

## Control of industrial major accident hazard regulation in Malaysia: second decade in examination

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### ABSTRACT

The Control of Industrial Major Accident Hazards (CIMAH) regulations was introduced in 1996 to regulate workplaces with hazardous chemicals in their facilities. The Regulations provide a minimum standard to ensure precautionary measures related to major hazard risks are taken. Although the Regulations have been enforced for more than two decades in Malaysia, there have been limited efforts to review related information, trends and data since its inception. The study aimed to provide an overview of the position of CIMAH regulations after two decades of being enacted in Malaysia. Data were extracted from the published and unpublished reports and documentations by Department of Occupational Safety and Health of Malaysia (DOSH), as well as available publications from literary journals. Analysis of the contents revealed three categories of data: i) CIMAH regulations' administrative governance changes; ii) major hazard industries—categorization and registration trends; and iii) CIMAH regulations' punitive activities. The findings provide an overview of relevant trends and data related to CIMAH regulations in the past two decades, and may provide stakeholders such as policymakers, practitioners, and researchers a groundwork for improvement initiatives.

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## 1. INTRODUCTION

Major hazard industries are a specific sector that regularly utilizes large quantities of hazardous chemicals as integral component in their daily operations and processes. The properties of these chemicals are commonly combustible, explosive and toxic; capable of causing severe damages to life, properties, and environment. An example of recent major hazard accident is the two explosions at the Beirut city port, Lebanon in year 2020 that has caused at least 200 deaths, over 6,000 injuries and US 15 billion in property damage [1], [2]. A publication reviewing 319 major hazard accidents occurred between 1917–2011 reported that majority of the major industrial accidents (58%) were primarily traced to explosive-related cases [3]. Similar findings were reported elsewhere, as most common types of major hazard accidents reported were fire-related incidents and explosions, as well as the release of toxic chemical [4], [5].

The after-effect of major hazard accidents is destructive. In an analysis of causes and consequences of major accidents, a publication reported that fire-related accidents are the most frequent, though explosion-related accidents are likely more damaging to human lives or properties [5]. The authors also claimed that toxic-related accidents were more likely result in larger scale fatalities. Major hazard accident cases have been documented globally. For example, in 2015, an explosion accident occurred in Tianjin Port of Korea, where it

caused 137 deaths and massive property damages [6], [7]. In 2009, oil depot fire accident in Jaipur resulted in a week-long blaze and causes evacuation of 500,000 peoples in the surrounding area [8]. Toxic methyl isocyanate gas release in Bhopal, India in 1984 impacted workers on both acute and chronic levels. There were approximately 3,800 instant fatalities during the disaster, and the number eventually totaled up to 20,000 deaths [9]. In addition, the aftermath from Bhopal tragedy led to a substantial economic and financial impacts to government, industries, and the population at large [5]. Detailed case study of these accidents, and many others have been reported, examined, and reviewed in other publications [10]–[13].

Subsequent to the major accident hazard occurrences, multiple government agencies introduced some degrees of regulatory requirements to ensure the relevant major hazard industries involved would take necessary actions to ensure industrial activities involving major hazard materials are operating in safe conditions. Examples of passed legislations around the world include Control of Industrial Major Accident Hazards Regulations 1984 (CIMAH) in the UK, Manufacture Storage and Import of Hazardous Chemicals Regulation, 1989 in India, and the Seveso Directive 82/501/EEC in Europe. Other countries with laws or regulations to control of major hazards include Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Holland, Portugal, Spain, Sweden, Singapore, Hong Kong [14]. These regulators were mostly introduced in the 80s and 90s, which has been associated with the declining trend of major hazard accident occurrences after 1996 [3].

