EMERGENCY PREPAREDNESS AND RESPONSE PLAN IN MAJOR CYANIDE HANDLING COMPANIES

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By

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OSHA – Occupational Safety and Health Act – Malaysia

CIMAH – Control of Industrial Major Accident Hazard – Regulations

BOMBA – Malaysian Fire and Rescue Department.

LD 50 – Lethal Dose

HCN – Hydrogen Cyanide

MIC – Methyl Isocyanate

CSB – Chemical Safety Board – United States of America

U.S- United States of America

SOCSO – Social Security Organisation-Malaysia

DOSH – Department of Occupational Safety and Health

MHI – Major Hazard Installation

EPA – Environmental Protection Agency- United States of America

OSHA – US – Occupational Safety and Health Administration – United States of America.

ISO – International Organisation of Standardisation

MS – Malaysian Standard

HSE – Health and Safety Executive – United Kingdom

MSDS- Material Safety Data Sheet

CSDS – Chemical Safety Data Sheet

ICS – Incident Command System

HAZMAT – Hazardous Materials

CN – Cyanide

MEL – Maximum Exposure Limit

TLV –TWA – Threshold Limit Value- Time Weighted Average

R-phrases – Risk Phrases

S-phrases – Safety Phrases

KCN – Potassium Cyanide

U.K – United Kingdom

ERT –Emergency Response Team

LEV – Local Exhaust Ventilation

TNA – Training Need Analysis

PPE – Personal Protective Equipment

ABSTRACTS

Cyanide chemicals are highly toxic to human as well as environment. In Malaysia Cyanide chemicals are mainly used in electroplating industry. Among the main cyanide chemicals used are Potassium Cyanide (KCN). One of the world famous industrial accidents, Bhopal Disaster, is due to cyanide related chemical. In Malaysia so far we didn't experience any cyanide-related disaster yet but this doesn't mean that it will never happen especially when the number of electroplating companies in Malaysia are increasing.

This research purpose is to assess the status of preparedness in handling cyanide emergency by cyanide handling companies. The companies selected for this research consists of two categories that are electroplating companies and cyanide chemical suppliers.

The result of research clearly indicates that the cyanide chemical suppliers are less prepared to handle cyanide related emergency compare to electroplating companies. However most of the electroplating companies preparedness also not fully as per legal requirements or national and international guidelines or practises.

Based on the research outcome a recommendation is made on the requirements of Emergency Preparedness and Response Plan in Cyanide handling companies. This recommendation expected to be very useful especially to the small scale electroplating or chemical supplying companies.

ABSTRAK

Bahan kimia sianida merupakan bahan yang sangat toksik untuk manusia dan juga alam sekitar. Pegunaan sianida di Malaysia adalah terutamanya diindustri penyaduran elektrik. Kalium Sianida (KCN) merupakan diantara bahan kimia sianida yang digunakan secara meluas. Salah satu kemalangan industri yang terkenal ialah Tragedi Bhopal di India , dimana berkaitan dengan bahan kimia sianida.Walaubagaimanapun di Malaysia kita belum pernah mengalami sebarang kemalangan besar melibatkan sianida, tetapi in tidak bermakna ia tidak akan berlaku dimasa akan datang ,terutamanya dengan peningkatan bilangan kilang – kilang penyaduran elektrik.

Tujuan kajian ini ialah untuk menilai tahap persediaan dalam pengendalian kecemasan melibatkan bahan kimia sianida di syarikat-syarikat yang megendali sianida. Syarikat-Syarikat yang dipilih untuk kajian ini terdiri daripada dua kategori iaitu, kilang-kilang penyaduran elektrik dan pembekal-pembekal bahan kimia sianida.

Hasil kajian ini jelas menunjukkan yang pembekal-pembekal bahan kimia sianida kurang bersedia untuk menghadapi kecemasan melibatkan bahan kimia sianida berbanding dengan kilang-kilang penyaduran elektrik.

Namun begitu secara keseluruahan persediaan kilang-kilang penyaduran elektrik juga tidak ke tahap yang memenuhi kesemua keperluan undang-undang dan panduan-panduan kebangsaan atau antarabangsa.

