RESPONSIBLE CARE ®

PROCESS SAFETY

CODE OF MANAGEMENT PRACTICES

Developed by
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PROCESS SAFETY CODE

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Introduction

After the Bhopal tragedy, every incident drew much attention, creating a tremendous level of public concern. This triggered a new focus on improving process safety through better management. The focus was on management systems that ensure safe design, inspections and deal with minimisation of what is classified as human error. There are 22 management practices which can be broadly classified into four sections :- management leadership, technology, facilities and personnel.

The Code is telling that management must provide commitment and leadership that displays the highest standard of safety. Firstly, the Code attempts to ensure that the reactions of the community to issues in a chemical plant site are communicated to those who are doing the designs and modifications at the site. Secondly, the Code pin points the company's role in validating the fitness of employees in safety critical jobs – for instance, checking for drug abuse. Thirdly, the Code is built around the idea of on-going improvements in process safety with regular audits and impact of organisational or policy changes on process safety. Fourthly, contractors must have process safety programmes for their own employees consistent with applicable sections of the Process Safety Code.

Scope

It identifies areas where companies can improve their safety performance from process design, through continued operation and routine maintenance. The Code is designed to prevent fires, explosions and accidental chemical releases.

Objectives

The Process Safety Code encourages companies to listen to the concerns of the community when designing and implementing process safety systems which must be written, tested and communicated to the employees.

Compliance with Responsible Care Guiding Principles

1. Recognise and response to community concerns about chemicals and the operations.

2. Develop and produce chemicals that can be manufactured, transported, used and disposed off safely.

3. Make health, safety and environmental considerations a priority in planning for existing and new products and processes.

4. Operate plants and facilities in a manner that protects the environmental and health and safety of employees and the public.

MANAGEMENT PRACTICES AND IMPLEMENTATION GUIDELINES

The 22 Management Practices that help prevent fires, explosion and accidental chemical releases :-

Management Practices	Implementation Guidelines
1. Leadership by senior management through policy, participation, communications and resource commitments in achieving continuous improvement of performance.	Written process safety policy which defines plant process safety goals and objectives (see Appendix I). This policy must be communicated to all levels of workers. Management to provide necessary resources and participate in process safety programmes e.g. reviewing process incidents at meetings.
2. Clear accountability for performance against specific goals for continuous improvement.	All individuals be aware of their process safety responsibilities and held accountable. Written process safety goals for specific individuals. Goals progress monitored and evaluated periodically.
3. Measurement of performance, audits for compliance and implementation of corrective actions.	Establish performance measurement criteria and develop compliance audit procedure. Audit recommendations implemented and verified.
4. Investigations, reporting, appropriate corrective action and follow-up of each incident that results, or could have resulted in a fire, explosion or accidental chemical release or exposure.	Define reportable incidents and develop reporting and investigation procedure. Set up incident review committee, analyse root cause and implement corrective action to prevent recurrence (see Appendix II)
5. Appropriate sharing of relevant safety knowledge and lessons learned from such incidents with industry, government and the community.	Organise regular dialogues, meetings with industry, government and the community for sharing incident related information.
6. Use of the Community Awareness and Emergency Response (CAER) process to obtain public input for consideration in the design and implementation of the facility's process safety systems.	Communicate with the community for solicitation information feedback to be considered in design and implementation of the process safety system design.
7. Current, complete documentation of process design and operating parameters and procedures.	Clear and updated documentation on Piping and Instrumentation Diagram (P&ID), process safety systems and safe operating procedures and parameters.

