

PROCESS SAFETY MANAGEMENT PROGRAM

UNIPAR CARBOCLORO



Clorosur Technical Seminar & WCC Safety Workshop

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☐ Facility

- Cubatao, Sao Paulo - Brazil
- 1,000 metric tons chlorine/day
- In operation since April 1964

☐ Products

- Chlorine
- Caustic soda
- Hydrogen
- Hydrochloric acid
- Sodium hypochlorite
- EDC



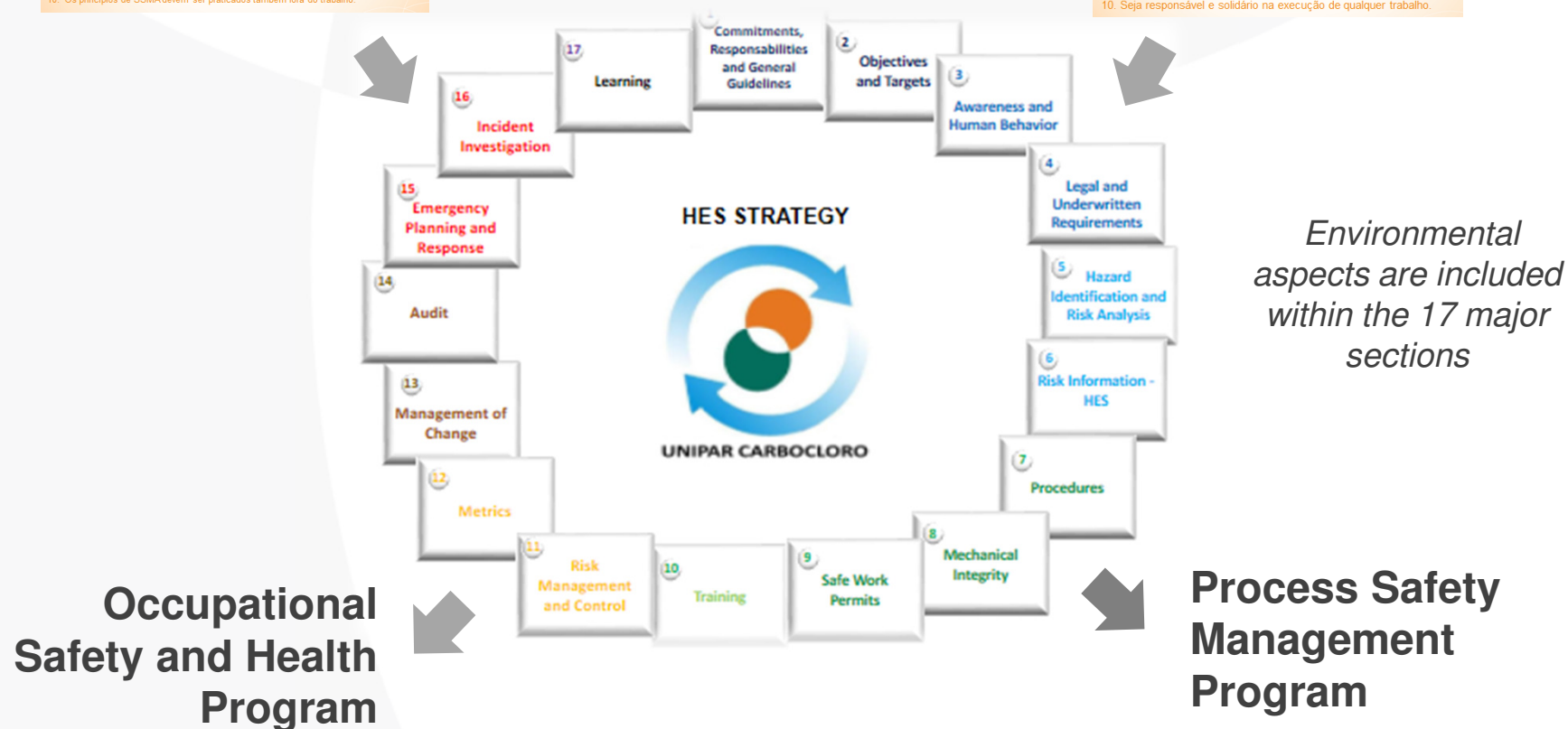
HES MANAGEMENT

HES Principles

1. Todos os acidentes, doenças ocupacionais e incidentes ambientais podem ser evitados;
2. A liderança é a principal responsável pela prevenção dos incidentes de SSMA;
3. Envolvimento dos funcionários é fundamental;
4. Treinamento e capacitação são essenciais para conduzir a adoção de comportamentos seguros;
5. Todos os procedimentos de SSMA devem ser seguidos rigorosamente sem abreviações;
6. Todos os desvios de SSMA devem ser prontamente comunicados, isolados e corrigidos, garantindo que os riscos sejam eliminados ou que quaisquer exposições a riscos remanescentes sejam controladas;
7. Todo incidente relevante deve ser analisado e corrigido para evitar recorrência;
8. Auditorias devem ser realizadas;
9. Trabalhar de maneira segura e protegendo o meio ambiente é condição de emprego;
10. Os princípios de SSMA devem ser praticados também fora do trabalho.

