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TOWARDS AN AUSTRALIAN SYSTEM FOR HAZARDOUS MATERIAL INCIDENTS REPORTING*

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Summary

Information on incidents involving hazardous materials is often inaccurate, incomplete or absent. This has been highlighted by a number of well publicised incidents and the growing realisation that many incidents are poorly recorded. Existing overseas reporting systems are briefly reviewed and an historical perspective of the Australian scene is given together with current developments in this area. A start has been made to addressing the issue of an Australian system for hazardous material incident reporting (ASHMIR). A Discussion Paper on ASHMIR was issued for public comment in late 1987 by the Australian National Occupational Health and Safety Commission (Worksafe Australia), which received strong support. The public comment received by Worksafe Australia on ASHMIR is summarised. An operational trial, which will cover both spills and fires involving the major fire brigades in Australia, is being developed by Worksafe Australia. It is hoped that the trial will indentify and correct problems prior to development of a full draft proposal for hazardous material incident reporting in Australia.

Introduction

Industrial development has not been free of incidents. In recent years, Flixborough, Seveso, Mexico City/Pemix, Bhopal, Chernobyl, Rhine River and Piper Alpha are obvious examples. These (and other) names have become associated with incidents involving hazardous materials that have presented major risks to workers, the community and the environment. Although general

*The conclusions reached and scientific views expressed in this paper are solely those of the authors. These do not necessarily reflect the views and policies of the organisation in which they work.

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principles exist related to dealing with these matters, the potential for them to occur continues.

Socially, the general complacency with which the safety of well designed and well controlled complex technologies has been regarded in the past is gradually being replaced by a growing expectation which demands that such technologies should not harm health or the environment. Whatever the cause of the incidents, it is obvious that the development and implementation of local, national and international programs are needed, essentially aimed at prevention.

While Australia has been relatively fortunate in avoiding disasters of significant magnitude (both in terms of the numbers of lives lost, and in the costs for dealing with their aftermath), there have been a number of incidents in recent years which have caused concern. Notably:

- a fire at a chemical transport company in Melbourne, Victoria, on the night of 12 April 1985, which destroyed or damaged 2300 tonnes of a wide array of 130 organic and inorganic chemicals in a warehouse fire. The subsequent run off of water from fire hoses caused significant environmental damage;
- an explosion at an aluminium recycling smelter in Laverton North, Victoria, on 30 September 1986. Sodium nitrate (labelled in Chinese and incorrectly stored in a sodium chloride storage area) was added to the molten contents of a smelter causing explosion and four deaths;
- a fire on an oil platform in the Bass Strait in November 1986, where one engineer was killed and another suffered severe burns during the testing of production equipment;
- a chemical factory explosion in Rhodes, New South Wales, on 29 November 1986, where a welding accident in maintenance operations following a routine plant shutdown killed five workers and injured 21 others;
- a massive liquid gas leak (22 tonnes) from a liquefied petroleum gas (LPG) rail tanker in Cairns, Queensland, on 17 August 1987. Failure by rupture of one of the liquid LPG transfer hoses lead to the leak, which was ignited by a nearby source, resulting in an unconfined vapour cloud explosion (UVCE). A boiling liquid expanding vapour explosion (BLEVE) occurred nine minutes later. The resultant fireball caused injuries to 28 people (of whom 26 received burns, 5 seriously). One of these, a bystander, died three days later as a result of burns to 80% of his body.

These incidents highlight the often uneasy relationship between the control of complex technologies and public safety. Such well publicised incidents are only the tip of a relatively large iceberg, and a glance at any world newspaper indicates that there may be hundreds of incidents involving hazardous materials each year which are potentially dangerous to local communities. This is supported by data available from other, more local sources [1–3].

There is a need for the consistent reporting of incidents involving hazardous materials. This will allow collection of more accurate statistics, and enable better planning of safer technologies and contingencies for handling emergen-

cies. Considerable effort has gone into designing systems for the collection of such information in North America and Europe, and a start has been made in Australia.

Currently, the major source on information of incidents involving hazardous materials (HAZMAT) in Australia is from press reports or coronial reports if the incident results in loss of life. As such reports are not compiled by experts in the field, these do not provide the accurate data required for a detailed assessment of HAZMAT incidents. An Australian incident reporting system and database could provide for the collection and dissemination of information on incidents involving the transport, storage, handling, use, disposal and accidental release of hazardous materials. An independent Australian system providing such information would be of paramount importance to improve the health and safety of the Australian public, in that it would ensure the continued improvement of workplace health and safety and it would assist in developments in environmental protection.

