

Process safety management in the pulp and paper industry

Carl A. Brown and Chris A. Buettner

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Introduction

Many industries are faced with new regulations that place an ever increasing demand on available resources, and the pulp and paper industry is no exception. Environmental and process safety management regulations are two of the most important issues that will require a commitment of resources over the next few years.

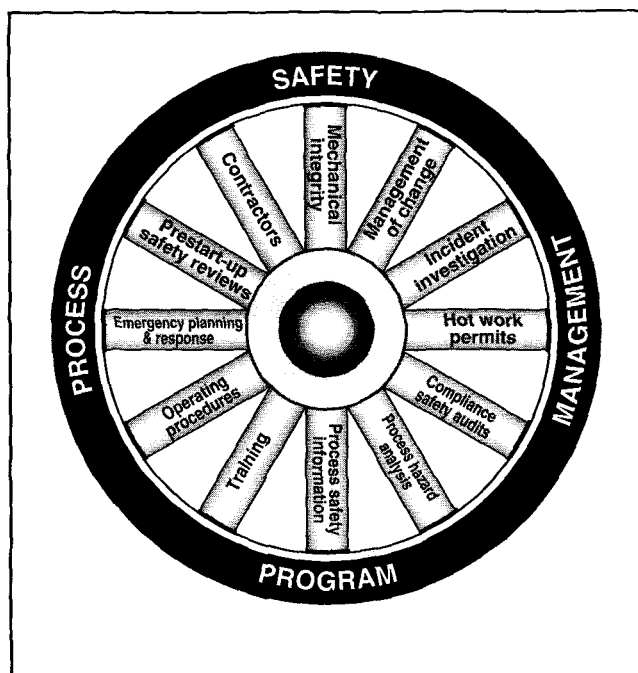
This article examines integrated process safety management programs and their application to the pulp and paper industry. A complete integrated process safety management program will reduce the potential for accidents that result in injuries or fatalities. It is reasonable to expect additional benefits of reduced downtime, increased product quality, and lower production costs.

OSHA 29 CFR 1910.119, Process Safety Management of Highly Hazardous Chemicals, and the EPA Clean Air Act 304-c are two examples of federal regulations that address process safety issues. Compliance is complicated by several overlapping or duplicate requirements. Further, states are tossing their hats into the process safety regulation ring and beginning to promulgate regulations that parallel or exceed the federal requirements.

The requirements of the OSHA process safety management regulations have been selected as a basis for illustrating the elements of a typical process safety management program. At this time, compliance with the OSHA requirements is expected to meet those of other agencies. Appendix A of the OSHA regulation contains a list of highly hazardous chemicals to which the regulation applies. Also, certain flammable liquids and gases are included when the quantities equal or exceed 10,000 lb. The EPA and other regulatory agencies have similar lists of materials that are classified as highly hazardous.

A process safety management program should encompass all operations and processes in the mill that involve hazardous

1. An integrated process safety management program encompasses 12 elements.



materials. At a minimum, it must include those materials listed in applicable regulations, e.g., chlorine, hydrogen sulfide, chlorine dioxide, and ammonia. Less-hazardous materials encountered in the pulp and paper industry should also be given consideration. Materials such as sulfur dioxide, turpentine, caustic, sulfuric acid, and sodium hypochlorite should be included when they represent a potential exposure to humans.

A complete process safety management program will include all of the 12 basic elements that follow. Many of the elements are interrelated such that omission of one will reduce the effectiveness of another. The letter in parentheses following each element heading corresponds to the paragraph in 29 CFR 1910.119 for that requirement. The 12 elements are compared with other regulations in Table I and depicted graphically in Fig. 1.

Brown is manager, process safety and fire protection, Brown & Root Braun Engineering, P.O. Box 4574, Houston TX 77210. Buettner is department process manager, Brown & Root Pulp & Paper Engineering, P.O. Box 3, Houston, TX 77001.

I. Comparison of process safety program elements

Program element	OSHA 1910.119 ¹ (paragraph)	CMA PSC-MP ² (practices)	CAAA Sec. 304-C ³ (items)	API RP 750 ⁴ (section)
Employee participation	c	—	—	—
Process safety information	d	7, 8	1	2
Process hazard analysis	e	9	2, 3, 4	3
Operating procedures	f	7, 18	6	5
Training	g	14, 17, 19, 20	7	7
Contractors	h	12, 22	8	—
Pre-startup safety review	i	13	12	9
Mechanical integrity	j	2, 12, 14, 18	10, 11	8
Hot work permit	k	18	—	6
Management of change	l	10, 11	14	4
Incident investigation	m	4, 5	13	11
Emergency planning and response	n	5, 6, 11, 16	9	10
Compliance safety audits	o	3	5	12
Trade secrets	p	—	—	—

Sources:
¹OSHA 29 CFR 1910.119, Process Safety Management of Highly Hazardous Chemicals, 1992.
²Chemical Manufacturers Association (CMA), Responsible CARE Process Safety Code of Management Practices, 1990.
³Environmental Protection Agency (EPA), Clean Air Act Amendments of 1990, Title III, Air Toxics, 1990.
⁴American Petroleum Institute (API), Recommended Practice (RP) 750, Management of Process Hazards, 1990.

