SAFETY REPORT: MAINTAINING STANDARD AND REVIEWING

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Synopsis
Malaysia promulgated Control of Industrial Major Accident Hazards (CIMAH) Regulations in February 1996. Since then there have been 159 major hazard installations (MHI) and 321 non-major hazard installations (NMHI). The classification of MHI and NMHI is based on threshold quantity (TQ) of hazardous substance(s). For MHI the quantity of the hazardous substance(s) in its vicinity is equal or exceeds the specified threshold quantity while NMHI poses the material(s) in between 10% TQ and TQ. According to the regulations, the MHI must submit a safety report and emergency response plan (ERP) to the Department of Occupational Safety and Health (DOSH) but the NMHI is only required to show its activities are safe and to submit of an emergency response plan (ERP). The importance of the safety report is to identify the nature and scale of use of the dangerous substances, describe the type, relative likelihood and consequences of major accidents and the arrangements for safe operation and control and mitigation of major accidents. In order to meet the requirement or standards of the safety report, the regulations require that the MHI(s) consult the registered Competent Person(s) for advice and approval (screening) of the report. It was anticipated that the use of the service of the competent persons for approval of the safety report will reduce the number of reports that are rejected, need modification or need correction. This paper discusses result of a review of the safety reports.

KEYWORDS: Safety report, standard, CIMAH, major accidents, review, errors/ omissions

INTRODUCTION

According to The Occupational Safety and Health (The Control of Industrial Major Accident Hazards) Regulations, 1996, all Major Hazard Installations (MHIs) must submit Safety Reports to the Department of Occupational Safety and Health (DOSH). Its content must fulfill the legal requirements as stated in Schedule 6 (Subregulations 14(1) and 15(1)) i.e. *Information to be Included in Report of Industrial Activity"*. The preparation of the safety report must include:[1]

i) Information relating to every hazardous substance
ii) Information relating to the installation
iii) Information relating to the management system for controlling the industrial activity
iv) Information relating to the potential major accidents in the form of risk assessment

The safety report is a documentation of activities of an installation for the prevention, control, and mitigation of potential accidents. It is a management tool to manage risk on-site and a facilitating device for surveillance by the DOSH inspector. In preparation of safety report errors and omission must be avoided so as to comply with the legal requirement

(CIMAH). Furthermore, it should not be a one off preparation but rather a dynamic safety manual that requires be reviewing or updating continuously. The rationale is that the plants might undergo process modification, or change of work procedures, or surrounding development during the installation life cycle. Reviewing of the safety report must be carried out every three years or soon after any modification has been made.

THE SAFETY REPORT

In mid 1970's after several occurrences of major accidents in Europe, European Community governments passed regulations requiring chemical process facilities to demonstrate that their activities were managed safely. This major hazard directive is commonly referred to as the Seveso Directive. Britain has enforced the directive, which is known as the Control of Industrial Major Hazard (CIMAH) regulations in 1984. The government of Malaysia adopted the CIMAH regulations and promulgated the Regulations in February 1996. In the United Kingdom (U.K.), the enforcement of CIMAH regulations is under the Health Safety Executive (HSE) but in Malaysia it comes under the Department of Occupational Safety and Health (DOSH).

The objectives of CIMAH are:

i. To prevent major accidents
ii. To limit the consequences to people and environment

In order to meet the above objectives, a criteria was developed to recognize the installations that pose potential major accidents such as fire, explosion and release of toxic substances. In CIMAH it is based on hazardous substances (HS) and its threshold quantity (TQ). A hazardous substance is defined in the regulations as toxic, flammable, explosive and oxidizing substance. Above a certain amount or inventory (threshold quantity), is believed to be potentially a major accident that threaten the safety and health of workers on-site or to the public surrounding the installation. The Bhopal disaster is an example of a major accident where 2,500 people lost their lives and 200,000 were people injured due to an accident of releasing methyl isocyanate (MIC).

