

## DEPARTMENT OF LABOR

## Occupational Safety and Health Administration

## 29 CFR Part 1910

RIN 1218-AB20

## Process Safety Management of Highly Hazardous Chemicals; Explosives and Blasting Agents

AGENCY: Occupational Safety and Health Administration (OSHA), Labor.

ACTION: Final rule.

**SUMMARY:** This final rule contains requirements for the management of hazards associated with processes using highly hazardous chemicals. It establishes procedures for process safety management that will protect employees by preventing or minimizing the consequences of chemical accidents involving highly hazardous chemicals. Employees have been and continue to be exposed to the hazards of toxicity, fires, and explosions from catastrophic releases of highly hazardous chemicals in their workplaces. The requirements in this standard are intended to eliminate or mitigate the consequences of such releases. This rule is being referenced in OSHA's Explosives and Blasting Agents standard, 29 CFR 1910.109.

**DATES:** This final rule will become effective on May 26, 1992.

**ADDRESSES:** In compliance with 28 U.S.C. 2112(a), the Agency designates for receipt of petitions for review of the standard, the Associate Solicitor for Occupational Safety and Health, Office of the Solicitor, room S4004, U.S. Department of Labor, 200 Constitution Avenue, NW., Washington, DC 20210.

**FOR FURTHER INFORMATION CONTACT:** Mr. James F. Foster, U.S. Department of Labor, Occupational Safety and Health Administration, Office of Information, room N3647, 200 Constitution Avenue, NW., Washington, DC 20210, (202) 523-8151.

**SUPPLEMENTARY INFORMATION:** In this preamble, OSHA identifies sources of information submitted to the record by an exhibit number (Ex. 3). When applicable, comment numbers follow the exhibit in which they are contained (Ex. 3: 1). If more than one comment within an exhibit is cited, the comment numbers are separated by commas (Ex. 3: 1, 2, 3). For quoted material, page numbers are cited if other than page one (p.2). The transcript of the hearing is cited by the page number (Tr. 321). Transcript pages are separated by commas. Exhibits and transcripts are separated by semicolons (Ex. 1; Tr. 50).

## I. Background

Releases of toxic, reactive or flammable liquids and gases in processes involving highly hazardous chemicals have been reported for many years. Incidents continue to occur in a variety of industries which use a variety of highly hazardous chemicals which may be toxic, reactive, flammable, or explosive or exhibit a combination of these attributes. (See for example, Ex. 2: 2, 4, 12, 13; Ex. 11: 2, 5, 6, 22, 28, 30, 31, 33, 41, 50, 63, 84, 94, 99, 120-136, 163; Ex. 15B, C; Ex. 53A; Ex. 114; Ex. 118; Tr. 2070, 2230, 2441-42, 2451, 2502.)

Regardless of the industry that uses these highly hazardous chemicals, there exists a potential for an accidental release if a highly hazardous chemical is not properly controlled. This in turn presents the potential for a devastating incident. Recent major incidents include the 1984 Bhopal incident resulting in more than 2,000 deaths; the October 1989 Phillips 66 Chemical Plant incident resulting in 24 deaths and 132 injuries; the July 1990 Arco Chemical incident resulting in 17 deaths; the July 1990 BASF incident resulting in 2 deaths and 41 injuries; and the May 1991 IMC incident resulting in 8 deaths and 128 injuries. While these major incidents involving highly hazardous chemicals have drawn national attention to the potential for major catastrophes, the record is replete with information concerning many other releases of highly hazardous chemicals (as referenced above). These releases continue to pose a significant threat to employees. The continuing occurrence of incidents has provided impetus, internationally and nationally, for authorities to develop or consider the development of legislation and regulations directed toward eliminating or minimizing the potential for such events.

International efforts include the development of the Seveso Directive by the European Economic Community after several large scale incidents occurred in the 1970's, including Flixborough and Seveso. The Directive addresses the major accident hazards of certain industrial activities, lists the hazardous materials of concern and is directed toward controlling those activities that could give rise to major accidents in an effort to protect the environment and the safety and health of persons (Ex. 11-53).

Subsequent international efforts include the development of guidelines for identifying, analyzing and controlling major hazard installations in developing countries and a hazards assessment manual which provides measures to

control major hazard accidents developed by the World Bank (Ex. 2: 2); the development of the Code of Practice on the Prevention of Major Accident Hazards by the International Labour Organization (Ex. 11: 154); and the special conferences held by the Organization of Economic and Cooperative Development (Ex. 11: 153) to consider the catastrophic potential of accidents involving hazardous substances and the means to prevent their occurrence and mitigate their impact.

In the United States, Congress, Federal agencies, State governments, industry, unions and other interested groups have become actively concerned and involved with protecting employees, the public and the environment from major chemical accidents involving highly hazardous chemicals.

In 1985, the Environmental Protection Agency (EPA) in response to the potential for catastrophic releases initiated a program to encourage community planning and preparation relative to serious hazardous materials releases (Ex. 2: 5). In 1986, Congress passed the framework for emergency planning efforts through Title III of the Superfund Amendments and Reauthorization Act (SARA), also known as the Emergency Planning and Community Right-to-Know Act (42 U.S.C. 11001 *et seq.*). SARA encourages and supports states and local communities in efforts to address the problems of chemical releases. Under section 302 of SARA, 42 U.S.C. 11002, EPA was required to publish a list of extremely hazardous substances with threshold planning quantities which would trigger planning in states and local communities (52 FR 13378).

After the 1984 Bhopal, India incident involving an accidental release of methyl isocyanate which resulted in more than 2000 deaths, OSHA determined that it was necessary to immediately investigate U.S. producers and users of methyl isocyanate. This investigation indicated that while the chemical industry is subject to OSHA's general industry standards, these standards do not presently contain specific coverage for chemical industry process hazards, nor do they specifically address employee protection from large releases of hazardous chemicals.

OSHA standards do exist for employee exposure to certain specific toxic substances (see subpart Z of part 1910), and hazardous chemicals are covered generally by other OSHA standards such as the Hazard Communication Standard, § 1910.1200. While these standards do address



hazardous chemicals, they focus on routine or daily exposures and while in many cases they also address emergencies such as spills, OSHA believes that they do not address the precautions necessary to prevent large accidental releases that could result in catastrophes.

Additionally, OSHA has certain standards contained in subpart H of 29 CFR part 1910, Hazardous Materials, concerning flammable liquids, compressed and liquified petroleum gases, explosives and fireworks. The flammable liquids and compressed and liquified petroleum gas standards emphasize equipment specification and the flammability of materials and do not thoroughly address other hazards of materials such as toxicity, and the standard concerning explosives and fireworks does not address the hazards involved during their manufacture. Beyond these standards, OSHA must depend on section 5(a)(1) of the Occupational Safety and Health Act, the general duty clause, to protect employees from other hazardous situations arising from the use of highly hazardous chemicals in certain industrial processes and must use national consensus standards and industry standards to support these general duty clause citations.

The need to focus on safety and health in the chemical industry was reinforced in August 1985. A serious release of highly hazardous chemicals (aldicarb oxime and methyl chloride) occurred at a plant in Institute, West Virginia. While no deaths occurred, 135 persons were injured (Ex. 2: 7). The experience of investigating this release indicated to OSHA that there was a need to look beyond existing standards and led OSHA to develop a demonstration program of special inspections in a small segment of the chemical industry (Ex. 2: 7). The purpose of the program was to examine industry practices for the prevention of disastrous releases and the mitigation of the effects of releases that do occur, and to consider ways in which OSHA could best protect employees in the industry from these hazards. Based on the results of the program, OSHA determined that chemical plant inspections need a comprehensive inspection approach which includes plant physical conditions and management systems.

Since this program was initiated, OSHA has issued a series of inspection directives, updated by growing experience and knowledge, that address system safety evaluations of operations with catastrophic potential. One important change in the successive

directives was the expansion of the scope of facilities to be inspected. Inspections were to be conducted in industries beyond chemical manufacturing because potentially hazardous chemical releases are not limited to chemical manufacturing and similar precautions should be implemented in operations in which hazardous chemicals are used, mixed, stored or otherwise handled (Ex. 2: 8).

Several states have developed legislation intended to prevent catastrophic events in their communities by requiring employers to take steps to control the highly hazardous chemicals in the workplace (e.g., Delaware, California, New Jersey (Ex. 2: 9)).

Industry has also taken measures aimed at improving the protection of public health and safety by improving chemical process safety to prevent releases. The Chemical Manufacturers Association (CMA) developed the Chemical Awareness and Emergency Response Program to foster cooperation, knowledge and response within communities (Ex. 11: 23, 24; Ex. 3: 48). Additionally CMA produced a report on process safety management, "Process Safety Management, (Control of Acute Hazards)," in order to increase knowledge among CMA members about systematic approaches to process safety analysis (Ex. 11: 25).

In 1985 a professional organization involved with process safety and loss control, the American Institute of Chemical Engineers, formed a separate branch, the Center for Chemical Process Safety (the Center). The Center's charter is to develop and disseminate technical information to be used in the prevention of major chemical accidents (Ex. 11: 16, 17, 18). The Center has become well known for its process safety management guidance publications (see appendix D).

Also an industry consulting group, the Organization Resources Counselors (ORC), and an industry trade association, the American Petroleum Institute (API), have developed recommended practices to address the protection of employees and the public through the prevention or mitigation of the effects of dangerous chemical releases. The ORC recommended practices (Ex. 2: 10) are discussed later in this notice. In 1990 API published its Recommended Practice 750, Management of Process Hazards (Ex. 2: 11), "to provide a more structured and formal approach to existing practices and to ensure a comprehensive approach to process safety" (Ex. 3: 106).

Unions representing employees immediately exposed to danger from

processes using highly hazardous chemicals have demonstrated a great deal of interest and activity in controlling major chemical accidents. For example, the International Confederation of Free Trade Unions and the International Federation of Chemical, Energy and General Workers' Unions issued a special report on the Bhopal, India accident (Ex. 2: 12). Additionally the United Steelworkers of America investigated and issued a special report on the 1988 PEPCON plant oxidizer accident in Henderson, Nevada (ammonium perchlorate explosion, two deaths and 350 injuries (Ex. 2: 13)). Further, unions including the United Steelworkers of America, the International Chemical Workers, and the Oil, Chemical and Atomic Workers, have undertaken large-scale efforts to train and educate their members who work in the petrochemical industry (e.g., Ex. 11: 2, Tr. 2262-63, 2265).

OSHA believed that available evidence supported the need for a standard and that adequate data and information existed upon which a standard could be based. Accordingly, on July 17, 1990, OSHA published in the *Federal Register* (55 FR 29150) a proposed standard containing requirements for the management of hazards associated with processes using highly hazardous chemicals in order to help assure that workers have a safe and healthful workplace.

OSHA's proposed rule emphasized the management of hazards associated with highly hazardous chemicals. The application of management controls to processes involving highly hazardous chemicals was recommended to OSHA by the Organization Resources Counselors (ORC). ORC (Ex. 2: 14) observed:

[W]hen OSHA issued its final report on the Special Emphasis Program for the Chemical Industry (Chem SEP), among its findings were that "specification standards \* \* \* will not \* \* \* ensure safety in the chemical industry \* \* \* [because such standards] tend to freeze technology and may minimize rather than maximize employers safety efforts." The Chem SEP report recommended a new approach to the identification and prevention of potentially catastrophic situations. This approach would involve "performance-oriented standards \* \* \* to address the overall management of chemical production and handling systems."

Further regarding the recommended standard, ORC noted (p.1-2) that:

The recommendations it contains are a systematic approach to chemical process hazards management which, when implemented, will ensure that the means for preventing catastrophic release, fire and explosion are understood, and that the



necessary preventive measures and lines of defense are installed and maintained.

The application of management controls to processes involving highly hazardous chemicals was also supported by other interested groups (Ex. 2: 11; Ex. 11: 23, 24).

The OSHA proposed standard established a comprehensive management program; a holistic approach that integrated technologies, procedures, and management practices. The proposal contains provisions addressing process safety information, process hazard analysis, operating procedures, training, contractors, pre-startup safety reviews, mechanical integrity, hot work permits, management of change, incident investigations, emergency planning and response, and compliance safety audits (Ex. 1).

The notice of proposed rulemaking invited comment on any aspect of the proposed standard for process safety management of highly hazardous chemicals. Additionally comment was invited on a series of issues concerning the requirements and appendices contained in the proposed standard which OSHA believed needed special emphasis. Specific questions were raised on the application of the standard; process hazard analyses; phase-in periods; team composition; training; contractors; critical equipment; drills; and notification. Finally, the notice announced the scheduling of a hearing to begin on November 27, 1990, in Washington, DC.

The Oil, Chemical and Atomic Workers Union requested that OSHA hold a regional hearing in Houston, Texas (Ex. 3: 13). OSHA agreed that the second hearing would be useful and on November 1, 1990, OSHA published a Federal Register notice (55 FR 46074) scheduling a second hearing to begin on February 26, 1991, in Houston, Texas; enumerating additional issues; and extending the written comment period until January 22, 1991. The additional issues in the hearing notice concerned a broader permit system; aggregation of threshold quantities of covered chemicals; workplace fuel consumption; and flammable liquid storage.

The hearings on the proposed standard for process safety management were held in Washington, DC, from November 27 through December 4, 1990, and in Houston, Texas from February 26 through March 7, 1991. The Administrative Law Judge presiding at the hearings allowed participants to submit post-hearing comments by May 6, 1991, and post-hearing briefs by June 5, 1991.

Approximately four months after the publication of OSHA's proposed standard for process safety management of highly hazardous chemicals, the Clean Air Act Amendments (CAAA) were enacted into law (November 15, 1990). The CAAA requires in section 304 that the Secretary of Labor, in coordination with the Administrator of the Environmental Protection Agency, promulgate, pursuant to the Occupational Safety and Health Act of 1970, a chemical process safety standard to prevent accidental releases of chemicals which could pose a threat to employees. The CAAA require that the standard include the development of a list of highly hazardous chemicals which include toxic, flammable, highly reactive and explosive substances. The CAAA specified the minimum elements which must be covered by the standard. The OSHA standard must require employers to:

- (1) Develop and maintain written safety information identifying workplace chemical and process hazards, equipment used in the processes, and technology used in the processes;
- (2) Perform a workplace hazard assessment, including, as appropriate, identification of potential sources of accidental releases, an identification of any previous release within the facility which had a likely potential for catastrophic consequences in the workplace, estimation of workplace effects of a range of releases, estimation of the health and safety effects of such range on employees;
- (3) Consult with employees and their representatives on the development and conduct of hazard assessments and the development of chemical accident prevention plans and provide access to these and other records required under the standard;
- (4) Establish a system to respond to the workplace hazard assessment findings, which shall address prevention, mitigation, and emergency responses;
- (5) Periodically review the workplace hazard assessment and response system;
- (6) Develop and implement written operating procedures for the chemical process including procedures for each operating phase, operating limitations, and safety and health considerations;
- (7) Provide written safety and operating information to employees and train employees in operating procedures, emphasizing hazards and safe practices;
- (8) Ensure contractors and contract employees are provided appropriate information and training;
- (9) Train and educate employees and contractors in emergency response in a manner as comprehensive and effective as that required by the regulation promulgated pursuant to section 126(d) of the Superfund Amendments and Reauthorization Act;
- (10) Establish a quality assurance program to ensure that initial process related equipment, maintenance materials, and spare

parts are fabricated and installed consistent with design specifications;

(11) Establish maintenance systems for critical process related equipment including written procedures, employee training, appropriate inspections, and testing of such equipment to ensure ongoing mechanical integrity;

(12) Conduct pre-start-up safety reviews of all newly installed or modified equipment;

(13) Establish and implement written procedures to manage change to process chemicals, technology, equipment and facilities; and

(14) Investigate every incident which results in or could have resulted in a major accident in the workplace, with any findings to be reviewed by operating personnel and modifications made if appropriate.

Also under the CAAA, the Environmental Protection Agency has specified duties relative to the prevention of accidental releases (see section 301(r)). Generally EPA is required to develop a list of chemicals and a Risk Management Plan.

OSHA received more than 175 comments in response to the notice of proposed rulemaking. In addition to these comments, the hearings resulted in almost 4000 pages of testimony and almost 60 post-hearing comments and briefs.

Shortly after the catastrophic Phillips 66 Company's Houston Chemical Complex incident, OSHA asked the John Gray Institute of Lamar University to conduct a study of safety and health issues as they relate to contract work in the petrochemical industry. The issue of the role of contractors in the petrochemical industry surfaced since a contractor had been working in the vicinity of the Phillips' release. Additionally, OSHA's experience indicated that a significant number of companies were using contractors to perform work at their plants. The Agency determined additional information was needed on contractors since it wanted to assure that safety issues surrounding contractor employees who are exposed or may expose site employees to potentially catastrophic events are thoroughly addressed in the process safety management standard. Upon the completion of the report, OSHA decided to give interested persons an opportunity to comment on the report and, therefore, reopened the record to receive public comment on the report and to reexamine the provisions concerning contractors. On September 24, 1991, OSHA published a notice in the Federal Register announcing the availability of the John Gray report and requesting public comment (56 FR 48133). OSHA received more than 300



requests for the John Gray Institute report. The comment period ended on October 24, 1991, and OSHA received 37 comments in response to the notice. The Administrative Law Judge certified the public record for the proposed rule to the Assistant Secretary of Labor for Occupational Safety and Health on November 29, 1991.

The record for this rulemaking is extensive and OSHA appreciates the time and effort expended by interested parties to ensure that as much information as possible was available to the Agency for purposes of making decisions on the final standard. In analyzing the record and preparing this final document, OSHA has carefully reviewed all of the information received, and has considered the concerns expressed by the parties participating in this rulemaking and has carefully examined the requirements of the Clean Air Act Amendments in order to assure that the final standard reflects its intent.

## II. Agency Action

OSHA believes that processes involving highly hazardous chemicals present the potential for accidents, such as spills or other uncontrolled releases that could have catastrophic results. Information available to OSHA indicates that accidents have occurred in workplaces with processes involving highly hazardous chemicals for many years and that they continue to occur. Reports of incidents clearly show that there is a significant risk to employees in industries covered by this rule and that mandatory standards are reasonably necessary and appropriate and will reduce deaths and injuries due to accidental releases of highly hazardous chemicals which expose employees to the hazards of toxicity, fires and explosions. OSHA believes that this final rule will significantly reduce deaths and injuries associated with accidental releases of highly hazardous chemicals.

In conclusion, OSHA has determined that employees in industries with processes involving highly hazardous chemicals have been for many years exposed to the hazards of releases of highly hazardous chemicals which may be toxic, reactive, flammable, or explosive; that employees continue to be exposed to the hazards of releases of toxic, reactive, flammable, or explosive chemicals; that incident information and other relevant data demonstrate that these hazards pose a significant risk to employees; that this standard is reasonably necessary and appropriate; and that feasible control measures are available that will reduce the risk of employees in these industries being

injured or killed. The final standard reflects OSHA's determination that a standard is reasonably necessary and appropriate to provide safe and healthful employment and places of employment for employees in industries which have processes involving highly hazardous chemicals. Additionally, OSHA is convinced that compliance with the final standard provisions will mitigate many of the hazards present in processes involving highly hazardous chemicals. As a result, OSHA believes the risk of death or injury to employees exposed will be significantly reduced.

Finally, the Clean Air Act Amendments of 1990 clearly require OSHA to develop a chemical process safety standard containing certain minimum requirements to prevent accidental releases of chemicals which could pose a threat to employees (section 304(a)). The standard must contain clearly defined minimum requirements. Thus, in addition to being convinced that a process safety management standard is necessary and appropriate, OSHA is fulfilling its obligation under the Clean Air Act Amendments to develop this final standard. This final rule is consistent with the mandate of the CAAA.

## III. Summary and Explanation of the Final Rule

This section contains an analysis of the record evidence and policy decisions pertaining to the various provisions of the standard.

The Occupational Safety and Health Act (OSH Act) defines an occupational safety and health standard as a standard which requires conditions, or the adoption or use of one or more practices, means, methods, operations, or processes, reasonably necessary or appropriate to provide safe or healthful employment and places of employment.

Under section 6(b) of the OSH Act, the Secretary (of Labor) may by rule promulgate, modify or revoke any occupational safety and health standard in a prescribed manner. The Act directs the Secretary of Labor to consider in promulgating standards, national consensus standards. In this instance, there is no existing consensus standard that addresses process safety management of highly hazardous chemicals.

The proposed process safety management standard contained the following paragraphs:

Purpose: Paragraph (a)  
Application: Paragraph (b)  
Definitions: Paragraph (c)  
Process safety information: Paragraph (d)

Process hazard analysis: Paragraph (e)  
Operating procedures: Paragraph (f)  
Training: Paragraph (g)  
Contractors: Paragraph (h)  
Pre-startup safety review: Paragraph (i)  
Mechanical integrity: Paragraph (j)  
Hot work permits: Paragraph (k)  
Management of change: Paragraph (l)  
Incident investigations: Paragraph (m)  
Emergency planning: Paragraph (n)  
Compliance safety audits: Paragraph (o)

In the final standard, OSHA has added two additional paragraphs: employee participation and trade secrets. OSHA determined that the logical placement of the paragraph regarding employee participation should be at the beginning of the rule since the provisions require that employers consult with employees and their representatives on the general development of a process safety management program, as well as on the process hazards analyses. In order to accommodate the placement of the provisions concerning employee participation in the beginning of the final standard but also to minimize any unnecessary redesignation of paragraphs, OSHA has decided to remove the letter designation "(a)" from the "purpose" paragraph. This results in the following changes:

### Purpose

Application: Paragraph (a)  
Definitions: Paragraph (b)  
Employee participation: Paragraph (c)  
The paragraph on trade secrets has been added to the end of the standard and becomes new paragraph (p). Therefore, the paragraphs in the final rule are designated in the following manner:

### Purpose

Application: Paragraph (a)  
Definitions: Paragraph (b)  
Employee participation: Paragraph (c)  
Process safety information: Paragraph (d)  
Process hazards analysis: Paragraph (e)  
Operating procedures: Paragraph (f)  
Training: Paragraph (g)  
Contractors: Paragraph (h)  
Pre-startup safety review: Paragraph (i)  
Mechanical integrity: Paragraph (j)  
Hot work permit: Paragraph (k)  
Management of change: Paragraph (l)  
Incident investigation: Paragraph (m)  
Emergency planning and response: Paragraph (n)  
Compliance safety audit: Paragraph (o)  
Trade secrets: Paragraph (p)

A significant number of commenters and hearing participants supported the proposed standard and its purpose (e.g., Ex. 3: 10, 17, 18, 22, 25, 26, 28, 29-32, 38, 39, 40, 42, 45, 46, 53, 59, 69, 70, 71, 72, 76, 77, 79, 80, 82, 83, 86, 87, 91, 95, 96, 97, 101,



103, 104, 106, 107, 108, 113, 117, 120, 121, 127, 129, 134, 143, 146, 152, 153, 158, 162, 164, 168, 171; Ex. 89; Ex. 91; Ex. 112; Ex. 138; Tr. 730, 779, 1204, 1594, 1614, 1802, 1998-99, 2155, 2172, 2245, 2506, 2570, 2652, 2768, 3115, 3157, 3236, 3345, 3404, 3442, 3461, 3604, 3753). A participant from The Upjohn Company (Ex. 3: 22) stated:

We are pleased at this proposed rule (1910.119) which will require all employers to implement programs to ensure the safety and health of those employees working with and around processes which involve highly hazardous chemicals. In addition, we are encouraged that the effort to establish this standard included cooperation from business and government to propose a standard that is both beneficial and workable.

The Food and Allied Services Trades, of the AFL-CIO, (Ex. 3: 25, p. 3) remarked:

The proposed rule is well-intended and there is little question that such regulation is needed. Recent events \* \* \* underscore this need. These events include not only the catastrophic explosions that occurred at Phillips Petroleum and Arco Chemical in the Houston area, but hundreds of smaller explosions and disasters that were not as widely reported by the press.

BP Oil Company (Tr. 1802) stated:

We are here today to comment on a proposed regulation which we regard as of major importance to our industry. We strongly support the Occupational Safety and Health Administration's approach to protecting workers and the public from industrial operation hazards.

Finally, the United Steelworkers of America (Tr. 2231) observed:

But the real problem is that OSHA has no standard requiring process hazard analysis, written operating procedures, adequate training in process safety, periodic safety reviews, quality assurance for critical equipment or the investigation of near-miss accidents.

Had such a standard been in place at Neville Chemical, Jim Thompson would be alive today. So might all the other chemical workers killed by accidental releases of hazardous chemicals in the past several years including the 40 in Pasadena and Channelview. Clearly, it is time to give OSHA inspectors the tools they need to prevent catastrophic accidents.

It is also time to give workers the tools they need to protect themselves and their communities.

Participants in the rulemaking also supported OSHA's development of a performance-oriented standard (e.g., Ex. 3: 27, 33, 39, 45, 46, 48, 69, 76, 134, 146, 161, 162, 171; Ex. 91; Ex. 133; Ex. 138; Tr. 1009, 1999, 2284, 3726). The Chemical Manufacturers Association (Ex. 3: 48) remarked:

Initially CMA would like to commend OSHA on its efforts to craft a comprehensive performance based standard addressing

process safety management of highly hazardous chemicals. As CMA has commented in past rulemakings, performance language capitalizes on industry's ingenuity and capability to effectively reduce hazards as they may be uniquely applied to a particular safety concern.

Ashland Petroleum Company (Ex. 3: 80) stated:

Ashland \* \* \* is generally supportive of the efforts of the Secretary and of the Occupational Safety and Health Administration with respect to this proposed regulation. While our internal commentators had divided between a desire for specificity and the obvious value of the non-detailed performance approach, ultimately we believe the "performance standard" approach is the best way to regulate a wide variety of situations for which a common end is desired.

The American Society of Safety Engineers (Ex. 3: 146, p. 2) noted:

The Society commends OSHA's use of a performance standard rather than a specification rule, believing this is the better means to help ensure each affected facility address its individual situation.

Many participants in the rulemaking acknowledged their belief that a process safety management standard is the most effective approach available in the prevention of catastrophic releases and others acknowledged their belief that the standard will improve the safety and health of employees (e.g., Ex. 3: 71, 72, 91, 94, 95, 96, 101, 106, 113, 120, 121, 127, 129, 158; Ex. 131; Tr. 1998, 3719). For example, Amoco (Ex. 3: 95) found that:

In general, we are very favorably impressed with the regulation as written. This standard is comprehensive, and when properly applied, should be effective in reducing loss of life, serious injury, and damage to property.

The American Petroleum Institute (API) (Ex. 3: 106) indicated:

API member companies support OSHA's effort to develop an effective process safety management rule. API believes process safety management is the most effective approach available in the prevention of catastrophic releases, a goal which we share with OSHA completely.

Finally, Oryx Energy Company (Tr. 3719) testified:

I think the proposed rule and 750 [API RP 750]—you know, they are similar—they will both accomplish the mission of making a safer workplace. I think—I know of no other system that is better than the system that is proposed by OSHA.

Before discussing the provisions of the final standard, OSHA would like to address several issues that were brought up during the rulemaking. First, many participants asserted that OSHA should permit required information to be stored electronically or on computers.

Electronic storage or computerized storage of records and information required by this standard is permissible, as long as it is readily accessible and easily understood.

Second, in Issue 10 of the proposal (55 FR 29159) OSHA asked whether provisions should be delayed or phased-in (timeframes for conducting process hazard analyses were discussed in a separate issue, Issue 3 at 29158). Participants suggested a variety of schedules (e.g., Ex. 3: 41, 45, 48, 53, 69, 81, 96, 101, 106, 113, 127, 134; Ex. 138; Tr. 735, 1616, 3241). However, OSHA has decided that, with the exception of allowing a phase-in period for paragraph (d), process safety information, and paragraph (e), process hazards analysis, no other phase-in period is necessary or warranted. OSHA realizes, as it does with any other newly promulgated standard, that employers will be working toward implementation of the provisions contained in the standard as quickly as possible. The standard will become effective in 90 days, thereby giving employers a brief period to familiarize themselves with the provisions of the standard and begin its implementation. OSHA believes this schedule is practical and feasible.

