throughout the entire process. Martin et al.'s approach is especially interesting since it involves using both qualitative and quantitative analysis, which is oftentimes necessary when performing risk analysis.

The tool that the article describes consists of two parts [19]:

- RBP–risk balancing profile. This part is used during early phase of project and is a qualitative tool presentation of risks. During the earlier phases of the projects that were described the analysis is focused on costs, planning and requirements. The risks are addressed with the information that is available in the first stages of a project.
- DDP-defect, detect, prevention - is used during later phase of project. During the later phases of a project the analysis involves more detailed analysis of requirements and operations. The analysis in the later parts is primarily quantitative.

The focus of the article is combination of the two parts since they both have advantages. Since RBP was less restricted than DDP they had to make RBP more restricted to be able to use features from both parts of the tool together. But they also extended DDP with RBP like capabilities. The changes that were done made it possible to crosscheck later phase details against early phase estimates. The two parts had different features RBP named their first feature risk and DDP named it failure mode. RBP had a list over possible risks but DDP used a failure mode tree to show the connection between different incidents. DDP also had one more feature that RBP didn't the possibility to add additional risk to the list. In both parts there was a feature that connected a risk or failure mode with an activity. [19] Below features from the different tools are summarized.

Table 6.2

Feature	**Origin**
Risk List	*RBP*
Risk Priority (enumerated set): • high • medium • low • unknown, • not applicable	*RBP*
Risks • Risk from lists • Can order new risk	*DDP*
Activity List	*RBP/ DDP*
Risk Tree	*DDP*
Risk/Activity Link	*RBP/ DDP*

[19]

6.2 Criteria for risk analysis framework

To be able to determine which criteria the available, risk analysis methods should be evaluated according to interviews were conducted.

6.2.1 Interviews to determine importance of the identified criteria

A selection of features and criteria mentioned in chapter 6.1.1 and 6.1.2 were put together in a list over possible criteria to be used when evaluating risk analysis methods and the risk management framework in the present context. The list can be seen in the column to the left in table 6.3. To determine which criteria that were the most important for the future users at Trelleborg several employees, either production mangers or safety/environment managers, ranked the following criteria. The personnel ranking the criteria were given an explanation to each criterion before starting their ranking. The explanations were as follows. The criteria and the explanation can be seen in table 6.3. The employees were shown one list over all criteria. But the criteria originated from two lists. One list for general features for the framework and one list for the risk analysis methods that were going to be used in the framework. The list over the criteria for the framework can be seen in table 6.4 and the list of the criteria for the risk analysis methods can be seen in table 6.5. The reason for putting them into the same list during the interviews was to make it easier for the person being interviewed to select the features that were the most important to him or her.

Table 6.3 Criteria for framework and method for risk analysis

1.	Thorough analysis	Is an analysis that analyses all parts of an object/ facility thoroughly
2.	Overview analysis	Is an analysis that analyses the larger parts of an object/facility and identifying needs for further analysis?
3.	Simplicity to generate statistics	An analysis which makes it possible to ad frequencies and consequences to risks that have been identified.
4.	Possibility to connect to incident reports	The analysis can be connected to incident reports and almost incident rapports.
5.	Possibility to do follow-ups	It is possible to follow up on completed analysis and see how much progress or retreat that has been done.
6.	Possibility to consider different causes and aspects	It is possible to consider several causes to one risk.
7.	The analysis should be comparable in between	The analyses could be compared in between and to be able to do so the analysis done should consider the same parameters and risks.
8.	There are sufficient data to support the results	It should not be possible to perform the analysis without sufficient data to support the results.

9.	The results are logical	It should be possible to check if the results are logical.
10.	The uncertainties are taken in to the calculations	It should be possible to rank how certain the data in the analyses are.
11.	Considers long time effects	Risks that could arise after a long time is possible to identify.
12.	Sensitivity analysis is possible	It should be possible to analyse errors and weaknesses in the analyses done.
13.	Ability to handle both qualitative and quantitative data	Ability to both handle deterministic data and statistic data.
14.	Possible to rank the risk in between	It should be possible to compare different risks and to decide which the most severe risk is.
15.	Possible to analyse course of events	It is possible to analyse risks that could be the outcome when several incidents happens at the same time or after each other.
16.	Possibility to choose risks from list	To have a previous put together list where you could choose risks from.
17.	Possibility to type in additional risk	It should be possible to complement the list by adding additional risk that has been overlooked by the person that has put the list together.

Table 6.4 Criteria for general features for framework

4	Possibility to connect to incident reports
8	There are sufficient data to support the results
11	Considers long time effects
13	Ability to handle both qualitative and quantitative data
16	Possibility to choose risks from list
17	Possibility to type in additional risk

Table 6.5 Criteria for methods for risk analysis

1	Thorough analysis
2	Overview analysis
3	Simplicity to generate statistics
5	Possibility to do follow-ups
6	Possibility to consider different causes and aspects
7	The analysis should be comparable in between

10	The uncertainties are taken in to the calculations
12	Sensitivity analysis is possible
14	Possible to rank the risk amongst each other.
15	Possible to analyse course of events

6.2.2 Results from interview

The results from the interviews have been divided into the two groups mentioned in the section before: criteria for choice of risk analysis methods and criteria for the design of a risk management framework for Trelleborg. During the interviews the employees were given the opportunity to rank the different criteria for the evaluation of risk analysis methods and risk management framework. The top 6 criteria for evaluation of the risk analysis methods can be found in table 6.6. The top 9 criteria for the design of a framework for risk management can be found in table 6.7.

Table 6.6 Ranked criteria for framework

1	Possibility to choose risks from list
2	Possibility to type in additional risk
3	Possibility to connect to incident reports
4	Ability to handle both qualitative and quantitative data
5	There are sufficient data to support the results
6	Considers long time effects

Table 6.7 Ranked criteria for risk analysis methods

1	Possible to rank the risk in between
2	Overview analysis
3	Thorough analysis
4	Possible to analyse course of events
5	Simplicity to generate statistics
6	Possibility to consider different causes and aspects
7	The insecurities are taken in to the calculations
8	Possibility to do follow-ups
9	Sensitivity analysis is possible

6.3 Analysis according to established criteria

In this section each risk analysis method will be evaluated according to the established criteria. The criteria for the model will be added to the prior established features for good risk management that was found in chapter 4.

6.3.1 Analysis of risk analysis methods according to criteria

In this section the analysis of the identified criteria will be presented. In table 6.7 there is a list over the ranked criteria for risk analysis methods. Since many of the interviewed personal were less sure of the criteria they ranked as least important, the top five criteria was chosen to be used in the analysis and therefore it is only the top five criteria that can be seen in the second column in table 6.8. Each of the chosen risk analysis methods will be analysed in this chapter according to the different criteria. The analysed methods will be given a grade 1, 2 or 3. 1 if there is little or none compliance with the criteria, 2 if there is some compliance with the criteria and 3 if there is much compliance with the criteria. In table 6.8 the grading of the different methods can be seen. The analysis methods that can provide thorough analysis are: Hazop, What if, Index methods, FMEA, QRA, PRA and ETA [10,11]. These methods can provide thorough analysis by breaking down parts of processes into small parts and analysing how they affect each other. These methods will be given the grade 3 for the criteria “thorough analysis”. Checklists can be designed with more or less thorough questions, but is normally used for more overview analysis, and will therefore get the grade 2 for thorough analysis. The analysis method that provides the best overview analysis is preliminary risk analysis method (grovanalys). Preliminary risk analysis is mostly used to analyse larger parts of a facility and identifying needs for more thorough analysis. It is often the first step of risk analysis. Preliminary risk analysis will be given the grade 3 for overview analysis. Checklists can be used for both overview and thorough analysis and will therefore be given the grade 2. The analysis methods that make it simple to generate statistics are QRA and PRA. These are both methods that demands data on failure or incident data which is needed if statistics is to be generated. Both methods also uses failure trees which makes it easy to create statistics over different combinations of events. QRA and PRA will be given the grade 3 for simplicity to generate statistics. Index method, FMEA and ETA will be given the grade 2 in this criterion. Analysis methods that makes it possible to rank the risk in between should make it possible to compare different risks and to decide which is most severe. Checklists will be given the grade 3 in this criterion. The analysis methods which make it possible to analyse course of events are: Preliminary risk analysis, Haz-Op, What If, FMEA, QRA, PRA and ETA. These methods make it possible to analyse risks that could be the outcome when several incidents happens at the same time or after each other. In table 6.8 the summarization of the grading that was described above can be seen.

Table 6.8 Top 5 criteria and graded risk analysis methods

Weight	Criteria	Prelim-inary risk analysis	Haz-Op	What –If	Check -lists	Index - method	FMEA	QRA	PRA	ETA
5	Possible to rank the risk in between	3	1	1	2	1	1	1	1	1
4	Overview analysis	3	1	1	2	1	1	1	1	1
3	Thorough analysis	1	3	3	2	3	3	3	3	3
2	Possible to analyse course of events	3	3	3	1	1	3	3	3	3
1	Simplicity to generate statistics	1	1	1	1	2	2	3	2	2

In order to use the ranked criteria in calculations the criteria were given a weight. The criteria were given a weight between 5 and 1. The criterion judged to be most important by the employees were given a weight of 5 and the least important were given a weight of 1.

A final ranking of each risk analysis method was established by multiplying each of its grades for the different criteria by the weight of the particular criterion and then summarizing these products. The methods with the highest numbers were chosen to be included in the framework. The calculations with results can be seen in table 6.9.

Table 6.9 Calculated ranking of risk analysis methods by multiplying grade of method with weight of criteria and summarizing them for each method.

New Nbr.	Criteria	Prelim-inary risk analysis	Haz-Op	What –If	Check -lists	Index - method	FMEA	QRA	PRA	ETA
5	Possible to rank the risk in between	5	5	5	15	5	5	5	5	5
4	Overview analysis	12	4	4	8	4	4	4	4	4
3	Thorough analysis	3	9	9	6	9	9	9	9	9
2	Possible to analyse course of events	6	6	6	2	2	6	6	6	6
1	Simplicity to generate statistics	1	1	1	1	2	2	3	3	2
	$\sum$	27	25	25	32	22	26	27	27	26

The results and ranking of methods can be seen in table 6.10. The method with the highest total grade is ranked as number one and so on.

Table 6.10 Ranked risk analysis methods

1	Check lists	32
2	Preliminary risk analysis	27
3	QRA	27
4	PRA	27
5	ETA	26
6	FMEA	26
7	Haz-Op	25
8	What If	25
9	Index method	22

6.3.2 Suggesting a framework for risk management

In the framework for risk management different aspects will be weighed both in those aspects that were identified in chapter 5 as insufficient and those criteria that were chosen by the employees. Because there was so much difference in importance in-between the criteria the top four criteria have been chosen and can be seen in table 6.11.

Table 6.11 Top 4 criteria for the framework for risk management

1	Possibility to choose risks from list
2	Possibility to type in additional risk
3	Possibility to connect to incident reports
4	Ability to handle both qualitative and quantitative data

According to the analysis done in chapter 5 there are several aspects that Trelleborg risk management needs to improve. These aspects have been summarized in table 6.12 and had its origin in table 5.4, 5.5 and 5.16. The aspects in table 6.12 will be taken into consideration when designing the framework for risk management support.

Table 6.12 Aspects that the framework will facilitate.

System for monitoring the procedures and make sure that weaknesses in the organisation are corrected.
System for monitoring risk management performance.
Formal staff reporting system.
Report both incidents and near misses.
Confidential blame free accident reporting.
System for feedback to management.
Feedback system from customers and lessons learnt back to design, procedures and staff education/training.
Provides an instrument to facilitate knowledge and ideas to be transmitted within the organization.
Distribution within the company so that all personnel can learn from each others mistakes.
Acquires knowledge from employees experiences from all levels of the organization.

7 The Framework

The framework for risk management for Trelleborg AB is described in this chapter. The framework consists of two parts. The first part is the general features and the second part is the risk analysis methods that will be used when analysing the risks at Trelleborg. The general features are features in the framework that will support risk managers at Trelleborg. The analysis methods are the methods that have been chosen according to the criteria that the employees evaluated. A summarization of features that is included in the framework can be found in table 7.1. The whole model can be found in appendix A. In appendix A each frame in the framework is marked with a number from 1 to 41 and will be referred to as page 1-41 in the description of the framework below.

Table 7.1 Features that is included in the risk management framework for Trelleborg AB.

Model summary

1 General features

1.1. System for monitoring the procedures and to make sure that weaknesses in the organisation are corrected.
1.2. System for monitoring risk management performance.
1.3. Ability to handle both qualitative and quantitative data.
1.4. Provides an instrument to facilitate knowledge and ideas to be transmitted within the organization.
  1.4.1. Formal staff reporting system.
  1.4.2. Report both incidents and near misses.
  1.4.3. Confidential blame free accident reporting.
  1.4.4. Possibility to connect to incident reports.
  1.4.5. Distribution within the company so that all personnel can learn from each others mistakes.
  1.4.6. Feedback system from customers and lessons learnt back to design, procedures and staff education/ training.
  1.4.7. Learns from employees experiences from all levels of the organization.
  1.4.8. System for feedback to management.

2 Risk analysis methods

2.1. Check lists
2.2. Preliminary risk analysis
  2.2.1. Possibility to choose risks from list.
  2.2.2. Possibility to type in additional risk.
2.3. QRA
  2.3.1. CBA

7.1 General features

The framework is designed to be a risk management support and help risk managers to get an overview of risk management activities. The support comes from creating the possibility to illustrate weaknesses by having a system that makes it possible to chose which results to be shown. One example is to only show the risks that needs immediate attention. Another example is to show how the results from a certain analysis have developed over several years and see if the company has made progress or not. One additional feature is the possibility to connect the risk management framework with incident reports and creating the possibility to use reported frequencies of accidents in the analysis. To be able to combine all the necessary features IECs simplified relationship between risk analysis and other risk management activities is used to illustrate the different parts of the risk management process. Figure 7.1 shows the relationship between different risk management activities according to the IEC. [3]

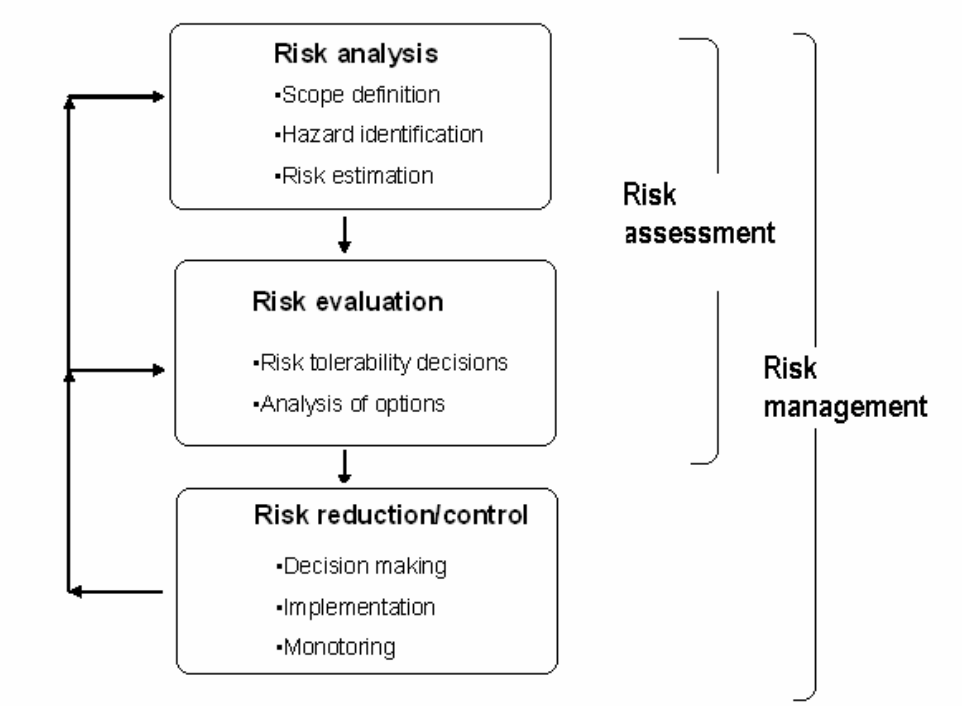

Figure 7.1 The IEC's simplified relationship between risk analysis and other risk management activities.

The three activities shown in figure 7.1 that represent the essential decision-making steps in the risk management process are each involved in examining different aspects of risk problem.

7.2 Risk analysis methods

The analysis methods that are used in this framework are check lists, preliminary risk analysis, QRA-Quantitative Risk Analysis and cost benefit analysis. These methods are described in chapter 4. Since the methods are described in chapter 4 this chapter will only consist of a description of how the methods should function together and how they should be used in a risk management system.

7.2.1 Checklists

As mentioned in chapter 4 checklists can be used to control that activities meet the requirements. In appendix A page 7 the checklist page can be found. In page 7 there are buttons which leads to five different options: checklist information, checklist areas, checklist statistics, checklist formulary and checklist history. The Checklist information button leads to page 8 which contains general information on purpose of the analysis and how it should be conducted. The check list area button leads to page 9 which contains a list over the different checklist areas. The checklist statistics button leads to page 22 and contains diagrams on the analysis that have been done. It is a graphical comparison between the different years. The checklist formulary button leads to page 19-20 which contains the checklist formulary. The checklist history button leads to page 21 which contains a list with links to all analysis that have been done.

7.2.2 Preliminary Risk analysis

Preliminary risk analysis is a method that is described in chapter 4. The method can be used to get a rough overall picture of the risks in a facility or system. It is a method that brings up the most critical risk to the surface so that they can be analysed more thoroughly with a more detailed risk analysis method. In appendix A page 10 the PRA page can be found. On the PRA page four buttons can be found: PRA information, PRA history, PRA statistics and New PRA. The PRA information button leads to page 11 which contains information on how PRA analysis should be conducted. The PRA history button leads to page 12 which contains a list with links to all analysis that have been done. The PRA statistics button leads to page 15 which contains a list of the risk that has been identified during the analysis. The new PRA button leads to a new PRA formulary which can be used and submitted.

7.2.3 QRA

As mentioned in chapter 4 QRA (Quantitative Risk Analysis) is a quantitative method which answers the three following questions: What can go wrong? How likely is it? What are the consequences? [12] In appendix A page 16 the QRA page can be found. On the QRA page three buttons can be found: new report, history and statistics. Information on PRA can also be found on this page. The new report button leads to page 30 in which a new QRA formulary can be found. The history button leads to page 31 which contains a list with links to all conducted analysis. The statistics button leads to statistics from reports that can be used in the analysis instead of using estimated frequencies. When a QRA analysis have been done it should be possible to do a Cost benefit analysis, which is described in chapter 4, on page 37 in appendix A.

7.2.4 Cost benefit analysis (CBA)

As mentioned in chapter 4 Cost benefit analysis (CBA) is done by going through certain steps: Identify a set of alternative projects, list the impacts, predict the impacts quantitatively, put money values to all impacts [6] these steps are very similar to QRA steps: What can go wrong? How likely is it? What are the consequences? [12]. Therefore the author has chosen that it should be possible to connect the QRA analysis to the CBA analysis. As mentioned above, page 37 QRA-CBA page can be reached directly from the QRA analysis. But it can also be reached from page 38. Page 37 contains the form that should be used when performing CBA analysis and it also contains a link to contact information for the person responsible for the risk, this contact

information can be seen in page 41. Page 38 is the CBA page whith links to CBA analysis, old analysis, new QRA analysis and completed QRA analysis. In page 39 the completed CBA analysis can be reached.

7.3 Improof

In this section a programme in which the framework will be integrated in will be explained. Improof is a Lotus Notes application, which is an application many companies uses to handle mail and documents. Improof is used by Trelleborg protective in Ystad, together with a few other Trelleborg subsidiaries, uses to handle incident reports and to coordinate follow ups according to their management system based on ISO 1400 [20]. The aim of the program is according to the manual to facilitate a swift and controlled management of change and improvements tasks. [21] In table 7.2 the basic routines in the program is listed.

Table 7.2 Basic routines for handling an errand [21]

1	Errand for improvements is registered.
2	The errand is investigated and the cause is identified.
3	Decision is made about what measures that should be taken.
4	Follow ups are done to control if the measures had any effect.

Some of Improof's many functions can be seen in figure 7.2. The image in figure 7.2 is the first frame in Improof. The frame contains links to all the features in the application: management, resources, processes, methods, evaluation, and development. The different functions in the image are clickable and lead to their respective function.

Table 7.3 Functions in Improof

Controlled errand flow:	With measure and follow up management.
Possibility to overview:	Inspection reports on ongoing errands with status lights.
Follow up and decision routines:	With dynamic reports on for example costs, number of errands and time guide.
Connected documents:	Files can be connected directly to errands.
Alarm and emergency functions:	Automatic email to person responsible when an errand has high priority or is delayed.
Export function to Word /Excel:	Simple to export information to Word or Excel.

[21]

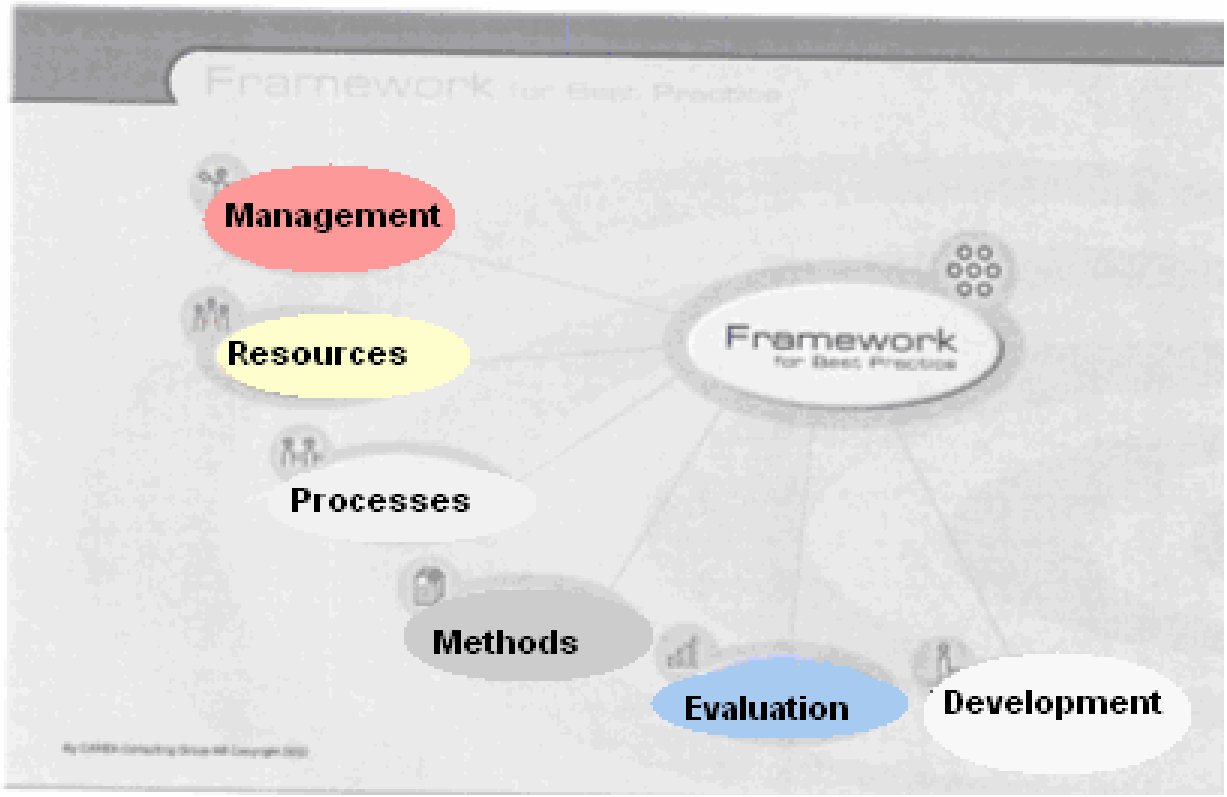

Figure 7.2 Image of the translated first frame in Improof [21].

7.3.1 Event reporting

One of Improof's functions is the event reporting system which has four functions. The functions are listed in table 7.4. The reports are submitted through a web-formulary. The person that is reporting an event fills out the web formulary by entering name and email, category (is listed in table 7.5) and description of the event [20]. The report is registered and the person who is responsible for the category gets an email and the task is added to his or hers errands [20]. The person who reported the event will get feedback through mail when the report leads to measures [20].

Table 7.4 Events reported through Event reporting function.

Deviation
Reclamation
Suggestion for improvement
Incident report

[21]

Table 7.5 Categories for event reports

Work environment
Fire protection
Delivery note/ order number
Suggestions for improvement
Complaints from customer
Deviation from quality
Delivery
Environment
Reclamations
Returned article from customer
Returned article to supplier
Scrap an article
Damage from transportation
Other

[21]

8 Discussion

In this section several aspects from this thesis will be discussed. Both the topics that have been dealt with in the thesis and those that should be studied in the future are discussed.