Lists of hazardous substances and the threshold quantity are presented in Schedule 1 and 2. Industrial activities are classified into Major Hazard Installation, Non Major Hazard installation and No-Threshold Quantity as depicted in figure 1:

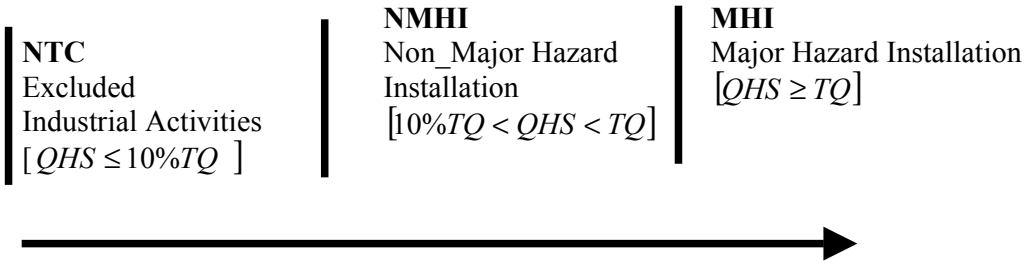

Figure 1. Classification of industrial activity according schedule 1 and 2

Installations having hazardous substance equal or higher than the threshold quantity (TQ) are classified as Major Hazard Installation (MHI), whereas those that contain the material in between 10% threshold quantity and threshold quantity are categorized as Non-Major Hazard Installation (NMHI) and installations with less than or equal to ten percent of threshold quantity are called Non-Threshold Category (NTR).

From Notifications received by DOSH until 2001 there were 159 MHI and 321 NMHI. The state of Selangor registered the highest number of MHI, which is 37 installations whilst Johor had the highest number of NMHI i.e. 46.

As required by the CIMAH regulations, the MHI must submit a Safety Report and on site Emergency Response Plan (ERP) to The Director General of DOSH.
The objectives of the safety report are:

i. To identify the nature and scale of the use of dangerous substance at the installation.
ii. To give an account of the arrangements for safe operation of the installation, for control of serious deviations that could lead to a major accident and for emergency procedures at the site.
iii. To identify the type, relative likelihood and consequences of major accidents.
iv. To demonstrate that the manufacturer has identified the major hazard potential of his activities and has provided appropriate controls.

The DOSH requires that the information of the safety report must include:[2]

i. Hazardous substances: name/quantity, hazards, purity/impurity.
ii. Installation: a map of the site: a scale plan of site showing locations and quantities of hazardous substances; process description and conditions; number of persons on site; nature of land use and population in the vicinity, and the nearest emergency services.
iii. Management System: staffing arrangements (person in charge, responsible for safety, to set emergency procedures); safe operation; design, construction, testing, operation, inspection and maintenance; staff/worker training programs.
iv. Risk Assessment: description of potential sources, conditions and events; diagram to show features for accident control; description of measures taken to prevent, control and minimize the consequences; prevailing meteorological conditions; and consequences to the surroundings in the form of appropriate risk measures.

Other requirements imposed on manufacturers under MHI are to keep an up to date report and plan, to inform local authority and help them to prepare off-site ERP, inform the public and DOSH about any major accident.

The obligations of manufacturers under the NMHI category are notification of an industrial activity, preparation and submission of Demonstration Operation Document and Emergency Response Plan (ERP) to DOSH in case the Director General requests, for them and to keep an up to date report and plan and inform DOSH of any major accident.

In order to maintain the standard and quality of the safety report submitted to DOSH, its Major Hazard Division registers consultants as “Competent Persons” to approve the reports. Originally they were it called ‘register persons’ a term used by other government agencies for one who has been appointed by an authority to approve a report such as the report of Environmental Impact Assessment (EIA). The Criteria used to register a Competent person by DOSH is mainly based on academic qualifications and experience in the area. Such a person

is required to possess a Bachelor of Science or Engineering and also meet other criteria such as adequate knowledge, skill expertise and experiences in area related to the content of safety report. So far, 69 competent persons have been registered by DOSH compared to 159 Major Hazard Installations (MHI) in Malaysia.

Although the competent person approves the safety report, it still requires to be reviewed by the DOSH. The manufacturer is also asked to present the report to the DOSH officers. Any unsatisfactory report due to the inadequacy or discrepancy of the information must be corrected before the manufacturer can re-submit the report to the DOSH. For a satisfactory report, the DOSH will acknowledge the acceptance by sending a letter to the manufacturer.

MAJOR HAZARD INSTALLATIONS

The government of Malaysia promulgated Control of Industrial Major Accident Hazards (CIMAH) Regulations in February 1996. From Notifications received by DOSH up to 2001 there were 159 MHI and 321 NMHI. The state of Selangor registered the highest number of MHI, which is 37 installations whilst Johor had the highest number of NMHI i.e. 46.

As required by the CIMAH regulations, the MHI must submit Safety Report and on site Emergency Response plan (ERP) to The Director General of DOSH. Other requirements imposed are to keep up to date report and plan, inform local authority, help local authority to prepare off-site ERP, inform the public and inform to DOSH about any major accident. The responsibility of manufacturers under the NMHI category are notification of an industrial activity, prepare and submit Demostration Operation Document and Emergency Response Plan (ERP) to DOSH if the Director General request, keep up to date report and plan and inform DOSH of any major accident.