Third, also in Issue 10, OSHA asked whether it is necessary for all of the covered industries to meet all of the proposed provisions. OSHA was concerned about the potential impact on small businesses. Most of the participants who addressed this issue believed that small facilities should not be exempted if they have the threshold quantity of chemicals in their processes since the potential for a catastrophe is based on the amount of chemical present rather than on the size of facility (e.g., Ex. 3: 9, 20, 38, 47, 59, 69, 95, 103, 138; Tr. 2010-1, 2176, 3421). Several of these participants suggested that OSHA provide special assistance to small employers. OSHA agrees with participants that plants should be covered based on whether they have the threshold quantity of a covered highly hazardous chemical. OSHA also agrees with the recommendation suggesting that OSHA provide special assistance to small businesses and is considering this issue at this time. As an immediate step, OSHA has developed nonmandatory appendices which will assist in providing small businesses with guidance on complying with the process safety management standard and sources of further information and assistance (appendix C and appendix D respectively). Additionally, the Agency is developing a compliance assistance



"outreach" program to assist small businesses.

Finally, in Issue 11 (55 FR 29159) of the proposal, OSHA asked whether employers, when they have a threshold quantity of a highly hazardous chemical as specified by the standard, should be required to notify the OSHA Area Office of their location. Other entities which regulate potentially catastrophic workplaces require notification of the regulating authority.

Numerous participants addressed this issue. Some participants believed that notification should be required (e.g., Ex. 3: 20, 25, 71, 86, 99, 115; Ex. 101, Tr. 2253). Other participants indicated that while they did not see a benefit to notification, they would not object if a notification requirement was kept simple (e.g., Ex. 3: 26, 28, 29, 69, 113, 120; Tr. 3279, 3376). Still others objected to notification as an unnecessary burden, and in some cases observed that EPA already requires notification or that perhaps OSHA should access the information already required to be submitted to EPA (e.g., Ex. 3: 30, 38, 64, 80, 109, 113, 120, 122, 127, 134, 141, 146; Ex. 103, Tr. 1025). For example, Organization Resources Counselors (Ex. 131, p.11) indicated that:

Before OSHA inserts such a requirement into the standard, it should determine what use it will make of such notification and whether or not the information is already available from other resources.

OSHA has decided not to require notification in the final standard. OSHA believes requiring such information would be redundant with requirements that already exist under SARA and under the Clean Air Act Amendments which require reporting. Since similar information is already required to be reported, OSHA will work with EPA to obtain needed plant location information, instead of placing a redundant burden on employers.

On September 19, 1990, the Office of Management and Budget (OMB) filed comments on the process safety management proposal (Ex. 3: 14). OMB raised several concerns about the proposal. OMB observed that:

- (1) OSHA failed to consider alternative regulatory options;
- (2) The effectiveness of OSHA's approach is uncertain;
- (3) The costs of the standard may be higher than estimated and may adversely affect profitability;
- (4) The standard may have high costs and few benefits for small employers and, therefore, could be anticompetitive; and
- (5) OSHA should consider a sunset provision in the final rule that would cause the rule to expire after five years

if it does not have the intended effect of providing significant reductions in the number of workplace accidents associated with hazardous chemicals.

OSHA has carefully evaluated the OMB comment and believes that the modifications to the proposed rule and the issues discussed below are responsive to the OMB concerns. The major concerns are addressed below.

(1) OMB stated that OSHA had failed to consider alternative regulatory options that might protect workers equally well at lower cost (Ex. 3: 14, p.1-3). OSHA believes that its latitude to consider regulatory options such as those contemplated by OMB is somewhat limited by the Clean Air Act Amendments (CAAA). For example, in section 304 of the CAAA, OSHA was directed to enact a chemical process safety standard containing certain minimum elements within one year. The Clean Air Act Amendments specified 14 elements which OSHA must include in the process safety standard. OSHA has included these elements in its final process safety management standard. OMB suggested that OSHA consider an alternative regulatory approach that allows firms to use the results of the hazard analysis to determine which of the other safety requirements are appropriate. The Congressional mandate does not allow OSHA this flexibility. In addition, participants addressed this issue (Ex. 131; Tr. 307, 818) and the consensus was that the provisions of the standard were inextricably intertwined and they could not be considered separately without adversely affecting the contemplated effectiveness of the rule. For example, the Organization Resources Counselors (ORC) stated that its member companies "indicate that most, if not all, process related incidents involve a breakdown of one or more of OSHA's Process Safety Management elements" (Ex. 131, p.9). American Cyanamid Company (Ex. 3: 127) observed:

We concur with the concept of a comprehensive management system which addresses technology, equipment, procedures, training and management oversight. Deficiencies in any one of these areas can lead to a breakdown in process safety and increase the potential for a serious accident.

In addition, OMB suggested that OSHA should look more closely at the potential for accidents from various types of hazardous chemicals (Ex. 3: 14, p.2). In establishing the list of substances to be regulated under the process safety management rule, OSHA carefully considered the potential for catastrophic events posed by a large number of chemicals. In order to select

chemicals with catastrophic potential, OSHA consulted the lists developed by the Environmental Protection Agency and Department of Transportation and various states with regulatory experience in this area; namely Delaware and New Jersey. In developing the list of covered substances, OSHA also reviewed materials on this subject developed by the World Bank, the European Economic Community (the Seveso Directive), the National Fire Protection Association and ORC. While it is true that all chemicals on the list do not have equal catastrophic potential, OSHA addressed this issue in two ways. It developed appropriate thresholds for each of these chemicals by consulting with the sources above and relying on its own expertise, and it developed the flexible performance-oriented approach of the standard by mandating a process hazard analysis which will itself indicate the necessary safety precautions to take according to the incidence of use in a particular industrial setting.

(2) OMB claimed that the effectiveness of OSHA's approach is uncertain (Ex. 3: 14, p.3-4). In its preliminary regulatory impact analysis (PRIA, Ex. 4), OSHA claimed that after the standard had been in effect for 5 years, injuries and illnesses resulting from potentially catastrophic incidents would be reduced by at least 80% (Chapter V-14). This effectiveness rate is consistent with that used in other OSHA Regulatory Impact Analyses such as Electrical Safety-Related Work Practices (Final Rule, 55 FR at 32011, August 6, 1990, Regulatory Impact Assessment); Control of Hazardous Energy Source (Lockout/Tagout) (85 percent, Final Rule, 54 FR at 36685, September 1, 1990, Regulatory Impact Analysis); Permit Required Confined Spaces; Notice of Proposed Rulemaking (54 FR at 24097, June 5, 1989, Benefits); and Hearing Conservation (Final Regulatory Analysis of the Hearing Conservation Amendment, U.S. Department of Labor, January 1981, Chapter III-27; benefits of 85% at equilibrium from the hearing conservation amendment).

Participants also acknowledged their belief that the process safety management standard will be substantially effective in improving safety. For example, Arco Chemical (Ex. 3: 71) stated:

ARCO Chemical Company strongly endorses OSHA's proposed rulemaking \* \* \* ACC's President and Chief Executive Officer, stated that ACC shares \* \* \* the Congress' desire to further improve process safety management in the chemical industry," and



that ACC believes that OSHA's proposed rules "—as minimum standards—will substantially improve safety across the entire U.S. process industry."

American Cyanamid Company (Ex. 3: 127) remarked:

American Cyanamid believes that the proposed standard, if implemented, will substantially reduce the risk of accidental releases, fires and explosions from processes involving highly hazardous substances.

Additionally, the Organization Resources Counselors (Ex. 131, p.9-10) stated:

Given effective implementation and compliance with the provisions of the proposed standard, we agree with OSHA's estimate of at least 80% reduction in serious process incidents.

Quantitative evidence from Air Products and Chemicals, Inc., suggests that instituting a comprehensive process safety program which includes a hazard analysis could result in an even more significant reduction in accident and injury rates (97.5%; RIA, Chapter V-11-12). Moreover, empirical data from a senior safety consultant showed that in dealing with 500 companies of all sizes (over a 15 year period) "those committed to the development of a long-term program" similar to that described in the process safety management standard, achieve median improvement in their safety programs after the third year of implementation of nearly 75% (RIA, Chapter V-13).

Although one of the studies cited by OMB (the St. John's River Power Plant project) only accomplished a 56% decrease in accidents, it is important to note that the potential hazards faced by the plant studied were significantly lower than those posed by the use and handling of the threshold amounts of chemicals covered by the process safety management rule; and the program studied was not as comprehensive as that contemplated in the PSM standard. It is not unreasonable to assume that where, as here, highly hazardous chemicals are being used in potentially catastrophic amounts and there is a comprehensive standard in effect that has the force and effect of law, that an additional 25% effectiveness could be accomplished. While one cannot predict benefits absolutely it would seem that the 80% estimate assumed by the RIA is reasonable and supported by substantial evidence in the record as a whole.

(3) OMB also indicated that the costs may be higher than estimated and may adversely affect profitability (Ex. 3: 14, p. 4-6). The PRIA predicted that compliance with the proposed standard would cost \$638 million in direct annualized gross costs (estimated per

year for a ten year period). These estimates were based in large part on the Kearney/Centaur Report, "Proposed OSHA Rule for the Process Hazards Management of Highly Hazardous Chemicals: An Industry Profile, Cost Assessment and Benefits Analysis" (Ex. 5). A number of commenters believed that the PRIA had underestimated the costs of complying with the proposed standard (e.g., 3: 45, 69, 95, 106, 109, 150, 153). In response to comments in the record, OSHA updated and refined the Kearney/Centaur industry profile, its estimates of current industry compliance with the proposed process safety management standard, and the estimate of the number of processes per establishment that would be covered by the standard (RIA, Chapter V). This resulted in the calculation of increased costs of compliance with the process safety management standard. The final RIA predicts gross costs of \$863.5 million/year during the first 5 years that the standard is in effect (as opposed to the \$638 million estimated by the PRIA) (RIA, Chapter IV-11) and \$390.1 million/year during the next 5 years. In order to better understand the true costs associated with the process safety management rule, the gross cost of compliance must then be adjusted downward to account for the many benefits of the standard, such as increased productivity, decreased property damage, and decreased fatalities and injuries. When these offsets are taken into account, OSHA predicts that the standard will cost approximately \$143.5 million per year for the first 5 years. Cost savings are expected to exceed direct costs for most industry groups in years 6 through 10.

OSHA also looked at the effect of the costs of compliance on the profitability of the affected industries and found that, assuming that the affected companies would not pass on any of the costs of compliance to customers (a worst case assumption), in the first five years compliance with the process safety management rule might decrease profits anywhere from .09 percent to 15.7 percent depending on the industry group. Worst-case profit impacts would average 1.1 percent for large establishments and 3.2 percent for small establishments. Therefore the final figures show that the standard is not only economically feasible, but it will not unreasonably affect the profitability of the affected industries and is well within the mandates of the CAAA, the Occupational Safety and Health Act and Executive Order 12291.

(4) OMB also believed that the process safety management rule might have high costs and few benefits for

small employers and, therefore, could be anticompetitive (Ex. 3: 14, p. 6-7). As stated above, the final RIA indicates the gross costs of complying with the process safety management standard will be \$863.5 million/year during the first 5 years that the standard is in effect and \$390.1 million/year during the next 5 years for all industry. Of this total gross cost of compliance, small business will bear approximately \$88.9 million/year during the first 5 years that the standard is in effect and \$33.0 million/year during the next 5 years. While accounting for approximately 10 percent of costs, small firms will realize considerable benefits from compliance; 21 percent of fatalities avoided and 9 percent of lost-workday injuries avoided will occur in small establishments.

OSHA's estimates for small-firm costs declined in the final impact analysis after incorporating the ideas of inventory reduction and a learning-curve effect during compliance. A small business might reduce the potential hazard by purposely controlling its on-site inventory of highly hazardous chemicals by ordering more frequent, smaller shipments so that they do not exceed the threshold for coverage set forth in the rule. Also, they may segregate their inventory by dispersing the storage around the worksite so that the release of a highly hazardous chemical from one storage area would not cause the release of the other inventory stored on site. This remote storage approach would also be a feasible alternative. Moreover, small employers who use batch processes may be able to use a generic approach to the required process hazards analysis which would help to further reduce the estimated cost of compliance. For example, a generic process hazard analysis of a representative batch might be used where there are only small changes in the process chemistry and this is documented for the range of batch processes (see appendix C).

Also, as a general rule, small employers have greater flexibility within their workplaces than do large employers. Employees may be trained to do more than one job and have a greater understanding of the interrelationship of the different factors that can adversely affect the process and produce a potentially catastrophic incident.

Some participants believe that there will be long-term benefits to full implementation of process safety management (e.g., Ex. 11: 87; Ex. 99; Ex. 131; Tr. 1050-52, 3052). For example, evidence in the record from a manager of a small plant which had recently undergone the experience of



implementing process safety management practices and techniques indicates that the benefits of the standard can be substantial and realizable (Ex. 131, Attachment III, p. 5-6). For example, he wrote:

The benefits of a comprehensive process safety program are substantial, but are often difficult to quantify. This is particularly true if one tries to develop a traditional "return on investment."

Perhaps the biggest benefit is in the alteration of thinking that is inherent to the system. It became apparent that there was a subtle shifting of approach to problems by plant staff. . . . Our small organization was quietly infused with a rebirth of innovative thinking. Process technology that was more than 35 years old was routinely being questioned and inspected for safer ways to do the task at hand. This quickly led to the same questioning being applied to process improvement. . . .

The net result has been not only that safety performance has been enhanced, and the process operational risks materially reduced, but the resultant attitude and approach to daily tasks have resulted in material gains in directly accountable issues such as process yields. Ultimately, I believe that this thoroughness and rigorous training approach will result in cost savings to a small plant site on the order of 4 to 7 percent of an operating budget. . . .

(5) OMB also felt that OSHA should consider a sunset provision in the final rule that would cause the rule to expire after five years if it does not have the intended effect of providing significant reductions in the number of workplace accidents associated with hazardous chemicals (Ex. 3: 14, p. 3). In its proposal, OSHA did not propose a specific timeframe for compliance. The final OSHA rule, because of feasibility considerations, does not become fully effective for five years and if the comment is read literally, the rule might "set" before it was fully implemented. Therefore, the 5-year "sunset" timeframe would not be compatible with the process safety management regulatory framework. The process safety management standard is based on the Occupational Safety and Health Act and the Clean Air Act Amendments of 1990 (CAAA). The CAAA does not contemplate a "sunset" provision and this is probably because we know that the chemicals which this standard regulates are intrinsically hazardous and the hazard will not go away as long as these chemicals are being used in industrial processes. Even if the OMB comment were read to mean that OSHA should consider a sunset provision 5 years after the rule becomes effective, there is nothing in the present record that would support the inclusion of a sunset provision in the final rule. The Agency believes that this final rule will

be highly effective and will significantly reduce workplace accidents and injuries. This view is supported by substantial evidence in the record as a whole. Therefore it would be arbitrary and contrary to the record evidence for the Agency to include a sunset provision in the final rule. Moreover, it is questionable whether this approach (i.e., a sunset provision) is consistent with the procedural framework of the Occupational Safety and Health Act, which directs the Secretary to use specified procedures to amend or revoke a standard adopted under the Act. These procedures include public notice and an opportunity for the public to file comments and objections and to request a public hearing on the proposed amendments or revocation (29 U.S.C. 655).

It is, of course, possible that after the process safety management rule has been in effect for a while, however, facts may emerge to indicate that there is a need to change the regulation (e.g., safety prevention provisions, highly hazardous chemical lists, etc.). If such facts emerge, either based on safety experience under the rule or on an OSHA retrospective study of the costs and benefits of the rule, the Agency might then consider amending the regulation to make it more effective. This would, of course, be done under section 6 of the Occupational Safety and Health Act, perhaps with the assistance of other potentially relevant statutes such as the Alternative Dispute Resolution Act (Pub. L. 101-552) and the Negotiated Rulemaking Act (Pub. L. 101-648). Under any of these vehicles, however, interested persons would be given a chance to comment and present evidence on all relevant issues, a safeguard that might be missing if a sunset provision were used.

#### Purpose

It was pointed out to OSHA by several commenters (e.g., 3: 12, 48, 53) that in the proposed paragraph concerning the purpose of the standard (proposal paragraph (a)), OSHA did not correctly state the types of chemicals covered by the proposal since in addition to "toxic, flammable or explosive chemicals," OSHA was also covering reactive chemicals. This intent was stated in other locations in the proposal including the description of the highly hazardous chemicals covered by appendix A of the proposal. In response, OSHA has added "reactive" to the purpose paragraph and it now states that the section contains requirements for preventing or minimizing the consequences of "toxic, reactive, flammable, or explosive chemicals."

Additionally, OSHA has added that the standard is intended to address the hazards to employees from toxicity, fire or explosion.

#### Application: Paragraph (a)

The application section in proposed paragraph (b) specified those types of highly hazardous chemicals covered by the proposal. The application section also included processes involving certain specified highly hazardous chemicals at or above a stated threshold which was listed in appendix A: processes involving flammable liquids or gases on site in one location in quantities of 10,000 pounds or greater (with two exceptions discussed later in this preamble); the manufacture of explosives and pyrotechnics; and processes involving chemicals developed after the promulgation of the final standard which meet certain criteria contained in proposed mandatory appendix B (Substance Hazard Index). Additionally, OSHA proposed to exclude retail facilities, oil and gas well drilling and servicing operations and normally unmanned remote facilities from the standard.

The application paragraph was addressed by the vast majority of rulemaking participants. OSHA received a great deal of support concerning its general approach to covering highly hazardous chemicals but also received numerous recommendations for clarifications; criticisms regarding the toxic and reactive list (appendix A); the inclusion of 10,000 pounds of flammable liquids rather than the use of a vaporizable amount (5 tons of vapor); and recommendations for additional exemptions for certain processes or industries. OSHA has carefully evaluated participants' comments and information concerning the appropriate scope and application of the standard in order to assure that the standard is clearly and properly focused to achieve its goal of eliminating the occurrence of releases or mitigating the consequences of releases that occur.

Before discussing the proposed application provisions in detail, OSHA would like to address and clarify OSHA's use of the plural word "processes" in the application paragraph of the proposal. This use resulted in commenters (e.g., Ex. 3: 104, 109, 112, 119, 125, 126) questioning whether the use of the word "processes" meant that the amount of highly hazardous chemical used at a plant must be aggregated to meet the threshold for coverage even though the amount of highly hazardous chemicals used at any one location might be less than the



threshold amount or the amount of highly hazardous chemical in use might be divided among remote processes. Also, participants asked whether the proposal required that the highly hazardous chemical threshold quantity be aggregated over a period of time or whether it must be present at one point in time to be covered by the proposal. OSHA addressed this concern in its November 1, 1990, *Federal Register* notice in Issue 2 (55 FR 46075).

OSHA's view at that time was that if a plant exceeded the threshold quantity of a listed chemical but the chemical was used in smaller quantities around the plant and was not concentrated in one process or in one area, then OSHA believed that a catastrophic release of the threshold quantity would be remote due to the reduced availability of a concentrated amount of the chemical in one location. However, OSHA requested comment on the point at which a chemical should be considered in its aggregate due to the proximity of the sites at which it was being used in a plant.

While a few participants indicated that the amounts of a highly hazardous chemical used at various sites around the plant should all be counted toward the threshold amount for coverage (e.g., Ex. 3: 12, 18, 41; Ex. 153), most participants who discussed this issue noted that the threshold quantity should not be aggregated (e.g., Ex. 163; Ex. 164; Tr. 2591, 3192). They agreed that highly hazardous chemicals in less than threshold quantities distributed in several processes would not present as great a risk of catastrophe as the threshold quantity in a single process.

OSHA continues to believe that the potential hazard of a catastrophic release exists when the highly hazardous chemical is concentrated in a process and therefore agrees with these commenters. OSHA has clarified the language contained in the application paragraph to reflect its intent that coverage is triggered by a specified threshold quantity of an appendix A substance being used in a single process. This revision also clarifies the fact that the presence of a threshold quantity of a highly hazardous chemical in a process is to be at one point in time; not aggregated over a period of time.

In the application section (paragraph (b)(1)(i)) of the proposal, a process would be covered if it involved a toxic or reactive highly hazardous chemical listed in appendix A, at or above a specified threshold quantity. Appendix A was a compilation of highly hazardous chemicals that could cause a serious chemical accident, by toxicity or

reactivity, and a consequent potential danger to employees in a workplace.

The appendix A list has been drawn from a variety of relevant sources which include: The New Jersey "Toxic Catastrophe Prevention Act," the State of Delaware's "Extremely Hazardous Substances Risk Management Act," the World Bank's "Manual of Industrial Hazard Assessment Techniques," the Environmental Protection Agency's "Extremely Hazardous Substance List," the European Communities Directive on major accident hazards of certain industrial activities (82/501/EEC, sometimes called the Seveso Directive), the United Kingdom's "A Guide to the Control of Industrial Major Accident Hazards Regulations 1984," the American Petroleum Institute's RP 750, "Management of Process Hazards," the National Fire Protection Association's NFPA 49, "Hazardous Chemicals Data," and the Organization Resources Counselors, Inc.'s "Recommendations for Process Hazards Management of Substances with Catastrophic Potential."

Every chemical listed in appendix A is on at least one list compiled by these agencies and organizations as warranting a high degree of management control due to its extremely hazardous nature. Most of the chemicals are on several lists. Not every list contains the same chemicals or quantities. Based on a review of these sources, OSHA has sought to include those toxic and reactive chemicals it believes are most significant in potentially becoming a catastrophic event. OSHA has also sought to develop a reasonable listing of threshold quantities which, when used in a process, would invoke coverage of the standard.

Those appendix A highly hazardous chemicals which are highly reactive or explosive-type chemicals have been drawn from chemicals listed in the National Fire Protection Association (NFPA) document, NFPA 49, "Hazardous Chemicals Data" and cross-referenced with other sources mentioned above. The Agency decided to include substances with the two highest or most dangerous reactivity ratings from NFPA 49 because these chemicals present the most severe exposure potential to workers. These substances, which are rated 3 or 4 by NFPA 49, are those which are capable of undergoing detonation or explosive decomposition. These are the substances which can generate the most severe blast or shock wave, and can cause fragmentation of piping, vessels and containers, as well as causing

serious damage to buildings and structures.

The minimum threshold quantities for the highly reactive chemicals covered by the standard have been determined by calculating the amount of material needed to propagate a blast wave that creates an overpressure of 2.3 psi (15.85 kPa) to a flat surface perpendicular to the direction of the blast wave at a distance of 100 meters from the point of origin. This approach is similar to that used by the State of Delaware.

The toxic chemicals contained in appendix A were drawn from the various resource documents discussed above. Most of the toxic chemicals listed in appendix A are on a majority of the lists produced by these resource documents.

In determining threshold quantities for toxic chemicals, OSHA used the Turner described Gaussian dispersion model. This approach, again, is similar to that used by the State of Delaware. Both OSHA and Delaware made the following assumptions: Average conditions of 4.3 m/sec. wind speed and D stability with urban dispersion coefficients; continuous steady-state release for one hour; no liquid pools; all released chemicals in vapor or gaseous state; chemical release is at ambient temperature and at ground level; chemical gas or vapor cloud is neutrally buoyant; and no design features prevent downwind dispersion. The calculated threshold quantities were rounded by OSHA to further simplify the standard.

The lowest threshold quantity that the Agency has used is 100 pounds (45.4 kg) for the most hazardous of the chemicals listed. The OSHA threshold quantities are the same or somewhat greater than the Delaware "sufficient quantity level" (threshold quantity) due to the rounding up by the Agency for the vast majority of the toxic chemicals listed. This has been done to simplify the application of this final rule and also in recognition that the Agency has other standards which address the hazards of lower quantities of toxic materials in the workplace.

OSHA specifically solicited comments on the sufficiency of the list and threshold quantities in appendix A (55 FR at 29158). Appendix A generated a significant amount of discussion during this rulemaking.

Some commenters (e.g., Ex. 3: 18, 35, 89, 152) asked why OSHA's resulting list was different than the Environmental Protection Agency's (EPA) Extremely Hazardous Substance (EHS) list and some suggested further expansion of the list. For example the Consumer Policy Institute (Ex. 3: 152, p.2) stated:



CPI recommends that the highly hazardous substance list be expanded to include all substances on the EPA SARA Title III list of extremely hazardous substances, all substances found to be involved in incidents at facilities and all substances listed by the European Economic Community under the Seveso directive.

The Shipbuilders Council of America (3:18, p.4) indicated:

[I]t is recommended that the two agencies [OSHA and EPA] publish one consistent list of chemicals which both would consider "extremely" or "highly" hazardous. Employers would then be required to deal with one list of chemicals for reporting purposes under SARA regulations and for safely managing processes that use these chemicals under the OSHA regulations.

Under section 302 of the Superfund Amendments and Reauthorization Act (SARA) also known as the Emergency Planning and Community Right-to-Know Act (42 U.S.C. 11001 *et seq.*), EPA was required to publish a list of extremely hazardous substances with threshold planning quantities which would trigger planning in states and local communities (52 FR 13378). EPA's EHS list is quite extensive (more than 300 hazardous substances) and serves as an emergency response planning list directed toward addressing hazards to the public and the environment.

Section 304 of the Clean Air Act Amendments (CAAA), paragraph (b), List of Highly Hazardous Chemicals, mandates that:

The Secretary [of Labor] shall include as part of such standard [Chemical Process Safety Standard] a list of highly hazardous chemicals, which include toxic, flammable, highly reactive and explosive substances (Emphasis added).

The paragraph further indicates that the Secretary may include those chemicals listed by the Environmental Protection Agency under section 302 of the Emergency Planning and Community Right to Know Act of 1986.

Further the CAAA did not anticipate that even EPA would adopt the whole EHS list for the purpose of prevention of accidental chemical releases. Section 301(r) indicated that EPA's first list must contain no less than 100 substances which may be from the EHS list. EPA's 301(r) list is not a planning tool but rather a list that requires covered plants to develop comprehensive Risk Management Plans.

While OSHA considered this list, it does not consider all of the substances on the EHS list to present a potential catastrophic situation for employees in workplaces within its jurisdiction. Therefore, OSHA believes it has acted reasonably and appropriately in evaluating a variety of chemical lists

including the EHS list in order to identify those highly hazardous chemicals which present a potential catastrophic threat to employees. These events typically include toxic releases, fires and explosions as opposed to potential environmental threats such as spillage of a pesticide.

Several participants in the rulemaking (e.g., Ex. 3: 6, 45, 51, 150; Ex. 141) advised OSHA that certain chemicals which appeared in appendix A, including dimethyl sulfide, isopropyl formate, and methyl disulfide had been deleted from EPA's EHS list based on a reconsideration of the data and a determination that the data did not support the inclusion of the chemicals on the EHS list. OSHA agrees that it is appropriate to delete these chemicals from its list since a redetermination had been made that data and information available did not support their inclusion on the EPA list. OSHA has therefore removed these chemicals from its appendix. Other changes to OSHA's appendix A list include: (1) A change in the amount of anhydrous ammonia from 5,000 to 10,000 pounds to better reflect its hazards; (2) a change in the stated threshold quantity of ammonia solutions from 10,000 to 15,000 pounds to better reflect its dilution by water and its consequent decreased flammability and potential adverse health affects; (3) a change in the amount of 3-bromopropyne (also listed as propargyl bromide) from 7,500 pounds to 100 pounds to reflect its toxic characteristics rather than its reactive characteristics; (4) elimination of the erroneous description of formaldehyde, in "concentrations greater than 90%," since no such concentration exists, and the addition of formalin in the description to assure that no doubt exists that formalin is covered under the formaldehyde entry; (5) an editorial change to peracetic acid (also called peroxyacetic acid) which inadvertently did not include the description "concentration > 60%" which was correctly included in the subsequent entry of peroxyacetic acid; (6) the elimination of the word "liquid" from the description of sulfur dioxide since it may also be a gas and the health hazards are the same regardless of its state; (7) and changes based on a reevaluation of available information, in the threshold amounts of allylamine from 1500 pounds to 1000 pounds, peracetic acid (also called peroxyacetic acid, concentration > 60%) from 5000 pounds to 1000 pounds, and tetramethyl lead from 7500 pounds to 1000 pounds to better reflect their toxic hazards.

Some participants expressed their general support for the list contained in

appendix A (e.g., Ex. 3: 17, 45, 59, 62, 82, 88, 95, 127, 134; Tr. 1999-2000). Allied-Signal Inc. (Ex. 3: 17, p.15) observed:

Appendix A is a credible compilation of chemicals that are sufficiently toxic and volatile that their release could result in a catastrophic event. We applaud OSHA's use of list of toxic and reactive/unstable chemicals developed by other Federal and State agencies to develop appendix A.