The first question that was asked was: What is good risk management and how can the quality of risk management be determined in a company? This is a difficult question to answer although there are plenty literature regarding risk management. The difficulties lie in finding the most fitting literature and to authenticate that the literature that is chosen is the most fitting. When it comes to choosing the correct literature this has been done by looking for literature that describes risk management in a way that makes it possible to review a risk management system with features from the literature. To make it possible to use the features described in the literature it had to give clear direction and preferably be built around a few points or questions. Both The 4 C:s and INSAG:s documents were built up like that.

This risk management framework has the possibility to have a large impact on risk management at Trelleborg. There will be an impact if Trelleborg expands their current program Improof with the features recommended in this thesis. If this is done they will have a framework that will simplify the risk management process because it will no longer be limited to risk identification but it will also include risk handling and follow up as well. In time this will lead to much better long term planning concerning risks.

To answer the second question “in what areas within risk management does Trelleborg need improvements?” there were many difficulties. One of the difficulties was to get correct information from several different sources. When dealing with these kinds of subjects there are always two or more sides. The first side is the management side and on this side there are clear directions and goals together with written routines. On this side everyone in the organisation uses the routines and is well aware of the goal and in most cases the management strives to achieve it. On the other side there are employees that aren’t aware of the routines they are supposed to use or they think their own way of doing this is better. This problem is present at Trelleborg. There is no correct answer to the question “in what areas within risk management does Trelleborg need improvements?”. The recommendations that are given in this thesis are built on information from both sides. The full answer to the second question:” what areas within risk management do Trelleborg need improvements?” can be found in chapter 5 and the conclusions in chapter 10.

The third question “how can the areas within risk management where Trelleborg needs improvements be improved and implemented in a framework for risk management”. This question led to a series of more detailed questions such as “which criteria should the chosen framework comply with?”, “which information is needed to establish the criteria?”, “which risk analysis methods comply with the criteria in the best way?”. The first difficulty in answering these questions was not to answer them but to authenticate the answer. It would have been easy to choose criteria, which suited the author of this thesis and then make a subjective analysis of the methods according to these criteria. But this thesis answer were authenticated by literature studies which led to suggestions for criteria that later where ranked by employees at Trelleborg. The

employees at Trelleborg were chosen because they dealt with risk management issues everyday. Had there been more time, a greater number of employees would have been included in the study. But the employees that where included is representative for Trelleborg. The result from the interviews varied much because of the differentiated knowledge within risk management among the employees.

At the start-up of this thesis it was meant to have resulted in a suggestion for a completely new system for risk management. After interviewing personnel at Trelleborg an already existing system was discovered. It was Trelleborg Protective that has a system for incident reporting and revision. The system is called Improof and is described in chapter 7. After the discovery of the existing system there was a need for changing the direction of this thesis since there was no longer a need within Trelleborg AB for a completely new system. Improof makes it possible to report incidents and to administrate follow up on the reports. This could easily be connected to risk analysis in the way it is mentioned in chapter 7. Even if there still isn't any global system, within Trelleborg for incident reports that could be connected to risk analysis, this system could easily be expanded to other subsidiaries.

After literature studies and interviews, enough information had been gathered to design the framework. This brought up a new difficulty. Which of the identified weaknesses should the framework consider? During the interviews it was established that Trelleborg had a good policy but lacked systematic routines. Therefore the focus was on creating a framework with routines for risk management. The different ingredients in the framework are put together in a way so that all selected features were included.

To be able to use this model in a correct way there has to be a database with statistic from Trelleborg operations. It will probably take time before they have statistics on all risks. Until there are sufficient statistics the analysis has to be done in the traditional way where persons with experience evaluate the risks. During this time the implemented framework can be used for incident reporting, for administrating conducted analyses, and monitoring follow-ups. The implemented framework will make it easier to do the analysis in a more structured way. It will also make it easier to do follow ups and to compare different areas when there are need for prioritizing between investments.

9 Conclusions

In this section conclusions from this thesis will be presented and the questions that were asked in the beginning of the thesis will be answered.

The main aim of this thesis is to design a framework for risk management for Trelleborg AB. To be able to design the framework this thesis sheds light on the following more specific questions.

- What is good risk management and how can the quality of risk management be determined in a company?
- In what areas within risk management does Trelleborg need improvements?
- The following questions will answer how the identified good risk management and the needs at Trelleborg can lead to a framework: Which criteria should the chosen framework for risk management comply with? Which information is needed to establish the criteria? Which risk analysis methods comply with the criteria in the best way?

9.1 Conclusions on good risk management

The first question was answered by literature studies and the results were shown and discussed in chapter 4. The IEC' features for risk management, INSAG and 4 C's were chosen as guidelines that represent good risk management. Both INSAG and the 4C's were divided into lists over aspects that need to be considered when conducting risk management. Therefore they were both fitting for analysis of quality of risk management [8] [9]. There were several factors that made the author chose the IEC characteristic for risk management to be the base in the framework. The first reason is that IEC is a well known and accepted organisation for standardization [3]. The second reason is that the feature simplifies the connections between the different parts of risk management. It simplifies the connection by including risk analysis, risk evaluation, risk control and the connections in-between. The last reason could be very important when Trelleborg shall manage the risk in such a large organisation because it creates simple interfaces between the different stages in the risk management process.

Another feature that was chosen as good risk management was Cost Benefit Analysis (CBA) the reason for choosing it is that it will make it easier for Trelleborg to compare different investments benefits. It is important to make some kind of decision after a risk analysis is done. The reason for this is that otherwise the time the analyst has put into the analysis will go to waste and the analysis will make no difference. This could happen if the analyst creates a report with results and recommendations without anyone making sure that measures are taken or follows up on analysis to make sure that the risks are lowered or transferred.

It has been identified during assembly of this thesis that good risk management includes organisational aspect such as safety culture and commitment to safety and to improvement of the safety culture. It has also been identified that to have good risk management the organisation needs risk analysis methods that are applicable to the specific risks that the organisation in question faces.

9.2 Conclusions on risk management at Trelleborg AB

Through studies of risk management documents and interviews the author of this thesis has come to the conclusion that Trelleborg has a well written risk management policy and risk management guidelines. It has also been discovered trough interviews that the policy is well communicated within the company and the personnel are well aware of the purpose of risk management at Trelleborg AB. This is shown by the fact that the employees are committed to the policy and knows that risk management is important for the company. Through the interviews it was established that there are no established routines for analysis, feedback and follow ups. This is shown by the fact that the employees knows that they should analyse the risks that they are in charge of. However, they lack directions and have different ways to analyse risks in all parts of the company. During the interviews it became clear that the reason that risk management at Trelleborg AB has such a high level as it has depends on the employees that are the driving forces within the organisation. Driving forces within Trelleborg means employees who take initiatives without support from specified routines or encouragement from management. It is the driving forces at Trelleborg which makes the risk management routines functional even if there isn't any system to support them. Trelleborg weakness lies in that there isn't any system for controlling and following up on the analysis that has been done and there isn't any global system for incident reporting. It is crucial for top management in a large organisation to have insight of risk management on a local level. If there is a lack of insight it can result in that Trelleborg will be vulnerable if they lose the personnel that are the driving forces since they have no system that could lead the less experienced personnel.

9.3 Conclusions on the framework for risk management support

The questions: "which criteria should the chosen framework for risk management comply with?", "which information is needed to establish the criteria?" And "which risk analysis methods comply with the criteria in the best way?" were answered by interviews where the personnel ranked the criteria for the risk analysis methods and the criteria for the risk management framework.

The top five criteria for risk analysis methods were overview analysis, possible to rank the risk in between, thorough analysis, possible to analyse course of events and simplicity in generating statistics. This shows that the model had to consist of more than one analysis method since the employees found it important to have the possibility to both have a thorough analysis and an overview analysis. The employees also found it important that statistics is simple to generate which makes it important to connect the analysis with incident reporting. The analysis methods that were chosen are checklists, preliminary risk analysis and QRA which will constitute a good mix of risk analysis that fills different needs. Checklists, which can be used both for overview analysis and thorough analysis, will make it possible to do non time consuming analysis and control predefined risks. Preliminary risk analysis will make it possible to do overview risk analysis that could be used to identify areas that need more thorough analysis. QRA will make it possible to do thorough analysis and to quantify the size on specific risks which will help the company to rank the risks in between.

The top four criteria for risk management framework were: possibility to choose risks from list, possibility to type in additional risk, possibility to connect to incident reports and ability to handle both qualitative and quantitative data. All four of these criteria are aligned with good risk management and possible to integrate in Improof. The possibility to choose risk from a list makes it possible for personnel that are inexperienced within risk management to analyse risks. The possibility to ad additional risk makes it possible to ad new risks. The possibility to connect with incident report makes it possible to use the incident reports to discover new risks. The ability to handle both qualitative and quantitative data makes it possible to analyse the risks that aren't possible to quantify together with the ones that are.

If the framework that has been designed is integrated in Improof, which is described in chapter 7, it can be an efficient help for personnel responsible for risk management. It can also be a way to create a system that makes it easier to discuss and compare risk analysis for the central risk management functions. The model can also be a way to transfer knowledge within the company so that everybody can learn from each other's experience or mistakes. In addition, it can also be used as a system for control and follow-up of risk analyses.

9.4 Conclusions about the future

There are opportunities for improvement at Trelleborg AB, within risk management, even with small means. By using the existing system Improof, with some expansion, Trelleborg could easily get a system that spreads information, compares analysis, creates statistics, render possibility to follow up on already made analysis, give feedback to those who has done the analysis and most important make it possible to see the changes that come with the analysis.

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10.3 Verbal sources

RM Trelleborg AB

Bertil Nilsson, Energy supply manager

Per Nilsson, Quality- and Environmental Manager, TWS Materials

Thorsten Bladh, General manager, TWS Materials

Stefan Ekstrom, General manager, Agri

Ulf Lundgren, Quality- and Environmental Manager, Mould design, Agri

Karl-Erik Karlsson, Quality- and Environmental Manager

Appendix A

Model of a Risk management Tool for Trelleborg AB

Model summary

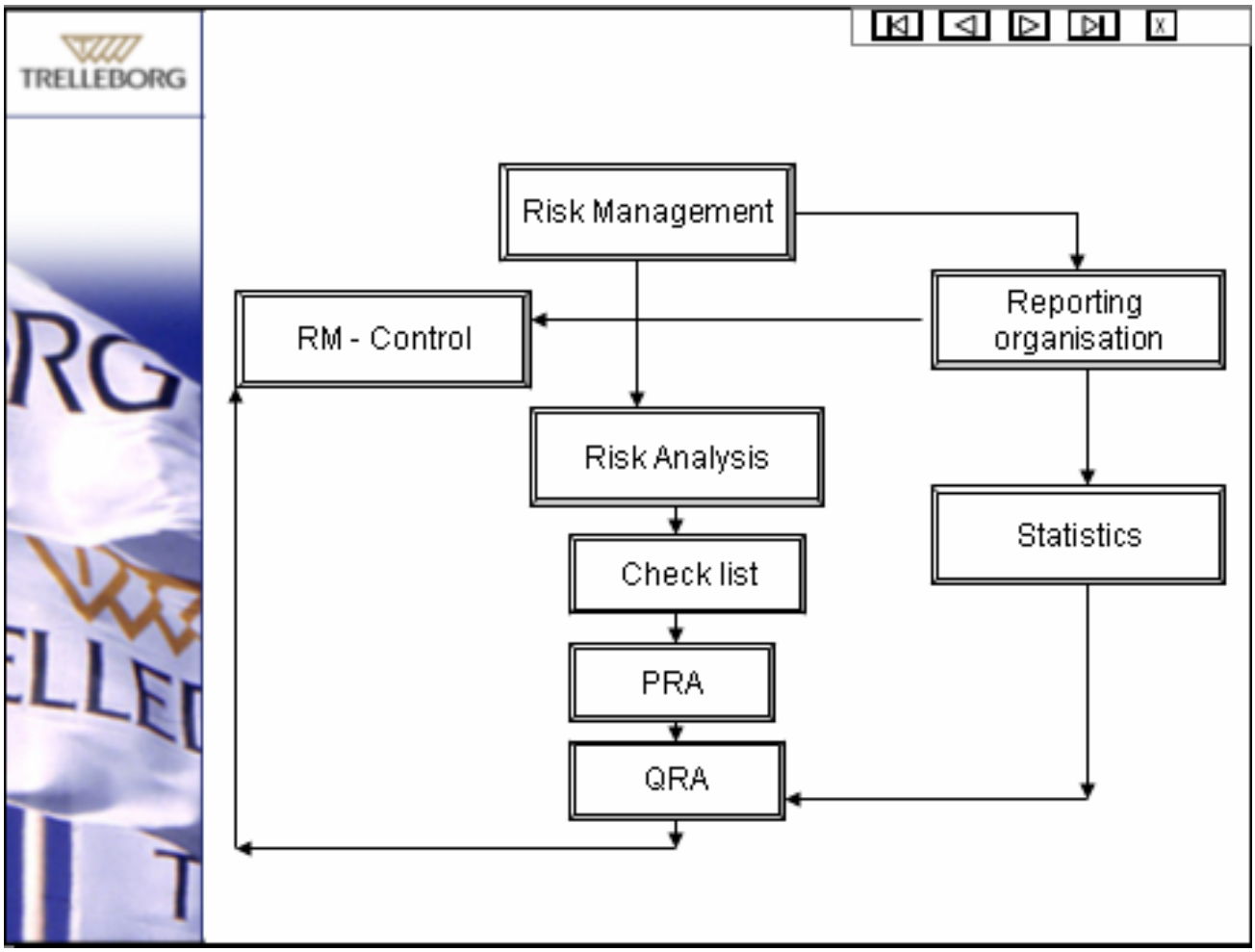
1 General features

1.1. System for monitoring the procedures and make sure that weaknesses in the organisation are corrected.
1.2. System for monitoring risk management performance.
1.3. Ability to handle both qualitative and quantitative data.
1.4. Provides an instrument to facilitate knowledge and ideas to be transmitted within the organization.
- 1.4.1. Formal staff reporting system.
- 1.4.2. Report both incidents and near misses.
- 1.4.3. Confidential blame free accident reporting.
- 1.4.4. Possibility to connect to incident reports.
- 1.4.5. Distribution within the company so that all personnel can learn from each others mistakes.
- 1.4.6. Feedback system from customers and lessons learnt back to design, procedures and staff education/ training.
- 1.4.7. Learns from employees experiences from all levels of the organization.
- 1.4.8. System for feedback to management.

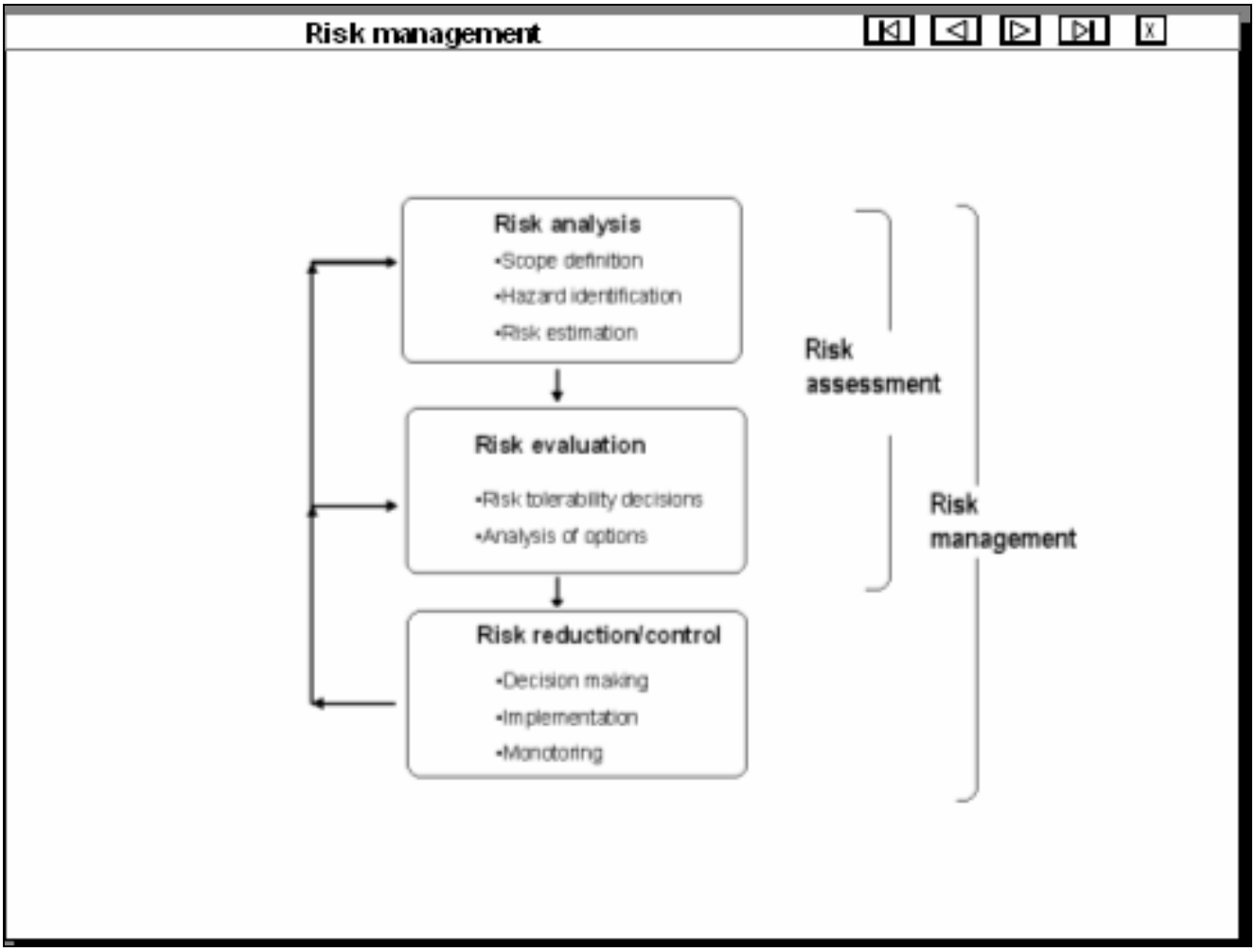
2 Analysis methods

2.1. Check lists
2.2. Preliminary risk analysis
- 2.2.1. Possibility to choose risks from list.
- 2.2.2. Possibility to type in additional risk.

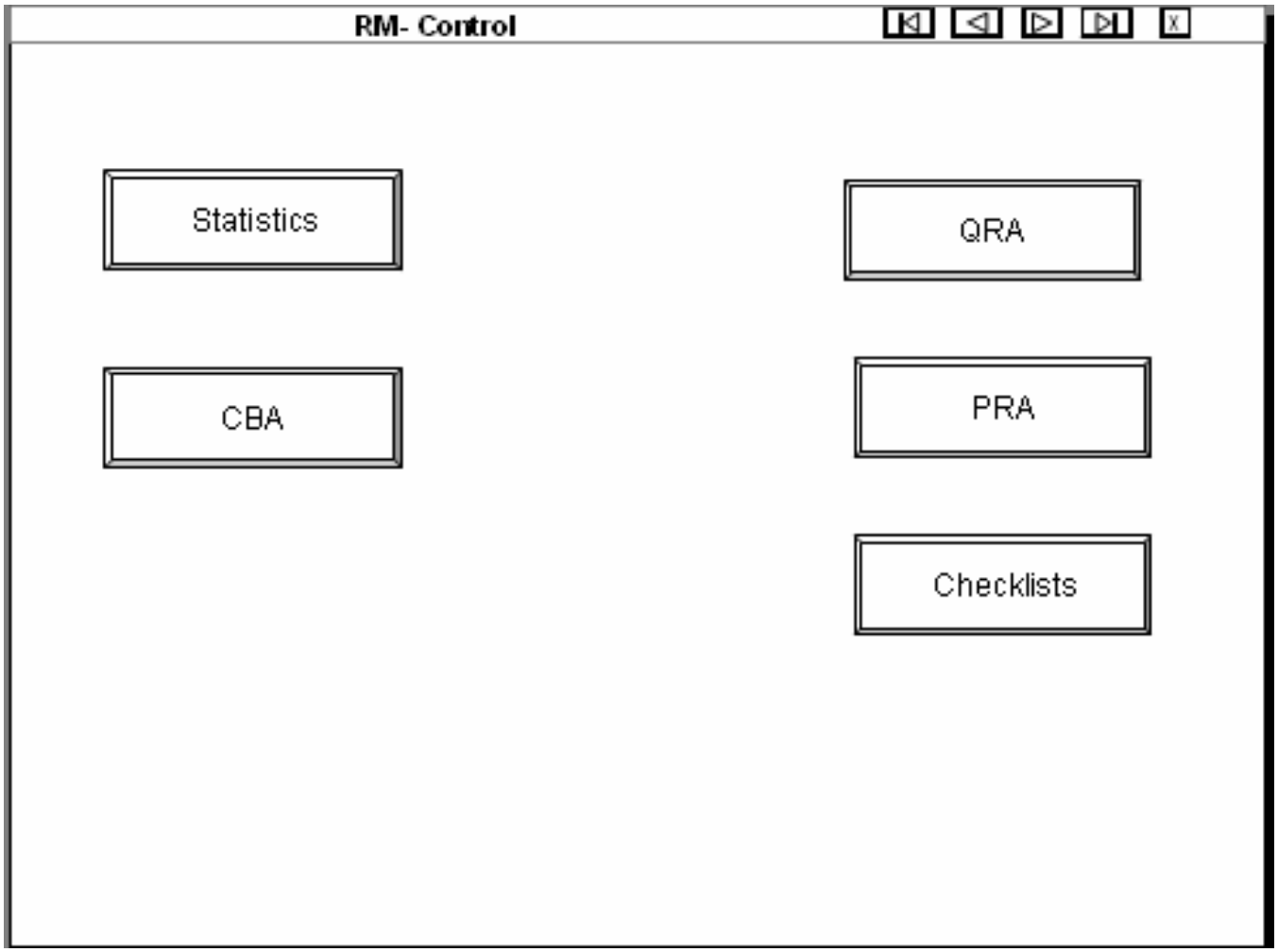
2.3. QRA
- 2.3.1. CBA



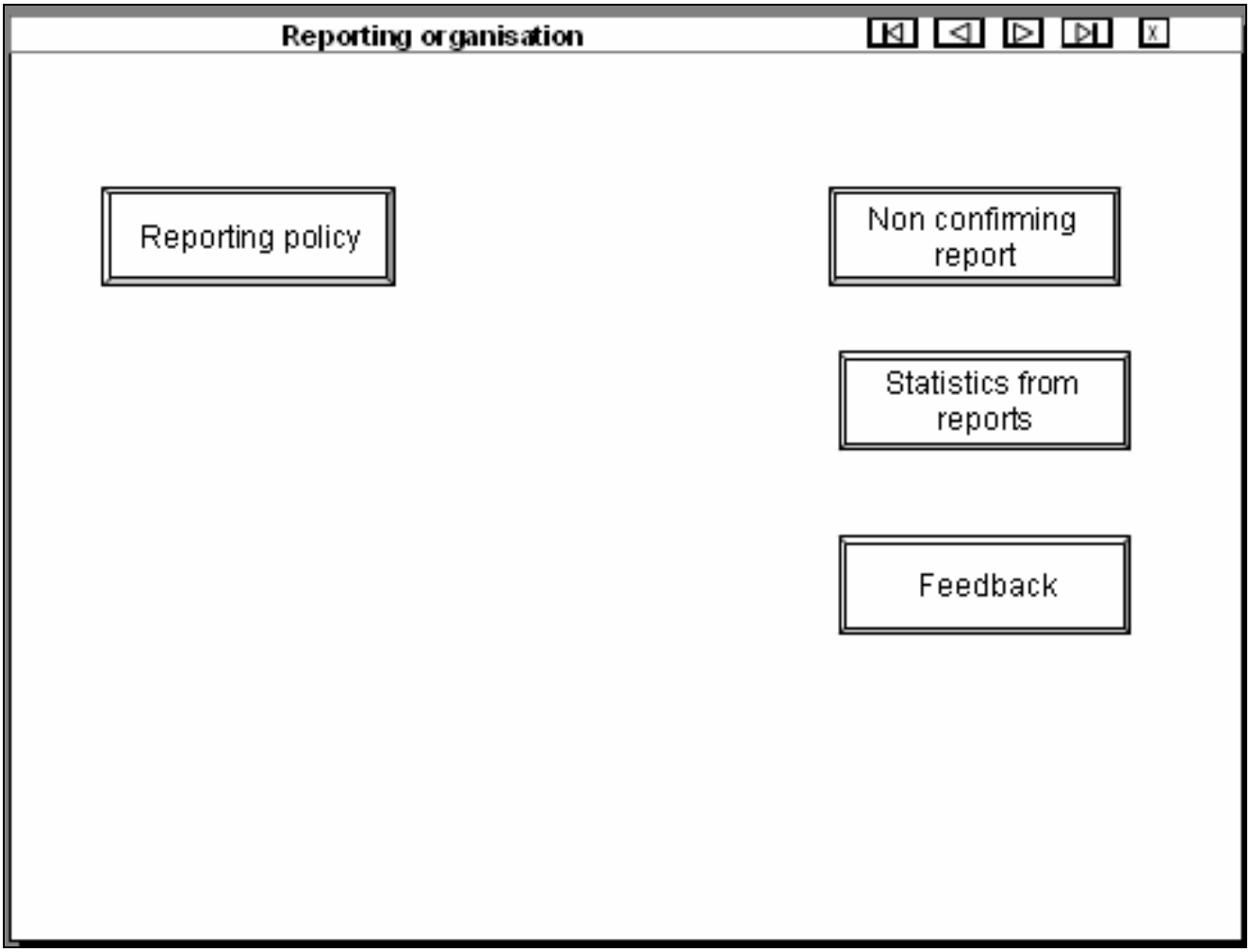
Page 1).This is the first page when opening the tool. The page shows an overview of the part of which the tool consists of. The different parts are reached by clicking on parts of the page.



