GUIDELINES FOR THE PREPARATION OF CIMAH SAFETY REPORT

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Scope and Purpose

- These guidelines represent a method for the preparation and review of the report under the CIMAH Regulations 1996

Philosophy

- The safety report contains the information specified in Schedule 6 of the regulations.

- The principal objectives of a safety report can be summarised as:

  - To identify the nature and the scale of the use of dangerous substance at the activity;

  - To identify the type, relative likelihood and the consequence of a major accident that might occur, and

  - To give account of the arrangements for safe operation of the activity, for control of serious deviations that could lead to a major accident, and for emergency procedure at that site.

Presentation

- Schedule 6 of the regulations requires the following to be provided:
  - Information relating to every dangerous substance involved in the activity in a relevant quantity listed in the Schedule 1 or Schedule 2.
  - Information relating to the installation
  - Information relating to the management system for controlling the industrial activity, and
  - Information relating to the potential major accidents

Predictive Element in Safety Report

- For a hazardous plant a two stage approach is applied to identify a list of representative release cases:

- Identify those sections of plants with the most hazardous inventories. These will generally be those sections with large inventories of flashing materials.

- To estimate the impact of the plant in terms of risk to those who work on the site or who work or live off the site.

Estimation of Impact

- Conducting consequence analysis for potential catastrophic releases (vessel failures or guillotine failure of pipework) involving worst inventory and smaller releases which are taken to represent releases from a range of generic failure events.

- Identify nearby fixed onsite and offsite populations.

- Identify those releases which could cause serious hazard to the on and off site populations.

CIMAH Safety Report

- This requirement refers to the Schedule 6 of the regulation (Sub-regulation 14(1) and 15(1)).

- The preparation of the core document may be facilitated by the use of suitable checklist.

Introduction

- This section is used to introduce the scope of the report.

- If the report is a three year update or resubmission due to modification, a summary should be made of any significant changes, any incidents or advances in the technical knowledge which have occurred since the last submission.

- **Information Relating to the Hazardous Substances - Schedule 6 (a)**

Schedule 6 (a) (i)

- *"The name of the hazardous substance as given in Schedule 2 or, for a hazardous substance included under a general designation, the name of the corresponding to the chemical formula of the hazardous substance".*

- Give names of individual hazardous substance named in the Schedule 1 or 2 used or stored within the site.

- Multicomponent mixtures such as gasoline or naphtha for example can be identified by means of the CAS number

Schedule 6 (a) (ii)

- *"A general description of the analytical methods available to the manufacturer for determining the presence of the hazardous substance, or reference to such methods in the specific literature".*

- Give details of specific methods used in the plant eg fixed or portable monitoring instruments, laboratory analysis method for a toxic by-product etc.

- This should include not only "safety" monitors but also equipment such as on-line analysers, to detect impurities if they could create potential hazard.

Schedule 6 (a) (iii)

- *" A brief description of the hazards which may be created by the hazardous substance".*

- The information shall include:
  - *type and origin of the substance*
  - *physical and chemical properties*
  - *toxicological, flammability and explosive characteristics*
  - *Others*

- Most information may be found in chemical safety data-sheets

Schedule 6 (a) (iv)

- *"The degree of purity of the hazardous substance and the names of the main impurities and their percentages"*

- Refer to any specific impurities which may create a potential hazard eg peroxides or other unstable by-products

- Information Relating to the Hazardous Substances - Schedule 6 (b)

Introduction

- An introductory section should contain general information on the establishment, i.e.
  - purpose of the site;
  - main activities and production;
  - history and development of the activities;
  - the number of persons working at the site (i.e. internal and contractors' personnel, specifying working times, visitors, etc.);
  - general statements characterizing the site with respects to its main hazards due to relevant substances and processes.