Process safety information (d)

Any effective process safety management program begins with a complete, accurate, and up-to-date information database. Several process safety program elements depend on the accuracy of the process safety information maintained by the mill. Several federal or state regulations require that certain information be maintained at each mill location. The database should help with some of these redundant requirements, e.g., Material Safety Data Sheets (MSDS). Some regulations may expect the same information to be maintained by different groups within the mill. Although this duplication may be justified in specific cases, it most often occurs due to the absence of a formal information database.

The database should include information pertaining to hazards of the chemicals and materials being processed and handled; hazards related to the process operation; and information on the process equipment employed, particularly the equipment necessary for the safe operation of the process. Included in these categories are MSDS, P&IDs, maximum inventories, material and energy balances, process and reaction descriptions, safety and relief systems, and a listing of reference design codes and industry practices.

Process hazard analysis (e)

Process hazard analysis is the foundation of any successful process safety management program. Process hazard analysis techniques serve one or both of two basic functions: the identification of potential hazards and an estimation of the extent of associated consequences.

Hazard identification techniques or procedures include hazard and operability (HAZOP) studies, what-if, experience-based checklists, FMEA, and fault trees. A wide range of industries use the HAZOP procedure. Its popularity stems from a structured and thorough approach to hazard identification that has a proven track record of producing meaningful results.

Sometimes it is necessary to estimate the magnitude of certain consequences. The three main areas of vulnerability commonly considered in consequence analysis are: potential for harm to persons, damage to equipment, and damage to the environment. Business interruptions, lost or reduced production, and damage to company image may be other consequences of interest.

The OSHA regulation specifies a time schedule for conducting process hazard analyses: a minimum of 25% of the hazard analyses must be completed by May 1994, 50% by May 1995,

75% by May 1996, and 100% by May 1997. Each mill should first determine which processes require a process safety hazard analysis and then rank the processes by some order of priority criteria. Some mills have already performed process hazard analyses on selected processes. If these analyses were performed after May 1987 and meet the requirements of the OSHA regulation, they will meet the intent of the regulation. However, considerations given to human factors may be one area where existing hazard analyses may not meet the intent of the regulation. At this time, it is not clear what OSHA means by human factors.

The regulation also requires that process hazard analyses be updated at least every five years and that records be maintained for the life of the process. For a large integrated mill, this schedule should require that no more than one or two process hazard analyses be performed each year over the next five years.

Operating procedures (f)

Written operating procedures are a necessary element of any process safety management system. The absence of complete and up-to-date operating procedures has contributed to major accidents. Operating procedures must accurately reflect the actual operation of the process. A complete set will cover all modes of operation, e.g., normal operation, startup, normal shutdown, and emergency shutdown. Operating procedures should be written in an easy-to-use and understandable format. The procedures should provide for recognition of deviations of process variables from the design intent and should describe associated consequences of the deviations. They should specify what corrective action should be taken and why the action is required.

Training (g)

A formal training program is another essential element of an effective process safety management program. The absence of formal training, or the failure to follow established procedures, have also been contributing factors in major accidents. In many cases, procedures were not followed because personnel were not aware that the procedure existed or were not properly trained to implement all functions.

The training should be comprehensive and based on the performance of tasks. Provisions for initial training, refresher training, certification and documentation, and a periodic evaluation of the effectiveness of the program should be included.

Contractors (h)

Most mills employ outside contractors to perform a variety of tasks, e.g., new construction, routine maintenance, turnarounds, revamps of existing facilities, and specialty services. The mill's criteria for selecting a contractor to perform any task should consider the contractor's past safety performance record, and formal safety programs. New regulations place a higher degree of responsibility on the owner for contractor's employee safety. It is important that the contractor employees working on or near equipment containing hazardous ma-

terials be aware of the potential hazards.

The mill process safety management system should adequately address outside contractor issues such as assignment of authority, accountability and responsibility, hazard communications, training, administrative controls, and effective monitoring of actual field practices.

The mill is responsible, as an employer of outside contractors, to:

- Ensure that contractors are aware of potential process hazards
- Ensure that contractors understand the mill's emergency response plan
- Assist contractors in developing safe work practices in process areas.

The mill is also responsible for evaluating the contractor's safety performance record and maintaining a log of injuries/illnesses for contractor employees working in the process area.

Outside contractor issues are not limited to the responsibilities of the mill. The contractor is ultimately responsible for:

- Training their employees in safe work practices and documenting the training
- Assuring that all employees understand the potential hazards associated with the processes they are working on or near
- Knowing what actions are required by the mill's emergency response plan
- Assuring that employees follow the safety rules of the mill
- Advising the designated mill representative of any potential hazards that the contract work itself might represent to the process.

Pre-startup safety review (i)

Pre-startup safety reviews should be conducted prior to the startup of any new or modified process facility. A pre-startup safety review serves four prime functions.

