

**CONTRA COSTA WATER DISTRICT**  
**PROCESS SAFETY MANAGEMENT**

Revised July 2005

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# 1.0 INTRODUCTION

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## 1.1 Policy Statement

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Contra Costa Water District (CCWD) will comply with all elements of the California Occupational Safety and Health Administration (Cal-OSHA) Process Safety Management (PSM) of Acutely Hazardous Materials (AHMs) standard. Responsibility for compliance resides with the line management.

## 1.2 Introduction

---

CCWD has developed a PSM program which is being implemented at facilities with AHMs (Regulated Substances) in quantities that exceed the regulatory threshold quantities. Currently, the only facility affected is the Randall-Bold water treatment plant. The primary objective of the program is to reduce risks by minimizing the potential for catastrophic releases of AHMs (Regulated Substances). The program is also intended to provide management with assurance that Randall-Bold is in compliance with PSM regulations promulgated by the State of California.

This PSM Manual has been compiled to define the standards and procedures to be used for implementing PSM. The manual is intended to serve as a reference resource for management, and as a "road map" to provide guidance for employees as they implement the program.

The manual includes an overview of PSM and its applicability, a list of definitions for terms used throughout the manual, and separate sections to address the specific requirements for each PSM element. The manual will be reviewed and revised, if needed, annually. It is the responsibility of the PSM Coordinator to ensure that an annual review of the manual is conducted, and that revisions are made and distributed.

The following sections of the overview discuss the regulatory requirements for PSM programs; a discussion of the applicability of the PSM regulations to water treatment facilities; an outline of the management system to be used for implementing the PSM program; PSM training requirements; and the establishment of a PSM Committee and PSM Coordinator.

## 1.3 Summary of Regulatory Requirements

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In 1992, the Federal OSHA promulgated a Process Safety Management standard in the Code of Federal Regulations, Title 29, Part 1910.119 (29 CFR 1910.119) with requirements for preventing or minimizing the consequences of catastrophic releases of toxic, reactive, flammable, or explosive chemicals. Subsequent to the promulgation of the federal OSHA PSM standard, in August 1992 Cal-OSHA promulgated a similar PSM standard for affected facilities in the California Code of Regulations, Title 8, General Industry Safety Order 5189 (8 CCR 5189). CCWD will follow the requirements of the State of California Process Safety Management for AHMs (Regulated Substances) . These standards include the following elements:

<b>Element</b>	<b>Federal OSHA</b>	<b>Cal-OSHA</b>
Scope and Purpose	29 CFR 1910.119	8 CCR 5189 (a)
Application	29 CFR 1910.119 (a)	8 CCR 5189 (b)
Definitions	29 CFR 1910.119 (b)	8 CCR 5189 (c)
Employee Participation (EP)	29 CFR 1910.119 (c)	8 CCR 5189 (p)
Process Safety Information (PSI)	29 CFR 1910.119 (d)	8 CCR 5189 (d)
Process Hazard Analysis (PHA)	29 CFR 1910.119 (e)	8 CCR 5189 (e)
Operating Procedures	29 CFR 1910.119 (f)	8 CCR 5189 (f)
Training	29 CFR 1910.119 (g)	8 CCR 5189 (g)
Contractors	29 CFR 1910.119 (h)	8 CCR 5189 (h)
Pre-startup Safety Review (PSSR)	29 CFR 1910.119 (i)	8 CCR 5189 (i)
Mechanical Integrity	29 CFR 1910.119 (j)	8 CCR 5189 (j)
Hot Work Permit (HWP)	29 CFR 1910.119 (k)	8 CCR 5189 (k)
Management of Change (MOC)	29 CFR 1910.119 (l)	8 CCR 5189 (l)
Incident Investigation	29 CFR 1910.119 (m)	8 CCR 5189 (m)
Emergency Planning and Response (EP&R)	29 CFR 1910.119 (n)	8 CCR 5189 (n)
Injury and Illness Prevention Program (IIPP)		8 CCR 5189 (o)
Compliance Audits	29 CFR 1910.119 (o)	8 CCR 5189 (o)
Trade Secrets	29 CFR 1910.119 (p)	8 CCR 5189 (p)

The federal and California PSM standards are generally consistent; however there are minor differences in some of the elements. The differences are discussed in the applicable sections for each element.

Other regulations that address Process Safety Management are the U.S. EPA Risk Management Plan (RMP) Rule, and the Cal EPA Accident Release Program (CalARP).

The CalARP is adopted from the federal RMP, with certain state-specific additions. The Cal/ARP consists of three major parts, each with progressively stricter compliance standards. The first part, Hazard Assessment, is performed to determine the effects that a potential release of a regulated substance could have on the public. The second part is

the Prevention Program that consists of 12 elements designed to improve the system safety and decrease the likelihood of a release. The Prevention Program elements are identical to these OSHA PSM elements, except they are focused on off-site receptors rather than employees who are covered by the OSHA Standards.

This manual includes the PSM requirements required by the Cal-OSHA PSM standard. Given that the PSM standard and the Cal/ARP program have much overlap, the PSM program is obviously interrelated with the Cal/ARP. The two programs are cross-referenced within this manual.

## 1.4 Applicability

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The applicability of the PSM standard is dependent on the chemicals and respective quantities stored at a facility. The Cal-OSHA Standards state that the standard applies if a process involves a chemical at or above the specified threshold quantities. Section 2 of this manual includes the Cal-OSHA definition for a “process.”

Chlorine is an AHM (Regulated Substance) used at Randall Bold, and subject to PSM. The PSM Threshold Quantities (TQs) is 1,500 pounds (lb) for Chlorine. The Chlorine TQ is exceeded at Randall Bold because of the use of Chlorine in one-ton containers.

The Hazardous Materials Business Plan Inventory is used as the primary method of identifying covered processes. At CCWD apart from chlorine, there are no other AHMs (Regulated Substances) with quantities that exceed the TQs, and no flammable materials in excess of 10,000 lb.

The PSM elements apply to the Chlorine process, the associated control systems, monitoring systems, and safety systems. Operational activities included are day-to-day operations, and unloading of one-ton containers on a monthly basis.

CCWD is committed to replacing the Chlorine with alternative chemicals that are not listed as AHMs (Regulated Substances). This is a policy decision that has been made to reduce the risk of catastrophic accidents that could have significant impact on employee safety and the offsite community. The alternative treatment systems are currently being considered.

## 1.5 Management System

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Since the OSHA PSM Standard is a performance-based standard, it is important for businesses and agencies to define their own standards for implementation. This provides flexibility to allow each facility to evaluate the PSM requirements against its own specific operations, and to apply good engineering practices accepted by the industry. To meet this intent, a management system has been developed that consists of performance standards and implementing procedures for each element of the PSM Standard. The management system established within this manual has been developed to ensure that the following seven aspects are addressed for the PSM program:

- Policies, programs and procedures
- Definition of responsibilities
- Approvals and authorizations

- Personnel training and experience
- Protective measures
- Documentation
- Internal verification

Each PSM element is defined in terms of a policy or procedures, its purpose, regulatory requirements, scope, schedule, documentation requirements, responsibilities, and procedures that provide a detailed description of how the element is to be implemented. This format is consistent with the broad framework used by CCWD to administer safety and health requirements in general (refer to the CCWD Safety and Health Manual).

## 1.6 Training

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Two training programs have been developed for PSM:

- Overview of OSHA PSM Standard for management and supervisors.
- PSM implementation training for affected employees.

## 1.7 PSM Committee and Coordinator

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### 1.7.1 PSM Committee

A PSM Committee has been established as a Sub-Committee to the District-Wide Safety Committee to develop PSM policy and to review all aspects of the PSM program as it is developed and implemented. The PSM Committee plays a vital role in solving implementation problems as they are encountered, and it serves as an oversight committee for PSM compliance.

The PSM Committee includes at least one representative from each of the following:

- Randall-Bold Plant/Water Treatment Operations
- Maintenance
- Water Treatment Process Engineering
- Safety

### 1.7.2 PSM Coordinator

A PSM Coordinator position has been established. The CCWD Safety Officer serves as the PSM Coordinator for the Randall-Bold plant. This is a key role in providing PSM leadership and monitoring PSM implementation.

A Local PSM Coordinator position has also been established for the Randall-Bold Plant. The Randall-Bold Water Treatment Supervisor serves as the Local PSM Coordinator. Roles and responsibilities for the PSM Coordinator are discussed under Employee Participation, Section 3.

## 2.0 DEFINITIONS AND ACRONYMS

---

This section includes definitions and acronyms from the Cal-OSHA PSM standard (marked as OSHA) and others used in this manual. They have been compiled in this section to provide one source for all acronyms and definitions.

### 2.1 Definitions

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An **accident** or incident is an unplanned event or series of events that have the potential for undesirable consequences. [AIChE Center for Chemical Process Safety]

**Advisory alarm** is intended as an aid to the operator in performing the job. Response to this alarm is not required to maintain plant safety or environmental integrity.

**Acutely Hazardous Material** (AHM) is a substance possessing toxic, reactive, flammable or explosive properties. This is a Cal-OSHA definition. The list of AHMs is identical to the federal list of Highly Hazardous Chemicals (HHCs). [8 CCR 5189 (c)]

**Atmospheric tank** means a storage tank which has been designed to operate at pressures from atmospheric through 0.5 psig (pounds per square inch gauge, 3.45 Kpa). [29 CFR 1910.119 (b)]

**Audit** is a comprehensive survey and test of the completeness and working of a management program (e.g. PSM audit).

**Boiling point** means the boiling point of a liquid at a pressure of 14.7 pounds per square inch absolute (psia) (760 mm). For the purposes of this manual, where an accurate boiling point is unavailable for the material in question, or for mixtures which do not have a constant boiling point, the 10 percent point of a distillation performed in accordance with the Standard Method of Test for Distillation of Petroleum Products, ASTM D-86-62, may be used as the boiling point of the liquid. [29 CFR 1910.119 (b)]

**Catastrophic release** means a major uncontrolled emission, fire, or explosion, involving one or more highly hazardous chemicals, that presents serious danger to employees in the workplace. [29 CFR 1910.119 (b)]

**Change** - See PSM-Covered Change

**Contract employee** is any person performing work at a facility or location that is under a contract basis and is not a direct employee.

**Contributing cause** is a cause that contributed to an incident, accident or near-miss. By itself, a contributing cause may not have caused the incident. A contributing event, if corrected, may prevent occurrence or recurrence.

**Covered process** - see Process.

**Critical alarm** is one which is needed to maintain plant safety, environmental integrity and/or operability of the plant. A critical alarm requires the operator to respond as determined by the PHA and the Operating Procedures for the process.

**Deficient equipment** is equipment that is no longer capable of meeting its original design limits.

**Explosive** is a substance identified in 49 CFR 172 by the Department of Transportation, effective on December 31, 1990. [8 CCR 5189 (c)]

**Facility** means the buildings, containers or equipment which contain a process. [8 CCR 5189 (c)]

**Flammable** liquids or gases as defined in Section 5194(c) onsite and in one location in quantities of 10,000 pounds or more. [8 CCR 5189 (c)]

**Highly Hazardous Chemical (HHC)** means a substance possessing toxic, reactive, flammable, or explosive properties as specified by OSHA Regulations. [29 CFR 1910.119 (b)]

**Hot work** means electric or gas welding, cutting, brazing, or any extreme heat, flame or spark-producing procedures or operations. [8 CCR 5189 (c)]

**Injury and Illness Prevention Program (IIPP)** is a formal program required by Cal-OSHA (8 CCR 3203) to protect safety and health of employees.

**Incident** - see accident.

**Major Accident** is any event involving fire, explosion, or release of a substance covered by this section which results in a fatality or a serious injury (as defined by Labor Code Section 6302) to persons in the workplace.

**Modified facility** - An existing facility that is modified to the extent that a change in process safety information is required.

**New facility** refers to a new system or facility that is designed to handle or process a HHC (AHM).

**Normally Unoccupied Remote Facility** means a facility which is operated, maintained or serviced by employees who visit the facility only periodically to check its operation and to perform necessary operating or maintenance tasks. No employees are permanently stationed at the facility. Facilities meeting this definition are not contiguous with, and must be geographically remote from, all other buildings, processes or persons. [8 CCR 5189 (c)]

**Out of Service Safety Equipment** is a safety device or safety feature that is inactive or inoperable.

**Process** means any activity conducted by an employer that involves an acutely hazardous material, flammable substance or explosive including any use, storage, manufacturing, handling, or the on-site movement of any of the preceding substances or combination of these activities. For purposes of this definition, any group of vessels which are interconnected and separate vessels which are located such that an acutely hazardous material could be involved in a potential release shall be considered a single process. [8 CCR 5189 (c)]

**Process Safety Management (PSM)** is the application of management programs, which are not limited to engineering guidelines, when dealing with the risks associated with handling or working near AHMs, flammables or explosives.

**PSM-covered change** is an addition, modification or deletion of PSM-covered equipment, operating procedures, processing conditions, raw materials, or chemicals. By definition it excludes preventive maintenance, inspection and testing, replacement-in-kind, and repair-in-kind.

Level-1 (Minor)

Level-2 (Comprehensive and/or Complex)

**PSM covered process** - see Process.

**Replacement in kind** means a replacement which satisfies the design specification. [8 CCR 5189 (c)]

**Root cause** is the most basic reason for an effect which, if corrected, will prevent occurrence or recurrence.

**Safety-critical equipment** is equipment that is determined to be critical to the safe operation of the covered process or is critical to the containment of the Acutely Hazardous Material (Regulated Substance). This equipment is included in the Mechanical Integrity program.

**Safety interlock** is a shutdown system that is independent of the normal process control system. The system monitors safety-related process parameters and initiates automatic action to preclude hazards if these parameters deviate from safe operating ranges.

**Tailgate session** is a periodic safety meeting of employees working with a covered process.

**Temporary PSM-covered change** is a non-permanent modification, addition, or deletion to PSM-covered equipment or to PSM-applicable management systems.

**Trade secret** means any confidential formula, pattern, process, device, information or compilation of information that is used in an employer's business, which gives the employer an opportunity to obtain an advantage over competitors who do not know or use it. Appendix D of 29 CFR 1910.1200 lists the criteria to be used in evaluating trade secrets. [29 CFR 1910.119 (b)]

## 2.2 Acronyms

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AIChE - American Institute of Chemical Engineers

AHM - Acutely Hazardous Material

Cal/ARP - California Accidental Release Program

Cal/OSHA - California Occupational Safety and Health Administration

CCR - Code of California Regulations

CCWD - Contra Costa Water District  
CFR - Code of Federal Regulations  
EAP - Emergency Action Plan  
EP - Employee Participation  
EP&R - Emergency Planning and Response  
EPA - Environmental Protection Agency  
ER Plan - Employee Participation Plan  
ERPG - Emergency Response Planning Guide  
ESD - Emergency Shut Down  
HAZOP - Hazard and Operability Study  
HAZWOPER - Hazardous Waste Operations Emergency Response  
HHC - Highly Hazardous Chemical  
HVAC - Heating, Ventilation and Air Conditioning  
ID - Identification  
IDLH - Immediately Dangerous to Life and Health  
IIPP - Illness and Injury Prevention Plan  
IT - Inspection and Testing  
Kpa - Kilo pascals  
MI - Mechanical Integrity  
MOC - Management of Change  
MP - Maintenance Procedure  
MSDS - Material Safety Data Sheets  
NaOH - caustic soda  
Na<sub>2</sub>CO<sub>3</sub> - soda ash  
O&M- Operation and Maintenance Manuals  
OP - Operating Procedure  
OS&H - Occupational Safety and Health  
OSCA - Offsite Consequence Analysis  
OSHA - Occupational Safety and Health Administration

OSSE - Out Of Service Safety Equipment  
PEL - Permissible Exposure Limit  
PFD - Process Flow Diagram  
PHA - Process Hazards Analysis  
PM - Preventive Maintenance  
PM/IT - Preventative Maintenance/Inspection and Testing  
psi - pounds per square inch  
psia - pounds per square inch absolute  
PSI - Process Safety Information  
PSM - Process Safety Management  
PSSR - Pre-Startup Safety Review  
RMP - US EPA Risk Management Plan  
SCBA - Self Contained Breathing Apparatus  
SOP - Standard Operating Procedure  
SWP - Safe Work Practice  
TLV-STEL - Threshold Limit Value - Short Term Exposure Level  
TLV-TWA - Threshold Limit Value - Time Weighted Average  
TQ - Threshold Quantity

## 3.0 EMPLOYEE PARTICIPATION PLAN

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### 3.1 Policy

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Employees will be involved in all safety and health related activities and programs involving PSM. Employee input will be sought and integrated into the PSM Program through an Employee Participation (EP) Plan.

### 3.2 Purpose

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The purpose of this section is to document an EP Plan that successfully integrates the specific knowledge of operating, maintenance, engineering and construction, and safety personnel into a comprehensive and effective PSM Program, and to foster employee “ownership” of the PSM Program.

### 3.3 Regulatory Requirements

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Cal-OSHA (8 CCR 5189 (p)):

*The employer shall develop a written plan of action to ensure employee participation in process safety management which includes:*

*(1) Employer consultation with employees and their representatives on the conduct and development of the elements of process safety management required by this section; and*

*(2) Providing employees and their representatives with access to all information required to be developed by this section without regard to possible trade secret status of such information.*

The Federal OSHA PSM standard differs from the Cal-OSHA PSM standard in that the requirements for Employee Participation and Trade Secrets are included in separate elements (29 CFR 1910.119 (c) and (p), respectively).

### 3.4 Scope

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The EP Plan applies to all employees who work near or whose work directly involves processes which use AHMs (Regulated Substances), including employees who might be affected by an incident or accident involving those processes. It applies to operators and maintenance employees. There are two important requirements to be fulfilled through the EP Plan:

(1) To consult employees on the development and implementation of procedures instituted for PHAs and the other elements of the PSM program.

(2) To provide employees with reasonable access to all information developed for the PSM program.

Table 3.1 lists the main activities for each PSM element together with the main areas of involvement for employees. The table shows where employees are expected to provide

input to the program, and also how they will be given access to information developed through the PSM Program.

### 3.5 Schedule

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The Employee Participation Plan will be updated as determined by the PSM Committee. The EP Plan will consist of regularly scheduled meetings involving employees and the ongoing involvement of employees in PSM-related issues. (See Section 3.8.1.)

### 3.6 Documentation Requirements

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The primary documentation requirement for this element is an Employee Participation Plan. To verify the effective implementation of the EP Plan, copies of the minutes from safety meetings and tailgate sessions will be maintained together with attendance lists.

### 3.7 Responsibilities

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The responsibilities for implementing the employee participation element of the PSM program are outlined below.

<i>Operations &amp; Maintenance</i>	
Water Treatment Superintendent, Maintenance Superintendent and Water Treatment Supervisor	<ul style="list-style-type: none"> <li>• Ensure that employees are consulted and the consultation is documented regarding the development and implementation of PSM compliance activities.</li> <li>• Provide copies of the EP Plan to all employees who work at or near a process which uses AHMs (Regulated Substances).</li> <li>• Provide employees access to PSM information (Section 3.8.2).</li> <li>• Inform employees of relevant safety and health issues resulting from incident investigation, process hazard analysis, and other facility hazard assessments.</li> </ul>
All employees who work on or with a PSM-covered process which uses AHMs (Regulated Substances)	<ul style="list-style-type: none"> <li>• Read and understand the PSM EP Plan through new employee and annual training.</li> <li>• Provide feedback to the PSM Committee on the PSM program.</li> </ul> <p style="margin-left: 20px;">Actively implement the Illness and Injury Prevention Program (IIPP).</p>
<i>PSM Committee and PSM Coordinators</i>	
PSM Committee	<ul style="list-style-type: none"> <li>• Ensure that the Employee Participation Plan is developed and updated as necessary.</li> </ul>

	<ul style="list-style-type: none"> <li>• Communicate employee feedback on PSM program.</li> </ul>
PSM Coordinator	<ul style="list-style-type: none"> <li>• Prepare and implement the Employee Participation Plan.</li> </ul>
Supervisor	<ul style="list-style-type: none"> <li>• Communicate PSM information to employees.</li> </ul>

### 3.8 Procedures

To fulfill the requirements of the OSHA PSM Standard, the Employee Participation Plan specifies the approach to be taken for consulting with employees on the development and conduct of PSM elements as well as on the means to provide employees access to PSM information.

#### 3.8.1 Employee Consultation And Involvement

Employees will be actively encouraged to participate in the PSM through the Employee Participation Plan. Employee participation in safety-related issues and PSM-related developments are discussed below.

***Illness and Injury Prevention Program.*** The Illness and Injury Prevention Program (IIPP) provides a formal system for employees to identify and correct job hazards, report and investigate accidents, receive training, establish methods of communication, clarify responsibilities, and provide a means of ensuring safety compliance.

***Safety Committees.*** Safety Committees have been established for the purpose of giving employees an opportunity to take part in the safety program.

***Tailgate Safety Meetings.*** Tailgate meetings are held routinely and provide an opportunity for exchanging PSM information.

***PSM Committee.*** The PSM Committee is responsible for reviewing all aspects of the PSM program and providing recommendation to improve the program.

***New Project User Groups.*** These groups are formed whenever capital projects are initiated. Employees from the affected process area are appointed to New Project User Groups.

***Incident Investigation.*** All incidents will be examined by an investigation group. Each incident investigation group must have employee representation from operations, maintenance and the contractor organization (if a contractor employee was involved). Further details are provided in the Incident Investigation element (Section 13).

***Emergency Drills.*** Emergency drills will be performed according to the requirements of the Emergency Planning and Response element of this PSM program (Section 14).

Employees will be trained through these drills and the results and evaluations of these drills will be discussed with employees.

**Safety Bulletins.** Safety bulletins will be issued in memo form and discussed at safety meetings. Issues will include PSM standards and procedures, and the progress made in each element. Notices as to training requirements and dates to be provided will also use this method. This ensures a consistent forum for distributing information on the PSM program to affected employees.

**Safety Policies And Standards.** Safety policies and standards (in addition to the PSM program) will be developed through the Safety and Health Manual. The standards include Safe Work Practices as required by PSM.

### 3.8.2 Employee Access To Information

Information related to the PSM program that will be made accessible to all affected employees will include the following:

- PSM Manual showing in detail each element of the PSM program
- PSI for each covered process at each affected facility (Section 4)
- Process Hazards Analysis reports and follow-up information (Section 5)
- Operating Procedures (Section 6)
- Training certifications and requirements (Section 7)
- Results from Pre-Startup Safety Reviews (Section 9)
- Policies and guidelines for Mechanical Integrity (Section 10)
- Management of Change (MOC) policy and guidelines (Section 12)
- Incident investigation procedures, policy and investigation results (Section 13)
- Emergency plans and procedures (Section 14)
- Emergency planning and response training guidelines and emergency drill reports (Section 14)
- Results of compliance audits (Section 15)

Methods used to communicate this information will include:

- Routine Safety Meetings
- Written Memos
- Posted Bulletins
- Operator Logs

TABLE 3.1

**PSM Activities and Employee Participation**

<b><i>PSM Element</i></b>	<b><i>Activity</i></b>	<b><i>Employee Involvement</i></b>
<b>Employee Participation</b>	Establish PSM Committee.	Include employees from Operations & Maintenance, and Safety.
	Maintain Employee Participation Plan.	Review by PSM Committee.
	Present overview of PSM regulations, PSM policy, and employee participation plan to employees.	Make presentations at safety meetings.
	Use work teams to address PSM policy issues and problems.	Include PSM Committee members and employees from affected organizations.
<b>Process Safety Information</b>	Develop interpretations and definitions of appropriate PSI.	Review by PSM Committee.
	Document equipment compliance.	Review by PSM Committee.
	Update and compile PSI.	Facility employees review validity of information.
<b>Process Hazards Analysis</b>	Develop PHA guidelines and PHA schedule.	Review by PSM Committee.
	Conduct initial PHA on all affected processes.	Involve facility employees in PHAs.
	Conduct follow-up PHA every 5 years.	PSM Committee to establish schedule. Facility employees to be involved in each PHA.
	Maintain records of PHA results and make available to employees	Employees access PHA results in their areas of work.

TABLE 3.1

**PSM Activities and Employee Participation**

<b><i>PSM Element</i></b>	<b><i>Activity</i></b>	<b><i>Employee Involvement</i></b>
<b>Operating Procedures</b>	Review existing operating procedures.	Plant operators validate OPs with Job Task Analysis; PSM Committee to review.
	Develop guidelines for routine review and update of OPs.	Employees identify OP deficiencies. Review by PSM Committee.
	Ensure OPs are developed for each operation of the PSM-covered process.	Employees identify missing OPs. Review by PSM Committee.
<b>Training</b>	Provide initial training to operators prior to the start of work in a newly assigned process.	Employees informed of requirement at safety meetings.
	Revise PSM process refresher training modules as needed.	Input obtained from employees; review by PSM Committee.
	Certify employee training on Standard Operating Procedures.	Review results with each employee.
	Conduct contractor training to meet PSM requirements.	Review of training modules by PSM Committee.
<b>Pre-Startup Safety Review</b>	Conduct PSSRs.	PSM Committee and other plant employees involved to ensure completeness of checklists, and verify that the review meets PSM requirements.
<b>Mechanical Integrity</b>	Identify PSM covered equipment.	Routine review by PSM Committee.
	Implement PSM equipment specific maintenance procedures.	Employees identify deficiencies in maintenance procedures; review by PSM Committee.
	Document maintenance employee training levels and certification.	Review results with each employee.