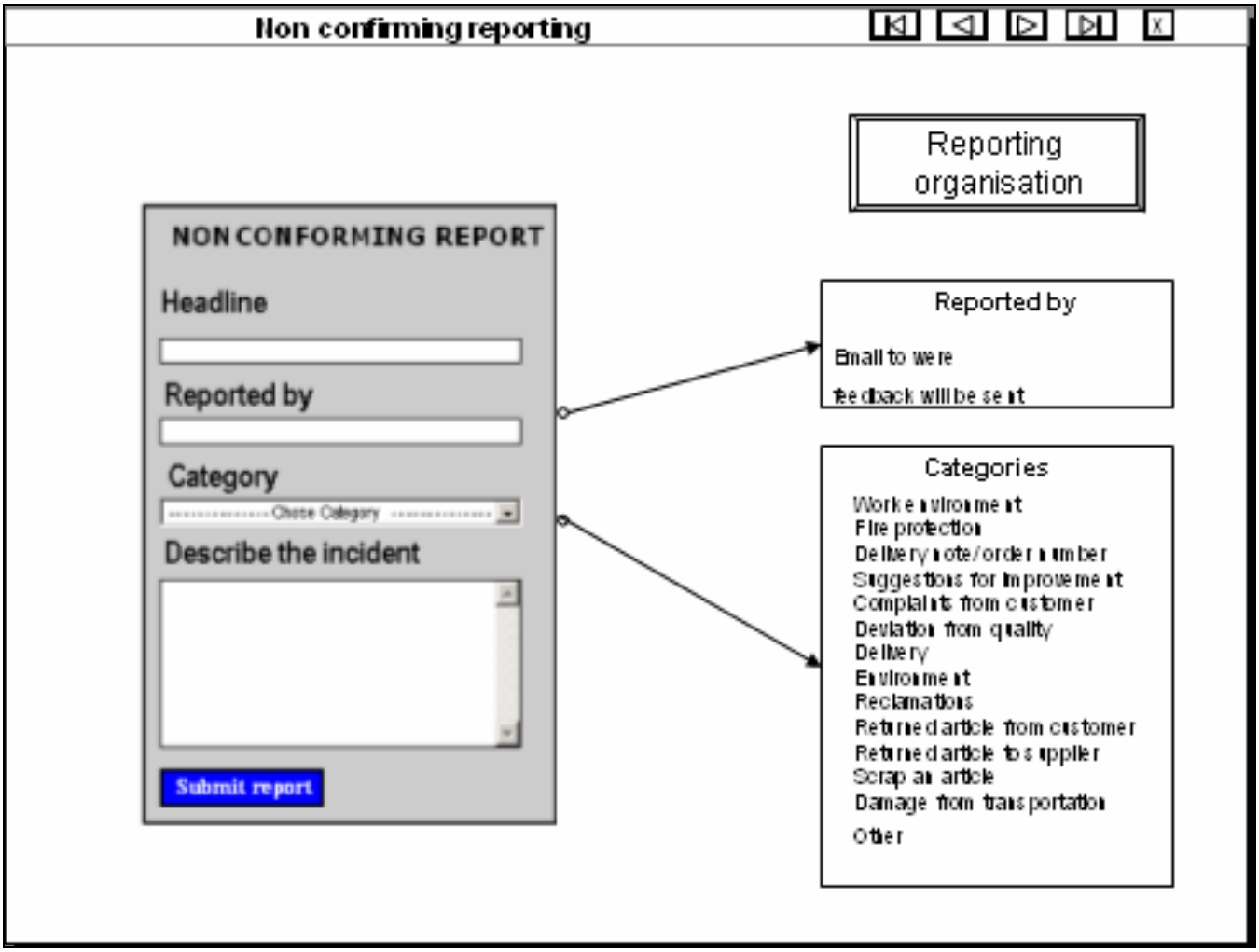
Page 2) This page shows the connection by which the tool is built on. [8]



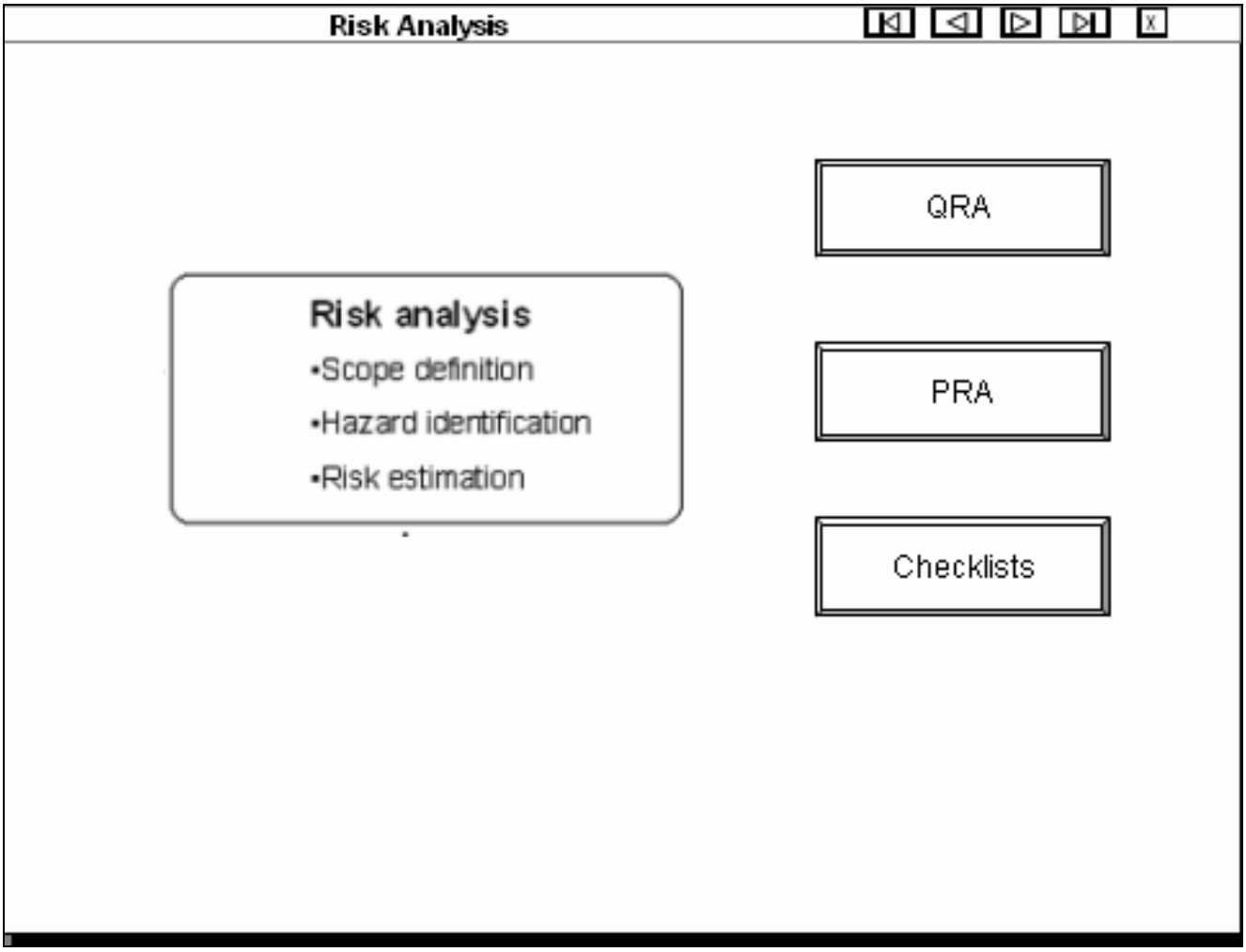
Page 3) This page is the RM control page were statistics from incidents reports and results from risk analysis can be reached by clicking on the push buttons.



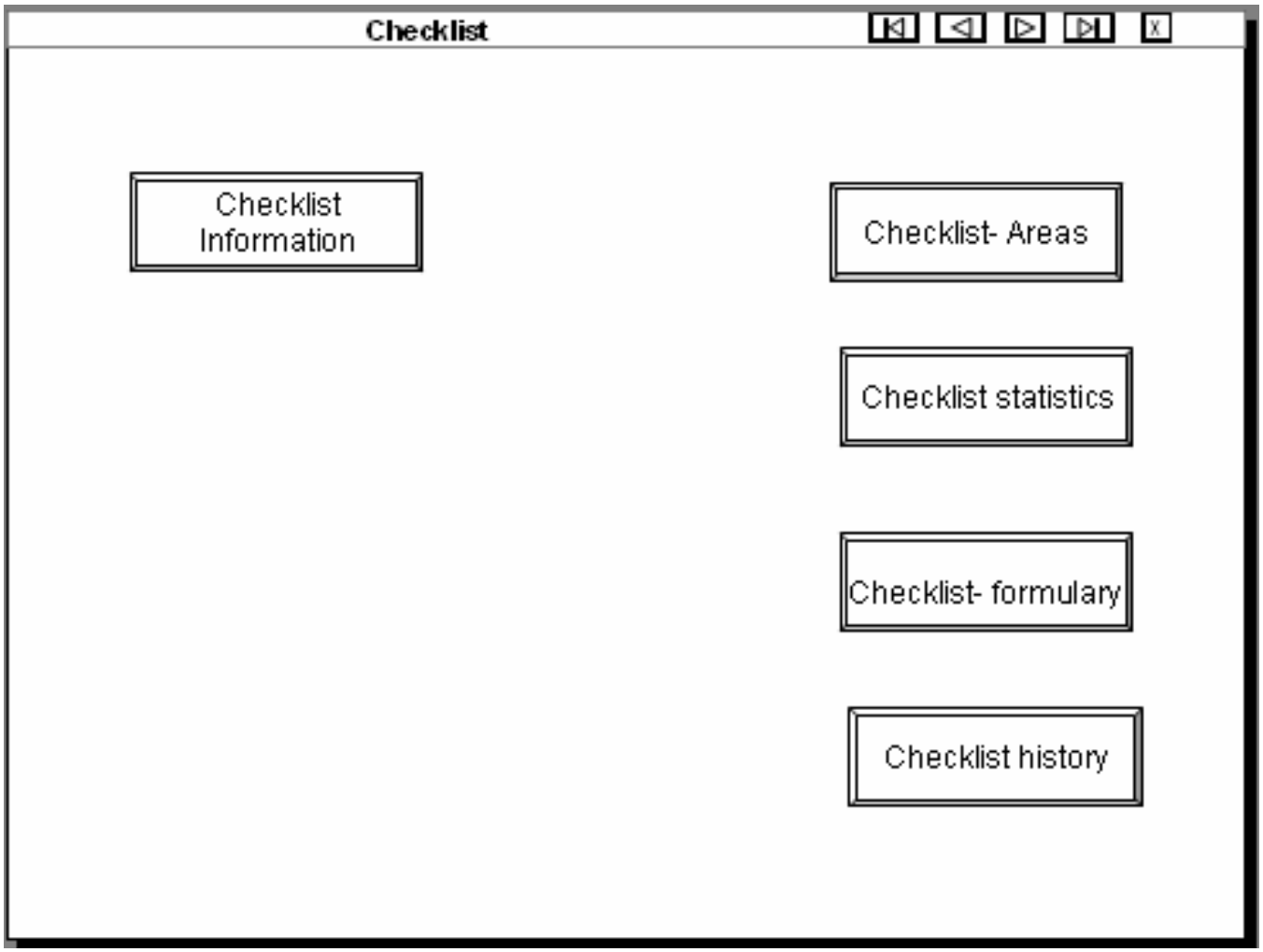
Page 4) *This page is the reporting organisation page. From this page the suggested reporting policy, the report formulary, statistics from reports and the feedback tool can be reached by clicking on the push buttons.*



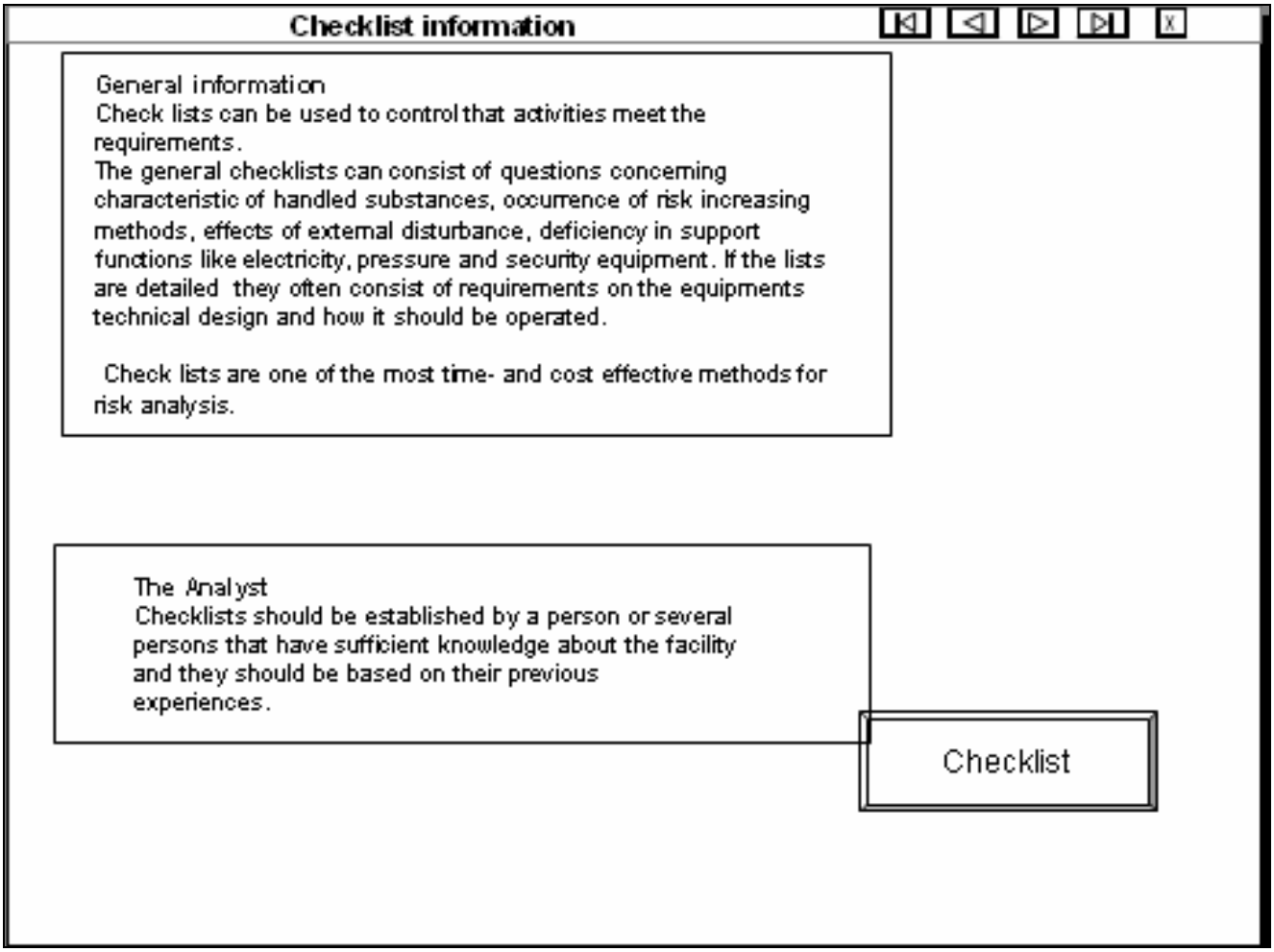
Page 5) *This page is the non conforming report page. In this page the non conforming report can be found.*



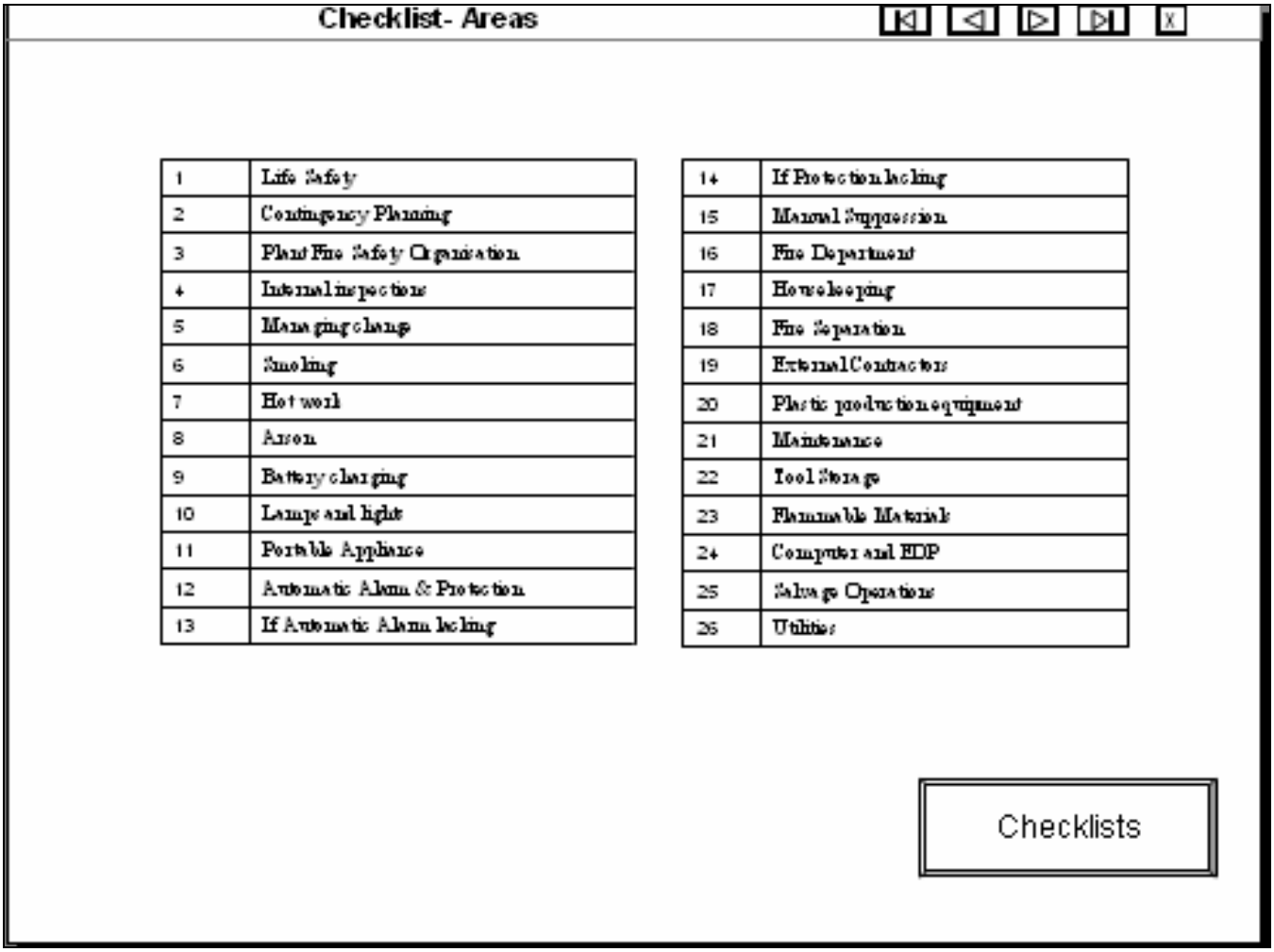
Page 6) This page is the Risk analysis page. From this page the different methods for Risk analysis can be reached by clicking on the push buttons.



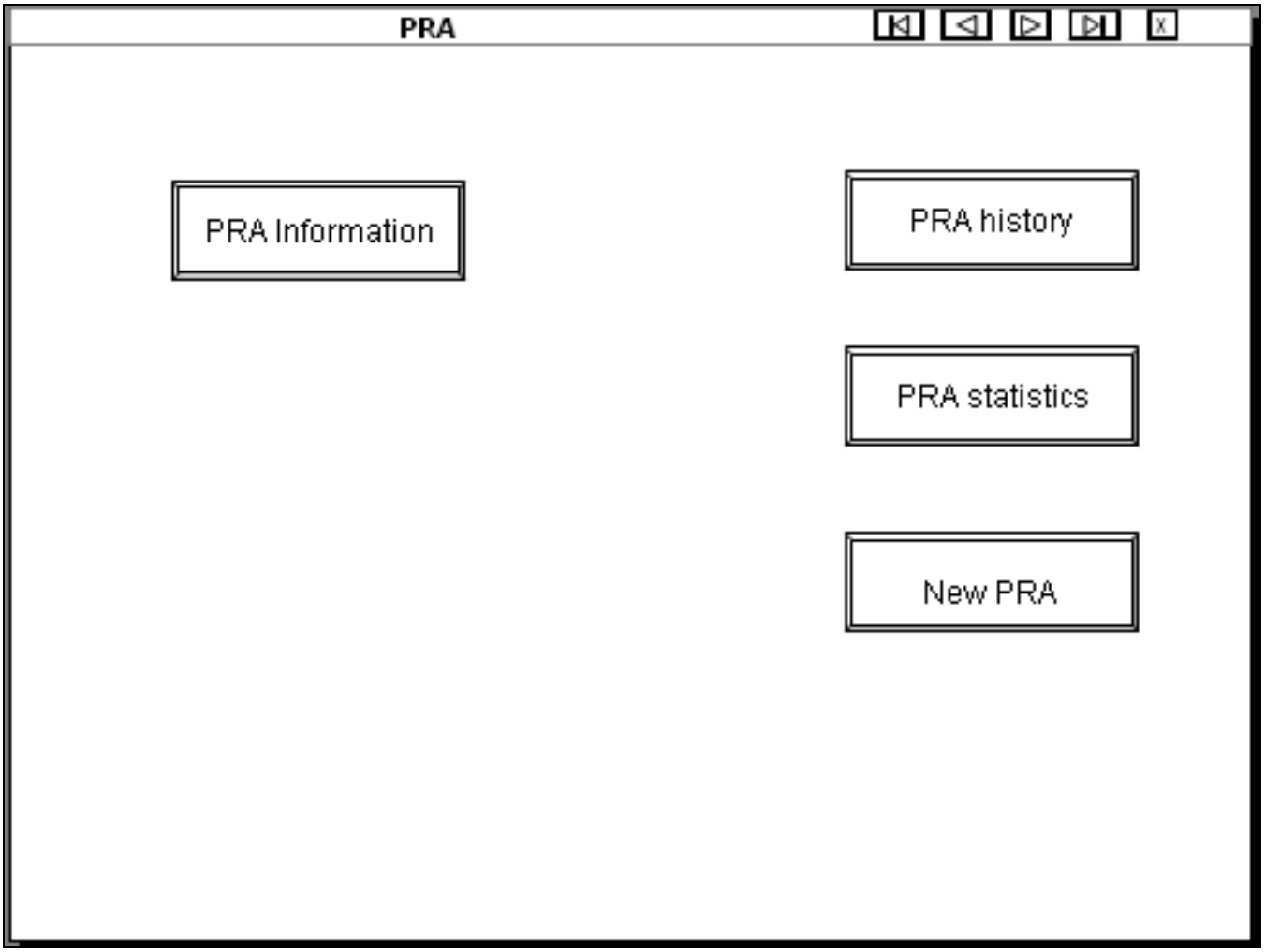
Page 7) This page is the check list page. From this page the check list information, checklist areas, checklist statistics, checklist formulary and checklist history can be reached by clicking on the push buttons.



