OCCUPATIONAL SAFETY AND HEALTH (CONTROL OF INDUSTRIAL MAJOR ACCIDENT HAZARDS) REGULATIONS 1996 (CIMAH) AND THE ENVIRONMENT: THE WAY FORWARD

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ABSTRAK

The increasing risks to the natural environment is always associated with the development of human civilization and technology. In particular, the risks posed by industrial plants that use hazardous substances in process of production. The experience of the last few decades shows that such failures cause serious damage to the environment and material or human losses. In Malaysia, laws and regulations have been enacted to prevent such accidents and limit their possible consequences. One of the enacted regulations is the Occupational Safety and Health (Control of Industrial Major Accident Hazards) Regulations 1996 (CIMAH). This paper aims to study how this piece of legislation protects the environment and, in the event, where major industrial accident has occurred, what are the necessary steps to be taken by the authorities and the employers to minimize the impact of such accident to the environment. It is found the focus on the protection of environment in this regulation could be improved. The environmental protection could be increased by including risk assessment on and appropriate control measures to reduce the impact of major accident to the environment. Unfortunately, to date there has been no widely accepted quantitative risk indexes available to assess the risk deriving from

the environmental consequences of the release and only a few qualitative or at least semi-quantitative scoring methods available to estimate the environmental risk of major accidents for generic risk sources.

Keyword: Occupational Safety and Health (Control of Industrial Major Accident Hazards) Regulations 1996 (CIMAH), environment, industrial major accident

1. Introduction

It is a critical need to have a clear and systematic approach to regulate the potential for major industrial accidents, which has become more significant with the increasing production, storage and use of hazardous substances. Regulators must ensure the specific laws and regulations put in place are able to protect workers, the public and the environment. Historically, the most tragic disaster of this kind happened in 1984 in Bhopal, India which was caused by the leakage of more than 40 tonnes of methyl isocyanate from a pesticide manufacturing plant (owned by an American company Union Carbide) and had resulted in a large death tolls (Materniak, 2018). In 1976, more than 2,000 people were affected in Seveso, Italy because of an explosion in an artificial fertilisers manufacturing plant that leads to the contamination of the environment (the atmosphere, the ground as well as ground and surface waters) with significant amount of toxic and carcinogenic substances (Materniak, 2018). After this incident, the Seveso Directives 82/501/EEC of 24 June 1982 on major accident hazards of certain industrial activities was introduced in Europe (Duffield, 2003).

In 1986, an accident occurred in Switzerland highlighted the potential hazards caused to the environment by the process industry (Duffield, 2003). The water contaminated with mercury, organophosphate pesticides and other chemicals drained into the Rhine and caused massive pollution of the river through Germany, France and the Netherlands killing over half a million fish and contaminating drinking water (Duffield, 2003). In Romania, a tailing pond burst that leads to wastewater containing up to 120 tonnes of cyanide and heavy metals being released into the Lapus river, then travelling downstream into the Somes and Tisa rivers into Hungary before entering the Danube destroyed large numbers of plant and wildlife species (Duffield, 2003).

Looking at the environmental dimension of the impacts of major accidents, the laws must correspond adequately in protecting the environment by providing effective laws and regulations in preventing the major accidents and minimising its impacts on human and environment if it happened. One may argue that the central of the control of industrial major accident hazards laws and regulations is focusing on the workers and the industrial sites; however, this type of legislation is also considered as a preventive measure and as a control disaster instrument that is significantly contribute to the extent of damage done to the environment. On that basis, it is suggested that proper risk assessment of the environment should also be included in the control of industrial major accident hazards laws and regulations.

2. Occupational Safety and Health (Control of Industrial Major Accident Hazards) Regulations 1996 (CIMAH)

The Occupational Safety and Health (Control of Industrial Major Accident Hazards) Regulations 1996 (CIMAH) came as a result of lessons learnt from major accidents worldwide and local accidents for instance the Bright Sparklers incident which refers to an explosion in a fire crackers factory in 1990. (K. G. Rampal and J. Mohd Nizam, 2006). These regulations that are enacted by the Department of Occupational Safety and Health (DOSH) are based on CIMAH United Kingdom (UK 1984) in order to prevent the possibility of any major accidents in industries (Hanida Abdul Aziz and Azmi Mohd Shariff, 2017). It is observed that the approach to the control of major accidents specified by CIMAH is followed internationally accepted methods and is quite similar to those implemented other countries, and also is in line with the requirements proposed by the International Labor Organization (ILO) (Ibrahim M. Shaluf and Fakharu'l-razi Ahmadun, 2003). It is important to note that these regulations apply to all industrial activities except for those listed in Reg 2 (CIMAH 1996).