TABLE 3.1

**PSM Activities and Employee Participation**

<b><i>PSM Element</i></b>	<b><i>Activity</i></b>	<b><i>Employee Involvement</i></b>
	Implement policy and procedures for meeting PSM quality assurance requirements.	Employees identify non-standard equipment, chemicals and materials.
<b>Mechanical Integrity (cont)</b>	Implement policy and procedures for meeting PSM deficient equipment resolution program requirements.	Employees notified of all deficient equipment at tailgates and safety meetings.
	Maintain log of deficient equipment.	Employees notified of all deficient equipment at tailgates and safety meetings.
<b>Hot Work Permit</b>	Review hot work safety standard and determine need for modification.	Reviewed by PSM Committee.
<b>Management of Change</b>	Implement MOC policy and procedures.	PSM Committee reviews changes. All affected employees notified and trained; employees identify change during the course of their work and in New Project User Groups; employees notified of all relevant changes.
<b>Incident Investigation</b>	Implement incident investigation procedures and policy.	Employees involved in incident investigations; informed of all actions taken to prevent recurrence.
<b>Emergency Planning and Response</b>	Train employees on the ERP contents and activities.	Employees involved in emergency response.
	Conduct emergency drills to test and train employees on the ERP.	Employees provide feedback after drills.
<b>Injury / Illness Prevention Program Compliance Audits</b>	Conduct PSM compliance audits every three years. Conduct facility safety inspections annually.	Employees participate in audits and inspections. PSM Committee reviews results of audits and inspections.
<b>Trade Secrets</b>	Not Applicable	Not Applicable

## 4. PROCESS SAFETY INFORMATION

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### 4.1 Policy

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Written Process Safety Information (PSI) as required by the Cal-OSHA Process Safety Management Standard Cal-OSHA (8 CCR 5189): will be developed, maintained current, and readily available to employees who work at the facility.

### 4.2 Purpose

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The purpose of this standard is to enable the employer and employees involved in operating and maintaining the process to provide accurate and current information pertaining to the process chemicals, technology and equipment. PSI provides the necessary information required to conduct PHAs, and it provides information to affected employees.

### 4.3 Regulatory Requirements

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Cal-OSHA (8 CCR 5189 (d)):

*The employer shall develop and maintain a compilation of written safety information to enable the employer and the employees operating the process to identify and understand the hazards posed by processes involving acutely hazardous, flammable and explosive materials before conducting any process hazard analysis required by this regulation. The employer shall provide for employee participation in this process. Copies of this safety information shall be made accessible and communicated to employees involved in the processes, and include:*

*(1) Information pertaining to hazards of the acutely hazardous and flammable materials used in the process. This information shall consist of at least the following:*

- (A) Toxicity information;*
- (B) Permissible exposure limits as listed in Section 5155;*
- (C) Physical data;*
- (D) Corrosivity data;*
- (E) Thermal and chemical stability data;*
- (F) Reactivity data; and*
- (G) Hazardous effects of incompatible mixtures which could foreseeably occur.*

*NOTE: Material Safety Data Sheets meeting the requirements of Section 5194(g) may be used to comply with this requirement to the extent they meet the information provisions.*

*(2) Information pertaining to the technology of the process. Information concerning the technology of the process shall include at least the following:*

- (A) A block flow diagram or simplified process flow;*

- (B) *Process chemistry;*
- (C) *Maximum intended inventory;*
- (D) *Safe upper and lower limits for process variables such as temperatures, pressures, flows, levels and/or compositions; and,*
- (E) *The consequences of deviations, including those affecting the safety and health of employees.*

*NOTE: For processes for which data are unavailable, the information concerning the technology of the process may be developed from a process/hazard analysis conducted in accordance with subsection (e).*

(3) *Information pertaining to the equipment in the process.*

(A) *Information pertaining to the equipment in the process shall include at least the following:*

1. *Materials of construction;*
2. *Piping and instrument diagrams (P&IDs);*
3. *Electrical classification;*
4. *Relief system design and design basis;*
5. *Ventilation system design;*
6. *Design codes employed including design conditions and operating limits;*
7. *Material and energy balances for processes built after September 1, 1992;*
8. *Safety systems (such as interlocks, detection or suppression systems, etc.); and,*
9. *Electrical supply and distribution systems.*

(B) *The employer shall document that the equipment complies with the criteria established in subsection (d)(3)(A) in accordance with recognized and generally accepted good engineering practices.*

(C) *For existing equipment designed and constructed in accordance with codes, standards, or practices that are no longer in general use, the employer shall determine and document that the equipment is designed, maintained, inspected, tested, and operating in a safe manner.*

(4) *A copy of the process safety information and communication shall be accessible to all employees who perform any duties in or near the process.*

The federal OSHA PSM standard differs from the Cal-OSHA PSM standard in the following ways:

- The employer need not provide for employee participation in the compilation process.

- Permissible Exposure Limits (PELs) are not referenced.
- The phrase “inadvertent mixing” is used in place of “incompatible mixtures.”
- Under PSI Technology, “level” is not included as a parameter requiring safe upper and lower limits.
- Under PSI Process, the federal OSHA standard includes “design codes and standards employed” whereas the Cal-OSHA standard includes “design codes employed including design conditions and operating limits.”
- The requirement for material and energy balances is for processes built after May 26, 1992.
- PSI is not required for electrical supply and distribution systems.
- PSI and communications are not required to be accessible to employees who perform duties in or near the process.

#### 4.4 Scope

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The PSI shall be developed as follows: (1) chemical data for chlorine, the AHM (Regulated Substance) of concern; (2) the technology of the process; and (3) information pertaining to the equipment of the process. The equipment of the process is defined as the equipment that is directly covered by the PSM regulations and the equipment that indirectly could produce a hazardous situation in the affected process.

#### 4.5 Schedule

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PSI information should be reviewed annually to ensure that it accurately defines the current operation, following any Pre-Startup Safety Review (Section 9) or Management Of Change (MOC) action (Section 12), and prior to conducting any PHA. The last date reviewed should be noted with the PSI.

#### 4.6 Documentation Requirements

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The PSM standard requires that employers compile, retain, maintain and make available to employees information pertaining to the chemicals, processes, and equipment involved in PSM affected facilities. This process safety information should be compiled prior to conducting a PHA on the process. The PSI for the Randall-Bold Plant is in Table 4.1, along with the location where the source information is maintained. The MOC procedure is used to identify when PSI documentation needs to be revised or updated.

##### 4.6.1 Chemical Data

Most of the required data on chemicals are included in the Material Safety Data Sheets (MSDS). The MSDS sheets are required to be located at the facility. Additional information on chlorine and its hazards is included in the RMP and the Chlorine Institute Chlorine Manual.

Process Technology

*Process Flow Diagrams* (PFDs) have been prepared for each plant, and they are included in the RMP documents.

*Maximum intended inventory* for each AHM (Regulated Substance) is included in the Hazardous Materials Business Plan Inventory.

*Process chemistry information* includes information on the chemical reactions and/or mixing that occurs as a part of the process. Since there are no chemical reactions involving chlorine prior to injection, there is no need to develop process chemical information.

*Safe upper and lower limits* are considered to be the limits defined by the engineering standards utilized in the design. As such they are different from Safe Operating Limits. They are identified in design documents.

An *evaluation of the consequences of deviating from safe limits* was addressed in the PHA and the Offsite Consequence Analysis conducted for the Bollman Plant in the RMP.

#### 4.6.2 Process Equipment

*Materials of construction* are specified in the design documents.

*P&IDs* were developed as part of the RMP preparation.

*Electrical classification, electrical distribution, relief system design, ventilation system design, material/energy balances.* This information is available for each plant as part of the facility design report and operating & maintenance manuals.

*Safety systems.* Safety systems include chlorine detectors and alarms. Information on these is documented in the RMP documents.

*Equipment designed and constructed in accordance with codes/standards/practices no longer in use* is addressed through an engineering review.

#### 4.6.3 Location

Much of the PSI information resides outside of the plant; however, the information is available and can be accessed by personnel and employees at the plant. Table 4.1 shows the locations where original, source documents are maintained for the Randall-Bold Plant. This table provides a “roadmap” for employees to access PSI, as required.

### 4.7 Responsibilities

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The responsibilities for implementing the process safety information element of the PSM program are outlined below.

#### 4.7.1 Procedures

Table 4.1 provides the current status of the Randall-Bold PSI. The following procedures will be followed to ensure that the information is kept current and maintained in an accessible format for employee access.

ENGINEERING DEPARTMENTMANA GER	<ul style="list-style-type: none"> <li>• Document maximum intended inventory for chlorine systems.</li> <li>• Define safe upper and lower limits for chlorine systems.</li> <li>• Maintain as-built Piping and Instrumentation Diagrams (P&amp;IDs).</li> <li>• Keep current information on materials of construction, electrical classifications and electrical distribution systems for chlorine systems.</li> <li>• Maintain detailed information that describes the design basis for the relief systems, ventilation system, and safety systems.</li> <li>• Document the design codes and standards used for the construction and installation of the chlorine systems.</li> <li>• Ensure that equipment used in the chlorine systems complies with recognized and generally accepted good engineering practices.</li> <li>• Verify that any existing equipment designed and constructed in accordance with obsolete codes, standards and practices is designed, maintained, tested and operated in a safe manner.</li> </ul>
WATER TREATMENT SUPERVISOR	<ul style="list-style-type: none"> <li>• Maintain accurate block flow diagrams for the chlorine systems with the Operating Procedures (OPs).</li> <li>• Define safe upper and lower operating limits with the OPs.</li> <li>• Evaluate the consequences of operating outside the safe operating limits.</li> <li>• Maintain current MSDS for chlorine.</li> <li>• Ensure that the information on the MSDS includes all chemical data required by PSM.</li> </ul>
PSM COORDINATOR/COM MITTEE	<ul style="list-style-type: none"> <li>• Review PSI to verify that PSM objectives are being met.</li> </ul>

#### 4.7.1.1 *Modifications to Process Chemistry*

Any modifications to process chemistry will require an MOC review. The procedures outlined in Section 12 will be used to ensure that PSI is revised to reflect changes in process chemistry.

#### *4.7.1.2 Modifications to Process Technology*

Any modifications to process technology will require engineering review. This will also require an MOC review, and possibly PSSR. These reviews will ensure that PSI is updated as appropriate.

#### *4.7.1.3 Modifications to Process Equipment*

Modifications to process equipment may occur through engineering projects and/or minor modifications made by operators or maintenance personnel. For any equipment changes the PSI listed in Table 4.1 will be revised using the MOC review procedure. Equipment which meets the “replacement-in-kind” definition will not be subject to MOC review.

Table 4.1

## PSI Road Map For Randall-Bold Plant

PSI Item	Source Document	Location
<b>Chemical Data:</b> Toxicity information Permissible exposure limits Chemical physical data Chemical reactivity data Chemical corrosivity data Thermal and chemical stability data Hazardous effects of mixing chemicals	Reference 1 (chlorine)	Operations Building
<b>Process Technology:</b>		
Process block flow diagram	Reference 6, DWG-6-5 Reference 4, Figure 1-3 Reference 8	Operations Building
Maximum intended inventory	Reference 2 (8 tons maximum)	Operations Building
Process chemistry	N/A	
Safe upper and lower limits	Reference 5, Section 23, Reference 7	Operations Building
Evaluation of consequences of deviations	Reference 4, HAZOP and Offsite Consequence Analysis	Operations Building
<b>Process Equipment</b>		
Materials of construction	Reference 5, Sections 23 and 28 Reference 7	
Piping and Instrument Diagrams	Reference 6, Chlorination Figures 2-3 References 7, 8	
Electrical classifications	Reference 5, Spec. 15,000 Reference 7	Engineering Department -microfiche
Electrical distribution	References 5, 7	Operations Building
Relief system design and design basis	N/A	
Ventilation system design	Reference 5, Exhaust Fans	Operations Building
Material and energy balances	N/A	
Safety systems	References 5, 7, 8 Reference 6, XIV Plant Reliability	Engineering Department Operations Building
Design codes and standards	Reference 5, Section 2.06 Reference 7	Engineering Department - microfiche

## References:

- Reference 1 Material Safety Data Sheets, Randall-Bold Plant
- Reference 2 Hazardous Materials Business Plan, Current Calendar Year (note: This plan renewed annually)
- Reference 3 Operations and Maintenance Manual, 1992
- Reference 4 CalARP RMP June 2000 (note: RMP to be updated in 2004)
- Reference 5 Specifications for Construction of Randall-Bold Water Treatment Plant, James M. Montgomery 1992, CCWD Engineering Department Reproduction Room
- Reference 6 Operations Plan, Randall-Bold Water Treatment Plant, March 1992  
Reference 7 Specifications for Construction of Randall-Bold MultiPurpose Pipeline Booster Chloramination System, MWH, 2003
- Reference 8 Randall-Bold MultiPurpose Pipeline Booster Chloramination System Operations and Maintenance Manual, MWH, 2003

## 5. PROCESS HAZARD ANALYSIS

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### 5.1 Policy

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A Process Hazards Analysis (PHA) will be conducted on each covered process and the critical systems or equipment which contain or could affect the containment of AHMs (Regulated Substances).

### 5.2 Purpose

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The purpose of the Process Hazard Analysis element is to define steps for conducting a hazards analysis, and to establish criteria for prioritizing and scheduling the performance of Process Hazard Analyses on critical facilities identified as subject to OSHA Process Safety Management regulations.

### 5.3 Regulatory Requirements

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Cal-OSHA (8 CCR 5189 (e)):

*(1) The employer shall perform a hazard analysis appropriate to the complexity of the process for identifying, evaluating, and controlling hazards involved in the process and shall determine and document the priority order for conducting process hazard analyses based on the extent of process hazards, number of potentially affected employees, age of the process and process operating history, using at least one of the following methodologies:*

- (A) What-If;*
- (B) Checklist;*
- (C) What-If/Checklist;*
- (D) Hazard and Operability Study (HAZOP);*
- (E) Failure Mode and Effects Analysis (FMEA); or*
- (F) Fault Tree Analysis.*

*NOTE: The employer may utilize other hazard analysis methods recognized by engineering organizations or governmental agencies. In the absence of (A) - (F) or other recognized hazard analysis methods, the employer may utilize a hazard analysis method developed and certified by a registered professional engineer for use by the process hazards analysis team.*

*(2) The process hazard analysis shall address:*

- (A) The hazards of the process;*
- (B) Engineering and administrative controls applicable to the hazards and their interrelationships;*
- (C) Consequences of failure of these controls;*

- (D) *Facility siting;*
- (E) *Human factors;*
- (F) *A qualitative evaluation of a range of the possible safety and health effects of failure of controls on facility employees; and,*
- (G) *The identification of any previous incident which had a likely potential for catastrophic consequences in the workplace.*
- (3) (A) *The process hazard analysis shall be performed by a team with expertise in engineering and process operations, and the team shall include at least one operating employee who has experience and knowledge specific to the process being evaluated. The team shall also include one member knowledgeable in the specific process hazard analysis methodology being used. The final report containing the results of the hazard analysis for each process shall be available in the respective work area for review by any person working in that area.*
- (B) *The employer shall consult with affected employees and where appropriate their recognized representatives on the development and conduct of hazard assessments performed after the effective date of this section. Affected employees and where applicable their representatives shall be provided access to the records required by this section.*
- (4) *The employer shall establish a system to promptly address the team's findings and recommendations; document any actions taken to implement the team's recommendations; develop a written schedule of when these actions are to be completed; assure that the recommendations are resolved in a timely manner; make them available to operating, maintenance and any other persons whose work assignments are in the facility, and who are affected by the recommendations or actions; and assure that the recommendations are evaluated in a timely manner or implement at alternative resolution which appropriately addresses the degree of hazard posed by the scenario.*
- (5) *At least every five (5) years, the process hazard analysis shall be updated and revalidated, by a team meeting the requirements in subsection (e)(3), to assure that the process hazard analysis is consistent with the current process.*
- (6) *Employers shall retain process hazard analyses and/or updates or revalidations for each process covered by this section, as well as the documented actions described in subsection (e)(4).*
- (7) *Upon request of any worker or any labor union representative or any worker in the area, the employer shall provide or make available a copy of the employer's RMP.*
- (8) *The employer shall conduct the process hazard analysis as soon as possible but not later than the dates shown in subsection (b)(3).*

The federal OSHA PSM standard differs from the Cal-OSHA PSM standard in the following ways:

- The final report containing PHA results need not be available in the respective work area for review by any person working in that area.

- The employer is not required to assure that PHA recommendations are evaluated in a timely manner or implement an alternative resolution which addresses the degree of hazard posed by the scenario.

#### 5.4 Scope

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This PHA element applies to all processes covered by the PSM Standard.

#### 5.5 Schedule

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Initial PHAs were conducted on all covered processes during May 1992 . The most recent PHA was conducted June 2004. A PHA team will be reassembled and the PHA will be updated every 5 years to ensure that the PHA is consistent with the current process. However, any change to a covered process that requires a change to the PSI will require a PHA to assess the hazards.

#### 5.6 Documentation

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For each PHA conducted on a covered process, a record will be established containing the following details:

1. The formal record of the PHA sessions.
2. Drawings which record the nodes considered in the PHA session.
3. Background drawings or other information used in PHA.
4. Summary write-ups describing the facility's process flow.
5. Follow up actions and resolutions of action items determined by the PHA.
6. All PHA reports and the current status of the recommendations shall be made available for access by employees in the process work areas.

## 5.7 Responsibilities

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The responsibilities for implementing the process hazard analysis element of the PSM program are outlined below.

<b>WATER TREATMENT SUPERINTENDENT</b>	<ul style="list-style-type: none"><li>• Provide required resources and ensure that PHA objectives are being met.</li><li>• Assign the appropriate personnel to be team members of the PHA.</li></ul>
<b>MAINTENANCE SUPERINTENDENT</b>	<ul style="list-style-type: none"><li>• Provide required Maintenance personnel to be team members of the PHA.</li></ul>
<b>PSM COORDINATOR</b> (Safety Officer)	<ul style="list-style-type: none"><li>• Coordinate the PHA process including the development of PHA schedules.</li><li>• Provide a facilitator for the PHAs as needed.</li><li>• Provide support as needed to ensure that the PHA meets the PSM requirements.</li></ul>

## 5.8 Procedures

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The performance of process hazards analysis is a very important aspect of a process safety management program. A PHA identifies hazards that may be associated with a process, and it develops recommendations to ensure the risks associated with these hazards are reduced to an acceptable level. The PHA procedure to be followed is detailed below. Following this procedure will ensure that all facilities affected by the PSM requirements are evaluated efficiently and thoroughly.

PHAs have been performed for all plants covered by the PSM Standard as part of the RMP preparation. The HAZOP method used to perform the PHAs meets the requirements of both RMP requirements and the OSHA PSM Standard. The RMP included a schedule and responsibilities for implementing the recommendations that were generated during the PHA.

### 5.8.1 Process Hazards Analysis Criteria

The following criteria were used to conduct the initial PHAs. For any PHA that may be required in the future, these same criteria will be used.

1. Develop complete PSI
2. Establish appropriate PHA team
3. Select appropriate PHA method
4. Review previous accidents/incidents

5. Review engineering and administrative controls
6. Determine consequences of failures
7. Review facility siting, human factors and potential for external events
8. Evaluate employee impacts (qualitative)
9. Develop recommendations and system for follow-up

These PHA criteria are described in detail below.

#### **5.8.1.1 Process Safety Information**

Process safety information will be developed and made available to the PHA team for the duration of the PHA. The PSI must be developed to meet the requirements of the PSM Standard. Any missing PSI items will be compiled prior to conducting the PHA.

The PSI should also be confirmed as being accurate before the start of the PHA. This involves inspecting the system and identifying any deficiencies or inaccuracies in the P&ID (and other PSI). All team members should then be made aware of these changes as part of the PHA meeting.

#### **5.8.1.2 PHA Team**

A PHA team must be compiled that includes at least the following team members attending the PHA on a full time basis.

- A person familiar with the day-to-day operations of the process.
- One or more persons familiar with the hands-on maintenance activities of all aspects of the process (i.e., mechanical, electrical, instrumentation, etc.).
- A person familiar with the design and design intention of the process.
- A health and safety representative (can be part time).
- A person trained in leading the PHA meeting.
- A documentation secretary, if desired.

All team members should become familiar with the PSI process before beginning the meeting. The team should also be trained in the PHA method to be utilized at the beginning of the PHA meeting.

#### **5.8.1.3 Appropriate PHA Method**

The PHA method will be chosen before the beginning of the PHA. For all new facilities, the HAZOP method will be used. For PHAs required for minor actions under Management Of Change (MOC), alternative methods may be used (See Section 12).

With the HAZOP method, the following design parameters, at a minimum will be examined:

- Flow
- Pressure
- Temperature
- Mixing (if applicable)
- Level
- Reaction
- Time and sequencing
- Utility Failure

Each design parameter should be varied using the following deviation parameters, as applicable:

- More
- Less
- None
- Reverse
- Part of
- As well as
- Other than

This approach will create a matrix of the parameters and the deviations. This method will allow for a thorough analysis of potential design deviations.

The general philosophy used in the HAZOP is that a “scenario” is considered to be acceptable if it can occur as a result of two (or less) independent events. Those events can occur from any combination of human error or equipment failure. A valid HAZOP scenario could be any of the following:

- Two simultaneous independent equipment failures.
- Two simultaneous independent human errors.
- An equipment failure independently coupled with a human error.

#### **5.8.1.4 Previous Accidents/Incidents**

All previous incidents and accidents over a five year period should be compiled and included for study by the PHA team. This includes all employee injury and illness reports as well as all accident and incident investigations carried out as part of the PSM program. The team should also discuss during the PHA any incidents that were not recorded but that may be considered a concern.

#### **5.8.1.5 Engineering And Administrative Controls**

Engineering and administrative controls include operating procedures, training of personnel, maintenance procedures, tagging and labeling lines and equipment, etc. Operating and maintenance “setup” procedures that are considered “critical” should be identified prior to the start of the PHA and examined as individual “nodes” during the

PHA review. For example, nodes could include chlorine cylinder changeouts, line breaking, or any procedure that currently requires the wearing of respiratory protection.

The review should ensure that the following criteria are met:

- The procedure exists, and is written in a clear and concise manner.
- The written procedure is what is actually performed.
- What is actually performed is in accordance with all safety procedures and standards for human factors.

Maintenance setup procedures are considered to be those maintenance activities that occur immediately prior to the actual maintenance on a part or assembly. This would include the shutting down of the equipment, lockout/tagout procedures, line breaking procedures and requirements and subsequent re-start procedures.

#### 5.8.1.6 Consequences Of Failures And Qualitative Evaluation Of Employee Impacts

All scenarios that produce a hazardous material release must be ranked by risk. Risk-ranking will help to determine the consequences of the failure in terms of impacts on employees, potential offsite impacts and the frequency of the failure scenario. Designations as shown in the table below, will be used to rank each scenario. This risk ranking should be done as a qualitative exercise by the PHA team. Any scenario that receives a risk ranking of a level A or B must receive a recommendation to mitigate the risk.

<b>Risk Rank</b>	<b>Criteria</b>
<b>A</b>	<b>Very Serious Concern:</b> Potential for catastrophic consequences (fatality, etc.). Need to address situation immediately. Emergency work order.
<b>B</b>	<b>Serious Concern:</b> Potential for severe consequences (serious injury, etc.). Need to address the situation soon. Work order done within 48 hours.
<b>C</b>	<b>Concern:</b> Potential for moderate consequences (lost time accident, etc.). Need to address situation within 48 hours.
<b>D</b>	<b>Minor Concern:</b> Potential for minor consequences (first aid, etc.). Eventually address situation within 5 working days.

#### 5.8.1.7 Facility Siting, Human Factors, External Events and Other Checklists

Checklists to evaluate facility siting and human factors issues are shown in Tables 5.1 and 5.2. Exhibits 7.4 d-h of Appendix H of the CCC CalARP Program Guidance document lists potential hazards, process controls, mitigation systems, monitoring/detection systems, and types of process changes that could occur. These checklists should be used during the PHA to guide the brainstorming session toward

developing additional scenarios or operability issues of concern. Each item on the checklist should be reviewed by the team, and any issues raised should be recorded in the meeting notes. To meet the CalARP requirements, external events should also be examined (Table 5.3).

