

State of California

DEPARTMENT OF INDUSTRIAL RELATIONS

DIVISION OF OCCUPATIONAL SAFETY AND HEALTH



Proposed GISO §5189.1

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Process Safety Management for Petroleum Refineries

Title 8. Industrial Relations
Division 1. Department of Industrial Relations
Chapter 4. Division of Industrial Safety
Subchapter 7. General Industry Safety Orders
Group 16. Control of Hazardous Substances
Article 109. Hazardous Substances and Processes
Proposed §5189.1 Process Safety Management for Petroleum Refineries

This version of the proposed GISO §5189.1 incorporates changes recommended by the PSM Labor-Management Advisory Committee to version 2.0 of October 31, 2014. This version is also harmonized with the Enhanced Program 3 elements of CCR Title 19, Division 2, California Governor's Office of Emergency Services, Chapter 4.5, *California Accidental Release Prevention (Cal/ARP)* program.

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§ 5189.1. Process Safety Management for Petroleum Refineries.

(a) Scope and Purpose.

This Section contains requirements for petroleum refineries to prevent major incidents and minimize the process safety risks to which employees may be exposed.

(b) Application.

This Section shall apply to petroleum refineries.

For petroleum refineries, this regulation supersedes and replaces Title 8 (Industrial Relations), Division 1 (Department of Industrial Relations), Chapter 4 (Division of Industrial Safety), Subchapter 7 (General Industry Safety Orders), Group 16 (Control of Hazardous Substances), Article 109 (Hazardous Substances and Processes), §5189 (Process Safety Management of Acutely Hazardous Materials).

(c) Definitions.

Change. Any alteration in process chemicals, technology, procedures, process equipment, facilities or organization that could affect a process. A change does not include replacement-in-kind.

Damage Mechanism. The mechanical, chemical, physical, or other process that results in equipment or material degradation.

Employee Representative. A union representative, where a union exists, or an employee-designated representative in the absence of a union. The term is to be construed broadly, and may include the local union, the international union, or an individual designated by these parties, such as the safety and health committee representative at the site or a non-employee consultant.

Facility. The plants, units, buildings, containers or equipment that contain(s) or include(s) a process.

Feasible. Capable of being accomplished in a successful manner within a reasonable period of time, taking into account health, safety, economic, environmental, legal, social and technological factors.

Flammable. A liquid or gas as defined in Title 29 Code of Federal Regulations Section 1910.1200 Appendix B.

Hierarchy of Hazard Controls. Hazard prevention and control measures, in priority order, to eliminate or minimize a hazard, as described in subsection (z). Hazard prevention and control measures ranked from most preferred to least preferred are: First Order Inherent Safety, Second Order Inherent Safety, and passive, active and procedural protection layers. .

Hierarchy of Hazard Controls Analysis (HCA). A procedure that applies the Hierarchy of Hazard Controls for the purpose of selecting recommendations that eliminate or minimize a hazard, or that reduce the risk presented by a hazard.

Highly Hazardous Material. A substance possessing toxic, reactive, flammable, explosive, or other dangerous properties, exposure to which could result in death or serious physical harm, as defined by Labor Code 6432 (e).

Hot Work. Electric or gas welding, cutting, brazing or any similar heat, flame, or spark-producing procedures or operations.

Human Factors. The design of machines, operations, and work environments such that they closely match human capabilities, limitations and needs. Human factors include environmental, organizational and job factors, as well as human and individual characteristics, such as fatigue, that can affect job performance, process safety, and health and safety.

Independent Protection Layers (IPL). Safeguards that reduce the likelihood or consequences of a major incident through the application of devices, systems or actions. IPLs are independent of an initiating cause and independent of other IPLs. Independence ensures that an initiating cause does not affect the function of an IPL and that failure in any one layer does not affect the function of any other layer.

Inherent Safety. An approach to safety that focuses on eliminating or reducing the hazards associated with a set of conditions. A process is inherently safer if it reduces or eliminates the hazards associated with materials or operations used in the process, and this reduction or elimination is permanent and inseparable from the material or operation. A process with reduced hazards is described as inherently safer compared to a process with only passive, active, and procedural safeguards. The process of identifying and implementing inherent safety in a specific context is known as inherently safer design.

- First Order Inherent Safety measure. A measure that prevents a major incident by eliminating or reducing the hazard. Changes in the chemistry of a process that eliminate or reduce the hazard(s) of the chemicals used or produced are usually considered First Order Inherent Safety measures; for example, by substituting a flammable chemical with an alternative chemical that can serve the same function but with lower vapor pressure and narrower flammable range.

- Second Order Inherent Safety measure. A measure that reduces the severity of a hazard or the likelihood of a release without the use of add-on safety devices. Changes in process variables to minimize, moderate and simplify a process are usually considered Second Order Inherent Safety measures; for example, redesigning a high-pressure, high-volume, and high-temperature system to operate at lower temperatures, volumes, and pressures.

Initiating Cause. An operational error, mechanical failure or other internal or external event that is the first event in an incident sequence, and which marks the transition from a normal situation to an abnormal situation.

Isolate. A procedure whereby equipment is removed from service and completely protected against the inadvertent release or introduction of material or energy by such means as blanking or blinding; misaligning or removing sections of lines, pipes, or ducts; implementing a double block and bleed system; or blocking or disconnecting all mechanical linkages.

Major change. Any of the following:

- Introduction of a new process, new process equipment, or new highly hazardous material;
- Any change in safe operating limits;
- Any alteration in a process, in process equipment or in process chemistry that introduces a new hazard or worsens an existing hazard.

Major Incident. An event within or affecting a process that causes a fire, explosion or release of a highly hazardous material which has the potential to result in death or serious physical harm, as defined in Labor Code Section 6432(e).

Petroleum Refinery. Industrial site engaged in activities set forth in North American Industry Classification System (NAICS) Code 324110 (formerly Standard Industrial Classification (SIC) Code 2911).

Process. Petroleum refinery activities involving a highly hazardous material, including use, storage, manufacturing, handling, piping, or on-site movement. Utilities and safety-related process equipment may be considered part of the process if in the event of an unmitigated failure or malfunction they could potentially contribute to a major incident.

Process Equipment. Any equipment, piping, instrumentation, control, safeguard, or appurtenance related to a process.

Process Safety Culture. The core values and behaviors resulting from a collective commitment by leaders and individuals that emphasize process safety over competing goals in order to ensure protection of people and the environment.

Process Safety Management. The application of management systems to ensure the safety of petroleum refinery processes.

Process Safety Performance Indicators. Measurements of the refinery's activities and events that are used to evaluate the performance of process safety systems.

Qualified Operator. A person designated by the employer who, by fulfilling the requirements of the training program defined in subsection (g), has demonstrated the ability to safely perform all assigned duties.