Berdasarkan pada kajian ini, satu cadangan dibuat mengenai keperluan Persediaan Kecemasan dan Plan Tindakan Kecemasan untuk syarikat-syarikat yang terlibat dengan pengendalian bahan kimia sianida. Cadangan ini dijangka akan sangat berguna terutamanya kepada syarikat-syarikat kecil penyaduran elektrik dan pembekal-pembekal bahan kimia.

CHAPTER I

INTRODUCTION

OBJECTIVES

- Study existing emergency preparedness and response plan in Cyanide handling companies.
- Recommend requirements for Emergency Preparedness and Response Plan in Cyanide handling companies based on the research conducted.

SCOPE

- Studies carried out at selected major electroplating companies and cyanide chemical suppliers in Malaysia.
- The study of Emergency Preparedness and Response Plan for handling cyanide aimed at major cyanide handling companies (companies handling more than 500kg of cyanide chemicals) but the result of the study and recommendation can be used by any companies handling cyanide chemicals including cyanide waste treatment companies.

BACKGROUND AND STATEMENT OF PROBLEM

In Malaysia electroplating industry started more then 20 years ago but this industry started to become more prominent in early 1990s. Before 1990s electroplating was mainly on Chrome plating and cosmetic plating of gold and silver. In 1990's the industry started to expand rapidly, many Japanese and other multinational electroplating companies started operation in Malaysia .The most popular type of electroplating industry is lead frame plating for IC and transistor in electronics industry. Most of these companies use Cyanide based electroplating system. Among the widely used cyanides are Copper Cyanide, Potassium Cyanide, Potassium Silver Cyanide and Sodium Cyanide . All these chemicals are highly toxic with LD 50(oral) rat mg/kg body weight < 25 (OSHA, CIMAH, 1996 regulations classification).

Supporting industries such as cyanide chemical supplier and cyanide waste treatment companies also started operation to support these electroplating industries. Since these IC and transistor electroplating companies are classified as electronic companies, the authority in some cases fails to identify them as having potential for major accident hazard. However recorded experiences in handling cyanide emergency in Malaysia is not available. Even our BOMBA's HAZMAT team was established few years ago only as a part of government's effort to improve the capability of rescue units in handling emergency related with hazardous material. In worldwide perspective we can take the example of famous BHOPAL incident at Union Carbides factory, Bhopal, India. In this incident methyl isocyanate was released. It killed over 2000 people and many more lost their eyesight and injured. The Bhopal disaster clearly illustrates the disaster potential

of cyanide related industrial processes. Anticipation of a disastrous failure would have prevented loss of life and injury. Taking into consideration the potential of major accident in chemical related installation, the Malaysian Government released new sets of regulations under Occupational Safety And Health Act (OSHA, 1994) named Occupational Safety And Health (Control of Industrial Major Accident Hazards) Regulations (CIMAH, 1996). The Department Of Environment (DOE) is planning to classify electroplating companies as prescribed premises under Environmental Quality Act 1974. Actually there are lot of small scale electroplating company in Malaysia without proper Safety, Health and Environment Management System. This kind of research and information paper will be very useful for them as a guide to improve their Safety, Health and Environment Management System and be prepared to handle emergency situation with comprehensive Emergency Response Plan. This research focuses on both proactive measures that should be in place to prevent accident as well as reactive measures to handle emergency situation. This research paper also expected to be useful as a guide to the emergency rescue teams such as BOMBA in handling emergency such as fire with cyanide, cyanide chemical spill or toxic Hydrogen Cyanide (HCN) gas release.

BIBLIOGRAPHY

1. Malaysia, Occupational Safety And Health Act, 1994.
2. Malaysia, Occupational Safety And Health (Control of Industrial Major Accident Hazards) Regulations, 1996.
3. Malaysia, Occupational Safety And Health (Safety And Health Committee) Regulations, 1996.
4. Malaysia, Occupational Safety And Health (Classification, Packaging and Labelling of Hazardous Chemicals) Regulations, 1997.
5. Malaysia, Occupational Safety And Health (Safety And Health Officer) Regulations, 1997.
6. Malaysia, Occupational Safety And Health (Safety And Health Officer) Order, 1997.
7. Malaysia, Factories and Machinery Act & Regulations, 1967.
8. Malaysia, Poison Act, 1952.
9. Malaysia, Environmental Quality Act,1974
10. Malaysia, Environmental Quality (Clean Air) Regulations,1978.
11. Malaysia, Environmental Quality (Sewage and Industrial Effluents) Regulations, 1979.
12. Malaysia, Environmental Quality (Scheduled Wastes) Regulations, 1989.
13. Jonathan, B; Bernard,D.S; Silverstein, D. 1999.Emergency Response Plans –The Benefits of Integration. Pages 44-48. Occupational Hazards, The Magazine of Safety, Health and Loss Prevention, September, Vol.61 No.9

14. Michael, J.F. 1999.Crisis In The Workplace: Mass Casualties and The Aftermath. Pages 33-35. Occupational Hazards, The Magazine of Safety, Health and Loss Prevention, July, Vol.61 No 7.