#### **5.8.1.8 Recommendations And Action Item Follow-up**

The goal of the PHA session is to identify hazards and to develop recommendations that mitigate the risk of these hazards to an acceptable level. Therefore, it is important that recommendations produce action items which are completed. One method is to create a list assigning responsibility for acting on each recommendation, a schedule for completion, and a status summary. This list will help to ensure that all recommendations and action items are completed. Additionally, any and all recommendations arising out of or directly from a PHA will be thoroughly reviewed. The review will address the seriousness of the PHA findings. Comensurate with the review findings a resolution timeframe will be established.

#### **5.8.2 Checklist**

A PHA checklist should be used to ensure all issues and information have been developed, including those developed before and during the PHA. This checklist is shown in Table 5.4.

#### **5.8.3 Documentation**

All PHA resolutions will be documented, attached to the PHA and saved indefinitely. A copy of each PHA will be kept at the location upon which the PHA was performed for the life of the process.

##### **5.8.3.1 PHA Record**

The PHA meeting must be fully documented and a written report prepared for each PHA study. A HAZOP worksheet should be used to show PHA notes generated. For each “node” of the system, the worksheet shows that each design parameter and deviation was covered. This requires the notation of each criteria discussed. For example, the documentation could indicate “no hazards identified.” An example of appropriate HAZOP worksheets is shown in Table 5.5. Also, the written report will include completed checklists and references to all source material used.

The list that includes recommendations for action items, responsibilities, schedule for implementation, and status must be kept at the process site for the life of the process.

#### **5.8.4 Status Of PHAs**

Copies of drawings and other materials used in the PHA will be either included in the report or referenced explicitly. A sample table of contents for the PHA report is shown in Table 5.6.

#### *5.8.4.1 Recommendation Tracking System*

The recommendations and action items generated by the PHA will be tracked separately from the PHA report. A sample recommendation tracking system is shown in Table 5.7.

#### *5.8.4.2 Access to PHA Documentation*

The PHA report will be made available for access by employees and contract workers who work in or near the process analyzed. All PHAs are accessible to employees in the process area control rooms.

Table 5.1

Facility Siting Checklist

---

- Protection of small bore line and fittings from external impact.
- General condition of equipment and housekeeping.
- Location and identification of critical safety systems and equipment (e.g., area fire water monitors, emergency shutdown, fire protection equipment, safety showers, breathing apparatus, gas detectors, and alarms).
- Site security systems
- Electrical classification or the location of flammable to ignition sources.
- Proper buffer zones in case of fire or explosion (e.g., distances to control room or other inhabited areas).
- Wind direction in case of toxic releases, wind socks visible, etc.
- Vent, drain, or relief valve discharge location.
- Secondary containment, diking or drainage in case of liquid (toxic or flammable) release.
- Review emergency or evacuation assembly points of impact from potential incident.
- Location and accessibility of valves or controls for isolating large inventories of hazardous materials.

Table 5.2

Human Factors Checklist

---

1. **Operator/Process Interface Issues**
  - Existing/proposed control and display layout
  - Process information clear, concise and accessible
  - Accessibility of controls and control valves
  - Security of instrumentation/control set-points
2. **Procedures**
  - Consistent, clear and comprehensible procedures
  - Periodic review and updating of procedures
  - Operator involvement in procedure development/review
3. **Work Place And Working Environment Issues**
  - Posture, movement, spacing and accessibility issues (i.e., valves, equipment, escape devices, use of emergency equipment, etc.)
  - Environmental conditions (i.e., noise, temperature, illumination, etc.)
  - Communications methods (radio, intercom, etc.)
4. **Training And Education**
  - Process related training and job requirements
  - Training modules and methods, frequency
  - Hands on exercises or simulations
  - Training or support for substance abuse or mental health problems
  - Supervisor training for substance abuse or stress
5. **Organization And Policy Issues**
  - Human factors engineering policies (established, communicated, etc.)
  - Communications and follow-up mechanism
  - Policies/procedure to review new design/modifications regarding human factors
6. **Task Design And Job Organization**
  - Defined individual operators responsibilities, job descriptions, etc.
  - Psychological and physical demands during normal and emergency operations, overtime, etc.

Table 5.3

External Events Checklist

---

- |  |  |
|--|--|
| <input type="checkbox"/> Aircraft Impact                       | <input type="checkbox"/> Low Lake or River Level                 |
| <input type="checkbox"/> Avalanche                             | <input type="checkbox"/> Low Winter Temperature                  |
| <input type="checkbox"/> Coastal Erosion                       | <input type="checkbox"/> Maintenance Activity                    |
| <input type="checkbox"/> Construction                          | <input type="checkbox"/> Nearby Pipeline Accident                |
| <input type="checkbox"/> Drought                               | <input type="checkbox"/> Release of Chemical From Onsite Storage |
| <input type="checkbox"/> External Flooding                     | <input type="checkbox"/> Release of Chemicals                    |
| <input type="checkbox"/> Extreme Winds                         | <input type="checkbox"/> River Diversion                         |
| <input type="checkbox"/> Fire                                  | <input type="checkbox"/> Sabotage/Vandalism                      |
| <input type="checkbox"/> Fog                                   | <input type="checkbox"/> Sandstorm                               |
| <input type="checkbox"/> Forest Fire                           | <input type="checkbox"/> Seismic Activity                        |
| <input type="checkbox"/> Frost                                 | <input type="checkbox"/> Shipwreck                               |
| <input type="checkbox"/> Hail                                  | <input type="checkbox"/> Snow                                    |
| <input type="checkbox"/> High Summer Temperatures              | <input type="checkbox"/> Soil Shrinkage/Consolidation            |
| <input type="checkbox"/> High Tide/Lake Level/River Level      | <input type="checkbox"/> Storm Surge                             |
| <input type="checkbox"/> Hurricane                             | <input type="checkbox"/> Toxic Gases                             |
| <input type="checkbox"/> Ice Cover                             | <input type="checkbox"/> Transportation Accidents                |
| <input type="checkbox"/> Industrial/Military Facility Accident | <input type="checkbox"/> Tsunami                                 |
| <input type="checkbox"/> Intense Precipitation                 | <input type="checkbox"/> Turbine Generated Missiles              |
| <input type="checkbox"/> Internal Flooding                     | <input type="checkbox"/> Volcanic Activity                       |
| <input type="checkbox"/> Landslide                             | <input type="checkbox"/> Waves                                   |

Table 5.4

PHA Checklist

---

Facility: \_\_\_\_\_

Start Date: \_\_\_\_\_

- Specific Technique used (Circle): Hazop, What-If, What-If/Checklist, Reliability Centered Maintenance
- Confidentiality agreement for contract workers, if applicable
- Scope of study determined by Leader and Design Engineer. Designate specific equipment pieces to outline scope
- Compile PSI information as per the PHA criteria listing
- Ensure as-built consistency of P&IDs by walking through facility
- Compile list of previous incidents over 3 years from accident/incident investigation
- Identify applicable operations and maintenance programs and procedures
- PHA minimum team consisting of:
  - PHA Leader and Scribe
  - Process Design Expert
  - Operations
  - Maintenance
  - Health, Safety and Environmental
- Study Meeting:
  - Conduct training
  - Hazards identification
  - Operating procedures review
  - Maintenance programs and procedures review.
  - Facility siting and human factors issues using checklists
  - Past accident/incidents review
- Assign responsibilities and schedule for each recommendations developed
- Develop report as per RMP format

Table 5.5

Example HAZOP Worksheet

DATE:									
LOCATION:									
PROCESS:									
NODE:									
ID	GUIDEWORD		CAUSE	CONSEQUENCE	CONSEQUENCE RISK <sup>1</sup>			EXISTING ACCIDENTAL RELEASE SAFEGUARD S	RECOMMENDED RISK REDUCTION MEASURES
	PROCESS PARAMETER	DEVIATIO N			S	P	R		
1									
2									
3									
4									
5									

Footnote: 1 – S = Severity, P = Probability, R = Risk Code

Table 5.6

PHA Report Sample Table Of Contents

---

- 1.0 Management Summary
- 2.0 Study Objectives
- 3.0 Team Members
- 4.0 Schedule And Location
- 5.0 Process Description
  - 5.1 Chlorine Process Description
  - 5.2 Ammonia Process Description
- 6.0 Scope Of Study
- 7.0 Results of HAZOP Study
  - 7.1 Human Factors, Facility Siting
  - 7.2 Accident Incident Review
  - 7.3 External Events
- 8.0 HAZOP Sheets

List Of Tables

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- 7.1 Listing Of HAZOP Recommendations - Chlorine System
- 7.2 Listing Of HAZOP Recommendations - Ammonia System
- 7.3 Human Factors Checklist
- 7.4 Facility Siting Checklist
- 7.5 Identification of Credible External Events

List Of Figures

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- 6-1 HAZOP Matrix
- 6-2 Chlorine Vacuum System Piping & Instrumentation Diagram
- 6-3 Chlorine Liquid/Pressure System Piping & Instrumentation Diagram
- 6-4 Ammonia System Piping & Instrumentation Diagram

Table 5.7

Tracking System For PHA Recommendations

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<b>Type of Review:</b>			<b>Date:</b>	
<b>Project:</b>			<b>Date of Review:</b>	
<b>Tracked by:</b>		<b>Review Team Leader/Members:</b>		
<b>Finding</b>	<b>Recommendation</b>	<b>Action Item</b>	<b>Responsibility</b>	<b>Status</b>

## 6.0 OPERATING PROCEDURES

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### 6.1 Policy

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Operating Procedures (OPs) and Safe Work Practices (SWPs) for PSM-covered processes will be developed and made available to plant operators, maintenance personnel, and contract employees who work on or near the process. The OPs and SWPs will include proper operating practices and critical process/safety information required for the safe operations of PSM-covered processes.

### 6.2 Purpose

---

Proper operation of process equipment is a principal means of preventing an unintended release of an AHM (Regulated Substance). A key element in promoting proper operations is the ready availability of an information source that includes a correct sequence of events required to safely conduct operating activities and lists critical process and equipment-related data. It is generally recognized and accepted that the most effective and efficient means of providing this critical information to affected personnel is through OPs and Safe Work Practices (SWPs). OPs are used for operating the PSM-covered process. SWPs are used for routine activities that indirectly affect the safety of the PSM-covered process, such as maintenance and equipment modifications. Both OPs and SWPs are used for training purposes. To accomplish the intended purpose, it is essential that OPs and SWPs be clear, concise, correct, easily read, and readily understood by the operators and other users in the facility.

### 6.3 Regulatory Requirements

---

Cal-OSHA (8 CCR 5189 (f)):

*(1) The employer shall develop and implement written procedures that provide clear instructions for safely conducting activities involved in each process consistent with the process safety information and shall address at least the following elements.*

*(A) Steps for each operating phase:*

- 1. Start-up;*
- 2. Normal operation;*
- 3. Temporary operations as the need arises;*
- 4. Emergency operations, including emergency shutdowns, and who may initiate these procedures;*
- 5. Normal shutdown; and,*
- 6. Start-up following a turnaround, or after an emergency shutdown.*

*(B) Operating limits:*

- 1. Consequences of deviation;*
- 2. Steps required to correct and/or avoid deviation; and*

3. *Safety systems and their functions.*
- (C) *Safety and health considerations:*
1. *Properties of, and hazards presented by, the chemicals used in the process;*
  2. *Precautions necessary to prevent exposure, including administrative controls, engineering controls, and personal protective equipment;*
  3. *Control measures to be taken if physical contact or airborne exposure occurs;*
  4. *Safety procedures for opening process equipment (such as pipe line breaking);*
  5. *Verification of raw materials and control of hazardous chemical inventory levels;*  
*and,*
  6. *Any special or unique hazards.*
- (2) *A copy of the operating procedures shall be readily accessible to employees who work in or near the process area or to any other person who works in or near the process area.*
- (3) *The operating procedures shall be reviewed as often as necessary to assure that they reflect safe operating practices, including changes that result from changes in process chemicals, technology, and equipment; and changes to facilities.*
- (4) *The employer shall develop and implement safe work practices to provide for the control of hazards during operations such as opening process equipment or piping and control over entrance into a facility by maintenance, contractor, laboratory, or other support personnel. These safe work practices shall apply to employees and contractor employees.*

The federal OSHA PSM standard differs from the Cal-OSHA PSM standard in the following ways:

- OPs are required just for initial startup.
- OPs are required for temporary operations
- Safety systems are not included under operating limits.
- OPs shall be “readily accessible to employees who work in or maintain a process.”
- Safe work practices are specially required to address lockout/tagout, confined space entry, and control over entrance into a facility by maintenance, contractor, laboratory, or other support personnel.

## 6.4 Scope

---

Plant operations subject to PSM requirements are listed in Table 6.1. The attachment summarizes the OPs and SWPs required for the PSM-covered processes and the current status of development. The attachment also includes a listing of where OPs and SWPs are to be located in the work areas.

For each operation, OPs will be developed and/or reviewed for completeness in addressing at least the following elements (where applicable):

1. Steps for each operating phase

A proper activity sequence will be denoted where appropriate for:

- Initial Startup
- Normal Operations
- Temporary Operations
- Emergency Shutdown
- Emergency Operations
- Normal Shutdown
- Startup following a turnaround, or after an emergency shutdown

2. Operating limits

- Maximum/minimum temperature, pressure, flow, level, and other pertinent operating parameters (pH, etc.) where applicable.
- Consequences of deviation.
- Steps required to correct or avoid deviation.

3. Safety and health considerations

- Properties of, and hazards presented by, the chemicals used in the process.
- Precautions necessary to prevent exposure, including engineering controls, administrative controls, and personal protective equipment.
- Control measures to be taken if physical contact or airborne exposure occurs.
- Quality control for raw materials and control of hazardous chemical inventory levels.
- Any special or unique hazards.

4. Safety systems and their functions

- Alarm and shutdown settings
- Cause and effect logic/function
- Gas monitoring location/settings where applicable
- Fire detection/fighting systems where applicable
- Emergency shutdown systems/considerations

- Relief valve/flare/vent information where applicable

SWPs will be available to provide for the control of hazards associated with the following activities:

- Work in oxygen, gas, or chlorine environments
- Line breaking, line entry, and opening process equipment
- Control over entry into a process area

The Hot Work Permit program is addressed separately in Section 11 of the PSM Manual. Confined Space Entry and Lock and Tag Procedures are addressed in the Safety and Health Manual.

#### **6.5 Schedule**

---

OPs and SWPs will be in place prior to the operation of any new or modified covered process. The OPs will be reviewed and updated on a timely basis, and certified annually as being current and correct. SWPs will also be updated periodically as required by changing regulations and/or work practices at the plant.

#### **6.6 Documentation Requirements**

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1. Written set of OPs for at least the elements listed above
2. Periodic certification of procedure accuracy and currency
3. Control copies at designated locations
4. SWPs for line breaking/line entry, and control over entry into a process area

## 6.7 Responsibilities

---

The responsibilities for implementing the operating procedures element of the PSM program are outlined below.

Water Treatment Superintendent	<ul style="list-style-type: none"><li>• Develop OPs for each covered process.</li><li>• Ensure that OPs are being utilized by the plant operators.</li><li>• Approve updates to OPs in a timely manner.</li><li>• Develop, review and update SWPs related to covered processes involving chlorine.</li></ul>
Water Treatment Supervisor	<ul style="list-style-type: none"><li>• Verify that the OPs required for PSM purposes are correct and complete.</li><li>• Certify OPs periodically.</li><li>• Identify the need for updates to OPs.</li><li>• Ensure that OPs are being utilized by the operators.</li></ul>
Maintenance Superintendent	<ul style="list-style-type: none"><li>• Review and implement SWPs.</li></ul>
Associate Engineer, O&M	<ul style="list-style-type: none"><li>• Provide data and support as required by the Water Treatment Superintendent for developing complete OPs.</li></ul>
Plant Operators and Maintenance Personnel	<ul style="list-style-type: none"><li>• Conduct all operations involving the covered process in accordance with the OPs and SWPs.</li></ul>
PSM Coordinator/ PSM Committee	<ul style="list-style-type: none"><li>• Review OPs to verify that PSM objectives are being met.</li><li>• Provide support as needed to establish compliance with PSM requirements.</li></ul>

## 6.8 Procedures

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### 6.8.1 Document Control System

A Document Control System will be established that addresses the following elements:

- Each OP will be assigned a unique document ID within the document control system. The ID numbers will be coordinated by the Division Managers.
- A standard format will be used for all related OPs.
- Pages will be marked to identify the page number, the current version of the OP, and the document ID.
- OPs will be reviewed and approved at least annually by Water Treatment staff. Comments will be resolved by the procedure authors in collaboration with the operating personnel.
- Effective dates will be identified on OPs.
- A distribution list will be established for each OP.
- OPs will be released by the Water Treatment Superintendent who will maintain distribution lists, and distribute OPs.
- Current OPs will be maintained in the work areas.
- Interim changes to OPs will be made if deficiencies are identified. Interim changes will be fully incorporated at the time of annual review.
- One copy of superseded and discontinued OPs will be retained for future reference.

### 6.8.2 Identifying Deficiencies With Existing OPs

- Existing procedures will be reviewed to identify deficiencies.
- Requirements for new operating procedures will be identified.

### 6.8.3 Preparing OPs

- The content of OP's will be consistent with PSM requirements, technically accurate, and understandable.
- After completing the draft, the author will "walk through" the steps to verify that they are accurate and complete.

#### 6.8.4 Reviewing, Approving, And Releasing OPs

Each OP will be reviewed to see that it accurately describes the process used to perform the work, that it helps ensure the accuracy and repeatability of the operation, and that it complies with PSM requirements. The OP should be reviewed for:

- Clarity
- Inclusion of appropriate requirements
- Adequacy of interfaces between organizations, other procedures, and instructions
- Impact on other activities or organizations
- Effectiveness of method, including adequacy of controls and efficient use of resources

After review, all review comments should be addressed in a modified draft OP. The OP should then be submitted for approval, and the approval process should check to see that the OP:

- Accurately describes the process
- Has been “walked through” by the author to verify its steps
- Has been developed and reviewed according to operating practice

The approved OP should be given to the person responsible for releasing OPs and made readily accessible to employees who work near or maintain the processes. OPs shall be reviewed as often as necessary to assure that they reflect current operating practice, including changes that result from changes in process chemicals, technology, and equipment, and changes to facilities. The Water Treatment Supervisor is responsible for certifying annually that OPs are current and accurate.

Each plant will implement SWPs to provide for the control of hazards during such operations as lockout/tagout, confined space entry, opening process equipment or piping, and control over entry into a facility by maintenance, contractor, laboratory, or other support personnel.

#### 6.8.5 Modifying OPs

- OPs will be modified to reflect changes in operations, personnel, equipment, and materials.
- Changes to OPs will be communicated to affected personnel.
- OPs will be revised whenever changes have occurred that make the existing version of the OP incorrect, inadequate, or unsafe to follow.
- Revisions to OPs will be reviewed and approved according to the above guidelines.

#### 6.8.6 Current OPs and SWPs

Lists of current OPs and SWPs are included as Tables 6.1 and 6.2. Safe operating limits and consequences of deviation are shown in Table 6.3. Safety and health effects of chlorine are included in Attachment 6-1.

Table 6.1

Chlorine Response and Standard Operating Procedures

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<b><i>Operating Procedure</i></b>	<b><i>Location</i></b>
CHLORINE SYSTEM STATUS DEFINITION	SECTION 10, SAFETY & HEALTH MANUAL
Self-Contained Breathing Apparatus use	Section 10, Safety & Health Manual
Chlorine emergency response	Section 10, Safety & Health Manual
Chlorine one-ton container handling	Section 10, Safety & Health Manual
General chlorine handling procedures	Section 10, Safety & Health Manual
Leak repair	Section 10, Safety & Health Manual

Table 6.2

Safe Work Practice Requirements

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<b><i>Safe Work Practice</i></b>	<b><i>Location</i></b>
LOCKOUT/TAGOUT	Section 6, Safety & Health Manual
Confined space entry	Section 5, Safety & Health Manual
Line clearance	SWP, Control Room
Hot work permit program	Section 11, PSM
Site access, sign in/control	SWP, Control Room

Table 6.3

## Chlorine Safe Operating Limits and Consequences of Deviation

System Segment or Equipment Item	Operating Parameter	Safe Operating Limits	Consequences of Deviation	Method of Identification	Operator Response
Ton containers	Gas Pressure	140 psig (high)	Fusible plug opens with chlorine release	Chlorine detector	Initiate emergency response
		40 psig (low)	No chlorine feed	Low flow in chlorinators	Change containers
Chlorine Headers (Vacuum)	Gas Pressure	Any positive pressure (high)	Possible damage to chlorinator with release	Chlorine detector	Initiate emergency response
		Excessive vacuum (low)	High feed	High flow through chlorinators	Check setting on chlorinators
Chlorinators (Vacuum)	Flow	High flow (?)	Excessive chlorination	Residual Analyzer	Check setting on chlorinator
		Low flow(?)	Inadequate chlorination	Residual Analyzer	Check setting on chlorinator

### Chemical Description

Chlorine (Cl<sub>2</sub>) is a greenish yellow gas with a pungent suffocating odor, which is used to purify water, bleach woodpulp, and to make other chemicals. It is extremely toxic by inhalation and is slightly soluble in water. Chlorine reacts explosively or forms explosive compounds, with many common chemicals. It is normally shipped as a liquid in cylinders or tank cars. Contact with liquid should be avoided as it can cause frostbite. The liquid readily vaporizes to a gas. Chlorine does not burn but will support combustion (although lets other articles burn). Long term exposure to low concentrations or short term exposure to high concentrations may result in adverse health effects from inhalation.

### Physical Properties

The physical properties of chlorine are summarized below.

<b>Property</b>	<b>Value</b>	<b>Reference</b>
Molecular Weight	70.91	(EPA, 1990)
Boiling Point	-30.3°F at 760 mm of Hg	(EPA, 1990)
Flash Point	N1. Not flammable	(USCG, 1991)
Melting Point	-150°F	(EPA, 1990)
Vapor Pressure	7600 mm at 86°F	(EPA, 1990)
Vapor Density (air = 1)	2.4	(USCG, 1991)
Specific Gravity, Liquid	1.424 at 59°F	(USCG, 1991)
Lower Exposure Limit	N1. Not flammable	(USCG, 1991)
Upper Exposure Limit	N1. Not flammable	(USCG, 1991)
Auto Ignition Temp	N1. Not flammable	(USCG, 1991)

### Chemical Uses

Chlorine may be used to purify water, bleach woodpulp, and to make other chemicals. At the Randall-Bold facility, chlorine is used for disinfection.

### Nature Of Hazard And Toxicity

This section summarizes the hazards associated with the AHMs (Regulated Substances) used at the facility, including hazards associated with storage and handling, fire response, non-fire response and general toxicity. Additional information on emergency response issues and first aid is also summarized in this attachment based on information contained in the Computer Aided Management of Emergency Operations (CAMEO) modeling system.

### Health Hazards

Chlorine vapors are much heavier than air and tend to settle in low areas. Chlorine is poisonous and may be fatal if inhaled and may cause death or permanent injury after very short exposure to small quantities. Contact may cause burns to skin and eyes, bronchitis or chronic lung conditions (EPA, 1990). Chlorine is an eye and respiratory tract irritant. Persons with asthma, subnormal pulmonary functions or cardiovascular disease are at a greater risk (EPA, 1990). Exposure levels are summarized as follows:

<b>Level</b>	<b>Amount</b>	<b>Reference</b>
TLV TWA	0.5 ppm	(ACGIH, 1991)
TLV STEL	1 ppm	(ACGIH, 1991)
IDLH	30 ppm	(NIOSH, 1990)
ERPG-2	3 ppm	(AIHA, 1988)
ERPG-3	20 ppm	(AIHA, 1988)

**Threshold Limit Value - Time Weighted Average (TLV-TWA)** is defined as a time-weighted average concentration to which workers may be exposed up to eight hours per day with no ill health effects.

**Threshold Limit Value - Short Term Exposure Limit (TLV-STEL)** is defined as a 15-minute, time-weighted average concentration to which workers may be exposed up to four times per day with at least 60 minutes between successive exposures with no ill effect if the threshold limit value/time-weighted average is not exceeded.

**Immediately Dangerous to Life and Health (IDLH)** is the maximum airborne contaminant concentrations from which one could escape within 30 minutes without any escape-impairing symptoms or any irreversible health effects.

Safety and Health Effects Of Chlorine (cont)

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***Emergency Response Planning Guideline 2 (ERPG-2)*** is defined as “The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual’s ability to take protective action.”

***Emergency Response Planning Guideline 3 (ERPG-3)*** is defined as “The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing life-threatening health effects.”

#### First Aid Issues

Effects of chlorine exposure may be delayed. Chlorine is corrosive and may be converted to hydrochloric acid in the lungs.