RAGAGEP (Recognized and Generally Accepted Good Engineering Practices). Engineering, operation, or maintenance activities established in codes, standards, technical reports or recommended practices and published by the American Institute of Chemical Engineers (AIChE), American National Standards Institute (ANSI), American Petroleum Institute (API), American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE), American Society of Mechanical Engineers (ASME), American Society of Testing and Materials (ASTM), Center for Chemical Process Safety (CCPS), National Fire Protection Association (NFPA), and Instrument Society of America (ISA), or other standard setting organizations. RAGAGEP does not include standards, guidelines or practices developed for internal use by the employer.

Replacement-in-kind. A replacement that satisfies the design specifications.

Root Cause. The underlying reasons, such as deficiencies in management systems, which if corrected would prevent, or significantly reduce the likelihood of, the problem's recurrence.

Safeguard. A device, system or action that interrupts the chain of events following an initiating cause, or that mitigates the impacts of an incident.

- Passive Safeguards. Process and equipment design features that minimize a hazard by reducing either its frequency or consequence without the active functioning of any device; for example, a diked wall around a storage tank of flammable liquids.
- Active Safeguards. Controls, alarms, safety instrumented systems, and mitigation systems used to detect and respond to deviations from normal process operations; for example, a pump that is shut off by a high-level switch.
- Procedural Safeguards. Policies, operating procedures, training, administrative checks, emergency response and other management approaches used to prevent incidents or to

minimize the effects of an incident. Examples include hot work procedures and emergency response procedures.

Safety Instrumented Systems. Systems designed to achieve or maintain safe operation of a process in response to an unsafe process condition.

Serious Physical Harm. Defined by Labor Code Section 6432(e).

Turnaround. A planned total or partial shutdown of a petroleum refinery process unit or plant to perform maintenance, overhaul or repair of a process and process equipment, and to inspect, test, and replace process materials and equipment.

Utility. A system that provides energy or related services to enable the safe operation of a refinery process. Examples include electrical power, fire water systems, steam, instrument power and instrument air.

(d) Process Safety Information.

(1) The employer shall develop and maintain a compilation of written process safety information before conducting any Process Hazard Analysis (PHA), Hierarchy of Hazard Controls Analysis (HCA), Safeguard Protection Analysis (SPA) or Damage Mechanism Review (DMR), as required by this Section. The compilation of written process safety information shall be sufficient to enable the employer and employees involved in operating or maintaining a process to identify and understand the hazards posed by the process. The process safety information shall include information pertaining to (A) the hazards of highly hazardous materials used in or produced by the process, (B) the technology of the process, (C) process equipment used in the process, and (D) results of previous Damage Mechanism Reviews. The employer shall provide for employee participation in this process, pursuant to subsection (q). The process safety information shall be made available to all petroleum refinery employees and employees of contractors. Information pertaining to the hazards of the process shall be effectively communicated to all affected employees.

(2) Information pertaining to hazards of highly hazardous materials used in, present in or produced by the process shall include at least the following:

- (A) Toxicity information, including acute and chronic health hazards;
- (B) California Permissible Exposure Limits (PELs), as listed in Section 5155;
- (C) Physical data;
- (D) Corrosion data;

(E) Thermal and chemical stability data;

(F) Reactivity data; and,

(G) Hazardous effects of incompatible mixtures that could foreseeably occur.

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

(3) Information pertaining to the technology of the process shall include at least the following:

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

(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 chemical mixing and/or reactions that may affect the safety and health of employees.

(4) Information pertaining to process equipment shall include at least the following:

(A) Materials of construction;

(B) Piping and instrument diagrams (P&IDs);

(C) Electrical classification;

(D) Relief system design and design basis;

(E) Ventilation system design;

(F) Design codes and standards employed, including design conditions and operating limits;

(G) Material and energy balances for processes built after the effective date of this Section;

(H) Safety systems, such as interlocks and detection and suppression systems; and,

(I) Electrical supply and distribution systems.

(5) The employer shall document that process equipment complies with RAGAGEP, where RAGAGEP has been established for that process equipment, or with other equally protective standards that ensure safe operation. If the employer installs new process equipment for which no RAGAGEP exists, the employer shall document that this equipment is designed, constructed, installed, maintained, inspected, tested and operated in a safe manner.

(6) If existing process equipment was designed and constructed in accordance with codes, standards, or practices that are no longer in general use, the employer shall document that the process equipment is designed, installed, maintained, inspected, tested, and operating in a safe manner for its intended purpose.

(e) Process Hazard Analysis.

(1) The employer shall perform and document an effective process hazard analysis (PHA) appropriate to the complexity of each process, in order to identify, evaluate, and control hazards associated with each process. All initial PHAs for processes not previously covered by Section 5189 shall be completed within three years of the effective date of this Section, in accordance with this subsection. PHAs performed in accordance with the requirements of Section 5189 shall satisfy the initial PHA requirements of this Section. All modes of operations shall be covered by the PHA.

(2) The employer shall determine and document the priority order for conducting process hazard analyses based on the extent of process hazards, the number of potentially affected employees, the age of the process and the process operating history. The employer shall use 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);

(F) Fault-Tree Analysis;

(G) Other PHA methods recognized by engineering organizations or governmental agencies.

(3) The PHA shall address:

(A) The hazards of the process;

(B) Previous major process incidents in the petroleum refinery and petrochemical industry sectors that are applicable to the process;

(C) All applicable Damage Mechanism Reviews (DMRs) and their recommendations, pursuant to subsection (k);

- (D) All applicable Hierarchy of Hazard Control Analyses (HCAs) conducted for the process and their recommendations, pursuant to subsection (l);
- (E) Potential consequences of failures of process equipment;
- (F) Facility siting, including the placement of processes, equipment, buildings, employee occupancies and work stations, in order to effectively protect employees from process safety hazards, including explosions, fires and exposure to highly hazardous materials.
- (G) Human Factors, as required under subsection (s);
- (H) A qualitative evaluation of the types, severity and likelihood of possible incidents that could result from a failure of the process or of process equipment;
- (I) The potential effects of external events, including seismic events, if applicable; and,
- (J) The findings of incident investigations relevant to the process, as required by subsection (o).
- (4) The PHA shall be performed by a team with expertise in engineering and process operations and shall include at least one refinery operating employee who has experience and knowledge specific to the process being evaluated. The team shall also include one member with expertise in the specific PHA methodology being used. As necessary, the team shall consult with individuals with expertise in damage mechanisms, process chemistry, and control systems. The employer shall provide for employee participation in this process, pursuant to subsection (q).
- (5) For all PHA recommendations, the employer shall apply and document the iterative HCA Method, pursuant to subsection (z). The employer shall perform a Hierarchy of Hazard Controls Analysis (HCA), pursuant to subsection (l), for all PHA recommendations that result from a scenario that identifies the potential for a major incident.
- (6) The employer shall document the PHA team's findings and recommendations in a report, which shall be available in the respective work area for review by any person working in that area.
- (7) The PHA report shall include: (A) the methodology, analysis and factors considered by the PHA team; (B) the findings of the PHA team; (C) the team's recommendations and schedule for implementation. The employer shall make the report available to operating, maintenance and other persons whose work assignments are in the petroleum refinery and who may be affected by the findings and recommendations.
- (8) The employer shall implement all recommendations in accordance with subsection (y).
- (9) At least every five (5) years, the written PHA shall be updated and revalidated in accordance with the requirements of this subsection to ensure that the PHA is consistent with the current process.

