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# Process Safety Management Protocols

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## Site XYZ Audit/Verification Dates

### Foreword

This interview workbook has been designed by the Process Safety Management (PSM) Subject Division of the Canadian Society for Chemical Engineering (CSChE) as a helpful tool to supplement the Audit Protocol for the CSChE Process Safety Management Standard. It is available for free download from the website of the PSM Division, and may be used or edited to meet a user's needs, provided that this Forward, and accompanying Disclaimer and Introduction are retained, with an added notation that the modified workbook has been adapted from the original PSM Division template.

The PSM Guide, upon which the Standard is based, was developed through the Major Industrial Accidents Council of Canada (MIACC), a voluntary alliance of interested parties dedicated to reducing the frequency and severity of major industrial accidents. From 1987 until its dissolution in 1999, this partnership included the federal, provincial and municipal governments, industry, labour, emergency response groups, public interest groups and academia. On the dissolution of MIACC, the PSM aspects of this initiative were transferred to the new subject division of the CSChE, which was formed for this purpose.

The material in the PSM Guide is based on the approach developed by the U.S. Center for Chemical Process Safety (CCPS). The CCPS was established in 1985 as a Directorate of the American Institute of Chemical Engineers to focus on engineering practices that will help prevent or mitigate catastrophic process safety incidents.

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### Disclaimer

The proposed application of this publication is stated in the Introduction. While the information presented in this document is intended to assist users in the safe design and operation of facilities handling, using, processing or storing hazardous materials, the user is advised that neither the Canadian Society for Chemical Engineering (CSChE) nor persons involved in producing this publication warrant to represent, expressly or implicitly, the correctness or accuracy of the information presented herein. This publication is intended to provide general guidance and not advice for specific situations, nor is it meant to constitute a legal standard of care.

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## Introduction

The **Process Safety Management Standard** established by the Canadian Society for Chemical Engineering in 2012 identifies the requirements of a **management system** that will address the scope of issues covered by **Process Safety Management (PSM)** for facilities handling or storing potentially hazardous materials. The overarching purpose of the Standard is to identify the performance requirements that can be audited by an organization or a third party to recognize and address gaps that may exist in the overall management system. The Standard identifies the expected results of the various policies, practices and procedures that will help to ensure the organization achieves the desired results.

The Standard defines the minimum requirements that must be in place to ensure the 12 Elements are adequately addressed. Any deficiencies can lead to unacceptable risks to safety, health and the environment or loss of assets and/or production. An organization would normally include these minimum requirements in an integrated health, safety, environmental and risk management program that will be effective in preventing incidents at facilities that manufacture, store, handle or otherwise use potentially hazardous materials. The Standard also includes Guidelines for some of the elements. While not mandatory, the Guidelines have been included as they represent recommended best practices in helping to meet the Standard.

The questions in the PSM Audit Protocol have been prepared as a master audit tool that can be used to establish whether an organization is meeting the requirements of the PSM Standard. While many of the audit questions imply yes/no answers, they do require technical knowledge to verify. In addition, some of the questions are of a more qualitative nature. Thus an audit of adherence to the standard needs to be conducted by an individual or team who are knowledgeable in the principles and practice of process safety. For convenience, questions that address the Guidelines have also been included in italics for easy identification.

This audit workbook has been created as a tool that auditors may use when examining an organization's adherence to the PSM Standard. It is intended to simplify the task by conveniently grouping together all the audit questions for each functional group of the organization.

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# Company XYZ Example Audit Agenda

## Dates

<b>Sunday – 20:00 – 21:00 – Hotel Lounge</b>		
Item	Attendees	Time
Pre-Audit Team Meeting	Audit Team	20:00

<b>Monday - 08:00 – 16:30</b>		
Item	Facility/Audit Resource	Time
1. Safety Orientation	Safety Specialist	08:00
2. Plant Safety Induction	Safety Specialist	08:30
3. Overview of facility operations	Process Engineer	09:00
4. Plant Tour and Inspection	Tour Guide	09:30
5. Review notes and observations	Tour Guide	11:30
6. Lunch		12:00
7. Opening Meeting <ul style="list-style-type: none"> <li>• Introduction &amp; Objectives of the audit</li> <li>• Past Significant Incident History</li> <li>• Organization chart</li> <li>• Review Interview Schedule</li> </ul>	Site Leadership Team Audit Leaders Leadership Leadership Leadership	13:30
8. Review HS&E Management System	HSE Manager	14:30
9. Interview Leadership representative	Site Leadership	15:00
10. Review documentation/Prepare notes	Audit Team	16:00
11. Finish for the day	Audit Team	16:30

<b>Tuesday - 08:00 – 16:30</b>		
Item	Facility/Audit Resource	Time
1. Interview Operations representatives	Operations Leadership	08:00
2. Interview Engineering representatives	Engineering Leadership	10:00
3. Review Engineering documentation	Project Engineer	11:30
4. Lunch		12:00
5. Interview Maintenance representatives	Assurance Leadership	13:00
6. Review equipment/maintenance documentation	Assurance Department	14:00
7. Interview Inspection representative	Inspectors	15:00
8. Review Inspection documentation	Inspection Department	15:45
9. Prepare notes and working papers	Audit Team	16:15
10. Finish for the day		16:30

**Wednesday - 08:00 – 22:00**

Item	Facility/Audit Resource	Time
1. Interview Safety representative	Safety Representative	08:00
2. Interview Purchasing representative	Buyer or designate	09:00
3. Review Purchasing documentation	Audit Team	09:30
4. Interview Human Resources representative	Human Resources	10:00
5. Review HR documentation	Audit Team	10:30
6. Interview Training representative	Training Coordinator	11:00
7. Review and verify training documentation	Trainer or designate	11:30
8. Lunch		12:00
9. Interview Engineering, Procurement, and Construction Contractor and conduct a survey at the fabrication facilities	EPC Representatives	13:00
10. Revisit field concerns	Audit Team	15:30
11. Leave the plant		16:30
12. Supper		17:30
13. Identify potential gaps in program or practices	Audit Team	19:00
14. Prepare findings for closeout meeting		20:00
15. Begin preparation of closeout presentation		20:30
16. Finish for the day		22:00

**Thursday - 08:00 – 16:00**

Item	Facility/Audit Resource	Time
1. Review potential gaps with Leadership Team	Site Leadership	08:00
2. Review additional data regarding potential gaps	Audit Team	08:30
3. Finalize Closeout Presentation	Audit Team	11:00
4. Lunch		12:00
5. Closeout presentation <ul style="list-style-type: none"> <li>• Positive aspects of the site</li> <li>• Global site issues</li> <li>• Critical Program Gaps (no program in place)</li> <li>• Non-critical Program Gaps (program in place)</li> </ul>	Closeout Meeting attendees	13:00
6. Leave the plant		14:30







# Protocols

## Engineering Protocol

	<b>Element 1. Accountability; Objectives and Goals</b>	
1b	Are PSM goals and objectives visible to and understood by all workers?	
1c	Are there company objectives that demonstrate the priority of Process Safety compared to other business objectives like production and cost?	
1d	Is accountability for Process Safety clearly identified in roles, responsibilities, and position descriptions?	
1e	Are there appropriate resources available to meet the Process Safety goals and objectives?	
1f	Are there examples of management commitment to Process Safety at all levels of the organization, e.g., directives that state inadvertent loss of process containment situations must be eliminated?	
1A	<b>Continuity of operations</b>	
1A3	How is the need for spare and redundant equipment identified at the design stages of a project so the facility can reduce the need for a complete shutdown?	
1A4	How does the company decide when to segregate parts of a facility so that small sections of the facility can be shut down without shutting down the complete operation?	
1A5	Is there a process in place to decide when there is a need to install multiple lines rather than relying on a single stream operation?	
1B	<b>Continuity of systems</b>	
1B1	Are resource allocations driven by the process hazards rather than by the economic viability of the process?	
1C	<b>Continuity of organization</b>	
1C1	Are PSM responsibilities clearly defined as part of position or job descriptions?	
1D	<b>Quality process</b>	
1D1	Do workers understand the scope of issues involved in PSM?	
1D2	Does the facility maintain monitoring programs to track the status of Process Safety?	
1D3	Are there established goals, targets and key performance indicators (KPI) for measuring Process Safety performance?	
1D5	Is there a quality assurance system for all aspects of work that includes checking, verification, validation, documentation and configuration management, as appropriate?	
1E	<b>Control of exceptions</b>	
1E1	Is there a process in place to allow exceptions in engineering designs to be managed with appropriate controls by assigning accountability to qualified personnel?	
1E2	Is there a process in place to assign accountability for construction, commissioning and decommissioning of facilities?	
1G	<b>Management accessibility</b>	
1G1	Is management available to assist in the decision-making process?	
1G2	Is leadership available to resolve conflicting views among safety, engineering, maintenance, production and business managers?	
1G3	<i>Is there a process in place for conflict resolution on issues that include Process Safety?</i>	
1H	<b>Communications</b>	

1H1	Does senior management communicate their understanding of Process Safety accountability for their unit and individuals within it?	
1H2	Are overlapping responsibilities between individuals/units clearly defined and communicated to ensure that no gaps exist?	
1I	<b>Company expectations</b>	
1I1	How does the Board of Directors and the Executive Management Team communicate their expectations regarded Process Safety performance?	
1I2	Are the Process Safety goals consistent with other aspects of the organizational vision or master plan?	
1I3	Are broad Process Safety goals established by management?	
1I4	Is there a process in place to measure Process Safety performance and take any action that may be required?	
1I5	Do Process Safety goals address the long-term aims of the company as well as detailed short-term targets?	
1I6	Are adequate resources available within or outside the company to achieve Process Safety goals?	
1I7	<i>Have key leading and lagging indicators been established to measure Process Safety performance (e.g. Process Safety-related incidents should be included as a lagging metric)?</i>	
1I8	<i>Has the organization been benchmarked against others to ensure the best practices are being used?</i>	
	<b>Element 2. Process Knowledge and Documentation</b>	
2a	Is information necessary for the safe design, operation and maintenance of the facility written, reliable, current and easily accessible by people who need to use it?	
2b	Where does the facility store the documentation to support Process Safety knowledge?	
2A	<b>Chemical and occupational health hazards</b>	
2A1	Are Material Safety Data Sheets (MSDS) available for every chemical used, stored or produced at the site?	
2A3	for those involved in process development and design, and	
2B	<b>Process definition/design criteria</b>	
	Does the facility have up-to-date and available:	
2B1	process flow diagrams;	
2B2	data on relevant operating envelopes and safe operating limits (e.g. levels, temperatures, pressures, flows, time, cycles and compositions);	
2B3	data for evaluation of the effects, on health, safety and the environment, of operating outside the safe upper and lower limits;	
2B4	data on process chemistry, including chemistry of side reactions, by-products and contaminants;	
2B5	specifications on the maximum intended inventory; and	
2B6	material and energy balances?	
2C	<b>Process and equipment design</b>	
	Does the facility have up-to-date and available:	
2C1	pipng and instrument diagrams (P&IDs);	
2C2	data regarding materials of construction and their suitability to handle process material;	
2C3	data regarding process control systems, including software integrity;	
2C4	data regarding ventilation system design;	
2C5	data regarding critical alarms and systems;	
2C6	data regarding design codes and standards employed;	

2C7	electrical area classification drawings; and	
2C8	plot plans?	
2D	<b>Protective systems</b>	
	Does the facility have up-to-date and available data regarding:	
2D1	critical interlocks (systems which either prevent or mitigate incidents);	
2D2	pressure relief and venting systems;	
2D3	data regarding relief system design and design basis;	
2D4	Fire and gas detection and protection equipment;	
2D5	emergency isolation valves; and	
2D6	effluent treatment systems?	
2F	<b>Process risk management decisions</b>	
2F1	Is there a process to facilitate risk management decisions on an ongoing basis?	
2F2	Are risk management decisions documented, showing the decisions made and the basis on which they were made?	
2G	<b>Company memory (management of information)</b>	
2G1	Is there a process to document knowledge and information gained from plant experience that is likely to be important for the future safety of the facility?	
2G2	Is the knowledge and information sufficiently catalogued and detailed so that it is not overlooked or forgotten as personnel or the organization change?	
	<b>Element 3. Capital Project Review and Design Procedures</b>	
3A	<b>Appropriation request procedures</b>	
3A1	Does the approval process for new capital projects ensure that the request has identified risks as well as capital and other resources necessary to manage those risks?	
3A2	Does the approval process require Process Safety reviews to be satisfactorily completed at each stage in order for the project to proceed to the next stage?	
3B	<b>Hazard reviews</b>	
3B1	Are hazard reviews completed to ensure risks associated with hazardous material and energy have been identified and the risks are acceptable?	
3B2	Are adequate capital and other resources made available to minimize exposure to workers, the public and the environment to the effects of hazardous materials and energy associated with the process?	
3B3	Is the scale of the review dependent upon the hazards of the proposed process and the stage of the project?	
3B4	Are more intensive review techniques required as additional information becomes available as the design proceeds?	
3C	<b>Siting</b>	
	Does the siting of a proposed expansion or new plant consider:	
3C1	buffer zones between the plant and the public;	
3C2	worst credible scenarios for release of a toxic chemical, explosion or fire, and effect(s) on exposed groups;	
3C3	exposure hazard to and from adjacent plants or facilities;	
3C4	possible exposures due to natural events such as earthquake, flood, tornado, etc.;	
3C5	the effects of transporting hazardous material feedstocks or products through local communities; and	