***Signs and Symptoms Of Acute Chlorine Exposure.*** Signs and symptoms of acute exposure to chlorine may include tachycardia (rapid heart rate), hypertension (high blood pressure) followed by hypotension (low blood pressure), and cardiovascular collapse. Pulmonary edema and pneumonia are often seen. Eyes, nose, throat, and chest may sting or burn following exposure to chlorine. Also, cough with bloody sputum, a feeling of suffocation, dizziness, agitation, anxiety, nausea, and vomiting are common. Dermal exposure may result in sweating, pain, irritation, and blisters.

***Emergency Life Support Procedures.*** Acute exposure to chlorine may require decontamination and life support for the victims. Emergency personnel should wear protective clothing appropriate to the type and degree of contamination. Air-purifying or supplied-air respiratory equipment should also be worn, as necessary. Rescue vehicles should carry supplies such as chlorine-resistant plastic sheeting and disposable bags to assist in preventing spread of contamination.

#### Inhalation Exposure

1. Move victims to fresh air. Emergency personnel should avoid self-exposure to chlorine.
2. Evaluate vital signs including pulse and respiratory rate, and note any trauma. If no pulse is detected, provide CPR. If not breathing, provide artificial respiration. If breathing is labored, administer oxygen or other respiratory support.
3. Obtain authorization and/or further instructions from the local hospital for administration of an antidote or performance of other invasive procedures.
4. Transport to a health care facility.

## Attachment 6-1

### Safety and Health Effects Of Chlorine (cont)

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#### Dermal/Eye Exposure

1. Remove victims from exposure. Emergency personnel should avoid self- exposure to chlorine.
2. Evaluate vital signs including pulse and respiratory rate, and note any trauma. If no pulse is detected, provide CPR. If not breathing, provide artificial respiration. If breathing is labored, administer oxygen or other respiratory support.
3. Remove contaminated clothing as soon as possible.
4. If eye exposure has occurred, eyes must be flushed with lukewarm water for at least 15 minutes.
5. Wash exposed skin areas for at least 15 minutes with soap and water.
6. Obtain authorization and/or further instructions from the local hospital for administration of an antidote or performance of other invasive procedures.
7. Transport to a health care facility.

#### Fire And Explosion Hazards

May ignite other combustible materials (wood, paper, oil, etc.). Mixture with fuels may cause explosion. Container may explode in heat of fire. Vapor explosion and poison hazard indoors, outdoors or in sewers. Hydrogen and chlorine mixtures (5-95 percent) are exploded by almost any form of energy (heat, sunlight, sparks, etc.). May combine with water or steam to produce toxic and corrosive fumes of hydrochloric acid. Emits highly toxic fumes when heated. Avoid plastics and rubber. Avoid heat and contact with hydrogen gas or powdered metals.

#### Fire Fighting

Evacuate area endangered by gas. Stay upwind; keep out of low areas. Wear positive pressure breathing apparatus and full protective clothing. Move container from fire area if you can do so without risk. Spray cooling water on containers that are exposed to flames until well after fire is out. If it is necessary to stop the flow of gas, use water spray to direct escaping gas away from those effecting shut-off. Will not burn, but most combustible materials will burn in chlorine as they do in oxygen; flammable gases will form explosive mixtures with chlorine.

## Attachment 6-1

### Safety and Health Effects Of Chlorine (cont)

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#### Protective Clothing And Suit Material Compatibility

For emergency situations, wear a positive pressure, pressure-demand, full-facepiece self-contained breathing apparatus (SCBA) or pressure-demand supplied air respirator with escape SCBA and a fully-encapsulating, chemical resistant suit (EPA, 1990). Resistance ratings are:

<b>Material/Product</b>	<b>Application</b>	<b>Rating</b>
Barricade	Fabric	Greater Than 3 hours
Blue Max	Fabric	Greater Than 3 hours
BUTYL	Fabric Gloves	Greater Than 3 hours Greater Than 3 hours
BUTYL/NEOP	Fabric	Greater Than 3 hours
Checkmate	Fabric	Greater Than 3 hours
CHEMREL	Fabric	Greater Than 3 hours
CHEMREL MAX	Fabric	Greater Than 3 hours
CPF III	Fabric	Greater Than 3 hours
FEP Teflon	Faceshield	Greater Than 3 hours
Interceptor	Fabric	Greater Than 3 hours
NEOP	Fabric Gloves Boots	Greater Than 3 hours Greater Than 3 hours Greater Than 3 hours
NEOP/BUTYL	Gloves	Greater Than 3 hours
NIT/Polyurethane/PVC	Boots	Greater Than 3 hours
NITRILE	Gloves	Greater Than 3 hours
PE	Fabric	Less Than 1 hour
PE/EVAL/PE	Boots	Greater Than 3 hours
Polyurethane+PVC	Gloves	Greater Than 3 hours
PTFE TEFLON	Fabric	1-3 hours
PVC	Fabric	Less Than 1 hour
Responder	Fabric	Greater Than 3 hours
SARANEX23P	Fabric	Greater Than 3 hours
VITON	Fabric	Greater Than 3 hours
VITON/NEOP	Fabric	Greater Than 3 hours

**Attachment 6-1**

**Safety and Health Effects Of Chlorine (cont)**

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**Non-Fire Response**

Keep material out of water sources and sewers. Attempt to stop leak if there is no undue personnel hazard. Do not apply water to point of leak in tank car or container. Apply water spray or mist to knock down vapors. Vapor knockdown water is corrosive or toxic and should be diked for containment.

- Land spill - Dig a pit, pond, lagoon, holding area to contain liquid or solid material. Dike surface flow using soil, sand bags, foamed polyurethane, or foamed concrete. Neutralize with dilute caustic soda (NaOH) or soda ash (Na<sub>2</sub>CO<sub>3</sub>).
- Water spill - Add diluted caustic soda (NaOH). If dissolved, in region of 10 ppm or greater concentration, apply activated carbon at ten times the spilled amount. Use mechanical dredges or lifts to remove immobilized masses of pollutants and precipitates (AAR, 1991).

## 7.0 TRAINING

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### 7.1 Policy

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All personnel who operate or directly supervise or affect the operation of processes containing AHMs (Regulated Substances) will be properly trained. All personnel who maintain such equipment will be trained in maintenance procedures and the Safe Work Practices required to conduct their job safely.

### 7.2 Purpose

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This policy establishes procedures for effectively training those personnel responsible for operating and maintaining plant facilities which contain or could affect the containment of AHMs (Regulated Substances), so as to minimize the potential for an unintended release of such chemicals. It also establishes the methods to be used to certify operators as competent to operate a particular system before assuming direct "stand alone" responsibility for operating that system. The policy defines training required in terms of Maintenance Procedures (MPs), Safety Work Practices (SWPs), procedures for emergency response and related training including procedures applicable to each job and an overview of the covered processes and their hazards (29 CFR 1910.119 (j)). Note that this policy includes training required for maintenance personnel in Section 10.

### 7.3 Regulatory Requirements

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Cal-OSHA (8 CCR 5189 (g)):

- (1) *Initial training. Each employee presently involved in operating or maintaining a process, and each employee before working in a newly assigned process, shall be trained in an overview of the process and in the operating procedures as specified in subsection (f). The training shall include emphasis on the specific safety and health hazards, procedures, and safe work practices applicable to the employee's job tasks.*
- (2) *Refresher and supplemental training. At least every three years, and more often if necessary, refresher and supplemental training shall be provided to each maintenance or operating employee and other workers necessary to ensure safe operation of the facility. The employer, in consultation with employees involved in operation or maintenance of a process, shall determine the appropriate frequency of refresher training.*
- (3) *Training certification. The employer shall ensure that each employee involved in the operation or maintenance of a process has received and successfully completed training as specified by this subsection. The employer, after the initial or refresher training, shall prepare a certification record which contains the identity of the employee, the date of training, and the signatures of the persons administering the training.*

- (4) *Test procedures shall be established by each employer to ensure competency in job skill levels and safe and healthy work practices.*

The federal OSHA PSM standard differs from the Cal-OSHA PSM standard in the following ways:

- The training element does not include maintenance employees in addition to operators for initial and refresher training.
- For experienced operators working on the process on May 26, 1992, “an employer may certify in writing that the employee has the required knowledge, skills, and abilities to safely carry out the duties and responsibilities as specified in the operating procedures.”
- After initial training, “supplemental training” is not required in addition to refresher training.
- Employers are not required to have testing procedures to ensure competency in job skills and safe work practices.

#### 7.4 Scope

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This policy applies to:

- Personnel who operate a covered process.
- Supervisors and superintendents who are responsible for operating covered processes.
- Maintenance personnel who are responsible for maintaining the integrity of covered process equipment.

It covers training requirements in terms of OPs, MPs, SWPs, and procedures for emergency response.

#### 7.5 Schedule

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Initial training will be provided to all new and reassigned employees. Refresher training in the operating procedures will be provided at least every three years following the initial training. Training requirements for Safe Work Practices and other health and safety topics will be conducted in accordance with the specific regulatory requirements.

#### 7.6 Documentation Requirements

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1. Training modules will be in place and kept current to provide training in OPs and SWPs.
2. Training evaluations will be in place to evaluate operator competency in each of the training modules (OPs and SWPs).
3. Training records will be maintained for each operator to record the system(s) trained on, training dates, methods of training, testing and/or verification results, and certifications.

## 7.7 Responsibilities

The responsibilities for implementing the training element of the PSM program are outlined below.

<p><b>WATER TREATMENT SUPERINTENDENT</b></p>	<ul style="list-style-type: none"> <li>• Certify that operators have the required knowledge, skills, and abilities to safely carry out the duties and responsibilities as specified in the operating procedures.</li> <li>• Develop and provide technical training for operators who work on the covered processes and for verifying operator understanding of that training.</li> <li>• Ensure that PSM training requirements are being met for the operators who work on covered processes.</li> <li>• Administer verbal and written tests to determine competency of operators and supervisors in the OPs relating to the covered processes.</li> <li>• Develop training programs in Safe Work Practices.</li> <li>• Maintain all training records documenting that PSM training requirements are being met.</li> </ul>
<p><b>MAINTENANCE SUPERINTENDENT</b></p>	<ul style="list-style-type: none"> <li>• Develop and provide process overview training for maintenance personnel.</li> <li>• Certify that maintenance personnel have the required knowledge, skills, and abilities to safely carry out the duties and responsibilities as specified in the maintenance procedures and Safe Work Practices.</li> <li>• Develop and provide training to maintenance personnel in the maintenance procedures for PSM-covered processes (1910.119 (j)).</li> <li>• Administer verbal and written tests to determine competency of maintenance personnel in the job skills and SWPs relating to the PSM-covered processes.</li> </ul>
<p><b>PSM COORDINATOR</b></p>	<ul style="list-style-type: none"> <li>• Review training activities to ascertain if PSM objectives are being met.</li> <li>• Provide support as needed to establish compliance with PSM requirements.</li> </ul>

## 7.8 Procedures

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### 7.8.1 Operator Training

#### 7.8.1.1 *Training Content*

The training modules that are required for operators are shown in the Training Matrices for PSM Core Courses (Table 7.1) and for training in the chlorine Operating Procedures (Table 7.2).

#### 7.8.1.2 *Training Methods*

- Established written operating and/or maintenance procedures will be utilized as a basis for training on Operating Procedures.
- Both classroom and "on the job" training methods will serve as the means of delivering this training.

#### 7.8.1.3 *Verification Of Training Effectiveness*

- Written tests will be used to verify the operator has the knowledge required to perform the tasks included in the Operating Procedures.
- Field tests will be used (in addition to the written tests) to verify the operator can perform the tasks in a safe and competent manner. These tests will involve observation in the field and answering additional questions administered by the evaluator.
- All written tests and field tests will be evaluated by the Water Treatment Supervisor or Superintendent. The Safety Officer will assist in evaluating tests for Safe Work Practices and Safety and Health Effects of the process.
- Results of any testing will be recorded and signed off by the test evaluator (Water Treatment Supervisor or Superintendent).
- A score of 80 percent is required to pass any test. If a test is failed, the operator may not retake the test until at least one week later.

#### 7.8.1.4 *Initial vs. Refresher Training*

- The first training on the Operating Procedures will be conducted as "initial training." To gain certification for the chlorine system, an operator must successfully complete the training for all Operating Procedure modules relating to chlorine and all of the PSM Core Courses.

- Refresher Training will consist of a subset of critical items taken from the initial training, to be determined by the Water Treatment Superintendent. Refresher training will involve both knowledge and performance based training with the number of questions reduced by 50 percent over initial training. A score of 80 percent is again required for a pass.

#### **7.8.1.5 Training Records**

- Successful completion of training for each OP module, SWPs and the PSM Core Courses will be recorded in the Training Records System maintained by the Treatment Supervisor and in the master file kept by the field clerk at Randall-Bold.
- When an operator completes the training for the chlorine system, the Core Courses and the SWPs, then the operator will be certified for that system, and the certification will be recorded.
- Records of all completed training and copies of certifications will be maintained in individual Employee Training files kept at the Randall-Bold Water Treatment Plant.

### **7.8.2 Maintenance Personnel Training**

#### **7.8.2.1 Training Content**

- The generic PSM training required for maintenance personnel is shown in the Training Matrix for PSM Core Course. (Table 7.1).
- The specific PSM Maintenance Course will consist of training in the maintenance procedures for chlorinators, filters, pressure reducing valves and injectors.
- Training in any other Preventive Maintenance and Inspection and Testing (PM/IT) procedures will be provided, as required, based on the written procedures and information included in the manufacturer's equipment manuals.

#### **7.8.2.2 Training Methods**

- Training methods for the PSM Core Courses, SWPs and the PSM Maintenance Course will be classroom with instructor and/or by video. Both methods will involve a written test following the training.
- Additional training on PM/IT procedures will be "one-on-one" training conducted prior to the maintenance activity being performed. Both classroom and "on the job" training methods may serve as means of delivering this training. This will be informal and not recorded.

#### **7.8.2.3 Verification Of Training Effectiveness**

- Written tests will be utilized to verify employee understanding for the PSM Core Courses, SWPs and the PSM Maintenance Course.

- All written tests will be evaluated by the employee's supervisor. The Safety Officer will assist in evaluating tests for Safe Work Practices and Safety and Health Effects.
- Results of any testing will be recorded and signed off by the test evaluator (employee's supervisor or the Workplace H&S Section Trainer).

#### **7.8.2.4 Training Records**

- Successful completion of training in PSM "Core Courses," SWPs and the PSM Maintenance Course will be recorded in the Training Record System.
- Records of all training completed will be maintained in Employee Training files which are kept at the Randall-Bold Water Treatment Plant for operators, or at the CCWD offices for maintenance employees.

#### **7.8.3 Contractor Training**

- The PSM training required for contractors working in or near the chlorine system is shown in the Training Matrix for PSM Core Course. (Table 7.1).
- The training may be provided by CCWD personnel or by the contractor. In either case, CCWD staff will verify that required PSM training has been successfully completed by all contract employees prior to working at the plant.
- The contractor will retain records of all PSM training for their own employees and provide them to CCWD as requested.

Table 7.1 PSM Core Courses (One Time Only)

Course #	Title	Operators & Operations Supervisors	Treatment Superintendent	Maintenance Employees	Maintenance Superintendent	Contractors (Cl <sub>2</sub> /SO <sub>2</sub> )
PSM-01	PSM Overview	X	X	X	X	X
[1]	Safe Work Practices	X	X	X	X	X
[2]	Chlorine Emergency Response	X	X	X	X	X
PSM-02	Chlorine Process Overview	X	X	X	X	X
PSM-03	Chlorine Safety and Health Hazards	X	X	X	X	X
PSM-04	PSM Maintenance Procedures for Chlorine [3]			X	X	X [4]

[1] Training for Safe Work Practices should be integrated with existing training:

Lock Out/Tag Out

Confined Space Entry

Hot Work Permit

- Line Clearing, Line Entry
- Control of Site Entry

[2] Training for Chlorine Emergency Response should be integrated with existing training

[3] Specific to chlorinators and pressure-reducing valves

[4] Required for contract employees if they are providing onsite maintenance support for chlorine

Table 7.2 Training for Chlorine Operating Procedures (Every Three Years)

Element #	Procedure Element [1]	Operators & Operations Supervisors	Treatment Superintendent
CL2-01	System Description including Safe Upper and Lower Operating Limits and Consequences of Deviation	X	X
CL2-02	Safety and Health Hazards	X	X
CL2-03	Safety Systems (SCBA and leak repair)	X	X
CL2-04	Startups – initial and following container changes	X	
CL2-05	Normal Operations	X	
CL2-06	Shutdowns – normal and emergency	X	

[1] Refer to Section 6 for details of the Chlorine Response and Standard Operating Procedures and their specific content.

## Attachment 7-1

### Example Training Module - Chlorine System Process Overview

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#### Student Objectives

- Become familiar with the chlorine system process flow and associated equipment.
- Recognize hazards associated with the chlorine system.
- Gain an understanding of the use of Personal Protective Equipment (PPE) suitable for chlorine response.
- Know who is responsible at the plant for specific situations including routine operations and emergencies.

#### Training Course Format

Classroom, video or computer based

#### Training Materials

Instructors Manual

Lesson Plan

Roster

Test

Answer key

Video(s)

#### Lesson Plan

1. Introduce subject and objectives
2. Explain that the course includes a written test
3. Present course objectives
4. Show layout of facilities (plot plan)
5. Discuss purpose and location of major equipment involved in the process
6. Show and discuss process flow diagrams
7. Introduce operating parameters and limitations (pressures, flows and temperatures)
8. Discuss operational control of system
9. Briefly discuss alarms and safety systems

## Attachment 7-1

### Example Training Module - Chlorine System Process Overview (cont)

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10. Administer test

11. Review and correct test

#### Documentation

- Complete roster including course identification number and social security numbers for students.
- After test, route the roster to the Training Coordinator with all completed tests for entry into the individuals records and Taskmaster.
- Return course materials to Training Coordinator.

## 8.0 CONTRACTORS

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### 8.1 Policy

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Contractors' safety and health performance must be considered by management when selecting contractors, when contracts are awarded, and when contractor employees are on site performing work.

### 8.2 Purpose

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To provide assurance that contractors selected to work on covered processes and in the area of covered processes emphasize the importance of safety in the conduct of their work, and that they are aware of the process hazards and have been provided the necessary training to prevent accidental releases of AHMs (Regulated Substances).

### 8.3 Regulatory Requirements

---

Cal-OSHA (8 CCR 5189 (h)):

- (1) *The employer shall inform contractors performing work on, or near, a process of the known potential fire, explosion or toxic release hazards related to the contractor's work and the process, and require that contractors have trained their employees to a level adequate to safely perform their job. The employer shall also inform contractors of any applicable safety rules of the facility, and assure that the contractors have so informed their employees.*
- (2) *The employer shall explain to contractors the provisions of the emergency action plan required in subsection (n).*
- (3) *Contractors shall assure that each of their employees have received training to safely perform their job and that the contract employees shall comply with all applicable work practices and safety rules of the facility.*
- (4) *The contractor's training program shall be performed in accordance with the requirements of subsection (g).*
- (5) *The employer, when selecting a contractor, shall obtain and evaluate information regarding the contract employer's safety program.*
- (6) *The employer shall periodically evaluate the performance of contract employers in fulfilling their obligations as specified in subsection (h)(3) of this section.*
- (7) *The employer shall obtain and make available upon request a copy of the contract employer's injury and illness log related to the contractor's work in the process areas.*

The federal OSHA PSM standard differs from the Cal-OSHA PSM standard in the following ways:

- There is an exclusion for contractors providing incidental services (e.g., janitors, etc.).
- The employer is not required to inform the contractor of specific safety rules and to assure that the contractor informs their employees.
- Contract employee training is not required to be the same as for facility employees.

#### **8.4 Scope**

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This policy applies to all contracts awarded for work on or near PSM-covered processes, and it directly involves personnel who are involved in the selection of such contractors, personnel who oversee contractor work activities at the plants, and contractors and subcontractors who work on or adjacent to covered processes.

#### **8.5 Schedule**

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These requirements of this policy apply to all new contracts and existing contracts relating to PSM-covered processes.

#### **8.6 Documentation Requirements**

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1. Bid packages and contract documents with language that includes the requirements of this policy.
2. Documentation of contract employees training.
3. Records that show contractor employee injury and illness entries relating to work onsite.
4. Contractor evaluation records.
5. Records will be retained by the Safety Officer until the completion of the project.

## 8.7 Responsibilities

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The responsibilities for implementing the contractors element of the PSM program are outlined below.

DIRECTOR OF CONSTRUCTION (CAPITAL PROJECTS) OR MAINTENANCE SUPERINTENDENT (ROUTINE MAINTENANCE CONTRACTS)	<ul style="list-style-type: none"><li>• Evaluate contractor safety record as part of the selection process.</li><li>• Ensure that contractors selected by the Construction Department are advised of this Contractor Safety Program.</li><li>• Evaluate long-term contractors in terms of safety performance.</li></ul>
Maintenance Supervisor (routine maintenance work) or Construction Administrator (capital improvement projects)	<ul style="list-style-type: none"><li>• Monitor contractor work activities to ensure they are following SWPs and all appropriate maintenance and/or operating procedures.</li><li>• Ensure that contractors obtain training in a process overview, the hazards associated with the process, and the procedures in the emergency response plan.</li><li>• Ensure that contractors have the capability to perform work safely and competently.</li></ul>
PSM Coordinator Safety Officer	<ul style="list-style-type: none"><li>• Assist the Construction Department and/or the Maintenance Department in determining appropriate contractors for performance of services with regard to safety performance.</li><li>• Review and evaluate contractor safety statistics and other safety program information submitted in proposal packages.</li><li>• Ensure that contractors are maintaining complete and accurate OSHA Illness and Injury logs.</li></ul>

## 8.8 Procedures

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### 8.8.1 Contractor Selection

Safety performance is to be included as a criterion for contractor selection. Table 8.1 provides a screening form to compile relevant information for selection purposes.

### 8.8.2 Contract Language

All contracts related to contracts for PSM-covered processes will include language to:

- Require contractor to assure that PSM safety requirements are met.
- Outline procedures and actions to be taken in the event of an emergency.
- Ensure contractor personnel are able to perform essential functions of the work to which they are assigned.
- Ensure contractor will provide all required safety training to contract employees, at least to the minimum level required for CCWD employees engaged in the same tasks. This will include Safe Work Practices: Lockout/Tagout; Confined Space Entry; Line Breaking; Hot Work Permit program; site entry control.
- Ensure contractor personnel are instructed in the known potential fire, explosion of toxic release hazards related to the job and the applicable provisions of the Emergency Response Plan.

### 8.8.3 Contractor Briefings

Prior to contract employees starting work onsite, CCWD will:

- Provide an orientation that discusses known hazards, a process overview, the provisions of the Emergency Response Plan, and the requirements regarding control of access to the work area.
- Train contract employees to respond properly in the event of an emergency.
- Hold other pre-job meetings to review safety and health aspects of the work to be performed.

### 8.8.4 Contract Term

- Ensure contractors sign in and out of work area on a daily basis using plant log.
- Evaluate contractor safety performance and provide feedback to contractor management. Table 8.2 provides a contractor performance evaluation form for this purpose.
- Notify contractor of deficiencies in safety and health performance.
- Suspend contract work when there is an obvious and imminent threat to the safety of employees, and/or contract personnel.
- Require contract employees to report any unique hazards presented by the work, or any hazards found by the contractor, verbally and in writing within 24 hours.

Table 8.1

Contractor Selection Screening Form

Item	Yes/ No	Comment
Is the contractor's "statistical performance" of safety for the previous three calendar years satisfactory? <sup>1</sup>		
Do the contractor's safety and health programs reflect recognition of current applicable OSHA standards and efforts to maintain compliance?		
Does the contractor's submittal demonstrate an understanding of the health and safety issues specific to the scope of work?		
Are onsite job-site managers and supervisors accountable for safety performance?		
Does the contractor have written safety and health programs, policies and procedures to be followed by the contractor and the contract employees?		
Does the contractor have adequate safety and health resources available to contract employees? Is there a safety and health organization?		
Does the contractor have a safety incentive program?		
Does the contractor identify safety and health equipment to be provided and utilized by contractor employees? Does this equipment include personal protective equipment suitable for the scope of work?		
Does the contractor have a preventive maintenance program for the contractor's equipment?		
Does the contractor implement an Injury and Illness Prevention Program (IIPP)? Does the contractor propose to hold safety meetings and tailgates? Will safety inspections be performed?		
Does the submittal include safety and health training requirements and a plan for meeting them?		

<sup>1</sup> Statistical performance can be based on OSHA recordable Injury and Illness Rates or Lost Time Injury Rates and/or the Workman's Compensation Insurance Experience Modification Rates (EMRs) which are available from insurance carriers reflecting a company's recent past experience as an insured risk. OSHA recordable figures can be compared with workforce averages for comparable industries kept by the National Safety Council or the Bureau of Labor Statistics. EMRs of less than or greater than 1.0 will indicate better than or worse than average accident rates, respectively.