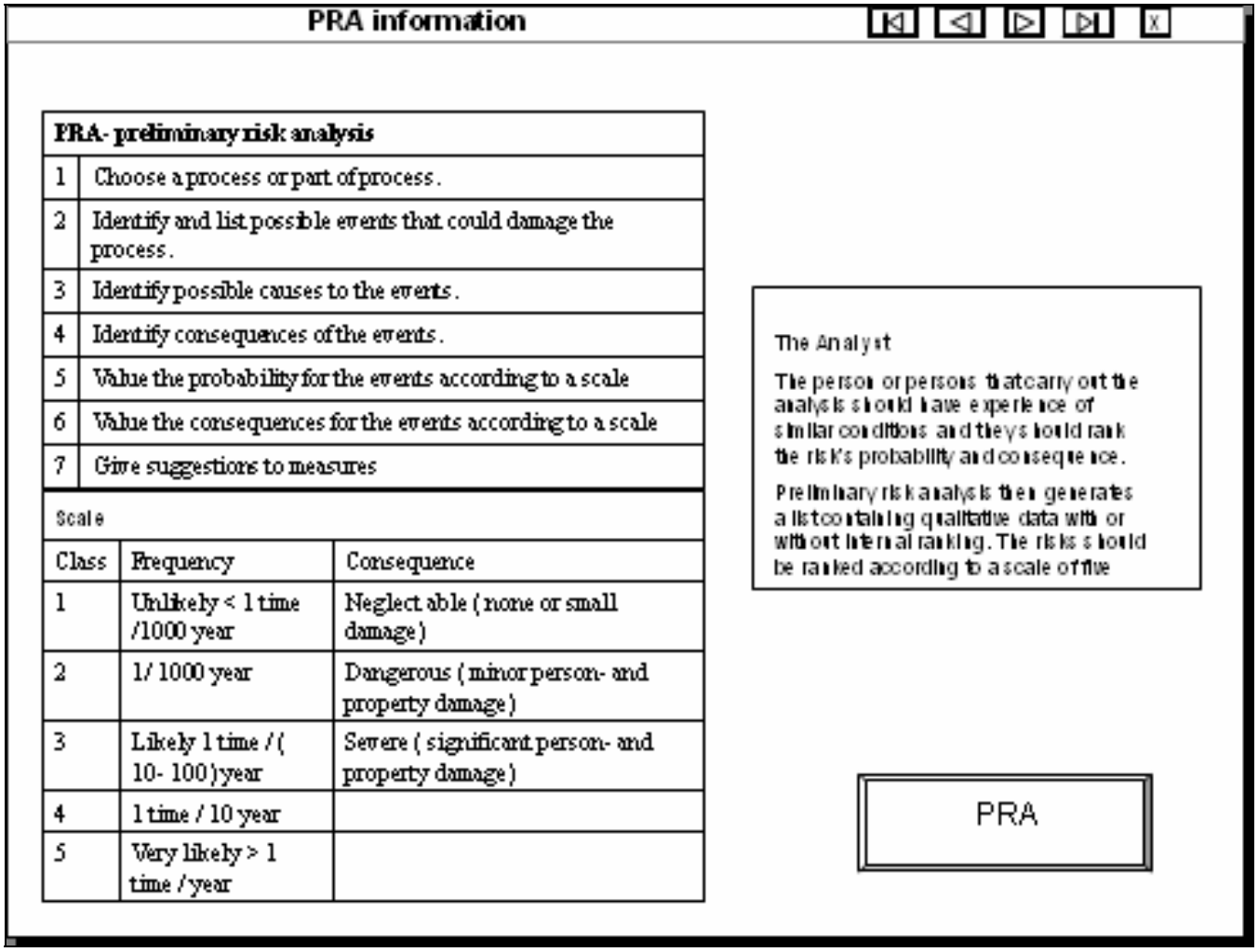
Page 8) This page is the check list information page. In this page information on checklist and how they should be used can be found.



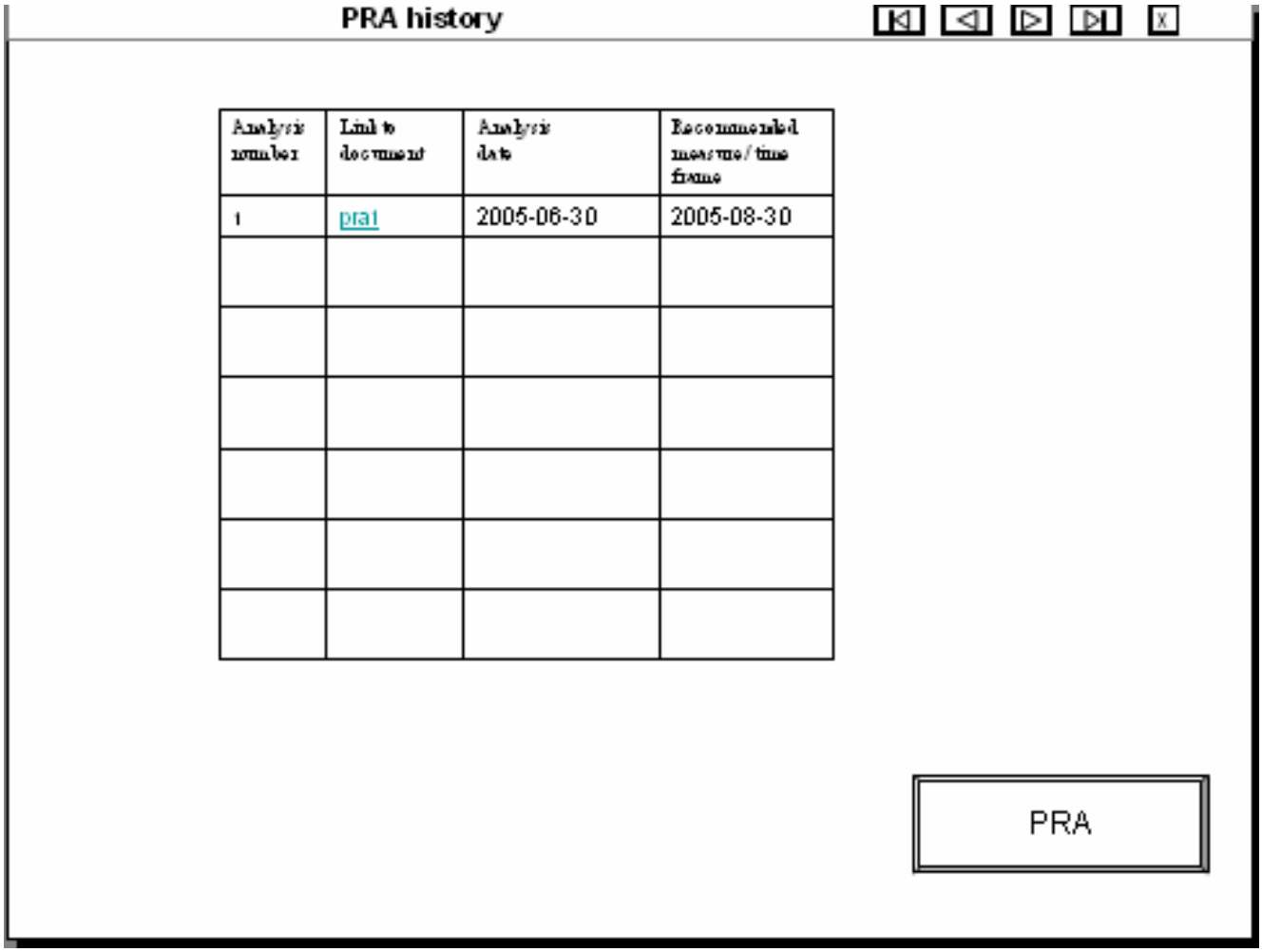
Page 9) This page is the check list areas page. In this page information on which checklist areas that area available.



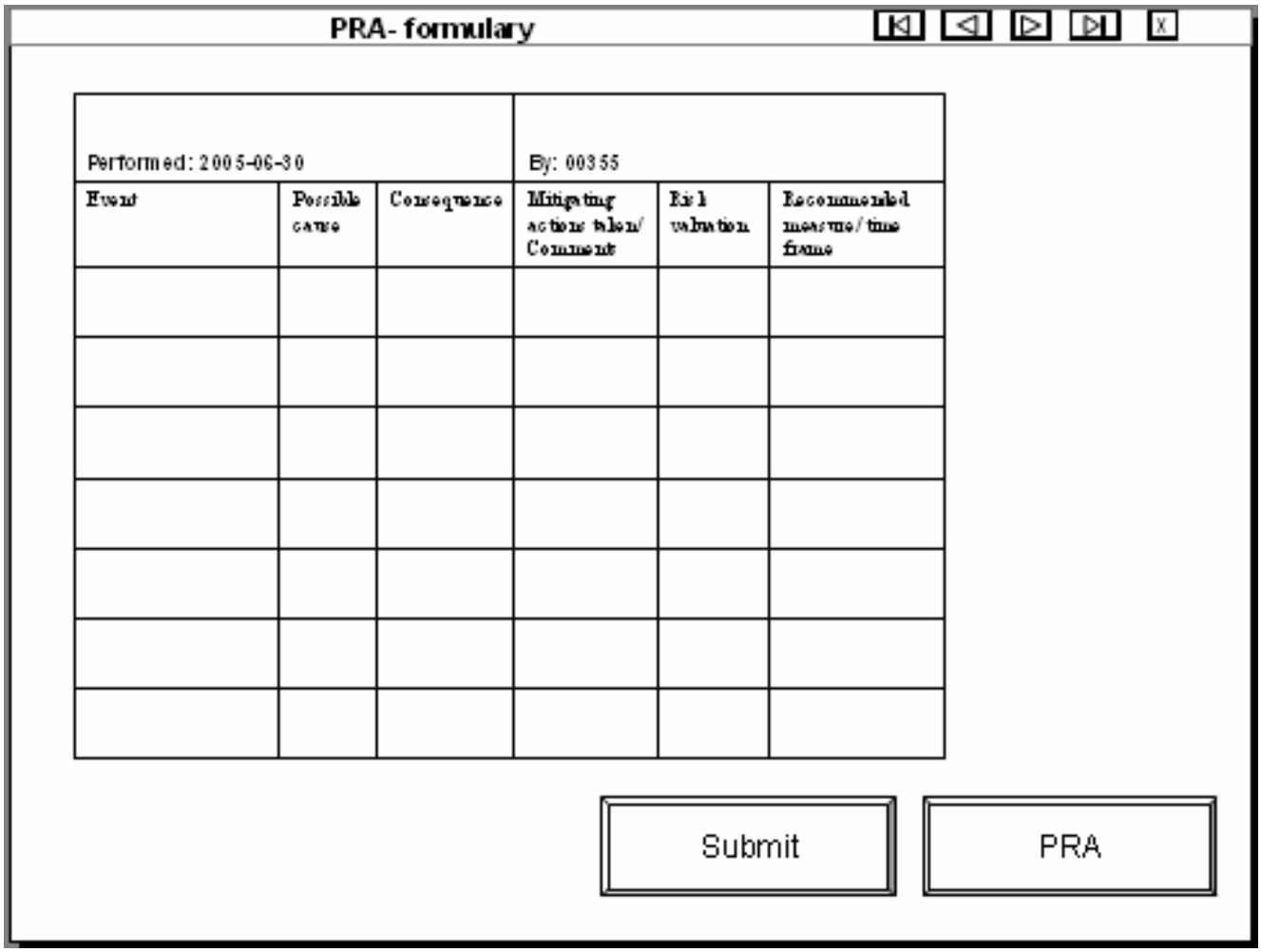
Page 10) This page is the PRA page. From this page the different features in preliminary risk analysis can be reached by clicking on the push buttons.



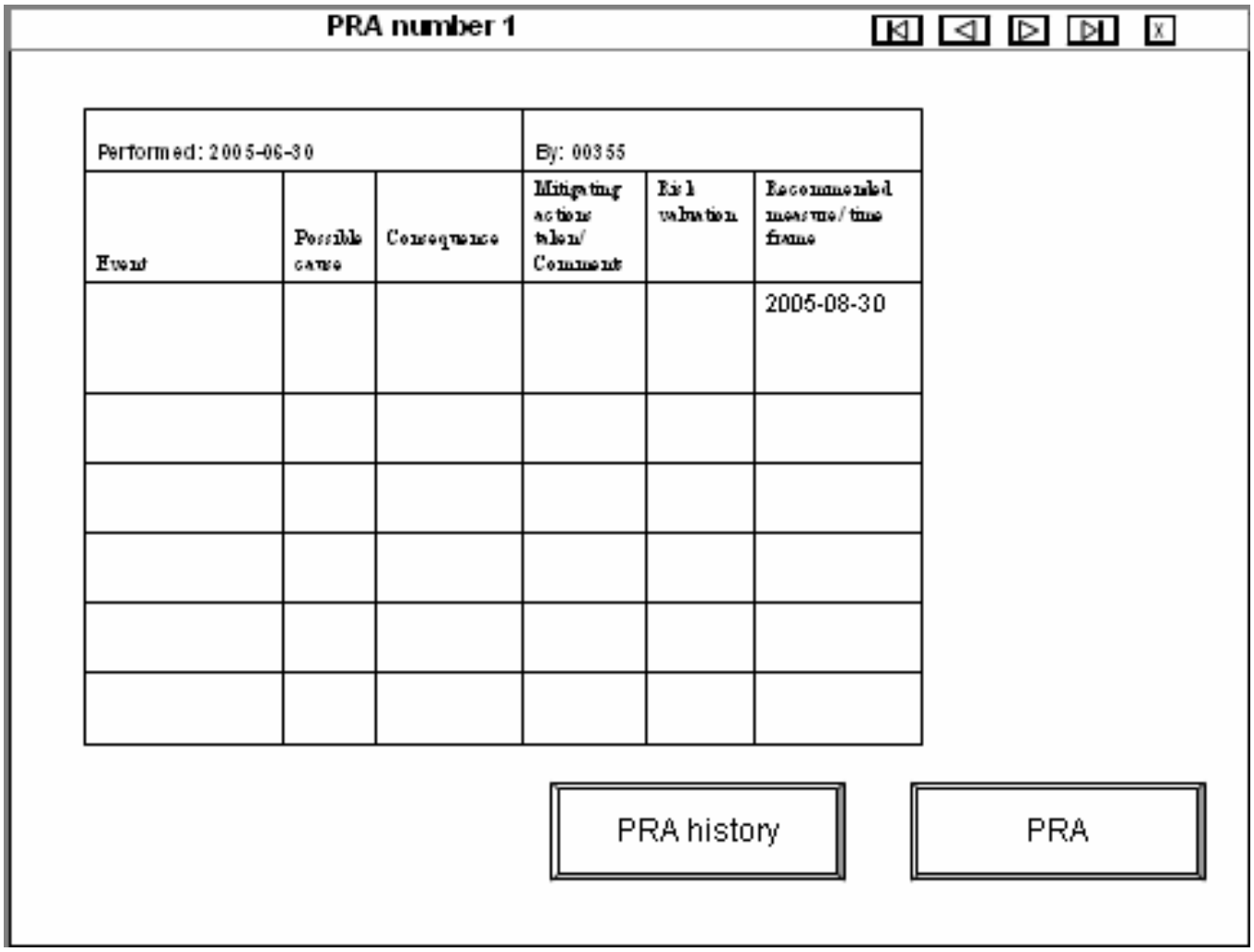
Page 11) This page is the PRA information page. In this page information on preliminary risk analysis can found.



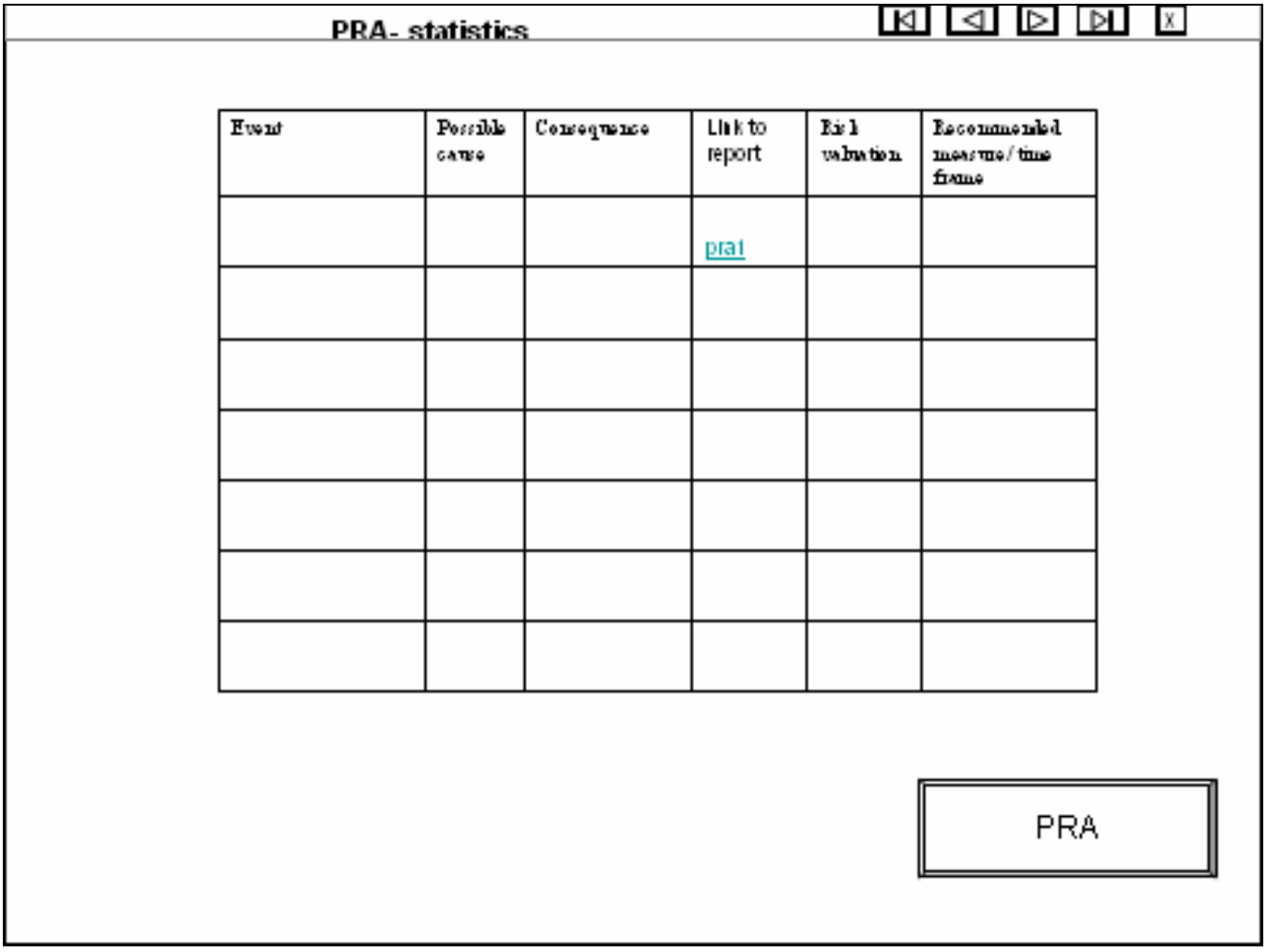
Page 12) This page is the PRA history page. From this page the prior preliminary risk analysis can be reached by clicking on the highlighted link in the tables.



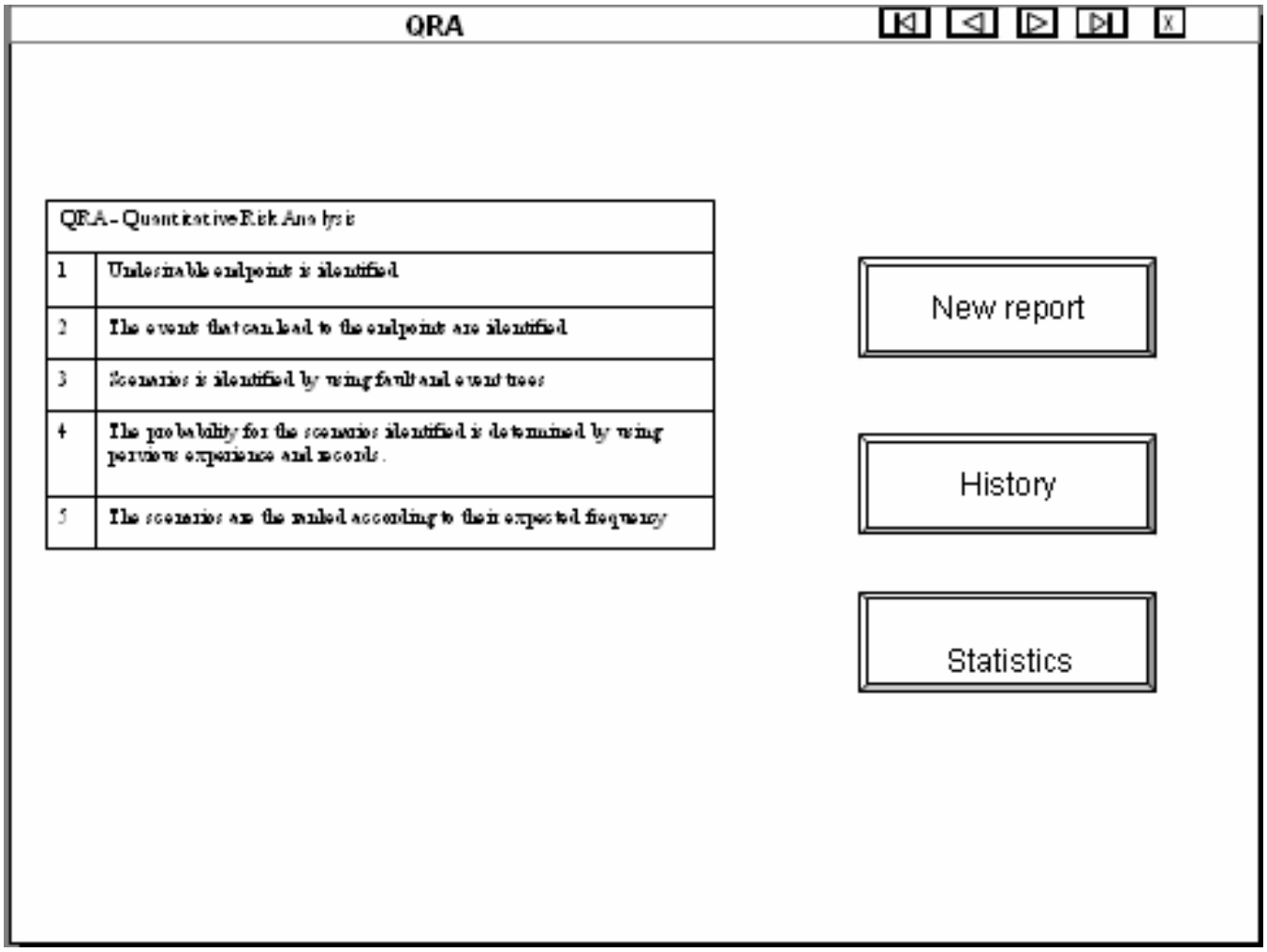
Page 13) This page is the PRA formulary page. From this page the formulary for preliminary risk analysis can be found and results can be submitted by clicking on the push button.