(10) The employer shall retain for the life of the process all PHAs and PHA updates and revalidations for each process covered by this Section. This information shall include the documented resolution of all recommendations developed pursuant to this subsection.

(f) Operating Procedures.

(1) The employer shall develop and implement effective written operating procedures. The operating procedures shall provide clear instructions for safely conducting activities involved in each process. The operating procedures shall be consistent with the process safety information and shall address, at a minimum, the following:

(A) Steps for each operating phase or mode of operation:

1. Start-up;
2. Normal operation;
3. Temporary operations as the need arises;
4. Emergency shutdown, including the conditions under which emergency shutdown is required, provisions granting the authority of the qualified operator to shut down the operation or process, and the assignment of responsibilities to qualified operators in order to ensure that emergency shutdown is executed in a safe and timely manner;
5. Emergency operations, including any response to the over-pressurizing or overheating of equipment or piping, and the handling of leaks, spills, releases and discharges of highly hazardous materials. These procedures shall provide that only qualified operators may initiate these operations, and that prior to allowing employees in the vicinity of a leak, release or discharge, the employer shall, at a minimum, do one of the following:
 - a. Shutdown and depressurize all process operations where a leak, release or discharge is occurring;
 - b. Isolate any vessel, piping, and equipment where a leak, spill or discharge is occurring; or,
 - c. Alternatively, the employer may define conditions under which procedures for handling leaks, spills, or discharges can be implemented if the employer can demonstrate that the procedures provide a level of protection that is functionally equivalent to, or safer than, shutting down or isolating the process;
6. Normal shutdown; and,
7. Start-up following a turnaround, or planned or unplanned shutdown, or after an emergency shutdown.

(B) Operating limits:

1. Consequences of deviation(s); and,
2. Steps required to correct and/or avoid deviation(s).

(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 passive, active and procedural safeguards, and personal protective equipment;
3. Protective measures to be taken if physical contact or inhalation exposure occurs;
4. Safety procedures for opening process equipment;
5. Verification of the composition and properties of raw materials and control of hazardous chemical inventory levels; and,
6. Any special or unique hazards.

(D) Safety Systems and their functions.

(2) A copy of the operating procedures shall be readily accessible to employees who work in or near the process area and to any other person who works in or near the process area or who maintains a process.

(3) The operating procedures shall be reviewed and updated as often as necessary to ensure that they reflect current, safe operating practices. The operating procedures shall include any changes that result from alterations in process chemicals, technology, personnel, process equipment, or other changes to the facility. Changes to operating procedures shall be managed in accordance with the requirements of subsection (n). The employer shall certify annually that operating procedures are current and accurate.

(4) The employer shall develop, implement and maintain safe work practices to prevent or control hazards during specific operations, such as: opening process equipment or piping; tasks requiring lock-out/tag-out procedures; confined space entry; handling, controlling, and stopping leaks, spills, releases and discharges; and control over entry into hazardous work areas by maintenance, contractor, laboratory or other support personnel. Safe work practices shall apply to employees and employees of contractors.

(g) Training.

(1) Initial training. Each employee involved in the operation or maintenance of a process, and each employee prior to 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 material on specific safety and health hazards, procedures, including emergency operations and shut-down, and safe practices applicable to the employee's job tasks.

(2) Refresher and supplemental training. At least every three years, and more often if necessary, effective refresher and supplemental training shall be provided to each operating or maintenance employee and other employees to ensure that employees understand and adhere to current operating and maintenance procedures. The employer, in consultation with the employees involved in operating the process, shall determine the appropriate frequency and content of refresher training.

(3) Training certification. The employer shall ensure that each employee involved in the operation or maintenance of a process has received, understood and successfully completed training as specified by this subsection. The employer, after the initial or refresher training, shall prepare a certification record containing the identity of the employee, the date(s) of training, the means used to verify that the employee understood the training, and the signature(s) of the person(s) administering the training.

(4) The employer shall develop and implement an effective written program that includes (A) the requirements that an employee must meet in order to be designated as qualified, and (B) employee testing procedures to verify understanding and to ensure competency in job skill levels and work practices that protect employee safety and health.

(5) The employer shall develop and implement an effective training program to ensure that all employees are aware of and understand all PSM elements described in this Section. Employees and employee representatives participating in a team pursuant to this Section shall be trained in the PSM elements relevant to that team.

(6) The employer shall provide for employee participation in developing and implementing the training program, pursuant to subsection (q).

(h) Contractors.

(1) This Section applies to contractors performing maintenance or repair, supply services, turnaround, major renovation, or specialty work on or adjacent to a process. It does not apply to contractors providing incidental services that do not influence process safety, such as janitorial work, food and drink services, laundry, delivery or other supply services.

(2) Petroleum refinery employer responsibilities.

(A) When selecting a contractor, the petroleum refinery employer shall obtain and evaluate information regarding the contractor's safety performance, including programs used to prevent employee injuries and illnesses.

(B) The petroleum refinery employer shall inform the contractor of the potential hazards associated with the contractor's work and the process, including fires, explosions, loss of containment, exposure to highly hazardous materials and high temperatures and pressures.

(C) The petroleum refinery employer shall explain to the contractor the applicable provisions of this Section, including the provisions of the refinery's Emergency Action Plan, developed pursuant to subsection (p) and Section 3220.

(D) The petroleum refinery employer shall develop and implement effective written procedures in order to ensure the safe entry, presence, and exit of the contractor and employees of the contractor in process areas.

(E) The petroleum refinery employer shall periodically evaluate the performance of contractors in fulfilling their obligations, as specified in this subsection. The employer shall ensure and document that the requirements of this subsection are performed and completed by the contractor.

(F) The petroleum refinery employer shall obtain and make available to the Division upon request a copy of the contractor's injury and illness log related to the contractor's work in the process areas.

(3) Contractor responsibilities.

(A) The contractor shall ensure that all of its employees are effectively trained, as specified in subsection (g) in the work practices necessary to safely perform their jobs, including applicable provisions of the refinery's Emergency Action Plan.