Table 8.2

Contractor Performance Monitoring Form

Question	Response
Are all contract employees trained/instructed in (1) the safe work practices necessary to safely perform their jobs, (2) the known potential fire, explosion, or toxic release hazards related to the job and the process, and (3) the applicable provisions of the emergency response plan?	
Does the contract employer maintain records to document that each contract employee has received and understood the required training?	
Has the contractor appointed a site safety representative?	
Are all contract employees following the safety rules and safe work practices of the facility?	
Did all contract employees attend the safety training meetings and safety briefings held prior to contract initiation?	
Does the contractor hold routine safety meetings for contract employees?	
Is the contractor thorough in preplanning each job/task with regard to safety?	
Has the contractor provided and assured the proper use of safety equipment and PPE?	
Have there been any work-related accidents or incidents that have resulted in contract employee injuries or property damage?	
Does the contractor maintain a contract employee injury and illness log related to work in the process area?	
Does the information in the contractor log match records maintained by the District?	
Has the contractor advised the District of any unique hazards presented by the contractor's work, or of any hazards found by contract employees during the course of their work?	
Does the contractor correct safety and health problems in a prompt and effective manner?	
Has there been any occasion when contract work has been suspended because of obvious and imminent threat to the safety and health of employees?	

## 9. PRE-STARTUP SAFETY REVIEWS

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### 9.1 Policy

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A Pre-Startup Safety Review (PSSR) shall be conducted prior to the startup of any new or modified facility. Definitions for new facility and modified facility are included in Section 2 of this manual.

### 9.2 Purpose

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This policy is intended to ensure that safety and health considerations are properly addressed prior to activation of a new or modified facility and to minimize the potential for catastrophic incidents.

### 9.3 Regulatory Requirements

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Cal-OSHA (8 CCR 5189 (i)):

- (1) *The employer shall perform a pre-startup safety review for new facilities and for modified facilities for which the modification necessitates a change in the process safety information.*
- (2) *The pre-start up safety review shall confirm that prior to the introduction of acutely hazardous, flammable and explosive materials to a process:*
  - (A) *Construction and/or equipment are in accordance with design specifications;*
  - (B) *Safety, operating, maintenance, and emergency procedures are in place and are adequate;*
  - (C) *For new facilities, a process hazard analysis has been performed and recommendations have been resolved or implemented before start-up; and modified facilities meet the requirements contained in subsection (1)); and*
  - (D) *Training of each operating employee and maintenance worker has been completed.*
- (3) *The Pre-start Up Safety Review shall involve employees with expertise in process operations and engineering. The employees will be selected based on their experience and understanding of the process systems being evaluated.*

The federal OSHA PSM standard differs from the Cal-OSHA PSM standard in the following ways:

- Training must be provided for “each employee involved in the process” whereas the Cal-OSHA requirement is for “each operating employee and maintenance worker.”
- There is no requirement that the PSSR involve employees with expertise in process operations who are selected for their experience and understanding of the process systems being evaluated.

#### 9.4 Scope

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This standard applies to all new or modified facilities involving processes covered by the PSM requirements.

#### 9.5 Schedule

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The PSSR checklists are to be used for the startup of new facilities, and for the startup of modified facilities when the modification requires a change in the PSI. The checklists should also be reviewed and updated with any change in PSI to ensure all aspects of a safe start-up are addressed.

#### 9.6 Documentation Requirements

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For each startup affected by this element, the following documentation will be maintained:

1. A brief report based on the PSSR checklist (Table 9.1) which identifies the facility, the new or modified section of the facility that is under review, names of the review team or individual reviewer, a concise statement of the PSSR findings, a listing of recommendations and resolutions (if any), and sign offs indicating completion of recommendations.

#### 9.7 Responsibilities

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The responsibilities for implementing the pre-startup safety review element of the PSM program are outlined below.

<b>WATER TREATMENT SUPERINTENDENT</b>	<ul style="list-style-type: none"><li>• Determine if a PSSR is required.</li><li>• Assign personnel to the PSSR team.</li><li>• Assign PSSR team leader.</li><li>• Confirm that the PSSR has been completed in an appropriate manner.</li><li>• Confirm action items identified by the PSSR have been resolved prior to startup.</li><li>• Approve the PSSR and associated documentation.</li></ul>
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WATER TREATMENT SUPERVISOR	<ul style="list-style-type: none"> <li>• Notify the Superintendent of any changes to equipment, facilities, or process prior to startup.</li> <li>• Receive notification from the Superintendent that a PSSR needs to be conducted or is not required prior to startup of a new or modified facility.</li> </ul>
PSSR TEAM LEADER OR INDIVIDUAL REVIEWER	<ul style="list-style-type: none"> <li>• Ensure proper review activities are accomplished.</li> <li>• Coordinate the overall PSSR activities.</li> <li>• Confirm information pertinent to the facility or modifications under review has been developed (completing detailed check sheets where appropriate, etc.).</li> <li>• Communicate action items identified by the review to affected parties (after review of those items with the Superintendent).</li> <li>• Ensure appropriate documentation has been completed and filed.</li> </ul>
TEAM MEMBERS OR INDIVIDUAL REVIEWERS	<ul style="list-style-type: none"> <li>• Conduct a thorough review of the facilities/changes utilizing their best knowledge and experience, and develop information and/or checklists as appropriate.</li> </ul>
PSM COMMITTEE	<ul style="list-style-type: none"> <li>• Provide timely guidance and recommendations to the Superintendent and/or reviewers as required.</li> <li>• Verify the review meets Process Safety Management (PSM) requirements.</li> </ul>

## 9.8 Procedures

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### 9.8.1 Method

The pre-startup safety review process is instituted through a checklist method that is reviewed by a PSSR team. The checklists that have been developed must be signed off before introduction of the hazardous material into the process system. Pre-startup checklists are divided into the following areas:

1. Documentation
2. Rotating Equipment
3. Training
4. Design and Operations Review
5. Startup Preparation
6. Inspections & Testing

Each PSSR team will be established as follows:

- Appointed by the Treatment Superintendent.
- Will vary with the size and complexity of the facility or modification.
- Should include at least one person knowledgeable in PSM principles and one person with explicit knowledge of the type of facilities equipment, and/or process being addressed. Team members should be knowledgeable in the area(s) they are assigned to review.
- May be one (or more) individual reviewer(s) for very small facilities or non-complex modifications but should be knowledgeable in all involved areas.
- Led by Superintendent for appropriate situations.

The PSSR Team will conduct an equipment walkdown and review using the PSSR checklists.

#### 9.8.2 Documentation System

- The SD-1 PSSR checklist will be completed and stored at SD-1 for the life of the process.
- A PSSR Report will be prepared to summarize the results of the PSSR.
- Process Safety Information will be compiled prior to startup.

Table 9.1

Pre-Startup Safety Review Checklist

Project \_\_\_\_\_ MOC # (if applicable) \_\_\_\_\_

		Yes/No/ NA	Sign- Off	Comment
<b>1.0</b>	<b><i>Documentation</i></b>			
1.1	PSI has been developed and is available. (includes up-to-date P&ID)			
1.2	Vendor data are available for all equipment and appropriate checklists from vendors are followed.			
1.3	Written preventative maintenance procedures are available for all process equipment.			
1.4	Documentation has been reviewed to ensure that equipment has been installed correctly. Installation has been checked by a third party.			
1.5	PHA has been conducted.			
1.6	All PHA recommendations have been implemented or addressed.			
1.7	Written operating procedures have been prepared for: Initial startup Normal operations Temporary operations Emergency operations Emergency shutdown Normal shutdown Startup			
1.8	Environmental issues have been resolved and all permits acquired.			
1.9	Emergency response plan been revised.			
1.10	MOC requirements have been met.			

Table 9.1

Pre-Startup Safety Review Checklist (cont)

		Yes/No/ NA	Sign- Off	Comment
<b>2.0.</b>	<b><i>Rotating equipment</i></b>			
2.1.	Supports for rotating equipment have been set up properly.			
2.2.	Motor rotation has been checked.			
2.3.	Torque specifications for flanges of pumps have been met.			
2.4.	Rotating equipment guards have been installed.			
<b>3.0.</b>	<b><i>Training</i></b>			
3.1.	Operators have been trained on all elements of the operations manual.			
3.2.	Unit hazards have been reviewed with all affected personnel and contractors.			
3.3.	Maintenance personnel have been trained on PM procedures.			
3.4.	Contractor personnel have received appropriate training.			

Table 9.1

Pre-Startup Safety Review Checklist (cont)

		Yes/No/ NA	Sign- Off	Comment
<b>4.0.</b>	<b><i>Design and Operation Review</i></b>			
4.1.	Setpoints for pressure relief, alarms, detectors and shutdown systems have been checked with process parameters.			
4.2.	Piping systems have been reviewed from the standpoint of isolation.			
4.3.	Controls and equipment layouts have been reviewed.			
4.4.	Critical equipment and instruments are accessible in emergencies.			
4.5.	Access/egress routes are available for all process areas.			
4.6.	Vents and drains have been routed to safe locations.			
4.7.	Detection systems have been properly located.			
4.8.	Interlocks and interlock bypass systems have been reviewed with potential emergency actions.			
4.9.	Construction meets design codes and specifications.			
4.10.	Electrical classification areas comply with design drawings.			
4.11.	Ventilation systems are operative.			

Table 9.1

Pre-Startup Safety Review Checklist (cont)

		Yes/No/ NA	Sign- Off	Comment
<b>5.0.</b>	<b><i>Startup Preparation</i></b>			
5.1.	Emergency equipment is in place: (fire extinguishers, foam systems).			
5.2.	Breathing air is accessible in an emergency (i.e.; not in hot zone).			
5.3.	Safety equipment is available (gloves, protective suits, breathing air, respirators, etc).			
5.4.	Scrubber systems have been tested and interlocked.			
5.5.	Gas and fire detection systems have been tested and in service.			
5.6.	Have all defeating systems on safety systems been removed.			
5.7.	Appropriate piping system preparations been conducted: valves stroked valves lubed plugs installed packing adjusted piping purged leak checked free of moisture			
5.8.	Vessels and piping have been pressure tested.			
5.9.	Valves are properly lined up.			

Table 9.1

Pre-Startup Safety Review Checklist (cont)

6.0.	<i>Inspections &amp; Testing</i>	Yes/No/ NA	Sign- Off	Comment
6.1.	Filters, screens, and strainers have been checked.			
6.2.	Vents and drains are unplugged.			
6.3.	Piping and vessels have been examined for damage.			
6.4.	Valves have been checked for proper flow orientation.			
6.5.	Pressure relief valve set points have been tested or verified.			
6.6.	Instrument air has been checked.			
6.7.	Areas have emergency/sufficient lighting during of loss of power.			
6.8.	All systems have been inspected by maintenance			
6.9.	Maintenance procedures are adequate to ensure the integrity of the process.			
6.10.	Electrical system has been tested.			
6.11.	Detector and interlock systems have been tested.			

Checklist Sign Off \_\_\_\_\_

Date: \_\_\_\_\_

## 10. MECHANICAL INTEGRITY

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### 10.1 Policy

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All mechanical equipment used to contain, handle or process AHMs (Regulated Substances) will be designed, installed and maintained in accordance with recognized codes, standards, and good engineering practices such that the equipment is fit for the service intended and that the potential for a release of a AHM is minimized.

### 10.2 Purpose

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The primary objective of a Process Safety Management (PSM) program is to prevent catastrophic releases of AHMs (Regulated Substances). The purpose of the Mechanical Integrity element is to verify the integrity of the new equipment used for the PSM-covered process and the installation of such equipment, and to maintain this equipment in a manner that minimizes the potential for a release.

### 10.3 Regulatory Requirements

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Cal-OSHA (8 CCR 5189 (j)):

(1) *Written procedures.*

(A) *The employer shall establish and implement written procedures to maintain the ongoing integrity of process equipment and appurtenances. These procedures shall include a method:*

1. *for allowing employees to identify and report potentially faulty or unsafe equipment; and*
2. *to record their observations and suggestions in writing.*

(B) *The employer shall respond regarding the disposition of the employee's concerns contained in the report(s) in a timely manner.*

(C) *The employer shall provide employees and their representatives access to the information required in subsection (j) (1).*

(2) *Inspection and testing*

(A) *Inspections and tests shall be performed on process equipment.*

(B) *Inspection and testing procedures shall follow recognized and generally accepted good engineering practices.*

(C) *The frequency of inspections and tests shall be consistent with applicable manufacturers' recommendations and good engineering practices, and more frequently if determined to be necessary as dictated by operating history.*

(D) *The employer shall have a certification record that each inspection and test has been performed in accordance with this subsection. The certification shall identify*

*the date of the inspection, the name of the person who performed the inspection and test, and the serial number or other identifier of the equipment.*

- (3) *Equipment deficiencies. The employer shall correct deficiencies in equipment which are outside acceptable limits defined by the process safety information in subsection (d) before further use, or in a safe and timely manner provided means are taken to assure safe operation.*
- (4) *Quality assurance*
  - (A) *The employer shall assure that in the construction of new plants and equipment modified, repaired, or fabricated, equipment suitable for the process application for which they will be used.*
  - (B) *Appropriate checks and inspections shall be performed to assure that equipment is installed properly and is consistent with design specifications and the manufacturer's instructions.*
  - (C) *The employer shall assure that maintenance materials, spare parts and equipment meet design specifications and applicable codes.*

The federal OSHA PSM standard differs from the Cal-OSHA PSM standard in the following ways:

- This section applies to specific equipment: pressure vessels and storage tanks, piping systems, relief and vent systems and devices, emergency shutdown systems, controls, and pumps.
- There is no requirement for written procedures for allowing employees to identify and report potentially faulty or unsafe equipment and to record their observations and suggestions in writing.
- Maintenance materials must be “suitable for the process application” which is less specific than the state requirement that materials meet “design specifications and applicable codes.”
- Each inspection and test must be “documented,” as opposed to being “certified.”

#### 10.4 Scope

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This policy applies to all equipment used in PSM-covered processes, including control systems and safety equipment. It covers the standards required for written preventive maintenance procedures, equipment inspections and testing, procedures for managing deficient equipment, and quality assurance for new materials, new construction, and materials used in maintenance. Each PSM affected facility will maintain a list of critical equipment covered by this element, and the programs for maintaining the equipment and conducting inspections and testing.

There are six separate, related, and yet distinct issues to the mechanical integrity element:

- PSM-Covered Equipment Identification

- Inspection and Testing Programs
- Maintenance Procedures
- Training of Maintenance Personnel
- Deficient Equipment Resolution Procedures
- Quality Assurance

These issues are addressed below.

#### 10.4.1 PSM Covered Equipment Identification

All equipment in PSM-affected processes will be reviewed to determine whether it is affected by the Mechanical Integrity element of the PSM Regulation. Equipment within the boundaries of a PSM-affected process is determined to be PSM covered equipment if it meets either of the following criteria:

- The equipment is in contact with, or acting to physically contain, the AHM (Regulated Substance). This would include vessels, tanks, valves, filters, and all piping system components.
- The equipment or system is identified as a safety system, i.e. serving to prevent or control any release of AHM (Regulated Substance) that does occur. This would include systems such as gas detection, relief systems, alarms, interlocks, scrubbers, etc.

#### 10.4.2 PSM Covered Equipment Inspection and Testing Program

The PSM standard requires that PSM-covered process equipment be inspected and tested to assure the ongoing integrity of this equipment. The standard specifically indicates that PSM-covered equipment will be inspected at a frequency in accordance with equipment manufacturer's recommendations "and good engineering practices, and more frequently if [determined to be necessary] ..." This requirement has been interpreted to mean that equipment must be inspected or tested at a frequency suggested by the manufacturer or at a lower frequency if justified by using sound maintenance engineering techniques, or at a higher frequency of historical testing data indicate such a need.

Written procedures will be developed for all inspection and testing activities necessary to meet the PSM Regulations. Separate written procedures should be developed for each of the following inspection and/or testing activities:

- Testing of relief systems
- Piping Inspection
- Safety Systems Testing (Interlocks, Gas Detectors, HVACs, Chlorine Scrubber)

Written inspection and/or testing procedures should contain the following information:

- Scope of the procedure - to which equipment does the procedure apply?

- Basis - what is the regulatory, industry standard, company policy, etc., which serves as the basis for the procedures?
- References - information supporting the inspection and/or testing procedure.
- Inspection and/or testing methodologies.
- Inspection and/or testing frequencies - basis for determining and modifying frequency.
- Administration - details for how actual inspection and/or testing activity will take place.
- Consistency - information pertaining to how the procedure will be consistently applied to the equipment from a methodology and frequency standpoint.
- Documentation - details associated with the hard copy of electronic documentation of the inspection and/or testing results for the life of the process, including the minimum required by the regulations.

Inspection and maintenance practices, if any, to maintain the integrity of structural components will be implemented as required from action items developed from the most current seismic study.

#### 10.4.3 PSM Covered Equipment Maintenance Procedures

The PSM regulations require written procedures to be in place for maintaining the ongoing integrity of PSM-covered equipment. These procedures are in addition to the procedures required for inspection and testing (Section 10.4.2), and include such activities as preventive maintenance (PM) and repair. The requirements and guidelines below will be used to review and modify, upgrade or develop maintenance procedures for PSM-covered equipment.

In the process of developing maintenance procedures to meet the requirements of the PSM regulations, vendor information and/or good maintenance practices shall be the basis for procedures utilized for performance of maintenance activities. The following guidelines will also be considered:

- Establishment of PSM maintenance procedures should make maximum use of procedures that currently exist in our facility equipment files, PM program, and inspection and testing programs.
- Procedures that require development should make maximum use of available vendor maintenance procedures, manuals, and other information. New procedures should be developed only on equipment for which vendor maintenance information is not obtainable.
- Procedures should be suitably written for use by a qualified maintenance technician.

- Wherever practical, maintenance procedures should utilize a “generic approach”. That is, generic procedures should be developed to address maintenance activity for identical or similar equipment.

Maintenance procedures in PM activities intended to meet the PSM requirements should consider the following issues:

- Safety information unique to the task (that is, serious potential hazards that SWPs to be used).
- Special skills necessary to perform the work tasks.
- Special tools required to do the job.
- Work steps necessary to perform the job tasks.
- Documentation requirements.

Inspection and maintenance practices to maintain the integrity of structural components will be implemented as required from action items developed from the most current seismic study.

#### 10.4.4 PSM Maintenance Training

The PSM regulations require that the people who work in or on PSM-affected facilities or processes be trained to perform their responsibilities in a safe manner. The training required specifically for maintenance workers is addressed in Section 7.

#### 10.4.5 Deficient Equipment Resolution Procedures

Maintenance, inspection and test procedures conducted as part of Mechanical Integrity activities will occasionally reveal equipment deficiencies (in the chlorine systems). When PSM-covered equipment is found to be incapable of operating within its safe allowable limits, it will be designated as “Deficient Equipment.” Similarly, a safety system or safety equipment may become inoperable and placed out of service as Out of Service Safety Equipment (OSSE). To address deficient equipment, one of the following options must be followed:

- Repair the equipment deficiency before it is placed back in service; or
- Take necessary means (through administrative procedures) to assure safe operation of the equipment until the deficiency can be corrected.

Examples of deficient equipment are:

- Ultrasonic testing reveals that the evaporator bath wall thickness has decreased to the point where it cannot be operated at its design pressure.
- Maintenance PM efforts indicate a pressure sensor is not functioning properly, repair of the sensor is not possible, and this sensor is involved in a safety interlock circuit.

An OSSE procedure is required to authorize, record and monitor all safety equipment that is out of service. An OSSE Log will be utilized and to ensure that the potential impact to process safety as well as personal safety and health is acceptable. The OSSE Log, maintained in the facility control room, will specify the date, time, equipment item number, reason for equipment being out-of-service, impact to process safety, and an authorizing signature for allowing operations to continue with the OSSE.

#### 10.4.6 PSM Quality Assurance

The PSM regulations require that written quality assurance procedures be developed to perform quality verifications on equipment fabrication, installation, inspection, testing and maintenance of PSM-covered equipment and associated materials and spare parts.

#### 10.5 Schedule

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The Mechanical Integrity program will be implemented for all covered processes whenever activities occur involving maintenance, inspection and testing, for facility modification and for new PSM-covered facilities. Formal schedules for maintenance and for equipment inspection and testing programs will be developed and documented.

#### 10.6 Documentation

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The following documentation will be maintained for each covered process:

1. Listing of equipment covered under the PSM Mechanical Integrity program.
2. Documented PM program with frequencies, schedules and PM records.
3. Documented Inspection/Testing program with IT results.
4. Description of operating tolerances which determine acceptability of test results.
5. Certification of outside laboratories providing Mechanical Integrity inspection and testing services.
6. Written procedures for PM/IT.
7. Current log of deficient equipment and defeated safety devices.
8. Quality assurance procedures.

## 10.7 Responsibilities

The responsibilities for implementing the mechanical integrity element of the PSM program are outlined below.

<p>MAINTENANCE SUPERINTENDENT</p>	<ul style="list-style-type: none"> <li>• Develop and maintain a list of PSM-covered equipment.</li> <li>• Develop and maintain the procedures for PM/IT activities for the chlorine systems.</li> <li>• Ensure that all maintenance is done in accordance with written procedures and Safe Work Practices.</li> <li>• Develop and maintain the procedures for PM/IT activities for the chlorine systems.</li> <li>• Document the basis used for determining the frequencies used for PM/IT activities.</li> <li>• Schedule PM/IT activities at the designated intervals.</li> <li>• Provide training to maintenance employees to ensure they have the necessary knowledge and skills to perform the required tasks.</li> </ul>
<p><b>MAINTENANCE STAFF</b></p>	<ul style="list-style-type: none"> <li>• Conduct maintenance in accordance with written PM/IT procedures.</li> <li>• Document the results of maintenance activities.</li> </ul>
<p>WATER TREATMENT SUPERINTENDENT</p>	<ul style="list-style-type: none"> <li>• Ensure that all maintenance work conducted by contract employees is done in a safe manner in accordance with contract conditions and Water Treatment Section Safe Work Practices.</li> </ul>
<p><b>PLANT OPERATORS</b></p>	<ul style="list-style-type: none"> <li>• Provide information to maintenance personnel regarding equipment to be serviced.</li> <li>• Isolate the process equipment prior to any maintenance activities.</li> </ul>
<p>ENGINEERING AND CONSTRUCTION DEPARTMENT DIRECTORS</p>	<ul style="list-style-type: none"> <li>• Assure that new or modified facilities are manufactured, fabricated and installed in a way that is suitable for the process.</li> <li>• Provide Construction Inspectors to oversee construction work involving new or modified facilities for the chlorine processes.</li> <li>• Ensure that all new contracts for the chlorine systems include provisions to ensure that contractors perform work in accordance with the bidding documents and contract specifications.</li> </ul>
<p>PURCHASING DEPARTMENT</p>	<ul style="list-style-type: none"> <li>• Order manufacturer approved parts for the chlorine systems.</li> </ul>

### 10.8.1 PSM Covered Equipment

The Randall-Bold Water Treatment Plant Mechanical Integrity program consists of Preventive Maintenance and Inspection and Testing (PM/IT). PSM-covered equipment for the chlorine system is listed in Table 10.1. Included in this table are the details of the PM/IT activities applicable to the equipment listed. Also included in the table are the frequencies for performing PM/IT activities and the basis for setting these frequencies for each item.

### 10.8.2 PSM Covered Equipment Maintenance Procedures

Written procedures are being developed for all PM/IT activities for covered processes. All maintenance procedures will address the following issues:

- Safety information unique to the task (that is, serious potential hazards that require Safe Work Practices to be used).
- Special skills necessary to perform the work tasks.
- Special tools required to do the job.
- Work steps necessary to perform the job tasks.

#### 10.8.2.1 Existing Equipment

Maintenance procedures for existing equipment address the following activities:

- Chlorinator rebuild
- VRCU rebuild
- Detector gas test
- Piping and pigtail inspections

Equipment to be added to the PM program:

- Piping (gas vacuum) replacement schedule
- Ventilation system (operation and flow)
- Leak alarm circuits and alarm annunciators (verify weekly)

Develop a complete Emergency Shut Down (ESD) testing program (detector response):

- Determine and document frequency
- Initiation by all chlorine detectors
- Check alarm annunciators
- Verify HVAC system response

An example of a written maintenance procedure (for chlorinator servicing) is included as Attachment 10-1. Any changes to the procedures or the maintenance frequencies are effected through the Management of Change (MOC) system.

#### 10.8.2.2 *New Equipment*

For new or modified equipment, the following procedure will be used to establish the PM/IT program.