1. It ensures that construction and installation (additions and modifications) are in accordance with the design documents.
2. It verifies that recommendations resulting from the process hazard analysis have been resolved.
3. It confirms that safe operating, maintenance, and emergency response procedures are in place.
4. It ensures that those persons responsible for operation and maintenance of the facility understand the process and associated hazards and are properly trained to safely perform their duties.

Mechanical integrity (j)

The mechanical integrity element of a process safety management program basically ensures that process equipment and components will function safely. Pressure vessels; tanks; piping system and components; relief and vent systems; emergency shutdown and control systems; and critical monitors, sensors, interlocks, and alarms are included. Compliance with the latest edition of applicable design codes and industry standards should provide an acceptable level of mechanical integrity for new designs and modifications.

Inspection and testing programs are necessary for existing equipment and components to ensure continued safe operations. Equipment and components in older facilities should be reviewed based on the requirements of applicable current codes and standards. Where deficiencies are found to exist, a closer evaluation should be performed to determine if present operations are safe.

Hot work permit (k)

The OSHA regulation singles out hot work permits as one of the 12 elements of a process safety management program. Hot work performed in a facility could represent a potential source of ignition to flammable liquids and gases. Most mills already have a procedure and permit system that adequately addresses hot work. Other procedures and permit systems, such as confined space entry and lockout/tagout, are covered in paragraph (f) Operating procedures of OSHA 29 CFR 1910.119. The program should also consider the safe work task procedures and permit system of outside contractors working in the mill.

Management of change (l)

Management of change ranks high in importance as a key element of a process safety management program. Absence of this element has resulted in catastrophic accidents in other industries. A management of change program should include formal written procedures that require certain reviews and checks be performed before any changes are made to the process. The procedure should include provisions for identifying the intent to make a change to the process before it occurs and obtaining appropriate approvals.

Changes are not limited to physical equipment or system components; process parameters, technology, and operating are included. A change that involves operating procedures or philosophy may require retraining of operators. The management of change procedure should require updating of existing process safety information.

Incident investigation (m)

An incident investigation program must be included to promptly identify, investigate, and report all incidents that result in (or could result in) a major accident. The investigation should begin as soon as possible (no later than 48 hours) after the accident has occurred. At least one person knowledgeable in the process should be on the investigation team.

The investigations should identify the cause or causes of the incident and make appropriate recommendations for corrective actions.

The recommendations and findings should be documented in a formal report and be reviewed with any mill and contractor employees that were or could have been involved in the incident. Similar incidents can be avoided at other mill locations by sharing information within a company. If appropriate, the results of incident investigations should be shared with other members of the industry. Provisions for tracking and following recommendations resulting from the investigation should be included. A mill database of "lessons learned" from incident investigations is a valuable source of information for developing preventive and corrective solutions to potential mill accidents.

Emergency planning and response (n)

Several regulatory agencies require emergency response plans to deal with the accidental release of hazardous materials. In many instances, effective emergency response planning has prevented small incidents from becoming major disasters.

Planning, procedures, equipment, and drills are key elements. The program should include meaningful emergency scenarios for drills to ensure all persons respond in a predictable manner. Procedures should include raising the alarm, escape, personnel accounting, notification of authorities, operation of critical equipment, rescue, and medical assistance.

Compliance safety audits (o)

Compliance safety audits serve to evaluate the effectiveness of the overall process safety management program. Audits should be conducted regularly to ensure all elements of the process safety management system are functioning as intended. When a deficiency is identified, recommendations should be made for modifications to correct the problem. The audit procedure should include provisions for tracking and following the recommendations.

Additional OSHA requirements

Two additional process safety management elements are contained in the final OSHA 1910.119 rule: employee participation and trade secrets. These two additional OSHA elements could prove to be obstacles in the implementation of the other 12 elements. Many industries did not anticipate these requirements, so they are not adequately addressed in most existing process safety management programs.

Employee participation (c)

The employee participation element requires employers to develop a written plan of action that describes how employees will participate in each of the 12 elements of a process safety management program. Employers are to consult with employees on the conduct and development of process hazard analyses and on the development of all other process safety management elements. Employees and their representatives

are to be provided access to all information developed in accordance with the basic elements.

Trade secrets (p)

The trade secret element requires that all information necessary to comply with any of the 12 basic elements be made available to persons responsible for implementing the element without regard to possible trade secret status of the information.

Conclusion

Process safety management will become increasingly important in the pulp and paper industry in both the near and distant future. Integrated process safety

management programs will be established that address many different concerns. Although the initial driving force for implementing a process safety management program may be regulations such as OSHA 29 CFR 1910.119, once programs are in place their success will depend on a realization of additional benefits. A true commitment to an integrated process safety management program has the potential for reducing accidents that result in injuries or fatalities, increasing productivity by reducing downtime, increasing product quality, and ultimately reducing production costs. A successful program requires the commitment of all levels of management. □

Keywords: Management, organizations, paper industry, processes, pulp industry, regulations, safety.