There are notable differences in major hazard accident statistics between developing and developed countries. Due to the demand, major hazard industries are more likely to be operated in developed countries [3]. According to the same publications, although there are more major hazard events reported in developed countries, the fatalities count is much smaller than those in developing countries. This may be attributed to stricter legislation and enforcement in developed countries. Malaysia as an emerging and developing country has also a fair share in experiencing the event of a major accident. One of the worst major hazard accidents in Malaysia was the explosion of the firecracker factory, Bright Sparkle Sdn. Bhd. in Sungai Buloh, Selangor [15]–[17]. The accident that occurred in 1991 recorded 23 deaths and 103 injuries. The explosion destroyed the factory buildings and the surrounding residential areas. At the time of the accident, there was no specific law designated to control the risk of hazardous materials [18]. The accident was considered to be one of the major precursor events leading to the legislation of major hazard activities in Malaysia.

In 1996, the Malaysian government introduced the control of industrial major accident hazard (CIMAH) regulations, under 1994's occupational safety and health act (OSHA) [19]. The main objective of CIMAH regulations 1996 is to regulate workplaces that utilize hazardous chemicals in their facilities, categorized as major hazard installation (MHI), with an overarching goal to prepare and prevent MHIs for the possible events of major hazard accident or disaster. The regulation provides a minimum standard to ensure that the MHIs' managements are responsible for planning and adopting precautionary measures related to major hazard risks [20]. In line with the 1994 OSH Act's principle, the responsibilities of the employers and employees are specified wherein the employers creating the risks should take all necessary efforts to control those risks, with support and cooperation from their employees [21].

The contents of Malaysia's CIMAH were primarily adapted from the United Kingdom's CIMAH regulations, 1984, and International Labour Organization (ILO) major hazard control manual, 1988 [22]. The major differences between the Malaysia's CIMAH and United Kingdom's CIMAH are the threshold quantities of hazardous material and the specific provisions and roles of major hazard competence persons [22], [23]. In addition, CIMAH also adopted a few components from ILO's manual contents, especially on stakeholders' roles, major hazard control strategies, and emergency planning. In terms of scope, CIMAH regulations 1996 apply to all industrial activities except nuclear installations, installations under armed forces, transportation activities to or from sites, and installations where hazardous substances are equal or less than 10% of threshold quantity set by CIMAH. Specifically, the contents consisted of several components including identification of hazardous material, notification of industrial activity, demonstration of safe operation, report on industrial activity, preparation of emergency response plan, notification of major accident, and penalties. These components provided some provisions with regards to activities before, during, and after the disaster occurrence. In some degrees, the components in CIMAH are in line with mitigation, preparedness, response and recovery phases in disaster management cycle model in other publications [24]–[26].

Since its inception, CIMAH regulations has become base legislation for Malaysian government's enforcement in controlling hazards from MHIs' industrial activities. However, even after more than two decades of being regulated, there has been limited documentations, studies and publications on Malaysian's CIMAH regulations [27]. As a result, there were shortages of information and summary on the position of CIMAH regulations for industrial practitioners, researchers, and relevant stakeholders in the field of Major Hazards in Malaysia. The study aims to provide an overview of the information and trends related to CIMAH regulations' governance, MHI registration trends, and punitive activities of CIMAH Regulations since its first introduction in 1996.

## 2. RESEARCH METHOD

This study adopted desk review methodology to process and analyze relevant trends and data in the past two decades that are related to CIMAHA regulations. In the effort of searching for contents, the study analyzes materials from multiple secondary data resources, both from hardcopy and online based documents. Similar approaches have been used by previous studies [28]–[30]. The hard copy documents examples are DOSH's annual reports, official documentations of law and regulations, as well as unpublished documents such as internal circulars, lists of registered MHIs, or enforcement activities from DOSH's Major Hazard Division and Petroleum Security Division. These documents were accessed and retrieved from DOSH's library as well as directly from DOSH officials in their headquarter offices.

The data collected was then processed for relevancy of contents. Each resource was screened through to determine if the contents and data were directly related to the specific context of major hazard and CIMAHA regulations. The screened resources were then compiled and analyzed for content themes. In order to systematically organize the contents, information was classified into three main categories of themes: i) CIMAHA regulations' administrative governance changes, ii) major hazard industries–categorization and registration trends, and iii) CIMAHA Regulations' punitive activities. These categories were based upon the main data and information that can be extracted from the DOSH documentations and reports. Although resources from DOSH have a slightly altered presentation format each year, the data in those reports can still be extracted and classified in these three categories of themes.

