Directory of ESReDA accident databases

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DIRECTORY OF ESReDA ACCIDENT DATABASES

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SUMMARY

Since 1993, a working group of European Safety, Reliability and Data Association (ESReDA) "Accident Analysis" has been dealing with data collection, quality, reliability and networking of accident data. The aim of this review paper is a description and possible uses of the ESReDA directory (issued in 1997) of accident databases involving chemicals. First, the requirements from end-users of accident data are described on the basis of an enquiry. Then, a brief description of the existing directory is given. The review will end on the current work on a guidance document for high quality databases. Details on this guidance document will be developed in other lectures.

KEYWORDS

Data collection, Data analysis, Reliability, Uncertainty, Accident, Hazardous material, Risk analysis.

INTRODUCTION

For long with the objective of improving the protection of environment and the avoidance of accidents, plant managers, insurers, authorities, consultants, research organisations are dealing with learning from investigations of accidents involving chemicals. Many databases on accidents implying chemicals are in existence and data are shared between database developers and end users. The reliability of data is strongly related to the quality of data collected from accident investigations and their subsequent analysis. Many frameworks for collecting, recording and ensuring quality do exist, but there is a need for harmonisation. Since 1993, a working group of European Safety, Reliability and Data Association (ESReDA) "Accident Analysis" (AA) is dealing with data collection, quality, reliability and networking of accident data.

In the 1994 seminar "Accident Analysis" (prepared under the auspices of ESReDA), the need of using validated and qualified data on accidents was emphasized. In a first step, it implies the collection of reliable data. A preliminary analysis of existing databases led to the conclusion that they are generally all "abstract" databases and result from an aggregation process of existing information. During this stage, some form of "filtering" and coding of this information originating from various analysis occurs. Even in a direct collection of data by database operators, the interpretation of the initiating events, the sequence of subsequent events and the effects and causes may be difficult owing to the large variety of involved materials, plants, processes and causative factors.

A methodology for direct investigation of accident was developed elsewhere and implies four main steps : gathering evidence with a search for information, exploring possible scenarios, investigating the scenarios and performing the validation of assumptions. More details and lessons learnt from investigations can be found in Pineau (1996) or in the paper to be presented in this seminar : "Investigation of accidents and sharing information : an expert point of view". Whatever the accident investigation could be, some explanation of the possible discrepancies between data from different databases are given by Haastrup (1994), first on an apparently well defined information such as the reported number of fatalities for the same accident. Therefore, it should be pointed out the influence of the uncertainty of data. Such findings can be extended to other types of information : chemicals and amounts involved, description of events. As a consequence, in statistical studies for quantitative risk analysis, uncertainty will be inherent in the accident case histories.

Despite these adverse conditions, the "AA" group had the objective to improve the current situation. Therefore, the involved members devoted their efforts to have a better knowledge of the requirements from end-users of accident data, to prepare a directory of existing accident databases and to define a guidance document for high quality databases. These three aspects will be developed in this review paper.

REQUIREMENTS FROM END-USERS OF ACCIDENT DATA

Various organisations (competent authorities, consultants, emergency planners and responders, engineering companies, general public, industrial firms, insurance and banking groups, manufacturers of equipment, research organisations and universities) can have special interests in accident data.

The most general and final objective is the improvement of the safety level of an equipment, a plant, a process or a system and the minimisation of losses.

In some countries, competent authorities can have access to tailor-shaped databases for the workplace, for transport system, for a given industrial field, for large accidents implying consequences for man and environment. For the latter object, five databases could be taken into consideration : MARS at the European Union level (Rasmussen - 1996), ARIA in France (Chaugny - 1994), FACTS in the Netherlands, MHIDAS (Painter - 1994) in United Kingdom and ZEMA in Germany (Brenig - 1994). The main goal of the review of reported accidents is the definition of proactive policies regarding safety studies, emergency planning and response, the improvement of reliability of equipment and preventive and protective devices and of safety management systems.

Manufacturers, consultants and engineering companies in charge of the operation and design of equipment and plan shall be able to identify the possible hazardous situations arising from use and manufacturing of a given substance in order to define the safe operating envelope (operating conditions for which no large accident and losses are possible) of the system under consideration. Thus, the determination of failure rates is important.

Insurance and banking companies are interested in the worst case scenarios in connection with the acceptability of risk and the definition of insurance premiums and money loans.

The development of a safety culture in industry and in the large public can be improved by learning from accident (case histories) at the industry level, in the curricula of scientists and in the general education.

And last but not least, accident investigation can show the lack of knowledge on the initiation causes, sequence of events in an accident scenario and convenient preventive and protective measures.

Bearing in mind these various objectives, an enquiry was set up among these possible end-users for understanding the strengths and weaknesses of existing databases (Keller - 1994). During this investigation, 93 questionnaires originating from twelve countries and valid for further analysis were returned. One fourth of the total were sent back respectively by governmental organisations and by consultants and one third by industrial firms. The three most commonly used databases were ARIA, FACTS and MHIDAS (40 % of the answers). In this enquiry, 83 different databases either dedicated in house or generic, were mentioned. This analysis allowed a better understanding of the main use of the generic databases and was the input for further work in "AA" group. The particular aims and the important features to be found in a given database are summarised in tables 1 and 2 in which the percentage of answers from responders are given.