Overseas initiatives

North America

Various agencies in the United States collect data on hazardous materials spills. Some information is available from:

- the Materials Transportation Bureau of the US Department of Transport (DOT). The Research and Special Programs Administration (RSPA) of DOT has developed a system of collecting information on incidents involving the transportation of hazardous materials. Failure to comply with DOT's reporting requirements can result in a civil penalty. The database does not include spills from stationary sources;
- the US Coast Guard is concerned with spills into US waterways and collects data which are added to a database at its national headquarters. The database contains information on numbers of incidents, types and quantities of materials spilled, causes and sources of spills and locations of incidents;
- the National Response Centre (NRC), established as part of the Comprehensive Environmental Response Compensation and Liability Act of 1980 (CERCLA) and commonly known as Superfund. The Superfund Law requires a person in charge of a vessel or facility to notify the NRC in the event that reportable quantities of hazardous materials have been released into the environment. The Superfund Amendments and Reauthorization Act of 1986 (SARA) gave the US Federal Government extensive power and authority to deal with environmental liability.

However, the US Government has no complete, centralised database on hazardous materials spills. As a result, trends in the number and type of incidents are difficult to assess [4].

Canada has had a hazardous material incident reporting (HMIR) system since 1973. The information in the Canadian Environmental Emergency Branch National Analysis of Trends in Emergencies System (NATES) database is stored in coded format. The fields cover topics such as location of spills, material involved, source of release, cause of release, consequences and action taken by the emergency services. In 1985 the database contained over 14,000 incident records [5].

Europe

A number of database have been developed in Europe to collect data on incidents with dangerous materials. These include:

- the FACTS database, operated by TNO Apeldoorn, The Netherlands [6]. This contains technical data of incidents with dangerous materials that occur during storage, transshipment, transport, use and disposal of chemicals, including 'near miss' information. In the period 1977–1982, this data bank collected information on over 6,000 incidents, covering 450 chemicals, the most commonly recorded being fuel oil, followed by LPG and natural gas. Of the toxic materials, chlorine featured in approximately 250 incidents, and ammonia in about 150 incidents.
- the CHAFINCH (Chemical Accidents, Failure, Incidents and Chemical Hazards) databank, operated by Risk Management Ltd (UK) and which was available in on line in Europe through the UK SIA Computer Service in 1985 [7]. The present status of this data bank is uncertain;
- MHIDAS (Major Hazard Incident Database Service) developed by the United Kingdom Health and Safety Executive and the Safety and Reliability Directorate [8].

Of these, MHIDAS is probably the most well known. This is a worldwide database established to record incidents involving hazardous materials which pose major risks to the public from anywhere in the world [8]. As at September 1988, MHIDAS has 3300 records of 2900 major hazard incidents which have occurred during the past 25 years, and entries are being added to the database at the rate of approximately 300 incidents a year. MHIDAS mainly contains information on incidents in North America and Europe, but is also making efforts to identify sources of information from other parts of the world, where details about chemical accidents are often sketchy.

Coded information is stored under 24 separate field which can be searched independently or in combination with other field(s). MHIDAS may be interrogated by organisations which are in a position to exchange information on major incident hazards or organisations that pay for the service. Data collected for MHIDAS have been used in risk analysis studies, for example in estimating the failure rate of underground pipes carrying petroleum gas.

MHIDAS is now available commercially in Australia and the Far East, although access is complicated by the difficulties of communication over long

distances. This situation will be improved in the latter part of 1989 when MHIDAS will be available as a CD/ROM compact disc and on line through the European Space Agency. Currently, the database contains very little information regarding incidents in Australia, with only about 25–30 (less than 1% of the total) entries, dating from 1947. However, this is probably a reflection of the actual numbers of incidents in Australia, compared with the total number of incidents that occur in Europe and North America.

International

International agencies with an interest in the control and use of hazardous materials are also becoming involved in HMIR, though the perspective is presently in the development of HMIR related policies, rather than the substance of HMIR.

The report "Issues of Concern to the International Labour Organisation (ILO) Arising out of Recent Industrial Accidents in Bhopal and Elsewhere" was submitted to the ILO in February 1985 [9]. In June 1985, a Tripartite *ad hoc* Meeting of Special Consultants on Methods for Prevention of Major Hazards was formed to provide guidance to the ILO on how to develop necessary steps to improve health and safety in the production and storage of dangerous substances. The report of this Meeting [9] recommended that accident/incident reporting be implemented.