Breakdown of MHI according to activity as tabulated in Table 1:

Table 1. Breakdown MHI according to activity

Activity	Number
Chemical processing plant	25
Bulk storage of petroleum products	23
Petrochemical plant	19
Water treatment plant	22
Bulk storage of hazardous substance	12
Bulk storage and bottling of LPG	11
LPG cylinder storage	8
Air separation plant	5
Rubber glove manufacturing	5
Bulk storage and bottling of ammonia	3
Insecticide mixing	3
Textile manufacturing	3
Others	20
Total	159

METHODOLOGY

Thirty safety reports were reviewed in this study. For the purpose a checklist was prepared according to Schedule 6 (Subregulation 14(1) and 15(1)) i.e. "Information To be Included In The Report on Industrial Activity". It contained a total of four components and the list presented as follows:

(a) Information relating to every hazardous substance involved in the activity in relevant quantity as listed in Schedule 2.
   i) The name of the hazardous substance as given in Schedule 2 or for a hazardous substance included in either of those Schedules under a general designation, the name corresponding to the chemical formula of the hazardous substance;
   ii) A general description of the analytical methods available to the manufacturer for determining the presence of the hazardous substance, or references to such methods in the scientific literature;
   iii) A brief description of the hazards, which may be created by the hazardous substance;
   iv) The degree of purity of the hazardous substance, and the names of the main impurities and their percentages.

(b) Information relating to the installation, namely
   i) A map of the site and its surrounding areas to a scale large enough to show any features that may be significant in the assessment of the hazard of risk associated with the site;
   ii) Scale plan of the site showing the locations and quantities of all significant inventories of the hazardous substance;
   iii) A description of the processes or storage involving the hazardous substance and an indication of the conditions under which it is normally held;
   iv) The maximum number of persons likely to be present on site;
   v) Information about the nature of the land use and the size and distribution of the population in the vicinity of the industrial activity to which the report relates;
   vi) Information on the nearest emergency services (fire station, hospital, police station, community hall, etc.)

(c) Information relating to the system of management for controlling the industrial activity, namely
   i) The staffing arrangement for controlling the Industrial activity with the name of the person responsible for safety on the site and the names of those who are authorized to set emergency procedures in motion and to inform outside authorities
   ii) The arrangements made to ensure that the means provided for the safe operation of the industrial activity are properly designed, constructed tested, operated, inspected and maintained.
   iii) The arrangements for training of persons working on the site.

(d) Information relating to a potential major accident in the form of risk assessment, which contains the following:
   i) A description of the potential sources of a major accident and the conditions or events, which could be significant in bringing one about.

ii) A diagram of the plant in which the industrial activity is carried on, sufficient to show the features which are significant as regards the potential for a major accident or its prevention or control.
iii) Information about prevailing meteorological conditions in the vicinity of the site;
iv) A estimate of the number of people on site who may be exposed to the hazards considered in the report;
v) The consequences to the surrounding areas in the form of risk assessment.

From the 30 safety reports (safety cases), which were reviewed, there were 599 errors/omissions found. The highest errors or omissions were observed under Part (d) (i.e. "Information relating to a potential major accident in the form of risk assessment") that contributed 286 errors, followed by Part (b) (i.e. Information relating to the installation) that gave a total of 182 of errors/omissions, 92 errors/omissions from Part (c) and the least errors/omissions from Part (a) which was only 39.

The highest errors/omissions from the itemized parameters which are under the sub-sections of the Parts (a), (b), (c) and (d) were investigated further. In this category the errors/emissions of "the quantity of hazardous substance" under the sub-section 'scale plan of the site showing the locations and quantities of all significant inventories of the hazardous substance' of Part (b) is the super highest (number one) among the highest that gave a total 23, followed by behind the errors/omissions of "justification of assumptions made" under the 'sequence study under risk assessment' that contributed 20 errors/omissions. The errors/omissions of the "constitution of site safety committee" under the sub-section of 'the staffing arrangement' of Part (c) and the "showing hazardous substance" that is a requirement under the sub-section 'scale plan of the site showing the locations and quantities of all significant inventories of the hazardous substance' had equal ranking i.e. were number three with number of errors/omissions of 14.