## 3. RESULTS AND DISCUSSION

The outcomes from the content analysis were organized into three categories: i) CIMAHA regulations' administrative governance changes, ii) major hazard industries–categorization and registration trends, and iii) CIMAHA regulations' enforcement activities.

### 3.1. CIMAHA regulations' administrative governance changes

Major hazard accident in Bhopal, India in 1984 is believed to be an initiator to early regulatory attempts by DOSH to monitor industries with hazardous substances, leading to the establishment of 'Major Hazard Unit' within DOSH in 1985 [22], [31]. The main task at the beginning of its establishment was to identify the existence of major hazard installations in Malaysia. The unit was then upgraded into the 'Major Hazard Division' in 1991, and enforcement activities began in 1995 with first audit visitation of five installations [31]–[32]. On February 1st 1996, DOSH was authorized by Tan Sri Lim Ah Lek, the then Minister of Human Resources of Malaysia to officially enforce CIMAHA regulations [19]. The number of audit inspections conducted by the 'Major Hazard Division' in 1996 increased to 43 plants, an increase of nearly 9 folds from the previous year [32]. In the first decade, the enforcement activities were limited to site visits and general audit of major hazard risks.

On April 1, 2005, organizational restructuring of DOSH resulted in the additional enforcement scopes to include monitoring of petroleum-related industrial activities. Within the same division, a new 'Enforcement Unit' was created under the 'Industrial Disaster Control Section' with specific roles of conducting enforcement activities. In addition to existing site visit and general audits of MHIs and non-MHIs, additional scopes related to CIMAHA regulations include classification of industrial activities, assessing industrial activity reports, evaluating site emergency reports, conducting major hazards audits, and disseminating of information leaflets to the public. Another organizational restructure of DOSH in 2008 resulted in the addition of 600 new positions throughout the nation. This was a major administrative governance change, in which the enforcement activities of CIMAHA regulations were decentralized [33]. The Department of Occupational Safety and Health (DOSH's) headquarter retains majority of previous scope, but some activities were delegated to DOSH's state offices, under the newly introduced 'Industrial Disaster Control Unit' within the 'Special Risk Section'. The state offices were responsible of activities such as classifying industrial type (MHI vs. non-MHI), assisting officers from DOSH's headquarter to audit MHIs, conducting independent auditing of non-MHIs, monitoring emergency exercises at MHIs, participating in information dissemination programs, and spearheading legal related activities such as non-compliance notice issuance and punitive persecution at court. This extended the enforcement ability as state offices are located closer to relevant industrial sites, resulting in a better utilization of personnel and resources. The overall outcomes of enforcement activities related to CIMAHA Regulations are jointly monitored and reviewed between the 'Special Risk Section' at DOSH's state offices and 'Major Hazard Division' at DOSH's Headquarter [34].

In 2014, another restructuring exercise results in another changes, in which the 'Major Hazard Division' was renamed to 'Petroleum Safety Division'. This new 'Petroleum Safety Division' still enforces CIMAHA Regulations, in addition to additional enforcement scope that was previously covered under Petroleum Measure Act, 1984. As a result of this merge, the 'Enforcement Unit' was upgraded to the 'Enforcement

Section'. The section still maintains enforcement activities and scopes as in the past, with the addition responsibilities including engagement activities such as organizing seminars and workshops, as well as dialogues with major hazard stakeholders such as competent persons and major hazard installations [35]. Over the past decades, there has been evidences of evolution changes in terms of administrative governance restructuring of CIMA Regulations. The changes over the years can overall be attributed to improved governance structures, activities, documentations & audit trails, human resources, and enforcement coverage capacity.