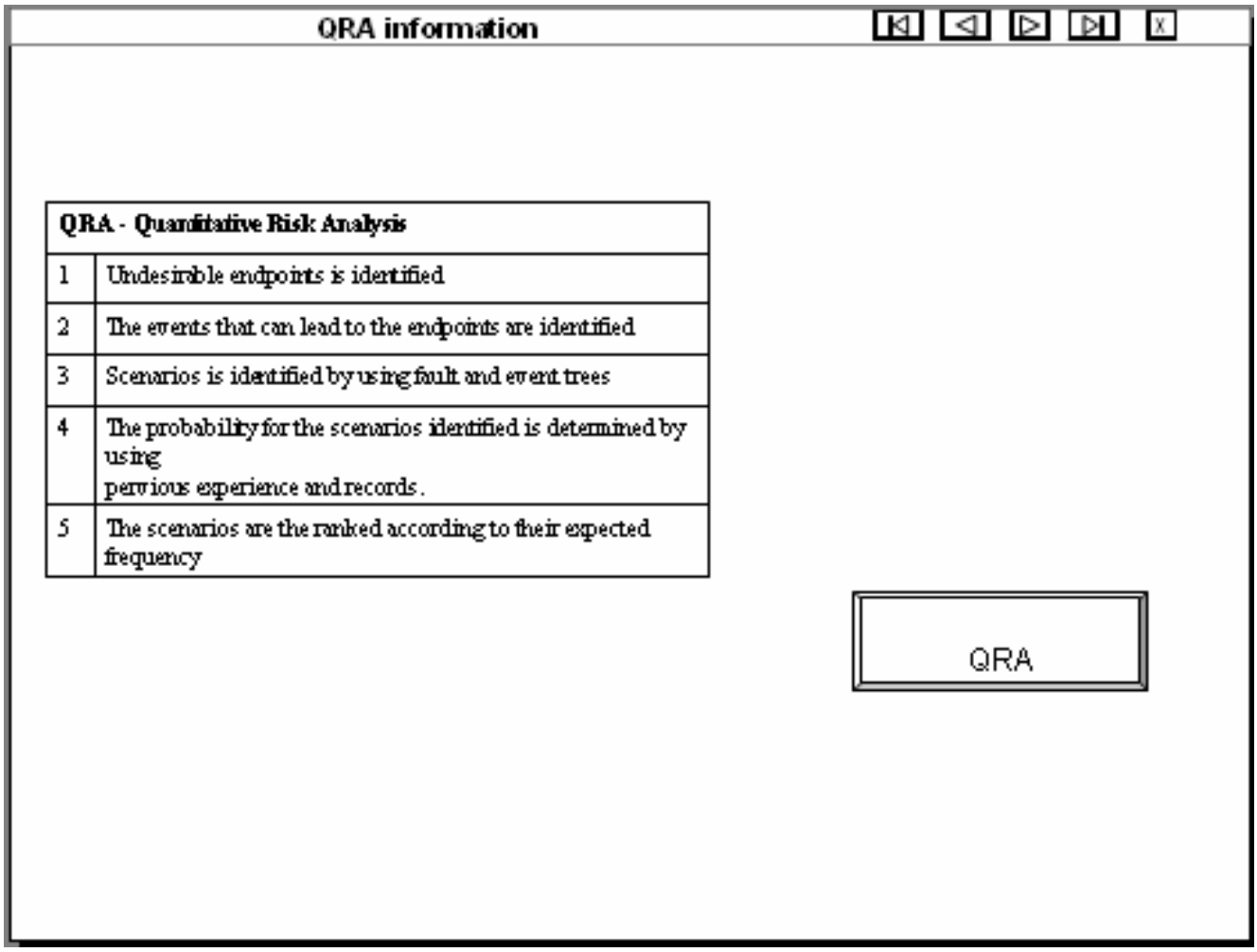
Page 14) This page is the PRA formulary page. From this page the formulary for preliminary risk analysis can be found and results can be submitted by clicking on the push button.



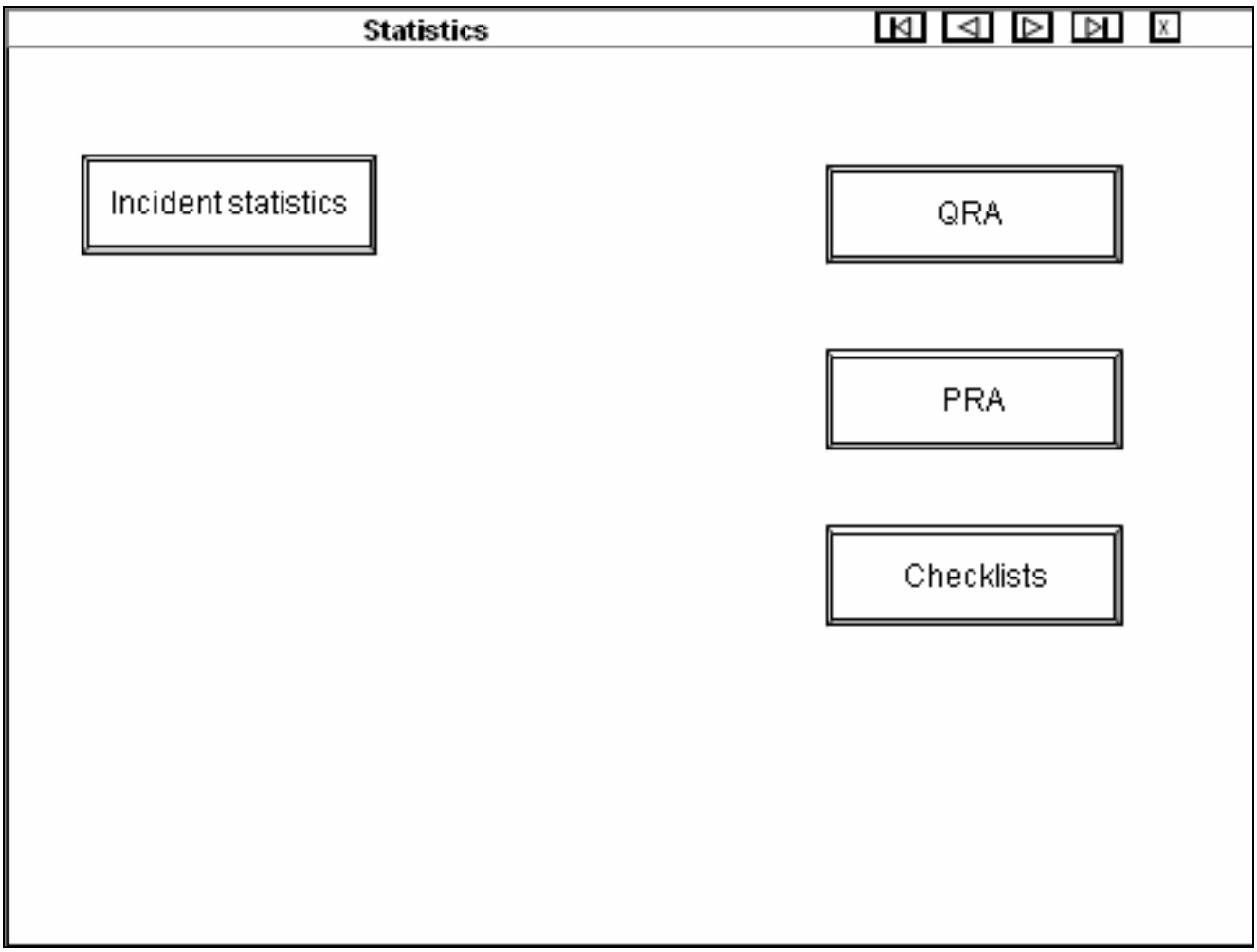
Page 15) This page is the PRA statistic page. From this page the statistics for preliminary risk analysis can be found.



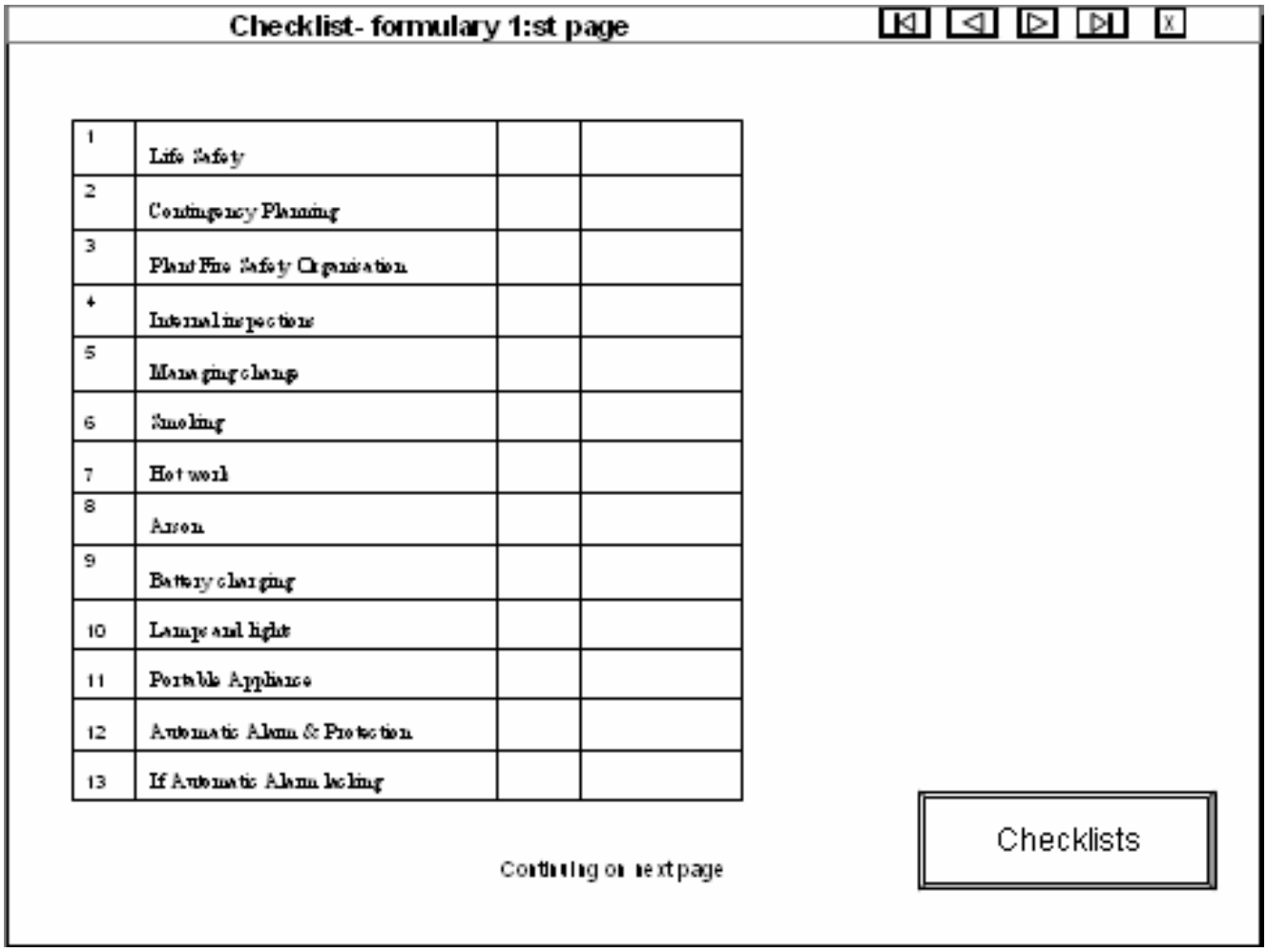
Page 16) This page is the QRA page. From this page the different features in quantitative risk analysis can be reached by clicking on the push buttons



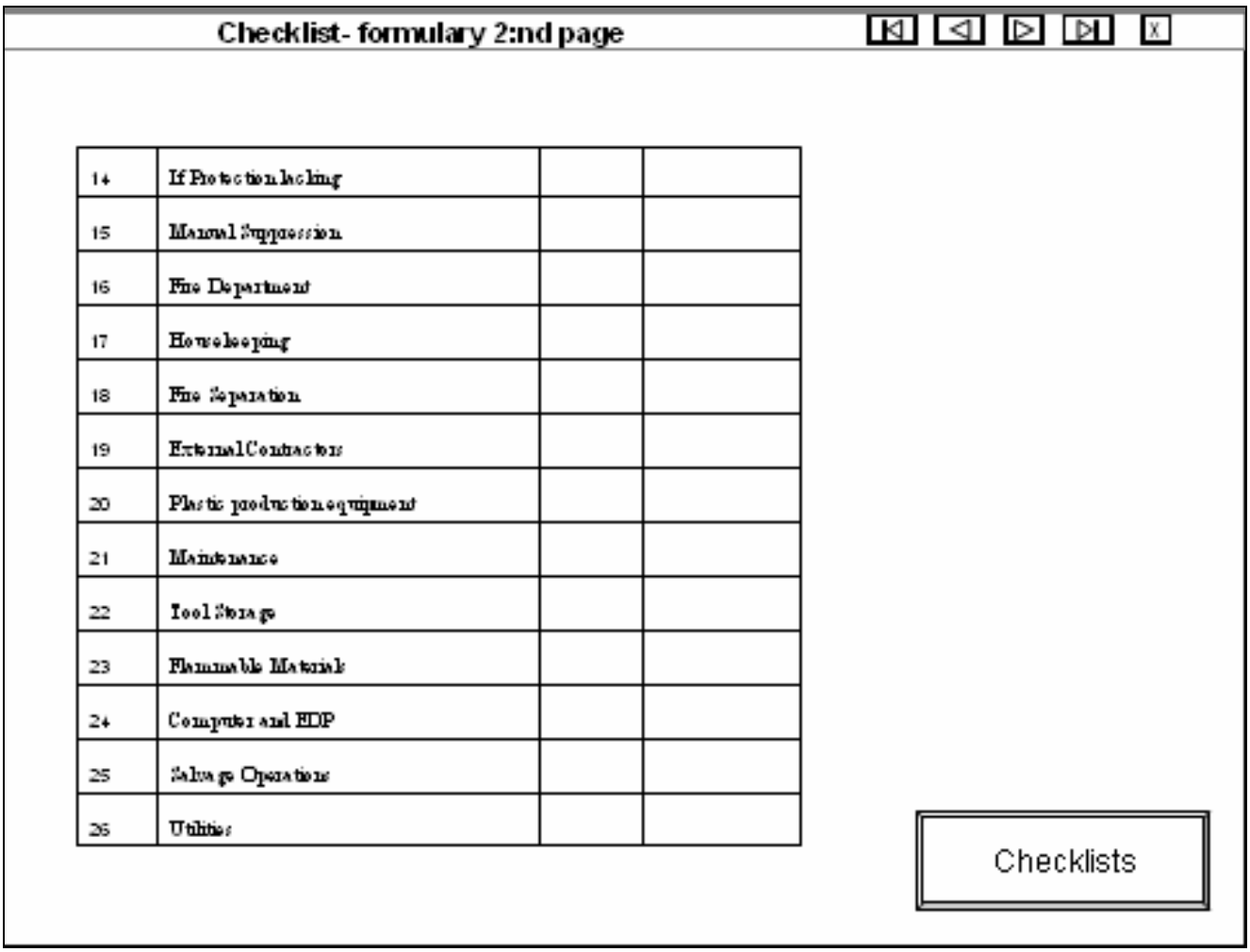
Page 17) This page is the QRA information page. On this page the different features in quantitative risk analysis is explained.



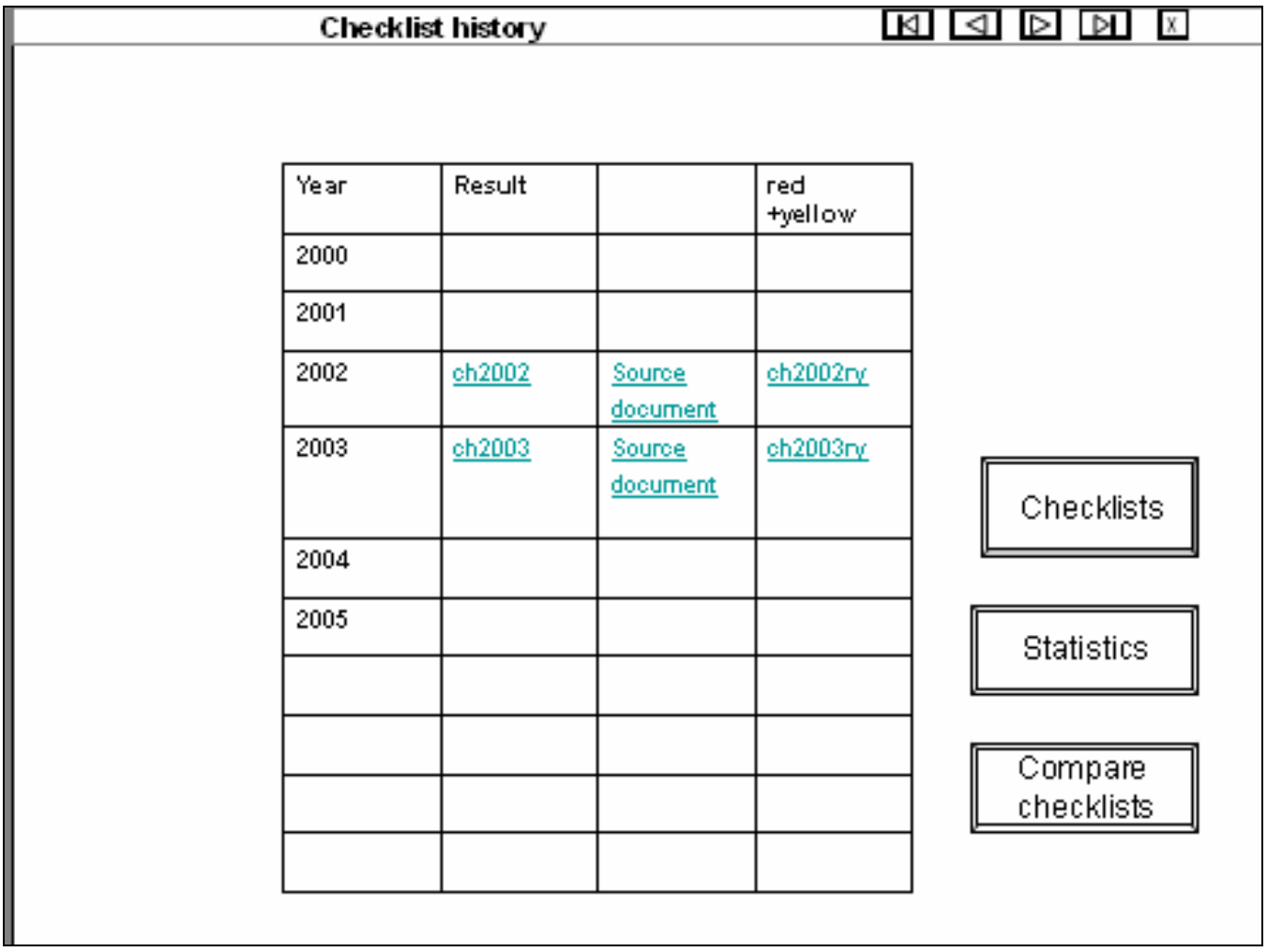
Page 18) This page is the statistics page. From this page the statistics from incidents reports and different risk analysis methods can be reached by clicking on the push buttons.



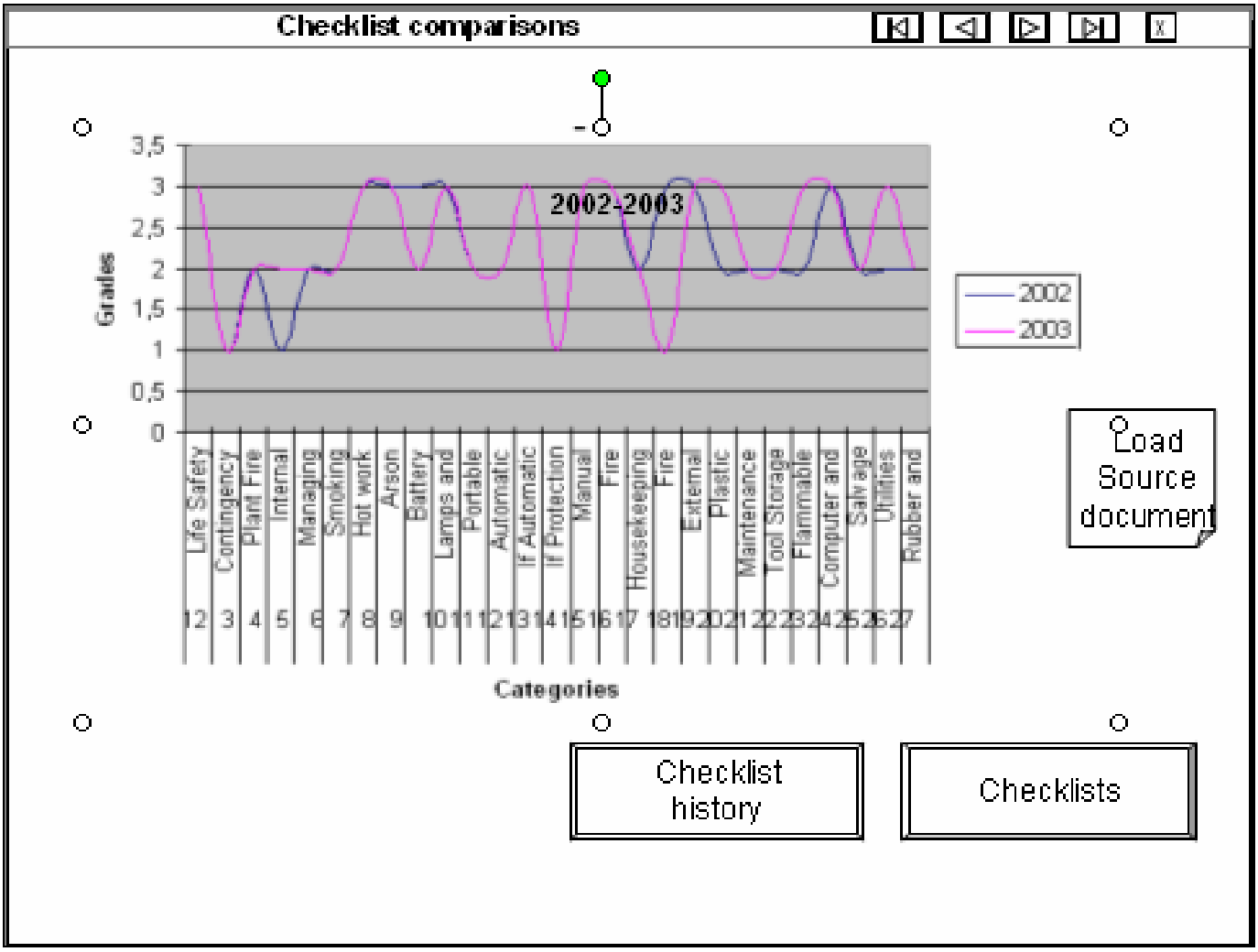
Page 19) This page contains the first page on the check list formulary.



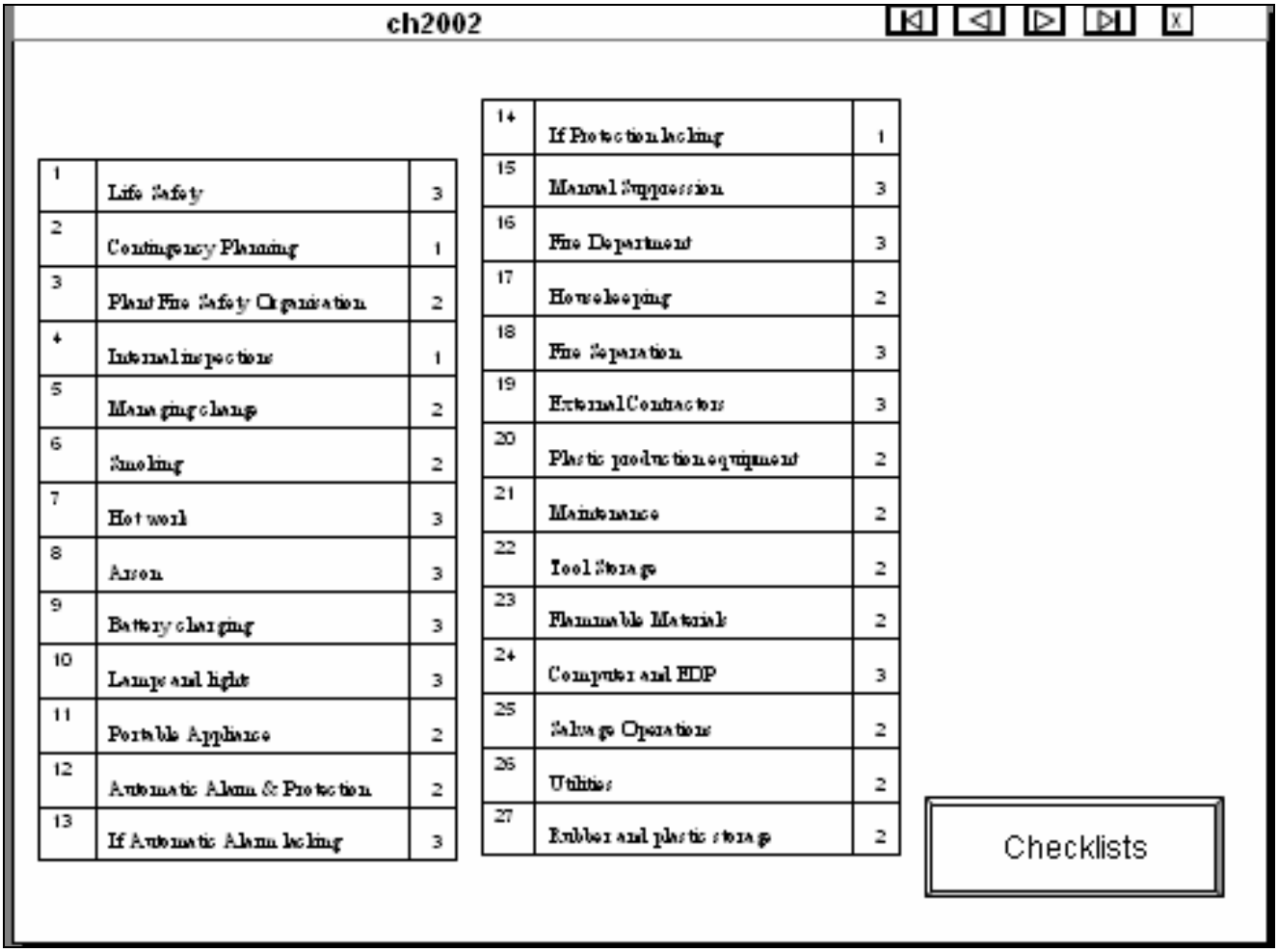
Page 20) This page contains the second page on the check list formulary.