Management Practices	Implementation Guidelines
8. Current, complete documentation of information relating to the hazards of materials and process technology.	Develop inventory for hazardous chemicals and maintain current CSDS. Establish documentation on current and complete process technology information and which include criteria for maximum inventory level for process chemical, upset conditions and deviations.
9. Periodic assessment and documentation of process hazards and implementation of actions to minimise risks associated with chemical operations, including the possibility of human error.	Identify Process Safety review team and provide training. Identify processes requiring hazard analysis (see Appendix III). Establish corrective, preventive and mitigative measures. Periodic assessment to evaluate effectiveness of measures taken.
10. Management of changes to chemical operations to maintain or enhance the safety originally designed into the facility.	Review and record all operational changes. Identify types of changes that could have negative impact on safety and revise or upgrade operational procedure accordingly (see Appendix IV). Training of appropriate personnel. Controls in place to assure procedure is followed. Documentation and retention of records of changes.
11. Consideration and mitigation of the potential safety effects of expansions, modification and new facilities on the community, environment and employees.	Assess the impact of potential risks to community, environment and employees due to new installations and modifications. Institute mitigative measures and controls.
12. Site design, construction and maintenance using sound engineering practices consistent with recognised codes and standards.	Select appropriate engineering standards and identify local, state and federal requirements. Controls in place to ensure that standards and regulations are followed.
13. Safety reviews on all new and modified facilities during design and prior to start-up.	Set guidelines for selecting review team. Establish design and pre start-up safety review procedures. Written verification of all such safety reviews.
14. Documented maintenance and inspection programmes that ensure site facility integrity.	Establish scheduled maintenance, repair, inspection and testing programmes. Periodic review of programme effectiveness to ensure facility integrity (emphasis on critical equipment). Proper documentation and record keeping.
15. Sufficient layers of protection through technology, facilities and employees to prevent escalation from a single failure to a catastrophic event.	Identify areas requiring multiple protection which must be installed according to best available technology. Train appropriate personnel on multiple protection and conduct regular testings.

Management Practices	Implementation Guidelines
16. Provision for control of processes and equipment during emergencies resulting from natural events, utility disruptions and other external conditions.	Identify potential external emergency events (e.g. flooding, power failure, etc.). Install proper equipment and develop procedures necessary to prevent or minimise impact of such occurrences or events.
17. Identification of the skills and knowledge necessary to perform each job.	Develop and maintain job description which identify essential functions, critical skills and knowledge necessary to perform all such functions.
18. Establishment of procedures and work practices for safe operating and maintenance activities.	Develop safe operating and maintenance procedures which include safety ñpermit to workò system. Train employees and conduct regular review of such procedures and practices.
19. Training for all employees to reach and maintain proficiency in safe work practices and the skills and knowledge necessary to perform their job.	Develop training need for all employees to perform their work proficiently and in safe manner. Periodic review of adequacy of such training programmes. Maintain training record for each employee.
20. Demonstrations and documentation of skill proficiency prior to assignment of independent work and periodically thereafter.	Develop measurable proficiency level for each job description that involves process safety. Employees must demonstrate acceptable level of proficiency prior to assignment to independent work. Regular re-evaluation of such proficiency thereafter.
21. Programmes designed to assure that employees in safety critical jobs are fit for duty and are not influenced by external factors like alcohol and drug abuse.	Identify those jobs where incapacities could lead to adverse safety impact. Establish ñfit for dutyò procedures which identify cases of inability to perform jobs safely. Institute drug and substance abuse policy and enforce for non-compliance. Provide assistance programme for affected employees.
22. Provisions that contractors either have programmes for their own employees consistent with applicable sections of this code or be included in the companyôs programme, or a combination of the two.	Contractor selection criteria contains safety performance standards consistent with company safety policy. Monitor contractor safety performance.

APPENDIX I

A TYPICAL EXAMPLE OF PROCESS SAFETY POLICY

Our company will maintain a process safety management policy which is developed to prevent fires, explosions, and accidental releases. Each manufacturing site will maintain a process safety management program which is based on the principle that facilities will be safe if they are designed according to sound engineering practices; built, operated, and maintained properly; and periodically reviewed for conformance.

Approved by : .....

Name : .....

Designation : .....