Following the accidental release of toxic materials into the Rhine River after a fire in a chemical warehouse at Basel, Switzerland in October 1986, the United Nations Environment Program drafted two treaties, one involving the notification of transborder spills (which could be facilitated by standard reporting), and the other concerned with mutual assistance in the case of such spills [10].

Also, the Environment Committee of the Organisation for Economic Cooperation and Development has formed an *ad hoc* Group of Experts on Accidents Involving Hazardous Substances in June 1988. This group will be working on a number of areas [11], including:

- exchange of accident experiences;
- improving the basis for accident statistics;
- an inventory of available information resources;
- exchange of information on accident prevention practices;
- developing guidance for the scaling of industrial accidents.

A separate review would be required to expand on the summary outlined above and to review in detail the national reporting systems and international initiative described. Such a study should also review the available data on incidents and the lessons learned, but is beyond the scope of the present article.

Initiatives in Australia

Politically, Australia comprises a Commonwealth of six States (New South Wales, Queensland, South Australia, Tasmania, Victoria and Western Aus-

tralia) and the Northern Territory, with a Federal Government located in Canberra. The Australian Capital Territory was governed by the Federal Government until 1989, when it obtained self-government.

Following the Federation of Australia in 1901, the Federal Government assumed responsibility under the Australian Constitution for a number of areas (such as defence, customs, international relations, etc) but transferred a significant number of powers back to the States. Therefore, relationships between State/Territory Governments and the Commonwealth are complex, and though the Commonwealth (Federal) Government has a number of important political responsibilities, jurisdictional power for the majority of government activities resides with State and Territory Governments. The role of the Federal Government agencies is to advise, rather than regulate, and encourage development and coordination of uniform regulatory policies within Australia.

In the specific area of reporting incidents involving hazardous materials, the Federal Government House of Representatives Standing Committee in Environment and Conservation recognised the need for HMIR in 1982. The Report of the Committee [12] recognised the need for a single incident notification system coordinated at the national level to cover all incidents involving dangerous goods, including hazardous chemicals, and recommended that such a system be established.

At the State or industry level, the number of mechanisms which have been developed for reporting certain categories of incidents, is not large. Examples include:

- major and minor transport spills and incidents involving the transport of dangerous goods (New South Wales State Pollution Control Commission and Department of Industrial Relations and Employment); and
- mine accidents (Western Australia Department of Mines);
- the New South Wales and Queensland Coal Associations have been conducting a system of significant incidents in the coal industry;
- pipeline failures (the Australian Welding Research Association);
- LPG incidents (Australian Liquefied Petroleum Gas Association);
- chemical manufacturers such as ICI, Monsanto and Dow have developed incident reporting for their company operations;
- the Australian Chemical Industry Council compile a quarterly report on transport incidents involving dangerous goods based on returns from member companies;
- boiler and pressure vessel authorities will be required under a new Australian Standard to publish a summary of failures and failure rates.

Reporting incidents involving hazardous materials may also be part of legislation. Most State and Territory Governments have enacted specific legislation relating to the control of hazards, including Explosives Acts, Dangerous Goods Legislation, Radioactive Substances Regulations, Poisons Acts, Pesticide Acts. Some of these may outline specific statutory HMIR-type require-

ments. Other legislation (for example, Factories Acts, Railways Acts, Pollution Control Legislation, Water or Air Quality Acts) may also have similar provisions. In most cases, reporting is to different Government Departments with relevant jurisdictional responsibilities (for instance, Departments of Health, Employment, Industrial Relations, Mines, Trade, Environment, etc).

The design of a HMIR scheme

This fragmentation by legislative responsibility or administrative demarcation has meant that development of a HMIR system in Australia has been difficult [13]. These issues were recognised by the Australian Federal Government body, the National Occupational Health and Safety Commission (Worksafe Australia), and in January 1988 it released the discussion paper "Australian System for Hazardous Material Incident Reporting (ASHMIR): Proposal for a Minimum Data Set" [14]. The Discussion Paper was prepared following wide consultation with a number of State and Federal Government bodies, and with the Australian standards setting body, Standards Australia. The purpose of ASHMIR was "to provide a clear and concise understanding of the sequence of events that lead to failure, so as to prevent similar incidents from occurring during the manufacture, use, storage or distribution of hazardous materials" [14].