Other errors/omissions of the itemized parameters under the Part (a), (b), (c) and (d) can be obtained from the Table 2. The errors/emissions which are frequently observed in the result of the checklist are no information represented by the term 'no explanation' (unexplained of the itemized parameters) like personnel protection equipment (PPE) and training requirement, less judgment as represented by the term 'not considered' for example there is no information of spontaneous failure due to original defect, human error and failure due to external events and inadequacy of information noted as 'not inadequate' such as in the term "preventive and control measures of consequence for the accident scenario". Some kinds of the errors/omissions, which were also regularly, encountered in U.K. CIMAH safety reports (Lees, 1989).

RESULT AND DISCUSSION

Table 2. Summary of result of safety reports review (number of safety report is 30)

Items		No. of non-compliance	Comments
a) Information relating to every hazardous substance involved in the activity in relevant quantity listed in Schedule 2, namely:			
i. the name of the hazardous substance as given in Schedule 2 or for a hazardous substance included in either of those Schedules under a general designation, the name corresponding to the chemical formula of the hazardous substance;	Name as in Schedule 2> threshold quantity	0	
	Other hazardous substances < threshold quantity	6	Doesn't mention other hazardous substances with less than threshold quantity because of the misunderstanding of CIMAH requirements. This hazardous substance is also a potential to create major accidents (escalation effect).
ii. a general description of the analytical methods available to the manufacturer for determining the presence of the hazardous substance, or references to such methods in the scientific literature	Method of determining the existence of a substance	14	- Liquid form so can be detected visually. - Doesn't have hazardous detector at all. - No a specific best engineering practice regarding to the detector requirement
iii. a brief description of the hazards which may be created by the hazardous substance	Description of hazards for every substance	7	- Doesn't describe hazard
iv. the degree of purity of the hazardous substance, and the names of the main impurities and their percentages	purity/impurity of hazards for every substance	12	- not described that this information - do not realise that this information can be obtained from quality sheet.

Note: No. of companies, which do not mention or explained regarding to the item specified in Schedule 6 of CIMAH

(b) Information relating to the installation, namely		No. of non-compliance	Comments
i. a map of the site and its surrounding areas to a scale large enough to show any features that may be significant in the assessment of the hazard of risk associated with the site;	map of site	5	- very hard to get map in Malaysia. - The map is out of date - The map is unclear
	with scale	15	- map without scale
	schools, hospitals, prisons, etc., if any	13	- map does not detail the items.
	industrial premises		
	Other hazardous installations		
	Roads, railways, airport, ports		
	Recreational areas		
	Reservoirs, rivers, lakes etc		
	Monuments, archaeological area, conservation areas		
ii. scale plan of the site showing the locations and quantities of all significant inventories of the hazardous substance	Attach a site plan	1	unclear
	A site plan with scale	9	- attach site-plan without scale. - Not up to date
	Showing hazardous substance	14	On site plan: - no indication of the hazardous substance
	Quantity of hazardous substance	23	- does not mention the quantity

iii. a description of the processes or storage involving the hazardous substance and an indication of the conditions under which it is normally held;	description of processes	4	- does not describe the process
	Simplified process flow diagram	5	- not attached process flow diagram
	Simplified piping and instrumentation diagram	5	- not provided P&ID
	Stated physical state, pressure and temperature	15	- process not mentioned parameter on the simplified P&ID
iv. the maximum number of persons likely to be present on site;	Maximum no. of workers day time	5	Not mentioned
	Maximum no. of workers night time	7	Not mentioned
	Located on site plan	21	- does not put the max. numbers of workers for day and night on the site plan. - No specific requirement on above.
v. information about the nature of the land use and the size and distribution of the population in the vicinity of the industrial activity to which the report relates;	land use	7	- does not describe surrounding area, neighbors or residential area
	population in the vicinity	11	- does not mentioned if any congested or populated area.
	population in the vicinity for day and night time	11	- the number of people surrounding not mentioned
	nearest emergency services	3	- the nearest emergency services such as bomba, hospital, ambulance, police etc. not mentioned
	Distance to the nearest emergency services	8	- does not mentioned the distance.

(C) Information relating to the system of management for controlling the industrial activity, namely-		No. of non-compliance	Comments
i. The staffing arrangement for controlling the Industrial activity with the name of the person response for safety on the site and the names of those who are authorized to set emergency procedures in motion and to inform outside authorities	Company/plant organisation chart	4	- not attached at all the general org. chart attached, not specific to the plant
	Any particular or unusual expertise required running plant safely.	3	- complex process requires special people to handle.
	General description of attributes appropriate to plant management and supervisory staff	5	- no explanation on job and task at management and supervisory level.
	Description of line management responsibilities and reporting relationships with safety and environmental implications.	4	- Job description with safety task.
	General description of managerial attributes appropriate to the site including experience and qualifications of staff at different levels.	4	- qualification and experience of staff especially those who carry out critical task not mentioned.
	Statement of general policy	9	- not attached policy - no requirement of policy if the number of staff is less than five.