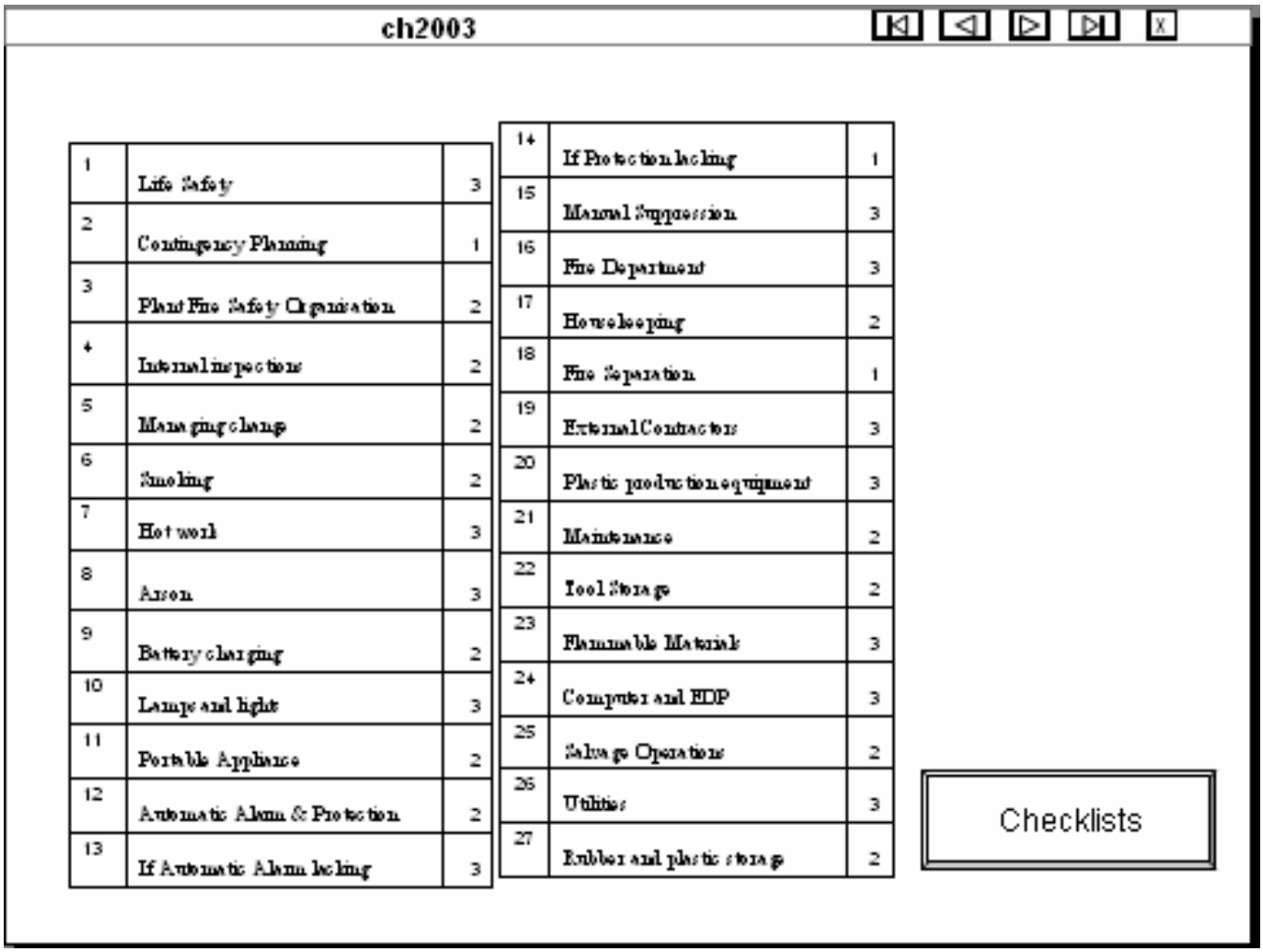
Page 21) This page is the check list history page. From this page the prior check list risk analysis can be reached by clicking on the highlighted link in the tables.



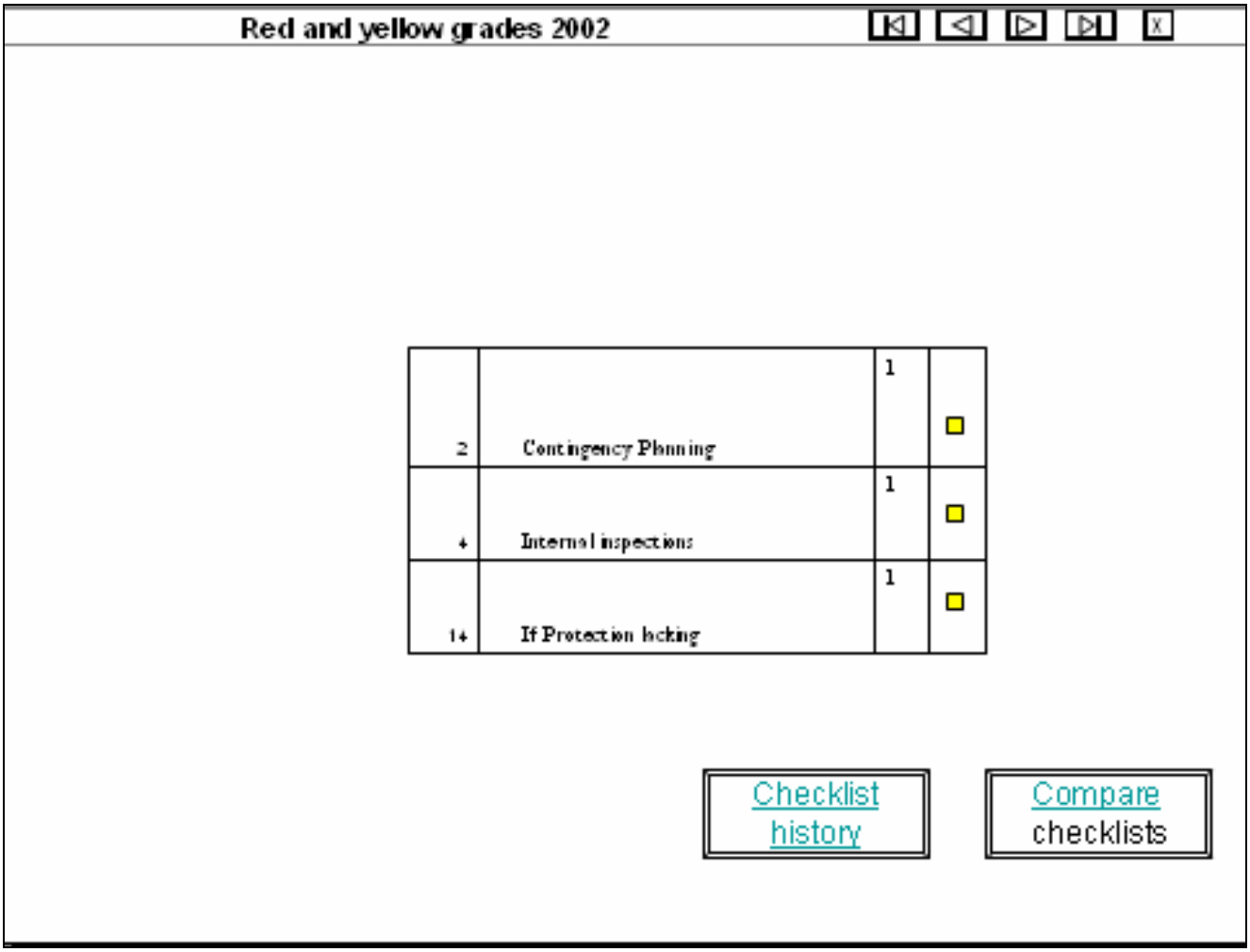
Page 22) This page is the check comparisons page. From this page the prior check list risk analysis can be compared.



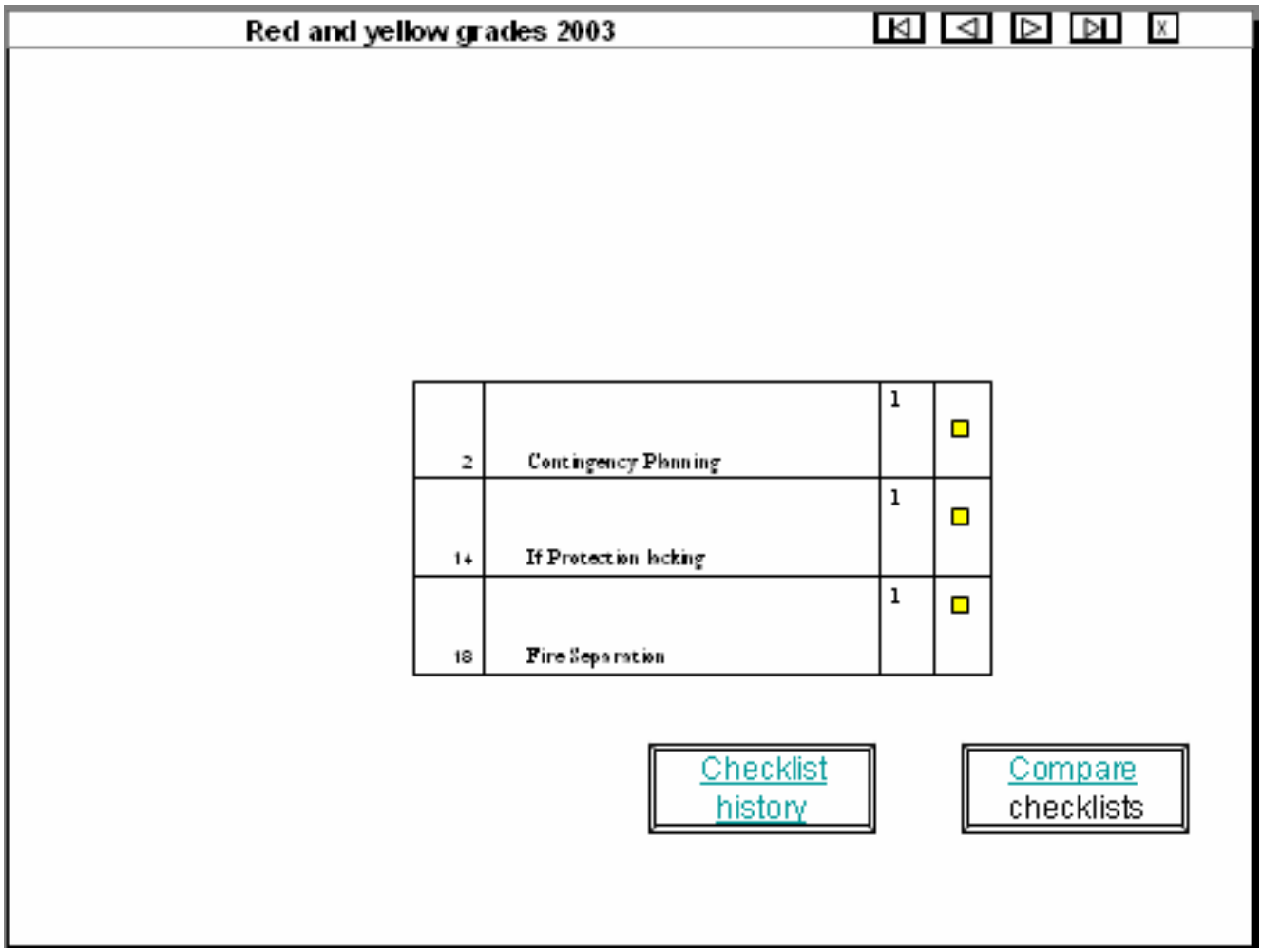
Page 23) This page is the check list 2002 page. On this page the check list risk analysis from 2002 can be found.



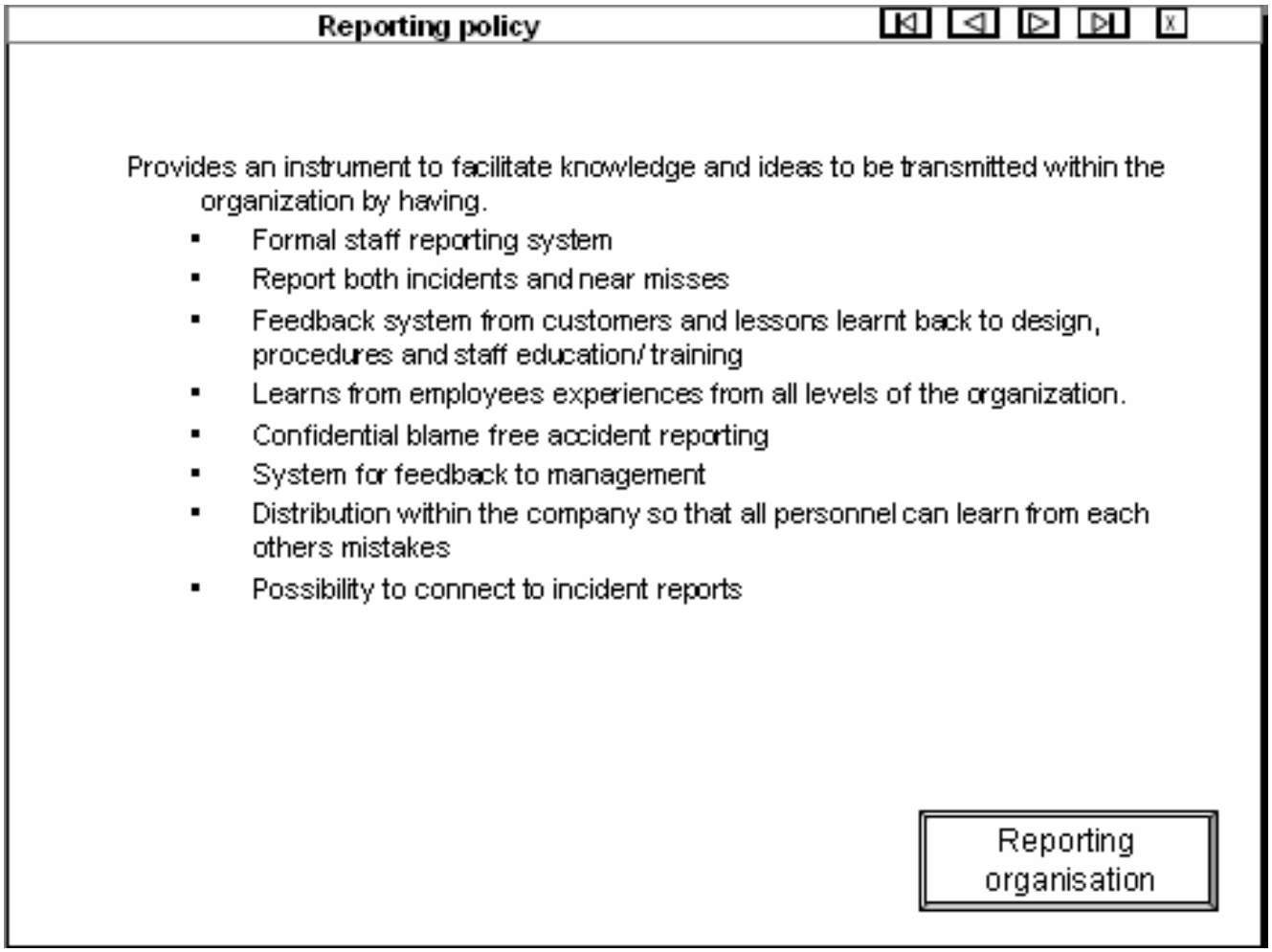
Page 24) This page is the check list 2003 page. On this page the check list risk analysis from 2003 can be found.



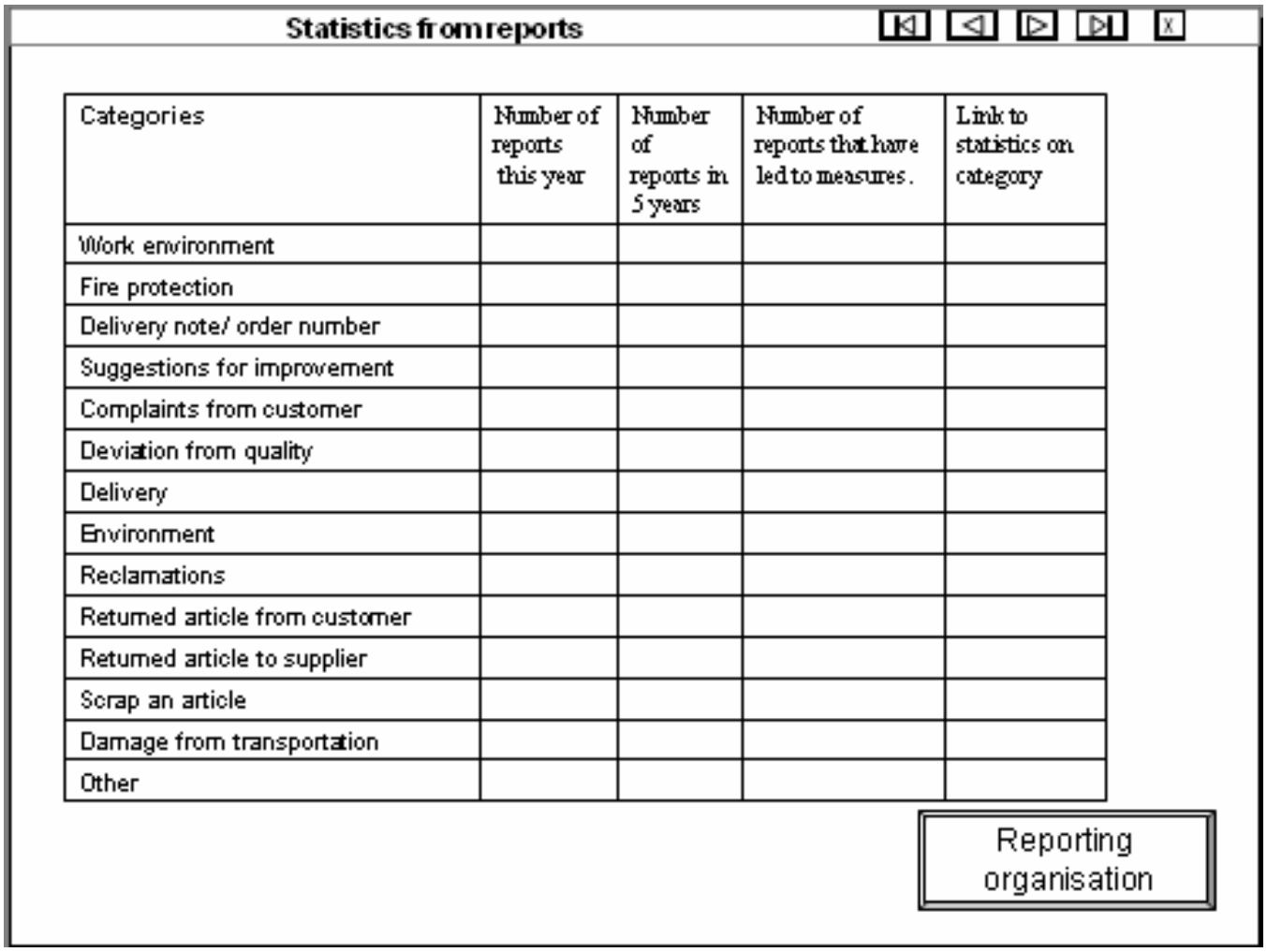
Page 24) This page is the red and yellow grades 2002 page. On this page the areas that were given grade 0-1 on the check list risk analysis from 2003 can be found.



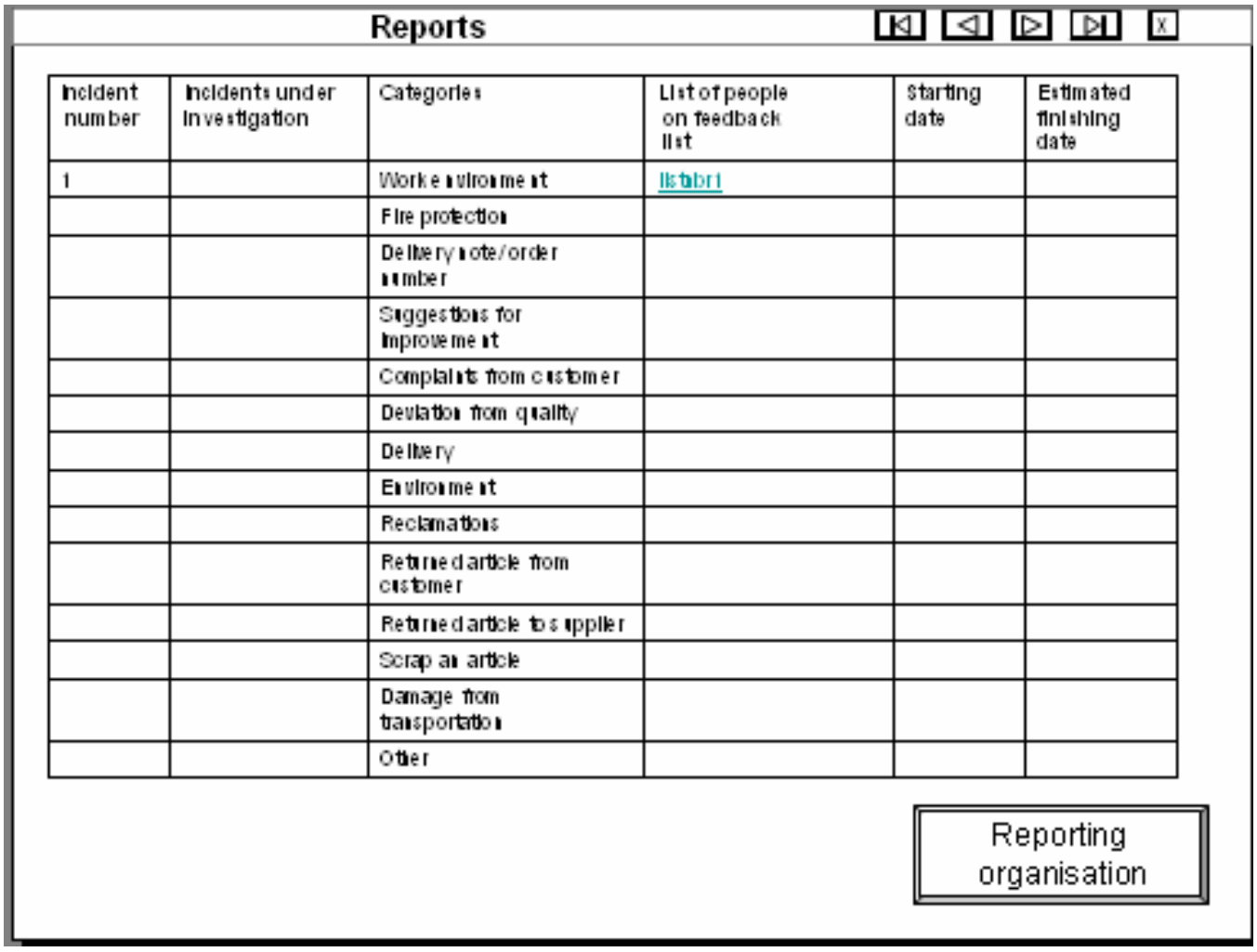
Page 25) This page is the red and yellow grades 2003 page. On this page the areas that were given grade 0-1 on the check list risk analysis from 2003 can be found.