3C6	location-specific information such as altitude, distance from the sea or ocean, land topography and meteorological conditions, e.g., direction and velocity of prevailing winds?	
3D	<b>Plot plan</b>	
	Does the plot plan review of a proposed expansion or new plant specifically consider:	
3D1	congestion, e.g. overlapping hazard zones, difficult access, possible confinement of a vapour release;	
3D2	location of control rooms, offices and other buildings;	
3D3	the location of storage areas;	
3D4	the location of loading and unloading areas;	
3D5	layout of drainage and location of containment areas;	
3D6	proximity to and hazards from other process areas;	
3D7	proximity to public receptors beyond the site boundary	
3D8	insurance requirements;	
3D9	federal, provincial and local regulations; and	
3D10	company/industry spacing guidelines?	
3E	<b>Process design &amp; review procedures</b>	
3E1	Does the design process include a system for review and approval, with appropriate sign off, at each stage of the design process?	
	Does the design process include reviews at the following project stages:	
3E2	conceptual design,	
3E3	process design,	
3E4	detailed engineering design,	
3E5	construction and	
3E6	commissioning?	
3E7	Is the depth of each review dependent upon the complexity and degree of hazard of the process?	
3F	<b>Project management procedures and controls</b>	
3F1	Are there controls in place to ensure that fabrication and installation of equipment corresponds to design intentions and specifications?	
3F2	Is a pre-startup safety review completed before new or modified facilities are put into service?	
	Does the pre-startup safety review:	
3F3	confirm that construction meets the design specifications;	
3F4	ensure safety, operating, maintenance, and emergency procedures are in place and adequate;	
3F5	confirm that all process hazard analyses have been completed and that recommendations have been resolved or implemented prior to start up;	
3F6	confirm that modified facilities meet the management of change requirements;	
3F7	ensure that worker training has been completed; and	
3F8	ensure critical equipment has been identified and incorporated into a preventive maintenance program?	
3F9	Are project management controls documented and do they form part of the project file?	
	<b>Element 4. Process Risk Management</b>	
4A	<b>Hazard identification</b>	
4A1	Does the facility have a practice in place to identify hazards associated with operation and maintenance of the facility?	
4A2	Does the facility have access to practitioners that are trained in hazard identification methods such as What If, Checklist, HAZOP, LOPA, Bow-Tie, FMEA, or Fault Tree Analysis?	
4A4	<i>Does the facility have access to practitioners that are trained in application of the Dow Fire and Explosion Index and the Dow Chemical Exposure Index to assess the degree of hazard?</i>	

4B	<b>Risk analysis of operations</b>	
4B1	Does the facility have a process to estimate the risks once hazards have been identified?	
4B2	<i>Does the facility estimate risk based on the combination of potential consequences and the likelihood of occurrence, using qualitative and/or quantitative methods such as fault tree, event tree or risk indices?</i>	
4B3	<i>Does the facility evaluate the total risk by comparison to criteria for acceptability?</i>	
4C	<b>Reduction of risk</b>	
4C1	Does the facility have a process to reduce those risks that are deemed unacceptable?	
4C2	<i>Does the range of risk reduction methodologies employed by the facility include protective equipment, improved training and procedures as well as Inherently Safe Design principles, such as inventory reduction, alternative processes and alternative materials?</i>	
4D	<b>Residual risk management</b>	
	Does the emergency response plan:	
4D26	<i>include contingency and recovery plans?</i>	
	<b>Element 5. Management of Change</b>	
5a	Is a written procedure required to manage all changes to the operation of any facility except replacement in kind?	
	Does the Management of Change system:	
5g	address updating of documentation including; Process Safety information, operating procedures, maintenance procedures, alarm and interlock settings, and fire protection systems?	
5A	<b>Change of Process Technology</b>	
5A1	Are critical operating parameters or safe operating limits readily available to operations personnel?	
5A2	Is proposed operation outside current operating limits subject to prior review and approval by qualified personnel?	
5B	<b>Change of facility</b>	
	Does the Management of Facility Change system:	
5B1	define facility changes that are not replacement in kind;	
5B2	address major equipment changes through the Capital Project Review and Design System;	
5B3	address smaller changes and minor changes, e.g. a cross connection or instrumentation change;	
5B4	require an assessment of hazards and risks associated with the change;	
5E	<b>Permanent changes</b>	
5E1	Does the facility subject permanent changes to the steps of planning, organizing, implementation and control in conjunction with other plant programs such as the systems for work order, purchase order, Capital Project Review and Design, etc.?	
5E2	Is risk management a part of the systems for dealing with permanent changes?	
5F	<b>Temporary changes</b>	
5F1	Does the facility subject temporary changes to conditions similar to those that apply to permanent changes?	

	<b>Element: 6. Process and Equipment integrity</b>	
6B	<b>Materials of construction</b>	
6B1	Have systems been established, where appropriate, to supplement industry standards such as piping and pressure vessel codes?	
6B2	Is there a system to identify critical items that may need special tracking to verify materials used are as specified?	
6D	<b>Installation procedures</b>	
6D1	Are critical steps in the installation of equipment identified during the planning phase?	
6D2	Is field inspection used to verify that installation corresponds to design?	
6F	<b>Process, hardware and systems inspection and testing</b>	
6F2	Does the pre-startup safety review cover both equipment and operating procedures to assure that all elements are in place and functional?	
6F13	<i>Is a pre-start-up safety review conducted before starting up replacement equipment or recommissioning mothballed equipment?</i>	
6I	<b>Decommissioning and demolition procedures</b>	
6I1	Does the facility have procedures in place to address safe removal of equipment from service, dismantling, decontamination and related disposal of waste?	
	<b>Element 7. Human Factors</b>	
7a	Is there a process or system to address human factors at the design, construction and operational phases of a project?	
7A	<b>Operator-process/equipment interface</b>	
7A1	Does the facility assess human interactions with the facility as part of the design process?	
7A2	Is there a process to address computerized control systems that can confront operators with unmanageable amounts of information during an upset condition (alarm management)?	
	Does the process examine the following interfaces for potential problems:	
7A3	alarm display;	
7A4	information display; and	
7A5	ergonomics?	
7A7	<i>Do human factors assessments address confusing equipment, positioning of dials, colour coding, different directions for on/off etc.?</i>	
7B	<b>Administrative control versus hardware</b>	
7B1	Is there a strategy with respect to the use of administrative versus hardware controls?	
7B2	<i>When administrative controls are installed in preference to engineering controls, is there a process to review the effectiveness of the administrative controls at a future date to ensure they remain effective?</i>	
7C	<b>Human error assessment</b>	
7C1	Does the company address human factors throughout the facility lifecycle including design, construction, commissioning, operation and maintenance?	
7C2	Does the company have access to individuals trained in human error assessment or does it provide training internally?	
	Do human factor reviews consider approaches to reducing human error that include:	
7C3	written guidelines and procedures;	
7C4	human factor audits;	

7C5	written communications; and	
7C6	design of operator - process/equipment interface?	
	<b>Element: 10. Company Standards, Codes and Regulations</b>	
10a	Does the company have a management system to ensure that the various internal and external guidelines, standards and regulations are current, disseminated to appropriate people and departments, and applied throughout the organization?	
10A	<b>External codes/regulations</b>	
10A1	Is there a process in place to monitor and respond to changes in applicable legislation and regulatory framework?	
	Does the process cover:	
10A2	environmental regulations;	
10A3	occupational health and safety regulations;	
10A4	planning and zoning regulations;	
10A5	boiler and pressure vessel codes;	
10A6	electrical and building codes; and	
10A7	fire codes?	
	Is there a process in place to monitor and respond to changes in external standards including:	
10A8	Industry-wide standards such as those published by the Canadian Standards Association (CSA), the American Petroleum Institute (API), the American Society of Mechanical Engineers (ASME), the American Society for Testing and Materials (ASTM) and the American National Standards Institute (ANSI);	
10A9	Professional technical bodies such as the Center for Chemical Process Safety (CCPS), the American Institute of Chemical Engineers (AIChE), design groups (e.g. the Design Institute for Emergency Relief Systems), the Canadian Society for Chemical Engineering (CSCHE), and the Chlorine Institute; and	
10B	<b>Internal standards</b>	
	Is there a process in place to monitor and respond to changes in internal standards, including:	
10B4	specific process standards, e.g. chemistry, process design principles, metallurgy, etc.; and	
10B5	mechanical, electrical, civil, and instrument design standards?	
	<b>Element: 12. Enhancement of Process Safety Knowledge</b>	
12a	Does the company encourage continuous improvement that builds on the experiences and knowledge within the company and incorporates the technological advances that are constantly emerging throughout the industry?	
	Does the company maintain a Process Safety resource system that contains:	
12c	material relevant to the design technology and operation of the process;	
12e	plant equipment design data;	
12f	plant equipment inspection/testing data;	
12g	design practices and specifications;	
12i	trade association information;	
12j	physical and chemical properties data, including reaction kinetics and safe handling information;	
12k	technical papers;	
12l	case histories concerning incidents which illustrate PSM principles;	
12m	a search facility available locally or through arrangement with another organization, e.g. a large local reference library; and	
12n	appropriate reference books?	



12B	<b>Professional and trade association programs</b>	
12B1	Does the company/facility encourage participation in professional and trade associations as a means to enhance Process Safety knowledge?	
12C	<b>Technical association programs</b>	
12C1	Does the company/facility encourage participation in technical associations as a means to enhance Process Safety knowledge?	
12D	<b>Research, development, documentation and implementation</b>	
12D1	Do research and development programs include Process Safety inputs from departments such as safety, environment, operations, engineering, and maintenance?	
12D2	Is data supplied from all research projects documented, available to all who need to know, and communicated to plant operations to assure that new knowledge is incorporated into the enhancement of Process Safety?	
12F	<b>Process Safety resource centre and reference library</b>	
12F1	Does the company/facility maintain a reference library?	
12F2	Does the company/facility reference library contain a Process Safety section?	
	Does the company/facility Process Safety section include:	
12F3	reference books,	
12F4	technology-specific references, and	
12F5	journals and proceedings of conferences to provide topical interest?	