### 3.2. Major hazard industries—categorization and registration trends

As per CIMA regulations, each workplace is required to keep track the quantities of hazardous chemicals handled within their facilities. The regulation listed set of hazardous substances and their threshold limits and organize them into four groups that are toxic substances  $\leq 1$  tons, toxic substances  $\geq 1$  tons, highly reactive substances, and explosive substances. The quantities of listed hazardous substances are to be declared to DOSH through submission of hazardous materials notification form, the 'JKKP 5 form'. There is no specific timeline specified for declaration, but companies with hazardous substances usually provide declaration upon purchase of these hazardous materials. DOSH will then categorize each facility the type of industry (from the perspective of major hazards) based on the declared threshold quantity of hazardous chemicals, as shown in Figure 1. There are three outcomes of this categorization process, in which each workplace submission will be categorized into major hazard installation (MHI), non-major hazard installation (NMHI) or 'not applicable' from CIMA regulations point of view. Upon categorization process, each workplace is required to abide by requirements according to the workplace's major hazard category. Generally, workplaces that were categorized as designated MHIs were bound to additional requirements and subject to stricter enforcement as compared to non-MHIs. It should be noted that MHI status is temporary in nature, as it depends on how much of the hazardous substances within the facility compound. As such, some facilities are known to adopt the 'Just in Time' (JIT) approach to keep the quantity of hazardous substances within their compound below the threshold set by CIMA regulations, and consequently avoid being designated as MHIs [1]. This will allow these facilities to operate without stricter requirements and enforcement that comes together with the MHIs status.

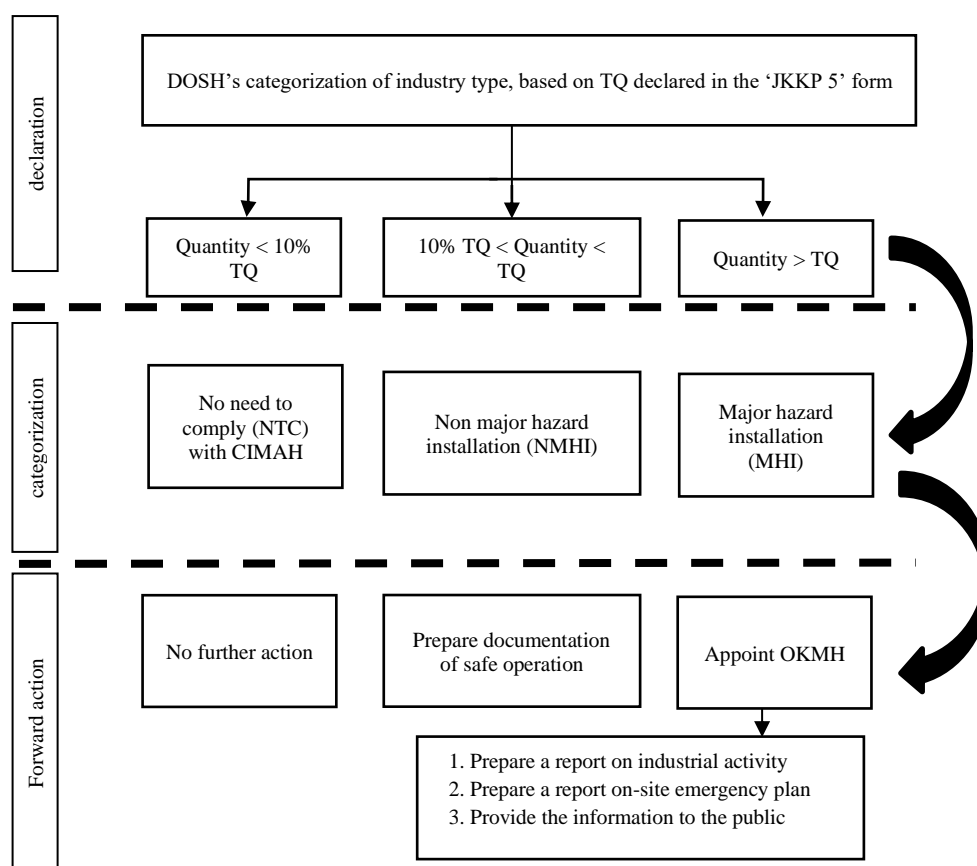


Figure 1. Categorization process of facilities handling hazardous materials under CIMA regulations [2]