The American Paper Institute (Ex. 3: 45, p.10) indicated:

The approach of tying process safety management requirements to the presence or absence of listed chemicals is an imperfect one. While the list-based approach may mean that the rule is both over and under inclusive, we have devised no approach that more closely tailors the process safety management requirements to real process safety hazards.

In general, appendix A appears to be a sufficient compilation of chemicals.

BP America Inc. (Ex. 3: 59A) noted:

BP America has reviewed the list of Appendix A chemicals and believes that the current compilation of chemicals is acceptable.

Amoco Corporation (Ex. 3: 95) stated:

We think that the list of highly hazardous chemicals in appendix A is sufficiently comprehensive in nature and reasonable with regard to threshold quantity to adequately cover the most toxic and hazardous chemicals in current use.

American Cyanamid Company (Ex. 3: 127, p.2) indicated:

Mandatory appendix A is a sufficient compilation of chemicals for the initial coverage of this proposed standard. We could find no major omissions from appendix A. Its completeness is undoubtedly attributable to careful research on OSHA's part and the experience factor derived from review of similar lists \* \* \*.

Lubrizol Petroleum Chemicals Company (Ex. 3: 134) stated:

The Houston plants agree with OSHA's belief that appendix A represents a reasonable and appropriate listing of chemicals and threshold quantities.

Finally, OSHA's expert witness, who worked for 37 years with Monsanto Company, the last 9 as corporate safety director (worldwide responsibilities) (Tr. 1999-2000) testified:

In my opinion, the list of chemicals with the stated threshold quantities in the appendix is reasonable and provides the focus for preventing catastrophic releases of hazardous materials in the processing industry.

OSHA based its list on information drawn from a variety of sources, including other federal and state agencies, national consensus standards and the United Kingdom Health and Safety Commission.



While any listing of hazardous chemicals is subject to revision, I support the listing of the chemicals in the appendix as appropriate.

It encompasses, in my experience, the vast majority of chemicals likely to cause catastrophic release and its consequences.

However, a number of participants felt OSHA should provide a technical basis for the appendix A list and its threshold quantities (e.g., Ex. 3: 26, 46, 48, 53, 97, 101, 129; Ex. 131; Tr. 66, 1015). Some participants noted that if no published technical basis existed then it would be difficult to add chemicals at a later time (e.g., Ex. 3: 46, 48; Ex. 131; Tr. 1016). OSHA believes that its review of available literature for the development of its list of highly hazardous chemicals and its technical approach (discussed previously) is an appropriate method to determine which toxic chemicals should be included on its list. OSHA also believes that it is reasonable to defer to groups that have already published their lists and which have withstood public scrutiny. OSHA is convinced that it has taken a correct and reasonable approach.

Additionally OSHA believes that additional consideration would be required to fully evaluate a "technical basis" other than that used by the Agency (e.g., a formula). The Organization Resources Counselors (ORC) recommended the use of a technical basis throughout the rulemaking. In its post-hearing comment (Ex. 131, Table A-1), ORC reassessed the OSHA appendix A list based on its suggested technical basis (a formula, similar to the Substance Hazard Index proposed by OSHA). The outcome resulted in significant differences in the threshold quantities for many chemicals. For example, OSHA lists the threshold quantity of acrylyl chloride at 250 pounds and arsine at 100 pounds; ORC lists the threshold quantity of acrylyl chloride at 200 pounds and arsine at 450 pounds. While the ORC approach is an interesting one, OSHA believes that its approach is also correct, and has decided to retain it in the final rule.

As noted, some participants indicated that without a technical basis for appendix A it would be difficult for OSHA to readily update its list in the future. OSHA believes that a means for adding highly hazardous chemicals to appendix A in the future can be considered at such time as the need arises. As discussed, OSHA has explained its technical basis for appendix A highly hazardous chemicals. OSHA does not believe that it should modify the approach it used in the development of the appendix A list especially in light of the many changes that would be necessitated through the

incorporation of other suggested approaches. In addition, with the exception of a few corrections and clarifications, there were no objections raised as to the appropriateness of the threshold quantities proposed, but as stated, general support for the list and threshold quantities.

As discussed, the application section (proposed paragraph (b)(1)(i)) triggering coverage of those processes using chemicals in quantities listed in appendix A, has been clarified to lessen confusion concerning the aggregation of chemicals by changing the term "processes" to "a process." No other changes have been made to the text of the paragraph but it has been redesignated as paragraph (a) and thus becomes paragraph (a)(1)(i).

The application section (paragraph (b)(1)(ii)) proposed to include processes involving flammable liquids or gases in quantities of 10,000 pounds or more. It has been suggested that OSHA cover flammable gases and liquids with a potential release of five tons of gas or vapor (Ex. 2: 10, 11).

The American Petroleum Institute's (API) Recommended Practice 750 (RP 750), Management of Process Hazards, uses the potential release of gas or vapor approach. The stated purpose of RP 750 is to help prevent the occurrence, or minimize the consequences of, catastrophic releases of toxic or explosive materials (Ex. 2: 11). Additionally in the application statement of RP 750 it is stated that the recommended practice is intended for facilities that use, produce, process, or store:

Flammable or explosive substances that are present in such quantity and condition that a sudden, catastrophic release of more than 5 tons of gas or vapor can occur over a matter of minutes, based on credible failure scenarios and the properties of the materials involved.

Appendices A and B to RP 750 provide information and guidance on the application of this paragraph.

However, OSHA believed that assessing the variables and assumptions inherent in determining whether five tons of gas or vapor could be released (temperature, pressure, rate of release, etc.) using undefined "credible release scenarios," would be an unnecessary burden on employers and compliance personnel. More importantly, depending on these variables, substances might sometimes be covered and sometimes not be covered, a potentially confusing situation. Therefore, OSHA decided to use a worst case approach and assume that the entire five ton quantity of a

highly hazardous chemical could be released into gas or vapor.

In Issue 1 in the notice of proposed rulemaking (55 FR at 29158) OSHA requested comments on other ways in which flammable liquids and gases might be covered. A variety of commenters supported the 10,000 pound threshold amount for coverage of flammable liquids and gases which OSHA proposed (e.g., Ex. 3: 45, 59, 81, 95, 99). BP America (Ex. 3: 59A) remarked:

BP America also believes that a five ton release of vapor as explained in the API Recommended Practice (RP) 750 is most appropriate. However, BP understands the administrative difficulties relating to enforcement of this provision and, therefore, supports the five ton flammable liquids and gases criterion as defined in the standard.

Goodyear Tire & Rubber Company (Ex. 3: 81) noted:

The threshold quantity of 10,000 pounds for flammable liquids and gases is appropriate for the standard.

Other participants (e.g., Ex. 3: 20, 26, 69, 71, 80, 91, 106, 108, 127, 129, 173; Tr. 1513, 2583, 3193) recommended that OSHA address only the amount of flammable liquid or gas that could result in the release of 5 tons of vapor using worst case release conditions in conjunction with appropriate flash calculations instead of credible release scenarios. For example, API (Ex. 3: 106A, p. 4) asserted:

As you know, API's Recommended Practice 750 applies to flammable liquids provided 10,000 pounds (5 tons) of gas or vapor can be released over a matter of minutes during credible release scenarios. We understand OSHA has rejected this approach . . . due to regulatory difficulties in defining credible release scenarios. Although API prefers the API RP 750 approach, we can accept the 10,000 pounds of inventory criteria as being simpler. However, API remains convinced that only the vaporizable portion of the flammable liquid should be included in the inventory.

Our concern stems from the fact that oil and gas operations handle complex substances which often will invalidate the appropriateness of the 10,000-pounds-of-inventory approach. For example, a release of 10,000 pounds of crude oil constitutes only a small fraction of the hazards of a release of 10,000 pounds of the C2-C8 hydrocarbon series. This is because only a small part of a crude oil release will immediately vaporize, and it is only the vaporizable portion that could potentially constitute a catastrophic hazard.

For these reasons, we propose . . . "Processes which involve flammable liquids or gases (as defined in 1910.1200(c) of this part) onsite in one location, in quantities that will vaporize 10,000 pounds or more under worst-case release conditions \* \* \*"



While this approach requires a routine flash calculation, it does remove the judgement regarding credible release scenarios that is currently provided by the RP-750 approach.

However, OSHA believes that the modified API recommendation calls for the use of yet another judgement by its use of the undefined "worst case release conditions." Further, OSHA believes that RP 750 does not directly address the hazards to employees of fires which might occur rather than explosions. For example, in appendix A of RP 750, the general discussion on the probability of ignition and explosion of vapor clouds (Ex. 2: 11, p. 11) reads:

When a hydrocarbon vapor cloud forms, the cloud may dissipate harmlessly, be consumed by a flash fire without causing significant blast overpressures, or explode \* \* \*

Although vapor cloud explosions have occurred after release as small as 1 ton, most of these explosions have occurred as a result of release of more than 5 tons \* \* \*

OSHA's proposed process safety management standard was directed toward the hazards of fires as well as the hazards of explosions.

For these reasons, OSHA continues to believe that the use of a 10,000 pound threshold for flammable liquids or gases is a reasonable approach and the provision has been retained in the final standard. This final provision becomes paragraph (a)(1)(ii).

In the proposed application section (paragraph (b)(1)(ii)(A)) OSHA proposed to exempt from coverage hydrocarbon fuels used solely for workplace consumption as a fuel (e.g., propane or oil used for comfort heating). OSHA believed that this type of use did not have the same catastrophic potential as those which were proposed. The exemption would exclude fuels used in general heating systems and refueling systems (for fleets) throughout the country. Such uses would still be regulated by other existing specific OSHA standards (such as § 1910.106, flammable and combustible liquids, and § 1910.110, liquefied petroleum gases) which adequately address these uncomplicated uses.

Additionally, in Issue 3 of the hearing notice (55 FR at 46075) OSHA indicated that some confusion existed regarding this proposed exemption. For example, some participants asked if this exemption included furnaces used in a process. Therefore OSHA solicited comments on this issue. Organization Resources Counselors (ORC, Ex. 131, p. 3-4) commented:

A number of persons testifying during the public hearings indicated concern and confusion over the wording of the proposed

exemption for hydrocarbon fuels that are present in quantities greater than 10,000 pounds, but are not part of a process. Examples of these would be propane or oil used for comfort heating and gasoline or diesel fuel for use in industrial vehicles. To remedy this confusion, ORC recommends that subparagraph (b)(1)(ii)(A) be amended to read:

Hydrocarbon fuels used solely as a fuel at a facility which is not otherwise covered by this rule.

This change will ensure that facilities which use hydrocarbon fuels in a processing step are not excluded from coverage under the standard, but that this subparagraph of the final rule properly continues to exclude facilities at which processing aberrations are absent \* \* \*

Further the American Petroleum Institute (Ex. 137, p. 12-13) observed:

It is our understanding that OSHA's intention in providing exemption (b)(1)(ii)(A) was to exclude the enormous number of small business locations across the nation which would not be covered by the proposed rule, except for their on-site storage of hydrocarbon fuels for low-risk applications such as heating, drying, and the like. Such activities are not the subject of this rule, and this exclusion is entirely appropriate.

On the other hand, interpreting this exclusion to apply to hydrocarbon fuels used for process-related applications such as furnaces, process heaters, and the like at facilities covered by the rule was not intended.

OSHA agrees with these participants and has changed the final provision to clarify its intent not to exclude from coverage hydrocarbon fuels used for process related applications such as furnaces, heat exchangers and the like at facilities covered by this rule. It becomes final paragraph (a)(1)(ii)(A) and exempts from coverage:

Hydrocarbon fuels used solely for workplace consumption as a fuel (e.g., propane used for comfort heating or gasoline used for vehicle fueling), if such fuels are not a part of a process containing another highly hazardous chemical covered by this standard.

The second proposed exemption concerned flammable liquids stored or transferred which are kept below their atmospheric boiling point without benefit of chilling or refrigeration and was proposed paragraph (b)(1)(ii)(B). Again, OSHA did not believe that the flammable liquids as described in the exemption have the same potential for a catastrophe as those proposed. Again an OSHA standard already regulates the treatment of the exempted flammable liquids (§ 1910.106, flammable and combustible liquids).

While many participants supported the exemption concerning flammable liquids stored or transferred which are kept below their atmospheric boiling

point without benefit of chilling or refrigeration, they recommended that OSHA clarify the exemption (e.g., Ex. 3: 48, 71, 106, 108, 119, 120; Ex. 93; Ex. 119; Tr. 2012) by using established language from its standard concerning flammable and combustible liquids. For example, the American Petroleum Institute (Ex. 3: 106A, p. 4-5) concluded:

OSHA's phrase "atmospheric boiling point" introduces unnecessary problems in applying this important exemption to various complex substances such as crude oil which do not have precise boiling points. OSHA has previously resolved this problem by providing definitions for "atmospheric tank" and "boiling point" in subpart H—1910.106(a)(2) and (a)(5).

OSHA agrees with this suggestion concerning the use of existing definitions; this does not change the intent of the exemption and merely clarifies the exemption. Therefore, proposed paragraph (b)(1)(ii)(B) becomes final paragraph (a)(1)(ii)(B) and has been clarified by adding existing language from OSHA's standard for flammable and combustible liquids, § 1910.106, "atmospheric tank" and "boiling point," and providing a definition for these terms in lieu of the proposal's term "atmospheric boiling point." OSHA believes that this exemption is reasonable and appropriate.

In the proposal paragraph (b)(1)(iii) proposed to cover the manufacture of explosives as defined in paragraph (a)(3) of § 1910.109, "Explosives and blasting agents." Additionally, proposed paragraph (b)(1)(iv) covered the manufacture of pyrotechnics (as defined in paragraph (a)(10) of § 1910.109), including fireworks and flares.

Although there is an existing OSHA standard for explosives and pyrotechnics (§1910.109), that standard does not address the hazards associated with their manufacture. OSHA believed that the requirements contained in the proposed process safety management standard should be applied to the explosive and pyrotechnic manufacturing process because of their potential for producing a major accident during manufacture. Therefore the proposal addressed a gap that exists in the Agency's current standard for explosives and pyrotechnics.

Some rulemaking participants (e.g., Ex. 3: 40, 52, 60; Tr. 3011-21) asserted that the manufacture of explosives and pyrotechnics should not be covered by proposed § 1910.119, because the hazards associated with these substances are already adequately covered by § 1910.109 of the OSHA standards, as well as requirements of



other regulatory agencies. For example, a commenter from the Society of Explosives Engineers (S.E.E., Ex. 3: 40, p.1-2) stated:

Because explosives are currently regulated by so many Federal, state, and local agencies, it is highly questionable that they could result in a catastrophic event typical of those described by OSHA in the background discussion.

S.E.E. believes that uniform, workable regulations are a key factor in the promotion and maintenance of explosive safety. We further believe that the use, storage, handling and transportation of explosives are already adequately covered by regulations in 29 CFR (OSHA), 30 CFR (MSHA and OSM), 49 CFR (DOT) and the regulations of state and local regulatory agencies and there is no need for OSHA to include the manufacture of explosives in 29 CFR 1910.119.

With respect to the manufacture of fireworks, a hearing participant from the American Pyrotechnics Association (APA, Tr. 3011) testified:

The APA endorses the concept of federal standards designed to adequately prevent or minimize the consequences of chemical accidents involving highly-hazardous chemicals. However, the APA believes that the statements cited by the Agency are incorrect.

The inclusion of fireworks manufacturing processes is unwarranted and could be interpreted to require protective measures which could impose substantial burdens on the fireworks industry without making a significant contribution toward work place safety.

In its comment (Ex. 3: 52), the APA further asserted that a gap does not exist in the OSHA standards with respect to the manufacture of fireworks. APA stated that the Bureau of Alcohol, Tobacco and Firearms (BATF) currently regulates the quantity of explosive and pyrotechnic materials which may be used at one time, and the distances between process and storage buildings. The APA contended that the BATF requirements and the requirements contained in § 1910.109 of the OSHA standards, together with OSHA enforcement of provisions contained in the National Fire Protection Association (NFPA) standard, "Manufacture, Transportation, and Storage of Fireworks" (NFPA-1124), adequately regulates the manufacture of fireworks.

Other rulemaking participants, however, strongly supported the inclusion of the manufacture of explosives and pyrotechnics within the scope of this proposed standard, and objected to excluding these activities. For example, a commenter from the Oil, Chemical & Atomic Workers (OCAW, Ex. 114, p.1-2) said:

[A]s far as the inclusion of the explosives industry in the standard coverage, OCAW

feels there is no room for debate. These industries are no different from the industries that fall within the scope of the proposed 1910.119. Further, the fact that there is already an explosives standard 1910.109 does not justify their exclusion from 1910.119 as 1910.109 does not address process safety in any manner.

OCAW buttressed their position (Ex. 114) concerning the inclusion of explosives manufacturing within the scope of this proposed standard by elaborating on the similarity of the explosives industry to other chemical industries that are proposed to be covered by § 1910.119.

In its post-hearing comment, the United Steelworkers of America (USWA, Ex. 118) asserted:

In the proposed Process Safety Management of Highly Hazardous Chemicals standard, paragraphs (b)(1)(iii) and (iv) proposed to include the manufacture of explosives and pyrotechnics. The United Steelworkers of America supports this inclusion. It is unthinkable that OSHA would even consider to exempt this industry, given the products that it manufactures and its accident history. How anyone could argue that the strategies for effective process safety management outlined in the proposed standard could not, or would not, enhance the overall safety of this industry and aid in the prevention and mitigation of major accidents is beyond reason.

Also in their comment, USWA described several incidents that occurred in the explosives industry, and with respect to one particular plant (Ex. 118, p.2), remarked:

In the past 50 years, 60 workers lost their lives at the plant. Of the six major accidents at the facility, not inclusive of the most recent incident, five of these were directly related to process safety hazards that are not covered by § 1910.109 or any other existing OSHA standard. Even though OSHA was able to cite the company for specific violations of existing standards, it has been repeatedly forced to rely on the general duty clause to address major concerns because of the absence of a process safety management standard.

One rulemaking participant (Ex. 3: 23) disagreed that § 1910.119 should apply to the manufacture of explosives and pyrotechnics and suggested, instead, that § 1910.109 be revised to include safety provisions for these manufacturing activities. Other rulemaking participants (e.g., Ex. 3: 62, 100, 116) believed that proposed § 1910.119 provided a technically sound, realistic methodology to improve explosive manufacture safety. They suggested, however, that the provisions of § 1910.119 be incorporated into § 1910.109 of the OSHA standards, so that all requirements pertaining to explosives will be contained in one standard.

For example, a hearing participant from the Institute of Makers of Explosives (IME, Tr. 1244) testified:

IME supports OSHA's proposed regulation for process safety management as a technically sound, logical, and realistic way to offer a methodology to improve explosive manufacture safety. However, IME recommends that OSHA delete the manufacture of explosives from § 1910.119(b)(1)(iii) and incorporate these safety regulations for the manufacture of explosives into 29 CFR 1910.109 Explosives and Blasting Agents at (b)(2).

It was contended (Ex. 130) that this approach would continue OSHA's 20-year history of maintaining a vertical regulation for commercial explosives; eliminate the alleged ambiguity that exists in the proposed rulemaking by including the manufacture of explosives in the application of the standard; and, would recognize the unique conditions under which explosives are manufactured.

In subsequent post-hearing comments, however, both Hercules and the IME (Ex. 125; Ex. 130) submitted draft regulations for the manufacture of commercial explosives. They suggested that the manufacture of commercial explosives be removed from the scope of § 1910.119, and that these draft regulations be included in a revision to § 1910.109 as an appropriate code to regulate the manufacture of commercial explosives.

OSHA appreciates the time and effort involved in developing these draft regulations, and believes that they constitute an excellent source document that the Agency can utilize when it revises the standards contained in § 1910.109. However, OSHA will not incorporate these draft regulations into § 1910.109 as a part of this rulemaking process since they did not receive the type of public comment and evaluation contemplated by section 6(b) of the Occupational Safety and Health Act.

After a thorough analysis of all of the information contained in this rulemaking record, OSHA remains convinced that the hazards associated with the manufacture of explosives and pyrotechnics have the potential of resulting in a catastrophic incident, and pose a significant risk to employees and that the manufacture of explosives and pyrotechnics should be covered by the provisions of the final process safety management rule.

However, the Agency has been persuaded by those participants who suggested that OSHA delete the manufacture of explosives and pyrotechnics from proposed § 1910.119, and incorporate the provisions of the



process safety management standard into 29 CFR 1910.109, "Explosives and Blasting Agents." This will have the effect of referencing in one place, the specific and significant OSHA requirements pertaining to explosives and blasting agents.

Accordingly, proposed paragraph (b)(1)(iii) has not been retained in the final rule for § 1910.119. Rather, § 1910.109 has been revised to add a new paragraph, (k)(2), that requires the manufacture of explosives to comply with the provisions contained in § 1910.119, process safety management of highly hazardous chemicals.

Similarly, proposed paragraph (b)(1)(iv) has not been retained in the final rule for § 1910.119. Again, § 1910.109 has been revised to add another new paragraph, (k)(3), that requires the manufacture of pyrotechnics, including fireworks and flares, to comply with the provisions contained in § 1910.119, process safety management of highly hazardous chemicals.

During this rulemaking process, some concern was expressed that this standard could be interpreted, inappropriately, to apply to all explosive and pyrotechnic manufacturing operations, even those operations of the manufacturing process where explosives or pyrotechnics are not present (e.g., Ex. 3: 62; Ex. 125; Ex. 130). This is not the intent of OSHA. The Agency wants to make it clear that the provisions contained in this final rule apply to explosives and pyrotechnics manufacturing operations only when such substances or other chemicals covered by the standard or in appendix A are present.

Finally, in paragraph (b)(1)(v) OSHA proposed a means for assuring that newly developed toxic chemicals which were not listed in appendix A but were introduced into a process would be evaluated for their degree of hazard and be included in the standard's coverage. A formula, the Substance Hazard Index (SHI), was contained in appendix B of the proposal. The formula relied on the availability of information concerning a chemical's level of hazard as established by the American Industrial Hygiene Association (AIHA) in its Emergency Response Planning Guidelines (ERPGs). The purpose of the SHI was to establish, using certain data, a relative ranking of toxic chemicals.

OSHA acknowledged in the proposal in Issue 2 (55 FR at 29158) that there might be some shortcomings in the use of the SHI. As noted, an important part of the SHI formula relied on the availability of the AIHA computation of

ERPGs for individual chemicals. Only a few ERPGs are presently available.

Generally participants objected (e.g., Ex. 3: 2, 12, 17, 33, 45, 46, 47, 48, 50, 59, 60, 64, 69, 71, 82, 86, 95, 101, 112, 122, 127, 132, 137, 152, 162, 171; Ex. 148; Tr. 968, 1017, 2177, 2654) to using the SHI and cited several reasons for not using it. They observed that OSHA is deferring rulemaking to a private entity; there is no reason to believe that ERPG development can or will be accelerated in order to be responsive to the standard; the 500 pound threshold quantity is arbitrary; and OSHA already has a sound mechanism for adding chemicals to appendix A, the rulemaking process.

OSHA has been convinced by participants in the rulemaking not to use the SHI formula to add additional toxic chemicals to the appendix A list at this time. While OSHA believes a formula would be a worthwhile approach to including new toxic chemicals under the standard, it has been persuaded by commenters that it should use section 6(b) rulemaking procedures until such time as a better formula can be developed by OSHA. Therefore this paragraph has been deleted from the final rule and OSHA will either try to develop a better formula or rely on rulemaking on a chemical by chemical basis to add chemicals to appendix A.

Certain exemptions were contained in the proposed application paragraph of the process safety management rule (paragraphs (b)(2) (i) through (iii)). These exemptions included: retail facilities; oil and gas well drilling and servicing; and normally unmanned remote facilities.

With respect to the exclusion of retail facilities and normally unmanned remote facilities, OSHA believed that such facilities did not present the same degree of hazard to employees as other workplaces covered by the proposal. Therefore OSHA should not require a comprehensive process safety management system in addition to other applicable OSHA standards addressing flammable and combustible liquids, compressed gases, hazard communication, etc., for retail facilities and unmanned remote facilities.

Certainly, highly hazardous chemicals may be present in both types of work operations. However, OSHA believes that chemicals in retail facilities are in small volume packages, containers and allotments, making a large release unlikely. OSHA received few comments disagreeing with the exemption of retail facilities (e.g., gasoline stations). OSHA has retained the exemption in the final rule.

In normally unmanned remote facilities (defined in proposed paragraph (c) and called "normally unoccupied remote facilities" in final paragraph (b)), the likelihood of an uncontrolled release injuring or killing employees is effectively reduced by isolating the process from employees. OSHA believes that the present OSHA standards contained in subpart H, such as § 1910.101, compressed gases, and § 1910.106 flammable and combustible liquids and in part 1910, subpart Z, toxic and hazardous substances, adequately address the chemical hazards presented in these work operations.

OSHA did receive significant comment supporting the exemption of normally unmanned remote facilities (e.g., Ex. 3: 30, 62, 64, 69, 71, 79, 129). Others suggested that OSHA redefine "normally unmanned remote facility" (e.g., Ex. 26, 32, 39, 69, 80, 82, 106, 108, 129). OSHA has retained the exclusion of normally unmanned remote facilities because the Agency believes such facilities pose a reduced likelihood of releases that could harm employees. The issue of modifying the definition will be discussed in the section concerning definitions.

OSHA also proposed to exclude oil and gas well drilling and servicing operations because OSHA had already undertaken rulemaking with regard to these activities (48 FR 57202). OSHA continues to believe that oil and gas well drilling and servicing operations should be covered in a standard designed to address the uniqueness of that industry. This exclusion is retained in the final standard since OSHA continues to believe that a separate standard dealing with such operations is necessary.

Finally, a number of participants requested special consideration for their processes or exemption from the standard. For example, concern was expressed by participants who conduct batch processing operations (e.g., Ex. 3: 50, 55, 74, 164, 169; Ex. 89; Tr. 972, 3202) regarding their ability to comply with the standard due to the dynamic nature of batch processing. With respect to this, the Synthetic and Organic Chemical Manufacturers Association (SOCMA, Ex. 3: 50, p.6-7) stated:

Batch processes are distinct from continuous operations in that a continuous operation has a constant raw material feed to the process and continual product withdrawal from the process. A batch process has an intermittent introduction of frequently changing raw materials into the process, varying process conditions imposed on the process within the same vessel depending on the product being



manufactured. Consequently under the process safety rule as proposed, a batch processor will be required to perform a process hazard analysis each time an order comes in for a chemical that may differ only slightly from the one previously produced.

A batch processing plant is in a constant state of change, always being adapted for different projects. It is not unusual for a batch processor to have a different plant configuration weekly. SOCMA suggests that batch processors be given the flexibility to do a process hazard analysis that is representative of many similar batches. If this recommendation is not adopted, then given the fundamental differences of batch processors, SOCMA recommends that OSHA address batch process safety in a separate rulemaking.

The Ecological and Toxicological Association of the Dyestuffs Manufacturing Industry (Ex. 3: 55) noted:

Based on our near total dependence on batch processing, we support the comments submitted by SOCMA \* \* \* We also strongly urge OSHA to address batch process safety in a separate rule making given the major differences in operation of continuous and batch processing plants.

However, other participants who have been involved in running both continuous processing and batch processing indicated that the standard for process safety management is appropriate for batch processing (Ex. 128; Tr. 1031, 1936). The Chemical Manufacturers Association (CMA, Ex. 128, p.7-8) stated:

CMA does not believe that facility owners/operators with batch processes should be exempted from complying with the proposed PSM standard \* \* \* The key question is whether the hazardous material is present in an amount at or above the threshold quantity. If the answer to this question is yes, then the provisions of the proposed standard should apply. CMA companies have extensive experience handling listed materials both in batch and continuous facilities. CMA supports applying the provisions of the proposed standard to any facility (batch or continuous) where the threshold quantities are exceeded.

OSHA agrees that the key question for coverage is whether the highly hazardous chemical is present in an amount at or above the threshold. However, OSHA acknowledges the concern of SOCMA regarding the potential difficulty of conducting a separate process hazard analysis for each variation of a batch process. OSHA has accepted SOCMA's suggestion concerning the development of a generic process hazard analysis which is representative of similar batches. Accordingly, OSHA has included information in appendix C on conducting process hazards analyses for batch operations.