# Human Resources Protocol

	<b>Element 1. Accountability; Objectives and Goals</b>	
1a	How are Process Safety goals and objectives established throughout the company?	
1d	Is accountability for Process Safety clearly identified in roles, responsibilities, and position descriptions?	
1B	<b>Continuity of systems</b>	
1B2	Is there a process to allocate adequate resourcing of supporting job functions or units for each phase of the life cycle of the process?	
1C	<b>Continuity of organization</b>	
1C1	Are PSM responsibilities clearly defined as part of position or job descriptions?	
1C2	During changes in organizational structure is there a process in place to assure that PSM responsibilities are maintained?	
1C3	Is accountability for PSM flexible enough to accommodate organizational changes while ensuring that Process Safety tasks are properly assigned and performed throughout the change?	
1D	<b>Quality process</b>	
1D3	Are there established goals, targets and key performance indicators (KPI) for measuring Process Safety performance?	
1D4	Is there guidance in place to address deviation from this performance?	
1E	<b>Control of exceptions</b>	
1E6	Is there a process in place to allow exceptions in qualifications of operating personnel to be managed with appropriate controls by assigning accountability to qualified personnel?	
1E8	<i>Has the facility identified the minimum operating staff requirements to deal with all foreseeable operating modes, including operational upsets during holidays, and are appropriate controls in place to deal with situations where this minimum operating requirement is not in place?</i>	
1G	<b>Management accessibility</b>	
1G3	<i>Is there a process in place for conflict resolution on issues that include Process Safety?</i>	
1I	<b>Company expectations</b>	
1I2	Are the Process Safety goals consistent with other aspects of the organizational vision or master plan?	
4D	<b>Residual risk management</b>	
	Does the emergency response plan contain:	
4D13	the requirements for internal and external communications;	
4D21	Are copies of the emergency response plan readily available to all workers?	
	<b>Element 5. Management of Change</b>	
5C	<b>Organizational changes</b>	
5C1	Does the company have a process in place to assess and deal with risks associated with changes to the organization and the organizational structure?	
	Does the Management of Organizational Change system:	
5C2	address the transition period as well as the way the new organization is to work;	
5C3	address change in reporting relationships even where no staff losses occur;	

5C4	address the need for transfer and retention of knowledge and skills due to departure of staff, and especially elimination of organizational units (e.g. through downsizing);	
5C5	ensure accountability and safe control of operations continues despite the loss of key knowledge and skills; and	
5C6	ensure the workload consequent to any staff reductions does not result in unacceptable short- or long-term increases in risk?	
	<b>Element 8. Training &amp; Performance</b>	
8A	<b>Definition of skills and knowledge</b>	
8A1	Are key jobs identified and their required skills, knowledge and abilities documented?	
8B	<b>Design of operating and maintenance procedures</b>	
8B1	Does the facility have a standard process or procedure for developing the job procedures, including job descriptions and job safety analysis?	
	<b>Element 9. Incident Investigation</b>	
9E	<b>Communication</b>	
9E1	Are key results of investigations shared, as appropriate, with other parts of the plant, and within the organization, the chemical industry and other industries where the lessons learned could usefully be applied?	

# Inspection Protocol

	<b>Element 1. Accountability; Objectives and Goals</b>	
1e	Are there appropriate resources available to meet the Process Safety goals and objectives?	
1A	<b>Continuity of operations</b>	
1A1	Is there a policy that makes it clear when operations personnel have the authority to shut down a facility if they believe it is unsafe to operate?	
1A2	Are there guidelines or procedures to determine when the facility should be shut down or output reduced for planned or unplanned maintenance or modifications?	
1A4	How does the company decide when to segregate parts of a facility so that small sections of the facility can be shut down without shutting down the complete operation?	
1A5	Is there a process in place to decide when there is a need to install multiple lines rather than relying on a single stream operation?	
1C	<b>Continuity of organization</b>	
1C1	Are PSM responsibilities clearly defined as part of position or job descriptions?	
1D	<b>Quality process</b>	
1D1	Do workers understand the scope of issues involved in PSM?	
1D2	Does the facility maintain monitoring programs to track the status of Process Safety?	
1D3	Are there established goals, targets and key performance indicators (KPI) for measuring Process Safety performance?	
1D4	Is there guidance in place to address deviation from this performance?	
1D5	Is there a quality assurance system for all aspects of work that includes checking, verification, validation, documentation and configuration management, as appropriate?	
1E	<b>Control of exceptions</b>	
1E2	Is there a process in place to assign accountability for construction, commissioning and decommissioning of facilities?	
1E4	Is there a process in place to allow exceptions in maintenance practices and procedures to be managed with appropriate controls by assigning accountability to qualified personnel?	
	<b>Element 2. Process Knowledge and Documentation</b>	
2C	<b>Process and equipment design</b>	
	Does the facility have up-to-date and available:	
2C1	piping and instrument diagrams (P&IDs);	
2C2	data regarding materials of construction and their suitability to handle process material;	
2C6	data regarding design codes and standards employed;	
2D	<b>Protective systems</b>	
	Does the facility have up-to-date and available data regarding:	
2D2	pressure relief and venting systems;	
2G	<b>Company memory (management of information)</b>	
2G1	Is there a process to document knowledge and information gained from plant experience that is likely to be important for the future safety of the facility?	
2G2	Is the knowledge and information sufficiently catalogued and detailed so that it is not overlooked or forgotten as personnel or the organization change?	

	<b>Element 3. Capital Project Review and Design Procedures</b>	
3F	<b>Project management procedures and controls</b>	
3F1	Are there controls in place to ensure that fabrication and installation of equipment corresponds to design intentions and specifications?	
3F2	Is a pre-startup safety review completed before new or modified facilities are put into service?	
	Does the pre-startup safety review:	
3F3	confirm that construction meets the design specifications;	
	<b>Element 5. Management of Change</b>	
5B	<b>Change of facility</b>	
	Does the Management of Facility Change system:	
5B4	require an assessment of hazards and risks associated with the change;	
5F	<b>Temporary changes</b>	
5F1	Does the facility subject temporary changes to conditions similar to those that apply to permanent changes?	
	<b>Element: 6. Process and Equipment integrity</b>	
	Are written procedures used to maintain the ongoing integrity of process equipment including:	
6a	pressure vessels and storage tanks;	
6b	pipng, instrument and electrical systems;	
6c	process control software;	
6d	relief and vent systems and devices;	
6e	emergency and fire protection systems;	
6f	controls including monitoring devices and sensors, alarms and interlocks;	
6g	power transformers, elevating devices, and cranes (including overhead type gantry units);	
6h	rotating and hydraulic equipment?	
6i	Is documentation maintained in a file for each piece of equipment?	
6B	<b>Materials of construction</b>	
6B1	Have systems been established, where appropriate, to supplement industry standards such as piping and pressure vessel codes?	
6B2	Is there a system to identify critical items that may need special tracking to verify materials used are as specified?	
6F	<b>Process, hardware and systems inspection and testing</b>	
6F1	Is a pre-startup safety review conducted before 'feed-in' for a new or modified process?	
	Is inspection and testing of process equipment:	
6F3	according to good engineering practices; and	
6F4	at a frequency determined by applicable codes and standards, or more frequently if operating experience suggests this is necessary?	
	Does inspection and testing of process equipment incorporate:	
6F5	a system to ensure corrective action is taken when results fall outside acceptable limits,	
6F6	documentation that includes:	
6F7	o date of inspection;	
6F8	o name of inspector;	
6F9	o serial number or other equipment identifier;	
6F10	o description of the tests done;	
6F11	o results of the inspection or test; and	
6F12	o recommended actions?	

6F13	<i>Is a pre-start-up safety review conducted before starting up replacement equipment or recommissioning mothballed equipment?</i>	
6F14	<i>Are baseline conditions established for equipment and piping?</i>	
6I	<b>Decommissioning and demolition procedures</b>	
6I1	Does the facility have procedures in place to address safe removal of equipment from service, dismantling, decontamination and related disposal of waste?	
	<b>Element: 12. Enhancement of Process Safety Knowledge</b>	
12a	Does the company encourage continuous improvement that builds on the experiences and knowledge within the company and incorporates the technological advances that are constantly emerging throughout the industry?	
12b	Does the company utilize the knowledge it gains through incident reports, maintenance records, case histories, and trend analysis of upset conditions to provide basic information and changes that can help prevent catastrophic events?	
12E1	Is the information contained in incident reports, equipment failures and maintenance records properly catalogued and analyzed for opportunities for continuous improvement in Process Safety?	

# Leadership Protocol

	<b>Element 1. Accountability; Objectives and Goals</b>	
1a	How are Process Safety goals and objectives established throughout the company?	
1b	Are PSM goals and objectives visible to and understood by all workers?	
1c	Are there company objectives that demonstrate the priority of Process Safety compared to other business objectives like production and cost?	
1d	Is accountability for Process Safety clearly identified in roles, responsibilities, and position descriptions?	
1e	Are there appropriate resources available to meet the Process Safety goals and objectives?	
1f	Are there examples of management commitment to Process Safety at all levels of the organization, e.g., directives that state inadvertent loss of process containment situations must be eliminated?	
1A	<b>Continuity of operations</b>	
1A1	Is there a policy that makes it clear when operations personnel have the authority to shut down a facility if they believe it is unsafe to operate?	
1A2	Are there guidelines or procedures to determine when the facility should be shut down or output reduced for planned or unplanned maintenance or modifications?	
1A3	How is the need for spare and redundant equipment identified at the design stages of a project so the facility can reduce the need for a complete shutdown?	
1A4	How does the company decide when to segregate parts of a facility so that small sections of the facility can be shut down without shutting down the complete operation?	
1A5	Is there a process in place to decide when there is a need to install multiple lines rather than relying on a single stream operation?	
1B	<b>Continuity of systems</b>	
1B1	Are resource allocations driven by the process hazards rather than by the economic viability of the process?	
1B2	Is there a process to allocate adequate resourcing of supporting job functions or units for each phase of the life cycle of the process?	
1C	<b>Continuity of organization</b>	
1C1	Are PSM responsibilities clearly defined as part of position or job descriptions?	
1C2	During changes in organizational structure is there a process in place to assure that PSM responsibilities are maintained?	
1C3	Is accountability for PSM flexible enough to accommodate organizational changes while ensuring that Process Safety tasks are properly assigned and performed throughout the change?	
1D	<b>Quality process</b>	
1D1	Do workers understand the scope of issues involved in PSM?	
1D2	Does the facility maintain monitoring programs to track the status of Process Safety?	
1D3	Are there established goals, targets and key performance indicators (KPI) for measuring Process Safety performance?	
1D4	Is there guidance in place to address deviation from this performance?	
1D5	Is there a quality assurance system for all aspects of work that includes checking, verification, validation, documentation and configuration management, as appropriate?	
1E	<b>Control of exceptions</b>	
1E2	Is there a process in place to assign accountability for construction, commissioning and decommissioning of facilities?	

1E7	Is there a process in place to deal with situations that are outside the defined elements of existing management systems?	
1F	<b>Alternative methods</b>	
1F1	How are accountability and responsibility assigned when practices and procedures are implemented in compliance with performance standards, which identify only desired results without identifying the methods to be used?	
1F2	Where more than one method is available for a given task, e.g. for process hazard reviews, what is the established process ensuring that the method selected is effective in completing the task?	
1G	<b>Management accessibility</b>	
1G1	Is management available to assist in the decision-making process?	
1G2	Is leadership available to resolve conflicting views among safety, engineering, maintenance, production and business managers?	
1G3	<i>Is there a process in place for conflict resolution on issues that include Process Safety?</i>	
1H	<b>Communications</b>	
1H1	Does senior management communicate their understanding of Process Safety accountability for their unit and individuals within it?	
1H2	Are overlapping responsibilities between individuals/units clearly defined and communicated to ensure that no gaps exist?	
1I	<b>Company expectations</b>	
1I1	How does the Board of Directors and the Executive Management Team communicate their expectations regarded Process Safety performance?	
1I2	Are the Process Safety goals consistent with other aspects of the organizational vision or master plan?	
1I3	Are broad Process Safety goals established by management?	
1I4	Is there a process in place to measure Process Safety performance and take any action that may be required?	
1I5	Do Process Safety goals address the long-term aims of the company as well as detailed short-term targets?	
1I6	Are adequate resources available within or outside the company to achieve Process Safety goals?	
1I7	<i>Have key leading and lagging indicators been established to measure Process Safety performance (e.g. Process Safety-related incidents should be included as a lagging metric)?</i>	
1I8	<i>Has the organization been benchmarked against others to ensure the best practices are being used?</i>	
	<b>Element 2. Process Knowledge and Documentation</b>	
2a	Is information necessary for the safe design, operation and maintenance of the facility written, reliable, current and easily accessible by people who need to use it?	
2b	Where does the facility store the documentation to support Process Safety knowledge?	
2A	<b>Chemical and occupational health hazards</b>	
2A1	Are Material Safety Data Sheets (MSDS) available for every chemical used, stored or produced at the site?	
2F	<b>Process risk management decisions</b>	
2F1	Is there a process to facilitate risk management decisions on an ongoing basis?	
2F2	Are risk management decisions documented, showing the decisions made and the basis on which they were made?	