“Golden” Rules

1. Em qualquer etapa do trabalho, o ser humano e o meio ambiente devem ser preservados;
2. Analise, planeje e programe antes de executar qualquer trabalho;
3. Pense antes de agir;
4. Execute o trabalho sem improvisar, obedecendo sempre os procedimentos ou alternativas seguras;
5. Selecione e inspecione os EPIs, equipamentos, ferramentas e materiais necessários, usando-os adequadamente;
6. Execute o trabalho somente se você tiver a qualificação necessária;
7. Concentre-se na execução do trabalho;
8. Mantenha comunicação efetiva com todos os envolvidos no trabalho;
9. Controle continuamente o trabalho e avalie os resultados;
10. Seja responsável e solidário na execução de qualquer trabalho.

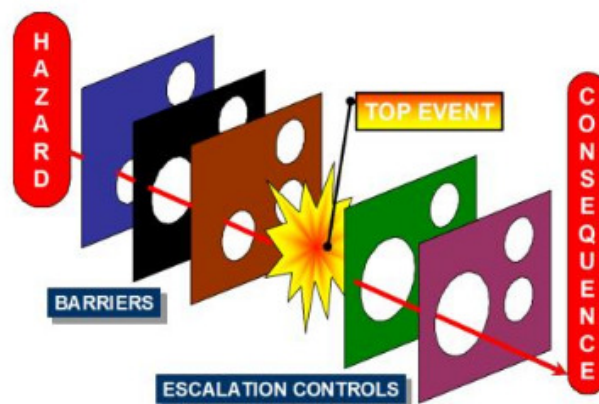


1910.119 Process Safety Management of Highly Hazardous Chemicals

Comprehensive management program that integrated technologies, procedures, and management practices. This section contains requirements for preventing or minimizing the consequences of catastrophic releases of toxic, reactive, flammable, or explosive chemicals. These releases may result in toxic, fire or explosion hazards.

CCPS

A management system that is focused on prevention of, preparedness for, mitigation of, response to, and restoration from catastrophic releases of chemicals or energy from a process associated with a facility.







Let's explore key points and plant practices in some elements...

ELEMENT 1: SITE PLAN

Explains and defines the facility's process safety management program.

❑ Site Plan is composed by:

- **Technical Analysis**

Define “covered areas”(Ex: Chlorine, EDC, etc)

- ✓ HHC substances
- ✓ Lead to undesirable events

- **Employee Participation**

Key point => Discipline, motivation, active participation

Examples:

- ✓ Employee role on each elements
- ✓ Accident Prevention Committee (National Regulation - NR 5)



ELEMENT 2: INFORMATION SHARING

Identifies how information will be made available while taking into consideration the company's trade secrets.

❑ Plant practices

- **Community:** Open Plant Program, Unipar Carbocloro Community Council
- **Associations:** ABIQUIM, ABICLOR, FIESP, CIESP e CHLORINE INSTITUTE, etc
- **Employees and Contractors:**
 - ✓ Monthly Safety Meeting (Ex: PSM)
 - ✓ Incident Investigation
 - ✓ Management of Change, etc



ELEMENT 3: PROCESS SAFETY INFORMATION

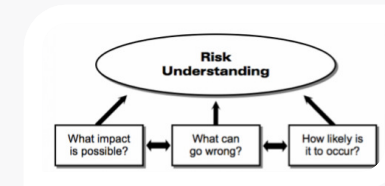
Information to support the understanding and identification of hazards.

❑ Plant Process Safety Information

- Available to personnel involved in the process
- Information groups:
 - ✓ Process Chemicals:
 - ✓ Process Technology:
 - ✓ Process Equipment:
 - ✓ Operating Procedures (Electronic system)



ELEMENT 4: PROCESS HAZARD ANALYSIS (PHA)



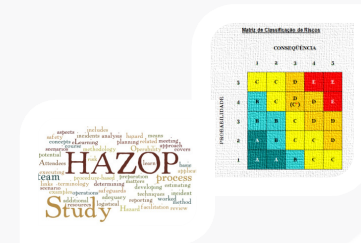
Identification of potential hazardous situations, understanding of the hazard scenario, and perform risk evaluation.