Some participants felt that their use of a particular highly hazardous chemical should not be covered in the process safety management standard since they observed that their type of process had not been included in the events described in the proposal; they did not feel their processes could create a catastrophic event; and that the broad definition of process used by OSHA captured industries which did not really process chemicals in the same manner chemical plants and refineries do. These participants address, for example, ammonia refrigeration (Ex. 3: 162, 168); steelmaking (Ex. 3: 161, 172); research and development facilities including pilot plants (Ex. 3: 56, 69; Tr. 662); bulk liquid terminals (Ex. 3: 8, 11, 16A, 37); and chlorination facilities (Ex. 90).

First, the catastrophic events described in the notice of proposed rulemaking were simply examples of what could happen upon the release of a highly hazardous chemical and in no way reflect all incidents which have occurred or which have the potential to occur. The National Wildlife Federation (Ex. 3: 86, p.3) observed:

The Acute Hazardous Events (AHE) Database, put together by EPA, catalogued 11,048 events spanning 8 years. In other words, this partial listing of the chemical incidents in the U.S. provides a record of nearly 4 accidents every day.

Second, OSHA has developed what it considers to be a reasonable and appropriate coverage of processes involving highly hazardous chemicals and further believes that those chemicals in their threshold amounts have the potential for a catastrophic release. OSHA believes its listing of highly hazardous chemicals fully meets the intent of the Clean Air Act Amendments (CAAA) which require OSHA to promulgate "a chemical process safety standard designed to protect employees from hazards associated with accidental release of highly hazardous chemicals in the workplace" and which require the standard include a "list of highly hazardous chemicals which includes toxic, flammable, highly reactive and explosives substances."

Third, as the Chemical Manufacturers Association succinctly observed, and with which OSHA concurs, the key question should be whether the highly hazardous chemical is present at or above the threshold quantity. Further, the United Steelworkers of America (Ex. 118, p.4) stated:

In the opinion of the USWA, there is no need to write a specific exemption for any industry. Section (b)(1) already limits the standard to those processes which involve a

highly hazardous chemical in sufficient quantities to cause a major accident. If a particular plant does not contain such a process, it will not be covered. If it does contain a hazardous process, it should be covered. There is no legitimate need for any further exemption \* \* \*

OSHA agrees with this rationale.

Finally, many participants (e.g., Ex. 3: 39, 41, 51, 69, 96, 106, 150, 173; Ex. 91; Ex. 93; Ex. 127; Tr. 1532, 1818, 2579) addressed their belief that gas processing should be excluded from the coverage of the process safety management standard. For example, the Gas Processors Association (Ex. 3: 28A, 1-3) stated:

75% \* \* \* of GPA member companies are small-to-medium sized independent, non-integrated producers and processors of natural gas \* \* \* GPA suggests that a policy similar to those found in certain plans developed for other government agencies could be utilized. In this approach small, remote, low risk facilities which qualify should be part of a two-tier concept in which the operator would develop and have available locally a plan describing efforts toward process safety management in lieu of full process hazard management. In the event of a major release or failure to maintain pre-defined accident experience standards, the local plan would be submitted automatically to OSHA for review and action. OSHA could require revision of the plan or mandate full compliance with Part 1910.119.

The American Gas Association (Ex. 3: 51, p.2) observed:

OSHA's broad proposal could apply to natural gas and liquefied natural gas (LNG) facilities used in the distribution, transmission and storage of gas, except for those facilities that are "unmanned remote facilities."

AGA further observed (p.3) that the standard is overly broad and that it is inappropriate because OSHA is preempted and there are major differences in processes and risk of chemical explosions or accidents at natural gas and LNG facilities as compared with chemical plants and refineries.

The American Petroleum Institute (API, Ex. 3: 106A, p.2) remarked:

API is concerned that OSHA's proposal to include all flammable liquids and gases \* \* \* will result in the application \* \* \* to an enormous number of relatively low hazard facilities, such as natural gas handling facilities, diluting industry's overall ability to comply with this important rule.

API urges OSHA to exclude certain natural gas handling facilities \* \* \* Our rationale is as follows:

High methane natural gas has a density less than that of air, which aids in dispersion \* \* \* has low reactivity and low burning speed \* \* \* flame speeds in natural gas



clouds are far below those that would produce dangerous overpressure.

Confinement, such as in enclosed compressor buildings, can increase the risk of localized damage; however, flame speeds decelerate very rapidly beyond the boundaries of the confinement, and overpressure decreases markedly, even if well mixed vapor clouds exist outside. Natural gas is flammable, of course, and does present a heat radiation hazard when burning. However, the lack of open air overpressures limit the extent of potential injuries.

At the Washington, DC, hearing an OSHA panel member inquired of a representative of API (Tr. 1885):

OSHA Panel Member: \* \* \* you're talking about some exemptions for gas processing plants, basically those that are dealing mainly with methane \* \* \* could you expand as to what type of radiation hazard we're talking about in a typical situation? Is the danger area 100 meters, 10 meters, 1,000 meters \* \* \*

API Representative Response: That depends purely on the size of the cloud and for how long it burns. If we're talking about an unplanned release that burns in a matter of seconds, then we're talking about, at most, a very few thousand BTUs that would—per square foot—that would be felt over a distance of only a few hundred feet, and probably less than 100 yards from outside the burn cloud. Now of course, if people were inside the burn cloud, that's an entirely different matter. They would probably be killed by the cloud or by inhaling the combustion gases.

OSHA disagrees with commenters that gas processing should be excluded from coverage. While OSHA is very concerned with explosions, OSHA is also concerned with fires resulting from releases of highly hazardous chemicals (55 FR at 29150) which as indicated above can occur and clearly endanger employees in the area. Therefore, OSHA believes that gas plants are appropriately covered by the process safety management standard.

#### Definitions: Paragraph (b)

Paragraph (b) contains the definitions of terms as they are used in the final rule. The proposed standard contained definitions for the following terms: Facility, highly hazardous chemicals, hot work, normally unmanned remote facility, process, and substance hazard index (SHI).

The final standard contains definitions for the following terms: Atmospheric tank, boiling point, catastrophic release, facility, highly hazardous chemical, hot work, normally unoccupied remote facility, process, replacement in kind, and trade secret. OSHA has added definitions for "atmospheric tank" and "boiling point" which are already in use in the

§ 1910.106 standard for flammable and combustible liquids in order to clarify the exemption from coverage for flammable liquids stored in atmospheric tanks or transferred which are kept below their normal boiling point without benefit of chilling or refrigeration.

A definition for catastrophic release was also added. The Organization Resources Counselors (Ex. 3: 53, p.3) advocated:

OSHA should add a definition for "catastrophic release" to make it clear that this standard is directed to major accidents which, as stated in the preamble, "have the potential of not only placing employees in grave and imminent danger but also could endanger employees throughout the workplace and even the general public." ORC recommends that the definition read as follows:

"Catastrophic release" means a major uncontrolled emission, fire, or explosion, involving one or more highly hazardous chemicals, that presents serious danger to employees or other persons both within and outside of the immediate workplace.

Other commenters supported the addition of a similar definition (Ex. 3: 12, 17, 48, 64, 71, 97, 101).

OSHA agrees that a definition for catastrophic release will provide for better consistency in the final standard. In the proposed standard OSHA used "catastrophic release" in paragraph (a), purpose, but in paragraph (m), incident investigation, OSHA used the term "major accident." Accordingly, OSHA has defined "catastrophic release" as recommended by ORC, leaving out any reference to "outside the immediate workplace" since OSHA only has jurisdiction to assure workplace safety. Consequently OSHA has changed "major accident" to "catastrophic release" in paragraph (m), incident investigation.

Some participants recommended defining "major accident" to mean any event involving fire, explosion, or release of a substance covered by this section which results in a fatality or five or more hospitalizations for medical treatment (Ex. 3: 106A). OSHA believes that the ORC definition for "catastrophic release" better reflects the intent of the Clean Air Act Amendments which require OSHA to develop a standard to prevent accidental release of chemicals which could pose a threat to employees and that, a definition of "major accident" is not needed.

Few participants raised significant issues concerning the definitions for facility, highly hazardous chemical and hot work. Therefore, these definitions remain the same as proposed.

As noted, OSHA excluded from coverage normally unmanned remote

facilities for the reasons discussed above in the application section. OSHA defined "normally unmanned remote facility" in the proposal (proposed paragraph (b)(2)(iii)) as:

*Normally unmanned remote facility* means a facility which is operated, maintained and serviced by employees who visit the unmanned facility only periodically to check the operation and perform necessary operating or maintenance tasks. No employees are permanently assigned. Facilities meeting this definition must be remote from other facilities.

The American Petroleum Institute (API, Ex. 3: 106) suggested that OSHA recognize that unmanned facilities may exist in remote areas away from the general public locations which possess little potential for a catastrophic event. API as well as other participants (e.g., Ex. 3: 26, 32, 69, 80, 82, 106, 108, 119, 120, 129; Tr. 1540, 3127) recommended retention of this exemption with certain modifications including a redefinition to include 10 or fewer persons potentially affected. API (Ex. 3: 106A, p.3-4) stated:

OSHA recognizes that "unmanned" facilities may exist in remote, away-from-the-general-public locations which possess little potential for catastrophic event. API agrees that it is appropriate to exclude such facilities from this rule in order to allow industry to address more significant facilities with the limited resources available.

API urges OSHA to retain this important exemption and clarify its application by defining the term "normally unmanned" to mean "facilities where the number of persons potentially affected by a major accident is 10 or less". This approach is similar to that taken by the Department of Transportation.

In addition, API suggests that a definition for "remote facility", similar to that published by API in Publication 2510A, "Fire-Protection Considerations for the Design and Operation of Liquefied Petroleum Gas (LPG) Storage Facilities," April 1989, page 4, would be useful and should be included in the rule. The definition in Publication 2510A states: "Remote facility means a facility that is 4000 feet or more from populated or industrial areas involving 10 or more persons."

API emphasizes that its purpose in urging these revisions is not to detract from the need to safely operate remote facilities; rather, it is to support the need to prioritize the allocation of limited resources, within OSHA and industry, for the implementation of the proposed rule.

OSHA's rationale for the exclusion of normally unmanned remote facilities from coverage was that these facilities did not have any employees present on a regular basis, i.e., a daily shift. Rather, employees only periodically visited the facility to check the operation and perform maintenance. OSHA believed that the likelihood of an uncontrolled release injuring or killing employees



was effectively reduced by the isolation of the process from employees. The reasons for the exclusion do not allow, nor does OSHA agree with, a redefinition of normally unmanned remote facility to a facility where the number of persons affected by a major accident is 10 or less.

Other participants supported the definition of normally unmanned remote facility but suggested that OSHA clarify the idea that the facility must be remote from other facilities (e.g., Ex. 3: 17, 25, 39, 48, 53, 64, 121). The Organization Resources Counselors (Ex. 3: 53, p. 5) noted:

It is important to emphasize that a "normally unmanned remote facility" is not meant to apply to an area that is located in a distant corner of a large facility. Rather, it is meant to apply to facilities that are so far removed from any other facility that they could not contribute to a catastrophic release, fire or explosion as defined by this standard.

Additionally some participants recommended that OSHA modify the language regarding the status of employees who visit the facility periodically (e.g., Ex. 3: 30, 59, 62). They observed that OSHA used the description in the definition "no employees are permanently assigned." Participants pointed out that an employee who visits such facilities periodically may in fact be assigned to the facility. The Chemical Manufacturers Association (Ex. 48, p. 8) suggested that OSHA define normally unmanned in the following manner:

"Normally unmanned remote facility" means a facility which is operated, maintained and serviced by employees based at a different location and who visit the remote facility to perform periodic tasks. Remote facilities are not within the boundaries nor are they contiguous to other operations of the employer.

OSHA agrees with these recommendations and has revised the definition to clarify that the facility must be "remote" and has changed the word "unmanned" to "unoccupied" to better reflect the Agency's intent. Accordingly this definition has been revised to read:

Normally unoccupied remote facility means a facility which is operated, maintained or serviced by employees who visit the facility only periodically to check its operation and to perform necessary operating or maintenance tasks. No employees are permanently stationed at the facility. Facilities meeting this definition are not contiguous with, and must be geographically remote from all other buildings, processes, or persons.

The definition of "process" remains essentially the same as proposed except for certain changes made to eliminate unnecessary words, and a modification

and addition of language to clarify the intent of the definition. OSHA has eliminated the words "conducted by an employer." These words serve no purpose because OSHA is only addressing processes conducted by an employer.

The term "process" when used in conjunction with the application statement of the standard establishes the intent of the standard. The intent of the standard is to cover a "process" where the use, storage, manufacturing, handling or the on-site movement of a highly hazardous chemical exceeds the threshold quantity at any time. The boundaries of a "process" would extend to quantities in storage, use, manufacturing, handling or on-site movement which are interconnected and would include separate vessels located such that there is a reasonable probability that an event such as an explosion would affect interconnected and nearby unconnected vessels which contain quantities of the chemical that when added together would exceed the threshold quantity and provide a potential for a catastrophic release. In order to clarify this intent, a new sentence has been added to clarify the fact that interconnected and nearby vessels containing a highly hazardous chemical would be considered part of a single process and the quantities of the chemical would be aggregated to determine if the threshold quantity of the chemical is exceeded. The new sentence reads as follows: "For purposes of this definition, any group of vessels which are interconnected and separate vessels which are located such that a highly hazardous chemical could be involved in a potential release shall be considered a single process." Vessels located at more remote distances must be evaluated by the employer to determine if they would interact during an incident, and if such a reasonable condition exists these vessels would be included in the process. Where a dike is used around a liquid storage vessel to fully contain released material and prevent it from interacting with another vessel outside the dike, and neither vessel by itself contains the threshold quantity, then this physical barrier would be considered acceptable in making the two vessels remote from each other.

Additionally, some unnecessary words have been eliminated and the use of the word "movement" used in the proposal has been changed to "on-site movement" to clarify that transportation falling under DOT jurisdiction is not covered.

OSHA believes that its definition of process reflects the intent of the CAAA

which requires that the standard be designed to protect employees from hazards associated with accidental releases of highly hazardous chemicals in the workplace.

Based on comments, OSHA has decided to add a definition for "replacement in kind" to clarify the types of changes which are not intended to be included in paragraph (1), management of change. The final definition states that "replacement in kind" means a replacement which satisfies design specifications.

Numerous participants expressed concerns (Ex. 3: 46, 48, 71, 76, 80, 81, 89, 97, 106, 112, 129; Ex. 162; Ex. 171; Tr. 1011, 1823, 2178) regarding trade secrets. For example, the Chemical Manufacturers Association (CMA, Ex. 3: 48, p. 2) remarked:

CMA also recommends that OSHA adopt the definition for "trade secret" as found within the Hazard Communication Standard (HCS) \* \* \* The final standard should also incorporate appendix D from the HCS.

In its post-hearing comment, CMA (Ex. 128, p. 18) expressed its concern again that:

The issue of trade secret protection has not been addressed within the proposed standard. Trade secret information may be included within a number of documents created as a part of implementing the proposed PSM standard. Unless trade secrets are protected, items which include trade secret information collected by OSHA as a result of an inspection could be made public. This situation could result in damage to an employer's competitive position. CMA previously provided curative language and strongly suggests that OSHA consider using it in the final standard.

OSHA has decided to include the definition for trade secret from § 1910.1200, Hazard Communication, and has included provisions in a new paragraph. These trade secret provisions will be discussed below.

#### *Employee Participation: Paragraph (c)*

In the proposed standard, OSHA required that a team be used to conduct a process hazard analysis (proposed paragraph (e)(3)). The proposal required that the team have expertise in engineering and process operations, and the team was required to have at least one employee who had experience and knowledge specific to the process being evaluated. In Issue 5 of the proposal (55 FR at 29158), OSHA asked whether it should require an employee representative on the process hazard analysis team, as well as on the incident investigation team required for incident investigations (proposed paragraph (m)). It had been proposed that an incident



investigation team consist of persons knowledgeable in the process. OSHA asked if the presence of an employee representative on the teams would assist in developing a cooperative participatory environment and the necessary flow of information from management to employees and from employees to management.

Several rulemaking participants supported the concept of having an employee representative on both the process hazard analysis team and the incident investigation team (Ex. 3: 20, 25, 47, 115; Tr. 2086, 2235, 2345). However, numerous participants objected to OSHA mandating the inclusion of an employee representative on the teams required by the standard and most stressed that team members should be chosen on the basis of their expertise and not on union membership (e.g., Ex. 3: 9, 21, 26, 28, 29, 30, 32, 41, 45, 59, 62, 69, 70, 76, 77, 80, 103, 106, 109, 112, 120, 123, 127, 129, 141, 155; Tr. 670, 740, 763, 1012, 1813, 2061, 2157, 2573-4, 3238, 3351, 3411).

The issue of employee participation in process safety management received even greater attention after the Clean Air Act Amendments (CAAA) were signed. The CAAA contains a requirement in section 304(c)(3) that the employer "consult with employees and their representatives on the development and conduct of hazard assessments and the development of chemical accident prevention plans and provide access to these and other records required under the standard."

Participants focused on what they believed was the intent of the CAAA and its language and suggested the manner in which the intent should be included in the final standard. Representatives from the United Steelworkers of America observed:

(Tr. 2235) The Clean Air Act Amendments make it clear that workers and their representatives—it is in the law—are to have an important role in process safety management.

(Tr. 2258) I want to clarify that the word participation and consultation means only that. They do not imply the power to veto or to change the programs required under this proposed standard \* \* \*

(Tr. 2356) Consult to us means—or should mean that we are part of the process, that we have a voice in discussing the kind of information that is developed in writing and reviewing those reports. You know, it doesn't mean that we get to write the report to the exclusion of management, but it means that we ought to be part of the team.

Other participants suggested that the language in the CAAA be incorporated as a separate paragraph in the OSHA final standard and asserted that the language did not mandate an employee

representative on the team conducting process hazards analyses or incident investigations.

A participant from Exxon U.S.A. (Tr. 3314) stated:

We conclude that the "consult with employees" provision in the Clean Air Act Amendments does not require that employees or their representatives be PHA [process hazard analysis] team members.

The requirement calls for the employer to exchange views on a process hazard analysis with employees and their representatives before a PHA is started.

Review of the wording in the clean Air Act would appear to call for a more structured exchange of views with wage personnel before starting a PHA.

Designated union representatives, such as union members on a plant safety committee, could be included in pre- and post-PHA discussions with wage employees.

A representative from the National Petroleum Refiners Association (Tr. 3372-74) testified:

As you are well aware, the operative wording from the Clean Air Act Amendment is consult with employees and their representatives on the development and conduct of hazard assessments and the development of chemical accident prevention plans, and provide access to these and other records required under the standard.

Now that is the law of the land, and we are clearly going to have to do that.

In Shell Oil Company, we think we know how to do that. We have consulted—we have well established procedures in place for consulting with our unions \* \* \*

We don't—speaking for Shell Oil Company, we don't believe that we need additional OSHA words—pages of regulations to help us interpret what consult with employee representatives means \* \* \*

Now, what is our position on involvement on teams? First, we support the involvement of workers on teams. We feel that the worker, the operator, the maintenance person, the foreman also can contribute significantly to the value of a PHA team.

But what they bring to that team is their knowledge of the unit in question, their knowledge of the operating practices, their knowledge of the maintenance practices in that particular unit, and those are the attributes they bring to that team and the participant workers should be selected on the basis of bringing those skills to the team rather than filling a role.

After a thorough analysis of the CAAA and the rulemaking record on this issue, OSHA has concluded that it is important for one member of each team be an employee who is knowledgeable about the process. This employee may very well be an employee representative; or, an employee representative may be participating on a team because of some expertise that the individual can contribute to the team. However, OSHA does not believe it necessary or appropriate to mandate

team membership on the basis of organization affiliation (i.e., union membership), nor does the Agency believe that this was the intent of the CAAA.

OSHA believes that the intent of the CAAA demands a broader approach to employee participation. A participant from the United Steelworkers of America (Tr. 2257) asserted:

Workers and their representatives should have the right to participate in the development of hazard analysis, incident investigations and all safety audits. They should be consulted with respect to training, maintenance and emergency response programs.

OSHA agrees with this participant. This confirms OSHA's belief that a broader participation was envisioned by the CAAA. OSHA believes that employers must consult with employees and their representatives on the development and conduct of hazard assessments (OSHA's process hazard analyses) and consult with employees on the development of chemical accident prevention plans (the balance of the OSHA required elements in the process safety management standard). And, as prescribed by the CAAA, OSHA is requiring that all process hazard analyses and all other information required to be developed by this standard be available to employees and their representatives.

Therefore, as suggested by several rulemaking participants, OSHA has added language contained in the CAAA to the final rule in a new provision, paragraph (c). OSHA believes that this new provision, which requires broad and active employee participation in all elements of the process safety management program through consultation will enhance the overall program. OSHA also believes that the CAAA requirements demand that an employer carefully consider and structure the plant's approach to employee involvement in the process safety management program. Consequently, OSHA believes that it must require the employer to address this issue to ensure that the employer actively considers the appropriate method of employee participation in the implementation of the process safety management program at the workplace. Thus, OSHA has included a specific requirement that an employer develop a plan of action on how the employer is going to implement the employee participation requirements.

The new paragraph which has been added to the final process safety management rule, paragraph (c), reads as follows:



**Employee participation.** Employers shall develop a written plan of action regarding the implementation of the employee participation required by this paragraph.

Employers shall consult with employees and their representatives on the conduct and development of process hazard analyses and on the development of the other elements of process safety management in this standard.

Employers shall provide to employees and their representatives access to process hazard analyses and to all other information required to be developed under this standard.

**Process Safety Information: Paragraph (d)**

Paragraph (d) addresses process safety information. OSHA proposed that the employer develop and maintain certain important information about a covered process such as information about the hazards and characteristics of the chemicals used, information about the process technology and how it works and information about the process equipment. This process safety information was to be communicated to employees involved in operating the process.

The compilation of information concerning process chemicals, technology and equipment provides the foundation for identifying and understanding the hazards involved in a process and is necessary in the development of a complete and thorough process hazard analysis, as well as other provisions in the final rule including management of change, operating procedures, and incident investigations, etc.

A number of participants had recommendations to clarify the process safety information provisions. OSHA has made changes to this paragraph based on these recommendations, where such suggestions did not change the intent of the provisions.

OSHA has decided to allow the compilation of process safety information to occur on a schedule consistent with the schedule for conducting process hazard analyses as described in final paragraph (e)(1). It is necessary to assemble the process safety information specified in the final rule in order to conduct an adequate process hazard analysis. Therefore it is reasonable to allow the collection and compilation of process safety information on a given process to be completed before a process hazard analysis on that process is begun, instead of requiring the compilation of all process safety information on all processes to be completed before any process hazard analyses are begun.

Many participants objected to the requirement that the process safety information must be communicated to

employees (e.g., Ex. 3: 17, 26, 33, 41, 48, 53, 103, 106, 109, 112, 119, 158).

Participants noted that a lot of the process safety information was highly detailed and expressed their doubts concerning the usefulness of communicating such detail to employees. They believed that such information should be made available to employees rather than communicated to them. Paragraph (c) of the final rule, employee participation, requires that employees and their representatives must have access to process hazard analysis reports and to all other information required to be developed under this standard. The recommended change to make the information available is unnecessary in view of this requirement. Also, OSHA believes that process safety information pertinent to the employees job tasks is required to be communicated to employees by the final standard: To operating employees in paragraph (g); to contract employees in paragraph (h); and to maintenance employees in paragraph (j). Therefore the requirement contained in paragraph (d) to communicate the process safety information to employees has been deleted since it is provided for by other provisions of the final standard, such as employee participation, contractors, and training.

The process safety information required by paragraph (d)(1) pertains to the hazards of the highly hazardous chemicals in the process. OSHA proposed that the information include: toxicity information; permissible exposure limits; physical data; reactivity data, corrosivity data; thermal and chemical stability data; and the hazardous effects of inadvertent mixing of different materials that could foreseeably occur. Most of the information may already be available from the material safety data sheet (MSDS). MSDSs would be acceptable in meeting this requirement to the extent that the required information is available on the MSDS. The information required to be collected on the hazards of the chemicals is unchanged from the proposal.

In paragraph (d)(2) OSHA proposed that the employer develop and maintain information pertaining to the technology of the process itself. Paragraph (d)(2)(i) specified the required information and included the following: a block flow diagram or simplified process flow diagram; process chemistry; maximum intended inventory; safe upper and lower limits for such factors as temperatures, pressures, flows or compositions; and the consequences of any deviation in the process including those affecting the safety and health of

employees. The final requirements remain virtually the same as those proposed except for a few minor editorial changes.

OSHA indicated in proposed paragraph (d)(2)(ii) that it might be difficult to obtain technical information for older existing processes. Therefore, it proposed to allow employers to develop such material from a hazard analysis conducted in accordance with paragraph (e) for processes initiated before January 1, 1980. OSHA believed that a properly conducted process hazards analysis should systematically identify technical information regarding the process and allow for adequate estimation of safe parameters for the process.

OSHA has reconsidered this paragraph and has decided that the best technical information available is the original information. Rather than include an arbitrary date, OSHA has decided to allow an alternate method of obtaining the technical information only for those processes where such information does not exist. In reviewing the record OSHA concluded that the American Petroleum Institute's RP 750 had acceptable language which met the intent of the Agency. Accordingly, OSHA has changed the final paragraph, (d)(2)(ii), to read as follows:

Where the original technical information no longer exists, such information may be developed in conjunction with the process hazard analysis in sufficient detail to support the analysis.

The final type of information that the proposal required to be collected ((d)(3)) pertains to the equipment in the process. Since the equipment used in a process can have a significant adverse impact on the facility and employee safety, OSHA wanted to assure that the equipment is appropriate for the operation and that it meets appropriate standards and codes such as those published by the American Society of Mechanical Engineers, the American Petroleum Institute, etc.

In paragraph (d)(3)(i) OSHA proposed that information be compiled concerning equipment used in the process including: materials of construction; piping and instrument diagrams (P&IDs); electrical classification; relief system design and design basis; ventilation system design; design codes employed; material and energy balances for processes built after the effective date of this standard; and safety systems (such as interlocks, detection, monitoring and suppression systems). Again, this paragraph remains virtually unchanged except for minor editorial changes.



In paragraph (d)(3)(ii) OSHA proposed that the employer document that the process equipment being used complies with applicable consensus codes and standards, where they exist; or be consistent with recognized and generally accepted engineering practices. OSHA has modified this paragraph by eliminating the list of codes and standards producing organizations. The discussion in paragraph (j), mechanical integrity, discusses the reasons for this change.

Paragraph (d)(3)(iii) required that when existing equipment was designed and constructed in accordance with codes, standards, or practices that are no longer in general use, the employer must ascertain that the equipment is designed, installed, maintained, inspected, tested and operated in such a way that safe operation is assured.

There are many instances where process equipment has been in use for many years. Sometimes the codes and standards to which the equipment was initially designed and constructed are no longer in general use. For this type of situation, OSHA wants to ensure that the older equipment still functions safely, and is still appropriate for its intended use. OSHA is not specifying the method for this documentation. Under this approach the employer would be permitted to use any of several methods such as: documenting successful prior operation procedures; documenting that the equipment is consistent with the latest editions of codes and standards; or performing an engineering analysis to determine that the equipment is appropriate for its intended use. This paragraph remains the same as that which was proposed except the final rule requires the employer to determine and document that the equipment is "designed, maintained \* \* \* and operating in a safe manner rather than "operating in such a way that safe operation is assured," as was proposed.

OSHA believes that the final provisions concerning process safety information meet the requirements in section 304(c)(1) of the CAAA. In this section OSHA must require employers to:

(1) Develop and maintain written safety information identifying workplace chemical and process hazards, equipment used in the processes, and technology used in the processes.