In 1996, the year CIMAH was first introduced, there was a total of 69 facilities in Malaysia that were designated as MHIs (DOSH, 1999). The numbers of MHI gradually increases each year. There was a total of 159 designated MHIs registered with DOSH in 2001, and the number increased to 315 by 2016 [3], [4]. The latest number of MHI in 2021 is 384 facilities. This translates to more than 100% increase within 20 years, and 400% increase within 25 years of its inception. The trend indicates a steady increase of major hazard activities over the years, which also translates into a steady increase of risk to potential major accident events. However, there has been no revision or updates on CIMAH regulations, which brings in the question if the current requirements are adequate in lights of increasing trend of MHIs registration and along with it, industrial major hazard activities.

MHIs industrial coverage are widely varied, as it involves any sector with hazardous substances. It covers different industries, from the simple storage facilities of hazardous materials to complex plants such as petrochemical plants, refineries and chemical processing factories. The highest increase in the number of MHIs, between 2001 to 2021 was found in the glove manufacturing industry (an increase of 780%), followed by the LPG storage industry (an increase of 475%) and the bulk storage industry (an increase of 300%). However, not all MHIs showed increase of number, as data showed reduction of MHIs in textile manufacturing, air separation plant, ammonia gas bottling facilities, and gas petroleum chemical bottling industry. The trends over these two decades showed the variations and dynamics of MHIs operation over the years, as businesses in specific sectors expanded or shrunk. Majority of industries reported positive changes, indicating an overall expansion on major hazard activities over the years. Comparison of the different type of registered MHIs by industry, and their numbers between 2001 and 2021 are shown in Table 1.

Table 1. The number of registered MHIs based on the types of business operation in Malaysia [3], [5], [6]

Types of industries	Number of MHIs		Change (%) in 20 years (2001-2021)
	1996	2001 2021	
Chemical processing plant		25 39	+56
Water treatment plant		22 59	+168
Petrochemical plant		19 32	+68
Bottling of gas petroleum chemical		12 12	0
Liquefied petroleum gas (LPG) cylinder storage		8 46	+475
Bulk storage of petroleum products		23 43	+87
Bulk storage of hazardous material	DATA NOT AVAILABLE	11 44	+300
Air separation plant		5 8	+60
Glove manufacturing		5 44	+780
Bottling of Ammonia Gas		3 3	0
Insecticide manufacturing		3 2	-33
Textile manufacturing		3 1	-67
Others*		20 51	+155
Total	69	159 384	+142

### 3.3. CIMAH regulations' punitive activities

CIMAH regulations included punitive provisions for non-compliance from law requirements. Enforcement activities conducted by DOSH may lead to five levels of punitive responses for violation cases of the regulations; issuance of command letter, issuance of the notice of improvement (NOI), issuance of the notice of prohibition (NOP), summon of compound, and legal prosecution in court. The DOSH annual report summarizes the data on punitive actions for all sector of industries. However, there were no specific sections of punitive activities in the annual report dedicated to CIMAH regulations, thus making it challenging to identify specific punitive actions that are directly related to non-compliance among major hazard industries.

However, there are limited data that can be inferred from the reports. For example, the 1999 annual report revealed that there was a total of thirty command letters issued to MHI to execute the public information programs [7]. In the following year, the number of command letters issued increased to 94, which is an increase of over 300%. There is no other data on command letter issuances available after 2000.

Non-compliance with the CIMAH regulations also allows DOSH officials to issue NOI to the manufacturers (MHIs and NMHIs). NOI is a form of corrective opportunity that provides the manufacturers to make improvements within the specific time frame, as mutually agreed upon by the manufacturer's representative and enforcing DOSH officers. Again, the available data are sparse. Documentations summarizing NOIs from DOSH State Offices revealed that 8 NOIs were issued in 2012 [8]. In 2014, the number of NOIs issued was 87 notices, which was a significant increase of more than 10 folds (1000%). In particular, the 2014 data shows that 34 NOIs were given to MHIs and the other 53 NOIs were issued to NMHIs [9].