1. Each new or modified item of equipment must be provided with a detailed Operation and Maintenance Manual.
2. The O&M manual will be reviewed by maintenance staff, and a Maintenance Summary Form will be drafted to summarize the manufacturer's maintenance procedures and recommendations for Preventive Maintenance and Inspection and Testing (PM/IT) frequencies.
3. A Maintenance Review Team will be established to review the information on the Maintenance Summary Form.
4. The Review Team will proceed as follows:
  - Review the adequacy of the manufacturer's maintenance procedures for compliance with PSM requirements;
  - Develop a PM Work Order form that includes the PM procedure with precautionary notes, required work permits, and supervisory requirements;
  - Identify the "skill level" requirements of the PM/IT procedure;
  - Review the manufacturer's recommended PM/IT frequencies and compare them with available historical data to establish plant-specific PM/IT frequencies;
  - Establish the man-hour and budgetary requirements are reviewed and confirmed; and
  - Identify additional training requirements.
5. The information developed by the review team is recorded and PM/IT activities are scheduled.

6. On an annual basis, the PM/IT procedures are reviewed to determine any changes in the type of maintenance, the PM/IT frequency, and/or the need for further training. Changes deemed necessary are incorporated into the maintenance schedules with justifications. A notice is circulated to all affected employees.
7. The agreements reached at all Maintenance Review Team meetings are to be recorded and maintained on file by the Maintenance Division.

### 10.8.3 PSM Maintenance Training

The training programs for maintenance workers are addressed above in Section 7.

### 10.8.4 PSM Covered Deficiency Equipment Resolution System

The procedures for resolving deficient equipment and Out-Of Service Safety Equipment (OSSE) are outlined below.

#### 10.8.4.1 *Deficient Equipment*

To address deficient equipment, one of the following options must be followed:

- Repair the equipment deficiency before it is placed back in service; or
- Take necessary means (through administrative procedures) to assure safe operation of the equipment until the deficiency can be corrected.

At any time equipment is identified as being deficient, immediate action will be taken to repair or replace it. If this cannot be achieved, the process will be shut down. If administrative procedures are established to accept the deficiency permanently, the Management of Change process is initiated to document the revised operating conditions.

#### 10.8.4.2 *Out-Of-Service Safety Equipment*

1. The OSSE Logs will be maintained in the Plant Control Room.
2. Any new OSSE will be tagged to identify the equipment number, the equipment deficiency, the operator's name, and the date.
3. Operators who identify OSSE will notify the Water Treatment Supervisor.
4. The Water Treatment Supervisor will be responsible for operating the chlorine system with OSSE.
5. The Water Treatment Supervisor will ensure that the potential impact to process safety as well as personal safety and health is acceptable.
6. The OSSE will be recorded in the OSSE Log.
7. Any persons doing work on OSSE will be informed of its status.
8. All OSSE shall be returned to operational condition as soon as possible.

9. The OSSE log will be annotated to document the time when the OSSE is returned to service.
10. The OSSE Log will be reviewed by the operators and the Water Treatment Supervisor at the beginning of each shift. If it shows any safety equipment out-of-service, the OSSE Log will be initialed by the operators and the Water Treatment Supervisor to indicate awareness of the OSSE.
11. For extended operations with OSSE, the OSSE Log will be signed as follows:
  - For equipment that is out-of-service for 30 days, the Water Treatment Supervisor's signature will be required on the OSSE log and every 30 days thereafter.
  - For equipment that is out-of-service for 60 days, the Water Treatment Superintendent's signature will be required on the OSSE log and every 30 days thereafter.
  - For equipment that is out-of-service for 90 days, the Operations Division Manager's signature will be required on the OSSE log and every 30 days thereafter.

## 10.8.5 PSM Quality Assurance

### 10.8.5.1 *New/Modified Facilities*

Assurance that fabricated equipment is suitable for the chlorine process is obtained through contractor oversight and field inspections. Field engineers and construction inspectors verify that work is done in accordance with plans and specifications. Both manufacturer inspection and O&M Manuals are required prior to equipment start-up. (Refer to Pre-Start-up Checklist).

During the construction process, work in the area is immediately stopped if the construction inspector identifies an imminent hazard. The contractor is required (verbally) to correct the problem. If no action is taken, a written notification is issued. If the contractor still fails to respond, notifications are made to OSHA and the contractor's bonding company.

The bidding documents and specifications package provides the written requirements for quality assurance for construction and installation of process facilities. Requirements included in this package are summarized below:

- Contractor and subcontractor licenses required for duration of contract (submitted with bid package).
- Contractors must have necessary experience.
- Contractor is responsible for safety of all job site personnel and property.
- Contract Engineer may suspend operations if an imminent safety hazard exists.

- Conditions for material and workmanship require all work to be done in a thorough, workman-like manner, guaranteed by the Contractor.
- All materials furnished will be the best of their class.
- None but skilled foremen and workmen shall be employed on work requiring special qualifications.
- No contract may proceed until it is properly executed, bonding and insurance requirements are met.
- Contractors duties include requirement to comply with codes, ordinances, rules, regulations, orders, and other legal requirements of public authorities which bear on performance of work.
- Contractor shall develop and maintain a construction safety program and maintain safety equipment applicable to the work.
- All injuries requiring medical treatment are to be reported to the Engineer.
- Payments will not be made until installation instructions and O&M Manuals have been submitted, reviewed and accepted.
- Manufacturers' certificates of proper installation are required from the Contractor.
- Adequate security precautions are required.
- Prior to startup, the Contractor will demonstrate that all equipment will operate in the intended manner, all safety and emergency equipment is in place and fully ready for operation, all safety hazards have been corrected, and a comprehensive safety inspection will be performed.
- Piping systems are to be hydrostatically tested, valve packing has to be provided to all valves, and identification labels are installed.
- All equipment and piping is anchored to resist seismic forces in accordance with the District's Seismic Design requirements.

#### *10.8.5.2 Replacement Equipment And Parts*

Only specific vendor equipment and parts may be ordered for the chlorine systems. The purchasing procedure requires that specific part numbers are required and all parts must be manufacturers' recommended parts. Parts are inspected upon receipt by maintenance personnel. Once accepted, the parts are placed in the storage bins.

#### **10.8.5.3 *Materials And Chemicals***

Quality assurance procedures for the one-ton containers used to transport chlorine to the water treatment plants are defined in the DOT regulations and the Chlorine Institute's *Chlorine Manual*. The inspections must include testing for hydrostatic pressure, and fusible plugs. This is done by the chlorine packager. Chemical quality is assured through contract specifications that include requirements for material purity and grade.

#### **10.8.5.4 *Maintenance Services***

Outside companies used to conduct Mechanical Integrity (MI) chlorine system maintenance at the Water Treatment Plants are required to verify that they are certified to perform the services that they are contracted to perform (Attachment 10-2).

Table 10.1

Covered Equipment for Mechanical Integrity (Randall- Bold Plant)

Desig.	Name	Install Date	Inspection Frequency	Basis for Inspection Frequency	Test Type
	Vacuum Relief Valve (built into chlorinator)	1992	Semi-Annual	Operating experience	Visual
FD-918	Chlorinator	1992	Semi-Annual Annual	Operating experience	Visual Rebuild
FD-919	Chlorinator	1992	Semi-Annual Annual	Operating experience	Visual Rebuild
	Chlorinator	2003	Semi-Annual Annual	Operating experience	Visual Rebuild
	Injector Direct Flash Mix	1992	Annual	Operating experience	Visual
	Injector Inline Flash Mix	1992	Annual	Operating experience	Visual
	Injector Post Ozone	1992	Annual	Operating experience	Visual
	Chlorine Detector (Storage Room)	1992	Weekly	Operating experience	Gas
	Chlorine Detector (Chlorination Room)	1992	Weekly	Operating experience	Gas
	Vacuum Regulator (built in to ozone generator)	1992	Annual	Operating experience	Visual
	Check Valve (2)	1992	Annual	Operating experience	Rebuild
	Chlorine Shut Off Valves (two)	1999	Annual	Operating experience	Visual

Required Supplies

- Clean cup
- Pair of tweezers
- 1,1,1-trichloroethane

**WARNING:** DO NOT USE HYDROCARBONS OR ALCOHOLS BECAUSE RESIDUAL SOLVENT MAY REACT WITH CHLORINE. CHLORINATED SOLVENTS CAN PRODUCE SERIOUS PHYSIOLOGICAL EFFECTS UNLESS USED IN STRICTEST COMPLIANCE WITH THE SOLVENT MANUFACTURER'S SAFETY RECOMMENDATIONS.

**SHUTDOWN PROCEDURES - ROTAMETER/V-NOTCH PLUG CLEANING**

1. If continual operation is required, start a standby unit, if available.
2. Close the chlorinator gas supply valves.
3. Turn the knob on the vacuum regulator(s) to OFF. After the supply vacuum gauge reads 58 to 66 inches H<sub>2</sub>O and the rotameter float rests on the bottom stop, turn off the injector operating water.
4. Remove rotameter. Take care not to lose the end stops, the float or any of the O-rings.
5. Place the end stops and float into the cup mentioned above.
6. Many chlorine contaminants are soluble in water. Hold the tube end under running warm (110-125°F) water so that the water enters the tube at one end and exits at the other to flush out deposits. Alternately, soak the tube in a container of warm water for about 30 seconds. Then hold the tube, half full with water with palms capping the ends and shake vigorously endwise for a few seconds. Discharge the water and repeat until clean. A common pipe cleaner may be used to scrub the interior. A detergent will promote cleaning action.
7. If water does not remove the deposits in two or three applications, use 1,1,1-trichloroethane.
8. Alternately, soak the tube in a container of solvent for about 30 seconds. Then hold the tube (half full of solvent) with stoppers capping the ends and shake vigorously endwise for a few seconds. Discharge the solvent and repeat until clean. Flush or soak in warm water.

## Attachment 10-1

### Example Maintenance Procedure - Chlorinator Cleaning (cont)

---

9. Drain and let dry. Do not use a pipe cleaner as a drying tool because the lint from it will stick to the tube interior. Place the tube at an angle between a horizontal and a vertical surface (as between a shelf and a wall) with both ends open so air can flow through. Drying will be hastened by heat, as from a light bulb nearby. Do not blow through the tube as moisture from the breath will condense on the tube walls.
10. To clean the float pour about an inch of warm to hot (130-150°F) water into the cup containing the float. Grasp the float with tweezers and shake it side to side while submerged for a few seconds. Release the float and pick it up again and repeat the action several times so all surfaces are washed. Hold the float with the tweezers, discard the wash water and repeat the above. A few drops of detergent will improve the process. Do not use your fingers to hold the float. If non-water-soluble deposits are on the float, use 1,1,1-trichloroethane.
11. Repeat the cleaning process using solvent in place of water. Allow the float to dry on a clean surface and then, with tweezers, place it in a clean dry cup.

**NOTE:** Do not attempt to dry the float with a rag or paper towel as electrostatic forces will make lint and other particles stick to the float.

12. Clean stops with water, or 1,1,1-trichloroethane and dry thoroughly before reassembly.
13. When tube, float and stops are clean and dry, wipe a thin film of silicone grease on the bottom O-ring and proceed with reassembly as described in INSTALLATION. Proceed to CLEANING V-NOTCH PLUG.

#### **V-NOTCH PLUG**

14. Remove the V-notch assembly completely from the control module.
15. Using running water or a cup full of water and a small, stiff brush (such as an old tooth brush), scrub out the V-notch groove and the shank of the plug. If a solvent is required to loosen the deposit, use 1,1,1-trichloroethane.
16. Do not soak the plug in solvent. Merely dip it, immediately withdraw it and scrub out the groove. Do not use a knife, a scraper or a file to clean out the groove. Dissolving action and scrubbing are all that is required.
17. Dry the plug with a clean cloth or paper towel.
18. Remove seal clamping screw and the extension chamber. Clean and inspect orifice and O-ring and replace if necessary.
19. Wipe a thin film of silicone grease on the gaskets of the V-notch assembly. Reinstall it in the control module and resume operation.

## CERTIFICATION FORM FOR ANALYTICAL TESTING

File Reference #: \_\_\_\_\_

Maintenance Task: \_\_\_\_\_ Date: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Contractor: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Certification/Expiration: \_\_\_\_\_

STAMP  
HERE

\_\_\_\_\_

Signature/Date

File: (1) \_\_\_\_\_

(2) \_\_\_\_\_

(3) \_\_\_\_\_

\_\_\_\_\_

Plant Staff

## 11. HOT WORK PERMITS

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### 11.1 Introduction

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The PSM Regulations contain provisions requiring employers to use a hot work permitting system to assure that affected employees are aware of hot work being performed and to make sure appropriate safety precautions are taken prior to beginning the hot work. A Hot Work Permit Program is used to ensure safe performance of hot work activity. The procedures for implementing the Hot Work Permit Program are provided in the following sections.

### 11.2 Purpose/Scope

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Hot Work Permit requirements apply to all hot work conducted on or sufficiently near a PSM-covered process that it could affect the process equipment. Hot work includes electric or gas welding, cutting, brazing or similar flame or spark producing operations.

### 11.3 Objectives

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1. Ensure the work area is inspected and combustibles and flammables are isolated from the hot work.
2. Establish fire watches when applicable.
3. Provide communication with all departments concerned.
4. Control how open flame or spark-producing equipment is used.
5. Formally document all hazardous conditions and special requirements of the work area.

### 11.4 Permit Initiation

---

The Maintenance Crew Leader or Contractor responsible for getting the work done will initiate or authorize the initiation of the permit at the Control Room.

### 11.5 Responsibilities

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#### 11.5.1 Maintenance Crew Leader:

1. Inspect the work area and adjacent areas for a distance at least 35' around the hot work site, including the other side of any wall or barrier, to which sparks or heat might spread.
2. Ensure that only approved equipment (i.e. torches, manifolds, regulators etc.) is used and the area has been properly prepared and is ready for the safe performance of the work.

3. Ensure that lines to be demolished or removed are properly identified and marked.
4. Make necessary tests for flammable and/or other hazardous conditions. No hotwork will be allowed if the gas concentration is above 20% LEL.
5. Show the persons doing the work the locations of the nearest communications equipment and applicable safety devices.
6. Check placement and condition of proper fire extinguishers and other safety equipment.
7. Inform fire watch of potential fire hazards.
8. Review checklist on back of Hot Work Permit.
9. List special precautions as necessary.
10. Sign the permit after the above conditions have been met.
11. Ensure that the hard copy of the permit has been posted at the work location.
12. Prevent an operation from being performed which has the potential to cause the area or equipment to become unsafe while the permit is in effect.
13. Monitor the work as it progresses to ensure that the conditions of the permit are not changing.
14. Stop the work if a change occurs which creates an unsafe condition. Work shall not resume until a safe condition is restored.
15. Inspect and gas check the work area continuously.
16. Advise relief operators of any permit in effect.
17. Inspect the work site after any interruption has occurred prior to resuming work.
18. Immediately after the work is completed, inspect the work area and adjacent areas to determine that they are in a safe condition.

#### 11.5.2 Senior Treatment Plant Operator:

1. Ensure that facility operations, construction or maintenance will not be adversely affected by the proposed work activities.
2. Ensure that the Treatment Plant Supervisor is notified of work to be done, and receive approval.
3. Sign the Hot Work Permit, certifying that the job is ready to proceed.
4. Hold hard copies of the permits until the work is ready to start.
5. Notify the Unit Operator when the permit is closed out.

### 11.5.3 Maintenance Supervisor and Water Treatment Supervisor:

1. Ensure all participants in the Hot Work Permit process have fulfilled their duties and responsibilities.
2. Be satisfied that the proper precautions for hot work have been taken.

### 11.5.4 Person Doing the Work:

1. Read, understand and follow the conditions listed on the Hot Work Permit.
2. Advise other workers of any special precautions or conditions pertaining to the job.
3. Survey the work area to confirm safe work conditions. Know the location of the nearest telephone, fire alarm, emergency communication system, fire extinguisher, safety shower, first aid kit, etc., before starting work, and know how to use them.
4. Confine all sparks and slag as close to the work area as possible.
5. Be constantly aware of conditions in the immediate work area, and be ready to stop work if conditions change. Do not resume work without approval of the Senior Treatment Plant Operator and the Maintenance Crew Leader.
6. Clean up and secure the work area after completion of work each shift. At the end of the shift or upon completion of the work, whichever comes first, return the permit to the Control Room or designated location, and sign the original. If the job is incomplete and the person or crew temporarily leaves the unit, the worker must notify the Senior Treatment Plant Operator and the Maintenance Crew Leader.
7. When any alarm or emergency Announcement is made, stop all work, disconnect all electrical equipment, and secure all gas cylinders. Do not resume any work until notified by the Unit operator.

### 11.5.5 Fire Watch:

1. Observe an area of at least 35' around the hot work site, including the other side of any wall or barrier, and maintain the area free of combustibles and tripping hazards.
2. Have no other duties assigned while on watch.
3. Understand and follow the conditions listed on the Hot Work Permit.
4. Be trained in the use of fire extinguishing equipment provided.
5. Understand the alarms and where and how to activate them.
6. Notify the person doing the work if any sparks are not contained at the work area.

7. Sound the alarm for assistance and extinguish any small fires started by sparks or slag.
8. Remain on the scene from the start until 30 minutes after the completion of all hot work.

#### 11.6 Special Considerations

---

1. Hot work will not be performed on in-service piping or equipment.
2. In areas where flammable vapors may be present, precautions must be taken to prevent ignition by eliminating or controlling sources of ignition. Examples of sources of ignition are motors, switches, tools, (electric or manual) which may give off sparks, generators of static electricity, lighting fixtures, vehicle starting or running, etc.

#### 11.7 Duration of Permits/Permit Close Out / Permit Retention Policy

---

1. Permits will be in effect until job completion or until an inactive period of two hours has elapsed unless test(s) determine the LEL is less than 20%. The permit will not extend beyond the end of the shift in which the permits were issued.
2. Completed hot work permits will be retained by the treatment plant supervisor six months from the date of issue.

Attachment A

Fire-Permit

HOT WORK PERMIT

Before starting this work, check to see if this job can be avoided or if there is a safer way to proceed.

Revised March 2002

This Hot Work Permit is required for any operation involving open flames or excess heat or sparks, including brazing, cutting, grinding, soldering and thawing pipe, torch-applied roofing and welding.

Part 1: For Fire-Safety Supervisor

INSTRUCTIONS:

1. Verify that the required Precautions Checklist is completed.
2. Complete and retain Section 1.
3. Issue Section 2 to the person who will perform the hot-work.

The person doing hot-work is an:

Employee: \_\_\_\_\_

Contractor: \_\_\_\_\_

Date: \_\_\_\_\_

Job

Number: \_\_\_\_\_

Location, Building and room: \_\_\_\_\_

Description of Job: \_\_\_\_\_

Person doing Hot-work: \_\_\_\_\_

I verify that the hot-work location has been examined, the precautions checked on the Required Precautions Checklist (page 2) have been taken to prevent fire, and permission is authorized for this work.

Fire-Safety Supervisor's Signature: \_\_\_\_\_

Permit Expiration date and time: \_\_\_\_\_

## Precautions Checklist

---

### To be filled out by Fire-Safety Supervisor

- ! Check that available sprinklers, hose streams and extinguishers are in service and operable.
- ! Check that hot-work equipment is in good repair and that only approved apparatus (torches, manifolds, regulators, etc.) are used.
- ! Prior to beginning hot work test and document that flammable gas or vapor is in concentration of less than 20% of LEL within 35 feet of hot work area.
- ! Remove flammable liquids, dust, lint and oily deposits from within 35ft of hot-work.
- ! Ducts or conveyors that might carry sparks to distant combustibles are protected or shut down.
- ! Sweep the floors from within 35 ft of hot-work.
- ! Wet down or cover all combustible flooring within 35 ft of hot-work with damp sand or fire-resistant sheets.
- ! Remove any other combustible material within 35 ft or protect with fire-resistant sheets.
- ! Cover all wall or floor openings within 35 ft.
- ! Suspend fire-resistant tarpaulins beneath work.
- ! For any work on floors or ceilings, assure that the construction is noncombustible and free of combustible covering or insulation
- ! For any work on floors or ceilings, assure that combustibles on the other side of the wall are moved away.
- ! For work on enclosed equipment, ensure that the equipment is cleaned out of all combustibles.
- ! For work on enclosed equipment, ensure that the containers are purged of flammable liquids and vapors.
- ! Ensure fire watch will be provided during and for 30 minutes after hot-work.
- ! Ensure fire watch is supplied with suitable extinguishers.
- ! Ensure fire watch is trained in the use of the fire safety equipment and alarms.
- ! Ensure fire watch knows to monitor applicable adjoining areas.
- ! Ensure hot-work area will be monitored for 4 hours after the job is completed.
- ! Ensure hot work permit is canceled due to inactivity of permitted hot work in excess of two hours unless test(s) determine the LEL is less than 20%.

Other precautions taken: \_\_\_\_\_

**WARNING**

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Revised March 2002

**Hot Work in Progress  
Watch for Fire!**

**Part 2: For the Person Doing the Hot-Work, The Fire-Watch and The Monitor**

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**INSTRUCTIONS:**

1. **Person Doing the Hot-Work:** Indicate the time the work is started and post this permit at the hot-work location. Survey the work area to confirm safe work conditions. After completion, indicate the time the hot-work is completed and leave the permit posted for fire-watch.
2. **Fire-Watch:** Before leaving the work area, perform a final inspection, sign the permit and leave it posted and notify the Fire-safety Supervisor.
3. **Monitor:** 4 hours after the work is completed, do a final inspection, sign this form and return it to the Fire-safety Supervisor.

The person doing hot-work is an:  ! Employee  ! Contractor: Name _____  Date: _____  Job Number: _____  Location, Building and room: _____ _____  Description of Job: _____ _____  Person doing hot work: Hot work area is safe to do the work Signature: _____ _____	I verify that the hot-work location has been examined, the precautions checked on the Required Precautions Checklist (page 2) have been taken to prevent fire, and permission is authorized for this work.  Fire-Safety Supervisor's Signature: _____  Time hot-work is started: _____  Time hot-work is finished: _____ _____  Permit Expiration date and time: _____	The work area and all adjacent areas where sparks and heat might have spread were inspected and were determined to be fire-safe.  Fire-Watch Signature: _____  <b>Monitor Sign-off:</b>  The work area was inspected for 4 hours following the hot-work and found to be fire-safe.  Monitor Signature: _____
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## Precautions Checklist

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### Must be retained 6 months as record of Hot-Work Activity

- ! Check that available sprinklers, hose streams and extinguishers are in service and operable.
- ! Prior to beginning hot work test and document that flammable gas or vapor is in concentration of less than 20% of LEL within 35 feet of hot work area.
- ! Check that hot-work equipment is in good repair and that only approved apparatus (torches, manifolds, regulators, etc.) are used.
- ! Remove flammable liquids, dust, lint and oily deposits from within 35 ft of hot-work.
- ! Ducts or conveyors that might carry sparks to distant combustibles are protected or shut down.
- ! Sweep the floors from within 35 ft of hot-work.
- ! Wet down or cover all combustible flooring within 35 ft of hot-work with damp sand or fire-resistant sheets.
- ! Remove any other combustible material within 35 ft or protect with fire-resistant sheets.
- ! Cover all wall or floor openings within 35 ft.
- ! Suspend fire-resistant tarpaulins beneath work.
- ! For any work on floors or ceilings, assure that the construction is noncombustible and free of combustible covering or insulation
- ! For any work on floors or ceilings, assure that combustibles on the other side of the wall are moved away.
- ! For work on enclosed equipment, ensure that the equipment is cleaned out of all combustibles.
- ! For work on enclosed equipment, ensure that the containers are purged of flammable liquids and vapors.
- ! Ensure fire watch will be provided during and for 30 minutes after hot-work.
- ! Ensure fire watch is supplied with suitable extinguishers.
- ! Ensure fire watch is trained in the use of the fire safety equipment and alarms.
- ! Ensure fire watch knows to monitor applicable adjoining areas.
- ! Ensure hot-work area will be monitored for 4 hours after the job is completed.
- ! Ensure hot work permit is canceled due to inactivity of permitted hot work in excess of two hours unless test(s) determine the LEL is less than 20%.

Other precautions taken: \_\_\_\_\_

## 12. MANAGEMENT OF CHANGE (MOC)

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### 12.1 Policy

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All changes that take place at or near to PSM-covered processes will be made in a controlled manner through a Management of Change (MOC) program that incorporates safety reviews and appropriate authorizations. Prior to the start-up of any process which has undergone a MOC all employees and contractors whose job tasks will be affected by the MOC shall be informed of and trained in the change prior to start-up.

### 12.2 Purpose

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This MOC program has been developed to ensure that all permanent and temporary changes to PSM-covered processes maintain or enhance the safety, environmental, mechanical and technical integrity of the intended design. The primary intent of the MOC program is to preclude the occurrence of catastrophic releases that could occur through the improper control of changes.