*Process Hazard Analysis: Paragraph (e)*

The vast majority of commenters addressed proposed paragraph (e) concerning process hazards analysis, often referred to as "hazard evaluation" (e.g., Ex. 3: 20, 21, 25, 26, 27-29, 33-35, 39,

41, 43-45, 59, 64, 69, 70, 76, 77, 79, 80, 83, 89, 96, 109, 112, 115, 119, 120, 122, 123, 126, 129, 138, 141, 149, 152, 155, 156, Ex. 91; Ex. 127; Ex. 141; Ex. 148; Tr. 671, 735, 968, 1018, 1114, 1206, 1922, 2059, 2156, 2174, 2572, 2650, 2689, 2773, 3136, 3259, 3348, 3683). These commenters were generally supportive of the provisions regarding process hazards analyses recognizing that the process hazard analysis is a key component of a process safety management system because it is a thorough, orderly, systematic approach for identifying, evaluating and controlling processes involving highly hazardous chemicals. However, participants recommended certain modifications to the process hazard analysis provisions. Participants also addressed several issues OSHA raised in the notice of proposed rulemaking (Issues 3, 4 and 5; 55 FR at 29158) concerning process hazard analysis timeframes, acceptable methodologies and process hazard analysis team membership.

In paragraph (e)(1) OSHA proposed to require employers to conduct an initial process hazard analysis on facilities covered by the standard in order to identify, evaluate and control the hazards of the process. By properly performing a hazard analysis, the employer can determine where problems may occur, take corrective measures to improve the safety of the process and preplan the actions that would be necessary if there were a failure of safety controls or other failures in the process. Paragraph (e)(1) required the employer to conduct the process hazard analyses using one of the methodologies listed.

Paragraph (e)(1) of the final standard reflects several changes from the proposal. The final standard still requires employers to conduct a process hazard analysis to identify, evaluate and control the hazards in a process. The provision addressing methodologies has been moved to paragraph (e)(2).

Also in paragraph (e)(1) is a new requirement that an employer select a process hazard analysis method which is appropriate to the complexity of the process being analyzed. This requirement was implicit in the proposal. The new language simply states OSHA's concern that an employer not choose an inappropriate process hazard analysis methodology.

OSHA anticipates that employers will be able to readily explain their plans for completing process hazard analyses and their reasoning for prioritizing which processes will be addressed first. Therefore OSHA is requiring that employers determine and document the priority order for conducting process

hazard analyses based on such considerations as the extent of the process hazards, number of potentially affected employees, age of the process, and operating history of the process. This requirement is written flexibly in recognition of the fact that different processes will require different considerations for prioritization.

A phase-in period for process hazard analyses may be necessary, particularly, for facilities with multiple covered processes. However OSHA believes that plants with a limited number of processes, with simple processes, or which have already completed a number of process hazard analyses, should complete process hazard analyses as soon as possible. Therefore, the final standard language indicates that process hazard analyses must be conducted as soon as possible.

In Issue 3 of the preamble to the proposal (55 FR at 29154) OSHA noted that no time period was specified in which to complete initial process hazard analyses. It had been suggested to OSHA that a 1-, 2-, 3-, or 5-year delay be allowed for employers to complete initial process hazard analyses. These extended compliance scenarios were based on the perception that there were not enough technical experts who had the experience to carry out the analyses required by the proposal. The issue was discussed extensively in the rulemaking.

A significant majority of participants discussed the timeframes they believed would be necessary to complete initial process hazard analyses. Recommended timeframes ranged from immediately to as many as ten years. The majority of commenters supported either a 5-year timeframe (e.g., Ex. 3: 21, 16, 33, 41, 43, 44, 48, 59, 64, 70, 76, 80, 77, 96, 109, 112, 122, 123, 129, 134, 138, 141, 149, 155, Ex. 127; Tr. 1018, 1114, 1206, 1922, 2059, 2156, 2689) or a 7-year timeframe (e.g., Ex. 3: 27, 28, 29, 39, 45, 69, 77, 106, 120; Ex. 91, Ex. 148; Tr. 671, 735, 968, 2174, 2572, 2478, 2594, 2650, 2773, 3136, 3259, 3348, 3683) in which initial process hazard analyses could be completed on covered processes. These suggested timeframes were based on similar reasons. For example, the National Cooperative Refinery Association (NCRA, Ex. 3: 21) stated:

NCRA, like most independent refineries, does not have sufficient staff to complete a project of this magnitude without extensive use of contract consultants \* \* \* Preliminary information indicates that it will be very difficult, if not impossible, for us to complete the analysis of all of the process units in the refinery in less than five years.

The American Petroleum Institute (API, Ex. 3: 106A, p. 7) noted:



API shares OSHA's concern that compliance with this rule could overwhelm existing resources unless an adequate implementation period is allowed. Further, API believes that experienced personnel needed to lead and participate in the process hazard analysis studies are not available in numbers sufficient to comply with the rule in fewer than seven years.

Marathon Oil Company (Ex. 3: 108) observed:

To start off, Marathon supports process safety management. Since the American Petroleum Institute published API Recommended Practice 750, "Management of Process Hazards" in January 1990, we have started implementing RP-750. This is a major, resource-intensive effort that we accepted voluntarily and estimate that it will require at least five years for implementation.

Phillips Petroleum (Ex. 3: 129, p. 3) indicated:

Completion of initial PHA should be within five years of the effective date. We feel this timeframe is needed to achieve quality results with the limited resources available, and the amount of complexity of the information to be handled.

Sun Refining and Marketing Company (Ex. 3: 155, p. 1-2) remarked:

Sun recommends that OSHA require all of the initial process hazards analyses be completed within five years of the effective date. While Sun recognizes the magnitude of work which will be required to implement these regulations as well as the limited number of resources, we believe that industry should take an aggressive approach to implementing this portion of the regulations. With such an approach, Sun believes a five year implementation schedule can be achieved and will accomplish process safety in a reasonable and realistic time frame.

OSHA accepts participants remarks that resources may be stretched by the requirement to conduct process hazard analyses. Further, OSHA agrees with participants that a five-year period may be necessary to complete good quality process hazard analyses but remains unconvinced that a seven-year timeframe is necessary, especially in light of the concentrated efforts directed toward meeting API's RP 750 published in January 1990 and the Chemical Manufacturers Association process safety management initiatives already described. After considering the evidence in the record on this issue, the Agency finds that the 5-year phase-in period to complete process hazard analyses required by the standard is feasible.

In recognition that time will also be needed to compile the information required in paragraph (d), process safety information, which is needed to conduct a process hazard analysis, OSHA has adopted a schedule that requires at least 25% of the process hazard analyses to be

completed each year, starting with the second year after the effective date of the standard. These provisions become final paragraphs (e)(1)(i) through (e)(1)(iv).

Finally, OSHA has added a new paragraph (e)(1)(v) which grandfathers process hazard analyses completed 5 years before the effective date of the standard. These process hazard analyses must meet the requirements contained in paragraph (e) and will have to be updated and revalidated, based on their completion date, in accordance with the requirements in paragraph (e)(6). Many commenters addressed the grandfathering of these analyses and OSHA agrees that appropriate grandfathering should be allowed. It would not be reasonable to require that resources be expended to conduct another process hazard analyses when a recent one already exists since these same resources could be better used to conduct initial process hazard analyses on other processes.

OSHA proposed a performance oriented requirement with respect to the process hazard analysis so that an employer would have flexibility in choosing the type of analysis that would best address a particular process. Consequently in paragraph (e)(1) OSHA proposed that an employer use one or more of certain listed methodologies to perform a process hazard analysis. The methodologies included: what-if; checklist; what-if/checklist; failure mode and effects analysis; hazard and operability study; and fault free analysis. More detailed information concerning the methodologies was included in nonmandatory appendix D. In Issue 4 in the proposal (55 FR at 29158), OSHA asked whether OSHA should consider additional methodologies, such as those approved by the American Institute of Chemical Engineers. Additionally, OSHA asked if appendix D, which contained descriptions of the methodologies in the proposal, should be made mandatory in order to assure a degree of uniformity when employers apply methodologies.

A vast number of participants opposed restricting process hazard analyses methodologies (e.g., Ex. 3: 9, 12, 17, 20, 21, 25, 26, 27, 28, 29, 30, 33, 38, 39, 41, 45, 47, 48, 50, 59, 62, 64, 69, 70, 71, 72, 73, 79, 83, 88, 92, 96, 99, 101, 106, 108, 109, 113, 115, 119, 120, 121, 127, 134, 137, 138, 139, 146, 150; Ex. 91; Ex. 127; Tr. 670, 736, 970, 1020, 1115, 1290-1, 1617, 1927, 2004, 2060, 2114, 2176, 3411, 3507). For example, Johnson Wax (Ex. 3: 12, p.28) stated:

[T]he six methodologies are not the only ones in current use or under development.

For this reason, we do not believe OSHA should limit "process hazard analyses" techniques to these six. Instead, we would recommend that OSHA allow any recognized "equivalent" methodology also be allowed under this rule.

We would urge OSHA to explicitly state that other "process hazard analyses methodologies" would be acceptable if they can provide "equivalent" information to those listed. This will allow new methodologies to be used to "meet" this rule as they are developed. Otherwise the Agency will "freeze" process hazard analyses to current technologies.

Exxon Company, U.S.A. (EUSA, Ex. 3: 39, p.5), noted:

Restricting process hazard analysis (PHA) methodologies is a critical issue, and one of our most serious concerns.

EUSA is vigorously opposed to restricting PHA methodologies to the six currently listed in the proposed rule. This would indeed freeze technology in the new and rapidly evolving field of chemical process risk management, thereby excluding new and better methods which will most certainly be developed.

The American Paper Institute (Ex. 3: 45, p.15) commented:

OSHA's proposal to list "acceptable" process hazard analysis methodologies is unnecessarily narrow. The better approach would be to eliminate the list and make this a performance-oriented requirement. OSHA should simply mandate that the employer use an appropriate methodology for the process hazard analysis.

Realities of the workplace argue for maximum flexibility in this area. For example, the employer may need to modify one of the established methodologies. In some cases, the employer may need to develop a new approach because none of the existing methodologies is appropriate for the process to be evaluated. The precise methodology is unimportant so long as the method used addresses the elements specified in proposed section (e)(2).

If OSHA elects to publish a list of acceptable methodologies, the rule should stress that these are examples and that other \* \* \* methodologies may be used so long as they are appropriate \* \* \*.

OSHA agrees with these commenters regarding the use of the methodologies. While many of these commenters indicated that OSHA should require methodologies recognized by the American Institute of Chemical Engineers, OSHA has decided against doing so since it agrees with those participants who believed that any methodology should be allowed as long as it meets the specified criteria described in paragraph (e). Therefore OSHA has added an additional paragraph to its list of acceptable methodologies allowing employers to use other appropriate methodologies capable of adequately addressing and



analyzing the elements in paragraph (e)(3) of the final rule.

OSHA has decided not to retain the proposal's nonmandatory appendix D, Process Hazard Analysis Methodologies. Since OSHA is now allowing other appropriate methodologies, OSHA believes the appendix no longer serves the purpose for which it was intended. Further, OSHA believes that the proposal's nonmandatory appendix E, Sources of Further Information (which becomes final appendix D), provides more thorough information to employers seeking assistance in conducting process hazard analyses. This information appendix has been expanded to provide additional sources.

Comments were received directed toward clarifying OSHA's proposed paragraph (e)(2) concerning what a hazard analysis must address (final rule paragraph (e)(3)). The proposal required that the analysis address the hazards of the process; engineering and administrative controls applicable to the hazards and their interrelationships; the consequences of failure of these controls; and a consequence analysis of the effects of a release on all workplace employees.

Proposed paragraph (e)(2)(i) which required that employers address the hazards of the process remains the same as proposed. The paragraph becomes final paragraph (e)(3)(i).

Under the Clean Air Act Amendments, section 304(c)(2), OSHA must require employers to perform a workplace hazard assessment (OSHA's process hazard analysis), including, as appropriate, identification of potential sources of accidental release, an identification of any previous release within the facility which had a likely potential for catastrophic consequences in the workplace, estimation of workplace effects of a range of releases, and an estimation of the health and safety effects of such ranges on employees.

OSHA believes that the provisions contained in proposed paragraph (e)(2) concerning what a hazard analysis must address were responsive to the CAAA but did not require the identification of any previous incident which had a likely potential for catastrophic consequences. The inclusion of previous incidents will help to assure that the process hazard analysis adequately addresses a wide enough range of concerns. OSHA has included a requirement in the final rule for employers to identify any previous incident which had a likely potential of catastrophic consequences in the workplace. This provision is responsive

to the CAAA and it becomes final paragraph (e)(3)(ii).

In proposed paragraph (e)(2)(ii), OSHA proposed to require that the process hazard analysis address the engineering and administrative controls applicable to the hazard and their interrelationships. The American Petroleum Institute (API) recommended that additional language be added concerning the detection of and monitoring for releases. OSHA believes that such information is important for employers to consider and has decided to accept the API (Ex. 137) suggestion for the most part. The paragraph becomes final paragraph (e)(3)(iii) and requires that the process hazard analysis address:

Engineering and administrative controls applicable to the hazards and their interrelationships, such as the appropriate application of detection methodologies to provide early warning of releases. (Acceptable detection methods might include process monitoring and control instrumentation with alarms, and detection hardware such as hydrocarbon sensors).

It should be noted, however, that detection methodologies is being used only as an example and there may be many other interrelationships that must be covered to comply with this provision for a particular process.

In proposed paragraph (e)(2)(iii), OSHA required that the "consequences of failure of these controls" be addressed. OSHA has changed this paragraph to clarify what is meant by "these." The final paragraph now requires that the process hazard analysis address "consequence of failure of engineering and administrative controls." This change merely clarifies the fact that OSHA wants employers to examine the failure of engineering and administrative controls; it does not change the intent of the provision. This provision becomes final paragraph (e)(3)(iv).

In paragraph (e)(2)(iv) of the proposal OSHA required that employers address a failure of controls through "a consequence analysis of the effects on all workplace employees." Participants encouraged OSHA to rephrase the paragraph to better define its intent (e.g., Ex. 3: 26, 28, 45, 48, 69, 71, 77, 120; Tr. 1013, 1227-28, 1533, 1810, 2014). For example, Chevron Corporation (Ex. 3: 26A, p.5) stated:

The term "consequence analysis" can be interpreted to mean many different types of evaluations, including studies and documentation far beyond what Chevron believes OSHA intends and far beyond what would add value to a PHA study. Additionally, Mobil Research and

Development Corporation (Ex. 3: 69, p.3) noted:

[W]e are concerned that the term "consequence analysis" \* \* \* could be misinterpreted as requiring highly specialized modeling and risk assessment techniques such as Probabilistic Risk Assessment (PRA) that are not called for in paragraph (e)(1) PRA's, vapor cloud modeling and other quantitative hazard assessment techniques are difficult to apply as a basis for regulatory control. Judgements and assumptions made by the individuals performing the assessments are subjective and findings are difficult to validate and compare to other assessments. Moreover, no nationally accepted risk criteria for industrial processes have been established.

OSHA has modified the paragraph to indicate that it did not intend employers to conduct probabilistic risk assessments to satisfy the requirement to perform a consequence analysis. OSHA agrees with commenters that specialized techniques such as vapor cloud modeling would add an unnecessary burden with respect to assessing the effects of releases on employees. OSHA believes employers can establish a reasonable range of possible effects of releases on employees without conducting these specialized quantitative analyses. Further OSHA believes it has insufficient data in this rulemaking record on which to establish what would be a reasonable quantitative analysis. Therefore, this clarified paragraph becomes final paragraph (e)(3)(vii) and requires a qualitative evaluation of the possible safety and health effects of failure of engineering and administrative controls on employees in the workplace. This evaluation is for the purpose of guiding decisions and priorities in planning for prevention and control, mitigation and emergency response. OSHA believes this better reflects what it intended to accomplish by the proposal.

Additionally, OSHA has added two additional elements to final paragraph (e)(3). OSHA believes and participants suggested (Tr. 2609, 2705, 2781, 3542) that facility siting should always be considered during process hazard analyses. In order to assure that employers do consider siting, OSHA has decided to specifically emphasize it. Facility siting becomes final paragraph (e)(3)(v).

Finally, OSHA has added paragraph (e)(3)(vi) to the final rule which requires that employers address human factors in the process hazard analysis. In response to an OSHA concern expressed during the rulemaking regarding the consideration of human factors in process hazard analyses, the Chemical



Manufacturers Association (CMA, Ex. 3: 128, p.6) observed:

Human error is but one, albeit important, cause for chemical process accidents. A number of the provisions of the proposed PSM standard implicitly require companies to address the possibility of human error \* \* \* Some individuals have testified that OSHA has not provided for the consideration of human error in the proposed standard-CMA disagrees with this shortsighted conclusion. However, CMA further stated that if the Agency wished to highlight the importance of addressing human factors issues, OSHA should include a requirement. OSHA agrees and, as noted above, has added a provision to highlight this concern.

Proposed paragraph (e)(3) required employers to conduct a process hazard analysis using a team approach. OSHA believes that in order to conduct an effective, comprehensive process hazard analysis, it is imperative that the analysis be performed by competent persons, knowledgeable in engineering and process operations, and those persons be familiar with the process being evaluated. Some employers may have a staff with expertise to perform a process hazard analysis. This staff will already be familiar with the process being evaluated. However, some companies, particularly smaller ones, may not have the staff expertise to perform such an analysis. The employer, therefore, may need to hire an engineering or consulting company to perform the analysis. OSHA believes it is important to note that in all situations, the team performing the process hazard analysis must include at least one employee from the facility who is intimately familiar with the process.

OSHA also believes that a team approach is the best approach for performing a process hazard analysis. This is because no one person will possess all of the knowledge and experience necessary to perform an effective process hazard analysis. Additionally, when more than one person is performing the analysis, different disciplines, opinions, and perspectives will be represented and additional knowledge and expertise will be contributed to the analysis. In fact, some companies even include an individual on the team who does not have any prior experience with the particular process being analyzed to help insure that a fresh view of the process is integrated into the analysis. Additionally, as discussed in the rulemaking, employees and other experts may be brought onto the team on a temporary basis to contribute their specialized knowledge to the conduct of the process hazard analysis.

The proposed provision required that the process hazard analysis be performed by a team with members who are knowledgeable in engineering and process operations, and that the team have at least one employee who has experience and knowledge specific to the process being evaluated.

In Issue 5 of the proposal (55 FR at 29158), OSHA inquired whether an employee representative should be included on process hazard analysis teams and incident investigation teams to assist in developing a cooperative participatory environment and to assist in developing the necessary flow of information.

OSHA received significant comment on the issue of teams and their makeup (e.g., Ex. 3: 9, 12, 15, 17, 20, 21, 25, 26, 28, 30, 32, 38, 39, 41, 45, 48, 50, 53, 59, 62, 69, 70, 76, 80, 81, 82, 83, 95, 96, 103, 106, 108, 109, 112, 113, 119, 120, 123, 127, 129, 134, 138, 139, 141, 143, 150, 155, 156; Ex. 91; Ex. 101; Ex. 134; Ex. 138; Ex. 143; Tr. 741, 1595-96, 1813, 2007, 2061, 3238, 3351, 3411). A vast majority of these commenters generally supported a team approach to conducting process hazard analysis as well as the team membership as specified in the proposal. As discussed previously, a great number of participants objected to the inclusion of an employee representative (union representative) on these teams; and as already indicated, OSHA has decided not to specifically require an employee representative on the team. Instead, the Agency has chosen to include a separate paragraph (final paragraph (c)) addressing employee participation in the process safety management program, which would require employee participation in the process hazard analysis by requiring that employers consult with employees and their representatives on the conduct and development of process hazard analyses. (See previous discussion of employee participation, final paragraph (c).) However, OSHA continues to require that an employee who has experience and knowledge specific to the process being evaluated be included on the team.

Numerous commenters noted that the proposal omitted a crucial team member, a person knowledgeable in the process hazard analysis methodology being used to evaluate the process in question (e.g., Ex. 3: 9, 17, 48, 69, 83, 103, 109, 115, 120, 153; Ex. 101; Tr. 1021, 1291). OSHA agrees with these commenters and has added a requirement that one team member must be knowledgeable in the specific process hazard analysis methodology being used. This paragraph concerning process hazard analyses

teams becomes paragraph (e)(4) of the final rule.

In proposed paragraph (e)(4), the employer was required to address the findings and recommendations of the process hazard analysis team, to document actions taken, and communicate the actions taken to employees whose work assignments are in the facility affected by the recommendations or actions. The employer was also required to assure that recommendations were implemented in a timely manner. With these provisions, OSHA wanted to assure that the results of a process hazard analysis were fully utilized to improve process safety.

Many commenters objected to OSHA's requirement that the recommendations resulting from the process hazard analyses be implemented in total (e.g., Ex. 3: 26, 30, 38, 39, 45, 48, 50, 69, 70, 81, 101, 106, 108, 109, 115, 120, 121, 129, 153, 155; Ex. 95, 136, 138, 148; Tr. 670, 970, 1015, 1811, 1854, 1931, 2061, 2159, 2654, 3351, 3411, 3510). The Fertilizer Institute (Ex. 3: 109, p.7) remarked:

Paragraph (e)(4) should be modified so that employers are not required to implement every recommendation offered by a Process Hazard Analysis Team. It is critically important that a PHA Team have freedom to make broad recommendations, at risk of being wrong, since they will not have time to completely research each recommendation. Working with the Team, Management must retain the responsibility for deciding which recommendations should be implemented\* \* \*.

The Synthetic Organic and Chemical Manufacturers Association (SOCMA, Ex. 3: 50, p. 5-6) observed:

SOCMA also agrees with OSHA's requirement that employers establish a system to promptly address the team's findings. However, SOCMA does not agree that the recommendations of the team should be "implemented" because that implies that every recommendation developed by the process hazard analysis team must be acted on exactly as recommended. Many times, on further study, process hazard analysis team recommendations are resolved in more effective ways than those originally envisioned by the team. The employer should be given the option to implement solutions that are more effective than those recommended by the team.

OSHA agrees with these participants that a process hazard analysis team should be encouraged to make broad recommendations. It is also possible that not all team recommendations will be correct or will resolve the problem found in the best way. OSHA has accordingly restructured, changed and added language to the final paragraph to



reflect the concerns of many participants. In the final paragraph, the employer must assure that the recommendations resulting from the process hazard analyses are "resolved" in a timely manner and that the resolution is documented. In this way, when a team recommendation is incorrect, the employer can analyze it and then document in writing why the recommendation is not being adopted or is being adopted with modification.

In conjunction with this change OSHA believes that when an employer decides that a recommendation requires action, then an employer should develop a written schedule of the actions which are to be completed. It is OSHA's intention that the actions to be taken as a result of the process hazard analysis recommendations be completed as soon as possible. In most cases, OSHA believes that employers will be able to complete these actions within a one to two year timeframe, but notes that in unusual circumstances longer completion periods may be necessary. The final paragraph becomes paragraph (e)(5) and the above language has been incorporated into the final provision.

In the proposal, paragraph (e)(5), the process hazard analysis was to be updated and revalidated at least every five years, using the process hazard analysis team to assure that the process hazard analysis is consistent with the current process. The Agency believed that this five year update and revalidation interval was a reasonable timeframe, particularly in consideration of the long life span, without change, of many processes. OSHA also believed that there were adequate safeguards elsewhere in the proposal to protect employees when the process changed. (See for example, paragraph (d), process safety information and (l), management of change.)

In Issue 3 of the proposal (55 FR at 29158) OSHA invited comment on whether the five year update and revalidation cycle was appropriate. Many participants addressed this provision and most supported the 5-year update and revalidation provision (e.g., Ex. 3: 17, 26, 33, 41, 45, 48, 50, 59, 64, 69, 88, 95, 96, 101, 109, 119, 120; Tr. 740, 1114, 1598, 1809, 2157, 2774, 3349, 3411). For example, Pennzoil (Ex. 3: 41, p.11) noted:

Pennzoil fully supports updating and revalidating the PHA every five (5) years, provided that OSHA does not intend updating and revalidating to mean doing a completely new PHA. As we understand the proposed language, during a PHA review, our PHA team would evaluate the previous PHA, examine the extent of any changes that might have occurred since the PHA was implemented (or last reviewed) and decide

what work is needed to make the PHA current. Given our understanding of how these updates will work and our limited resources, we believe that this interval is very practical.

The American Paper Institute (Ex. 3: 45, p.14) indicated:

API [American Paper Institute] believes that OSHA's proposal to require process hazard analyses updates and revalidations every five years is an appropriate choice. Adequate safeguards exist in the proposed rule to address potential concerns that might arise between periodic updates and validations. Elsewhere, OSHA has proposed that facilities prepare for and deal with changes; compliance with the requirements governing changes will provide ample protection until completion of the next regularly scheduled process hazard analysis validation/update. By selecting the five-year interval, OSHA has avoided imposing an unnecessary burden on facilities.

The American Petroleum Institute (Ex. 3: 106A, p.12) stated:

OSHA's proposal to update and revalidate every PHA on a five year basis is acceptable, providing it is not intended to mean that a team must necessarily conduct a new and complete PHA. API understands the proposed language to mean that the PHA team could evaluate the previous PHA, examine the extent of change that had occurred in the interim and the procedures used for implementing change, and reach a conclusion regarding the scope and extent of the work necessary to update and revalidate the PHA. With this understanding, we support the five-year interval. The procedures required by paragraphs (1) Management of change and (i) Pre-startup safety reviews will ensure the interim integrity of process safety.

Texaco Inc. (Ex. 3: 120, p.6) observed:

Paragraph (1), Management of Change, outlines the items the employer must address prior to any change. This enables the employer to determine the scope and extent of the work necessary to update and revalidate the process hazard analyses. Consequently, Texaco believes the five (5) year update and revalidation requirement for process hazard analyses is appropriate.

OSHA agrees with these commenters and has retained the five year update and revalidation schedule. Finally, OSHA has decided to clarify that the update and revalidation should occur five years after the completion of the initial process hazard analysis. This paragraph has been redesignated as paragraph (e)(6).

In paragraph (e)(6), OSHA proposed that employers retain the two most recent process hazard analyses and/or updates for each process covered as well as the documented responses to the process hazard analysis recommendations. Few participants addressed this particular provision. OSHA has determined, based on the

discussions in the rulemaking, particularly those concerning the update and revalidation of process hazards analyses, that the proposed requirement to retain the two most recent process hazard analyses and/or updates for each process failed to recognize the full importance of documents developed relative to process hazard analyses. This requirement has been modified in the final rule. New paragraph (e)(7) requires that employers retain the process hazard analysis and their updates and revalidation. The Agency does not believe that this requirement will pose an undue burden on employers in that retention of these documents is necessary to conduct the periodic updates and revalidations which are required under the standard.

OSHA believes that the process hazard analysis provisions contained in the final standard meet the requirements contained in section 304(c) (2), (4), and (5) of the Clean Air Act Amendments. The requirements state that the OSHA standard must require employers to:

(2) Perform a workplace hazard assessment [OSHA's Process Hazard Analysis] including, as appropriate, identification of potential sources of accidental release, an identification of any previous release within the facility which had a likely potential for catastrophic consequences in the workplace, estimation of workplace effects of such range on employees.

(4) Establish a system to respond to the workplace hazard assessment findings, which shall address prevention, mitigation, and emergency responses.

(5) Periodically review the workplace hazard assessment and response system.

*Operating Procedures: Paragraph (f)*

Paragraph (f) of the proposal contained provisions requiring the development and implementation of written operating procedures. The procedures are to provide clear instructions for safely conducting activities involved in covered processes and they must be consistent with the process safety information. To have an effective process safety management program, OSHA believed that tasks and procedures directly and indirectly related to the covered process must be appropriate, clear, consistent, and most importantly, communicated to employees.

Many different tasks may be necessary during a process, such as initial startup, handling special hazards, normal operation, temporary operations and emergency shutdown. The appropriate and consistent manner in which the employer expects these tasks and procedures to be performed consistent with the facility's operating



procedures is sometimes referred to as standard operating procedures.

It is important to have written operating procedures so employees working on a process do a given task in the same manner. There is less likelihood that incidents will occur if written operating procedures are developed so even a new employee or one who is relatively inexperienced will respond to a given event in a preconsidered and prescribed manner. It is also important that the procedures be written so that they can be communicated to employees in the most effective manner possible. Such written procedures comprise the employer's policy with respect to what is to be accomplished, and how it is to be accomplished safely. This will ensure that employees will perform like tasks and procedures in a consistently safe manner, and employees will know what is expected of them. These procedures must also be available for ready reference and review during production to make sure the process is operated properly. Accordingly, OSHA proposed that the employer develop and implement written operating procedures that provide clear instructions for safely conducting all activities involved in each process.