The next punitive response under DOSH's purview is the NOP. NOP can be issued whenever DOSH officials find any work activity that poses an immediate danger to workers. Issuance of NOP would result in

immediate stopping of work operations until the identified hazards were removed or at the very least, appropriate control measures were taken to reduce the risk. Another punitive option that can be initiated by DOSH is to issue summon for violation of the components in the regulations. Summon approval has to be obtained from the court, and once approved, the manufacturer is legally bounded to pay the compound as per value specified by DOSH. However, the study found no official record in DOSH's annual reports (1995–2021) regarding both NOP and summon issuances under the CIMAH regulations.

In general, all punitive actions taken by DOSH are legally bindings, and failure to comply to the directives from the issued command letters and the notices can subsequently end in legal actions. Under the CIMAH regulations, the indicted manufacturers could be fined a maximum of up to RM 50,000.00, or two years of imprisonment, or both [2]. There have been some documentations of DOSH's legal activity, in which the authority prepared charged cases in court against violators of CIMAH regulations. For example, there were two prosecution cases filed in court in 2009, where it marked the first time cases were being trialed under CIMAH regulations, after 13 years of its introduction [9]. The delayed legal actions are supposedly in line with DOSH corporate values which are "fair, firm and friendly" to the industry [10]. In both cases, both MHIs pleaded guilty on the charge of violating provisions under CIMAH regulations. The court sentenced the organizations fine that amounted to RM 35,000.00 [11]. However, there has been limited information available detailing out what type of offences committed by these MHIs. The next prosecution cases due to violation of CIMAH regulations were filed in 2014 by Perak and Sabah state offices [25]. The case in Perak involved failure of the industry to provide DOSH detailed notification of industrial activities. The accused party pleaded guilty and was sentenced a fine of RM 5000.00 or would face 4 months of imprisonment for failure to pay the fine. Meanwhile, the case in Sabah involved failure of the MHI to inform the public close to facility's vicinity about the hazardous material used in the area. Similar to previous case, the MHI pleaded guilty and was sentenced penalties of RM 2,000.00, or would face three months in jail if the accused party fails to pay the fine. In both cases, the MHIs pleaded guilty and paid the fines.

#### 4. CONCLUSION

The CIMAH regulations have been enforced for more than two decades in Malaysia. However, there have been limited efforts to review the information, trends and data related to the regulations. In conclusion, there has been several organizational changes in terms of administrative governance and assuming enforcement activities of CIMAH regulations since its inception in 1996. The changes were made to allow better administrative governance from the authority, which include improved structures, documentations & audit trails, human resources, and coverage capacity. In addition, there were significant increases in MHI registrations of the past two decades, indicating expansion and dynamic changes among industrial players in major hazard industries. Lastly, there have been several punitive and legal actions taken towards MHI by DOSH, which suggests a level of seriousness by the authority to enforce CIMAH regulations. The study offers summary of data trends related to CIMAH regulations in Malaysia, which would allow deeper analysis of the regulations' relevance and gaps to the policymakers. In addition, the findings may also provide directions for practitioners and academicians to bridge the gaps, and further contribute to betterment of regulations' enforcement and its impacts. Limitation of study is related to the type of data extracted for analysis. The lack of publications and public data to be accessed, due to the specialized area of the study resulted in limited pool of sources that can be used as references. As a result, the analysis conducted mostly relies on unpublished government data, which mostly looks into the trends from the authority's point of view. However, the findings from this study offered a preliminary groundwork that can be used to justify future works, based on the evident trends captured. Future research works should consider engagement with industry professionals, field researchers, and other stakeholders to provide a more comprehensive analysis on the information and trends related to CIMAH regulations.

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