Essentially, the Discussion Paper:

- proposed that a uniform national reporting system be established in Australia for reporting incidents involving hazardous materials:
- outlined the types of incidents to be reported (including 'near misses');
- outlined the possible uses and users of the information generated;
- provided suggested reporting criteria and formats, including -
  - standard detailed formats based on coded formats used in the reporting of fire incidents in Australia [15]. It was considered that while HMIR could be conducted by any agency, the most frequent compiler of hazardous material incident reports would be the emergency services, particularly the Fire Brigades. The criteria proposed for HMIR are qualitative in nature, which may present interpretation difficulties. However, it was felt that at this stage of development of ASHMIR, quantitative criteria based on definitive limits would be too restrictive or difficult to implement,
  - an option for simplified reporting for agencies which may feel that either a more detailed format is not appropriate to their needs, or a report in a more narrative style was preferred;
- suggested actions to be taken for implementation of a national HMIR system.

A number of submissions (from industry, union, emergency service and Government organisations) were received by Worksafe Australia during the three month public comment phase following release of the discussion paper. Broad support for further development of ASHMIR was received, including

strong support from all the major Australian fire brigades. The submissions raised important issues for further development of ASHMIR:

- ASHMIR should encompass all hazardous materials (the Discussion Paper proposed that explosives and radioactive materials be excluded, as they were controlled under separate legislation);
- definition of hazardous materials and categories of hazardous materials should be consistent with those operating internationally (especially those of the UN Committee of Experts on the Transport of Dangerous Goods);
- while appropriate dissemination of collected information is an obvious product, ASHMIR must contain safeguards for confidentiality;
- reports stemming from ASHMIR should not prejudice any legal or insurance positions, and should not be an avenue for development of more restrictive procedures (such as legislation);
- ASHMIR should cover not only 'major accidents' and 'potentially serious accidents,' but also, for example, incidents involving major hazards (not just hazardous materials);
- the scope of an incident involving hazardous materials should no be restricted in terms of manufacture and storage, but should also include 'off site' incidents such as those involved with transport and distribution. Criteria for reporting such incidents could be based on quantity limits;
- appropriate criteria for incident reporting need to be established in ASHMIR. Data are presently recorded by other groups, such as private sector (industry) and public sector (governments, through inspectorates and other activities) bodies. This information is often variable in content and quality because factors vary in its collection (including for example, thresholds, scenarios, jurisdictional responsibilities). Some of this information could, if collected together and standardised in terms of format and content, provide more useful data. This could occur at the State, National or International level;
- the Discussion Paper suggested reporting within 15 working days. A number of submissions considered that this was too short a period to generate a full report, though the possibility of submitting an interim report by this time was probably acceptable;
- ASHMIR should contain the ability to interchange information at an international level. Development of a centralised and uniform Australian HMIR system would provide the necessary information to integrate with an international HMIR database such as MHIDAS.

In addition, a number of submissions considered that the most cost-effective way to achieve a national reporting system was for the scheme to be conducted on a State basis, with coordination of standard reports at the national level. Arrangements within each State would depend on local arrangements and procedures, some of which may already be in place [13].

The practical issues and associated constraints in implementation of ASH-

MIR have been discussed elsewhere [13,14]. Briefly, some of the problems likely to be faced are:

- criteria setting and its interpretation;
- training of personnel involved in the provision of HAZMAT incident information;
- the diverse interests and capabilities of different reporting authorities such as metropolitan or country fire brigades, government agencies, or industry reporting to a single collection centre using a single reporting system; and
- the issues of complementarity and follow up reporting in circumstances where it is applicable.

The further issue of consultation should also be highlighted. It is essential to involve representatives of all interested bodies in the developmental process at an early stage. Direct involvement will ensure that the overall design of the system and its details are understood and acceptable on national basis. Only then will difficulties in ensuring overall acceptance, or obtaining the necessary committment, be overcome.

Trial reporting

Interest in the further development of the proposed reporting system has been generated to the stage that several fire brigades, including all the major Australian fire authorities, have agreed to an interim reporting for an operational trial. The trial will record fires and spills both inside and outside of site boundaries, which require the involvement and/or action by the fire brigades. The main providers of information will be the land based brigades (the Maritime Services, which have their own fire services, are not participating in the trial at this stage). However, the fire brigades do get involved with incidents at ports and harbours, and the Port Melbourne Emergency Service (the major Australian Port emergency service) is also participating. The trial is being developed and conducted by Worksafe Australia.