In proposed paragraph (f)(1)(i), OSHA required that the operating procedures address steps for each operating phase, including initial startup, normal operation, temporary operations, emergency operations, normal shutdown, and startup following turnaround or emergency shutdown.

In proposed paragraph (f)(1)(ii) OSHA proposed that the operating procedures address the process operating limits, including the following: consequences of deviation; steps required to correct and/or avoid deviation; and safety systems (including detection and monitoring equipment) and their functions.

In paragraph (f)(1)(iii), OSHA proposed that the operating procedures address safety and health considerations regarding the process, including the following: properties of, and hazards presented, by the chemicals used; precautions necessary to prevent exposure; control measures to be taken if physical contact or airborne exposure occurs; safety procedures for opening process equipment (such as pipe line breaking); quality control for raw materials and control of hazardous chemicals inventory levels; and any special or unique hazards.

Few participants criticized the contents or the merits of paragraph (f) in general. However, OSHA has restructured and clarified certain provisions of paragraph (f)(1). One

change includes a division of proposed paragraph (f)(1)(D) which addressed emergency operations, including emergency shutdowns, and who could initiate them. Proposed paragraph (f)(1)(D) has been divided into final paragraph (f)(1)(D) and final paragraph (f)(1)(E). Final paragraph (f)(1)(D) concerns emergency shutdown and requires that the employer assign shutdown responsibility to a qualified operator to ensure a safe and timely shutdown.

The second change is the relocation of (f)(1)(ii)(C), safety systems and their functions, to a separate paragraph. This paragraph becomes final paragraph (f)(1)(iv).

Proposed paragraph (f)(2) required that a copy of the operating procedures be readily accessible to employees who work in or maintain a process and it is retained in the final rule. This requirement assures that a ready and up-to-date reference is available to employees when needed. It will also form a foundation for training which employees need under this final rule.

In proposed paragraph (f)(3) OSHA proposed that the operating procedures be reviewed to assure that they reflect current operating practices and any changes to the process or facility. Since it is extremely important to the safe operation of covered processes that operating procedures remain current and accurate, OSHA has added a precaution to guard against the use of outdated or inaccurate operating procedures by requiring that an employer verify annually that the operating procedures are current and accurate. No other changes were made to the paragraph and it becomes final paragraph (f)(3).

Finally, OSHA has been persuaded by participants in the rulemaking that it should add another requirement to paragraph (f). Throughout the rulemaking OSHA has expressed its concern regarding the control of hazardous activities within a facility. For example, in the notice of hearing in Issue 1 (55 FR at 46075), OSHA asked whether it should require employers to issue permits for hazardous activities in addition to those for which hot work permits were required. It had been suggested that issuing permits would provide greater control of hazardous activities at a facility and would also facilitate a better coordination of contractor activities. A variety of participants objected to OSHA expanding the required permit system (e.g., Ex. 3: 154, 163, 166; Ex. 116; Tr. 1883).

However, the Organization Resources Counselors (ORC, Ex. 131, p. 5)

recommended and others concurred (Ex. 3: 165):

[T]he addition of a new paragraph to provide for the development and implementation of an on-going mechanism to ensure that all workers performing non-routine work are informed of existing hazards, appropriate precautions, and emergency procedures. . . .

The objectives of these requirements are, first, to insure that those persons operating high hazard processes are cognizant of any non-routine work (i.e., maintenance, construction, sampling or other activity) that is occurring in the process. The second objective is to insure that those in responsible control of the facility are also in control of such non-routine work so as to insure that the work does not undermine the safe control of the process. The third objective is to provide information to those workers performing non-routine work regarding the hazards and necessary precautions attendant to that work.

Ordinarily, in chemical plants, maintenance and construction activities are supervised by persons other than those in direct control of the process. Implementation of these practices will insure that control over all activity in high hazard plants remains with those who manage the production units while they are in operation.

OSHA agrees that this approach will provide significant safety to employees impacted by on-going work activities and prefers this performance oriented approach provision. Therefore OSHA has added a new paragraph (f)(4) in the final standard requiring the employer to develop and implement safe work practices to provide for the control of hazards during work activities.

OSHA believes that the provisions concerning operating procedures included in the final standard meet the requirements of sections 304(c) (6) and (7) of the CAAA which state that the OSHA standard must require employers to:

(6) Develop and implement written operating procedures for the chemical process including procedures for each operating phase, operating limitations, and safety and health considerations.

(7) Provide written safety and operating information to employees and training employees in operating procedures, emphasizing hazards and safe practices.

#### *Training: Paragraph (g)*

OSHA believes that the implementation of an effective training program is one of the most important steps that an employer can take to enhance employee safety. The Agency also believes that an effective training program will help employees understand the nature and causes of problems arising from process operations, and will increase employee awareness with respect to the hazards particular to a



process. OSHA is convinced that an effective training program will significantly reduce the number and severity of incidents arising from process operations, and can be instrumental in preventing small problems from leading to a catastrophic release.

While there were a few concerns expressed with respect to OSHA's performance-oriented approach to training, no participant disagreed with the importance of training. In fact, there was consensus among rulemaking participants that training is a necessary and integral part of any effective process safety management program.

Proposed paragraph (g)(1) covered initial training, and required each employee presently "involved" in a process, and each new employee before working in a newly assigned process, to be trained in an overview of the process and in the operating procedures that were specified in proposed paragraph (f) of the proposal. The proposal also required the training to include emphasis on the specific safety and health hazards, procedures, and safe work practices applicable to the employee's job tasks.

An extensive amount of comment and testimony resulted from this proposed provision. In its analysis of this rulemaking record, the Agency identified three broad topics that were addressed by rulemaking participants in relation to this proposed provision concerning initial training. These topics were: the application of this proposed provision (to whom the training applies); OSHA's approach (including the amount and method of training, and the content of the training program); and grandfathering of training (the recognition of training received by employees prior to promulgation of this standard).

#### Application

Several rulemaking participants (Ex. 3: 17, 33, 53, 71; Tr. 313; Tr. 389) remarked that the training coverage for "employees involved in a process" was too broad, and could be misinterpreted to mean contractor employees and maintenance employees, in addition to the operating employees that they assumed that this proposed provision was meant to address. They suggested that this proposed paragraph be renamed "Operator Training" and the applicability of this proposed paragraph be clarified; or, they suggested addressing training for all employees in this proposed paragraph, including training for contractor employees and maintenance employees. For example, a hearing participant from the

Organization Resources Counselors (ORC Tr. 313) testified:

To clarify the training requirements of this proposal, ORC recommends that OSHA either include the training appropriate for maintenance and contractor personnel in additional, separate subsections of paragraph G, or rename paragraph G as "operator training", and highlight those paragraphs in J and H which call for the training of other types of employees.

Another hearing participant from Chevron (Tr. 389) said:

Training should cover operating employees rather than as currently worded, "employees involved in the process" which is subject to interpretation.

A commenter from Allied Signal (Ex. 3: 17, p. 9) stated:

[I]t should be noted that the requirements of paragraph (g) are appropriate only for employees involved in operating the process. Training for mechanical personnel is referenced in paragraph (j)—specifically (j)(2)(ii)—and training for contractor employees is specified in paragraph (h).

Additionally, a commenter from ARCO Chemical Company (ACC, Ex. 3: 71, p. 3) remarked:

ACC recommends that OSHA limit the application of the training requirements of the proposed rule to those employees directly involved in the process with training limited to relevant operating procedures necessary for the safe performance of job tasks.

When OSHA proposed that this provision apply to employees "involved in a process," it intended for this provision to apply to only those employees, including managers and supervisors, who are actually involved in "operating" the process. While most OSHA standards, by their terms, apply to all employees in a particular situation and contract employees are considered "employees" in the broad sense of the word, this standard distinguishes in the training requirements between contract employees and direct hire employees. This was done primarily for emphasis and in recognition of the fact that in some segments of industry covered by the process safety management standard, contractors make up a substantial portion of on-site workers. OSHA wanted to focus attention on that situation and did so by imposing separate but similar training objectives for direct hire and contract employees. This is the reason, as discussed below, that training requirements for contractor employees and maintenance employees were addressed in separate paragraphs in the proposal.

OSHA agrees with rulemaking participants that this intent was not clear in the proposed rule. Therefore, the phrase "involved in a process" is being

replaced with the phrase "involved in operating a process" in paragraph (g)(1) of the final rule. This is intended to cover all direct hire employees not involved in maintenance. This paragraph is not intended to be limited to equipment operators. OSHA believes that this change together with other changes made to the training requirements for contractor and maintenance employees (addressed in paragraphs (h) and (j), respectively), will clarify the Agency's intent.

#### Approach

A few rulemaking participants (e.g., Tr. 1286, 2259, 2268-70, 2409) disagreed with OSHA's performance-oriented approach with respect to training, and contended that the proposed training requirements were inadequate and should be strengthened. For example, a hearing participant from the Laborers' National Health and Safety Fund (Tr. 1286) stated:

The training required in 119 (g) and (h) suffer from the usual deficient approach that's been taken b[y] OSHA in the past in that form, content, duration, scope, proficiency and competency aspects, among others, are not addressed. This key element in achieving reduced worker and public risk from operations covered by 119, is seriously deficient.

A participant from the Oil, Chemical and Atomic Workers (Tr. 2408-09) testified:

This standard doesn't propose to do anything. If you examine it closely, it is going to require industry to do no more than it does now, [no] more than it has said it has done over the last 20 and 30 years, and [no] more certainly than we think ought to be done in some of those areas.

When it talks about training, it talks about training for operators. And essentially, when we look at the standard, we think it calls upon industry to do what it has done.

When we looked at training and tried to fashion what the standard meant in terms of training for maintenance, our conclusion was that the standard essentially said, Do what you have done. When we looked at contractors in the one paragraph in the standard that talked about contractors, it essentially said, Do what you have done. And we don't believe that what has been done is enough \* \* \*.

Additionally, a hearing participant from the United Steelworkers of America (USWA, Tr. 2268-69) remarked:

Although both unions are pleased at OSHA's initial inclination to make training a component of the proposed 1910.119 standard, we find the proposal severely lacking in specific and detailed regulatory language, as well as scope and breadth.

In addition, we find the voluntary and self-regulatory—i.e., strictly performance-based— aspects of OSHA's proposed training



requirements to be insufficient to assure the safety of workers, chemical facilities and their communities.

USWA and the International Chemical Workers Union recommended specific subjects that an effective training program should include, and suggested that a stratified approach to training be used by OSHA in the final rule (Tr. 2270-77). This stratified approach would consist of a minimum number of hours of training for two categories of employees: employees who have the potential to affect imminent danger situations and employees who have the potential to be affected by but not affect any imminent danger situations.

It was suggested that the first category, employees who have the potential to affect imminent danger situations, be separated into two subgroups of employees. The first group would consist of managers and supervisors directly responsible for highly hazardous chemical operations with imminent danger potential. It was suggested that these employees receive a minimum of 80 hours of initial training, and a minimum of 40 hours of refresher training annually, thereafter. The second group would consist of all workers who could, through the course of their production, maintenance or emergency work activities affect highly hazardous chemical imminent danger situations. These workers would include, but not be limited to, chemical and petroleum operators and their assistants, electricians, plumbers, pipefitters, etc. It was recommended that this group of employees receive a minimum of 40 hours of initial training, and a minimum of 40 hours of refresher training annually, thereafter.

It was further suggested that the second category of employees, those who have the potential to be affected by an imminent danger situation, be provided with a minimum of eight hours of training annually.

A few other rulemaking participants (e.g., Ex. 3: 5, 138; Tr. 47) also suggested that OSHA specify a minimum number of training hours in the final rule. However, the vast majority of rulemaking participants supported a performance-oriented approach to training (e.g., Ex. 3: 9, 17, 20, 28, 29; Ex. 138; Tr. 78, 313-14, 388, 674, 1021, 1207, 1318, 1508, 1538, 1596, 1617, 1663, 1815, 2008, 2062, 2158). They asserted that there were several levels of complexity of operations among the various covered processes and experience and skill levels vary widely among employees. As a result, a specified number of training hours might be too little for some

employees, and more than is actually needed by other employees.

They contended that the employer should evaluate the complexity of operation, experience, and skill levels of employees. With this information, the employer would be able to determine the content of the training program as well as the amount and frequency of training that would best assure that employees will be able to perform their job tasks in a safe and effective manner. For example, a hearing participant from the Organization Resources Counselors (ORC, Tr. 313-14) testified:

Choice of the most appropriate means for determining employee comprehension and expertise, however, must be the responsibility of the employer rather than mandated by regulation, as only the employer has the knowledge necessary to do this.

Moreover, the employer is responsible for the safe management of processes involving highly hazardous chemicals and must be free to use whatever method he or she determines will best ensure that employees can and do perform their jobs safely.

ORC also strongly opposes the notion that minimum hours of training must be specified in this standard to ensure that employees receive adequate training. The level and extent of training necessary should be dependent upon the complexity of the operation.

A commenter, who is an independent consultant (Ex. 3: 9, p. 2), remarked:

As for training, setting a specific time period for the training seems unreasonable. Experienced personnel certainly need far less time than newly hired personnel. Also, the extent of training varies based on the difficulty of the operations being performed. Training is needed for all facilities where hazardous materials are present but, again it is impossible to set a specific single criteria for training covering all situations.

Another commenter from the Gas Processors Association (GPA, Ex. 3: 28, p. 12), stated:

GPA's position is that OSHA should not specify a minimum amount of training because the training needs vary greatly depending on the size, complexity, and nature of the operation and hazards involved. For example, at a small, simple operation the requirement for 40 hours of initial training may greatly exceed the amount of training necessary to assure that employees are properly and adequately trained for that operation. Other large complex operations could dictate that 40 hours or more of initial training be provided for some employees involved in the operation. In summary, employers should custom design the training program for a location based on that operation's specific requirements. Forty hours of initial training and 8 hours of refresher training for many operations could be unnecessary.

A hearing participant from Manufacturing Technology Strategies (Tr. 1318) said:

In terms of the amount of training required, we believe that time limits are not appropriate. Once again, it is our belief that the technology determines the extent and complexity of the needed training, and since this technology is highly variable from site to site, it is not possible to say 40 hours is sufficient or that 8 hours once annually would keep the person up to speed.

Additionally, a hearing participant from the Institute of Makers of Explosives (Tr. 1617-18) remarked:

On training, OSHA should neither specify a minimum number of hours for initial or refresher training, nor should OSHA require any specific method for training validation. The employer can best determine the degree of initial and refresher training needed. The level of training should depend on the complexity of the job, the skill level of the trainee, and the skills needed to safely perform the job. For example, an employee at a chlorine repackaging operation will not need the same amount or level of training as an employee at a chloralkali production facility.

Finally, OSHA's expert witness (Tr. 2007-08) testified:

In my experience, I have found that the amount of training should depend upon the complexity of the operation and the competence and experience level of the person being trained. A simple reaction using one reactor will require much less operator training than a complex chemical or petrochemical operation.

Therefore, I do not think that there should be a minimal number of hours of training specified in the standard. The training requirements should not be rigid, but should cover the essential parts of the process involved to ensure that employees are competent to perform their duties.

After a careful analysis of the rulemaking record with respect to proposed paragraph (g)(1), OSHA has concluded that a performance-oriented approach to training is appropriate. The Agency believes that employers can determine the amount of training and the content of the training program that best reflects the operation's complexity and the experience and necessary skill level of their employees.

Proposed paragraph (g)(1) has been redesignated as (g)(1)(i) in the final standard and has been revised to read as follows:

Each employee presently involved in operating a process, and each employee before being involved in operating a newly assigned process, shall be trained in an overview of the process and in the operating procedures as specified in paragraph (f) of this section. The training shall include emphasis on the specific safety and health hazards, emergency operations including



shutdown, and safe work practices applicable to the employee's job tasks.

#### Grandfathering

Many rulemaking participants (e.g., Ex. 3: 26, 33, 38; Ex. 138; Ex. 143; Tr. 388, 1022, 1122, 1207, 1618) contended that OSHA should recognize training that employees received prior to the promulgation of this standard. For example, a commenter from Chevron (Ex. 3: 26, p. 7) stated:

The rule also does not address training received prior to the effective date of the rule. To help alleviate some of the compliance burden placed on employers without compromising the safety of employees, OSHA should include a grandfather clause within the initial training requirement. As long as employees have received training comparable to that required by the standard, the employer should not be required to retrain these employees for the sake of the standard. These employees will still be covered by the refresher and supplemental training requirements of paragraph (g)(2).

A participant from Kodak (Ex. 3: 33A, p. 8-9), said:

OSHA needs to grandfather initial training requirements for existing employees. It would be an incredible burden to require retraining of all employees, many of whom are experienced with and participated in development of the process and operating procedures.

A commenter from Monsanto (Ex. 143, p.2) asserted:

Further, performance against established criteria by employees who are already performing these jobs should suffice for validation. These employees should not have to attend a training course on what they are already doing and again demonstrate their proficiency on the job to satisfy training/validation requirements. It will, therefore, be important that OSHA specifically "grandfather" training that has already been accomplished and employees are performing their jobs.

In testimony, a hearing participant from the American Petroleum Institute (API, Tr. 1122) observed:

API believes that where employers previously have provided initial training that meets OSHA basic requirements, recipients of that training should be grandfathered and not be required to repeat the initial training.

Also, OSHA's expert witness (Tr. 1207) remarked:

I suggest that training be phased in by grandfathering existing process operators, exempting them from the initial training requirement but making them subject to periodic refresher and supplemental training requirements.

OSHA agrees that previous training should be recognized if the employer certifies in writing that employees have the required knowledge, skills, and

abilities to safely carry out their duties and responsibilities, particularly since employees must still be provided with refresher training in accordance with paragraph (g)(2) of this section (discussed below in this preamble).

Therefore, OSHA is adding a new provision, (g)(1)(ii), to the final rule to allow grandfathering of initial training under certain circumstances. The new paragraph reads as follows:

In lieu of initial training for those employees already involved in operating a process on (Insert effective date of standard), an employer may certify in writing that the employee has the required knowledge, skills, and abilities to safely carry out the duties and responsibilities as specified in the operating procedures.

Proposed paragraph (g)(2) required refresher and supplemental training to be provided to each employee at least annually to assure that the employee understands and adheres to the current operating procedures of the process. Although the need for refresher training was well supported throughout this rulemaking record, some rulemaking participants (e.g., Ex. 3: 5, 26, 27, 30, 33, 38; Tr. 47, 1121, 1814-15, 2273) disagreed with OSHA that refresher training should be provided annually.

Some rulemaking participants contended that annual refresher training may not be necessary for some employees, and that OSHA should use a performance-oriented approach that would permit the employer to determine the appropriate frequency. Other rulemaking participants recommended that refresher training be held at least every three years. Some rulemaking participants asserted that OSHA should specify a minimum number of hours of refresher training, while still other rulemaking participants suggested that OSHA specify a minimum of 40 hours of refresher training annually. For example, a commenter from South Alabama University (Ex. 3: 5) said:

I believe that employees that deal with hazardous substances should have a minimum of 40 hours training. Refresher training should be the same amount of time.

A hearing participant from the American Petroleum Institute (Tr. 1814-15) testified:

[R]efresher training should be required every three years, not every year, as proposed by OSHA and be restricted to operators.

A commenter from Dupont (Ex. 120) suggested that this proposed provision be revised to read as follows:

Refresher and supplemental training shall be provided to each employee to assure that the employee understands and adheres to the current operating procedures. The employer

shall, in consultation with employees, prioritize and document refresher and supplemental training frequencies, which are not to exceed three years.

Another commenter, who was from ARCO (Ex. 3: 30A, p.5), remarked:

Paragraph (g)(2) should be amended to provide refresher and supplemental training on a frequency necessary to assure that the employee understands and adheres to the current operating procedures of the process. The words "at least annually" should be removed.

The key objective of this section is to assure that employees are knowledgeable about the current operating procedures and this should be a performance based requirement.

Also, a commenter from Chevron Corporation (Ex. 3: 26, p.8) stated:

Item (g)(2) should be modified to require refresher training every three years rather than annually.

Paragraph (1) Management of Change will require ongoing supplemental training for all covered changes.

After analysis of the rulemaking record on this issue, OSHA has concluded that as with the initial training, it would be inappropriate to prescribe a minimum number of hours of refresher training since there is a wide variation in operation complexity, and in the experience and skill levels of employees. The Agency believes that the employer, in consultation with employees, can best determine the appropriate frequency of refresher training.

OSHA believes, however, that the frequency of refresher training should be held at least every three years to assure that employees understand and adhere to current operating procedures.

Additionally, the Agency considers the terms "refresher training" and "supplemental training" to be similar and, consequently, has removed the term "supplemental training" from this provision of the final rule.

Accordingly, proposed paragraph (g)(2) has been revised in the final rule to read as follows:

Refresher training shall be provided at least every three years, and more often if necessary, to each employee involved in operating a process to assure that the employee understands and adheres to the current operating procedures in the process. The employer, in consultation with the employees involved in operating a process, shall determine the appropriate frequency of refresher training.

Proposed paragraph (g)(3) required the employer to certify that employees had received and successfully completed the required training. It also required the certification to identify the employee,



the date of the training, and the signature of the person doing the training.

The purpose of this proposed provision was to assure that employees not only receive training but, also, that they understand and can demonstrate what they have learned in order to perform their job tasks safely. This is especially important where, as here, comprehensive training and the understanding of the training plays such a crucial role in the risk reduction associated with the process safety management rule. OSHA also believed this proposed provision was necessary to serve as a tracking mechanism for the training that employees receive and when employees received the training.

Many rulemaking participants (e.g., Ex. 3: 21, 25, 26, 28, 30, 38; Ex. 134; Ex. 143; Tr. 389, 1022, 2009) were concerned that OSHA might revise this provision in the final rule to specify particular methods to validate that employees understood the training they had received such as written tests, oral examinations, on-the-job demonstrations, etc. It was suggested that some method, or combination of methods, would be appropriate to verify that employees have understood the training, but OSHA should not mandate any specific method of validation.

Based on the rulemaking record, OSHA believes that its performance-oriented approach with respect to the certification of training is appropriate and it recognizes that any one of several methods, or combination of methods, can be effective in verifying that employees understand the training that they have received. Employers are therefore free to devise the method that works best in their establishment to ascertain that employees have understood their training. Consequently, OSHA is not mandating any specific methods of training validation in the final rule.

Several rulemaking participants (e.g., Ex. 3: 28, 29, 33; Tr. 1599, 2158) suggested that OSHA replace the term "certify" with "document" because they believe some form of documentation was important but certification was unnecessary. OSHA agrees that the term "document" is descriptive of the Agency's intent, and has substituted the term "document" for "certify" in this provision of the final rule.

Additionally, the Agency believes that it is important that the training documentation contain the name of the person conducting the training, as opposed to the signature of the person conducting the training as was proposed. OSHA is therefore requiring the trainer name and is eliminating the

requirement for a signature. Also this will allow employers to keep training records on computer if they so desire.

Therefore, proposed paragraph (g)(3) has been retitled "Training documentation", and has been revised in the final rule to read as follows:

The employer shall document that each employee involved in operating a process has received and understood the training required by this paragraph. The employer shall prepare a record which contains the identity of the employee, the date of training, and the means used to verify that the employee understood the training.

Section 304(c)(9) of the Clean Air Act Amendments mandated that this standard contain a provision requiring employers to "train and educate employees and contractors in emergency response in a manner as comprehensive and effective as that required by the regulation promulgated pursuant to section 126(d) of the Superfund Amendments and Reauthorization Act" (SARA). That section of SARA requires that workers receive a specified minimum number of hours of training unless the worker "has received the equivalent of such training."

It is the Agency's position that the training requirements contained in paragraph (g) of the final rule, together with the requirements pertaining to emergency planning and response contained in paragraph (n) of the final rule (particularly the training requirements mandated by § 1910.38(a)), provide "equivalent training" to the training required for emergency response under section 126(d) of SARA. In addition, those employees who would be involved in emergency response must meet the training requirements in § 1910.120, Hazardous Waste Operations and Emergency Response, referenced in paragraph (n) of this final rule, which is directly responsive to section 126(d) of SARA.

#### *Contractors: Paragraph (h)*

In this final rule, paragraph (h), contractors, attempts to distinguish between the many types of contract workers who may be present at a job site and indicates the type of contract worker that the special training provisions of the regulation are attempting to cover. Among the many categories of contract labor that may be present at a particular job site, it is important to appreciate the differences among them. For example, contractors may actually operate a facility for an owner (who may own the facility but have little to do with the daily operation). In this case the contractor is the employer responsible for the

covered processes and would obviously be treated as the "employer." Some contractors are hired to do a particular aspect of a job because they have a specialized area of expertise of which the host employer has little knowledge or skill (for example, asbestos removal). Other contractors work on site when the operation has need for increased manpower quickly for a short period of time, such as those involved in a turnaround operation. While paragraph (h)(2) sets forth the duties of the host employer to contract employers, the extent and the depth of these duties will depend to some degree on the category of contractor present. For example, should a contract employer provide employees to operate a process, then those employees would obviously have to be trained to the same extent as the directed hire employees "involved in operating a process" under paragraph (g) of the final standard.

Generally speaking, all OSHA standards cover all employees including contract employees. In something of a break with tradition, the process safety management rule has separate provisions covering the training of contract employees. This was done primarily for emphasis since contract employees make up a significant portion of some segment of industries covered by the final rule. This is not to say, however, that paragraph (h) is the only section of the process safety rule that applies to contractors. As already indicated, under appropriate circumstances, all of the provisions of the standard may apply to a contractor (i.e., a contractor operated facility). After all, employees of an independent contractor are still employees in the broadest sense of the word and they and their employers must not only follow the process safety management rule, but they must also take care that they do nothing to endanger the safety of those working nearby who work for another employer. Moreover, the fact that this rule has a separate section that specifically lays out the duty of contractors on the job site does not mean that other OSHA standards, lacking a similar section, do not apply to contract employees.

OSHA has a long history of enforcing OSHA standards on multi-employer worksites. Nothing in this rule changes the position that the Agency has long taken in cases such as Anning-Johnson (4 O.S.H. Cas. (BNA) 1193), Harvey Workover, Inc. (7 O.S.H. Cas. (BNA) 1687) and in its Field Operations Manual (CPL 2.45B CH-1, Chapter V-9). As a general matter each employer is responsible for the health and safety of



his/her own employees. However, under certain circumstances an employer may be cited for endangering the safety of another's employees. In determining who to hold responsible, OSHA will look at who created the hazard, who controlled the hazard and whether all reasonable means were taken to deal with the hazard.

OSHA proposed in paragraph (h)(1) that the employer inform contractors performing work on or near a process, of the known potential fire, explosion or toxic release hazards related to the contractor's work and the process; ensure that contractor employees are trained in the work practices necessary to safely perform their job; and inform contractors of any applicable safety rules of the facility. OSHA also proposed in paragraph (h)(2) that the employer explain to contractors the applicable provisions of the emergency action plan. The purpose of these proposed requirements was to assure that contractors are aware of both the hazards associated with the work being performed and the actions to be taken during emergencies. Finally, OSHA proposed paragraph (h)(3) that contract employers assure that their employees follow all applicable work practices and safety rules of the facility.

In Issue 7 in the proposal (55 FR at 29159), OSHA requested comments on the extent and adequacy of contractor training. OSHA also asked if the standard should require contractors to inform the plant employer of the hazards presented by the contractor's work, and whether the contractor should be required to inform the employer of any hazards found during the contractor's work.

OSHA received a significant number of comments regarding the proposed contractor provisions (e.g., Ex. 3: 2, 4, 8, 11, 12, 16A, 17, 20, 25, 26, 29, 30, 32, 33, 37, 38, 39, 41, 43, 44, 45, 48, 59, 62, 66, 69, 70, 72, 80, 81, 88, 91, 95, 98, 99, 101, 104, 106, 108, 109, 112, 113, 115, 119, 120, 122, 123, 124, 127, 129, 130, 134, 150, 151, 152, 155, 156; Ex. 91; Ex. 103; Ex. 115; Ex. 128; Ex. 131; Ex. 133; Ex. 134; Ex. 138; Ex. 146; Tr. 741, 1013-14, 1227, 1538, 2009, 2158, 2365, 2445, 2574, 2655, 2695, 3157, 3442, 3605, 3752). Participants generally supported the inclusion of contractor provisions in the final standard. The Department of Environmental Protection of the State of New Jersey (Ex. 3: 20, p. 3) observed:

Contractors should be informed about the potential hazards and risk related to the contracted work. Clear communication must take place between the facility and the contractor concerning safety rules, emergency action plan, scope of work and unforeseen hazards found.