❑ Plant procedure

- Review of:
 - ✓ Design of existing facility, modifications, additions, new projects, incidents, etc
- Multidisciplinary team (Methodology + Process Expertise)
- Important aspects:
 - Each part of the process
 - Human factors, plant lay out, procedures, etc
 - ✓ Checklists
 - Layers of protection, Controls in place

PHA plant practices:

- Methodology depends on the process (Hazop, What If, PHA, etc)
 - ✓ QRA, Facility siting and consequence study are performed when required
- Recommendations: Risk Ranking (Matrix)
 - ✓ Recommendations to MI Program
- Revalidation schedule
- PHA study and action plan presented to plant managers
- Share information
- Track recommendations
- Plant next steps:
 - ✓ Working on method and frequency for revalidation based on the level of risk
 - ✓ LOPA





ELEMENT 5: MANAGEMENT OF CHANGE (MOC) & PSSR

Ensure changes to process are reviewed prior to implementation and do not inadvertently introduce new hazards or increase risk of existing hazards. Changes to a process must be thoroughly evaluated to fully assess their impact on employee safety and health and to determine needed changes to operating procedures.

☐ Plant Procedure:

- Define change
 - ✓ Categories: Administrative, Procedures and Process (Examples)
 - ✓ Except for “Replacements in kind”
 - ✓ Types of Changes: Permanent, Emergency or Temporary
 - ✓ Specific practices: Temporary repairs, temporary bypass, temporary impairments, etc
 - ✓ MOC owner

❑ MOC Plant Procedure:

- Technical basis are thoroughly reviewed
 - ✓ Face-to-face discussions
 - ✓ Hazard review
 - ✓ Team depends on the type of change
- Documenting and tracking all activities (electronic system)
- Level of notification and training is observed
- Pre-Start Up Safety Review (team)
- Level of Authorization depends on complexity of change



❑ Important points:

- *Identify changes (Training, procedure definition)*
- *Multidisciplinary analysis*
- Manage Temporary Changes



ELEMENT 6: OPERATIONAL TRAINING

Ensure that operators have proper training and qualification

☐ Plant Training program

- 4 levels of operator positions
- New operator will start in the first level
 - In each level the degree of complexity and responsibilities increases. The last level is the DCS operator
 - ✓ In each stage, training last 3 months at least
 - ✓ In each stage refresher training: every 3 years
 - ✓ Assessment consider technical and behavioral skills
- Includes all aspects of the operational procedures and safe work practices
- Provide employees with an understanding of hazards associated with their activities

ELEMENT 7: OPERATING PROCEDURES

Plant Procedures provides clear instructions to operate the plant.

☐ Items:

- Steps for each operating phase
- Safe limits
- Safety and health considerations
- Safe Work Practice
- *Lessons Learned*

☐ A electronic system is used to keep this information up-to-date.

☐ Reviewed and updated once a year, or as necessary.



ELEMENT 8: INCIDENT INVESTIGATION

PURPOSE:

- *Identify root causes and system failures*
- *Propose corrective action plan in order to prevent reoccurrence*
- *Learn from experience*



❑ Facility has a formal program for HES incidents investigation, which includes:

- Criteria for incidents investigation and Severity classification
- Investigation of near misses
- RCA Team: Process knowledge + Methodology
- Development of RCA mentality ⇒ Not Just For HES Incidents!
- Communicate of findings
- Automated System

ELEMENT 9: MECHANICAL INTEGRITY PROGRAM

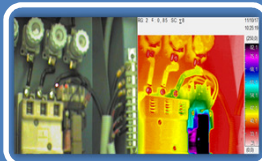
Ensure that process equipment are designed, constructed, installed and maintained properly.

Plant Practices:

- *Written procedures*
- *Training for maintenance activities*
- *Inspection, testing, and repair*
- *Equipment deficiencies management (SAP)*
- *Quality assurance (Ex: Technical specifications, PMI)*

- Training program for maintenance personnel includes:
 - ✓ Legal requirements
 - ✓ Technical specific practices (knowledge sharing sessions).
- Engineer team monitors deficiencies, evaluates performance, and proposes correction actions to MI program and practices.

Maintenance and Inspection Practices



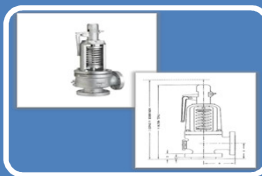
Electrical equipment and systems

- Depends on the system: Detailed Inspection, Visual Inspection, Oil Analysis, Electrical Tests, Thermography, Battery Tests



Rotating equipment

- ABC classification
- Vibration Analysis, Sensitive Maintenance, Oil Analysis.