Schedule 6 (b) (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 size".*
- Provide a site plan showing the relationship of the plant to the site in general and to the surrounding plants.
- Indicate the nature of the surrounding plants/storages and off-site establishment
- The description of the site should contain data on topography and accessibility to the site at a degree of detail commensurate with the extent of the hazards and the vulnerability of the surroundings
- The submitted topographic maps should be of an adequate scale and should include the establishment and surrounding developments within an area of sufficient extent in relation with the possible impact of accidents

Schedule 6 (b) (i)

- Maps shall clearly indicate:
  - The land use pattern industry, agriculture, urban settlements, environmentally sensitive locations etc.
  - The location of the most important buildings and infrastructures hospitals, police and fire stations, schools, other industrial sites, motorway / railway networks, stations and yards, airports, harbours, etc.
- The maps shall also indicate
  - access routes to the site
  - as the escape routes from the site and
  - other traffic routes significant for rescue and emergency operations

Schedule 6 (b) (ii)

- *"A scale plan of the site showing the locations and quantities of all significant inventories of the hazardous substances".*
- The lay-out of the plant as a whole and of its relevant installations should be clearly presented on adequately scaled plans.
- The lay-out should adequately identify installations and other activities of the establishment including:
  - main storage facilities;
  - process installations;
  - location of relevant substances and their quantities;
  - relevant equipment (including vessels and pipes);
  - spacing of the installations and their main sections;
  - clearance between flammable liquid storage tanks in multi-storage sites, etc.;
  - utilities, services and fire water system;
  - escape routes from the installations and across the establishment;
  - control rooms and office rooms

Schedule 6 (b) (iii)

- *"A description of the process or storage involving the hazardous substances and an indication of the conditions under which it is normally held".*
- Give a fairly detailed description of the process including:
  - Process chemistry
  - Physical properties and substances involved
  - Temperature and pressure of systems
  - Physical state of reactants
  - Include simplified process flow diagram (PFD).
  - Full detailed P&ID may or may not be submitted depending on the confidentiality nature of the information.
  - Inventories, flow, temperature and pressure and physical state should be indicated on the PFD

Schedule 6 (b) (iv)

- *“The maximum number of person likely to be present on site”*

- List number of personnel per shift, all grades.

- Typical maximum number of people who may be present during the day and night shift including contractors. Day and night population may be superimposed on to the map from Schedule (b) (ii) or (b) (i)

Schedule 6 (b) (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"*

- The description of the natural environment and the surroundings of the site should be detailed to an extent proportionate to the hazard

- This kind of information will support the assignment of the relevant measures against potential effects of a major accident on neighbouring inhabitants, ecosystems, properties and activities

- **Information Relating to the Hazardous Substances - Schedule 6 (c)**

Purpose

- This schedule seeks for the demonstration of a competent, effective and well-organised management systems for a site. Sections of the site/business safety policy could be included as appropriate.

Schedule 6 (c) (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 those who are authorised to set emergency procedures in motion and to inform outside authorities”.*

Schedule 6 (c) (i)

- The plant document should include at least the following:
  - Organisation chart down to the first line supervisory level
  - Description of the site Safety and Health Committee
  - Any particular or unusual expertise required to run the plant safely
  - General description of job description of the plant management
  - General reference concerning cover in the absence of plant manager etc
  - General description to frequency of safety audits of plant
  - Outline of any plant emergency procedure
  - Reference concerning adequate cover during the silent hour eg duty manager procedure

Schedule 6 (c) (ii)

- *"The arrangement made to ensure that the means provided for the safe operation of the industrial activity are properly designed, constructed, tested, operated, inspected and maintained"*
- The plant specific report should deal with the issues such as the ways it is being managed:
  - HSE management system describing the whole management of safety that determines and implements the HSE policy.

- Established procedures covering normal operation, start-up and shutdown as well as non-routine operations
- Communication of those procedures to relevant personnel through instruction, operating manual and permit to work
- Supervision of operating activities having a bearing on the safe running of the plant during normal operation and non-normal operation.

Schedule 6 (c) (iii)

- *"The arrangement for training of persons working on the site"*

- This section describes the safety training provided at the site and how training needs for the personnel are identified and implemented for all levels of staff including management and technical staff.