Chevron Corporation (Ex. 3: 29, p. 10) remarked:

Chevron agrees it is appropriate to address contractors in this rule to the extent that the contractors' activities actually bear on process safety.

The Chemical Manufacturers Association (CMA, Ex. 3: 48, p. 15) stated:

CMA concurs with OSHA's decision to address contractor safety within the context of the proposed process safety management standard. Overall, CMA agrees with OSHA's approach \* \* \*

The National Maintenance Agreements Policy Committee, Inc. (NMAPC, Ex. 3: 151, p. 2) remarked:

The NMAPC is in full support of OSHA's attempt to increase the level of safety for all workers at hazardous process facilities and to mitigate the potential for catastrophic accidents. There has been some discussion suggesting that outside contractors are of and by themselves a contributing factor to accidents in these facilities. Nothing could be further from the truth.

Unsafe conditions during maintenance operations are not caused by construction techniques, maintenance methods, tools or workers employed by contractors. What is needed is the assurance that proper training and communication is maintained between the owner and the maintenance contractor during maintenance operations.

Many participants criticized the proposed provisions, observing that they could be interpreted to mean that a plant employer would be responsible for training contractor employees, a responsibility they believed properly belongs to the contract employer (e.g., Ex. 3: 4, 8, 11, 16A, 17, 28, 30, 41, 48, 53, 59, 60, 62, 71, 87, 88, 91, 97, 101, 104, 113, 119, 120, 121, 127, 156, 161; Ex. 115; Ex. 127; Tr. 1597, 3510). The Santa Fe Pacific Pipeline, Inc. (Ex. 3: 124) observed that contractors in some cases are larger organizations than the employer and since an employer is paying a contractor as an expert, questioned how an employer could be expected to provide such training.

Other participants believed that the proposed contractor provisions were inadequate and urged OSHA to more thoroughly address contractors in the final standard (e.g., Ex. 3: 131; Tr. 1287, 1812, 2574, 3197, 3240). For example, the Food and Allied Service Trades Department of the AFL-CIO (Ex. 3: 25, p. 7) noted:

Unfortunately Paragraph (h) perpetuates the dual standard created between regular plant workers and contract employees by this proposed standard. The proposed training programs are far more complete than those for contract workers although both are working at the same worksite, encounter the same dangers and may even be performing

similar tasks. The reasons for the disparity in the training requirements are not immediately obvious to us and make little sense. We are unsure why OSHA has opted to establish one set of standards for some workers and a completely different set for others.

Organization Resources Counselors (ORC, Ex. 131, p. 4) stressed:

As discussed in our earlier comments and testimony, the issue of ensuring that contract personnel are adequately trained and supervised to safely perform work in and around highly hazardous chemical processes is an important one. It has become a highly controversial one as well. A number of commenters representing both labor and industry have questioned the adequacy of the language proposed by OSHA to deal with this issue.

ORC continues to recommend that the proposed standard's provisions for ensuring that contract personnel are adequately trained and supervised to safely conduct their work should be considerably strengthened. Also this section (paragraph (h)) should be organized to clearly delineate areas of site employer and contractor responsibility.

Many participants provided specific suggestions on how to revise the proposed provisions to improve, strengthen and clarify the language. Participants in addition to ORC suggested that the final rule should better delineate the duties and responsibilities of site employers who employ contractors and the duties and responsibilities of contractors who are providing specialized services at an employer's site (e.g., Ex. 3: 48, 106, 109; Ex. 128; Ex. 131; Tr. 2574, 3172, 3240, 3260, 3350, 3605).

On September 24, 1991, OSHA published a notice in the Federal Register announcing the availability of a report by the John Gray Institute on contractors and peer review of the report. The public was given an opportunity to comment and reexamine the contractor provisions of the proposed process safety management standard in light of the John Gray Report (56 FR 48133). (See preamble discussion in Part I, Background.) The comment period ended on October 24, 1991, and OSHA received 37 comments in response to the notice.

Generally commenters viewed some of the issues addressed in the John Gray Report (the Report) as important considerations (Ex. 154: 4, 5, 12, 18, 23, 24, 25, 28, 30). However, many commenters expressed their belief that the report should not be used as a basis in the development of the final contractor provisions in the final process safety management standard (e.g., Ex. 154: 4, 5, 7, 10, 12, 14, 15, 20, 23, 24, 30, 33, 34, 36, 37). Commenters



questioned the credibility of the Report's findings and recommendations and pointed to criticisms leveled at the report by its peer reviewers and the criticisms that resulted from the special evaluation of the final John Gray Report (Ex. 154: 3) conducted for The Business Roundtable by the University of Texas at Austin and Texas A&M University (e.g., Ex. 154: 4, 11, 14, 15, 18, 20, 22, 23, 24, 28, 30, 34, 36, 37, 38). The evaluation concluded (p. 2) that the John Gray Report's "conclusions are based on a highly problematic research design, research methodologies, data, analysis of data, and interpretation of results" and further observed (p.2) that the review teams (one from the University of Texas at Austin and one from Texas A&M University) "are unanimous in concluding that the JGI [John Gray Institute] report should be treated with extreme caution and should not be used as a basis for establishing national policy or industry standards."

Additionally, some commenters observed that the John Gray Report only dealt with the petrochemical industry and that OSHA should not use it to draw conclusions with regard to other industry segments covered by the process safety management standard (Ex. 154: 10, 14, 15).

OSHA has not used the final John Gray Report as a basis for requirements in the development of its final provisions concerning contractors. A review of the comments in the record indicates that significant other information and data is available on which the final contractor provisions can be based. While OSHA has decided not to use the Report as a basis for the final contractor provisions, OSHA believes that the final provisions have benefitted by the additional public input which reconfirms, clarifies and expands on comments and testimony previously received. OSHA believes the safety and health of all employees working in processes involving highly hazardous chemicals will benefit from a safer workforce and a safer workplace.

Despite concerns regarding the John Gray Report, several commenters noted that the Report did address some issues which they agreed with in principle; as a result these commenters suggested additional revisions to further strengthen the contractor provisions in the final standard (e.g., Ex. 154: 7, 13, 19, 20, 24, 25, 27, 36). The Associated Builders and Contractors (Ex. 154: 7, p. 1-2) asserted:

We urge OSHA to expand and strengthen Subparagraph (h) of the proposed rule to clearly assign responsibility to the plant manager and the contractor with respect to

the training and supervision of contract workers.

Subparagraph (h) should specifically state that the contractor is responsible for training and supervising its own employees to ensure that they perform their jobs safely and in accordance with the facility's safety rules. The standard should address safety in the selection of contractors, requiring facility owners to obtain and assess the safety performance records of contractors during a pre-bid, qualification round. Similarly, facility owners should conduct periodic reviews of contractors' safety records throughout the performance of the contract and verify contractors are fulfilling their responsibility to provide appropriate health, safety and craft training.

Safety is a shared responsibility. The facility owner hires the contractor for their expertise and contracts for supervisory personnel, as well as skilled tradesmen. The contractor has been selected for their ability to do the job correctly and safely which requires providing personnel with appropriate craft and safety training for each task. Consequently, the contractor is in the best position to train and supervise its own employees.

Communication between plant management and contractors is essential for a safe workplace. The facility owner must provide the contractor with sufficient information to enable the contractor to educate their employees about existing chemicals, potential hazards and site specific safety and health procedures. The contractor must provide its employees with site specific and task specific safety training. Owners may require the contractor to provide additional training on specified topics, and in some instances, may provide funding for the additional training. The facility owners should monitor the contractor's training of employees and audit the contractor's performance.

ABC supports expansion of Subparagraph (h) to incorporate the assignment of responsibility outlined above to improve health and safety practices and process management.

After carefully considering the record, OSHA believes that the expansion of the proposed contractor provisions is necessary and appropriate.

Accordingly, OSHA has been convinced by participants in the rulemaking to revise, reorganize, and add requirements to the final standard's provisions regarding contractors, final paragraph (h). Before discussing the final contractor provisions, OSHA would like to direct interested persons to final Appendix D, Sources of Further Information, which lists several sources of helpful assistance to employers who use contractors.

First, OSHA has added an application statement, paragraph (h)(1), to clarify which contractors are covered by the standard (e.g., Ex. 3: 26, 29, 33, 48, 62, 69, 70, 80, 95, 99, 106, 113, 130, 134, 151; Ex. 128; Ex. 154: 18, 19; Tr. 2774, 3260, 3350).

In the proposal, OSHA intended to cover those contractors whose work brings them into direct contact with, or whose work could affect the hazards of processes covered by the standard. OSHA believes that contractors providing incidental services are adequately covered under the 29 CFR 1910.1200, Hazard Communication standard. Therefore, the final contractor application provision better reflects OSHA's intent regarding which contractors will be covered by the final standard. This paragraph becomes final paragraph (h)(1) and reads as follows:

(h) *Contractors.* (1) *Application.* This paragraph applies to contractors performing operating duties, maintenance or repair, turnaround, major renovation, or specialty work on or adjacent to a covered process area. It does not apply to contractors providing incidental services which do not influence process safety, such as janitorial work, food and drink services, laundry, delivery or other supply services.

At the request of some rulemaking participants (e.g., Ex. 3: 33, 48, 106, 109; Ex. 128; Ex. 131; Tr. 3172, 3240, 3350, 3605, 3731) who believed that the contractor provisions needed to be clarified and better organized in the final rule, OSHA has delineated the responsibilities of employers and contractors. OSHA believes that the delineation will provide clearer and better organized requirements. Accordingly, OSHA has added paragraph (h)(2), employer responsibilities, and paragraph (h)(3), contract employer responsibilities.

The final provisions concerning employer responsibilities read as follows:

(2) *Employer responsibilities.* (i) The employer, when selecting a contractor, shall obtain and evaluate information regarding the contract employer's safety performance and programs.

(ii) The employer shall inform contract employers of the known potential fire, explosion, or toxic release hazards related to the contractors work and the process.

(iii) The employer shall explain to contract employers the applicable provisions of the emergency action plan required by paragraph (a) of this section.

(iv) The employer shall develop and implement safe work practices consistent with paragraph (f)(4) of this section, to control the entrance, presence and exit of contract employers and contract employees in process areas covered by this section.

(v) The employer shall periodically evaluate the performance of contract employers in fulfilling their obligations as specified in paragraph (h)(3).

(vi) The employer shall maintain a contract employee injury and illness log related to the contractor's work in process areas.



Paragraph (h)(2)(i) of the final standard, requires that an employer, when selecting a contractor, obtain and evaluate information regarding a contractor employer's safety performance and programs. Several commenters noted that this should be an important consideration on the part of an employer when hiring a contractor (e.g., Ex. 115; Ex. 128; Ex. 154: 4, 16A, 18, 19, 20, 23, 24, 25, 30, 31, 35, 36, 38; Tr. 831, 1283, 2034, 2696, 2781, 3525, 3760).

OSHA agrees with these remarks and believes that an employer should be fully informed about a contract employer's safety performance. Therefore the Agency is requiring an evaluation of a contract employer's safety performance (e.g., an employer's experience modification rate) and safety programs. OSHA believes that evaluating safety performance and programs is an important measure in preserving the integrity of processes involving highly hazardous chemicals. OSHA anticipates that the requirement will provide employers an opportunity to assure that they are not introducing additional hazards to their processes; and will give employers an opportunity to request that contract employers improve their safety performance or make other adjustments to their safety programs in order to enhance the safety of all employees working in processes involving highly hazardous chemicals. The final rule, being performance oriented, does not require that employers refrain from using contractors with less than perfect safety records. However, the employer does have the duty to evaluate the contract employer's safety record and safety programs. Where the evaluation indicates some gaps in the contract employer's approach to safety, the employer may need to be more vigilant in the oversight and may need to develop and implement more stringent safe work practices to control the presence of contractors in covered process areas (see (h)(2)(iv)).

Paragraphs (h)(2) (ii) and (iii) of the final standard were contained in the proposed standard. These provisions require the communication of basic process hazard and emergency information to contract employers and have been retained in the final rule.

Paragraph (h)(2)(iv) of the final standard references a new paragraph concerning safe work practices which was added to the final provisions concerning operating procedures (see discussion in paragraph (f), operating procedures). Organization Resources Counselors (ORC, Ex. 131, p.5) observed:

In the final rule \* \* \* we also recommend that paragraph (h) [Contractors] \* \* \*

contain a provision requiring the employer to develop a procedure for controlling access into covered facilities by contractor personnel. This provision cross-references the general requirements already contained in [the safe work practices in paragraph (f)].

ORC noted the objectives of these additional provisions were to insure that those persons operating high hazard processes are cognizant of any nonroutine work that is occurring and to insure that those in responsible control of the facility are also in control of nonroutine work. The Agency strongly agrees that these additional provisions are important in safely controlling activities in covered processes involving highly hazardous chemicals.

In paragraph (h)(2)(v) of the final standard, OSHA is requiring employers to periodically evaluate the performance of contract employers in fulfilling their obligations. Many participants recommended or followed this type of approach (e.g., Ex. 3: 53, 59, 71, 86; Ex. 115; Ex. 128; Ex. 131; Tr. 1624, 2010, 2442, 2714). ARCO Chemical Company (ACC, Ex. 3: 71, p. 23) stated:

ACC further recommends that OSHA require employers using contractors to verify that all contractor employers have been trained by contractor employers through new requirements \* \* \* These new requirements should stipulate that contractor employers document training of their employees and provide a copy of that documentation to employers for each contractor employees assigned per the contract. This will facilitate a second new requirement for periodic performance assessment that should be placed on employers using contractors to use such documentation for verification purposes. Requiring that a contractor employer document training they provide also holds them accountable, a control measure absent from the proposed rule.

Finally, OSHA has added paragraph (h)(2)(vi) to the final rule which requires a log of injuries and illnesses to be kept by the employer. This was supported by a variety of commenters (e.g., Ex. 3: 39, 86, 106, 152; Ex. 154: 15, 19, 24, 36, 37, 38; Tr. 1227-28, 1283, 1812, 2783, 3319, 3350, 3524, 3617) and many claimed to be doing it already. For example, a participant from Brown and Root Industrial Services (Tr. 3617) responded to a question from an OSHA panel member as follows:

OSHA Panel Member: You would not be at all opposed to the concept of requiring the site employer to keep track of injuries and incidents on the worksite involving everybody on the worksite. Is that correct?  
Response: I support that.

OSHA agrees that an employer should be informed of all of the injuries and illnesses occurring in processes involving highly hazardous chemicals at

the plant regardless of whether they be the employer's employees or the contractor's employees.

Paragraph (h)(3) of the final rule delineates the contract employer responsibilities and it includes the following provisions:

(3) *Contract employer responsibilities.* (i) The contract employer shall assure that each contract employee is trained in the work practices necessary to safely perform his/her job.

(ii) The contract employer shall assure that each contract employee is instructed in the known potential fire, explosion, or toxic release hazards related to his/her job and the process, and the applicable provisions of the emergency action plan.

(iii) The contract employer shall document that each contract employee has received and understood the training required by this paragraph. The contract employer shall prepare a record which contains the identity of the contract employee, the date of training, and the means used to verify that the employee understood the training.

(iv) The contract employer shall assure that each contract employee follows all applicable work practices and safety rules of the facility including the safe work practices required by paragraph (f)(4) of this section.

(v) The contract employer shall advise the employer of any unique hazards presented by the contract employer's work, or of any hazards found during the contract employer's work.

Paragraphs (h)(3) (i) and (ii) of the final standard were included in the proposal. These provisions require the communication of basic process hazard and emergency information by the contract employer to the contract employees. They have been retained in the final rule.

Paragraph (h)(3)(iii) of the final rule requires the contract employer to document that each contract employee has received and understood required training. Numerous commenters suggested that such a requirement (Ex. 3: 41, 48, 59, 113, 139, 152; Ex. 128; Ex. 154: 15, 16A, 17, 18, 24, 25, 30, 31, 35, 37, 38, Tr. 1620) is necessary to help ascertain that employees have been properly trained.

The requirements in paragraph (h)(3)(iv) of the final standard were also contained in the proposal except for the addition of the requirement pertaining to safe work practices discussed above. It is vitally important that contract employers assure that their employees follow the rules of the facility.

Paragraph (h)(3)(v) was added to the final rule as a result of the request for information in the proposal (55 FR at 29159). OSHA asked if the standard should require contract employers to inform the plant employer of the hazards presented by the contractor's work, and



whether the contractor should be required to inform the employer of any hazards found during the contractor's work. Participants supported the inclusion of this requirement (Ex. 3: 28, 41, 48, 53, 70, 71, 97, 103, 112, 113, 115, 120, 123, 146; Ex. 115; Ex. 127; Ex. 128; Tr. 1597, 2010, 2656, 3263, 3450).

Finally, the section 304 requirements of the Clean Air Act Amendments (CAAA) state that the OSHA standard must require employers to:

(6) Ensure contractors and contract employees are provided appropriate information and training.

(9) Train and educate employees and contractors in emergency response in a manner as comprehensive and effective as that required by the regulation promulgated pursuant to section 126(d) of the Superfund Amendments and Reauthorization Act.

OSHA believes that the contractor provisions contained in the final standard meet the requirements contained in section 304(c) (8) and (9) of the CAAA in a manner as comprehensive and effective as that required by the regulation promulgated pursuant to section 126(d) of the Superfund Amendments and Reauthorization Act for the reasons described in the preamble discussion regarding section 126(d) of the Superfund Amendments in paragraph (g), Training.

#### *Pre-startup Safety Review: Paragraph (i)*

Proposed paragraph (i)(1) required the employee to perform a pre-startup safety review for new facilities and for modified facilities when the modification necessitated a change to the process safety information. The purpose of this proposed requirement was to make sure that certain important considerations had been addressed before any highly hazardous chemical was introduced into a process.

Rulemaking participants (e.g., Ex. 3: 17, 26, 59, 62, 128) agreed with the importance of performing a pre-startup safety review to assure that adequate safety measures are in place and are operational. However, a few commenters (e.g., Ex. 3: 45, 71) did not believe it was necessary to require a pre-startup safety review for all modified facilities, particularly when the modifications were minor. These commenters suggested adding the word "significant" to this provision to describe the degree of modification that would necessitate a pre-startup safety review.

It was not the intent of OSHA to require a pre-startup safety review for each facility that may be modified slightly. OSHA believes that a pre-startup safety review is necessary for

modified facilities only when the modification is significant enough to require a change in the process safety information. The Agency has made minor editorial changes to this provision in the final rule to clarify its intent.

Proposed paragraph (i)(1) has been revised to read as follows:

The employer shall perform a pre-startup safety review for new facilities and for modified facilities when the modification is significant enough to require a change in the process safety information.

Paragraph (i)(2) of the proposal required that the pre-startup safety review confirm that construction was in accordance with design specifications, ((i)(2)(i)); safety, operating, maintenance, and emergency procedures were in place and were adequate ((i)(2)(ii)); process hazard analysis recommendations had been addressed and actions necessary for startup had been completed ((i)(2)(iii)); and, operating procedures were in place and training of each operating employee had been completed ((i)(2)(iv)).

OSHA did not receive any negative comments with respect to proposed paragraphs (i)(2)(i) and (i)(2)(ii). Therefore, these two provisions of the final rule remain the same as that which was proposed.

A few commenters (e.g., Ex. 3: 48, 71; Tr. 1933-35) believed that paragraph (i)(2)(iii) of the proposal was unclear and asked whether it implied that a process hazard analysis was required before startup for both new facilities and modified facilities. This was not the intent of OSHA. OSHA wants to assure that a process hazard analysis is performed for new facilities before startup, and that recommendations resulting from the process hazard analysis have been addressed before startup. The Agency believes that any actions necessary before startup in modified facilities will be addressed by the requirements contained in paragraph (1) of this section pertaining to management of change. Therefore, OSHA has revised paragraph (i)(2)(iii) of the final rule to clarify its intent.

Other commenters (e.g., Ex. 3: 71, 87) asserted that it is not necessary that all recommendations resulting from a process hazard analysis be implemented before startup. OSHA agrees with these commenters. Certainly, all of the recommendations resulting from a process hazard analysis need to be addressed or resolved, but it may not be necessary in every case to complete all of the recommendations prior to startup.

Accordingly, proposed paragraph (i)(2)(iii) has been revised in the final rule to read as follows:

For new facilities, a process hazard analysis is performed and recommendations have been resolved or implemented before startup; and modified facilities meet the requirements contained in management of change, paragraph (1).

In proposed paragraph (i)(2)(iv) OSHA required that operating procedures be in place prior to the introduction of a highly hazardous chemical to a process. Several commenters (e.g., Ex. 3: 53, 64, 71) noted that proposed paragraph (i)(2)(ii) also required that operating procedures be in place prior to the introduction of a highly hazardous chemical to a process. OSHA agrees that paragraph (i)(2)(ii) of the final rule already requires operating procedures to be in place and, therefore, the redundant reference to operating procedures has not been retained in paragraph (i)(2)(iv) of the final rule.

#### *Mechanical Integrity: Paragraph (j)*

Proposed paragraph (j) contained requirements for maintaining the mechanical integrity of process equipment in order to assure that such equipment is designed, installed, and operates properly.

Paragraph (j)(1) of the proposal specified certain process equipment to which the requirements of this paragraph would apply. This equipment included pressure vessels and storage tanks; piping systems (including piping components such as valves); relief and vent systems and devices; emergency shutdown systems; and controls, alarms, and interlocks. The Agency believed that any of this equipment could have a significant impact on the safety of a process that is covered by this standard if the equipment was improperly designed or installed or, if such equipment did not function as intended.

In the proposal OSHA specifically requested information and comments on whether the equipment listed in proposed paragraph (j) included equipment that does not impact the safety of a process, or whether additional equipment should be listed and covered by paragraph (j) (55 FR at 29159).

Several rulemaking participants (e.g., Ex. 3: 39, 41, 53, 71, 76; Ex. 127; Tr. 316, 1023, 1539, 1812) suggested that the Agency define the term "critical," and add this term to describe the process equipment that is to be covered by this paragraph. Some of these rulemaking participants also believed that the employer should be permitted to determine what process equipment should be identified as "critical." For example, a commenter from Chevron Corporation (Ex. 3: 28A, p.12) stated:



The basic intent of the mechanical integrity provision in the proposed rule is to ensure that highly hazardous chemicals are contained within the process and not released in an uncontrolled manner. To achieve this intent, Chevron believes OSHA should use performance language and require the employer to develop and maintain a list of equipment that the employer has determined to be critical to process safety. This equipment would be subject to the provisions of paragraph (j).

A commenter from the Chemical Manufacturers Association (CMA, Ex. 3: 48, p. 17) asserted:

Since all process equipment within a plant is not necessarily associated with Appendix A materials or flammable liquids or gases, CMA believes that section (j) should only apply to "Critical Equipment". CMA recommends that section (j) and a definition for critical equipment be reworked to ensure that this section pertains only to "Critical Equipment".

Rather than specify types of equipment as is in (j)(1), OSHA should use a performance oriented approach and require the employer to develop and maintain a list of equipment that has been determined to be critical to process safety. This equipment would be subject to the provisions of paragraph (j).

A hearing participant from the Gas Processors Association (GPA, Tr. 1539) testified:

GPA recommends that companies be required to define critical equipment at each facility and maintain a current list. GPA does not believe a generic list can be appropriate for all facilities.

Additionally, a commenter from the Chlorine Institute (Ex. 3: 113, p.3) added:

Instead of listing non specific equipment as is done in paragraph (j), the rule should require that the employer determine which process equipment is critical to prevention of a catastrophic release.

Other rulemaking participants (e.g., Ex. 3: 45, 51, 64, 96) agreed with the approach that the Agency proposed. For example, a commenter from the American Paper Institute (Ex. 3: 45, p.19) stated:

The list of equipment subject to the mechanical integrity requirements seems appropriate, except API believes that OSHA should add pumps to the list of process equipment.

A commenter from the Northwest Pipeline Corporation (Ex. 3: 96, p.4) said:

The equipment listed in paragraph (j) impacts the safety of a process and is adequate with respect to process safety at Northwest's facilities that would fall within the scope of the proposed standard.

Another commenter, who is from the Occidental Chemical Corporation (Ex. 3: 70-A, p.8), remarked:

"Critical" process equipment will vary from process to process. The generic listing in section (j) seems to be complete.

OSHA agrees with those rulemaking participants who believe that the goal of the mechanical integrity provisions is to ensure that highly hazardous chemicals covered by the standard are contained within the process and not released in an uncontrolled manner. The equipment OSHA has listed in proposed paragraph (j)(1) constitutes process equipment that the Agency considers critical in achieving this goal.

OSHA also agrees with those rulemaking participants who stated that process equipment will vary from process to process. This is the reason that the Agency did not propose that the employer determine the equipment "critical" to the process. Equipment considered critical to a process by one employer may not necessarily be considered critical to a different process by another employer. As a result, there could be confusion with respect to which equipment is subject to the requirements contained in paragraph (j).

The Agency believes that there is certain equipment, critical to process safety, that is common to all processes. This is the equipment specified in proposed paragraph (j)(1). It is the position of OSHA that at least the equipment specified in proposed paragraph (j)(1) must be subject to the requirements contained in paragraph (j). However, if an employer deems additional equipment to be critical to a particular process, that employer should consider that equipment to be covered by this paragraph and treat it accordingly.

OSHA also concurs with those rulemaking participants who said that all process equipment within a plant is not necessarily associated with appendix A materials or flammable liquids or gases. Paragraph (j)(1) is intended to cover only that equipment associated with a process that is covered by this standard.

After careful evaluation of the information contained in the record, OSHA believes that it is appropriate for the mechanical integrity requirements in paragraph (j) to apply to the equipment listed in proposed paragraph (j)(1). OSHA is accepting the recommendation of the American Paper Institute (Ex. 3: 45) and the United Steelworkers of America (Tr. 2512) that pumps be added to the list since OSHA agrees that pumps in a covered process could also significantly impact the safety of a process.

Accordingly, Paragraph (j)(1) of the final rule remains the same as that which was proposed except pumps

(paragraph (j)(1)(vi) of the final rule) have been added to the list of process equipment that must meet the mechanical integrity requirements contained in paragraph (j).

Paragraph (j)(2) of the proposal pertained to written procedures with respect to mechanical integrity. Proposed paragraph (j)(2)(i), required the employer to establish and implement written procedures to maintain the on-going integrity of listed process equipment. The purpose of this proposed provision was to require a written program that would assure that process equipment receives careful, appropriate, regularly scheduled maintenance to assure its continued safe operation.

The Agency did not receive any comments on this proposed provision and it is contained in the final rule as proposed. However, this provision has been redesignated as paragraph (j)(2) in the final rule instead of paragraph (j)(2)(i), because (as discussed below) the subsequent proposed paragraph concerning training of maintenance employees will be redesignated in the final rule.

Paragraph (j)(2)(ii) of the proposal required the employer to assure that each employee involved in maintaining the on-going integrity of process equipment be trained in the procedures applicable to the employee's job tasks. Several rulemaking participants (e.g., Ex. 3: 17, 33; Tr. 313, 389) were concerned that there might be some confusion with respect to the training requirements contained in paragraph (g), which apply to employees who are involved in operating a process, and the training requirements contained in this provision, which apply to maintenance employees. It was suggested that all training requirements be contained in paragraph (g) or, alternatively, that the Agency clarify that there are separate training requirements for maintenance employees. Other rulemaking participants (e.g., Ex. 3: 17, 53, 71; Tr. 313, 389) suggested that, because of its importance, the training requirement for maintenance employees should be separated from proposed paragraph (j)(2) and given its own heading. For example, a commenter from Organization Resources Counselors, Inc. (Ex. 3: 53, p.14) stated:

Training is an important issue which warrants special attention. Such attention might be better focused if the requirements in (j)(2)(ii) were separated from the current paragraph (j)(2), identified as (j)(3), and given their own heading \* \* \*.

OSHA believes that this is an excellent suggestion because it will focus more attention on the importance



of training of persons involved in maintaining equipment and will better distinguish these training requirements from those contained in paragraph (g).