(B) The contractor shall ensure that all of its employees are instructed in the potential hazards related to their jobs and the process, including fires, explosions, loss of containment, exposure to highly hazardous materials and high temperatures and pressures.

(C) The contractor shall document that each of its employees has successfully completed the training required by this subsection by maintaining a record identifying:

1. Each employee who has received training;
2. The date(s) and subject(s) of training each employee has received; and,
3. The means used to verify that the employee understood the training received.

(D) The contractor shall ensure that each of its employees understands and follows the safety and health procedures of the petroleum refinery and the contractor.

(E) The contractor shall advise the petroleum refinery of specific hazards presented by the contractor's work, as well as any hazards identified by the contractor while performing work for the petroleum refinery.

(i) Pre Start-Up Safety Review.

(1) The employer shall perform a Pre Start-up Safety Review (PSSR) for new processes and for modified processes if the modification necessitates a change in the Process Safety Information, as specified in subsection (d). The employer shall also conduct a PSSR for all turnaround work performed on a process.

(2) The PSSR shall confirm all of the following prior to the introduction of highly hazardous materials to a process:

(A) Construction, maintenance and repair work has been performed in accordance with design specifications;

(B) Process equipment has been maintained and is operable in accordance with design specifications;

(C) Effective safety, operating, maintenance, and emergency procedures are in place;

(D) For new processes, a Process Hazard Analysis, Hierarchy of Hazard Controls Analysis, Damage Mechanism Review, and Safeguard Protection Analysis have each been performed, as applicable pursuant to this Section, and recommendations have been implemented or resolved before start-up. For new or modified processes, all changes have been implemented in accordance with the requirements contained in the Management of Change subsection (n); and,

(E) Training of each operating employee and maintenance employee has been completed.

(3) The PSSR shall involve operating or maintenance employees with expertise and experience in process operations and engineering in the process being started. An operating employee who currently works in the unit and has expertise and experience in the process being started shall be designated as the employee representative, pursuant to subsection (q).

(j) Mechanical Integrity.

(1) Written procedures.

(A) The employer shall develop, implement and maintain effective written procedures to ensure the ongoing integrity of process equipment.

(B) The procedures shall provide clear instructions for safely conducting maintenance activities on process equipment, consistent with the Process Safety Information.

(C) The procedures and inspection documents developed under this subsection shall be readily accessible to employees and employee representatives, pursuant to subsection (x).

(2) Inspection and testing.

(A) Inspections and tests shall be performed on process equipment, using procedures that meet or exceed RAGAGEP.

(B) The frequency of inspections and tests shall be consistent with the applicable manufacturer's recommendations or RAGAGEP, whichever is more frequent. Inspections and tests shall be conducted more frequently if necessary, based on the operating experience with the process equipment.

(C) The employer shall retain a certification record to document that each inspection and test has been performed in accordance with this subsection. The certification record shall identify the date of the inspection, the name of the person who performed the inspection or test, a description of the inspection or test performed, the results of the inspection or test, and the serial number or other identifier of the process equipment.

(3) Equipment deficiencies. The employer shall correct deficiencies in process equipment consistent with RAGAGEP or other equally protective standards that ensure safe operation.

(4) Quality assurance.

(A) The employer shall ensure that all process equipment at a minimum complies with the criteria established pursuant to subsection (d) Process Safety Information. In meeting this requirement, the employer shall ensure that all process equipment is:

1. Suitable for the process application for which it is or will be used;
2. Fabricated from the proper materials of construction; and,
3. Designed, constructed, installed, maintained, inspected, tested, operated and replaced in compliance with manufacturer's and other design specifications and all applicable codes and standards.

(B) If the employer installs new process equipment or has existing equipment for which no RAGAGEP exists, the employer shall ensure that this equipment is designed, constructed, installed, maintained, inspected, tested and operated in a safe manner.

(C) The employer shall conduct regularly scheduled checks and inspections as necessary to ensure that the requirements of (j)(4)(A) are met.

(D) The employer shall ensure that maintenance materials, spare parts and equipment meet design specifications and applicable codes.

(E) The employer shall establish a process for evaluating new or updated codes and standards and implementing changes as appropriate to ensure safe operation.

(k) Damage Mechanism Review.

(1) The employer shall complete a Damage Mechanism Review (DMR) within five (5) years of the effective date of this Section for each process for which a damage mechanism exists. Where no DMR is performed, the employer shall document the rationale for the determination that no damage mechanisms exist. The employer shall determine and document the priority order for conducting DMRs based on the process operating history, the PHA schedule, and inspection records. No less than fifty (50) percent of the DMRs shall be completed within 3 years of the effective date of this Section.

(2) A DMR shall be revalidated thereafter at least once every five years.

(3) A DMR shall also be conducted as follows:

(A) On new processes;

(B) As part of a major change prior to initial approval of the change; and,

(C) As part of an incident investigation, pursuant to subsection (o) where a damage mechanism is identified as a contributing factor. When conducting a DMR as part of an incident investigation, the employer shall review the most recent DMR(s) that are relevant to the investigation. If a DMR has not been performed on the processes that are relevant to the investigation, a DMR shall be completed prior to completing the incident investigation.

(4) The DMR for a process unit shall be available to the team performing a Process Hazard Analysis (PHA) for that process unit.

(5) The DMR shall be performed by a team with expertise in engineering, operation of the process or processes under review, equipment and pipe inspection, and damage and failure mechanisms. The team shall include one member knowledgeable in the specific DMR methodology being used. The employer shall provide for employee participation in this process, pursuant to subsection (q).

(6) The DMR for each process shall include:

- (A) Assessment of Process Flow Diagrams (PFDs);
 - (B) Identification of all potential damage mechanisms;
 - (C) Determination that the materials of construction are appropriate for their application and are resistant to potential damage mechanisms;
 - (D) Assessment of the rate at which damage is likely to occur;
 - (E) Methods to prevent or mitigate damage;
 - (F) Review of operating parameters to identify operating conditions that could accelerate or otherwise worsen damage, or that could minimize or eliminate damage; and,
 - (G) Selection of appropriate inspection techniques and the locations, methods and frequency of inspections.
- (7) For purposes of this subsection, damage mechanisms include, but are not limited to:
- (A) Mechanical loading failures, such as ductile fracture, brittle fracture, mechanical fatigue and buckling;
 - (B) Erosion, such as abrasive wear, adhesive wear and fretting;
 - (C) Corrosion, such as uniform corrosion, localized corrosion and pitting;
 - (D) Thermal-related failures, such as creep, metallurgical transformation and thermal fatigue;
 - (E) Cracking, such as stress-corrosion cracking; and,
 - (F) Embrittlement, such as high-temperature hydrogen attack.
- (8) DMRs shall include an assessment of previous experience with the process, including the inspection history and all damage mechanism data; a review of industry-wide experience with the process; and applicable standards, codes and practices.
- (9) At the conclusion of the analysis, the team shall prepare a written DMR report that shall include all of the following:
- (A) The process unit and damage mechanisms analyzed;
 - (B) Results of all analyses conducted, according to (k)(6);
 - (C) Recommendations for temporarily mitigating damage;
 - (D) Recommendations for preventing damage;
- (10) The report shall be provided to and, upon request, reviewed with employees whose work assignments are within the process unit described in the DMR.