15. Stephen G.M. 1999.Chemical Incidents Claim Lives. Page 31. Occupational Hazards, The Magazine of Safety, Health and Loss Prevention, April, Vol.61 No.4.

16. British Standard Institute (BSI).1999. Occupational Health and Safety Management Systems (OHSAS 18001).

17. ISO. 1996. Environmental Management Systems – Specification With Guidance For Use (ISO 14001),.pp 4.

18. ISO.1996. Environmental Management Systems- General Guidelines On Principles, Systems and Supporting Techniques (ISO 14004), .pp 20-21

19. Malaysian Standard.1994. Code Of Practice For Safety And Health At Work (MS 426),First Revision.

20. Degussa AG,Industrial and Fine Chemical Division. 1994.Cyanide Responsible Care.

21. CONOCO. 1997.Process for Continuous Safety Improvement, Downstream North America.

22. Department of Occupational Safety and Health (DOSH). 1996. Major Hazard Division, Guideline-Report on Industry Activity for CIMAH compliance.

23. Health and Safety Executives (HSE). 1992. U.K, Management of Health and Safety at Work. Approved Code Of Practice L21, ISBN 0 7176 04128.

24. Health and Safety Executive (HSE). 1984.U.K, Control Of Industrial Major Accident Hazards Regulations 1984 (CIMAH): Further guidance on emergency plans HS (G), ISBN 0 11 8838318.

25. Health and Safety Executive (HSE). 1995. U.K, The control of fire-water run- off from CIMAH sites to prevent environmental damage EH70, ISBN 0 7176 09901.

26. Toxic Substances Bulletin (TSB). 1996. Issue 29,January.

27. Martin A.1985. The Lessons of Bhopal – a community action resource manual on hazardous technologies; Publisher: International Organisation of Consumers Unions.

28. Roger D.Griffin, Principles of Hazardous Materials Management ; Publisher : Lewis.

29. Raymond P.Cote;Peter G.Wells,Contolling Chemical Hazards-Fundamental of The Management of Toxic Chemicals.pp.2.

30. Eugene Meyer,Chemistry of Hazardous Materials,2nd ed.;Publisher: Brady Book.

31. Degussa.1997.Safety Data Sheet (91/155/EEC)-Potassium Cyanide granular 98/99%, 001 22/3520800000/SDE/E 001,Version 01/01/223520800000,.

32. Drager.1997.MSDS – Hydrogen Cyanide.

33. Degussa, Cyanides – Antidotes – Information for Medical Practitioners, 1994.

34. Jeremy Stranks,RoSPA Handbook of Health and Safety Practice,4th ed.;Publisher :Pitman, pp 151-166.

35. Ir.Mohtar Musri.1999. Legislation System for Control of Chemical Substances in Malaysia, Sharing, Understanding and Implementing Chemical Safety Legislation, JISHA/MSOSH Joint Seminar, August.

36. Gregory, G. N; Michael, S.H and James, G.Y.1994. Hazardous Materials- Managing The Incident, 2nd. ed. Pages 1-75. Publisher: Fire Protection Publications, Oklahoma State University.

37. Hirokazu,O.1999. Methods to manage chemical substances. Proceedings of JISHA/MSOSH Joint Seminar –Sharing, Understanding and Implementing Chemical Safety Legislation of Japan Industries Safety and Health Association. August.

38. Christopher, A.J.1996.Employers'knowledge of the hazard communication standard requirements and the perceived barriers to compliance. Journal of Safety Research,Vol.27, No.4.

39. Kate,B.1996. Hazmat Drivers Don't Do It Alone. Today's Supervisor. December. National Safety Council.

40. Health and Safety Executive.1998.Five Steps to Risk Assessment. May. Health and Safety Executive Publication.