	Constitution of site safety committee.	14	Not mentioned: - committee members - structure
	Accident reporting and investigation	7	- no explanation
	Accident analysis	2	- no explanation
	System audit	6	- no explanation
	Personal protective equipments requirement	3	- no explanation
ii. The arrangements made to ensure that the means provided for the safe operation of the industrial activity are properly designed, constructed tested, operated inspected and maintained.	Plant design	0	
	Plant modification	4	- no explanation on how to manage plant change
	Plant construction	0	
	Plant operation	2	- no explanation
	Plant procedures	7	- no list of plant operation procedures
	Process and operational control	0	
	Plant maintenance	3	- no explanation
	Permit to work	1	- no ptw system explained
	Test and inspection	4	- not mentioned
	Control of contractors	6	- contractor selection not mentioned - contractor evaluation not mentioned - contractor supervision not mentioned
iii. The arrangements for training of persons working on the site.	Training requirements	4	- no explanation

(d) Information relating to a potential major accident in the form of risk assessment which contains the following:		No. of non-compliance		Comments
i. a description of the potential sources of a major accident and the conditions or events which could be significant in bringing one about.	Identify all hazardous substance	4	-	does not identify all hazardous substance
	Overall explanation on hazard identification technique	6	-	no explanation
	Spontaneous failure due to original defects	12	-	not considered
	Spontaneous failure due to those arising in the course of operation	1	-	not considered
	Failures in high risk activity (loading/unloading)	7	-	not considered
	Failures due to excursions from normal operating conditions	6	-	not considered
	Failures in maintenance, inspection and quality assurance	10	-	not considered
	Failures due to other on-site events	6	-	not considered
	Failures due to external events	13	-	not considered
	Human errors	13	-	not considered
	Overall explanation on consequence estimation/ calculation	5	-	no explanation on effect of fire, explosion and toxic release

	Consequence of each event considered	8	-	not considered
	Consider escalation effect	16	-	not considered
ii. A descriptions of the measures taken to prevent, control or minimise the consequences of any major accident.	Adequate preventive measures for each event	9	-	inadequate
	Adequate control measures for each event	9	-	inadequate
	Adequate measures taken to minimise the consequences	8	-	inadequate
iii. A diagram of the plant in which the industrial activity is carried on sufficient to show the features which are significant as regards the potential for a major accident or its prevention or control.	Adequate piping and instru-mentation diagram.	12	-	inadequate
	Indicate process parameter such as temperature, pressure, etc.	10	-	not indicated
iv. Information about prevailing meteorological conditions in the vicinity of the site;	Data from the nearest meteorology station.	5	-	no data at all
	Wind direction and distribution	5	-	data incomplete
	Wind stability	12	-	not mentioned
	Atmospheric temperature	12	-	not mentioned
	Relative humidity	13	-	not mentioned
v. an estimate of the number of people on site who may be exposed to the hazards considered in the report;	Estimate the number of on-site people affected	13	-	not mentioned
	Estimate the number of off-site people affected	15	-	not mentioned
vi. the consequences to the surrounding areas in the form of risk assessment.	Overall plant risk assessment methodology	12	-	no explanation

	Justification on assumption made	20	-	no explanation on assumption and limitation of methodology used.
	Generation of likelihood on every significant events	12	-	not conducted
	Risk contours	12	-	no risk contour.

CONCLUSION

The safety report is a tool or manual is which used for prevention, control and mitigation of potential accidents. The information contained in the report must be according to the standard as specified in the legal requirement (the CIMAH regulations) and satisfied by the authority i.e. the Department of Occupational Safety and Health (DOSH). Reviewing of safety reports approved by "a competent person" is a must since a significant number of errors/omissions were found in the checklist. However, it should be taken into consideration that the result obtained from the review is from the first group of safety reports after enforcement of the CIMAH regulations in Malaysia. Without the service of the competent persons, it is envisaged that DOSH officers might find more errors/omissions. However, there is a large space of improvement toward reducing the errors/omissions to a minimum such as through exchange of ideas, discussions or training of the people who are involved in the preparation of the safety reports. Symposiums, seminars or workshops are good platforms to achieve this objective.

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