- (11) The employer shall implement all recommended actions in accordance with subsection (y).
- (12) DMR reports shall be retained for the life of the process unit.

(I) Hierarchy of Hazard Controls Analysis.

(1) The employer shall conduct an HCA as a standalone analysis for all existing processes. The HCA for existing processes shall be performed in accordance with the following schedule, and may be performed in conjunction with the PHA schedule:

- (A) 50% of existing processes within three (3) years of the effective date of this Section.
- (B) Remaining processes within five (5) years of the effective date of this Section.

(2) The employer shall also conduct an HCA for the following: (A) PHA recommendations that result from a scenario that identifies the potential for a major incident, pursuant to subsection (e); (B) as part of a Management of Change (MOC) review whenever a major change is proposed, pursuant to subsection (n); (C) recommendations that result from the investigation of a major incident, pursuant to subsection (o); and (D) during the design and review of new processes, process units and facilities, and their related process equipment.

(3) All HCAs for existing processes shall be updated and revalidated as standalone analyses at least every five years, in conjunction with the PHA schedule.

(4) HCAs shall be performed, updated and revalidated by a team with expertise in engineering and process operations and shall include at least one operating employee who currently works on the process and has experience and knowledge specific to the process being evaluated, and one member knowledgeable in the HCA methodology being used. The employer shall provide for employee participation in this process, pursuant to subsection (q). As necessary, the team shall consult with individuals with expertise in damage mechanisms, process chemistry, and control systems.

(5) The HCA shall do all of the following:

- (A) Include all risk-relevant data for each process;
- (B) Identify, characterize and prioritize each process safety risk;
- (C) In accordance with subsection (z) to this Section, identify and evaluate all relevant inherent safety measures and safeguards (or where appropriate, combinations of measures and safeguards) in an iterative manner to reduce each risk to the greatest extent feasible. These inherent safety measures and safeguards shall include the following:

1. All control techniques or management systems that have been achieved in practice for the petroleum refining and related industrial sectors; and,
2. Control techniques or management systems that have been required or recommended for the petroleum refining industry and, where applicable, related industrial sectors in a regulation or report by a federal, state or local agency.

(6) In conducting the HCA, the team shall select and recommend first and second order inherent safety measures unless the team can demonstrate in writing it is not feasible to do so. Where the team does not recommend a first or second order inherent safety measure, the team shall document and justify in writing: (A) why that inherent safety measure is not feasible; and (B) why the inherent safety measure(s) and/or safeguards the team has recommended are the most protective feasible alternative.

(7) The employer shall complete an HCA report within 90 days following completion of the HCA, which shall include:

(A) A description of the composition, experience and expertise of the members of the team that performed the HCA;

(B) A description of the methodology used to analyze the hierarchy of controls;

(C) Identification and a description of the inherent safety measures and safeguards analyzed by the HCA team;

(D) The HCA team's recommended inherent safety measures and safeguards to address each process safety risk, in accordance with the iterative process described in subsection (z);

(E) The conclusions of the analysis and the justification for each conclusion;

(F) An action plan, including a timeline to implement the recommended actions from the HCA, pursuant to subsection (y); and,

(G) The plan for communicating the findings, recommendations and implementation schedule to all affected employees, pursuant to subsection (y).

(8) The employer shall implement all recommendations in accordance with subsection (y).

(9) The employer shall retain all HCA reports for the life of each covered process.

(m) Hot Work Permit.

(1) The employer shall develop, implement and maintain a written procedure for the issuance of hot work permits.

(2) The permit shall (A) certify that the applicable portions of the fire prevention and protection requirements contained in Sections 4848 and 6777 have been implemented prior to the initiation of hot work operations; (B) indicate the date(s) and times during which hot work is to be performed; (C) identify the equipment or process on which hot work is to be performed; and, (D) identify the name and employer of the party performing the hot work.

(3) All hot work permits shall be kept on file for one year.

(n) Management of Change.

(1) The employer shall develop, implement and maintain written Management of Change (MOC) procedures to manage changes (except for replacements-in-kind) in process chemicals, technology, procedures, process equipment, or facilities.

(2) The MOC procedures shall ensure that the following items are addressed and documented prior to any change:

(A) The technical basis for the proposed change;

(B) Potential process safety impacts of the change;

(C) Modifications to operating procedures;

(D) The time period required for the change; and,

(E) Authorization requirements for the proposed change.

(3) Prior to implementation of a major change, an HCA shall be performed pursuant to subsection (l) and the findings and recommendations of the HCA shall be included in the MOC documentation.

(4) The employer shall use qualified personnel and appropriate methods for MOCs based upon hazard, complexity and type of change.

(5) The employer shall provide for employee participation in this process, pursuant to subsection (q).

(6) Employees involved in the process, as well as maintenance workers and employees of contractors whose job tasks will be affected by a change, shall be informed of, and effectively trained in, the change as early as practicable prior to its start-up.

(7) If a change covered by this subsection results in a change to the Process Safety Information, such information shall be amended and updated as soon as possible, in accordance with subsection (d).

(8) If a change covered by this subsection results in a change to the Operating Procedures, the procedures shall be amended and updated as soon as possible, in accordance with subsection (f).

(o) Incident Investigation – Root Cause Analysis.

(1) The employer shall develop, implement and maintain written procedures for promptly investigating and reporting any incident that results in, or could reasonably have resulted in, a major incident.

(2) The written procedures shall include an effective method for conducting a thorough root cause analysis. The root cause analysis shall provide information sufficient for the employer to reduce the risk of a recurrence of the incident or a similar incident to the greatest extent feasible.

(3) The employer shall initiate the incident investigation as promptly as possible, but no later than 48 hours following an incident. As part of the incident investigation, the employer shall conduct a root cause analysis.

(4) An incident investigation team shall be established and shall, at a minimum, consist of a person with expertise and experience in the process involved; a person with expertise in the employer's root cause analysis method; and a person with expertise in overseeing the investigation and analysis. The employer shall provide for employee participation in this process, pursuant to subsection (q). If the incident involved the work of a contractor, then a representative of the contractor's employees shall also be included on the investigation team.