2G	<b>Company memory (management of information)</b>	
2G1	Is there a process to document knowledge and information gained from plant experience that is likely to be important for the future safety of the facility?	
2G2	Is the knowledge and information sufficiently catalogued and detailed so that it is not overlooked or forgotten as personnel or the organization change?	
	<b>Element 3. Capital Project Review and Design Procedures</b>	
3A	<b>Appropriation request procedures</b>	
3A1	Does the approval process for new capital projects ensure that the request has identified risks as well as capital and other resources necessary to manage those risks?	
3A2	Does the approval process require Process Safety reviews to be satisfactorily completed at each stage in order for the project to proceed to the next stage?	
3B	<b>Hazard reviews</b>	
3B1	Are hazard reviews completed to ensure risks associated with hazardous material and energy have been identified and the risks are acceptable?	
3B2	Are adequate capital and other resources made available to minimize exposure to workers, the public and the environment to the effects of hazardous materials and energy associated with the process?	
3B3	Is the scale of the review dependent upon the hazards of the proposed process and the stage of the project?	
3B4	Are more intensive review techniques required as additional information becomes available as the design proceeds?	
3C	<b>Siting</b>	
	Does the siting of a proposed expansion or new plant consider:	
3C1	buffer zones between the plant and the public;	
3C5	the effects of transporting hazardous material feedstocks or products through local communities; and	
3F	<b>Project management procedures and controls</b>	
3F2	Is a pre-startup safety review completed before new or modified facilities are put into service?	
	Does the pre-startup safety review:	
3F3	confirm that construction meets the design specifications;	
3F4	ensure safety, operating, maintenance, and emergency procedures are in place and adequate;	
3F5	confirm that all process hazard analyses have been completed and that recommendations have been resolved or implemented prior to start up;	
3F6	confirm that modified facilities meet the management of change requirements;	
3F7	ensure that worker training has been completed; and	
3F8	ensure critical equipment has been identified and incorporated into a preventive maintenance program?	
	<b>Element 4. Process Risk Management</b>	
4A	<b>Hazard identification</b>	
4A1	Does the facility have a practice in place to identify hazards associated with operation and maintenance of the facility?	
4A2	Does the facility have access to practitioners that are trained in hazard identification methods such as What If, Checklist, HAZOP, LOPA, Bow-Tie, FMEA, or Fault Tree Analysis?	
4A3	Are hazards that have been identified addressed by emergency response plans?	

4A4	<i>Does the facility have access to practitioners that are trained in application of the Dow Fire and Explosion Index and the Dow Chemical Exposure Index to assess the degree of hazard?</i>	
4B	<b>Risk analysis of operations</b>	
4B1	Does the facility have a process to estimate the risks once hazards have been identified?	
4B2	<i>Does the facility estimate risk based on the combination of potential consequences and the likelihood of occurrence, using qualitative and/or quantitative methods such as fault tree, event tree or risk indices?</i>	
4B3	<i>Does the facility evaluate the total risk by comparison to criteria for acceptability?</i>	
4C	<b>Reduction of risk</b>	
4C1	Does the facility have a process to reduce those risks that are deemed unacceptable?	
4D	<b>Residual risk management</b>	
4D1	Does the facility have a documented emergency response plan to manage residual risks and mitigate the effects should an incident occur?	
4F	<b>Encouraging client and supplier companies to adopt similar risk management practices</b>	
4F1	Does the facility have a process to encourage client and supplier companies to adopt risk management practices that will minimize the risks of incidents at upstream and downstream facilities and while materials are being transported between sites?	
4G	<b>Selection of businesses with acceptable risk</b>	
4G1	Does the company have a process in place to assess and deal with risks for new businesses or future acquisitions?	
	<b>Element 5. Management of Change</b>	
5a	Is a written procedure required to manage all changes to the operation of any facility except replacement in kind?	
	Does the Management of Change system:	
5b	contain a clear definition of change (scope of application);	
5c	require a description and technical basis for the proposed change;	
5d	address the potential impacts of the proposed change on health, safety and environment;	
5e	address authorization requirements to make the change;	
5f	address training requirements for workers or contractors following the change; and	
5g	address updating of documentation including; Process Safety information, operating procedures, maintenance procedures, alarm and interlock settings, and fire protection systems?	
5A	<b>Change of Process Technology</b>	
5A1	Are critical operating parameters or safe operating limits readily available to operations personnel?	
5A2	Is proposed operation outside current operating limits subject to prior review and approval by qualified personnel?	
5A3	Does the Management of Change system address the means to contact personnel if authorization of a change in process technology is needed on short notice?	
5B	<b>Change of facility</b>	
	Does the Management of Facility Change system:	
5B3	address smaller changes and minor changes, e.g. a cross connection or instrumentation change;	
5B5	require approval by qualified personnel; and	
5B6	address contingencies for "emergency" changes?	

5C	<b>Organizational changes</b>	
5C1	Does the company have a process in place to assess and deal with risks associated with changes to the organization and the organizational structure?	
	Does the Management of Organizational Change system:	
5C2	address the transition period as well as the way the new organization is to work;	
5C3	address change in reporting relationships even where no staff losses occur;	
5C4	address the need for transfer and retention of knowledge and skills due to departure of staff, and especially elimination of organizational units (e.g. through downsizing);	
5C5	ensure accountability and safe control of operations continues despite the loss of key knowledge and skills; and	
5C6	ensure the workload consequent to any staff reductions does not result in unacceptable short- or long-term increases in risk?	
5D	<b>Variance procedures</b>	
5D1	Is there a process in place to ensure that exceptions to procedures are managed promptly and the situation remains under control?	
5D2	Do variance procedures require review and approval by qualified personnel?	
5D3	Does the system ensure that all involved understand the basis for the approval and the new limits established for the variance?	
5D4	<i>Are variance procedures easy to use?</i>	
5E	<b>Permanent changes</b>	
5E1	Does the facility subject permanent changes to the steps of planning, organizing, implementation and control in conjunction with other plant programs such as the systems for work order, purchase order, Capital Project Review and Design, etc.?	
5E2	Is risk management a part of the systems for dealing with permanent changes?	
5F	<b>Temporary changes</b>	
5F1	Does the facility subject temporary changes to conditions similar to those that apply to permanent changes?	
	Does the Management of Temporary Change process require:	
5F2	the time limit for the change to be clearly defined;	
5F3	a review and approval if an extension of the time limit is required; and	
5F4	a plan to ensure that all equipment, etc. is returned safely to normal conditions at the end of the change?	
	<b>Element: 6. Process and Equipment integrity</b>	
6F	<b>Process, hardware and systems inspection and testing</b>	
6F2	Does the pre-startup safety review cover both equipment and operating procedures to assure that all elements are in place and functional?	
	<b>Element 8. Training &amp; Performance</b>	
8a	Does the company have a process in place to ensure workers receive training to provide the skills required to do the job?	
8b	Does the training process include ongoing retraining to maintain these skills?	
8A	<b>Definition of skills and knowledge</b>	
8A1	Are key jobs identified and their required skills, knowledge and abilities documented?	
8A2	Is training given to ensure that people doing these jobs are competent?	

8B	<b>Design of operating and maintenance procedures</b>	
8B1	Does the facility have a standard process or procedure for developing the job procedures, including job descriptions and job safety analysis?	
8B2	Does the facility use operating and maintenance procedures as the basis for developing training programs?	
8C	<b>Initial qualifications assessment</b>	
8C1	Does the facility specify qualification, testing and evaluation requirements to ensure that prospective workers have the aptitude and base knowledge/skills, which with appropriate training, will enable them to do the job?	
8D	<b>Selection and development of training programs</b>	
8D1	Does the facility require that workers and contractors be trained to understand and use site safety systems?	
	In particular, are the following items covered:	
8D2	general safety rules;	
8D3	permit to work procedures;	
8D4	use of personal protective equipment;	
8D5	emergency procedures;	
8D6	specific hazards of the area in which they will be working; and	
8D7	specific hazards of the materials which they may encounter?	
8D8	Is a competency test administered to workers and contractors to ensure that the information given has been understood?	
8E	<b>Measuring performance and effectiveness</b>	
8E1	Does the facility utilize a method of testing or verification to ensure that the training is understood to a level consistent with doing a job safely?	
8F	<b>Instructor program</b>	
8F1	Does the training program identify specific criteria for instructor selection?	
8F2	Does the training program identify specific instructor training to ensure that instructors have sufficient teaching/communications skills as well as the necessary technical knowledge?	
8G	<b>Records management</b>	
8G1	Does the facility maintain a record of training received by each person in each task?	
8G2	Do training records include the name of the trainer, the date of the training and the results of the competency verification?	
8G3	Are training documents used to track training received and to schedule retraining?	
8H	<b>Ongoing performance and refresher training</b>	
8H1	Does the training program include refresher training to ensure skills remain at a level consistent with the safe operation of facilities?	
	<b>Element 9. Incident Investigation</b>	
9A	Is there a program in place to investigate incidents, near misses and abnormal events?	
9B	<b>Major incidents</b>	
	Does the incident investigation process include:	
9B1	a clear definition of what is meant by major incident;	
9B2	investigation of every actual or potential process-related incident;	
9B3	procedures for doing an investigation;	

9B4	prompt investigation by a competent person having the knowledge, skill and experience to effectively lead and/or conduct the investigation and at least one person knowledgeable in the process where the incident occurred; and	
9B5	a report to management following the investigation stating:	
9B6	o incident date;	
9B7	o incident description;	
9B8	o factors which contributed to the incident, and	
9B9	o recommendations to prevent recurrence?	
9B10	<i>Are people involved in investigations required to receive training, with emphasis on root cause analysis?</i>	
9D	<b>Follow-up and resolution</b>	
9D1	Does the incident investigation process include a follow-up system to address the recommendations made in the report and ensure timely implementation of corrective actions?	
	<b>Element: 10. Company Standards, Codes and Regulations</b>	
10a	Does the company have a management system to ensure that the various internal and external guidelines, standards and regulations are current, disseminated to appropriate people and departments, and applied throughout the organization?	
10A	<b>External codes/regulations</b>	
10A1	Is there a process in place to monitor and respond to changes in applicable legislation and regulatory framework?	
	Does the process cover:	
10A2	environmental regulations;	
10A3	occupational health and safety regulations;	
10A4	planning and zoning regulations;	
10A5	boiler and pressure vessel codes;	
10A6	electrical and building codes; and	
10A7	fire codes?	
	<b>Element: 12. Enhancement of Process Safety Knowledge</b>	
12a	Does the company encourage continuous improvement that builds on the experiences and knowledge within the company and incorporates the technological advances that are constantly emerging throughout the industry?	
12b	Does the company utilize the knowledge it gains through incident reports, maintenance records, case histories, and trend analysis of upset conditions to provide basic information and changes that can help prevent catastrophic events?	
12A	<b>Quality control programs and Process Safety</b>	
12A1	Does the company/facility have an integrated approach to PSM that applies the concepts contained in quality management programs (Plan, Do, Check, Act)?	
12B	<b>Professional and trade association programs</b>	
12B1	Does the company/facility encourage participation in professional and trade associations as a means to enhance Process Safety knowledge?	
12C	<b>Technical association programs</b>	
12C1	Does the company/facility encourage participation in technical associations as a means to enhance Process Safety knowledge?	

12D	<b>Research, development, documentation and implementation</b>	
12D1	Do research and development programs include Process Safety inputs from departments such as safety, environment, operations, engineering, and maintenance?	
12D2	Is data supplied from all research projects documented, available to all who need to know, and communicated to plant operations to assure that new knowledge is incorporated into the enhancement of Process Safety?	
12F	<b>Process Safety resource centre and reference library</b>	
12F6	Are the necessary resources and accountability for the library and contents formally established?	
12F7	Is there a process to assure the information is kept current and disseminated throughout the plant to those who need to know?	