APPENDIX II

ACCIDENT INVESTIGATION REPORT

REPORT NUMBER

COMPANY _____ ADDRESS _____

DEPARTMENT _____

LOCATION (if different from above) _____

1. NAME OF INJURED	2. NRIC NO. SOCSO NO.	3. SEX ☐ M ☐ F	4. AGE	5. DATE OF ACCIDENT
6. HOME ADDRESS		7. EMPLOYEEôS USUAL OCCUPATION		8. OCCUPATION at TIME of ACCIDENT
11. EMPLOYMENT CATEGORY ☐ Regular, full-time ☐ Temporary ☐ Non-employee ☐ Regular, part-time ☐ Seasonal		9. LENGTH OF EMPLOYMENT ☐ Less than 1 mth ☐ 6 mths to 5 yrs ☐ 1-5 mths ☐ More than 5 yrs		10. TIME in OCCUPATION at TIME of ACCIDENT ☐ Less than 1 mth ☐ 6 mths to 5 yrs ☐ 1-5 mths ☐ More than 5 yrs
13. NATURE OF INJURY and PART of BODY		12. REPORT NUMBERS and NAMES of OTHERS INJURED in SAME ACCIDENT		
14. NAME and ADDRESS OF MEDICAL OFFICER		16. TIME OF INJURY a.m. A. _____ p.m. B. Time within shift C. Type of shift		17. SEVERITY of INJURY ☐ Fatality ☐ Lost workdays-days away from work ☐ Lost workdays-days of restricted activity ☐ Medical treatment ☐ First aid ☐ Other, specify _____
15. NAME and ADDRESS OF HOSPITAL / CLINIC				
18. SPECIFICATION OF ACCIDENT ON EMPLOYERSô PREMISES ? ☐ YES ☐ NO		19. PHASE OF EMPLOYEEôS WORKING TIME OF INJURY ☐ During rest period ☐ Entering or leaving plant ☐ During meal period ☐ Performing work duties ☐ Working overtime ☐ Other _____		

20. DESCRIBE HOW the ACCIDENT OCCURRED

_____

_____

_____

_____

_____

_____

21. ACCIDENT SEQUENCE. Describe in reverse order of occurrence events preceding the injury and accident. Starting with the injury and moving backward in time, reconstruct the sequence of events that led to the injury.

B. Injury Event _____

B. Accident Event _____

C. Preceding Event # 1 _____

D. Preceding Event #2. #3, Etc _____

_____

_____

22. TASK and ACTIVITY at TIME of ACCIDENT

A. General type of task _____

B. Specific activity _____

C. Employee was working :

☐ Alone ☐ With crew or fellow worker ☐ Other, specify _____

23. POSTURE OF EMPLOYEE

_____

24. SUPERVISION AT TIME OF ACCIDENT

☐ Directly supervised ☐ Not supervised

☐ Indirectly supervised ☐ Supervision not feasible

25. CAUSAL FACTORS. Events and conditions that contributed to the accident.

26. CORRECTIVE ACTIONS. Those that have been, or will be, taken to prevent recurrence.

PREPARED BY _____

TITLE _____

DEPARTMENT _____ DATE _____

APPROVED _____

TITLE _____ DATE _____

APPROVED _____

TITLE _____ DATE _____

Appendix III

METHODS OF PROCESS HAZARDS ANALYSIS

There are various methods of process hazard analysis and it may be helpful to explain some methods for those who are doing job hazard analysis.

(a) *What-If*. For relatively uncomplicated processes, review the process from raw materials to product. At each handling or processing step, ñwhat-ifòquestions are formulated and answered, to evaluate the effects of component failures or procedural errors on the process.

(b) *Checklist*. For more complex processes, the ñwhat-ifò study can be best organised through the use of a ñchecklistò, and assigning certain aspects of the process to the committee members having the greatest experience or skill in evaluating those aspects. Operator practices and job knowledge are audited in the field, the suitability of equipment and materials of construction is studied, the chemistry of the process and the control systems are reviewed, and the operating and maintenance records are audited. Generally, a checklist evaluation of a process precedes use of the more sophisticated methods described below, unless the process has been operated safely for many years and has been subjected to periodic and through safety inspections and audits.

(c) *What-If/Checklist*. The what-if/checklist is a broadly based hazard assessment technique that combines the creative thinking of a selected team of specialists with the methodical focus of a prepared checklist. The result is a comprehensive hazard analysis that is extremely useful in training operating personnel on the hazards of the particular operation.

The review team is selected to represent a wide range of production, mechanical, technical, and safety disciplines. Each person is given a basic information package regarding the operation to be studied. This package typically includes information on hazards of materials, process technology, procedures, equipment design, instrumentation control, incident experience, and previous hazards reviews. A field tour of the operation is also conducted at this time.

The review team methodically examines the operation from receipt of raw materials to delivery of the finished product to the customerôs site. At each step, the group collectively generates a listing of ñwhat-ifò questions regarding the hazards and safety of the operation.

When the review team has completed listing its spontaneously generated questions, it systematically goes though a prepared checklist to stimulated additional questions.