### 12.3 Regulatory Requirements

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Cal-OSHA (8 CCR 5189 (l)):

- (1) *The employer shall establish and implement written procedures to manage changes (except for "replacements in kind") to process chemicals, technology, and equipment and changes to facilities.*
- (2) *The procedures shall assure that the following are addressed prior to any change:*
  - (A) *The technical basis for the proposed change;*
  - (B) *Impact of change on safety and health;*
  - (C) *Modifications to operating procedures;*
  - (D) *Necessary time period for the change; and,*
  - (E) *Authorization requirements for the proposed change.*
- (3) *Employees involved in the process shall be informed of, and trained in, the change in the process as early as practicable prior to its start up.*
- (4) *If a change covered by this subsection results in a change to the process safety information, such information shall be appended and/or updated in accordance with subsection (d).*
- (5) *If a change covered by this subsection results in a change to the operating procedures, such procedures shall be appended and/or updated in accordance with subsection (f).*

The federal OSHA PSM standard differs from the Cal-OSHA PSM standard in the following ways:

- Written procedures are required when there are “changes to facilities that affect a covered process.”

- Training must be provided to “employees involved in operating a process and maintenance and contract employees whose job tasks will be affected by the change” as opposed to the state requirement to provide training to “employees involved in the process.”

#### 12.4 Scope

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This program applies to all changes involving any chemicals, procedures, process equipment, technology, control systems, monitoring systems and safety systems associated with PSM-covered processes. However, this does not include “replacement-in-kind” or “repair-in-kind.” Changes covered under this policy include those that occur through: process engineering, design, and construction; process operations; and process maintenance.

Table 12.1 provides a discussion of change, providing guidance on what items and activities would be covered under the MOC procedure.

#### 12.5 Schedule

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The MOC program will be in effect at all times and whenever changes occur at PSM covered processes.

#### 12.6 Documentation Requirements

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The required documentation for MOC is as follows:

1. MOC Record Form (for MOC applicable changes)
2. Safety review documentation
3. MOC Logs

The MOC Record Forms will be retained for one year. Safety reviews will be retained for the lifetime of the system. The documentation must include a description of the change, approval signatures for the change, date approved, and date change made. The MOC log must show all MOC actions for the life of the process.

12.7 Responsibilities

The responsibilities for implementing the management of change element of the PSM program are outlined below.

Employees and Contractors	<ul style="list-style-type: none"> <li>• Identify change and the need for implementing the MOC procedure.</li> <li>• Document potential MOC changes using the MOC Applicability Checklist.</li> </ul>
Water Treatment Supervisor	<ul style="list-style-type: none"> <li>• Identify MOC items and activities.</li> <li>• Review Maintenance Work Orders to identify changes that require MOC action.</li> <li>• Communicate MOCs through the PSM Committee.</li> <li>• Ensure that safety reviews are conducted when the need is identified.</li> <li>• Review the proposed change and recommend the level of safety review, i.e. Level 1 or 2.</li> <li>• Inform affected employees and contract personnel of the change.</li> <li>• Provide training for affected employees and contract personnel .</li> <li>• Retain documentation on MOC items and activities.</li> </ul>
Water Treatment Superintendent	<ul style="list-style-type: none"> <li>• Authorize the PSI to be updated, if required.</li> <li>• Initiate safety reviews.</li> <li>• Initiate a PSSR if the PSI has to be updated.</li> <li>• Initiate the update of Operating Procedures and Safe Work Practices, as needed.</li> <li>• Approve Level-1 and Level-2 MOCs.</li> <li>• Approve emergency MOCs.</li> <li>• Grant extensions to temporary changes.</li> </ul>
Maintenance Supervisor	<ul style="list-style-type: none"> <li>• Initiate the updating of Maintenance Procedures, as needed.</li> <li>• Review work order to identify changes that require MOC action.</li> </ul>
PSM Committee	<ul style="list-style-type: none"> <li>• Review MOCs.</li> </ul> <p>Communicate the effects of MOCs to affected employees.</p>

The method for implementing the MOC program is outlined in this procedure. The steps of this procedure are shown in the MOC diagram included as Figure 12-1.

### Identification and Review Of Change

To determine whether MOC applies, the MOC Applicability Checklist form will be used (Table 12.2). MOC will apply in the following cases:

- The proposed action is not a replacement-in-kind.
- It can affect the containment capability of any piece of equipment which contains chlorine or any other AHM (Regulated Substance) so as to cause an uncontrolled release.
- It affects the functioning of any equipment designated to prevent, monitor, or mitigate the release of a AHM (Regulated Substance).
- The proposed action is temporary in nature but the MOC Applicability Checklist requires the implementation of MOC protocol. There are no restrictions in the MOC protocol for temporary or emergency changes.

The MOC Applicability Checklist Form may be initiated by any employee within the organization.

The originator will make a preliminary determination of the applicability of MOC based on the completed checklist. The form will then be passed to the Water Treatment Supervisor for review.

Following review of the MOC Applicability Checklist Form, the Water Treatment Supervisor will confirm the determination of the originator, or, if there is disagreement, the change will be reviewed by the Water Treatment Superintendent, the Maintenance Superintendent, and the PSM Coordinator. If any one of these three consider that MOC is applicable, then the MOC review will proceed as discussed below.

If MOC does not apply, the Water Treatment Supervisor will sign off on the MOC Applicability Checklist Form, and the change will proceed under normal procedures.

If MOC does apply, then the Water Treatment Supervisor will assign an individual to proceed with the MOC review using the MOC Record Form (Table 12.3). The Water Treatment Supervisor will assign the MOC a number and enter it in the Plant MOC Log (Table 12.4).

### MOC Record Form, Section 1 (Description Of Change)

The reviewer will perform an initial review of the proposed change and complete Section 1 of the MOC Record Form. This section will then be reviewed with the Water Treatment Supervisor.

Based on this review, the Water Treatment Supervisor will determine the level of safety review appropriate for the proposed change<sup>2</sup>. A responsible person will be designated to lead the safety review process. (Section 2 of the MOC Record Form)

#### MOC Record Form, Section 2 (Safety Review)

The Level-1 Safety Review may be conducted by using the MOC Level-1 Safety Review Checklist (Table 12.5) in conjunction with supplementary information relating to the proposed change. The checklist may be completed alone by the Safety Review Leader or together with additional persons as necessary.

The Level-2 Safety Review must be conducted using a more advanced or comprehensive analysis method such as a PHA checklist, a What-If/Checklist, a written Safety Assessment, or a formal HAZOP. A formal Process Hazards Analysis will be conducted if required by the Water Treatment Superintendent or the Director of Operations and Maintenance. The recommendations and/or action items generated by the safety review will be documented. The Water Treatment Supervisor will be responsible for implementing these recommendations.

The safety review documentation requirements will be fulfilled through the following:

- Safety Review Checklist or Written Hazards Analysis Report
- List of recommendations and/or action items

Section 2 of the MOC Record Form must be completed by the safety review leader and approved by the Water Treatment Supervisor and the Water Treatment Superintendent or a designee (for Level 2 reviews).

#### MOC Record Form, Section 3 (Follow-up Items)

The Water Treatment Superintendent will initiate and verify implementation or resolution of any recommendations involving potential hazards.

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<sup>2</sup> A two-level safety review process is to be used. A **Level-1 Safety Review** is to be used if the change is minor and primarily involves a single piece of equipment, a single operating or maintenance procedure, a process parameter, etc. Examples of such change would be replacement of a ball valve with a gate or plug valve, or the extension of an alarm setting beyond a previously published limit. A **Level-2 Safety Review** is to be used for any other changes which are not considered to be minor. These changes include those involving multiple pieces of equipment, multiple operating/maintenance procedures, several process parameters, etc. These changes may also include changes to the design or operating limits. Examples of Level-2 changes would be the addition of piping by-passes or spare pieces of equipment (filters, pumps, etc.) to allow on-line maintenance or the changing of types of equipment which substantially perform the same requirements such as substituting pilot operated for spring loaded relief valves. Examples of more complex changes would be extensive modifications to existing equipment, the addition of major new equipment, the changing of a treatment process, or the changing of a major operating activity.

The need for other revisions and modifications will be addressed by the reviewer. These may involve:

- Process safety information
- Operating procedures
- Maintenance procedures
- Notification of employees affected by the change
- Training

Each supervisor is responsible for ensuring that training is provided to his/her personnel.

Training, modification of PSI and procedures, and notifications will all be conducted prior to the initiating time. Communicating MOC information will be done through the PSM committee.

#### MOC Record Form, Section 4 (Approval)

The Water Treatment Superintendent will approve the MOC as complete, prior to implementation of the proposed action. A time will be designated for the initiation of the change.

#### Documentation of MOC Actions

Management of Change activities and data to be documented and filed are as follows:

- MOC log
- MOC Applicability Checklist
- MOC Record Form
- Safety review or Process Hazards Analysis
- Copies of other documents used for the safety review
- Documentation to show that the safety review recommendations have been resolved
- Other data used in the MOC decision-making process

MOC records shall be retained for one year.

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Figure 12-1 MOC Flow Diagram

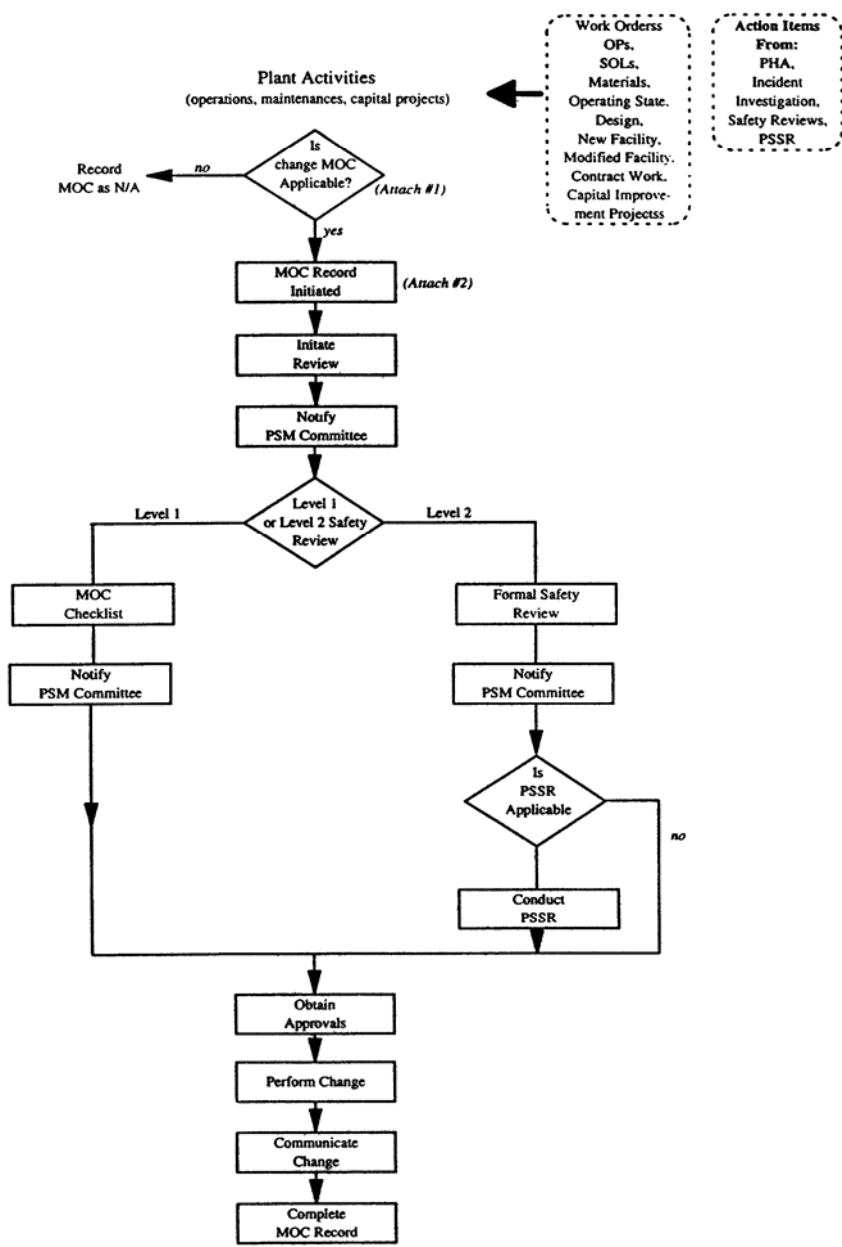


Table 12.1

## Examples Of Change Requiring Management Of Change Review

Category	Example of Change
Process Chemicals	Changes in chemicals used in the process.
Process Technology	<p>Operation outside the defined operating ranges of a process variable.</p> <p>Changes in the service of existing equipment.</p> <p>Continued operation without a piece of equipment (e.g. relief valve)</p> <p>Temporary piping systems unless they are covered in approved procedures.</p> <p>Increase of inlet flow rate to a level exceeding facility limits, as defined in the PSM process safety information.</p>
Process Equipment	<p>Changes in process piping.</p> <p>Modification of safety relief device.</p> <p>Addition, removal, or modifications to process safety interlocks.</p> <p>Addition, removal, or modifications to critical process alarms (see definition).</p> <p>Change in metallurgy of piping or equipment.</p> <p>Design changes in pump seal (materials of construction, seal flush medium, etc.).</p> <p>Changing pump impeller size.</p> <p>Changing trim size or type of a valve.</p> <p>Modifications of pressure vessels.</p> <p>Changes in control, alarm, and interlock logic.</p> <p>Instrument re-ranging.</p>
Process Procedures	<p>Labeling chlorine equipment.</p> <p>Revision of OPs</p>
Changes to Associated Facilities	Changes to safety systems (gas detectors, scrubbers, etc.)

Table 12.2

## Management Of Change Applicability Checklist

Process Area: \_\_\_\_\_

Proposed Change: \_\_\_\_\_

**Part 1 (Originator)**

Will the proposed change result in a change to any of the following?

<i>Item</i>	<i>Yes</i>	<i>No</i>
Process chemistry		
Raw materials or additives		
Established safe operating limits (temperature, pressure, flow)		
Procedures (operating, maintenance, training, incident investigation, emergency response)		
Additions, deletions, or bypasses of equipment, piping or instrumentation including safety systems		
Area electrical classification		
Computer software or hardware		
Alarm, interlock or relief setpoints		
Materials of construction		
Design specifications		
Operating state (e.g., decommissioning)		
Other (specify)		

Signature (*Originator*) \_\_\_\_\_ Date \_\_\_\_\_

**Part 2 (Water Treatment Supervisor)**

1. Review the above checklist and determine whether MOC applies. (MOC applies if the answer to any of the above question is yes).

MOC applies                      **Yes / No**

2. If MOC applies, assign MOC Number \_\_\_\_\_
3. Assign responsible person to complete MOC Record Form \_\_\_\_\_

Signature (*Water Treatment Supervisor*) \_\_\_\_\_ Date \_\_\_\_\_

Table 12.3

Management Of Change Record

---

Plant/Process Area: \_\_\_\_\_

Change #: \_\_\_\_\_

Proposed Change: \_\_\_\_\_

\_\_\_\_\_

Originator: \_\_\_\_\_

Date: \_\_\_\_\_

*To consider the process safety implications of a proposed change, the originator of the change should complete the following to insure the potential hazards associated with a change are identified and addressed. If a section does not apply, insert N/A in the appropriate blank. If additional comment space is required, attach pages.*

Section 1. Description Of The Change

1.1 Description and purpose of change: (Attach P&ID or sketch with P&ID reference, if appropriate).

1.2 Technical basis for change:

1.3 Potential for change to affect likelihood or severity of accidental release:

1.4 Is a pre-startup safety review (PSSR) required? \_\_\_\_\_

• Person assigned to lead review \_\_\_\_\_

• Level of Safety Review \_\_\_\_\_

Approved by: \_\_\_\_\_

*Water Treatment Supervisor*

*Date*

Table 12.3

Management Of Change Record (continued)

Section 2: Safety Review

Safety review leader \_\_\_\_\_

Additional persons involved in safety review \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Date of safety review \_\_\_\_\_

<b>Level of Safety Review:</b>	<input type="checkbox"/> Level 1	<input type="checkbox"/> Level 2
<b>Type of Safety Review:</b>	<input type="checkbox"/> MOC Checklist <input type="checkbox"/> Other _____	<input type="checkbox"/> PSSR Checklist <input type="checkbox"/> What If <input type="checkbox"/> Written Safety Assessment <input type="checkbox"/> HAZOP <input type="checkbox"/> Other _____

Attach completed checklist or Safety Review Report

Attach supplementary information relating to the proposed change.

Attach recommendations and/or action items generated by the safety review

Safety Review Leader \_\_\_\_\_ Date \_\_\_\_\_

Water Treatment \_\_\_\_\_ Date \_\_\_\_\_

Supervisor

Water Treatment \_\_\_\_\_ Date \_\_\_\_\_

Superintendent

Table 12.3

Management Of Change Record (continued)

**Section 3: Follow-Up Items**

This section must be completed prior to implementing the change.

<i>Item</i>	<i>Applicable (check) Not Applicable (NA)</i>	<i>Responsible Person</i>	<i>Date Complete</i>
Safety review is complete and recommendations have been implemented			

Revisions and modifications to the following have been addressed and completed:

<i>Item</i>	<i>Applicable (check) Not Applicable (NA)</i>	<i>Responsible Person</i>	<i>Date Complete</i>
Process safety information			
Operating procedures			
Maintenance procedures			
Safe work practices			
Emergency response plan			
Notification of employees affected by the change			
Training Operators Maintenance personnel Other			
Spare parts have been ordered			
Safety and health review			

Table 12.3

Management Of Change Record (continued)

---

<i>Item</i>	<i>Applicable (check)</i>  <i>Not Applicable (NA)</i>	<i>Responsible Person</i>	<i>Date Complete</i>
Field inspection completed			

<i>Item</i>	<i>Applicable (check)</i>  <i>Not Applicable (NA)</i>	<i>Responsible Person</i>	<i>Date Notified</i>
Engineering Support Supervisor has been notified that record drawings need to be updated.			

Water Treatment \_\_\_\_\_ Date \_\_\_\_\_  
 Superintendent





**Table 12.5 MOC Level – 1 Safety Review Checklist**

Note: If the MOC applies to the chlorine system respond to Questions 1-15. If the MOC does not apply to the chlorine system respond to Questions 4-18.

QUESTION	YES	REMARKS	RECOMMENDATIONS	BY	COMMENTS
1. Does the modification require that the onsite inventory of chlorine be increased?					
2. Does the modification require that chlorine be stored at higher temperatures or pressures than the current configuration?					
3. Does the modification require that chlorine detector placements be altered or additional detectors be installed?					
4. List the codes and standards to which the modified equipment has been designed (record in Remarks column). Does the modification meet the same codes and standards?					
5. Have the standard operating procedures (SOPs) been modified to reflect the equipment change?					
6. Does the modification change the normal permitted discharges to the air or water of the facility?					
7. Does the modification bypass any existing control interlock or safety features? If so, describe in the Remarks column what compensating features have been provided to preserve the same level of protection?					
8. Are the indications and alarms in the existing plant adequate for the modified plant?					
9. Does the modification require additional operator protection measures (e.g. PPE)?					
10. Have the modifications created any additional vulnerabilities to external events which did not exist before (vehicle traffic, fire, water accumulation, high wind, etc.)?					
11. Are electrical power and other services (e.g. cooling water) adequate to meet the demands of the modified plant?					
12. Has the change been reviewed and approved by the PSM Committee's Engineering Department representative?					
13. Has the change been reviewed and approved by appropriate operations management (including maintenance)?					
14. Has the change been reviewed and approved by regulatory compliance representatives?					
15. Is there a spare parts requirement to be fulfilled?					
16. Does the modification require that the onsite inventory of the chemical be increased?					
17. Does the modification require that the chemical be stored at higher temperatures or pressures than the current configuration?					
18. Does the modification require that chemical detector placements be altered or additional detectors be installed?					

## 13. INCIDENT INVESTIGATION

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### 13.1 Policy

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All incidents and accidents and near misses will be investigated to determine root causes, and recommendations will be developed and implemented to prevent recurrence of the accident/incident.

### 13.2 Purpose

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The purpose of this program is to provide a systematic approach to incident investigation to determine initiating events, contributing events, root cause, and contributing causes. The incident investigations must identify appropriate recommendations that address the problems and root causes identified. These may include upgrading engineering and administrative controls, and training for affected employees. Implementation of this program is intended to prevent and/or mitigate similar incidents and accidents in the future.

### 13.3 Regulatory Requirements

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Cal-OSHA (8 CCR 5189 (m)):

- (1) *The employer shall establish a written procedure for prompt reporting and investigating every incident which results in, or could reasonable have resulted in, a major accident.*
- (2) *Incident investigations shall be initiated no later than 48 hours following the incident.*
- (3) *An incident investigation team shall be established and consist of persons knowledgeable in the process involved including a contract employee if the incident involved work of the contractor, and other persons who are qualified to thoroughly investigate and analyze the incident.*
- (4) *A written report shall be prepared at the conclusion of the investigation which includes at a minimum:*
  - (A) *Date of incident;*
  - (B) *Date investigation began;*
  - (C) *A description of the incident;*
  - (D) *The factors that contributed to the incident; and*
  - (E) *Any recommendations resulting from the investigation.*
- (5) *The report shall be reviewed with all operating, maintenance, and other personnel whose work assignments are within the facility where the incident occurred.*

- (6) *The employer shall establish a system to promptly address and resolve the report findings and recommendations and shall implement the report recommendations in a timely manner, or take action to prevent a reoccurrence.*
- (7) *Incident investigation reports shall be retained for five (5) years.*
- (8) *The employer shall prepare a report and either provide a copy of the report or communicate the contents of the report to all employees and other personnel whose work assignments are within the facility where the incident occurred at the time the incident occurred.*

The federal OSHA PSM standard differs from the Cal-OSHA PSM standard in the following ways:

- A written procedure is not required for reporting and investigating.
- “Resolutions and corrective actions shall be documented,” as opposed to the state requirement that the employer establish a system to implement report recommendations in a timely manner or take action to prevent recurrence.
- The report “shall be reviewed with all affected personnel whose job tasks are relevant to the incident findings including contract employees where applicable” compared to the state requirement that the employer either “provide a copy of the report or communicate the contents of the report to all employees and other personnel whose work assignments are within the facility where the incident occurred at the time the incident occurred.”

#### 13.4 Scope

---

This program applies to all incidents and accidents that occur on processes covered by the PSM requirements. It applies to District and non-District personnel or equipment. All incidents, accidents, and near misses are included. (Incidents, accidents and near misses are defined in Section 2.) The program applies to events involving releases of hazardous chemicals, including fires, explosions, and toxic vapor clouds. The incident investigation procedure may also be used for other (non-PSM) incidents involving injuries, accidents and releases to the environment.

### 13.5 Schedule

---

The schedule for conducting investigations into incidents, accidents and near misses, developing recommendations and actions items and completing the actions items is listed below.

<b>Task</b>	<b>Time from Occurrence</b>
Assemble initial investigation team and begin the initial investigation.	Within 48 hours
Investigation team determines root causes, develops issues/scenarios, makes recommendations, and prepares the accident/incident report form.	Within 7 days
Present investigation form to the Superintendent.	Within 10 days
Identify action items associated with each recommendation and the responsibilities for implementation.	Within 3 weeks
Complete all action items as well as the status item column in the accident/incident report form.	Within 3 months
Accident/incident reports on file.	At least 5 years

### 13.6 Documentation Requirements

---

For each incident, accident, or near miss, a file will be created and kept for at least five years that includes the following documentation:

1. Incident investigation form.
2. Recommendation listing with follow-up responsibility, schedule and completion date.
3. Follow-up action taken and signature of closure.
4. Employee eyewitness accounts of the incident.
5. Copies of all related documentation.
6. Record of incident investigation procedure used.

### 13.7 Responsibilities

---

The responsibilities for implementing the incident investigation element of the PSM program are outlined below.

Water Treatment Superintendent	<ul style="list-style-type: none"><li>• Ensure that an investigation is initiated within 48 hours of an incident.</li><li>• Appoint an investigation team leader and establish an investigation team with the appropriate people involved.</li><li>• Ensure that all recommended actions following the investigation are implemented.</li><li>• Assign responsibility for implementing the action items.</li></ul>
Employees	<ul style="list-style-type: none"><li>• Report all accidents, incidents, and near misses that occur.</li><li>• Report in writing a description of the incident in which they are directly involved.</li></ul>
PSM Committee	<ul style="list-style-type: none"><li>• Communicate information relating to incidents and incident investigations throughout their respective work areas.</li></ul>
Safety And Health	<ul style="list-style-type: none"><li>• Ensure compliance with the OSHA regulations relating to incident investigations.</li><li>• Initiate the investigation in collaboration with the Water Treatment Superintendent.</li></ul>

### 13.8 Procedures

---

The incident investigation should begin after the situation has been determined "all clear" as determined by the Incident Commander if an emergency occurred, or as soon as possible for other incidents. The investigation must be initiated within 48 hours of an incident. For more information on the emergency response and incident command, refer to Emergency Planning and Response (Section 14).

A seven step process is used to conduct the incident investigation. It is the responsibility of the incident team to follow this process.