# Maintenance Audit Protocol

	<b>Element 1. Accountability; Objectives and Goals</b>	
1b	Are PSM goals and objectives visible to and understood by all workers?	
1c	Are there company objectives that demonstrate the priority of Process Safety compared to other business objectives like production and cost?	
1d	Is accountability for Process Safety clearly identified in roles, responsibilities, and position descriptions?	
1e	Are there appropriate resources available to meet the Process Safety goals and objectives?	
1f	Are there examples of management commitment to Process Safety at all levels of the organization, e.g., directives that state inadvertent loss of process containment situations must be eliminated?	
1A	<b>Continuity of operations</b>	
1A1	Is there a policy that makes it clear when operations personnel have the authority to shut down a facility if they believe it is unsafe to operate?	
1A2	Are there guidelines or procedures to determine when the facility should be shut down or output reduced for planned or unplanned maintenance or modifications?	
1A3	How is the need for spare and redundant equipment identified at the design stages of a project so the facility can reduce the need for a complete shutdown?	
1B	<b>Continuity of systems</b>	
1B1	Are resource allocations driven by the process hazards rather than by the economic viability of the process?	
1C	<b>Continuity of organization</b>	
1C1	Are PSM responsibilities clearly defined as part of position or job descriptions?	
1D	<b>Quality process</b>	
1D1	Do workers understand the scope of issues involved in PSM?	
1D2	Does the facility maintain monitoring programs to track the status of Process Safety?	
1D3	Are there established goals, targets and key performance indicators (KPI) for measuring Process Safety performance?	
1D4	Is there guidance in place to address deviation from this performance?	
1D5	Is there a quality assurance system for all aspects of work that includes checking, verification, validation, documentation and configuration management, as appropriate?	
1E	<b>Control of exceptions</b>	
1E4	Is there a process in place to allow exceptions in maintenance practices and procedures to be managed with appropriate controls by assigning accountability to qualified personnel?	
1G	<b>Management accessibility</b>	
1G1	Is management available to assist in the decision-making process?	
1G2	Is leadership available to resolve conflicting views among safety, engineering, maintenance, production and business managers?	
1G3	<i>Is there a process in place for conflict resolution on issues that include Process Safety?</i>	

1H	<b>Communications</b>	
1H1	Does senior management communicate their understanding of Process Safety accountability for their unit and individuals within it?	
1H2	Are overlapping responsibilities between individuals/units clearly defined and communicated to ensure that no gaps exist?	
1I	<b>Company expectations</b>	
1I1	How does the Board of Directors and the Executive Management Team communicate their expectations regarded Process Safety performance?	
1I2	Are the Process Safety goals consistent with other aspects of the organizational vision or master plan?	
1I3	Are broad Process Safety goals established by management?	
1I4	Is there a process in place to measure Process Safety performance and take any action that may be required?	
1I5	Do Process Safety goals address the long-term aims of the company as well as detailed short-term targets?	
1I6	Are adequate resources available within or outside the company to achieve Process Safety goals?	
1I7	<i>Have key leading and lagging indicators been established to measure Process Safety performance (e.g. Process Safety-related incidents should be included as a lagging metric)?</i>	
1I8	<i>Has the organization been benchmarked against others to ensure the best practices are being used?</i>	
	<b>Element 2. Process Knowledge and Documentation</b>	
2a	Is information necessary for the safe design, operation and maintenance of the facility written, reliable, current and easily accessible by people who need to use it?	
2b	Where does the facility store the documentation to support Process Safety knowledge?	
2A	<b>Chemical and occupational health hazards</b>	
2A1	Are Material Safety Data Sheets (MSDS) available for every chemical used, stored or produced at the site?	
	Is information on reactivity and chemical and physical properties readily available:	
2A4	for those involved in operation and maintenance of the facility?	
2C	<b>Process and equipment design</b>	
	Does the facility have up-to-date and available:	
2C1	piping and instrument diagrams (P&IDs);	
2C2	data regarding materials of construction and their suitability to handle process material;	
2C3	data regarding process control systems, including software integrity;	
2C5	data regarding critical alarms and systems;	
2D	<b>Protective systems</b>	
	Does the facility have up-to-date and available data regarding:	
2D1	critical interlocks (systems which either prevent or mitigate incidents);	
2D2	pressure relief and venting systems;	
2D4	Fire and gas detection and protection equipment;	
2D5	emergency isolation valves; and	
2D6	effluent treatment systems?	



2F	<b>Process risk management decisions</b>	
2F1	Is there a process to facilitate risk management decisions on an ongoing basis?	
2G	<b>Company memory (management of information)</b>	
2G1	Is there a process to document knowledge and information gained from plant experience that is likely to be important for the future safety of the facility?	
2G2	Is the knowledge and information sufficiently catalogued and detailed so that it is not overlooked or forgotten as personnel or the organization change?	
	<b>Element 3. Capital Project Review and Design Procedures</b>	
3F	<b>Project management procedures and controls</b>	
	Does the pre-startup safety review:	
3F8	ensure critical equipment has been identified and incorporated into a preventive maintenance program?	
	<b>Element 4. Process Risk Management</b>	
4A	<b>Hazard identification</b>	
4A1	Does the facility have a practice in place to identify hazards associated with operation and maintenance of the facility?	
5B	<b>Change of facility</b>	
	Does the Management of Facility Change system:	
5B1	define facility changes that are not replacement in kind;	
5B3	address smaller changes and minor changes, e.g. a cross connection or instrumentation change;	
5B4	require an assessment of hazards and risks associated with the change;	
5F	<b>Temporary changes</b>	
5F1	Does the facility subject temporary changes to conditions similar to those that apply to permanent changes?	
	Does the Management of Temporary Change process require:	
5F2	the time limit for the change to be clearly defined;	
5F3	a review and approval if an extension of the time limit is required; and	
5F4	a plan to ensure that all equipment, etc. is returned safely to normal conditions at the end of the change?	
	<b>Element: 6. Process and Equipment integrity</b>	
	Are written procedures used to maintain the ongoing integrity of process equipment including:	
6a	pressure vessels and storage tanks;	
6b	piping, instrument and electrical systems;	
6c	process control software;	
6d	relief and vent systems and devices;	
6e	emergency and fire protection systems;	
6f	controls including monitoring devices and sensors, alarms and interlocks;	
6g	power transformers, elevating devices, and cranes (including overhead type gantry units);	
6h	rotating and hydraulic equipment?	
6i	Is documentation maintained in a file for each piece of equipment?	
6A	<b>Reliability engineering</b>	
6A1	Has equipment critical for Process Safety been identified?	

6A2	Are predictive maintenance schedules established for monitoring, inspection and performance testing of equipment critical to Process Safety to enable cost effective correction of problems before they develop to a critical stage?	
6B	<b>Materials of construction</b>	
6B1	Have systems been established, where appropriate, to supplement industry standards such as piping and pressure vessel codes?	
6B2	Is there a system to identify critical items that may need special tracking to verify materials used are as specified?	
6C	<b>Fabrication and inspection procedures</b>	
	Does the quality assurance program include a material control system that ensures installed equipment:	
6C1	meets the requirements of the design specification;	
6C2	is traceable to its manufacturer;	
6C3	has met all required testing, with test results available on site; and	
6C4	is labeled to be clearly identifiable to the people doing the installation?	
6D	<b>Installation procedures</b>	
6D1	Are critical steps in the installation of equipment identified during the planning phase?	
6D2	Is field inspection used to verify that installation corresponds to design?	
6E	<b>Preventative maintenance</b>	
	Is there a preventative maintenance (PM) program in place that includes:	
6E1	a method of identifying critical equipment;	
6E2	a method to establish PM frequencies for critical equipment;	
6E3	a mechanism to ensure that PM is completed at the required frequency; and	
6E4	a record of the previous items?	
6F	<b>Process, hardware and systems inspection and testing</b>	
6F1	Is a pre-startup safety review conducted before 'feed-in' for a new or modified process?	
	Is inspection and testing of process equipment:	
6F3	according to good engineering practices; and	
6F4	at a frequency determined by applicable codes and standards, or more frequently if operating experience suggests this is necessary?	
	Does inspection and testing of process equipment incorporate:	
6F5	a system to ensure corrective action is taken when results fall outside acceptable limits,	
6F6	documentation that includes:	
6F7	o date of inspection;	
6F8	o name of inspector;	
6F9	o serial number or other equipment identifier;	
6F10	o description of the tests done;	
6F11	o results of the inspection or test; and	
6F12	o recommended actions?	
6F13	<i>Is a pre-start-up safety review conducted before starting up replacement equipment or recommissioning mothballed equipment?</i>	
6F14	<i>Are baseline conditions established for equipment and piping?</i>	
6G	<b>Maintenance procedures</b>	
6G1	Does the facility have safe work practices for proper control of maintenance, construction and related activities that apply to both workers and contractors?	

	As a minimum, do the safe work practices cover:	
6G2	permits to work and their application (hot work, confined space entry, lock out/tag out, excavation, master tag, etc.);	
6G3	opening of process lines and equipment;	
	Is there a system in place to:	
6G5	ensure maintenance procedures are in place and readily accessible to workers;	
6G6	regularly verify that procedures are current and accurate; and	
6G7	update procedures to incorporate changes in maintenance practice?	
6H	<b>Alarm and instrument management</b>	
6H1	Does the facility have safe work practices for alarm and instrument management that includes equipment hardware as well as computer components and software instructions for process control?	
	As a minimum, do alarm and instrument management programs cover:	
6H2	identification and prioritization of critical alarms and interlocks;	
6H3	a procedure to control changes to alarm set points and interlock systems; and	
6H4	a system of regular testing of interlock systems and pressure safety valves (PSVs)?	
6I	<b>Decommissioning and demolition procedures</b>	
6I1	Does the facility have procedures in place to address safe removal of equipment from service, dismantling, decontamination and related disposal of waste?	
	<b>Element 7. Human Factors</b>	
7A	<b>Operator-process/equipment interface</b>	
7A1	Does the facility assess human interactions with the facility as part of the design process?	
7A2	Is there a process to address computerized control systems that can confront operators with unmanageable amounts of information during an upset condition (alarm management)?	
7C	<b>Human error assessment</b>	
7C1	Does the company address human factors throughout the facility lifecycle including design, construction, commissioning, operation and maintenance?	
	<b>Element: 10. Company Standards, Codes and Regulations</b>	
10A	<b>External codes/regulations</b>	
	Does the process to monitor and respond to changes in applicable legislation and regulatory framework cover:	
10A5	boiler and pressure vessel codes;	
10A6	electrical and building codes; and	
10A7	fire codes?	
10B	<b>Internal standards</b>	
	Is there a process in place to monitor and respond to changes in internal standards, including:	
10B1	general standards, e.g. maintenance practices (hot work, inspection, etc.);	
	<b>Element: 12. Enhancement of Process Safety Knowledge</b>	
12a	Does the company encourage continuous improvement that builds on the experiences and knowledge within the company and incorporates the technological advances that are constantly emerging throughout the industry?	

12b	Does the company utilize the knowledge it gains through incident reports, maintenance records, case histories, and trend analysis of upset conditions to provide basic information and changes that can help prevent catastrophic events?	
	Does the company maintain a Process Safety resource system that contains:	
12c	material relevant to the design technology and operation of the process;	
12e	plant equipment design data;	
12E	<b>Improved predictive systems</b>	
12E1	Is the information contained in incident reports, equipment failures, and maintenance records properly catalogued and analyzed for opportunities for continued improvement in Process Safety?	

# Operations Audit Protocol

	<b>Element 1. Accountability; Objectives and Goals</b>	
1b	Are PSM goals and objectives visible to and understood by all workers?	
1c	Are there company objectives that demonstrate the priority of Process Safety compared to other business objectives like production and cost?	
1d	Is accountability for Process Safety clearly identified in roles, responsibilities, and position descriptions?	
1e	Are there appropriate resources available to meet the Process Safety goals and objectives?	
1f	Are there examples of management commitment to Process Safety at all levels of the organization, e.g., directives that state inadvertent loss of process containment situations must be eliminated?	
1A	<b>Continuity of operations</b>	
1A1	Is there a policy that makes it clear when operations personnel have the authority to shut down a facility if they believe it is unsafe to operate?	
1A2	Are there guidelines or procedures to determine when the facility should be shut down or output reduced for planned or unplanned maintenance or modifications?	
1A3	How is the need for spare and redundant equipment identified at the design stages of a project so the facility can reduce the need for a complete shutdown?	
1A4	How does the company decide when to segregate parts of a facility so that small sections of the facility can be shut down without shutting down the complete operation?	
1A5	Is there a process in place to decide when there is a need to install multiple lines rather than relying on a single stream operation?	
1B	<b>Continuity of systems</b>	
1B1	Are resource allocations driven by the process hazards rather than by the economic viability of the process?	
1C	<b>Continuity of organization</b>	
1C1	Are PSM responsibilities clearly defined as part of position or job descriptions?	
1D	<b>Quality process</b>	
1D1	Do workers understand the scope of issues involved in PSM?	
1D2	Does the facility maintain monitoring programs to track the status of Process Safety?	
1D3	Are there established goals, targets and key performance indicators (KPI) for measuring Process Safety performance?	
1D5	Is there a quality assurance system for all aspects of work that includes checking, verification, validation, documentation and configuration management, as appropriate?	
1E	<b>Control of exceptions</b>	
1E2	Is there a process in place to assign accountability for construction, commissioning and decommissioning of facilities?	
1E3	Is there a process in place to allow exceptions in operating procedures to be managed with appropriate controls by assigning accountability to qualified personnel?	
1E6	Is there a process in place to allow exceptions in qualifications of operating personnel to be managed with appropriate controls by assigning accountability to qualified personnel?	
1E8	<i>Has the facility identified the minimum operating staff requirements to deal with all foreseeable operating modes, including operational upsets during holidays, and are appropriate controls in place to deal with situations where this minimum operating requirement is not in place?</i>	