Subsequently, answers are developed for each question. The review team then works to achieve a consensus on each question and answer. From these answers, a listing of recommendations is developed specifying the need for additional action or study. The recommendations, along with the list of questions and answers, become the key elements of the hazard assessment report.

Hazard and Operability Study (HAZOP). HAZOP is a formally structured method of systematically investigating each element of a system for all of the ways in which important parameters can deviate from the intended design conditions to create hazards and operability problems. The hazard and operability problems are typically determined by a study of the piping and instrument diagrams (or plant model) by a team of personnel who critically analyse effects of potential problems arising in each pipeline and each vessel of the operation.

Pertinent parameters are selected, for example, flow, temperature, pressure, and time. Then the effect of deviations from design conditions of each parameter is examined. A list of key words, for example, ñmore ofò, ñless ofò, ñpart ofò, are selected for use in describing each potential deviation.

The system is evaluated as designed and with deviations noted. All causes of failure are identified. Existing safeguards and protection are identified. An assessment is made weighing the consequences, causes, and protection requirements involved.

Failure Mode and Effect Analysis (FMEA). The FMEA is a methodical study of component failures. This review starts with a diagram of the operation, and includes all components that could fail and conceivably affect the safety of the operation. Typical examples are instrument transmitters, controllers, valves, pumps, rotometers, etc. These components are listed on a data tabulation sheet and individually analysed for the following :

- Potential mode failure, (i.e., open, closed, on, off, leaks, etc);
- Consequence of the failure; effect on other components and effects on whole systems;
- Hazard class, (i.e., high, moderate, low);
- Probability of failure;
- Detection methods; and
- Remarks / compensating provisions.

Multiple concurrent failures also are included in the analysis. The last step in the analysis is to analyse the data for each component or multiple component failure and develop a series of recommendations appropriate to risk management.

Fault Tree Analysis. A fault tree analysis can be either a qualitative or a quantitative model of all the undesirable outcomes, such as a toxic gas release or explosion, that could result from a specific initiating event. It begins with a graphic representation (using logic symbols) of all possible sequence of events that could result in an incident. The resulting diagram looks like a tree with many branch listing the sequential events (failures) for different independent to the top event. Probabilities (using failure rate data) are assigned to each event and then used to calculate the probability of occurrence of the undesired event.

This technique is particularly useful in evaluating the effect of alternative actions on reducing the probability of occurrence of the undesired event.

APPENDIX IV

PROCESS CHANGE CHECKLIST

Information about the Process Change :

Originator | Date of Origination

Process Date of Change | Area

☐ Permanent ☐ Temporary From To

Description and Location of Change (Scope)

Technical Basis for Change

Nature of the Change:

Change affects : ☐ Safety ☐ Loss Prevention ☐ Environment ☐ Health

Type of Change : ☐ Pressure System ☐ Shutdown Point ☐ Addition or Removal of Equipment

☐ Piping Modification ☐ Chemicals ☐ Process Computer Control

☐ Job Procedure ☐ Instruments ☐ Equipment / Material Modification

☐ Other _____

Premodification Checklist :

Applicable	N / A	Initials	
☐	☐	_____	Study Block or Process Flow Diagrams
☐	☐	_____	Study piping and equipment specifications
☐	☐	_____	Perform reactive chemical testing ☐ In process ? Comply with regulations
☐	☐	_____	Consult maintenance (name)
☐	☐	_____	Consult instrument and electrical technicians (name)
☐	☐	_____	Consult store and parts technicians (name)
☐	☐	_____	Consult process engineering (name)
☐	☐	_____	Consult safety, health and environment officer (name)
☐	☐	_____	Evaluate and modify pressure relief system
☐	☐	_____	Review of completed process change

Postmodification Checklist (Before Startup):

Applicable	N / A	Initials	
☐	☐	_____	Performed prestartup audit
☐	☐	_____	Completed or updated training programmes
☐	☐	_____	Wrote and obtained approval for job procedures
☐	☐	_____	Updated P & IDs process flow sheets and plot plans
☐	☐	_____	Trained personnel on the change
☐	☐	_____	Updated critical instrument checklist
☐	☐	_____	Changed computer code and documentation

Approvals :	**Name**	**Date**
Originator		
First Reviewer		
Department Head / Superintendent		

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