- Details should be given on:
  - How training needs are identified
  - How training is carried out
  - What testing take place to ensure that the training message has been received
  - What records exist of training being carried out.

- Identification of training needs may be from critical task analysis, staff appraisal or supervisors identification.

- Information Relating to the
- Potential Major Accidents - Schedule 6 (d)

Purpose

- This section applies to the evaluation of the specific major accidents on the plant under consideration

Schedule 6 (d) (i)

- *“A description of the potential sources of major accident and conditions or events which could be significant in giving rise to one”.*

Determination of Qualifying Substances

- Selection of Representative Release Cases
- Consequence Analysis
- Causes of Events and Their Likelihood

All hazardous substances in the plant need to be identified and considered as potential source of a major accident

Schedule 6 (d) (i)

- **Selection of Representative Release Cases**
- Determination of the consequences of a maximum event, the release case therefore, be based on the maximum of:
  - Most hazardous isolatable inventory before isolation, and
  - Most hazardous isolatable inventory plus most hazardous adjacent isolatable inventory.
- *Note: The most hazardous inventory is likely to be the inventory giving rise to the largest flashed mass.*

- For smaller releases (13mm, 25mm, 50mm holes) the release duration will be determined by the time to isolate and the section to depressurise

Schedule 6 (d) (i)

- **Consequence Analysis**
- The following types of events should be considered:
  - **Flammables:**
    - - Pool fire
    - - BLEVE
    - - Jet flames
- Where a vapour cloud is generated and there is some delay in ignition the following will be considered:
  - Flash fire or distance to LFL
  - Vapour cloud explosion – overpressure created by the blast wave
  - **Toxic** - Release of toxic cloud

Schedule 6 (d) (i)

- **Causes of Events and Their Likelihood**
- Initiating Events
- Generic causes of events include:
  - - Loading and unloading operations
  - - Extreme operating parameters
  - - Potential for overpressure due to gas breakthrough
  - - Overfilling of vessels
  - - Potential for internal explosion
  - - Corrosion or erosion

- Prevention, Control and
- Mitigation Measures – Schedule 6 (d)

Schedule 6 (d) (iii)

- *"A description of the measures taken to prevent, control or minimise the consequences of a major accident"*
- Prevention, control and mitigation measures may include:
  - process control system including back-ups;
  - fire and explosion protection systems;
  - devices for limiting the size of accidental releases i.e. scrubbing systems, water spray;
  - vapour screens, emergency catch pots or collection vessels, emergency shut-of valves;
  - alarm systems including gas detection;
  - automatic shutdown systems;
  - inerting systems;
  - fail-safe instrumentation;
  - emergency venting including explosion panels;
  - fast shut-down and other emergency procedures;
  - special precautions against unauthorized actions related to the plant security (addressed in confidential reports available to CA on request).

Schedule 6 (d) (iv)

- *"Information about the prevailing meteorological conditions in the vicinity of site"*.
- As the natural environment of an establishment may present potential hazard sources, influence the development of an accident, and be affected by the consequences of an accident, data will be needed for the description of the relevant environmental factors. In general this includes *meteorological data* such as :
  - average and maximum indices on precipitation;
  - Thunderstorms;
  - Lightning;
  - humidity, fog, frost;
  - winds (direction, speed);
  - stability classes;
  - maximum and minimum recorded temperatures,

Schedule 6 (d) (iv)

- *“The consequence to the surrounding areas in the form of appropriate risk measures where possible”.*

- This section shall describe the plant responsibility toward the community during emergency as well as during normal operation

Checklist

- CIMAH Report Preparation

CIMAH Report Preparation Checklist

- **Plant General Procedures**
  - Design procedures
    - HSE reviews for projects
    - Standard and Codes of Practice: List the titles of all Standard which may be relevant to the site
    - Joint research project in safety
    - Use of Hazan and Hazop technique
    - Plant modification procedures
    - Environmental Impact Assessment
    - System and procedures for controlling design contractors
    - Assessment procedures for licenced processes
    - Concept safety evaluation
    - Use of MSDS
    - Hazardous Area Classification methods
    - Consultation with authorities