1F	<b>Alternative methods</b>	
1F2	Where more than one method is available for a given task, e.g. for process hazard reviews, what is the established process ensuring that the method selected is effective in completing the task?	
1G	<b>Management accessibility</b>	
1G1	Is management available to assist in the decision-making process?	
1G2	Is leadership available to resolve conflicting views among safety, engineering, maintenance, production and business managers?	
1G3	<i>Is there a process in place for conflict resolution on issues that include Process Safety?</i>	
1H	<b>Communications</b>	
1H1	Does senior management communicate their understanding of Process Safety accountability for their unit and individuals within it?	
1H2	Are overlapping responsibilities between individuals/units clearly defined and communicated to ensure that no gaps exist?	
1I	<b>Company expectations</b>	
1I1	How does the Board of Directors and the Executive Management Team communicate their expectations regarded Process Safety performance?	
1I2	Are the Process Safety goals consistent with other aspects of the organizational vision or master plan?	
1I3	Are broad Process Safety goals established by management?	
1I4	Is there a process in place to measure Process Safety performance and take any action that may be required?	
1I5	Do Process Safety goals address the long-term aims of the company as well as detailed short-term targets?	
1I6	Are adequate resources available within or outside the company to achieve Process Safety goals?	
1I7	<i>Have key leading and lagging indicators been established to measure Process Safety performance (e.g. Process Safety-related incidents should be included as a lagging metric)?</i>	
1I8	<i>Has the organization been benchmarked against others to ensure the best practices are being used?</i>	
	<b>Element 2. Process Knowledge and Documentation</b>	
2a	Is information necessary for the safe design, operation and maintenance of the facility written, reliable, current and easily accessible by people who need to use it?	
2b	Where does the facility store the documentation to support Process Safety knowledge?	
2A	<b>Chemical and occupational health hazards</b>	
2A1	Are Material Safety Data Sheets (MSDS) available for every chemical used, stored or produced at the site?	
	Is information on reactivity and chemical and physical properties readily available:	
2A4	for those involved in operation and maintenance of the facility?	
2B	<b>Process definition/design criteria</b>	
	Does the facility have up-to-date and available:	
2B1	process flow diagrams;	
2B2	data on relevant operating envelopes and safe operating limits (e.g. levels, temperatures, pressures, flows, time, cycles and compositions);	
2B3	data for evaluation of the effects, on health, safety and the environment, of operating outside the safe upper and lower limits;	
2B4	data on process chemistry, including chemistry of side reactions, by-products and contaminants;	

2B5	specifications on the maximum intended inventory; and	
2C	<b>Process and equipment design</b>	
	Does the facility have up-to-date and available:	
2C1	piping and instrument diagrams (P&IDs);	
2C2	data regarding materials of construction and their suitability to handle process material;	
2C3	data regarding process control systems, including software integrity;	
2C4	data regarding ventilation system design;	
2C5	data regarding critical alarms and systems;	
2C7	electrical area classification drawings; and	
2D	<b>Protective systems</b>	
	Does the facility have up-to-date and available data regarding:	
2D1	critical interlocks (systems which either prevent or mitigate incidents);	
2D2	pressure relief and venting systems;	
2D3	data regarding relief system design and design basis;	
2D4	Fire and gas detection and protection equipment;	
2D5	emergency isolation valves; and	
2D6	effluent treatment systems?	
2E	<b>Normal and upset conditions (operating procedures)</b>	
2E1	Are operating procedures in place and readily accessible to workers who work with the process?	
2E2	Is there a system for regularly verifying that procedures are accurate and current?	
2E3	Is there a system for updating procedures to ensure they reflect current operating practice including changes of process chemistry, technology, equipment, facilities or organization?	
	Do operating procedures address steps for each operating phase, including:	
2E4	initial start-up of a new facility;	
2E5	normal and temporary operations;	
2E6	emergency shutdown, including identification of conditions which require shutdown;	
2E7	normal shutdown; and	
2E8	start-up following an emergency or normal shutdown?	
2E9	Do operating procedures address steps required to correct or avoid a deviation from operating limits?	
2E10	Do operating procedures address safety systems and their functions?	
2F	<b>Process risk management decisions</b>	
2F1	Is there a process to facilitate risk management decisions on an ongoing basis?	
	<b>Element 3. Capital Project Review and Design Procedures</b>	
3F	<b>Project management procedures and controls</b>	
3F2	Is a pre-startup safety review completed before new or modified facilities are put into service?	
	Does the pre-startup safety review:	
3F3	confirm that construction meets the design specifications;	
3F4	ensure safety, operating, maintenance, and emergency procedures are in place and adequate;	
3F5	confirm that all process hazard analyses have been completed and that recommendations have been resolved or implemented prior to start up;	
3F6	confirm that modified facilities meet the management of change requirements;	
3F7	ensure that worker training has been completed; and	
3F8	ensure critical equipment has been identified and incorporated into a preventive maintenance program?	

	<b>Element 4. Process Risk Management</b>	
4A	<b>Hazard identification</b>	
4A1	Does the facility have a practice in place to identify hazards associated with operation and maintenance of the facility?	
4E	<b>Process Management during emergencies</b>	
4E1	Does the facility have written emergency procedures to cover management of both the process where the emergency occurs and also other processes which interact with or are near that process?	
	<b>Element 5. Management of Change</b>	
5a	Is a written procedure required to manage all changes to the operation of any facility except replacement in kind?	
5A	<b>Change of Process Technology</b>	
5A1	Are critical operating parameters or safe operating limits readily available to operations personnel?	
5A2	Is proposed operation outside current operating limits subject to prior review and approval by qualified personnel?	
5A3	Does the Management of Change system address the means to contact personnel if authorization of a change in process technology is needed on short notice?	
5D	<b>Variance procedures</b>	
5D1	Is there a process in place to ensure that exceptions to procedures are managed promptly and the situation remains under control?	
5D2	Do variance procedures require review and approval by qualified personnel?	
5D3	Does the system ensure that all involved understand the basis for the approval and the new limits established for the variance?	
5D4	<i>Are variance procedures easy to use?</i>	
5F	<b>Temporary changes</b>	
	Does the Management of Temporary Change process require:	
5F2	the time limit for the change to be clearly defined;	
5F3	a review and approval if an extension of the time limit is required; and	
5F4	a plan to ensure that all equipment, etc. is returned safely to normal conditions at the end of the change?	
	<b>Element: 6. Process and Equipment integrity</b>	
6F	<b>Process, hardware and systems inspection and testing</b>	
6F2	Does the pre-startup safety review cover both equipment and operating procedures to assure that all elements are in place and functional?	
6F13	<i>Is a pre-start-up safety review conducted before starting up replacement equipment or recommissioning mothballed equipment?</i>	
6G	<b>Maintenance procedures</b>	
6G1	Does the facility have safe work practices for proper control of maintenance, construction and related activities that apply to both workers and contractors?	
	As a minimum, do the safe work practices cover:	
6G2	permits to work and their application (hot work, confined space entry, lock out/tag out, excavation, master tag, etc.);	
6G3	opening of process lines and equipment;	



6G4	control of access to the facility by maintenance, contractor, laboratory and other personnel?	
6I	<b>Decommissioning and demolition procedures</b>	
6I1	Does the facility have procedures in place to address safe removal of equipment from service, dismantling, decontamination and related disposal of waste?	
	<b>Element 7. Human Factors</b>	
7A	<b>Operator-process/equipment interface</b>	
7A1	Does the facility assess human interactions with the facility as part of the design process?	
7A2	Is there a process to address computerized control systems that can confront operators with unmanageable amounts of information during an upset condition (alarm management)?	
	Does the process examine the following interfaces for potential problems:	
7A3	alarm display;	
7A4	information display; and	
7A5	ergonomics?	
7A6	Are task analyses used to determine what can go wrong during the task and how the potential problem areas can be controlled?	
7B	<b>Administrative control versus hardware</b>	
7B2	<i>When administrative controls are installed in preference to engineering controls, is there a process to review the effectiveness of the administrative controls at a future date to ensure they remain effective?</i>	
7C	<b>Human error assessment</b>	
7C1	Does the company address human factors throughout the facility lifecycle including design, construction, commissioning, operation and maintenance?	
	<b>Element: 10. Company Standards, Codes and Regulations</b>	
10B	<b>Internal standards</b>	
	Is there a process in place to monitor and respond to changes in internal standards, including:	
10B1	general standards, e.g. maintenance practices (hot work, inspection, etc.);	

# Purchasing Audit Protocol

	<b>Element 1. Accountability; Objectives and Goals</b>	
1b	Are PSM goals and objectives visible to and understood by all workers?	
1d	Is accountability for Process Safety clearly identified in roles, responsibilities, and position descriptions?	
1e	Are there appropriate resources available to meet the Process Safety goals and objectives?	
1A	<b>Continuity of operations</b>	
1A3	How is the need for spare and redundant equipment identified at the design stages of a project so the facility can reduce the need for a complete shutdown?	
1C	<b>Continuity of organization</b>	
1C1	Are PSM responsibilities clearly defined as part of position or job descriptions?	
1D	<b>Quality process</b>	
1D1	Do workers understand the scope of issues involved in PSM?	
1E	<b>Control of exceptions</b>	
1E2	Is there a process in place to assign accountability for construction, commissioning and decommissioning of facilities?	
1E5	Is there a process in place to allow exceptions in purchasing practices and procedures to be managed with appropriate controls by assigning accountability to qualified personnel?	
1G	<b>Management accessibility</b>	
1G1	Is management available to assist in the decision-making process?	
1G3	<i>Is there a process in place for conflict resolution on issues that include Process Safety?</i>	
1H	<b>Communications</b>	
1H1	Does senior management communicate their understanding of Process Safety accountability for their unit and individuals within it?	
1I	<b>Company expectations</b>	
1I1	How does the Board of Directors and the Executive Management Team communicate their expectations regarded Process Safety performance?	
1I2	Are the Process Safety goals consistent with other aspects of the organizational vision or master plan?	
1I3	Are broad Process Safety goals established by management?	
1I4	Is there a process in place to measure Process Safety performance and take any action that may be required?	
1I5	Do Process Safety goals address the long-term aims of the company as well as detailed short-term targets?	
1I6	Are adequate resources available within or outside the company to achieve Process Safety goals?	
1I7	<i>Have key leading and lagging indicators been established to measure Process Safety performance (e.g. Process Safety-related incidents should be included as a lagging metric)?</i>	
1I8	<i>Has the organization been benchmarked against others to ensure the best practices are being used?</i>	

	<b>Element 2. Process Knowledge and Documentation</b>	
2a	Is information necessary for the safe design, operation and maintenance of the facility written, reliable, current and easily accessible by people who need to use it?	
2b	Where does the facility store the documentation to support Process Safety knowledge?	
2A	<b>Chemical and occupational health hazards</b>	
2A1	Are Material Safety Data Sheets (MSDS) available for every chemical used, stored or produced at the site?	
2A2	Is there a process in place to ensure MSDS information remains current?	
2B	<b>Process definition/design criteria</b>	
	Does the facility have up-to-date and available:	
2B5	specifications on the maximum intended inventory; and	
3F	<b>Project management procedures and controls</b>	
3F1	Are there controls in place to ensure that fabrication and installation of equipment corresponds to design intentions and specifications?	
	<b>Element 4. Process Risk Management</b>	
4D	<b>Residual risk management</b>	
4D2	Does the emergency response plan identify an emergency control centre sited in a safe location?	
	Does the emergency response plan contain:	
4D7	emergency response procedures (fire suppression, spill control, etc.);	
4D9	organizational duties during an emergency;	
4D20	Are workers trained in the use of the emergency response plan?	
4D21	Are regular drills carried out to test the effectiveness of the emergency response plan?	
4D22	Are copies of the emergency response plan readily available to all workers?	
4F	<b>Encouraging client and supplier companies to adopt similar risk management practices</b>	
4F1	Does the facility have a process to encourage client and supplier companies to adopt risk management practices that will minimize the risks of incidents at upstream and downstream facilities and while materials are being transported between sites?	
4G	<b>Selection of businesses with acceptable risk</b>	
4G1	Does the company have a process in place to assess and deal with risks for new businesses or future acquisitions?	
	<b>Element 5. Management of Change</b>	
5a	Is a written procedure required to manage all changes to the operation of any facility except replacement in kind?	
	Does the Management of Change system:	
5d	address the potential impacts of the proposed change on health, safety and environment;	
	<b>Element: 6. Process and Equipment integrity</b>	
6B	<b>Materials of construction</b>	
6B2	Is there a system to identify critical items that may need special tracking to verify materials used are as specified?	