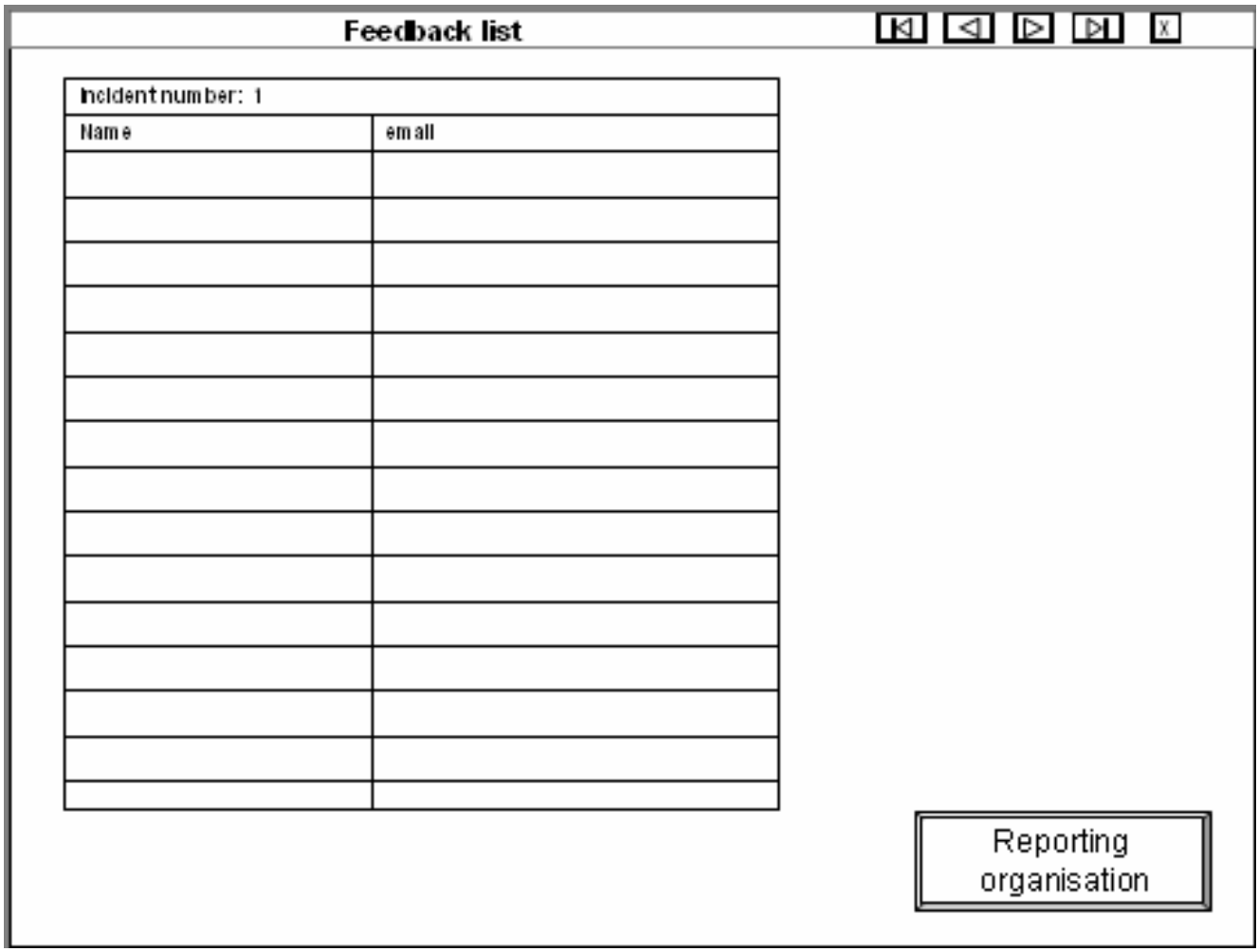
Page 26) This page is the reporting policy page. On this page the different features in the suggested reporting policy is listed.



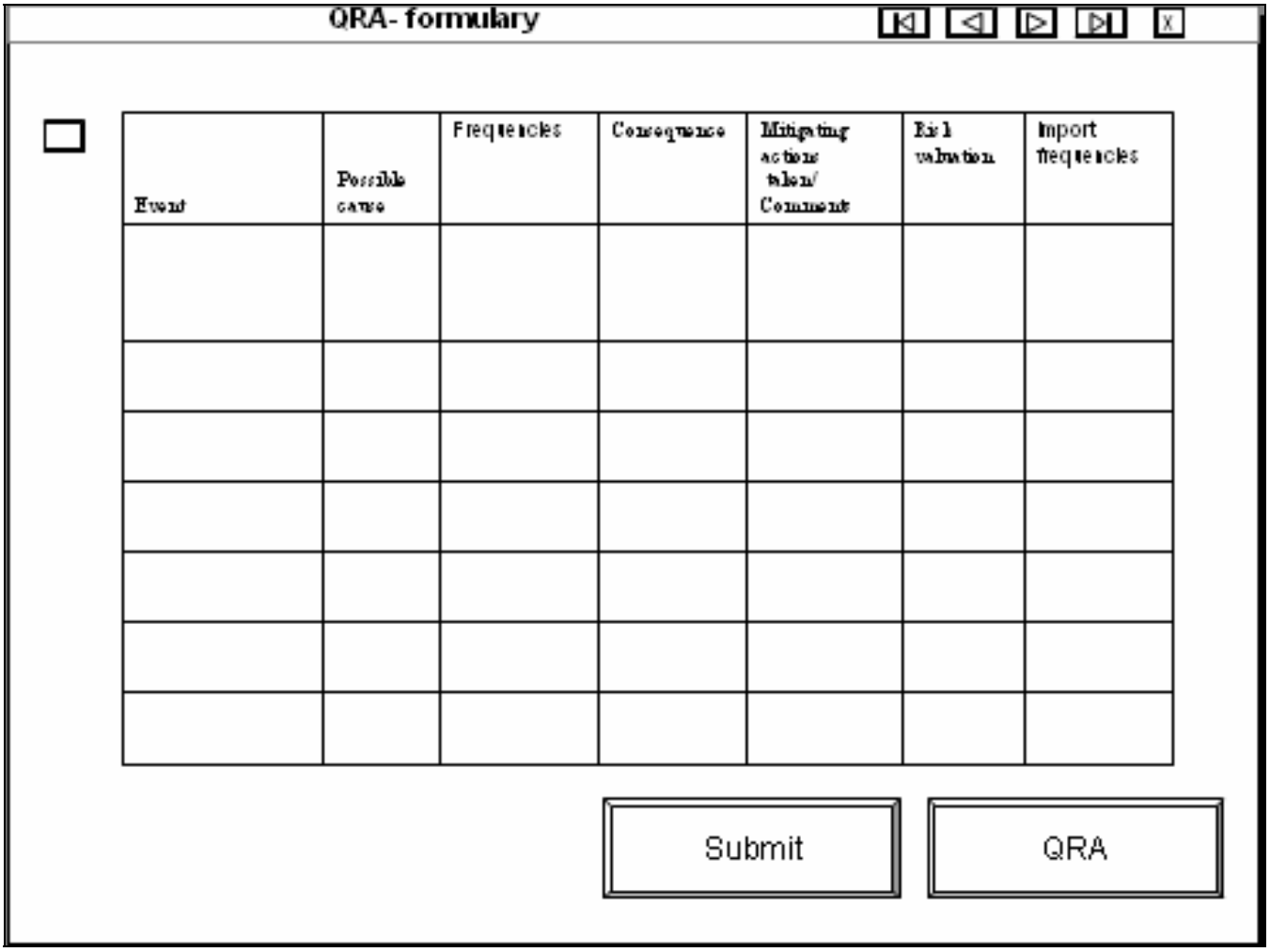
Page 27) This page is the statistics from reports page. From this page the statistics from incidents found.



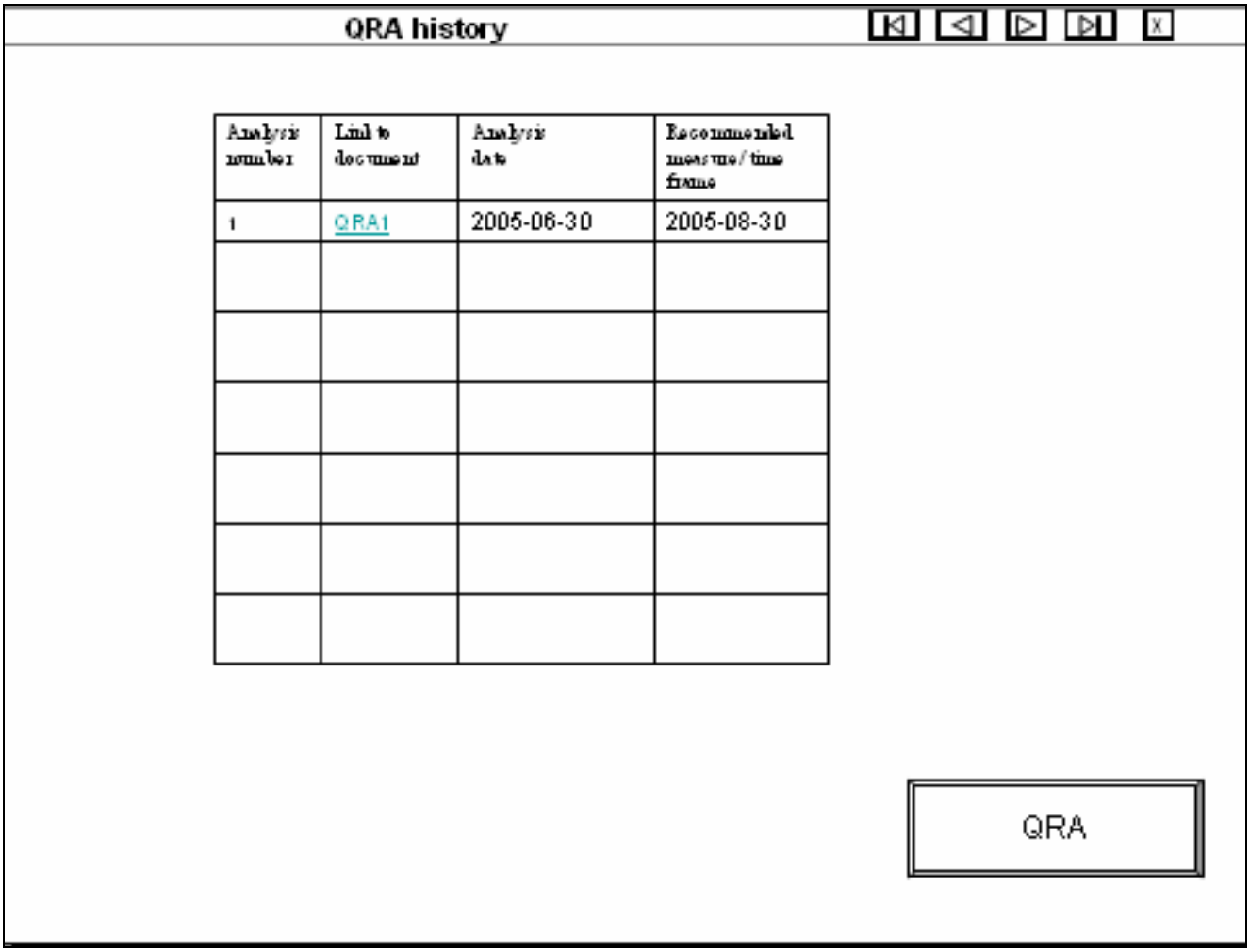
Page 28) This page is the reports page. From this page the statistics from incidents reports can be found. The statistics is categorized under the different categories of Trelleborg blue scoring system.



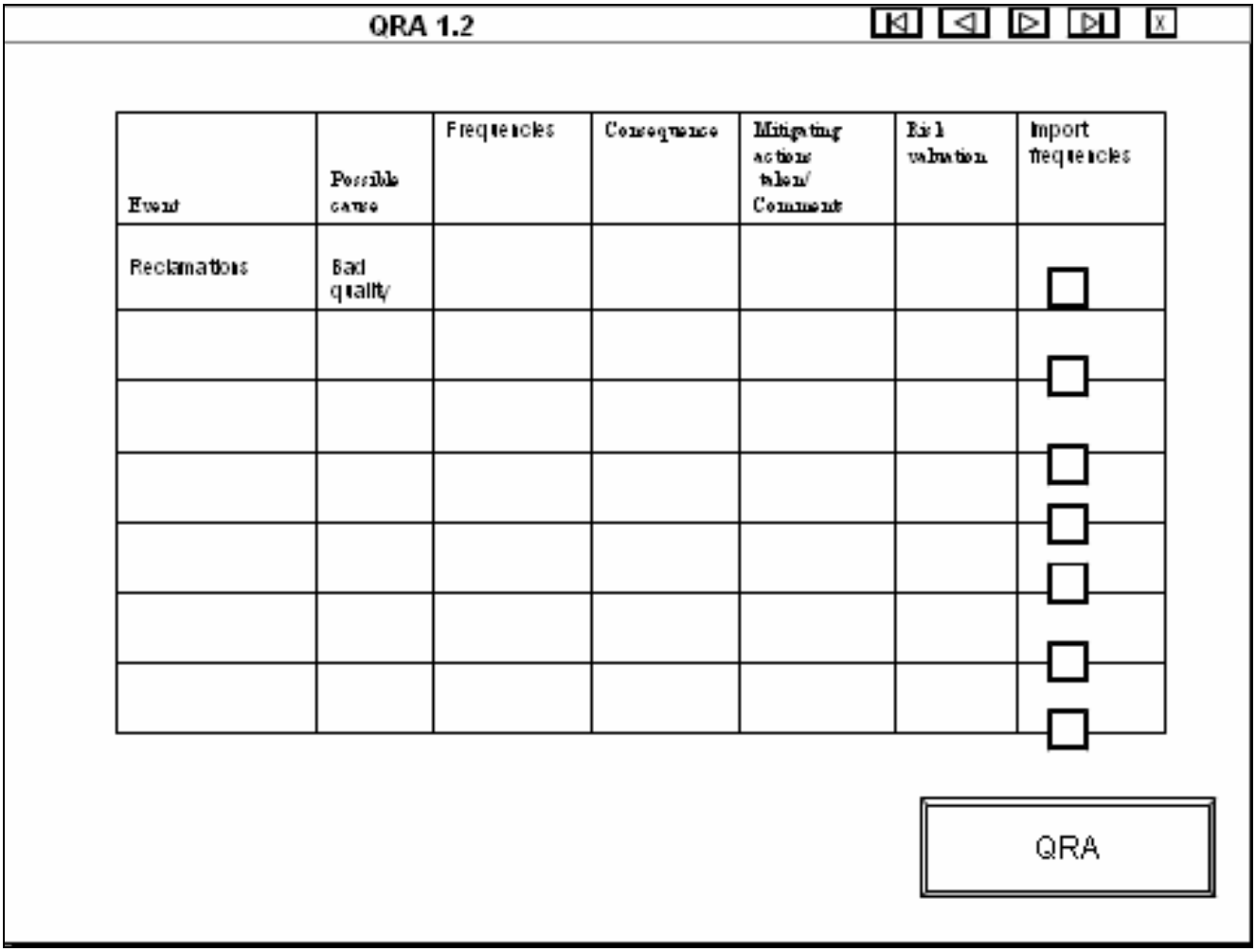
Page 29) This page is the feedback page. On this page the names and email to the personnel and costumers that have an interest in a specific report is listed.



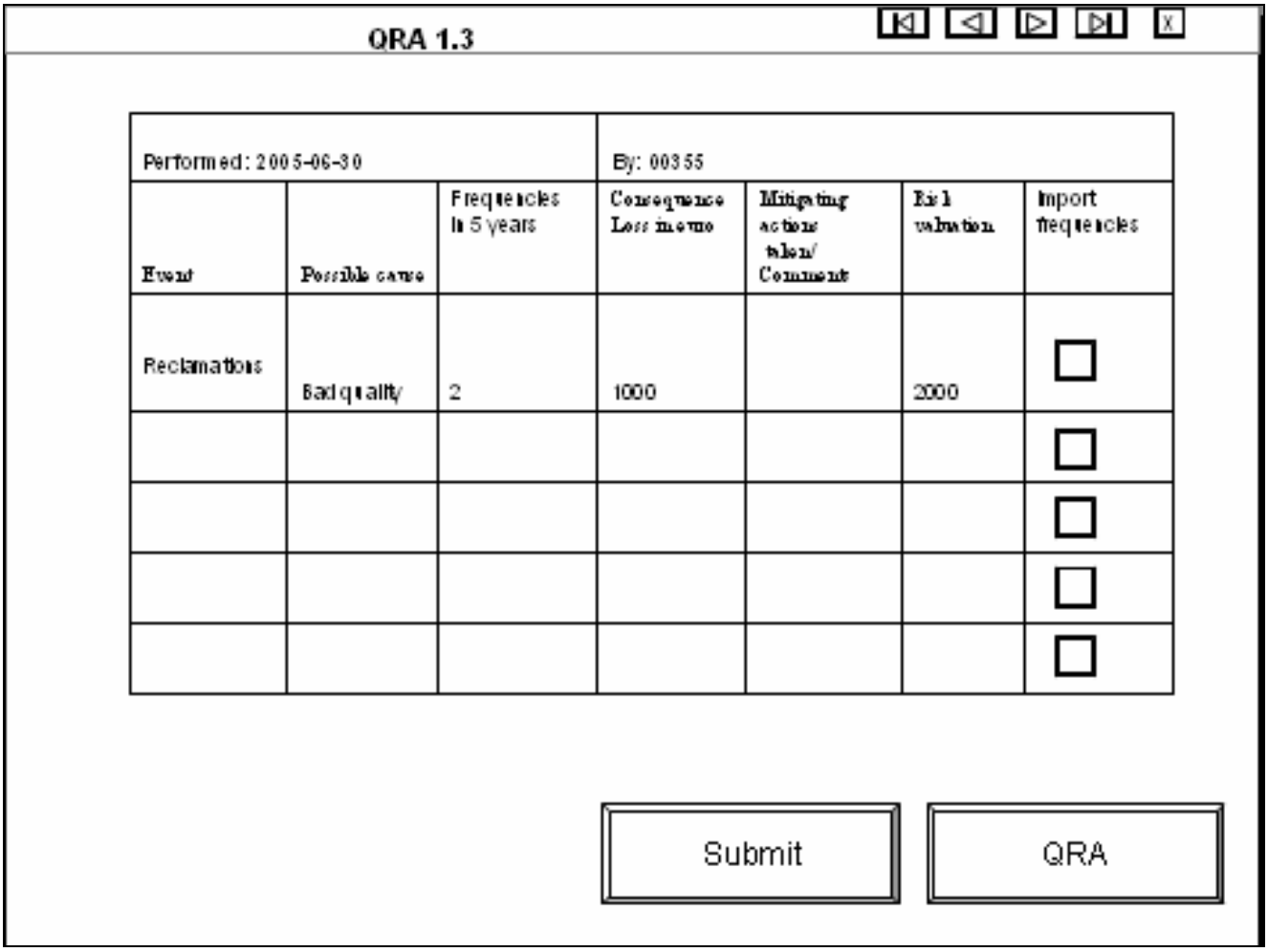
Page 30) This page is the QRA formulary page. From this page the formulary for quantitative risk analysis can be found and results can be submitted by clicking on the push button.



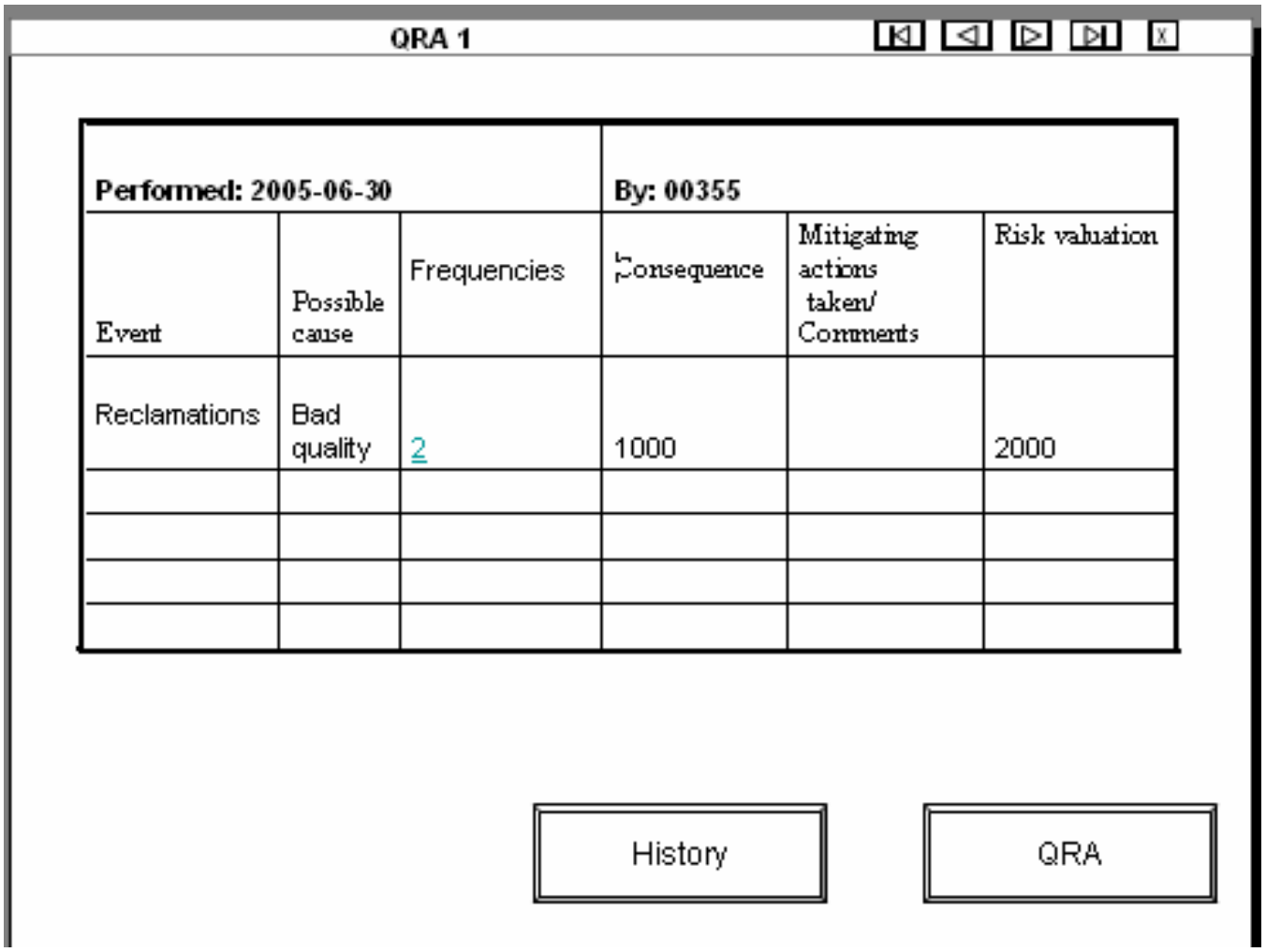
Page 31) This page is the QRA history page. From this page the prior quantitative risk analysis can be reached by clicking on the highlighted link in the tables.



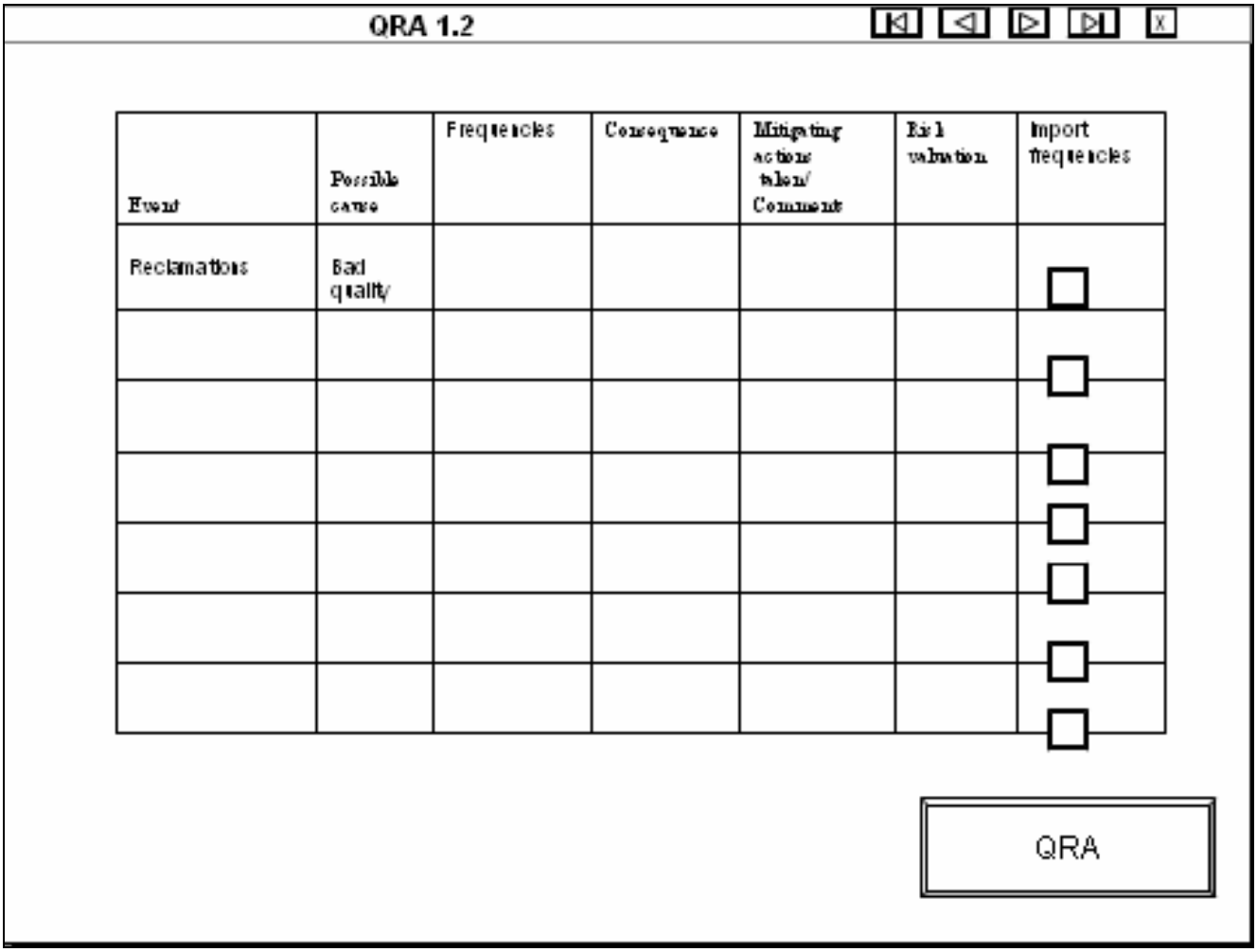
Page 32) This page is the QRA 1.2 page. In this page the first step of a quantitative risk analysis can seen and statistics can be reached by clicking on push button in the tables.