### 13.8.1 Establish Team and Initiate Investigation

1. Secure the area after the "all clear," assuring physical evidence is not disturbed.
2. Establish an initial investigation team of two or more members, one assigned as team leader. Assure one member is an employee from the process area where the incident occurred. If a contract employee was involved establish a team of three or more members, one being a contractor.
3. Begin initial investigation within 48 hours, examining the incident scene, photographing and videotaping physical evidence as necessary.
4. Form a full incident investigation team.
5. Train investigation team on procedures for root cause analysis.
6. Conduct a formal incident investigation meeting. The full team shall be composed of the initial investigation team and representatives from S&H, the incident commander and representatives from operations and maintenance, a team leader experienced in leading incident investigations as well as any other personnel deemed necessary by management.

### 13.8.2 Gather Information

1. Collect information such as records and pictures.
2. Obtain written descriptions of the incident from employees and conduct employee interviews, attempting to establish event timing and sequences.
3. Obtain all relevant training, maintenance, and permit records as well as operating procedures and make them available for the incident investigation team.

### 13.8.3 Identify Problems and Cause(s) of the Incident

1. Examine relevant training, maintenance, and permit records as well as operating procedures.
2. Establish a chronology of the incident, possibly using visual aids and "flow diagrams" to aid in an understanding of the event sequences. Break the event into distinct sequences, such as *actions leading up to the incident, the incident events, and the emergency response activities*.
3. Compare the event sequences with what "should" have occurred according to good industry practices, operating and maintenance manuals and emergency response guides and training. A brainstorming session, similar to a Process Hazards Analysis, may be conducted on the flow diagrams to identify problems and their causes.
4. Analyze all information gathered, establish and document the root cause of the incident. The systemic factors checklist (Attachment 13-1) can be used to guide this process through the seven systematic factors of any work process: (Management, Design, Equipment/Materials, Procedures, Training, Operations, External Factors).

5. Identify contributing factors and also areas of concern that did not necessarily contribute to the incident but which could be highlighted to improve response and/or operations issues.

#### 13.8.4 Develop Recommendations

Develop recommendations to address the problems and causes identified in Section 13.8.3.

#### 13.8.5 Document The Incident Investigation

1. Document all problems and recommendations in the incident investigation report.
2. Attach all required additional information such as personnel statements, associated work orders, log sheets, injury and illness forms, etc. This report shall be completed in draft form within three days of the investigation meeting.
3. Record the incident on the facility Incident Investigation Log (Table 13.1).

#### 13.8.6 Implement And Document Recommendations

1. Assign responsibilities for each of the recommendations. This step takes place after the incident investigation team meeting. Responsibilities shall be assigned by management.
2. Resolve any outstanding issues included in the incident report.
3. Address all recommendations and action items within the specified time period, and document completion on the incident investigation form (Table 13.2).

#### 13.8.7 Communicate The Results

Communicate and review the incident investigation results with affected employees, contractors, and community-representatives.

### 13.9 Incident Investigation Team Training

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All incident investigation team leaders and members shall be trained in incident investigation techniques. To meet this requirements, all team leaders and members shall take the CCWD online training course on Incident Investigation or an equivalent course.

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Table 13.1

Incident Log

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<b>Date</b>	<b>Incident #</b>	<b>Description</b>

Table 13.2

**Incident Investigation Form**

---

**Incident Summary Information**

Date of Incident: \_\_\_\_\_

Time of Incident: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Contract Employee Involved (Yes/No)? \_\_\_\_\_

Process(es) Affected: \_\_\_\_\_

\_\_\_\_\_

Incident Summary: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Incident Type:

- Fire
- Vapor Cloud
- Near Miss
- Explosion
- Spill
- 

**Incident Analysis**

---

Investigation Leader: \_\_\_\_\_ Other Team Members \_\_\_\_\_

\_\_\_\_\_

Date Investigation Began: \_\_\_\_\_

Investigation Technique: \_\_\_\_\_

Incident Description: \_\_\_\_\_

\_\_\_\_\_

Table 13.2

Incident Investigation Form (cont)

---

Reverse Chronology: \_\_\_\_\_

Initiating Event(s): \_\_\_\_\_

---

Root Cause: \_\_\_\_\_

---

Contributing Causes: \_\_\_\_\_

---

List of Supporting Documents: \_\_\_\_\_

---

List of Witnesses: \_\_\_\_\_

---

Actions and/or Equipment That Helped to Prevent a More Serious Incident: \_\_\_\_\_

---

List of Recommendations: \_\_\_\_\_

---

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Table 13.2

Incident Investigation Form (cont)

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Team Sign-off and Approval

Prepared by: \_\_\_\_\_

Team Sign-off with date: \_\_\_\_\_

Approved by: \_\_\_\_\_

*Title* \_\_\_\_\_

*Date*

Follow-up

Problem: \_\_\_\_\_

\_\_\_\_\_

Recommendation: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Planned Action: \_\_\_\_\_

\_\_\_\_\_

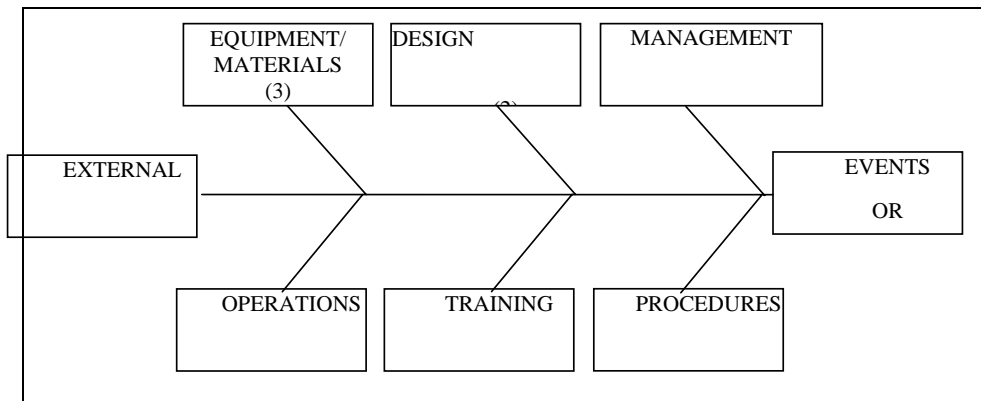
Responsibility: \_\_\_\_\_

\_\_\_\_\_

Due Date: \_\_\_\_\_

Status: \_\_\_\_\_

\_\_\_\_\_



The diagram above shows the systematic factors that represent the main levels of any work process. Listed below are questions representing the minimum areas to consider for each of the systemic factors.

Instructions: Following the instructions in Section 4.6, “Identifying Problems,” ask the questions that follow. Begin at the bottom of the list (i.e. 7.1, External-Non Human) and ask the questions in ascending order. Note that each question includes a list of areas to consider in answering the questions. The lists are not all-inclusive but intended to be “memory joggers.” The numbers at the left are Systemic Factors Analysis (FEA) codes.

## 1.0 MANAGEMENT

### 1.1 REQUIREMENTS:

Was the identification and interpretation of requirements adequate?

- Identification of requirements
- Interpretation of requirements
- Integration of requirements
- Resolution of conflicting requirements

1.2 **PLANNING:** Were overall goals, objectives, and policies adequate?

- Management Plan
- Quality Assurance Plan
- Established policy
- Complete policy
- Approved policy

1.3 **ORGANIZING:** Were organizational structure, resources, functional responsibilities, levels of authority, and interface requirements adequate?

- Definition of responsibility or ownership
- Management of change
- Job standards
- Facilities
- Qualifications of personnel
- Tools and materials
- Number of personnel
- Integration with other programs
- Allocation of personnel
- Budget

1.4 **DIRECTING:** Was the implementation of management plans adequate?

- Communication of policy
- Enforcement of policy
- Scheduling
- Effectiveness of policy
- Records
- Cost control
- Tracking of corrective actions
- Tracking of goals
- Feedback from implementation

1.5 **HAZARD CONTROL:** Were identification, evaluation, and control of hazards and risks adequate?

- Hazard identification
- Risk assessment
- Hazard assessment
- Administrative controls
- Safety review
- Engineered controls
- PHC data review

1.6 **ASSESSMENT:** Was the assessment of operations adequate?

- Appraisals/audits
- Management Surveillance's
- Inspections

## 2.0 DESIGN

### 2.1 SPECIFICATIONS: Was the design specification adequate?

- Review
- Requirements
- Standards
- Documentation
- Approval
- Interpretation of requirements
- Interfaces
- Life cycle

### 2.2 PROCUREMENT: Was the process for specifying and buying services, equipment, or material adequate?

- General technical specification
- Contractual terms
- Supplier verification
- Unique technical specification
- Statement of work
- Supplier Quality Assurance

### 2.3 CONFIGURATION CONTROL: Was the documentation of the as-built configuration of systems or equipment adequate?

- Review
- Field changes
- Accuracy
- Drawings/sketches
- Approval
- Change implementation
- Availability

### 2.4 HUMAN/MACHINE INTERFACE: Was the equipment used to communicate information from systems to personnel or from personnel to systems adequate?

- Labels
- Displays
- Audible cues
- Controls
- Layout

### 3.0 EQUIPMENT AND MATERIALS

3.1 **HANDLING:** Was the packaging, shipping, receiving, handling, or storage of equipment or materials adequate?

- Identification of contents
- Shelf life
- Receipt inspection
- Segregation
- Non-conforming items

3.2 **MANUFACTURING/CONSTRUCTION/INSTALLATION:** Were manufacturing, construction, installation, and acceptance of equipment or materials adequate?

- Standards
- Application of standards
- Acceptance testing

3.3 **MAINTENANCE/TESTING:** Was the ongoing maintenance of equipment or operability testing of systems adequate?

- Preventive maintenance
- Corrective maintenance
- Inspection
- Spare parts
- Calibration
- Equipment history
- Maintenance and test equipment

3.4 **EQUIPMENT/SYSTEM PERFORMANCE:** Was the performance of equipment or systems adequate?

- Component failure
- Erratic performance
- Below required performance

## 4.0 PROCEDURES

4.1 **CONTENT:** Was the format and content of the written procedure or guidance adequate?

- Review
- Environmental considerations
- Health considerations
- Quality control
- Specific situation
- Sequence
- Ambiguity
- Presentation of limits
- Computations
- Equipment identification
- Typographical errors
- Approval
- Safety considerations
- Emergency considerations
- Format
- Level of detail
- Actions per step
- Identification of revised steps
- Checklists
- Graphics
- Reference

4.2 **AVAILABILITY:** Was a written procedure or guidance developed and available for use?

- No procedures
- Out-of-date procedure
- Equipment Plan
- Availability
- Test Plan
- Operator aids
- Operating Procedures (OP)
- ES&H Standard Operating Procedure (ES&H SOP)

4.3 **USE:** Was a written procedure or guidance used properly?

- Followed incorrectly
- Did not use

## 5.0 TRAINING

5.1 **CERTIFICATION:** Was the testing, maintaining qualifications, or documenting qualifications of personnel adequate?

- Qualification testing
- Continuing training
- Records

5.2 **DEVELOPMENT:** Was the development of training material adequate?

- Job/task analysis
- Program design
- Objectives

5.3 **PRESENTATION:** Was the presentation of training material adequate?

- Classroom
- On-the-job
- Required reading
- Support equipment
- Instructor qualifications
- Instructor skills

5.4 **CONTENT:** Was the content of training material adequate?

- Systems
- Equipment
- Administrative
- Environmental concerns
- Safety concerns
- Health concerns
- Emergency concerns
- Quality control considerations
- Facility

5.5 **QUALIFICATIONS:** Were education, work experience, and training levels of personnel adequate?

- Education
- No training
- Experience
- Physical requirements

## 6.0 OPERATIONS

### 6.1 **DIRECT SUPERVISION:** Was the direct control of work adequate?

- No supervision
- Excessive supervision
- Preparation
- Selection of worker
- Assignment of worker tasks
- Briefings
- Feedback

### 6.2 **VERBAL COMMUNICATIONS:** Was the verbal presentation or exchange of information adequate?

- Method
- Communication established
- Timeliness
- Within working groups
- Between shifts
- Terminology
- Understanding
- Verification
- Between shifts and management

### 6.3 **CONDITIONS:** Were physical conditions in the work area adequate?

- Workplace layout
- Housekeeping
- Climate
- Lighting
- Crowded
- Noise
- Radiation hazard
- Chemical hazard
- Electrical hazard
- Signs
- Physical barriers

### 6.4 **CAPABILITIES:** Was the physical or emotional ability of personnel adequate?

- Overtime
- Inattention
- Fatigue
- Illness
- Sensory/perceptual capabilities
- Motor/physical capabilities
- Attitude
- Substance abuse

6.5 **PERFORMANCE:** Was the performance of work adequate?

- Documentation
- Emergency notifications
- Verification of actions
- Restoration of systems
- Use of tools
- Use of safety equipment
- Hazard identification
- Inappropriate actions
- Quality control
- Lockout/Tagout
- Use of equipment
- Use of protective clothing
- Halting unsafe operations

7.0 **EXTERNAL**

7.1 **HUMAN:** Was there a human factor beyond the direct control of CCWD?

- Sabotage
- Vandalism
- Civil unrest

7.2 **NON-HUMAN:** Was there a non-human factor beyond the direct control of CCWD?

- Off-site power failure
- Off-site explosion
- Hurricane
- Flood
- Animal interference
- Off-site fire
- Lightning
- Tornado
- Earthquake

## 14. EMERGENCY PLANNING AND RESPONSE (EP&R)

---

### 14.1 Policy

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An Emergency Response Plan (ERP) will be developed and maintained for each PSM covered facility, and all personnel at the plant will be trained in the applicable ERP procedures.

### 14.2 Purpose

---

The purpose of this policy is to ensure that emergency planning and emergency response are implemented with sufficiently detailed plans to insure safe evacuation of employees and a rapid, effective, and well-coordinated response to emergency situations.

### 14.3 Regulatory Requirements

---

Cal-OSHA (8 CCR 5189 (n)):

*The employer shall establish and implement an Emergency Action Plan which shall contain at a minimum the elements of Section 3220.*

*NOTE: The employer may use the business plan for emergency response submitted pursuant to subdivision (a) of Section 25503.5 and subdivision (b) of Section 25505 of the Health and Safety Code, to the extent that the requirements of subsection (n) are met.*

The federal OSHA PSM standard differs from the Cal-OSHA PSM standard in the following way:

- There is no substitution for establishing and implementing an emergency action plan for the entire plant.

### 14.4 Scope

---

The following requirements apply to facilities subject to the PSM Standard. They include HAZWOPER provisions in addition to those for the Emergency Action Plan (EAP).

- Required plan approvals
- Assigned responsibility for updating the plan
- Frequency of updates
- Required training and experience for personnel involved in updating the plan and conducting training
- Means of documenting training/drills
- Emergency escape procedures
- Route assignments

- Specific instructions for employees who remain to operate critical operations before evacuating
- Types of emergency evacuation to use
- Rescue and medical duties
- Job titles for information or explanation of duties under the plan
- Procedures for handling small releases
- Responsibilities for the following: initiating the plan during an emergency, acting as incident commander during emergencies, and assisting in the safe and orderly evacuation of employees

Training must be conducted on any updated ERP. This training will involve a review of the plan with all employees covered under the ERP and appropriate methods for training them in their duties under the ERP.

#### 14.5 Schedule

---

The provisions of the Emergency Response Plan are in effect at all times.

#### 14.6 Documentation

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The Randall-Bold Chlorine Response and Standard Operating Procedures

The Randall-Bold Hazardous Materials Business Plan (Emergency Response Plan).

## 14.7 Responsibilities

---

The responsibilities for implementing the emergency planning and response element of the PSM program are outlined below.

Water Treatment Superintendent	<ul style="list-style-type: none"><li>• Ensure that ERPs are in place.</li><li>• Update the ERPs on a routine basis.</li><li>• Test the ERP with exercises and drills.</li></ul>
Water Treatment Supervisor	<ul style="list-style-type: none"><li>• Ensure that the Emergency Response Plan is available and up-to-date.</li><li>• Ensure that employees are trained in the ERP and familiar with the response actions.</li><li>• Test the ERP on a routine basis.</li></ul>
Employees	<ul style="list-style-type: none"><li>• Know the location of the facility Emergency Response Plan.</li><li>• Understand the response procedures to be followed in the event of an emergency.</li></ul>

## 14.8 Procedures

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Emergency response procedures are included with the Standard Operating Procedures.

## 15. INJURY AND ILLNESS PREVENTION PROGRAM AND COMPLIANCE AUDITS

---

### 15.1 Policy

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Randall-Bold PSM-covered process will maintain and implement an Injury and Illness Prevention Program (IIPP). All elements of the PSM program will be audited at least every three years.

### 15.2 Purpose

---

The purpose of implementing the IIPP is to prevent incidents from occurring that could lead to injuries or illness. Implementation of the IIPP will also ensure that incidents that could lead to a release of chlorine are prevented. The purpose of the compliance audits is to ensure that the PSM program addresses all of the PSM requirements, and to ensure that it is being effectively implemented. The audits will identify areas of deficiencies in the PSM program.

### 15.3 Regulatory Requirements

---

Cal-OSHA (8 CCR 5189 (o)):

*The employer's Injury and Illness Prevention Program required by Section 3203 shall include applicable parts of this section.*

- (1) *The scheduled and periodic inspections of facilities covered by this section and required by Section 3203(a)(4) shall be conducted by at least one person knowledgeable in the process.*

The federal OSHA PSM standard differs significantly from the Cal-OSHA standard in that there is no specific requirement for an IIPP, but there is a requirement for Compliance Audits (29 CFR 1910.119 (o)). The federal OSHA regulatory requirements are as follows:

- (1) *Employers shall certify that they have evaluated compliance with the provisions of this section at least every three years to verify that the procedures and practices developed under the standard are adequate and are being followed.*
- (2) *The compliance audit shall be conducted by at least one person knowledgeable in the process.*
- (3) *A report of the findings of the audit shall be developed.*
- (4) *The employer shall promptly determine and document an appropriate response to each of the findings of the compliance audit, and document that deficiencies have been corrected.*
- (5) *Employers shall retain the two (2) most recent compliance audit reports.*

#### 15.4 Scope

---

An IIPP will be developed with provisions for:

- Identification of safety and health hazards in the work place.
- Procedures to communicate and correct unsafe or unhealthy working conditions.
- Steps to ensure employee participation and compliance.
- Training program to reduce risk of occupational-related illness or injury.

Compliance audits will be conducted at all facilities subject to the PSM standard. The scope of the audits will include all elements of the Cal-OSHA PSM standard.

#### 15.5 Schedule

---

The IIPP will be in effect at all times. The first compliance audit will be conducted prior to August 1995, and at least once every three years following.

#### 15.6 Documentation Requirements

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1. Compliance audit reports (See Table 15.1)
2. Compliance audit findings resolutions and action items taken
3. Compliance audit protocol
4. Documentation relating to employee observations and suggestions relating to faulty or unsafe equipment with employer's response
5. Record Retention: The two most recent compliance audit reports will be retained in the Safety Officer's files.

## 15.7 Responsibilities

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The responsibilities for implementing the compliance audit element of the PSM program are outlined below.

Safety Officer	<ul style="list-style-type: none"><li>• Develop or select audit guides and/or protocols.</li><li>• Select the audit team (including employees from other facilities).</li><li>• Train the audit teams in audit techniques.</li><li>• Schedule and conduct the compliance audits.</li><li>• Prepare a report including the results of the audit.</li><li>• Provide the report to the affected facility to ensure that deficiencies identified are addressed.</li></ul>
PSM Committee	<ul style="list-style-type: none"><li>• Obtain approvals and authorizations for audit guides.</li></ul>
Water Treatment Superintendent and Water Treatment Supervisor	<ul style="list-style-type: none"><li>• Provide support during the conduct of the audit.</li><li>• Provide documentation to demonstrate compliance with the PSM elements.</li><li>• Respond to the audit report by implementing the recommendations.</li><li>• Obtain approvals and authorizations for action plans.</li></ul>

## 15.8 Procedures

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The audit procedure will follow the Audit Protocol included in the Cal-OSHA Compliance Directive. The procedure also includes:

- a. Issuance of draft report: Plant and maintenance management will review draft findings and recommendations.

- b. Addressing Recommendations: Findings/Recommendations, Person(s) Responsible for Corrective Action, and Completion Dates will be tracked by the Safety Officer until resolved.

#### 15.9 Qualifications of Audit Team

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The qualifications for audit team members and leaders shall include:

1. Having operational knowledge of the chlorine process, and/or
2. Knowledge of the PSM Audit Protocol from the Cal-OSHA Compliance Directive.

Table 15.1

Sample Table Of Contents For Compliance Audit Report

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1.2 Scope

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2.1 General Audit Technique

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2.2.1 Audit Frequency Determination

2.2.2 Audit Team

2.2.3 Audit Report

2.2.4 Follow-Up to Findings

2.2.5 Report Retention

*Note: Section 2.2 and accompanying subsections explicitly list regulatory requirements along with the audit approach, activity, or product (e.g., report) intended to address those requirements.*

3.0 Findings

3.1 Management System

3.2 Process Hazard Analysis

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3.5 Training

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3.7 Pre-Startup Review

3.8 Management Of Change

3.9 Safety Audits

3.10 Accident Investigation

## 16. TRADE SECRETS

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### 16.1 Policy

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The PSM program will be fully implemented regardless of any trade secret information within process safety information (PSI) relating to technologies used at affected facilities. Any trade secret concerns will be satisfied through confidentiality agreements with the respective parties.

### 16.2 Purpose

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The purpose of this element is to ensure complete adherence to the PSM program mandate while protecting trade secret information.

### 16.3 Regulatory Requirements

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Cal-OSHA (8 CCR 5189 (p)):

Regulatory requirements for trade secrets are included with Employee Participation. (Refer to TAB 1, Section C).

The federal OSHA requirements (29 CFR 1910.119 (p)) are as follows:

- (1) *Employers shall make all information necessary to comply with the section available to those persons responsible for compiling the process safety information (required by paragraph (d) of this section), those assisting in the development of the process hazard analysis (required by paragraph (e) of this section), those responsible for developing the operating procedures (required by paragraph (f) of this section), and those involved in incident investigations (required by paragraph (m) of this section), emergency planning and response (paragraph (n) of this section) and compliance audits (paragraph (o) of this section) without regard to possible trade secret status of such information.*
- (2) *Nothing in this paragraph shall preclude the employer from requiring the persons to whom the information is made available under paragraph (p)(1) of this section to enter into confidentiality agreements not to disclose the information as set forth in 29 CFR 1910.1200.*
- (3) *Subject to the rules and procedures set forth in 29 CFR 1910.1200(i)(1) through 1910.1200(i)(12), employees and their designated representatives shall have access to trade secret information contained within the process hazard analysis and other documents required to be developed by this standard.*

#### 16.4 Scope

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Any information, equipment or technology with trade secret status used at or near a PSM-covered process is addressed by this element.

#### 16.5 Schedule

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This policy is in effect at all times.

#### 16.6 Documentation

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A written statement will be included in the PSM Manual to state that Trade Secrets do not apply to normal operations at any PSM-covered process.

#### 16.7 Responsibilities

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The responsibilities for implementing the trade secrets element of the PSM program are outlined below.

Water Treatment Superintendent	<ul style="list-style-type: none"><li>• Indicate, in writing, that no technology in the process area retains trade secret status.</li><li>• Review all proposed pilot projects and/or demonstrations for the process area to determine if trade secret information will be used.</li><li>• Require that suitable procedures are prepared to ensure employee access to safety information when projects onsite are identified with trade secret information.</li></ul>
Engineering Department	<ul style="list-style-type: none"><li>• Identify any trade secrets associated with pilot projects and demonstration technologies at PSM-covered processes.</li></ul>
Water Treatment Supervisor	<ul style="list-style-type: none"><li>• Notify all personnel working at the plant (including operators, maintenance personnel and contractors) about procedures in place to allow access to safety information concerning activities involving trade secret information.</li></ul>

## 16.8 Procedures

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A written notice will be retained on file to verify that there are no trade secret technologies or chemicals used at water treatment plants. Refer to Attachment 16-1.

All pilot projects/chemicals at water treatment plants will be reviewed for trade secret status through the MOC procedure.

If any trade secret project/technology/chemical is used in the chlorine systems, then safety information will be provided to employees through established PSI procedures and specific confidentiality agreements.

Attachment 16-1

Trade Secret Declaration

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Memo To File

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This memorandum confirms that there are no chemicals, equipment, nor technologies with trade secrets in effect at the Contra Costa Water District water treatment plants. Accordingly, all Process Safety Information (PSI) relating to this facility is readily available to treatment plant employees.

In the event that trade secret information does apply at water treatment facilities, then the potential process safety implications will be reviewed through the management of change procedure. Confidentiality agreements will be established, as needed, to ensure that treatment plant employees have complete access to relevant PSI.

Signed, \_\_\_\_\_ Date \_\_\_\_\_

Director of Operations &  
Maintenance