6C	<b>Fabrication and inspection procedures</b>	
	Does the quality assurance program include a material control system that ensures installed equipment:	
6C1	meets the requirements of the design specification;	
6C2	is traceable to its manufacturer;	
6C3	has met all required testing, with test results available on site; and	
6C4	is labeled to be clearly identifiable to the people doing the installation?	
6E	<b>Preventative maintenance</b>	
	Is there a preventative maintenance (PM) program in place that includes:	
6E1	a method of identifying critical equipment;	
6E2	a method to establish PM frequencies for critical equipment;	
	<b>Element 8. Training &amp; Performance</b>	
8A	<b>Definition of skills and knowledge</b>	
8A1	Are key jobs identified and their required skills, knowledge and abilities documented?	
8A2	Is training given to ensure that people doing these jobs are competent?	
8C	<b>Initial qualifications assessment</b>	
8C1	Does the facility specify qualification, testing and evaluation requirements to ensure that prospective workers have the aptitude and base knowledge/skills, which with appropriate training, will enable them to do the job?	
8D	<b>Selection and development of training programs</b>	
8D1	Does the facility require that workers and contractors be trained to understand and use site safety systems?	
8D8	Is a competency test administered to workers and contractors to ensure that the information given has been understood?	
8F	<b>Instructor program</b>	
8F1	Does the training program identify specific criteria for instructor selection?	
8F2	Does the training program identify specific instructor training to ensure that instructors have sufficient teaching/communications skills as well as the necessary technical knowledge?	
	<b>Element 9. Incident Investigation</b>	
9C	<b>Third party participation</b>	
9C1	Does the incident investigation process identify when external participants should be included in the investigation team?	
	<b>Element: 11. Audits &amp; Corrective Actions</b>	
11A	<b>PSM system audits</b>	
11A1	Do the management systems audits verify that the systems are effective in assuring company/plant policies and procedures are being implemented?	
	<b>Element: 12. Enhancement of Process Safety Knowledge</b>	
12F	<b>Process Safety resource centre and reference library</b>	
12F1	Does the company/facility maintain a reference library?	
12F2	Does the company/facility reference library contain a Process Safety section?	
	Does the company/facility Process Safety section include:	
12F3	reference books,	

12F4	technology-specific references, and	
12F5	journals and proceedings of conferences to provide topical interest?	

# Safety Audit Protocol

	<b>Element 1. Accountability; Objectives and Goals</b>	
1C	<b>Continuity of organization</b>	
1C1	Are PSM responsibilities clearly defined as part of position or job descriptions?	
1E	<b>Control of exceptions</b>	
1E2	Is there a process in place to assign accountability for construction, commissioning and decommissioning of facilities?	
1G	<b>Management accessibility</b>	
1G3	<i>Is there a process in place for conflict resolution on issues that include Process Safety?</i>	
1I	<b>Company expectations</b>	
1I3	Are broad Process Safety goals established by management?	
1I4	Is there a process in place to measure Process Safety performance and take any action that may be required?	
	<b>Element 2. Process Knowledge and Documentation</b>	
2b	Where does the facility store the documentation to support Process Safety knowledge?	
2A	<b>Chemical and occupational health hazards</b>	
2A1	Are Material Safety Data Sheets (MSDS) available for every chemical used, stored or produced at the site?	
2A2	Is there a process in place to ensure MSDS information remains current?	
	Is information on reactivity and chemical and physical properties readily available:	
2A4	for those involved in operation and maintenance of the facility?	
2B	<b>Process definition/design criteria</b>	
	Does the facility have up-to-date and available:	
2B3	data for evaluation of the effects, on health, safety and the environment, of operating outside the safe upper and lower limits;	
2B4	data on process chemistry, including chemistry of side reactions, by-products and contaminants;	
2C	<b>Process and equipment design</b>	
	Does the facility have up-to-date and available:	
2C8	plot plans?	
2D	<b>Protective systems</b>	
	Does the facility have up-to-date and available data regarding:	
2D1	critical interlocks (systems which either prevent or mitigate incidents);	
2D2	pressure relief and venting systems;	
2D4	Fire and gas detection and protection equipment;	
2D5	emergency isolation valves; and	
2E	<b>Normal and upset conditions (operating procedures)</b>	
	Do operating procedures address steps for each operating phase, including	
2E6	emergency shutdown, including identification of conditions which require shutdown;	

2F	<b>Process risk management decisions</b>	
2F1	Is there a process to facilitate risk management decisions on an ongoing basis?	
2F2	Are risk management decisions documented, showing the decisions made and the basis on which they were made?	
2G	<b>Company memory (management of information)</b>	
2G1	Is there a process to document knowledge and information gained from plant experience that is likely to be important for the future safety of the facility?	
	<b>Element 3. Capital Project Review and Design Procedures</b>	
3A	<b>Appropriation request procedures</b>	
3A2	Does the approval process require Process Safety reviews to be satisfactorily completed at each stage in order for the project to proceed to the next stage?	
3B	<b>Hazard reviews</b>	
3B1	Are hazard reviews completed to ensure risks associated with hazardous material and energy have been identified and the risks are acceptable?	
3B2	Are adequate capital and other resources made available to minimize exposure to workers, the public and the environment to the effects of hazardous materials and energy associated with the process?	
3B3	Is the scale of the review dependent upon the hazards of the proposed process and the stage of the project?	
3B4	Are more intensive review techniques required as additional information becomes available as the design proceeds?	
3E	<b>Process design &amp; review procedures</b>	
3E1	Does the design process include a system for review and approval, with appropriate sign off, at each stage of the design process?	
	Does the design process include reviews at the following project stages:	
3E2	conceptual design,	
3E3	process design,	
3E4	detailed engineering design,	
3E5	construction and	
3E6	commissioning?	
3E7	Is the depth of each review dependent upon the complexity and degree of hazard of the process?	
3F	<b>Project management procedures and controls</b>	
3F2	Is a pre-startup safety review completed before new or modified facilities are put into service?	
	Does the pre-startup safety review:	
3F4	ensure safety, operating, maintenance, and emergency procedures are in place and adequate;	
	<b>Element 4. Process Risk Management</b>	
4A	<b>Hazard identification</b>	
4A1	Does the facility have a practice in place to identify hazards associated with operation and maintenance of the facility?	
4A2	Does the facility have access to practitioners that are trained in hazard identification methods such as What If, Checklist, HAZOP, LOPA, Bow-Tie, FMEA, or Fault Tree Analysis?	
4A3	Are hazards that have been identified addressed by emergency response plans?	
4A4	<i>Does the facility have access to practitioners that are trained in application of the Dow Fire and Explosion Index and the Dow Chemical Exposure Index to assess the degree of hazard?</i>	

4B	<b>Risk analysis of operations</b>	
4B1	Does the facility have a process to estimate the risks once hazards have been identified?	
4B2	<i>Does the facility estimate risk based on the combination of potential consequences and the likelihood of occurrence, using qualitative and/or quantitative methods such as fault tree, event tree or risk indices?</i>	
4B3	<i>Does the facility evaluate the total risk by comparison to criteria for acceptability?</i>	
4C	<b>Reduction of risk</b>	
4C1	Does the facility have a process to reduce those risks that are deemed unacceptable?	
4C2	<i>Does the range of risk reduction methodologies employed by the facility include protective equipment, improved training and procedures as well as Inherently Safe Design principles, such as inventory reduction, alternative processes and alternative materials?</i>	
4D	<b>Residual risk management</b>	
4D1	Does the facility have a documented emergency response plan to manage residual risks and mitigate the effects should an incident occur?	
4D2	Does the emergency response plan identify an emergency control centre sited in a safe location?	
	Does the emergency response plan contain:	
4D3	emergency reporting procedures;	
4D4	a list of designated assembly areas with alternatives, if needed;	
4D5	emergency escape routes and evacuation procedures;	
4D6	procedures to account for people following an evacuation (headcount);	
4D7	emergency response procedures (fire suppression, spill control, etc.);	
4D8	rescue and medical duties;	
4D9	Organizational duties during an emergency;	
4D10	provisions for visitors, contractors and handicapped workers;	
4D11	information regarding co-ordination with local community fire department and/or other response personnel;	
4D12	procedures for workers required to operate critical systems;	
4D13	the requirements for internal and external communications;	
4D14	required response equipment and location; and	
4D15	notification of the affected public?	
	Does the facility have a site wide alarm system that:	
4D16	has distinctive alarms to indicate; "Alert", "Evacuate" and "All Clear";	
4D17	has an easily remembered means of activation, e.g. a special telephone number; and	
4D18	is regularly tested and maintained?	
4D19	Are workers trained in the use of the emergency response plan?	
4D20	Are regular drills carried out to test the effectiveness of the emergency response plan?	
4D21	Are copies of the emergency response plan readily available to all workers?	
4D22	<i>Is there a process to consult with those who may face risks resulting from process operations (e.g. workers, community)?</i>	
4D23	<i>Are critical portions of the emergency response plan posted in conspicuous locations throughout the facility along with a diagram detailing emergency evacuation routes?</i>	
	<i>Does the emergency response plan:</i>	
4D24	<i>comply with any applicable requirements under Section 200 of the Canadian Environmental Protection Act (CEPA);</i>	
4D25	<i>contain possible mutual aid arrangements, where necessary; and</i>	
4D26	<i>include contingency and recovery plans?</i>	



4F	<b>Encouraging client and supplier companies to adopt similar risk management practices</b>	
4F1	Does the facility have a process to encourage client and supplier companies to adopt risk management practices that will minimize the risks of incidents at upstream and downstream facilities and while materials are being transported between sites?	
	<b>Element 5. Management of Change</b>	
	Does the Management of Change system:	
5b	contain a clear definition of change (scope of application);	
5c	require a description and technical basis for the proposed change;	
5d	address the potential impacts of the proposed change on health, safety and environment;	
5e	address authorization requirements to make the change;	
5f	address training requirements for workers or contractors following the change; and	
5g	address updating of documentation including; Process Safety information, operating procedures, maintenance procedures, alarm and interlock settings, and fire protection systems?	
5B	<b>Change of facility</b>	
	Does the Management of Facility Change system:	
5B4	require an assessment of hazards and risks associated with the change;	
5B6	Address contingencies for “emergency” changes?	
	<b>Element: 6. Process and Equipment integrity</b>	
6I	<b>Decommissioning and demolition procedures</b>	
6I1	Does the facility have procedures in place to address safe removal of equipment from service, dismantling, decontamination and related disposal of waste?	
	<b>Element 7. Human Factors</b>	
7A	<b>Operator-process/equipment interface</b>	
7A6	Are task analyses used to determine what can go wrong during the task and how the potential problem areas can be controlled?	
7C	<b>Human error assessment</b>	
7C1	Does the company address human factors throughout the facility lifecycle including design, construction, commissioning, operation and maintenance?	
7C2	Does the company have access to individuals trained in human error assessment or does it provide training internally?	
	Do human factor reviews consider approaches to reducing human error that include:	
7C3	written guidelines and procedures;	
7C4	human factor audits;	
7C5	written communications; and	
7C6	design of operator - process/equipment interface?	
7C7	<i>Does the human factors review include factors such as understanding, judgment, motivation, education, training, stress, fatigue and cognition?</i>	
	<b>Element 9. Incident Investigation</b>	
9A	Is there a program in place to investigate incidents, near misses and abnormal events?	
9B	<b>Major incidents</b>	
	Does the incident investigation process include:	
9B1	a clear definition of what is meant by major incident;	
9B2	investigation of every actual or potential process-related incident;	

9B3	procedures for doing an investigation;	
9B4	prompt investigation by a competent person having the knowledge, skill and experience to effectively lead and/or conduct the investigation and at least one person knowledgeable in the process where the incident occurred; and	
9B5	a report to management following the investigation stating:	
9B6	o incident date;	
9B7	o incident description;	
9B8	o factors which contributed to the incident, and	
9B9	o recommendations to prevent recurrence?	
9B10	<i>Are people involved in investigations required to receive training, with emphasis on root cause analysis?</i>	
9C	<b>Third party participation</b>	
9C1	Does the incident investigation process identify when external participants should be included in the investigation team?	
9D	<b>Follow-up and resolution</b>	
9D1	Does the incident investigation process include a follow-up system to address the recommendations made in the report and ensure timely implementation of corrective actions?	
9E	<b>Communication</b>	
9E1	Are key results of investigations shared, as appropriate, with other parts of the plant, and within the organization, the chemical industry and other industries where the lessons learned could usefully be applied?	
9F	<b>Incident recording, reporting and analysis</b>	
9F1	Does the company maintain a system of analysis of incident reports to identify opportunities for elimination of commonly recurring or systemic causes?	
9G	<b>Near-miss reporting</b>	
9G1	Are near-misses and abnormalities recorded, investigated and analyzed as part of the incident investigation process?	
	<b>Element: 10. Company Standards, Codes and Regulations</b>	
10a	Does the company have a management system to ensure that the various internal and external guidelines, standards and regulations are current, disseminated to appropriate people and departments, and applied throughout the organization?	
10A	<b>External codes/regulations</b>	
10A1	Is there a process in place to monitor and respond to changes in applicable legislation and regulatory framework?	
	Does the process cover:	
10A2	environmental regulations;	
10A3	occupational health and safety regulations;	
10A4	planning and zoning regulations;	
10A5	boiler and pressure vessel codes;	
10A6	electrical and building codes; and	
10A7	fire codes?	
	Is there a process in place to monitor and respond to changes in external standards including:	
10A10	National and international codes, such as those published by the National Fire Protection Association (NFPA), and the International Labour Organization (ILO)?	