Table 1 - Aims*

Supplying data for	Percentage
Identification of accident scenarios	79
Identification of deficiencies in design of operation of hazardous installations and hazardous systems	58
Evaluation of emergency procedures	26
Formulation of policies on national/international scale	14
Formulation of policies for financial and insurance companies	5
Validation of models describing accidental phenomena	17
Improving of total quality management of safety	26
Establishment of reliability and failure rates	13
Complying with regulations and standards	17

*Multiple answers possible

Table 2 - Important features*

Focus	Percentage
The accident sequence	74
Chemicals involved	60
Human and management aspects	45
Technological aspects	68
External causes	40
Physical/chemical phenomena	54
Human loss	48
Environmental impact	53
Property and plant loss	44

*Multiple answers possible

An analysis of additional features and areas which users would like to see incorporated or improved upon in future accident databases are summarised in tables 3 and 4. Further information on this enquiry can be found in Keller (1994).

Table 3 - Areas for improvement

	Percentage
Identification	49
Type of activities	39
Chemicals involved	49
Equipment involved	44
Physical phenomena involved	40

Table 4 - Additional features*

Additional features	Not necessary	Just for information	Useful	Highly important	
Safety management	7	14	50	29	Useful
Initiating cause - Man made	4	2	23	71	Highly important
Initiating cause - Natural	6	9	29	56	Highly important
Environment - Geography	6	23	40	31	Useful
Environment - Population	4	27	40	29	Useful
Emergency response - on site	9	20	37	34	Useful
Emergency response - off site	10	31	35	24	Useful
Consequences on man - immediate	9	6	20	65	Highly important
Mid-term consequences	6	14	40	40	Highly important
Long-term consequences	8	21	33	38	Highly important
Financial costs	10	33	27	30	Just for information
Gravity scale	27	21	35	17	Useful
Violations of regulations	10	23	43	24	Useful
References to litterature	6	13	39	42	Highly important
Quality assurance	26	22	29	23	Useful

*Numbers are percentages

A DIRECTORY OF EXISTING ACCIDENT DATABASES

The basis of the directory issued in 1997 (Pineau - 1997) is a description in four sections : identification, technical aspects, access conditions and use, database details. Answers to an enquiry were received from 48 databases operators, but later only about 40, accepted the introduction of information in this directory as a two-page form for each database.

The industrial and activities are : chemical, explosives, mines, nuclear, oil including offshore, pesticides, refining, transport and water pollution.

The main criteria for including accidents and incidents are : chemicals involved, type of hazardous events, near miss, number of fatalities, or injuries, material and in some cases environmental losses.

When analysing in details the findings from this inquiry, it shall be pointed out that the objectives are so various that covering all the above mentioned industrial areas and activities is rather impossible even with a very extended database. It implies that specialization with experts in the field to be covered will be sought. As a consequence, a better networking of database operators will be required. Another positive effect of a networking will be the avoidance of multiple entries for the same incident. Improving the networking will require the development of a common accident data collection form on the basis of these in existence at European level for the MARS database or at the OECD-UN levels. Whatever this final form could be, more efforts will be devoted in general to have high quality input data.

HIGH QUALITY DATABASES

The work under progress is dealing with various topics such as :

- database operator
- database structure
- data collection, recording, validation
- quality assurance.

Currently, the members of "AA" group considered that, in the database structure, more relevant information shall be given on the object being exposed to the accident and its surrounding (setting of accident), the conditions of occurrence (external) and the operational conditions (internal), the description of the accident, the causes, the consequences, the emergency responses, the follow-up/resultant actions.

Information should also make reference to the original source and consider a much larger field of data than previously.

Data currently available are : date, time of occurrence, location and establishment, work being done, immediate effects, accident type. Information is to be extended to people working in the area, job supervision, permits issued, procedures and safety management system used, ecological components (inland, freshwater, shore, offshore - if relevant -, mid-term and long-term consequences on people and area concerned, specific process, equipment and substances involved, chain of events and causes ...).

Regarding the emergency response (if relevant), more information is to be reported on the measures taken with chronology and organisations involved.

The follow-up is dealing with the following aspects : legal, administrative, penalties, disruption of the community life, techniques used for remediation, post-emergency survey (eco-systems, health), insurance and financial implication.

Last but not least, the database structure should give a summary of the accident description including causes related to the operation, environment, organisation and person, and possibly the accident category and severity, referring to accepted scales and the lessons learned. It should be pointed out that gravity scales (for example, the gravity scale developed at the European level for industrial accidents involving dangerous chemicals - Amendola, A. et al, 1994 -) can ease comparison and classification of accidents allowing statistics and trend analysis and improve the reliability of data.

In the "AA" group, such a broad work involves database operators and end-users.

The final goal will be a guidance document to be included in the next revision in 1999 of the Directory of accident databases. Details on this guidance document will be given in a paper to be presented by E. Funnemark "High quality databases".

CONCLUSION

Sharing of reliable data from accidents is still questionable when looking at the variety of industrial situations, materials involved and origins of data. More efforts should be devoted to investigate accidents according to a well defined and accepted structure. Improvement of the use of reliable data can only occur if high quality data are included in the databases. It is the task of ESReDA "Accident Analysis" working group to develop actions in this area. We would be very pleased to take into account any suggestion for this work and to have participation of new members.

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