Interim reporting for a period of 6 months begins later in 1989. The data elements and codes for the trial were taken from the Australian Standard for reporting incidents involving fires [15] to ensure continuity and 'user friendliness' to report compilers in the fire brigades. This is a general fire incident reporting system, which is by no means complete or stand alone with regard to HMIR. In addition, the trial reporting format contains some fields for the MHIDAS system.

Worksafe Australia will be responsible for all data management and analysis. The methodology and results of trial reporting will be published at a later date. The results of analysis of the data will allow further development of the proposed system at an operational level, by enabling a more informed selection of reporting criteria, a clearer selection of items to be included on the reporting form and development of more efficient coding procedures.

Discussion

The total cost of occupational injury and disease in Australia is estimated to be in excess of Aus$12 billion each year, of which a major portion of the cost is borne by industry through compensation payements, lost time, retraining, and repair and replacement of equipment [14]. The development and implementation of a national reporting system is one way that some of these costs may be reduced significantly, and is therefore viewed as a priority by Worksafe Australia.

The generation of reliable information on hazardous material incidents is crucial for:

- a better understanding of chemical danger;
- a more accurate prediction of future or potential hazards; and
- more representative estimations of risk.

Considerable effort is being directed into the development of risk analysis methodologies that can predict the safety and reliability of new, existing and modified industrial technologies and processes [16]. These methodologies attempt to identify and predict the probability of unexpected or dangerous events, and try to estimate the consequence of such events. The presence of information of events that actually occurred (as opposed to synthesised data) can yield basic information on probabilities and consequences, and it can give increased confidence on predictive processes.

Recent surveys of industrial accident databases have been reported by TNO [17] (though information on the cause of incidents with related technical data in this survey is rather scarce) and by Marshall [18]. In Australia, particularly in New South Wales, significant advances have been made in the application of risk analysis techniques to major hazard planning and management [16,19], emergency response planning [20] and procedures for dealing with chemical incidents [21]. As part of the risk assessment process, generic data based on overseas plant experience and information systems have been used as the basis for such analyses. However, the lack of Australian data, which would enable more accurate assessment and relevant disaster planning, remains a problem.

Therefore, a system which collects information on incidents involved with hazardous materials has a number of uses:

- the collection of comprehensive information in a standardised format for significant numbers of incidents;
- the provision of data on prevalence and severity of incidents, and monitoring these events over time;
- the provision of information and statistical summaries of circumstances of incidents;
- the identification of potential hazards and dangers, and of trends and problems common to incidents necessary for the development of successful control strategies;

- the collection of data on the infrastructure of incidents, such as -
  - the adequacy of procedures for dealing with incidents,
  - the appropriateness of measures for personal protection and other equipment,
  - improving emergency preparedness plans and emergency response procedures,
  - improving communication links with relevant personnel and advisory bodies such as medical, health and environmental agencies,
  - activities to be avoided;
- assistance in the development of policies aimed at the prevention of incidents involving hazardous materials;
- the design of safe plants and the control of major chemical hazards;
- the generation of more precise risk estimates for industry and decision making bodies;
- the validation of assumptions and judgements presently used in the assessment of safety;
- the validation or refinement of existing theoretical models and procedures.

The system also has the potential to provide information to a reasonable number of users:

- federal, state and territory government agencies concerned with legislation, control, planning and response to hazardous materials incidents;
- local government;
- occupational health and safety professionals;
- insurance companies;
- employer and industry organisations;
- unions and employee bodies;
- community organisation;
- research organisations;
- international data collection systems.

It should be emphasised that, at present, discussion in Australia is concerned with recognising whether or not there is a need for a centralised HMIR system. Consideration of other important aspects, such as the scope of a future HMIR system, are still to be addressed. However, the results of Operational Trial Reporting will assist in more informed development, and provide guidance to further definition of the system, including administrative arrangement, criteria for reporting, selection of data elements, information dissemination mechanisms, reporting authority involvement, etc.

In summary, an Australian hazardous material incident reporting system requires careful consideration and evaluation. Eventually, a HMIR system could be incorporated into existing standard protocols for reporting other types of incidents, for example the Australian Standard for Collection of Data on Fire Incidents [15]. Such a system, if developed in Australia, would need to be comprehensive in scope and coordinated nationally to maximise impact. To

achieve any level of success, such a system would need the responsible and concerted support of a large number of diverse local, state and national agencies. Finally, to attain any level of international credibility, it needs to reflect those reporting systems already in place.

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