CIMAH Report Preparation Checklist

- **Construction Procedures**
  - QA/QC Procedures
  - Tie-in procedures
  - Project review procedures
  - System for managing contractors, monitoring progress and safety, independent inspection
  - Project coordination and project management system
  - Contractor selection and evaluation
  - Contractor induction and training

CIMAH Report Preparation Checklist

- **Testing Procedures**

  - Hydraulic and hydrostatic testing methods
  - Pneumatic testing procedures
  - NDT methods
  - Instrument testing method, loop testing, computer modelling
  - Relieve valve testing
  - Compliance to legal requirement testing
  - Product health and environment testing
  - Testing pollution control response
  - Testing of fire fighting and fire protection system
  - Inspection of vehicles for use in hazardous areas

CIMAH Report Preparation Checklist

- **Operation**
  - Operational procedures
  - Plant preparation procedures
  - Permit and other control system
  - Site HSE procedures
  - HSE auditing policy and frequencies
  - Incident investigation and follow-up procedures
  - Emergency planning
  - Ship-shore checklists
  - Log books and shift instructions
  - Emergency drills

CIMAH Report Preparation Checklist

- **Inspection**
  - Refer to relevant codes
  - Refer to any site policy on corrosion examination – external and internal

CIMAH Report Preparation Checklist

- **Maintenance**
  - Preventive versus breakdown maintenance policy
  - Turnaround
  - Special equipment maintenance eg furnace, boilers, turbines etc
  - Maintenance during catalyst change
  - Diagnostic technique including vibration analysis
  - Use of technical service specialist
  - 24 hour on-call maintenance service

CIMAH Report Preparation Checklist

- **Selection for Training**
  - Policy and procedures on:
    - Induction training for employees
    - Refresher training
    - Recruitment policy and selection
    - Specific HSE training – use of BA, extinguishers, PTW
    - Job orientation
    - PETRONAS trainings
    - Certification and competencies
    - Drills and exercises
    - Drill and training with local emergency providers

CIMAH Report Preparation Checklist

- **Arrangement for Training**

- Arrangement for competency trainings:
  - Operators
    - General process and plant familiarisation
    - Simulators
    - On plant
  - Craftsmen
    - General process and plant familiarisation
    - On plant
    - External equipment manufacturer
  - Supervisors
    - General process and plant familiarisation
    - On plant
    - External equipment manufacturer
    - Simulators
  - Professional Staff
    - External (similar plant, equipment manufacturers)

- Causes of Major Hazard Events

Causes of Major Hazard Events

- **Site Wide Events**
- Impact damage by vehicle, train, ship
  - Aircraft and helicopter accident
  - Flood
  - Subsidence
  - Earthquake
  - Explosion overpressure and missiles from events onsite and from adjacent sites
  - Wind and waves
  - Lightning strike
  - Loss of services and utilities
  - Sabotage

Causes of Major Hazard Events

- **Generic Failures**
  - Mechanical failures within design parameters
    - Structural failure due to shortcomings in design or fabrication
    - Joint or seal failure
  - Mechanical failures outside design parameters
    - Inadequate pressure relief
    - Design temperature exceeded
    - Low temperature failure
    - Corrosion – internal and external
    - Fatigue failure
  - Human error

Causes of Major Hazard Events

- **Special failures**
  - First consider the possible deviations from normal operating conditions of particular process or operation being studied.
- For example:
    - Internal explosion
    - Exothermic reaction
    - Spontaneous decomposition
    - Spontaneous polymerisation
    - Reaction due to contamination or incorrect mixing of reactants

Causes of Major Hazard Events

- **Escalation and Knock-ons**
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  - Failure due to pool or jet fire
  - Failure due to missile impact
  - Failure due to overpressure