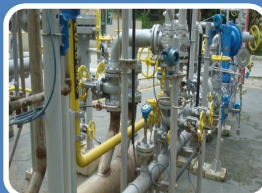
Relief devices and vent systems

- Routine maintenance and applicable function tests for Relief Devices in HHC service not to exceed 2 years, other Relief Devices follows National Regulation NR13.



Pressure vessels

- Technical references for pressure vessels MI monitoring: API 510, CI e NR13.



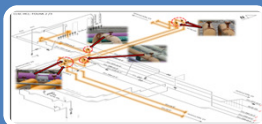
Emergency shutdown systems, control systems and alarms

- Frequency of tests and inspections follow recognized and generally accepted engineering practices and evaluation of risk associated to the loop (implementation in progress)



Storage tanks

- References: API 650/653



Piping systems and components

- References: API 570, Chlorine Institute and NR13



A yellow hard hat and a pair of brown leather work gloves.



- Contractor activity classification determines:
 - PPE, Required training, Requirements for occupational safety and health program
 - Training topics are stated by Unipar Carbocloro (regulation and specific hazards)
- General safety information
 - ✓ When starting to work
 - ✓ Refresher training: annually
- Monthly Safety Meetings and Safety Dialogs
- Evaluating and tracking contractor safety performance
- Audits

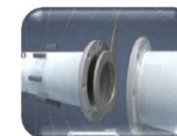
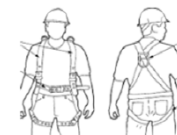
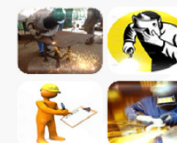
ELEMENT 11: SAFE WORK PRACTICES

Procedure for issuing written permission to perform safe work services.

☐ Plant Practices:

- Applied to employees and resident contractors
 - ✓ Refresher training every 3 years
- The permit shall be kept on file until work completion
 - ✓ Valid for one work day

Lock, Tag and Try Hot work Confined space entry Line breaking Fall protection	Key Procedures	Each activity has a specific procedure and form
Critical non-routine activities Non-critical non-routine activities		



ELEMENT 12: EMERGENCY PLANNING AND RESPONSE

The Emergency Response Plan details how the facility will respond to and mitigate emergency situations.

☐ **Facility has a written plan which:**

- Assigns responsibilities
- Details emergency steps
- Is based on State Fire Department regulations and on specific hazards
- Response team composed by employees
- Training and drills are based on selected accidental scenarios
- Selection of drills scenarios are based on a classification
- Plan is periodically evaluated and improved (yearly)





EMERGENCY PLANNING AND RESPONSE

Training and Drills

☐ Training

- Yearly training of employees and contractors
- Visitors receive safety and the emergency plan information
- Emergency Response Team: 3 levels of training based on role established on the ERP

☐ Emergency Response and Evacuation Drills

- 4 Emergency Response drills per year, one of them includes plant evacuation and one of them includes confined space rescue
- Community evacuation drill performed every five years
- Emergency exercises on a school nearby company (one per semester)
- The drills are evaluated and recommendations are tracked



ELEMENT 13: FIRE PROTECTION SYSTEMS

☐ **Plant Procedures and systems:**

- Fixed systems and mobile apparatus that is intended to either aid in the extinguishment and/or control of fires or explosions (Fire pumps, deluge systems, hydrants, underground distribution piping, etc)
- Fixed systems installed to notify personnel that a fire and/or gas release has occurred (Combustible gas detection systems and smoke detection systems)
- Defined frequency of Inspections, tests, and maintenance activities
- Formal documentation and approval for temporary impairment



ELEMENT 14: AUDIT

Verify if the obligations outlined in the PSM Program are being met.

☐ Facility PSM audit program:

- Cover the specific process safety aspects
- Includes contractor and maintenance activities
- Conducted every three years (all elements)
- Carried out by employee or external team
 - 9 employees certified by Abiquim (Responsible Care Program Audit)
- Non-compliance investigation
- Track action plan



ELEMENT 15: METRICS

Main objective:

- ***Monitor PSM effectiveness and suggest improvements.***

☐ Plant Procedure:

- Metrics considers:
 - ✓ MOC
 - ✓ Incident Investigations and recommendations
 - ✓ Last Line of Defense
 - ✓ Mechanical Integrity program (Inspection and maintenance)
- Report
 - Monthly metrics
 - Some items are discussed weekly





Final Comments

Continuous effort is essential to PSM program performance:

- ✓ **Commitment from all levels of management and staff**
- ✓ **Understanding of plant hazards.**
- ✓ **Analyze and manage risks**
- ✓ **Conduct periodic audits**
- ✓ **Management of “barriers” integrity**
- ✓ **Keep continuous improvement culture**

QUESTIONS?



THANK YOU!

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