(5) The incident investigation team shall implement the employer's root cause analysis method to determine the underlying management system causes of the incident, including organizational and safety culture causes. The team shall review the appropriate DMR(s) that were performed pursuant to subsection (k) and shall incorporate the findings from the DMR(s) into the incident investigation.

(6) The incident investigation team shall develop recommendations to address the findings of the root cause analysis. The recommendations shall include interim actions that will reduce the risk of a recurrence or similar incident until final actions can be implemented.

(7) The employer shall prepare a written report within 90 calendar days of the incident, unless the employer can demonstrate that additional time is needed due to the complexity of the investigation. In such cases, the employer shall prepare a status report within 90 calendar days of the incident and every 30 calendar days thereafter until the investigation is complete. The employer shall prepare a final report within five (5) months of the incident.

(8) The investigation report shall include:

(A) The date and time of the incident;

(B) The date and time the investigation began;

(C) A detailed description of the incident;

(D) The factors that caused or contributed to the incident, including direct causes, indirect causes and root causes, determined through the root cause analysis;

(E) A list of any DMR(s), PHA(s), HCA(s), and SPA(s) that were reviewed as part of the investigation;

(F) Results of any revalidated PHA(s), HCA(s), DMR(s) and SPA(s) conducted;

(G) Interim recommendations implemented by the employer to prevent a recurrence or similar incident; and,

(H) Recommendations for permanent corrective actions and their schedule for implementation, pursuant to subsection (y).

(9) The report shall be provided to and, upon request, reviewed with all operating, maintenance, and other personnel, including employees of contractors where applicable, whose work assignments are within the facility where the incident occurred or whose job tasks are relevant to the incident findings. The report shall also be provided to employee representatives and contractor employee representatives, where applicable.

(10) The employer shall implement all recommendations in accordance with subsection (y). Recommended actions shall include revalidation of the appropriate portions of all relevant PHAs and revalidation of all relevant DMRs.

(11) Incident investigation reports shall be retained for the life of the process unit.

(p) Emergency Planning and Response.

The employer shall develop, implement and maintain an Emergency Action Plan in accordance with the provisions of Section 3220.

(q) Employee Participation

(1) In consultation with employees and employee representatives, the employer shall develop, implement and maintain a written plan to effectively provide for employee participation in PSM elements, as required by this Section. The plan shall include provisions that provide for the following:

(A) Effective participation by affected operating and maintenance employees and employee representatives, at the earliest possible point, on all teams pursuant to this Section to conduct PHAs, DMRs, HCAs, MOCs, MOOCs, PSCAs, Incident Investigations, SPAs, and PSSRs;

(B) Effective participation by affected operating and maintenance employees and employee representatives, at the earliest possible point, throughout all phases of the development, training, implementation and maintenance of the PSM elements required by this Section;

(C) Access by employees and employee representatives to all documents or information developed or collected by the employer pursuant to this Section, including information that might be subject to protection as a trade secret;

(D) Where authorized collective bargaining agents exist, the employer shall allow for bargaining agents to select one or more representatives to participate in overall PSM program development and implementation planning and for one or more person(s) to participate in each team-based activity pursuant to this Section. The employer shall document each instance where collective bargaining agents or their selected representative(s) choose(s) not to participate;

(E) Where employees are not represented by an authorized collective bargaining agent, the employer shall establish effective procedures in consultation with employees for the selection of employee representatives.

(F) Nothing in this subsection shall preclude the employer from requiring an employee or employee representative to whom information is made available under subsection (q)(1)(C) to enter into a confidentiality agreement prohibiting him or her from disclosing such information, as set forth in Section 5194.

(2) The employer shall develop, implement and maintain effective Stop Work procedures that ensure:

(A) The authority of all employees, including employees of contractors, to refuse to perform a task where doing so could reasonably result in death or serious physical harm;

(B) The authority of all employees, including employees of contractors, to recommend to the operator in charge of a unit that an operation or process be shut down based on process safety concerns; and,

(C) The authority of the qualified operator in charge of a unit to shut down an operation or process based on process safety concerns.

(3) The employer shall develop, implement and maintain effective procedures to ensure the right of all employees, including employees of contractors, to anonymously report hazards. The procedures shall:

(A) Include a method for refinery employees and employees of contractors to anonymously report process safety hazards in writing; and,

(B) Require the employer to respond in writing within thirty (30) calendar days to written hazard reports submitted by employees or employees of contractors. The employer shall respond immediately to reports of hazards that present the potential for death or serious physical harm.

(4) The employer shall develop a system to effectively document and record (A) work refusals, as defined in (q)(2)(a); (B) written employee reports of safety or health hazards; (C) recommendations to shut down an operation or process; and (D) the actual shut down of an operation or process that occurs pursuant to this subsection.

(r) Process Safety Culture Assessment.

(1) The employer shall develop, implement and maintain an effective Process Safety Culture Assessment (PSCA) program.

(2) The employer shall conduct an effective PSCA and produce a written report and action plan within 18 months following the effective date of this Section, and at least every five years thereafter. The purpose of the PSCA shall be to evaluate process safety culture practices and, at a minimum, assess progress with regard to the following:

(A) Encouragement for reporting of process safety concerns;

(B) Ensuring that reward or incentive programs do not deter reporting by employees of process safety concerns, near misses, injuries and incidents;

(C) Ensuring that process safety is not compromised by production pressures; and,

(D) Promoting effective process safety leadership at all levels of the organization.

(3) The employer shall develop a written report and corrective action plan within ninety (90) calendar days of completion of the PSCA, which shall include:

(A) The method(s) used to assess the process safety culture;

(B) The conclusions of the process safety culture assessment;

(C) The rationale for the conclusions;

(D) The recommendations to address the findings of the PSCA.

(4) The employer shall implement all recommendations in accordance with subsection (y).

(5) The employer shall conduct a written interim assessment of the implementation and effectiveness of each PSCA recommendation within 3 years following the completion of a PSCA report.

(6) The refinery manager or designee shall serve as signatory to all process safety culture assessments, reports and corrective action plans.

(7) The employer shall provide for employee participation in this process, pursuant to subsection (q).

(8) The PSCA report and corrective action plan and the written three-year interim assessment shall be communicated and made available to employees, their representatives and participating contractors within 14 days of the completion of the report.

(9) Participating contractors shall provide the PSCA report and action plan and the written three-year interim assessment to employees of contractors and employee representatives within 14 days of receipt.

(s) Human Factors Program.

(1) The employer shall develop, implement and maintain an effective written human factors program.

(2) The human factors program shall evaluate staffing levels; the complexity of tasks; the length of time needed to complete tasks; the level of training, experience and expertise of employees; the human-machine and human-system interface; the physical challenges of the work environment in which the task is performed; employee fatigue and other effects of shiftwork and overtime; communication systems; and the understandability and clarity of operating and maintenance procedures.