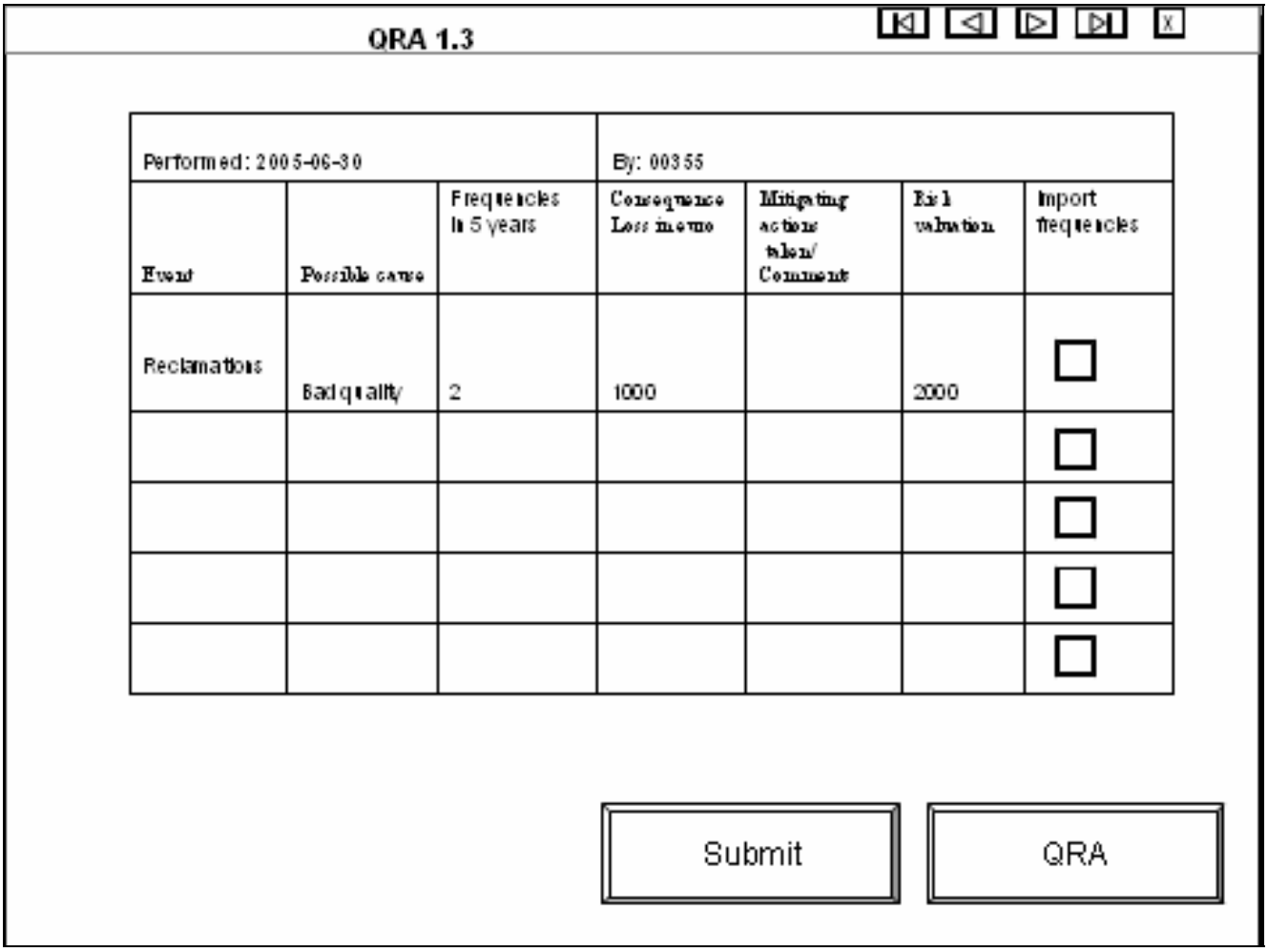
Page 32) This page is the QRA 1.3 page. In this page the second step in a quantitative risk analysis can seen and statistics can be reached by clicking on push button in the tables



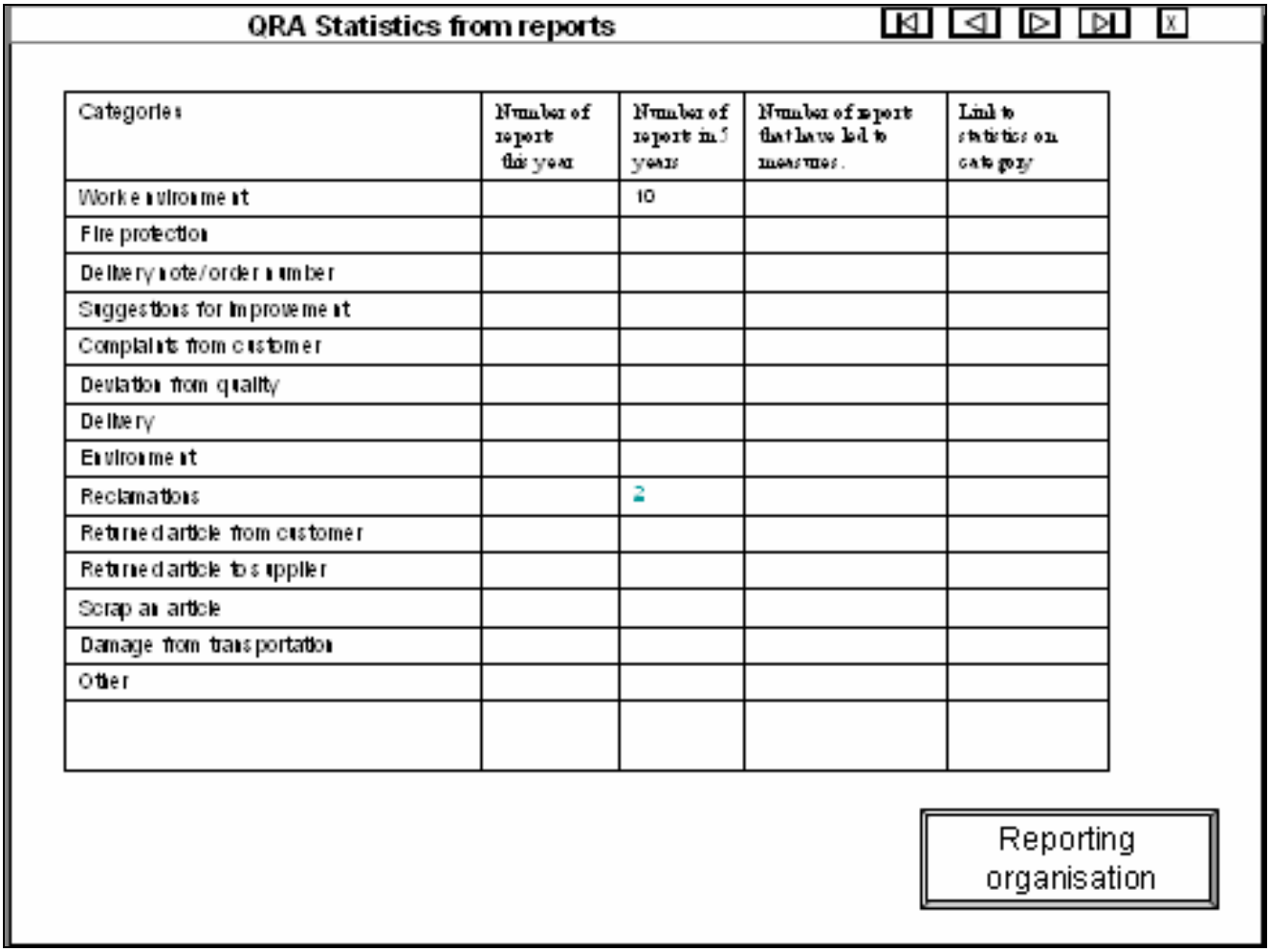
Page 33) This page is the QRA 1 page. This is an example of a result from a QRA analysis. From this page the statistics from incidents can be found and imported into the QRA risk analysis.



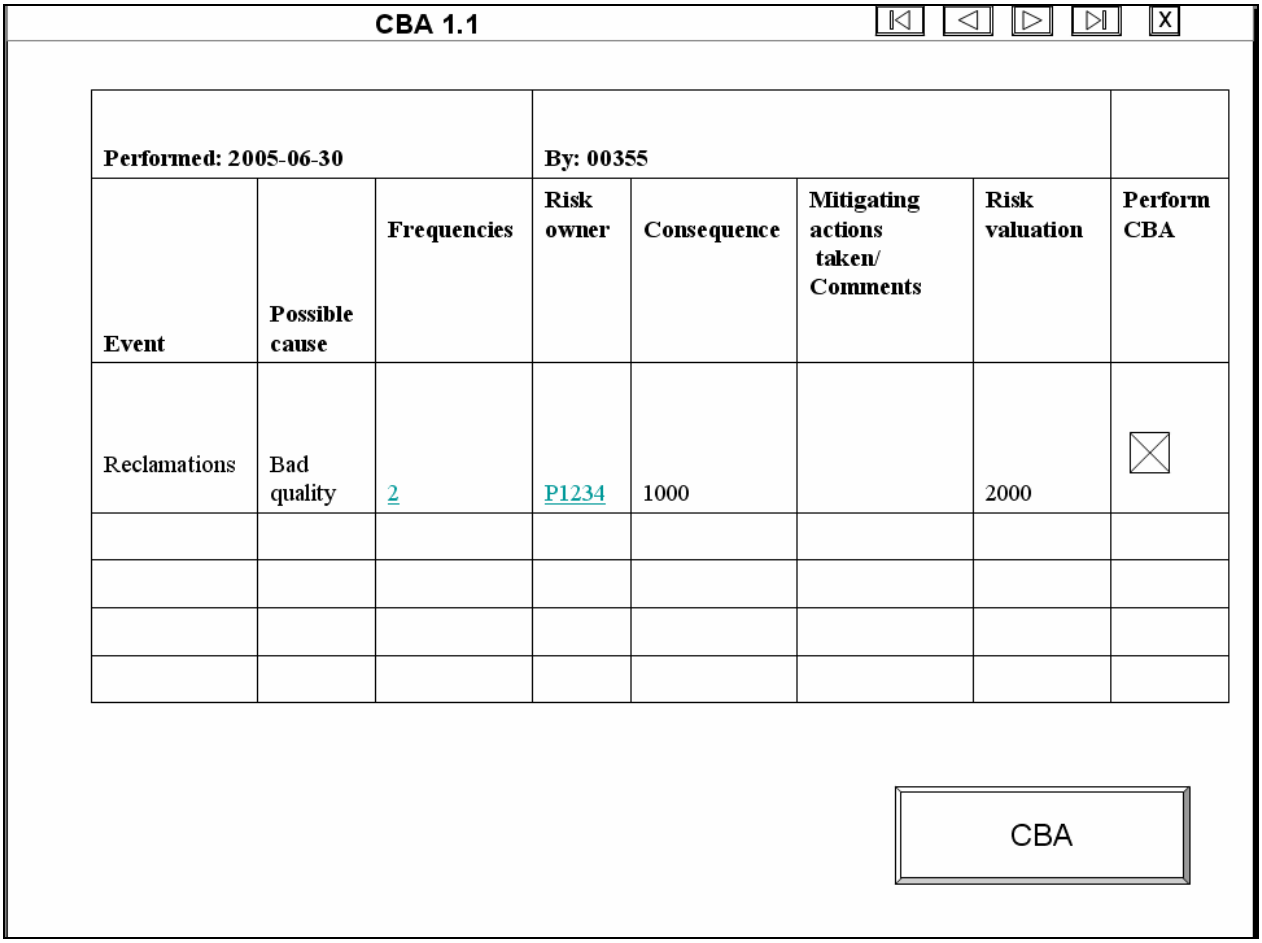
Page 34) This page is the QRA 1.2 page which means that it is the second stage in a QRA analysis. After identifying a risk it is possible to import statistics by clicking on the box to the right which leads to page 35.



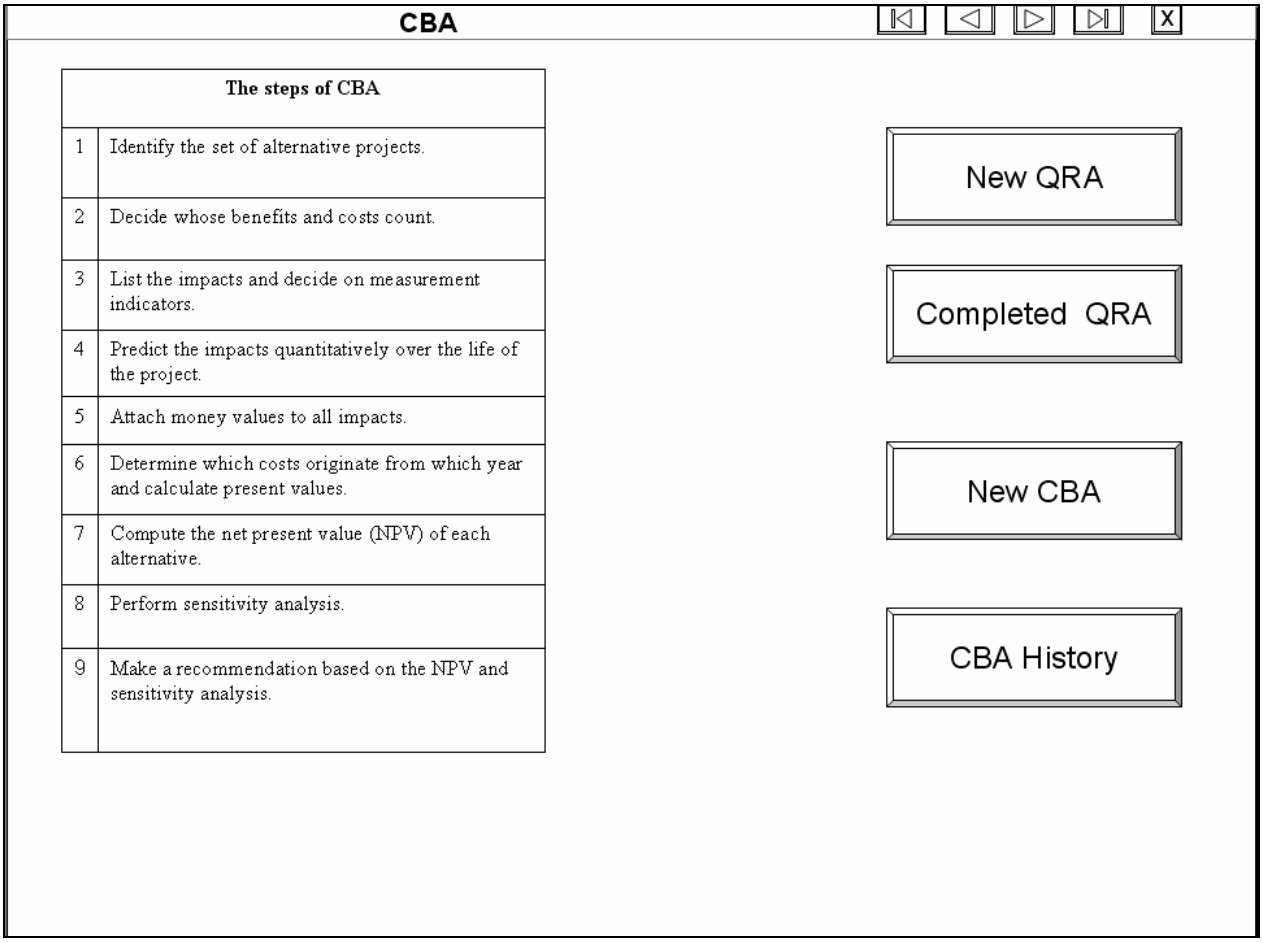
Page 35) This page is the QRA 1.3 page which means that it is the third stage in a QRA analysis. The statistics has been imported from the databases.



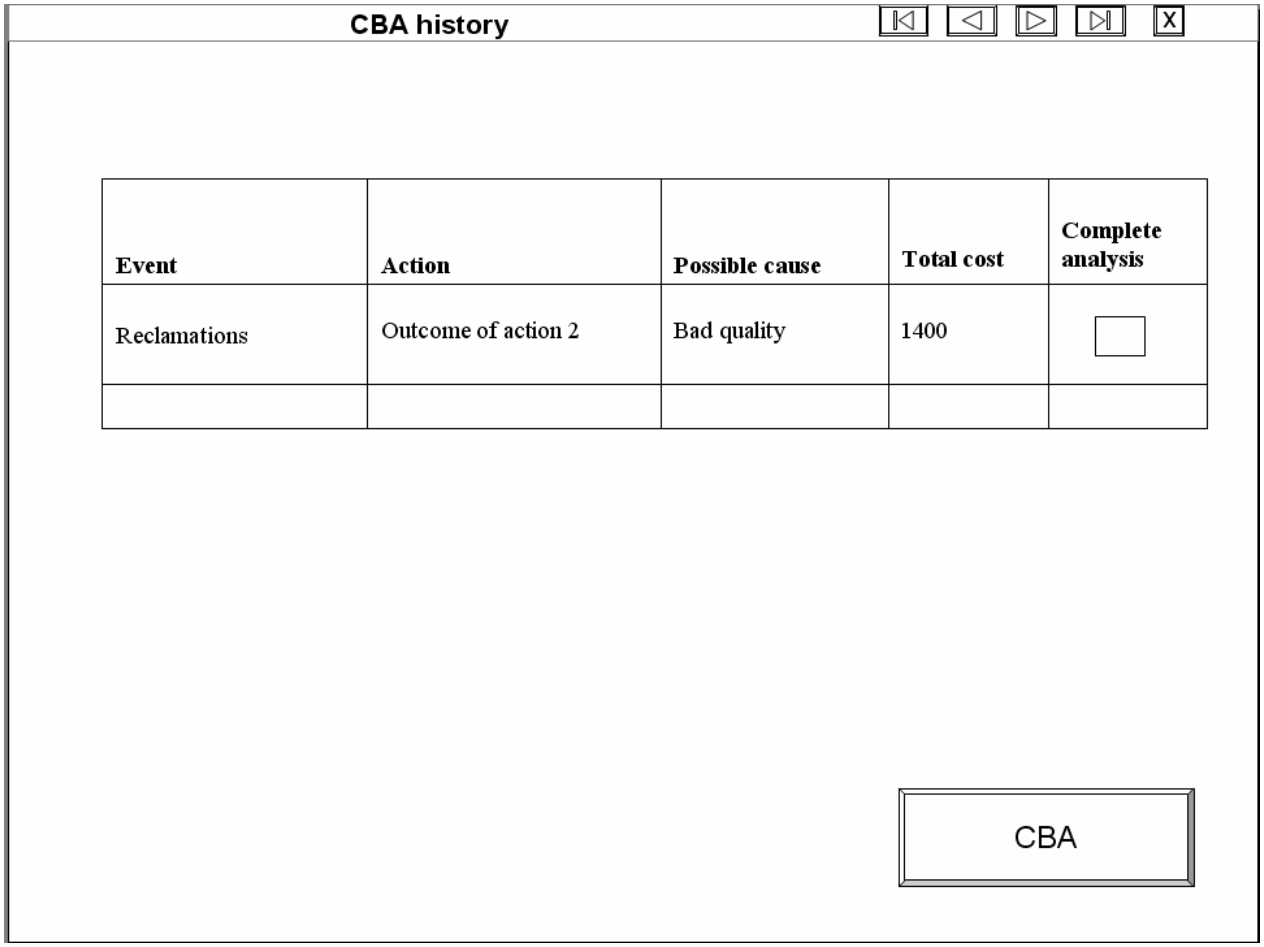
Page 36) This page is the QRA statistics from reports page. From this page the statistics from incidents can be found and imported into the QRA risk analysis.



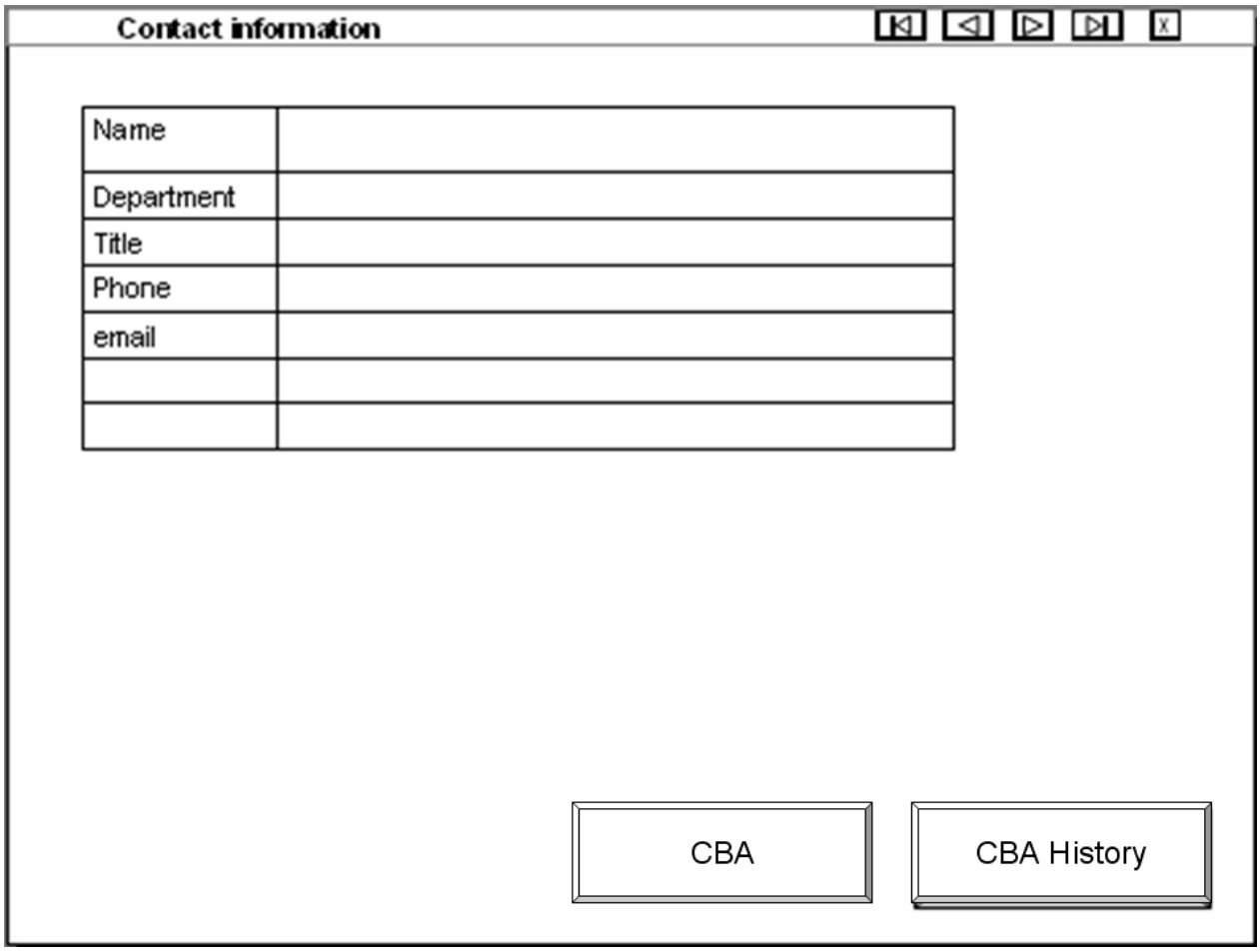
Page 37) This page is the QRA-CBA page. In this page CBA analysis can be chosen for the risks that have been identified.



Page 38) CBA page. In this page CBA analysis can be done or the risks that have been identified and costs from different investments can be compared.



Page 39) This page is the completed CBA page. In this page links to the CBA analysis that has been done can found. Information about the analysis can be reached by clicking on the complete analysis button.



Page 40) This page is the contact information page. Contact information for the person responsible for a specific risk can be found here.