10B	<b>Internal standards</b>	
	Is there a process in place to monitor and respond to changes in internal standards, including:	
10B2	reporting procedures (incident reporting, equipment data, etc.);	
10B3	behaviour in plant areas (smoking, driving, etc.);	
	<b>Element: 11. Audits &amp; Corrective Actions</b>	
11a	Has the company implemented an audit system to determine the status and effectiveness of safety management efforts versus goals and also the progress toward those goals?	
11A	<b>PSM system audits</b>	
11A1	Do the management systems audits verify that the systems are effective in assuring company/plant policies and procedures are being implemented?	
11A2	Do the management system audits identify opportunities where systems may be strengthened?	
11B	<b>Process Safety audits</b>	
11B1	Does the company have a system to conduct Process Safety audits to provide increased assurance that facilities are being operated and maintained in a way that properly protects the safety and health of workers, the environment, the surrounding community, plant assets and continuity of operations?	
11C	<b>Compliance reviews</b>	
11C1	Does the company conduct compliance reviews to verify adherence to regulations and to company/plant standards and procedures?	
11D	<b>Internal/external auditors</b>	
11D1	Are audits conducted by teams of plant personnel and partially staffed with expertise from outside the plant to provide objectivity and fresh ideas?	
11E	<b>Corrective actions</b>	
11E1	Do facilities develop an action plan with assigned responsibilities to resolve recommendations from an audit?	
11E2	Do facilities maintain a follow-up system to verify completion and track/report outstanding recommendations from an audit?	
	<b>Element: 12. Enhancement of Process Safety Knowledge</b>	
12a	Does the company encourage continuous improvement that builds on the experiences and knowledge within the company and incorporates the technological advances that are constantly emerging throughout the industry?	
12b	Does the company utilize the knowledge it gains through incident reports, maintenance records, case histories, and trend analysis of upset conditions to provide basic information and changes that can help prevent catastrophic events?	
12c	Does the company maintain a Process Safety resource system that contains:	
12d	incident reports;	
12h	appropriate laws and regulations;	
12E	<b>Improved predictive systems</b>	
12E1	Is the information contained in incident reports, equipment failures, and maintenance records properly catalogued and analyzed for opportunities for continued improvement in Process Safety?	

# Training Audit Protocol

	<b>Element 1. Accountability; Objectives and Goals</b>	<b>Contacts</b>
1b	Are PSM goals and objectives visible to and understood by all workers?	
1A	<b>Continuity of operations</b>	
1A1	Is there a policy that makes it clear when operations personnel have the authority to shut down a facility if they believe it is unsafe to operate?	
1A2	Are there guidelines or procedures to determine when the facility should be shut down or output reduced for planned or unplanned maintenance or modifications?	
1F	<b>Alternative methods</b>	
1F1	How are accountability and responsibility assigned when practices and procedures are implemented in compliance with performance standards, which identify only desired results without identifying the methods to be used?	
1F2	Where more than one method is available for a given task, e.g. for process hazard reviews, what is the established process ensuring that the method selected is effective in completing the task?	
	<b>Element 2. Process Knowledge and Documentation</b>	
2A	Are Material Safety Data Sheets (MSDS) available for every chemical used, stored or produced at the site?	
2C	<b>Process definition/design criteria</b>	
	Does the facility have up-to-date and available:	
2B1	process flow diagrams;	
2B2	data on relevant operating envelopes and safe operating limits (e.g. levels, temperatures, pressures, flows, time, cycles and compositions);	
2B3	data for evaluation of the effects, on health, safety and the environment, of operating outside the safe upper and lower limits;	
2B4	data on process chemistry, including chemistry of side reactions, by-products and contaminants;	
2B5	specifications on the maximum intended inventory; and	
2C	<b>Process and equipment design</b>	
	Does the facility have up-to-date and available:	
2C1	piping and instrument diagrams (P&IDs);	
2C2	data regarding materials of construction and their suitability to handle process material;	
2C3	data regarding process control systems, including software integrity;	
2C4	data regarding ventilation system design;	
2C5	data regarding critical alarms and systems;	
2C7	electrical area classification drawings; and	
2D	<b>Protective systems</b>	
	Does the facility have up-to-date and available data regarding:	
2D1	critical interlocks (systems which either prevent or mitigate incidents);	
2D2	pressure relief and venting systems;	
2D3	data regarding relief system design and design basis;	
2D4	Fire and gas detection and protection equipment;	
2D5	emergency isolation valves; and	
2D6	effluent treatment systems?	

2E	<b>Normal and upset conditions (operating procedures)</b>	
2E1	Are operating procedures in place and readily accessible to workers who work with the process?	
2E2	Is there a system for regularly verifying that procedures are accurate and current?	
2E3	Is there a system for updating procedures to ensure they reflect current operating practice including changes of process chemistry, technology, equipment, facilities or organization?	
	Do operating procedures address steps for each operating phase, including:	
2E4	initial start-up of a new facility;	
2E5	normal and temporary operations;	
2E6	emergency shutdown, including identification of conditions which require shutdown;	
2E7	normal shutdown; and	
2E8	start-up following an emergency or normal shutdown?	
2E9	Do operating procedures address steps required to correct or avoid a deviation from operating limits?	
2E10	Do operating procedures address safety systems and their functions?	
2F	<b>Process risk management decisions</b>	
2F1	Is there a process to facilitate risk management decisions on an ongoing basis?	
2G	<b>Company memory (management of information)</b>	
2G1	Is there a process to document knowledge and information gained from plant experience that is likely to be important for the future safety of the facility?	
2G2	Is the knowledge and information sufficiently catalogued and detailed so that it is not overlooked or forgotten as personnel or the organization change?	
	<b>Element 3. Capital Project Review and Design Procedures</b>	
3A	<b>Appropriation request procedures</b>	
3A1	Does the approval process for new capital projects ensure that the request has identified risks as well as capital and other resources necessary to manage those risks?	
3B	<b>Hazard reviews</b>	
3B1	Are hazard reviews completed to ensure risks associated with hazardous material and energy have been identified and the risks are acceptable?	
3F	<b>Project management procedures and controls</b>	
	Does the pre-startup safety review:	
3F7	ensure that worker training has been completed; and	
	<b>Element 4. Process Risk Management</b>	
4A	<b>Hazard identification</b>	
4A1	Does the facility have a practice in place to identify hazards associated with operation and maintenance of the facility?	
4A2	Does the facility have access to practitioners that are trained in hazard identification methods such as What If, Checklist, HAZOP, LOPA, Bow-Tie, FMEA, or Fault Tree Analysis?	
4A4	<i>Does the facility have access to practitioners that are trained in application of the Dow Fire and Explosion Index and the Dow Chemical Exposure Index to assess the degree of hazard?</i>	
4D	<b>Residual risk management</b>	
	Does the facility have a site wide alarm system that:	
4D17	has an easily remembered means of activation, e.g. a special telephone number; and	
4D18	is regularly tested and maintained?	
4D19	Are workers trained in the use of the emergency response plan?	

4D20	Are regular drills carried out to test the effectiveness of the emergency response plan?	
4E	<b>Process Management during emergencies</b>	
4E1	Does the facility have written emergency procedures to cover management of both the process where the emergency occurs and also other processes which interact with or are near that process?	
	<b>Element 5. Management of Change</b>	
5a	Is a written procedure required to manage all changes to the operation of any facility except replacement in kind?	
	<b>Element: 6. Process and Equipment integrity</b>	
6F	<b>Process, hardware and systems inspection and testing</b>	
6G	<b>Maintenance procedures</b>	
6G1	Does the facility have safe work practices for proper control of maintenance, construction and related activities that apply to both workers and contractors?	
	<b>Element 7. Human Factors</b>	
7A	<b>Operator-process/equipment interface</b>	
7A6	Are task analyses used to determine what can go wrong during the task and how the potential problem areas can be controlled?	
	<b>7C Human error assessment</b>	
7C1	Does the company address human factors throughout the facility lifecycle including design, construction, commissioning, operation and maintenance?	
7C2	Does the company have access to individuals trained in human error assessment or does it provide training internally?	
	<b>Element 8. Training &amp; Performance</b>	
8a	Does the company have a process in place to ensure workers receive training to provide the skills required to do the job?	
8b	Does the training process include ongoing retraining to maintain these skills?	
	<b>8A Definition of skills and knowledge</b>	
8A1	Are key jobs identified and their required skills, knowledge and abilities documented?	
8A2	Is training given to ensure that people doing these jobs are competent?	
	<b>8B Design of operating and maintenance procedures</b>	
8B1	Does the facility have a standard process or procedure for developing the job procedures, including job descriptions and job safety analysis?	
8B2	Does the facility use operating and maintenance procedures as the basis for developing training programs?	
	<b>8C Initial qualifications assessment</b>	
8C1	Does the facility specify qualification, testing and evaluation requirements to ensure that prospective workers have the aptitude and base knowledge/skills, which with appropriate training, will enable them to do the job?	

8D	<b>Selection and development of training programs</b>	
8D1	Does the facility require that workers and contractors be trained to understand and use site safety systems?	
	In particular, are the following items covered:	
8D2	general safety rules;	
8D3	permit to work procedures;	
8D4	use of personal protective equipment;	
8D5	emergency procedures;	
8D6	specific hazards of the area in which they will be working; and	
8D7	specific hazards of the materials which they may encounter?	
8D8	Is a competency test administered to workers and contractors to ensure that the information given has been understood?	
8E	<b>Measuring performance and effectiveness</b>	
8E1	Does the facility utilize a method of testing or verification to ensure that the training is understood to a level consistent with doing a job safely?	
8F	<b>Instructor program</b>	
8F1	Does the training program identify specific criteria for instructor selection?	
8F2	Does the training program identify specific instructor training to ensure that instructors have sufficient teaching/communications skills as well as the necessary technical knowledge?	
8G	<b>Records management</b>	
8G1	Does the facility maintain a record of training received by each person in each task?	
8G2	Do training records include the name of the trainer, the date of the training and the results of the competency verification?	
8G3	Are training documents used to track training received and to schedule retraining?	
8H	<b>Ongoing performance and refresher training</b>	
8H1	Does the training program include refresher training to ensure skills remain at a level consistent with the safe operation of facilities?	
	<b>Element 9. Incident Investigation</b>	
9C	<b>Third party participation</b>	
9C1	Does the incident investigation process identify when external participants should be included in the investigation team?	
9D	<b>Follow-up and resolution</b>	
9D1	Does the incident investigation process include a follow-up system to address the recommendations made in the report and ensure timely implementation of corrective actions?	
	<b>Element: 11. Audits &amp; Corrective Actions</b>	
11a	Has the company implemented an audit system to determine the status and effectiveness of safety management efforts versus goals and also the progress toward those goals?	
11A	<b>PSM system audits</b>	
11A1	Do the management systems audits verify that the systems are effective in assuring company/plant policies and procedures are being implemented?	
11A2	Do the management system audits identify opportunities where systems may be strengthened?	

	<b>Element: 12. Enhancement of Process Safety Knowledge</b>	
12a	Does the company encourage continuous improvement that builds on the experiences and knowledge within the company and incorporates the technological advances that are constantly emerging throughout the industry?	
12b	Does the company utilize the knowledge it gains through incident reports, maintenance records, case histories, and trend analysis of upset conditions to provide basic information and changes that can help prevent catastrophic events?	