(3) The employer shall include an analysis of human factors in the design phase of major changes and in all incident investigations, PHAs, MOOCs, and HCAs. The analysis of process controls shall include:

1. Error proof mechanisms;
2. Automatic Alerts; and,
3. Automatic System Shutdowns.

(4) The employer shall include an assessment of human factors in new operating and maintenance procedures.

(5) The employer shall assess human factors in existing operating and maintenance procedures and shall revise these procedures accordingly. The employer shall complete fifty (50) percent of assessments and revisions within two years following the effective date of this Section and one hundred (100) percent within three years.

(6) The employer shall train operating and maintenance employees in the written human factors program.

(7) The employer shall provide for employee participation in this process, pursuant to subsection (q).

(8) Pursuant to subsection (x), the employer shall provide a copy of the written human factors program to employees and their representatives and to affected contractors, employees of contractors, and contractor employee representatives.

(t) Management of Organizational Change.

(1) The employer shall develop, implement and maintain written procedures to manage organizational changes that could have an adverse effect on process safety. These include reducing staffing levels, changing shift duration, or making changes in employee responsibilities. The areas to which these procedures shall apply include operations, engineering, maintenance, health and safety, and emergency response. This requirement shall also apply to employers using employees of contractors in permanent positions in operations and maintenance.

(2) The procedures shall include a Management of Organizational Change (MOOC) assessment, which shall address the following:

(A) The experience levels of employees involved in the process before and after the proposed change, in order to ensure that the change will not compromise employee health and safety,

the safety of operations and maintenance, and the effectiveness of emergency operations and response; and,

(B) A description of the change being proposed, the makeup of the team responsible for assessing the proposed change, the factors to be evaluated by the team, the rationale for the team's decision to implement or not implement the change, and the actions required to make the change.

(3) Prior to conducting the assessment, the employer shall ensure that the job function descriptions are current and accurate for all positions potentially affected by the change.

(4) The refiner manager, or his/her designee, shall certify that the assessment is accurate and that the proposed organizational changes(s) will not increase the likelihood of a major incident.

(5) The employer shall provide for employee participation in this process, pursuant to subsection (q).

(6) The employer shall document the results of the analysis, including the change being proposed, the makeup of the team performing the analysis, what factors were considered, the decisions to implement or not implement the change, the basis for the decisions, and the necessary actions required to make the change.

(7) All MOOCs analyses shall include an analysis of human factors, pursuant to subsection (s).

(8) Prior to implementing a change, the employers shall inform all employees potentially affected by the change.

(u) Safeguard Protection Analysis

(1) For each process, the employer shall perform a written Safeguard Protection Analysis (SPA) where a PHA identifies the potential for a major incident, to determine (A) the effectiveness of existing individual safeguards; (B) the combined effectiveness of all existing safeguards for each failure scenario in the PHA; (C) the individual and combined effectiveness of safeguards recommended in the PHA; and (D) the individual and combined effectiveness of additional or alternative safeguards that may be needed.

(2) All safeguards for each failure scenario shall be independent of each other and independent of initiating causes.

(3) The SPA shall utilize a quantitative or semi-quantitative method, such as Layer of Protection Analysis (LOPA) or an equally effective method. The SPA may be a stand-alone analysis or may be incorporated into the PHA.

- (4) The employer shall develop and maintain a schedule for conducting and completing initial and revalidation SPAs in conjunction with the PHA schedule.
- (5) Beginning within six (6) months of the effective date of this Section, the employer shall complete all SPAs for a process within six (6) months following completion of the PHA.
- (6) All SPAs shall be performed by a team with expertise in engineering and process operations. The team shall include at least one operating employee who has experience and knowledge specific to the process, and one member who is knowledgeable about the specific SPA method used. As necessary, the team shall consult with other individuals with expertise in damage mechanisms, process chemistry, control systems and instrumentation. The employer shall provide for employee participation in this process, pursuant to subsection (q).
- (7) The SPA shall incorporate and document the following information from the PHA to conduct the analysis: potential initiating events and their likelihood and severity, including external events; equipment failures; human errors; loss of flow control; loss of pressure control; loss of temperature control; loss of level control; and excess reaction or other conditions that may lead to a loss of containment. The employer shall apply site-specific failure rate data, or in the absence of such data, industry failure rate data for each device, system, or human factor to determine the frequency rates of all potential initiating events.
- (8) The SPA shall apply a quantitative or semi-quantitative method in documenting the risk reductions achievable by existing safeguards and safeguards recommended in a PHA. The risk reduction obtainable by each safeguard shall be based on site-specific failure rate data, or in the absence of such data, industry failure rate data for each device, system, or human factor.
- (9) The SPA shall include a written report of findings, conclusions and recommendations, including additional or alternative safeguards that will reduce the risk of a major incident. The team shall select and recommend the most protective safeguards, unless the team can demonstrate in writing that it is not feasible to do so. Where the team does not recommend the most protective safeguards, the team shall document and justify in writing (A) why the safeguard is not feasible; and (B) why the safeguards the team has recommended are the most protective feasible alternative.
- (10) The SPA and written report for each process shall be made available to all employees and employee representatives, pursuant to subsection (x).
- (11) The employer shall implement all recommendations, pursuant to subsection (y).
- (12) At least every five (5) years, the SPA shall be updated and revalidated pursuant to the requirements of this subsection. All SPAs, revalidations, and updates shall be retained for the life of the process.

(v) Compliance Audits.

(1) Every three years, the employer shall conduct an effective compliance audit and shall certify that the refinery is in compliance with all provisions of this Section, and that all policies and procedures developed thereunder are being followed.

(2) The compliance audit shall be conducted by at least one person knowledgeable in the requirements of the subsection under review.

(3) The employer shall prepare a written report of the findings of the compliance audit, including documentation of all deficiencies identified in the audit and recommendations and corrective actions taken to correct those deficiencies. The report shall identify and state the qualifications of the persons performing the compliance audit.

(4) The employer shall make the report available to employees and employee representatives, in accordance with subsection (q). The employer shall respond in writing within sixty (60) days to any employee or employee representative comments on the report.

(5) The employer shall implement all recommendations in accordance with subsection (y).

(6) The employer shall retain the three most recent compliance audit reports.

(7) The compliance audit report shall fulfill the inspection requirements related to process safety under GISO Section 3203 but shall not relieve the employer of any other obligations thereunder, including inspection for other hazards.

(8) As part of the compliance audit, the employer shall consult with operators with expertise and experience in each process audited and shall document the content of these consultations in the audit report.

(w) PSM Management System.

(1) The employer shall develop and implement a written Process Safety Management (PSM) management system, which shall be reviewed and updated at least every three (3) years. The refinery manager shall be responsible for compliance with all portions of this Section and shall develop annual goals to achieve continuous improvement in all subsections.