Reg 3 of CIMAH 1996 defines 'major accident' as an occurrence including, in particular, a major emission, fire or explosion resulting from uncontrolled development in the course of an industrial activity which leads to serious danger to persons, whether immediate or delayed or inside or outside an installation, or to the environment, and involving one or more hazardous substances. Hazardous substance is

defined as any substance which is within any of the criteria laid down in Schedule 1 of the CIMAH 1996 or any substance listed in Part 1 of Schedule 2 of the CIMAH 1996. The term environment is not defined in CIMAH however; it is defined in section 2 of the Malaysian Environmental Quality Act 1974 as the physical factors of the surroundings of human beings including land, water, atmosphere, climate, sound, odour, taste, the biological factors of animals and plants and the social factor of aesthetics.

Apart from referring to Reg 2 in determining the application of these regulations, it is also pertinent to look into the classification of industrial activity. The CIMAH 1996 classify industrial activity into two categories; Non-Major Hazard Installation (NMHI) and Major Hazard Installation (MHI). Reg 9 of the CIMAH 1996 defines NMHI as:

a) an industrial activity in which there is involved or likely to be involved: -
    i. for a hazardous substance listed in Part 1 of Schedule 2, a quantity of the hazardous substance which is less than the threshold quantity specified therein; or
    ii. for substances and preparations falling within a category or categories specified in Part 2 of Schedule 2, a total quantity of the substances and preparations in the category or categories which is less than the threshold quantity specified therein and which is not determined as a major hazard installation under paragraph 7(2)(a); and
b) an installation which is determined as a non-major hazard installation by the Director General under paragraph 7(2)(b).

Reg 10 of CIMAH 1996 describes the demonstration of safe operation for NMHI. This is an important step for the prevention of major accidents. According to this regulation, a manufacturer who has control of an industrial activity must provide evidence including the production of documents to show that he has identified the possible major accident hazards and has taken adequate steps to prevent any major accident or minimise its consequences to persons and the environment and to provide persons working on the site with the information, training and equipment necessary to ensure their safety

and prepared and kept up to date an adequate on-site emergency plan detailing how major accidents will be dealt with.
As for MHI, it is referred to as:

a) an industrial activity in which there is involved or likely to be involved: -
    i. for a hazardous substance listed in Part 1 of Schedule 2, a quantity of the hazardous substance which is equal to or exceed the threshold quantity specified therein; or
    ii. for substances and preparations falling within a category or categories specified in Part 2 of Schedule 2, a total quantity of the substances and preparations in the category or categories which is equal to or exceed the threshold quantity specified therein,

and which is not determined as a non-major hazard installation by the Director General under paragraph 7(2)(b); or

b) an industrial activity which is determined as a major hazard installation by the Director General under paragraph 7(2)(a) (Reg 12, CIMAH 1996).

By virtue of Reg 14 of CIMAH 1996, MHI requires manufacturer to consult a Competent Person for a written report preparation containing the information as specified in Schedule 6 (CIMAH) and send a copy of the report to the Director General at least three (3) months before commencing industrial activity or within such short period as the Director General may consent in writing. This is not required for NMHI.

In the event where a major accident has occurred Reg 23 requires the manufacturer to notify the nearest occupational safety and health office of the accident by the quickest means available and the manufacturer who makes the notification shall provide the information that relates to the circumstances of the accident, the hazardous substances involved, the date available for assessing the effects of the accident on persons and the environment and the emergency measures taken and a statement of the steps envisaged to alleviate medium or long term effects of the accidents, if any, and prevent the recurrence of such an accident. In addition, Schedule 3 (Subregulation 22(1)) lists down the items of information to be communicated to the public. One of them is the general information

relating to the nature of a major accident hazard including its potential effects on the population and the environment.