(2) As part of the PSM Management System, the employer shall develop and maintain:

(A) Written PSM policies and procedures, as described below;

(B) Job descriptions of employer and employee roles and responsibilities under each subsection of this Section;

- (C) An organizational chart of personnel with responsibilities for each subsection;
 - (D) Written procedures for ensuring the effective communication of safety, operations, and maintenance information among and across process and maintenance employees, contractors, support personnel, supervisors and senior management;
 - (E) Policies and procedures to ensure that the findings, recommendations and corrective actions in all subsections are communicated effectively to employees and employee representatives; and,
 - (F) Policies and procedures to effectively provide for employee participation in all applicable subsections of this Section, pursuant to subsection (q).
- (3) As part of the PSM Management System, the employer shall track and document all changes to PSM program elements under this Section.
- (4) The employer shall develop, implement and maintain a program to track and document the following Process Safety Performance Indicators:
- (A) Past due inspections of process piping and components;
 - (B) Past due inspections for pressure vessels;
 - (C) Past due recommended actions required by this Section;
 - (D) Each leak seal repair installed on hydrocarbon and hazardous utility systems and the date(s) it was installed; the projected date(s) for implementing a permanent correction for each leak seal; and the total number of days each leak seal repair was in place, and,
 - (E) The number of major incidents that have occurred each calendar year.
- (5) For purposes of (4)(A) through (4)(C) of this subsection, the employer shall document an inspection or recommended action as past due if it is not completed by its scheduled completion date. Until an inspection or recommended action is completed, the employer shall maintain a record that documents each month that the inspection or recommended action remains past due.
- (6) The employer shall prepare an annual written report containing the information on all process safety performance indicators described in this subsection for the previous twelve month period. The employer shall certify annually that the report is current and accurate.

(x) Access to Documents and Information.

The employer shall provide all documents or information developed or collected pursuant to this Section to the Division upon request.

(y) Implementation

(1) The employer shall develop and document a corrective action work process to prioritize and implement the recommendations that result from the findings of a PHA, DMR, HCA, Incident Investigation, PSCA, Human Factors analysis, SPA, and Compliance Audit.

(2) All findings and associated recommendations must be provided to the employer by the team performing the review or analysis at the earliest opportunity.

(3) The employer may change or reject a team recommendation if the employer can demonstrate that the recommendation meets one of the following conditions:

(A) The analysis upon which the recommendation is based contains material factual errors;

(B) The recommendation is not relevant to process safety;

(C) An alternative measure would provide an equivalent or better level of protection, except that this provision shall not apply to first or second order inherent safety recommendations developed pursuant to subsection (l); or,

(D) The recommendation is infeasible.

(4) The employer shall document all instances where any of the conditions in (y)(3)(A) through (y)(3)(D) is applied for the purpose of changing or rejecting a team recommendation.

(5) Each recommendation that is changed or rejected by the employer shall be communicated to all team members. For each changed or rejected recommendation, the employer shall document all comments received from all team members. The employer shall document a final decision for each recommendation and shall report the decision to all team members.

(6) Based on the findings and recommendations of the team, the employer shall evaluate and document whether revalidation of any applicable PHA, HCA, DMR or SPA is needed. If the employer determines that any revalidations are needed, these revalidations shall be subject to the corrective action requirements of this subsection.

(7) The employer shall develop and document corrective actions to implement each accepted recommendation. The employer shall assign a completion date for each corrective action and a person responsible for completing the corrective action.

(8) The employer shall promptly complete all corrective actions. The employer shall treat any proposed change to a completion date as a change to be evaluated under the MOC process, pursuant to subsection (n). All completion dates shall be consistent with the requirements of this subsection.

(9) Except as provided in paragraph (10), each corrective action that does not require a process shutdown shall be completed within 30 months after the completion of the analysis, investigation or review, unless the employer can demonstrate in writing that it is not feasible to do so.

(10) Each corrective action from a compliance audit shall be completed within 18 months after completion of the analysis or review unless the employer can demonstrate in writing that it is not feasible to do so. Each corrective action from an incident investigation shall be completed within 18 months after completion of the investigation or within two (2) years after the date of the incident, whichever is earlier.

(11) Each corrective action requiring a process shutdown shall be completed during the first regularly scheduled turnaround of the applicable process following completion of the PHA, SPA, DMR, HCA, MOC, Compliance Audit or Incident Investigation, unless the employer can demonstrate in writing it is not feasible to do so.

(12) Notwithstanding paragraphs (y)(8) – (y) (10), hazards that present the potential for death or serious physical harm shall be corrected immediately, either through permanent corrections or interim measures that will ensure employee safety and health, pending permanent corrections.

(13) Where a corrective action cannot be implemented within the times described above, the employer shall document the decision and rationale for the delay and shall implement the corrective action as soon as possible. The documentation shall include:

(A) The rationale for deferring the corrective action(s);

(B) The documentation required under the MOC process;

(C) A timeline describing when the corrective action(s) will be implemented;

(D) A plan for effectively communicating the rationale and timeline to all affected employees and their representatives.

(14) The employer shall track and document the completion of each corrective action and shall append the documentation to the applicable PHA, DMR, HCA, Incident Investigation, PSCA, Human Factors analysis, SPA, or Compliance Audit.

(z) HCA Method

The employer shall apply the following iterative method in complying with the requirements of subsection (e), Process Hazard Analysis, and subsection (l), Hierarchy of Hazard Controls Analysis.

ACTIVITIES

1 Identify hazards and assess risk against risk management objectives; if necessary to further reduce risk, apply Steps 2-4

2 Apply inherently safer strategies to the hazards and design of the entire plant

2a Eliminate the hazards altogether

2b Reduce the absolute magnitude of incident impacts

2c Reduce the likelihood or escalation of an incident

3 Apply inherently safer strategies to the design of layers of protection

3a Use passive safeguards for prevention/mitigation

3b Use active safeguards for prevention/mitigation

3c Use procedures for prevention/mitigation

4 Iterate through inherently safer strategies and layers of protection until risks are reduced to the greatest extent feasible, pursuant to this Section.

STEPS

Avoid hazards

First-order inherent safety

Reduce severity

Second-order inherent safety

Reduce likelihood

Apply passive safeguards

Apply active safeguards

Layers of protection

Apply procedural safeguards

Identify, evaluate and address hazards and risks until risks are reduced to the greatest extent feasible, pursuant to this Section.

Adapted from Inherently Safer Chemical Processes: A Life Cycle Approach (2009). American Institute of Chemical Engineers, Center for Chemical Process Safety (p. 16).

Note: Authority cited: Section 142.3 and 7856, Labor Code. Reference: Sections 142.3 and 7855-7868, Labor Code.