3. Risk Assessment

Risk assessment has been widely implemented by process industries such as petroleum, chemical, mining, electricity and pharmaceutical as an effective tool for the process plant safety management to prevent loss arising from major accident (Li, W. et. al., 2019). Examples of risk assessment techniques are what-if analysis, fault tree analysis (FTA), failure model effectiveness analysis (FMEA), hazard and operability study (HAZOP). Major hazard installation (MHI) and Non-Major Hazard Installation (NMHI) employers need to recognise the hazards and associated risks created by their activities to implement any remedial action and to demonstrate that they are adequately controlling the risk. To determine whether a given degree of control is sufficient, it is necessary to consider both the severity and the likelihood/frequency of events ('scenarios') that might result from the hazards being realised (Vince, 2003). The final step in a risk assessment is to subject the amount of risk that remains after controls are accounted for, protection and mitigation measures in place or planned, to a triage: risks are compared against two threshold criteria and assigned into three categories; highest risks, intermediate risks and lowest risks (Vince, 2003).

The safety report required for a MHI to include a risk assessment focused on major accidents, as specified in Schedule 6 (Subregulation 14(1) and 15(1)) of CIMAH 1996 as:
(a) information relating to every hazardous substance involved in the industrial activity and its relevant quantity as listed in Schedule 2, namely-

> (i) the name of the hazardous substance as given in Schedule 2 or, for a hazardous substance included under a general designation, the name corresponding to the chemical formula of the hazardous substance;
> (ii) a general description of the analytical method available to the manufacturer in determining the presence of the hazardous substance or references to such method in the scientific literature;

(iii) a brief description of the hazards which may be created by the hazardous substance; and

(iv) the degree of purity of the hazardous substance and the names of its main impurities and their percentages;

(b) information relating to the installation, namely: -

(i) a map of the site and its surrounding area to a scale large enough to show any feature that may be significant in the assessment of the hazard or risk associated with the site;

(ii) a 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 the 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; and

(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 arrangements for controlling the industrial activity with the name of the person responsible for safety on the site and the names of the persons who are authorised 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; and

(iii) the arrangements for training persons working on the site; and

(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 giving rise to one;

(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) a description of the measures taken to prevent, control or minimise the consequences of a major accident;
(iv) information about the prevailing meteorological conditions in the vicinity of the site;
(v) an estimate of the number of people on-site and off-site who may be exposed to the hazards considered in the report; and
(vi) the consequences to the surrounding areas in the form of appropriate risk measures where possible.

4. Risk Assessment on the Impact of Major Accident to the Environment

There are several factors to be considered in assessing the appropriate depth of analysis including the level of the risk, the complexity of the operation and, especially in the case of environmental risks, the availability of data on the environmental vulnerability (Vince et al., 2008). In practice, however, even on complex, MHI sites where certain risks may demand the most detailed analysis, it is always possible to simplify the analysis overall, beginning with a preliminary screening-out of risks of palpably low consequence and/or low frequency/probability of occurrence.

Assessing impact on the environment is not as simple as assessing danger to human health (Vince et al., 2008). Vulnerability of environment is much more complex than vulnerability and difficult to assess both qualitatively and quantitatively due to lack of data and no general methodological approaches are available in the scientific and technical literature to quantify the impact on the environment of the risk related to major accidents (OECD, 1997; Bonvicini et al., 2018). Only a few qualitative or at least semi-quantitative scoring methods are available to estimate the environmental risk of major accidents for generic risk sources (Bonvicini et al., 2015). An example of onshore pipelines, the absence of descriptions or even references to environmental risk models – nor qualitative, nor quantitative ones - in the most authoritative guidelines about risk analysis of onshore pipelines is confirmed (CCPS, 1995; Muhlbauer, 2004; Committee for Prevention of Disasters, 1999; UNECE, 2006). However, there is

an innovative approach developed by Bonvicini et al. (2018) for the calculation of specific quantitative risk indexes capturing the potential damage to the environment deriving from accidents in pipelines. A model for the quantification of local and overall environmental risk indexes integrated to a software based on a Geographical Information System (GIS), able to manage the complex layers of data needed to carry out calculations and to visualize the results which also could be applied to study other major accidents.

5. Conclusion

Central to the CIMAH 1996 are requirements for manufacturers to provide evidence, which identifies the major accident hazards from their activities and which proves that they have taken necessary measures to prevent such major accidents and to limit their consequences to people and the environment. Nevertheless, it is found that there are no specific regulations in the CIMAH 1996 that requires environmental risk assessment to be conducted. It is suggested that the CIMAH 1996 should be reviewed and environmental risk assessment should be included in these regulations to make the regulations more holistic, not only protecting people and property but also the environment.

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