The Agency was also concerned that there might be some confusion between the training requirements in this mechanical integrity provision, and the training requirements contained in paragraph (g). It is the Agency's position that maintenance employees need not be trained in process operating procedures to the same extent as those employees who are actually involved in operating the process.

However, OSHA believes that maintenance employees must receive on-going training in an overview of the process and its hazards and training in the procedures applicable to their job tasks to assure that they can perform their tasks in a safe manner. Without continual attention to training needs due to process changes and other changes, little assurance will exist that maintenance employees will perform their tasks safely.

OSHA believes that assigning this paragraph its own heading will focus more attention on the training requirements contained in this provision, and will help to clarify the distinction between the training requirements pertinent to mechanical integrity and the training requirements pertinent to employees involved in operating a process.

The Agency also believes that it is necessary to revise this proposed paragraph to better describe its intent regarding the training of maintenance employees.

Consequently, this proposed provision has been redesignated as paragraph (j)(3), assigned the title of "Training for process maintenance activities", and has been revised to read as follows:

The employer shall train each employee involved in maintaining the on-going integrity of process equipment in an overview of that process and its hazards and in the procedures applicable to the employee's job tasks to assure that the employee can perform the job tasks in a safe manner.

Paragraph (j)(3)(i) of the proposal required inspections and tests to be performed on specified process equipment because of the potential safety and health hazards that could result if the equipment malfunctioned.

The Agency did not receive any comments on this particular provision, and it is contained in the final rule as proposed. However, it has been redesignated as (j)(4)(i) in the final rule instead of (j)(3)(i) as proposed.

In an effort to assure that inspections and tests are performed properly, proposed paragraph (j)(3)(ii) required

that inspection and test procedures follow applicable codes and standards. Paragraph (j)(3)(ii) also contained examples of codes and standards that an employer could use to comply with this proposed provision.

Many rulemaking participants disagreed with this proposed provision (e.g., Ex. 3: 12, 53, 64, 87, 97, 121; Tr. 722-23, 796-97, 2177). Some commenters were concerned that the Agency would incorporate by reference all of the codes applicable to testing and inspection such as those published by the National Fire Protection Association (NFPA), the American Society for Testing and Materials (ASTM), the American National Standards Institute (ANSI), etc. These commenters asserted that it would be difficult for an employer to obtain all such standards and decide which standards the Agency intended for them to use. They also stated that some of the standards may conflict with each other.

Other commenters were concerned that some of the standards may be outdated and no longer applicable to their process equipment. As a result, many of these commenters suggested that the employer be permitted to use their own internal standards, or that inspection and testing procedures follow recognized and generally accepted good engineering practices. For example, a commenter from the ARCO Chemical Company (ACC, Ex. 3: 71, p.26) remarked:

Subparagraphs (j)(3)(ii) and (j)(3)(iii) require equipment testing and inspection per "applicable" codes and standards "where they exist." Since some of these standards may be outdated and no longer represent a consensus of "good engineering practices", OSHA should provide employers the option of using internal engineering standards and practices, or practices recommended by equipment manufacturers.

Further, as stated previously in ACC comments, such standards and guidelines often represent the minimum (least common denominator) agreed to by the participants in the organization specifying the performance requirements. Consequently, OSHA should also allow employers the option of using more demanding internal standards as the source of primary requirements.

A commenter from MARS Incorporated (Ex. 3: 87, p.2) added:

A second overall concern is our strong objection to what appears to be an attempt to incorporate by reference into the Standard—binding legal requirements—all relevant codes and standards issued by the American Society of Mechanical Engineers, the American National Standards Institute, the American Society of Testing and Materials and the National Fire Protection Association.

A commenter from Union Carbide (Ex. 3: 112, p.21) stated:

These sections, which pertain to compliance with applicable codes and standards for equipment testing and inspection, are very restrictive.

We suggest that this section be modified to provide employers the latitude to use internal engineering standards and practices and standards and practices recommended by equipment manufacturers, for compliance with this section.

Additionally, a commenter from the American Iron and Steel Institute (Ex. 3: 161, p.22) said:

Paragraph (j)(3) is unclear. It should be revised to specify that inspections and tests shall be performed on process equipment "in accordance with applicable codes, standards, or recognized and generally accepted engineering practice."

The codes and standards contained in proposed paragraph (j)(3)(ii) were examples of what the employer could use for inspection and testing of process equipment. The Agency did not intend to incorporate by reference into the standard all of the codes and standards published by these consensus groups. As noted above, the purpose of this proposed provision is to make sure that process equipment is inspected and tested properly, and that the inspections and tests are performed in accordance with appropriate codes and standards. The phrase suggested by rulemaking participants: "recognized and generally accepted good engineering practices" is consistent with OSHA's intent. The Agency also believes that this recommended phrase would include appropriate internal standards of a facility, as well as codes and standards published by NFPA, ASTM, ANSI, NFPA, etc.

Accordingly, proposed paragraph (j)(3)(ii) has been redesignated as paragraph (j)(4)(ii) in the final rule, and has been revised to read as follows:

Inspection and testing procedures shall follow recognized and generally accepted good engineering practices.

Paragraph (j)(3)(iii) of the proposal required the frequency of inspections and tests to be consistent with applicable codes and standards; or, more frequently if determined necessary by prior operating experience. This proposed provision was a performance-oriented requirement that would provide flexibility for the employer to choose the frequency which would provide the best assurance of equipment integrity.

Several rulemaking participants (e.g., Ex. 3: 12, 53, 97, 161) suggested that if this provision is to be truly performance-oriented, employers should have the flexibility to follow internal standards and manufacturers' recommendations as well as applicable codes and standards.



OSHA agrees with these rulemaking participants. Since the phrase "recognized and generally accepted good engineering practices" would include both appropriate internal standards and applicable codes and standards, the Agency has decided to use this phrase in this provision of the final rule.

Accordingly, proposed paragraph (j)(3)(iii) has been redesignated as paragraph (j)(4)(iii) in the final rule, and has been revised to read as follows:

The frequency of inspections and tests of process equipment shall be consistent with applicable manufacturers' recommendations and good engineering practices, and more frequently if determined to be necessary by prior operating experience.

Proposed paragraph (j)(3)(iv) required the employer to have a certification record that each inspection and test had been performed in accordance with paragraph (j). It also required that the certification identify the date of the inspection; the name of the person who performed the inspection and test; and, the serial number or other identifier of the equipment.

Several rulemaking participants (e.g., Ex. 3: 33, 39, 71, 101) disagreed with the use of the term "certification" because they believed that the term "certification" could be misinterpreted to mean an assurance by a third party. These rulemaking participants suggested that "documentation" would be a better term. For example, a commenter from Monsanto (Ex. 3: 64, p. 9) stated:

In paragraph (j)(3)(iv), Monsanto recommends that the requirement for certification be deleted. The tests and inspections should be documented but certification, which implies a signature, should not be required. Electronic storage of the documentation is necessary and certification prohibits that or requires parallel hard copy be maintained in the files which is unnecessary.

A commenter from IMCERA (Ex. 3: 158, p. 6) remarked:

IMCERA feels that the word "certification" should be replaced with "documentation." \* \* \* Certification is commonly used in connection with validation by an outside professional body. We believe that the word "documentation" would better serve in this statement and avoid unnecessary confusion.

OSHA agrees that the word "documentation" (or "document") is descriptive of the Agency's intention with respect to this information.

Additionally, since OSHA is permitting inspection and test procedures to follow recognized and generally accepted good engineering practices, the Agency believes that different information than that proposed should be included in the record to

identify the inspections and tests that were performed, and the results of those tests and inspections.

Therefore, proposed paragraph (j)(3)(iv) has been redesignated as paragraph (j)(4)(iv) in the final rule, and has been revised to read as follows:

The employer shall document each inspection and test that has been performed on process equipment. The documentation shall identify the date of the inspection or test; the name of the person who performed the inspection or test; the serial number or other identifier of the equipment; the inspection or test that is performed; and, the results of the inspection or test.

Proposed paragraph (j)(4) required the employer to correct deficiencies in equipment which are outside acceptable limits before further use. OSHA received some excellent comments on this proposed provision. While most rulemaking participants agreed with the concept that equipment deficiencies must be corrected, several commenters (e.g., Ex. 3: 26, 39, 53, 64, 161) disagreed that the deficiencies must be corrected "before further use." It was contended that the phrase "before further use" would mean that the process would have to be shutdown, and that shutdown has its own inherent hazards. It was suggested that equipment operating beyond acceptable limits does not *always* create a serious hazard. Participants asserted that deficiencies might need to be corrected promptly, or in a time and manner to assure safe operation instead. As an example, a commenter from Allied Signal (Ex. 3: 17, p. 13) said:

We recommend that the words "before further use" be deleted from paragraph (j)(4), and that the paragraph be rewritten to read:

"The employer shall promptly correct deficiencies in equipment which are outside acceptable limits." The rationale for this change is that it is not always possible to correct a deficiency before further use, particularly with continuous process units. Moreover, immediate or rushed shut-downs can introduce risks that could otherwise be avoided.

A commenter from the Chevron Corporation (Ex. 3: 26, p. 12) remarked:

Under (j)(4) the OSHA-proposed language seems to require that when deficiencies are found, the process must be shut down before further use. But not all deficiencies result in an unsafe condition. Chevron therefore recommends the following for (j)(4):

"The employer shall correct deficiencies in critical equipment which are outside acceptable limits, before further use or in a time and manner to ensure safe operation."

Another commenter, who was from the ARCO Chemical Company (ACC, Ex. 3: 71, p. 26-27), stated:

ACC recommends that OSHA revise the (text) \* \* \* to read as follows:

"The employer shall promptly correct deficiencies in critical equipment so that critical equipment is within safe and acceptable limits, which are included in the process safety information required by paragraph (d)".

This language would tie this section into the requirements of subparagraph (d)(3) which pertains to information covering the critical equipment in a process subject to the proposed rule.

This language has also substituted the word "promptly" for the phrase "before further use". This change is suggested to allow employers the decision-making responsibility for determining whether to continue to operate, to shut down, to isolate equipment, etc. Immediate actions can introduce increased process risks that could otherwise be avoided.

Additionally, a commenter from the AMOCO Corporation (Ex. 3: 95, p. 8) stated:

In refining processes, there are occasionally instances when a piece of equipment exceeds what is deemed "acceptable", and interim measures are taken to bring the equipment back into conformance with safe operating parameters. Under (j)(4) it would be mandatory to immediately shut down the entire process upon discovery of such a situation. Shutdowns and startups are inherently dangerous operations which we try to avoid unless absolutely necessary. In addition, the life expectancy of certain components is directly affected by the number of cycles to which they are subjected. We feel that safety is promoted rather than diminished by keeping shutdowns to a minimum. We therefore propose that the phrase "before further use" be replaced with "in a safe and timely manner".

The purpose of this proposed requirement was to require equipment deficiencies to be corrected promptly if the equipment was outside the acceptable limits specified in the process safety information. The comments have convinced OSHA that there may be many situations where it may not be necessary that the deficiencies be corrected "before further use" as long as the deficiencies are corrected in a safe and timely manner when necessary means are taken to assure safe operation.

Consequently, proposed paragraph (j)(4) has been redesignated as paragraph (j)(5) in the final rule, and has been revised to read as follows:

The employer shall correct deficiencies in equipment that are outside the acceptable limits defined by the process safety information in paragraph (d) before further use, or in a safe and timely manner when necessary means are taken to assure safe operation.



Paragraph (j)(5) of the proposal pertained to quality assurance of mechanical equipment. Proposed paragraph (j)(5)(i) required the employer to assure that equipment as fabricated meets design specifications. Some rulemaking participants (e.g., Ex. 3: 53, 59, 71; Tr. 1124) suggested that this proposed paragraph be clarified as it relates to the construction of new plants and equipment. The Agency agrees with these rulemaking participants since this was the actual intent of this proposed provision.

Another commenter (Ex. 3: 28) asserted that employers cannot be held accountable for the design specifications of the original equipment manufacturer, and suggested that the phrase, "meets design specifications" be replaced with the phrase, "is suitable for the process application." The Agency believes that the suggested change better describes the purpose of this proposed provision.

Accordingly, proposed paragraph (j)(5)(i) has been redesignated as paragraph (j)(6)(i) in the final rule, and has been revised to read as follows:

In the construction of new plants and equipment, the employer shall assure that equipment as it is fabricated is suitable for the process application for which it will be used.

Proposed paragraph (j)(5)(ii) required appropriate checks and inspections to be performed as necessary to assure that equipment is installed properly and consistent with design specifications and manufacturer's instructions. The Agency did not receive any negative comments on this proposed provision and it is contained in the final rule unchanged. However, it has been redesignated as paragraph (j)(6)(ii) in the final rule.

Proposed paragraph (j)(5)(iii) required the employer to assure that maintenance materials, and spare parts and equipment, meet design specifications. Some commenters (e.g., Ex. 3: 28, 127, 158) expressed concerns with the phrase, "meet design specifications" similar to the concerns discussed above regarding paragraph (j)(6)(i) of the final rule. To clarify the Agency's intent and in order to be consistent with paragraph (j)(6)(i) of the final rule, the proposed paragraph, which becomes final paragraph (j)(6)(iii), has been revised to read as follows:

The employer shall assure that maintenance materials, and spare parts and equipment are suitable for the process application for which they will be used.

#### *Hot Work Permit: Paragraph (k)*

In proposed paragraph (k)(1), OSHA required the employer to issue a permit

for all hot work operations. The purpose of this proposed provision was to assure that the employer was aware of the hot work being performed, and that appropriate safety precautions had been taken prior to beginning the work.

The Agency did propose certain exceptions to this provision which included the following: Where the employer or the employer's representative, designated as responsible for authorizing hot work operations, is present while the hot work is being performed; and in welding shops authorized by the employer.

While a few rulemaking participants agreed with the Agency's approach (e.g., Ex. 3: 62, 162), many rulemaking participants (e.g., Ex. 3: 38, 53, 59, 71, 121, 153; Tr. 312-13) opposed the exceptions to this proposed provision. For example, a commenter from the Food and Allied Service Trades, AFL-CIO (Ex. 3: 25, p. 9) stated:

The first exception would forego the issuance of a permit if the employer or employer's representative is present during the work. We feel that this exception is unfounded and should be deleted from the rule.

Permits are required as a means of requiring employers to reexamine any and all processes for potential dangers. We feel that this analysis should take place for all hot work that may be necessary.

A commenter from Hoechst Celanese (Ex. 3: 76, p.3) said:

The exception to hot work permits provided for in paragraph (k)(1) is not appropriate. Strict adherence to established hazardous work permitting procedures must be maintained to assure safe work activity.

Another commenter, who was from MARS Incorporated (Ex. 3: 87, p.15), remarked:

The proposed standard requires that a hot work permit be required except where the person responsible for the permit is present. We are opposed to such an exemption and to any system that authorizes "general" hot work permits. The purpose of the permit system is not only to assure that the appropriate personnel are notified of the work. It is also to remind the person performing the work of the steps necessary to perform the job safely. Merely having the authorizing person present does not assure that all the proper steps are followed. The only way to do this is to require a permit which follows a systematic approach to granting the authority to do the work.

The second exception given is for hot work in welding shops. Unless the welding shop is located in the process area, it is not clear that such a location would be covered by the proposed Standard.

A hearing participant from Organization Resources Counselors, Inc. (ORC, Tr. 312-13) testified:

In the proposal, OSHA has addressed the issue of hot work, but ORC strongly disagrees with the proposal to exempt from hot work permitting procedures those cases where "the employer or his representative designated as responsible for authorizing hot work operations is present while the work is being performed."

Hot work permits and procedures should be followed regardless of who is present. Consistent use of effective safety procedures is an important step in preventing incidents which can result in catastrophic releases, fires, and explosions.

Additionally, a commenter from Vulcan Chemicals (Ex. 3: 101A, p.4) stated:

Vulcan Chemicals disagrees with the exceptions for performing hot work in paragraph (k). There should not be an exception to the hot work requirements because of the presence of an individual authorizing the work.

OSHA agrees with the commenters that the permit reminds the person performing the work of the steps necessary to perform the work safely; and if the hot work is performed on or near a covered process, then a permit should be required regardless of who is present. Additionally, this proposed provision would not require a permit for hot work operations in a welding shop unless the welding shop was located in a process area covered by the standard. OSHA believes that such a location would not exist. Consequently, the Agency has concluded that the proposed exceptions to this hot work provision are not appropriate, and the exceptions have not been retained in the final rule.

Therefore, paragraph (k)(1) of the final rule has been revised to read as follows:

The employer shall issue a hot work permit for hot work operations conducted on or near a covered process.

Proposed paragraph (k)(2) required the permit to certify that the fire prevention and protection requirements contained in 29 CFR 1910.252(a) had been implemented prior to beginning the hot work operations; indicate the date authorized for the hot work; and identify the equipment or facility on which the hot work was to be performed. It also required the permit to be kept on file until completion of the hot work.

Most rulemaking participants supported this proposed provision. However, one commenter (Ex. 3: 53) suggested that the Agency not address the contents of the permit. The Agency disagrees with this suggestion because it believes that it is important that employers are informed of what the Agency expects the permit to contain.

Another commenter (Ex. 3: 158) suggested that the word "certify" be



replaced with the word "document." The Agency is accepting this suggestion because it believes that the word "document" is descriptive of the intent of this proposed provision and is consistent with other changes made elsewhere in the final rule.

Accordingly, paragraph (k)(2) of the final rule remains the same as that which was proposed except for minor editorial changes which were made to clarify the intent of the requirement.

#### *Management of Change: Paragraph (1)*

OSHA believes that one of the most important and necessary aspects of a process safety management program is appropriately managing changes to the process. This is because many of the incidents that the Agency has reviewed resulted from some type of change to the process (e.g., the Flixborough incident).

Proposed paragraph (1) addresses management of change. While the Agency received some excellent suggestions concerning minor changes to improve this proposed provision, there was wide support for including a provision concerning the management of change in the final rule (e.g., Ex. 3: 41, 48, 62, 69, 71, 95, 101).

OSHA believes that it is necessary to thoroughly evaluate any contemplated changes to a process to assess the potential impact on the safety and health of employees and to determine what modifications to operating procedures may be necessary.

Proposed paragraph (1)(1) required the employer to establish and implement written procedures to manage changes (except for "replacement in kind") to process chemicals, technology, and equipment; and changes to facilities.

A few rulemaking participants suggested that the Agency define the term, "replacement in kind." For example, a commenter from Johnson Wax (Ex. 3: 12, p.22) remarked:

Under this rule, "replacements in kind" were exempted from the management of change requirements. While this term was offset by quotations to denote a specific definition, there was no definition in the rule itself.

Since OSHA apparently has a specific situation in mind for using this term, it should be explainable. If this is the case, we suggest that OSHA define this term in this part.

A commenter from the EXXON Company, U.S.A., (EUSA, Ex. 3: 39, p.4) stated:

[S]ubparagraph (1)(1) excludes "replacement in kind" from requirements of that paragraph. This term needs to be defined to avoid misunderstandings, e.g., it does not mean replacement with the same brand and model number. EUSA recommends:

"Replacement in kind means a replacement which satisfies the design specifications".

OSHA agrees that this term should be defined and has included a definition for "replacement in kind" in paragraph (b) of the final rule.

Another commenter, who was from Air Products and Chemicals (Ex. 3: 84, p.3), said:

In Section (1) "Management of Change", the definition in subparagraph (1) is directed to physical changes only. It should be broadened to include changes in procedures. If a modification to the operating procedure is being recommended, it should undergo the same scrutiny as a piping change or other physical change.

The Agency agrees with this suggestion. OSHA believed that this intent was addressed in proposed paragraph (1)(2)(iii) and (1)(5). However, in order to resolve any ambiguity, the Agency is adding the word "procedures" to paragraph (1)(1) of the final rule.

Other rulemaking participants recommended that the phrase "changes to facilities" be replaced by the phrase "changes to facilities that affect a process." For example, a commenter from Amoco Corporation (Ex. 3: 95, p.8) stated:

Amoco endorses the management of change provisions at paragraph (1), with the provision that under (1)(1) " \* \* \* changes to facilities" be limited to " \* \* \* changes to facilities which affect a process", in order to exclude incidental changes which have no bearing on safety.

A commenter from the American Iron and Steel Institute (Ex. 3: 161, p.23) remarked:

Subsection (1) should be modified to make clear that it applies only to those changes which may affect process safety. For example, as currently defined, "facility" means the "buildings, containers, or equipment which contain a process". In the steel industry, the building containing a process may be quite large, and many changes could conceivably be made to the structure itself which would have no impact on the safety of the process contained within the building. We do not understand OSHA to intend that such a change would be subject to the requirements of subsection (1). This point should be made clear in the final rule.

Again, it was the intent of the Agency that the phrase "changes to facilities" would mean only those facilities that would have an impact on a process covered by the proposed standard. To clarify its intent, the Agency has revised paragraph (1)(1) of the final rule to read, "changes to facilities that affect a covered process."

Consequently, proposed paragraph (1)(1) has been revised in the final rule to read as follows:

The employer shall establish and implement written procedures to manage changes (except for "replacement in kind") to process chemicals, technology, equipment, and procedures; and, changes to facilities that affect a covered process.

Proposed paragraph (1)(2) contained several considerations that must be addressed prior to any change. OSHA did not receive any comments with respect to this proposed provision and it is contained in the final rule as proposed, except for a minor editorial change.

Proposed paragraph (1)(3) required that employees involved in the process be informed of and trained in the change in the process as early as practicable prior to its implementation. Some rulemaking participants (e.g., Ex. 3: 26, 69, 91, 101, 121) suggested that this proposed provision be revised to clarify that the Agency intended the phrase "employees involved in the process" to mean only operating employees. They asserted that this change would make it clear that the proposed provision did not apply to maintenance or contract workers. These commenters misinterpreted the Agency's intent. OSHA believes that all employees whose job tasks will be impacted by a change must be informed of and trained in those changes with respect to what affect such changes will have on their job tasks. Otherwise, contract employees or maintenance employees who are unaware of the change, may unwittingly cause an incident by doing their job tasks as they have in the past. OSHA believes this training requirement to be important for maintenance and contract employees as well as those employees involved in operating a process.

The Agency has revised this provision in the final rule to clarify that this information and training provision applies to operating employees as well as to maintenance and contract employees whose job tasks will be affected by the change.

Other rulemaking participants (e.g., Ex. 3: 26, 56, 59; Tr. 2015) recommended that the phrase "prior to its implementation" be changed to "prior to start-up" to eliminate a possible misinterpretation of meaning before the change is made. OSHA agrees that the requirements contained in this provision must be completed before start-up and not necessarily before implementation of the change.

Accordingly, proposed paragraph (1)(3) has been revised in the final rule to read as follows:

Employees involved in operating a process and maintenance and contract employees



whose job tasks will be affected by a change in the process shall be informed of, and trained in, the change prior to start-up of the process or the affected part of the process.

Paragraph (1)(4) of the proposal required that if a change covered by this paragraph results in a change to the process safety information, that such information be appended and/or updated in accordance with paragraph (d) of this section. The Agency did not receive any comments on this proposed provision. It is, therefore, contained in the final rule as proposed, except for minor editorial changes that were made to eliminate unnecessary words.

Proposed paragraph (1)(5) required that if a change covered by this paragraph results in a change to the operating procedures, such procedures shall be appended and/or updated in accordance with paragraph (f) of this section. Again OSHA did not receive any comments on this proposed provision and it is contained in the final rule as proposed except for minor editorial changes that were made to eliminate unnecessary words.

#### *Incident Investigation: Paragraph (m)*

OSHA included requirements for incident investigation in the proposal because a crucial part of any process safety management program is the thorough investigation of any incident that resulted in, or could reasonably have resulted in a catastrophic release of a highly hazardous chemical in the workplace. Such investigations are extremely important for identifying the chain of events leading to the incident and for determining causal factors. Information resulting from the investigation will be invaluable to the development and implementation of corrective measures and for use in subsequent process hazard analyses.

Proposed paragraph (m)(1) required the employer to investigate every incident which results in, or could reasonably have resulted in (near miss), a major accident in the workplace. This proposed provision received wide support throughout the rulemaking proceeding, although several rulemaking participants (e.g., Ex. 3: 12, 26, 69, 112, 121, 149, 158; Ex. 91; Tr. 678, 1938) were opposed to the use of the term "major accident." These commenters contended that if this term is to be used, then OSHA should define "major." Other rulemaking participants (e.g., Ex. 3: 17, 53, 64, 71; Tr. 1575) suggested that the term "major accident" be replaced with the term "catastrophic release" and then "catastrophic release" should be defined. OSHA agrees that the applicability of this proposed provision should be better defined. The Agency

has decided to replace the term "major accident" with the term "catastrophic release" since this term is more consistent with the focus of the final rule and as discussed has added a definition for "catastrophic release" to paragraph (b) of the final rule.

Consequently, proposed paragraph (m)(1) has been revised in the final rule to read as follows:

The employer shall investigate each incident which resulted in, or could reasonably have resulted in a catastrophic release of a highly hazardous chemical in the workplace.

Proposed paragraph (m)(2) required incident investigations to be initiated as promptly as possible, but no later than 48 hours following the incident. It is important that an incident investigation be initiated promptly so that events can be recounted as clearly as possible; to preserve crucial evidence; and so that there is less likelihood that the scene will have been disturbed. The Agency also realizes that circumstances may not facilitate an immediate investigation because of the potential emergency nature of some incidents. This is the reason that this proposed provision required investigations to be initiated as promptly as possible, "but not later than 48 hours following the incident."

A few rulemaking participants disagreed with the 48 hour requirement contained in this proposed provision, and suggested several alternatives. For example, a commenter from the National Solid Waste Management Association (Ex. 3: 57, p.8) remarked:

By "incident", NSWMA assumes that OSHA is referring to a release of a HHC. The NSWMA is opposed to the subjectivity introduced to this requirement by the word "could." In fact, all unintentional or unauthorized releases should be investigated. As weekends and holidays may interfere with the 48-hour deadline to initiate investigations, NSWMA recommends that the time frame be extended to 72 hours.

A commenter from Monsanto (Ex. 3: 64, p. 10) said:

Paragraph (m)(2) requires that an incident investigation begin no later than 48 hours following the incident. This is acceptable for incidents involving a fatality, multiple injuries or catastrophic releases. However, this is an unnecessarily stringent time requirement when investigating near-miss incidents [required in paragraph (m)(1)]. Frequently, such near-miss accidents are not recognized for their potential impact until more than 48 hours following the event. It is recommended that paragraph (m)(2) be changed to read:

"Incident investigations for catastrophic releases in the workplace shall be initiated as promptly as possible, but no later than 48 hours following the incident." This wording eliminates the 48 hour requirement for

incidents which could have but did not result in a major accident, i.e., near misses.

Also, a commenter from IMCERA (Ex. 3:158, p. 6-7) stated:

Should a potentially serious incident occur the employer would immediately conduct an investigation to determine cause and corrective action. This is just good safety and business practices. Rather than establish time frames i.e., 48 hours, IMCERA would prefer to see this section be reworded as follows:

Incident investigations shall be initiated as promptly as possible and completed in a timely manner.

As discussed previously, OSHA believes that it is necessary to initiate investigations as soon as possible after the incident and sees no reasonable basis for relating the time period to initiate the investigation to whether the incident was a fatality or a near miss. Although the Agency understands the concerns of these rulemaking participants, the Agency believes that the provision allows enough flexibility to the employer by requiring an incident investigation be initiated as soon as possible but not later than 48 hours following the incident. OSHA believes that 48 hours is a reasonable timeframe within which to initiate an investigation. Accordingly, proposed paragraph (m)(2) is contained in the final rule as proposed. It should also be noted that the investigation need only be initiated within this timeframe, not completed, although it is contemplated that there will not be unnecessary delay between initiation and completion of the incident investigation.

Paragraph (m)(3) of the proposal required an incident investigation team to be established and to consist of persons knowledgeable in the process involved and other appropriate specialties, as necessary.

While some rulemaking participants (e.g., Ex. 114; Tr. 2257) recommends that OSHA mandate that an employee representative be on the investigation team, most rulemaking participants (e.g., Ex. 3: 57, 108, 161; Ex. 101; Tr. 316, 678, 742, 1813) supported the performance-oriented approach of this proposed provision. These rulemaking participants asserted that the employer should be responsible for determining the composition of the team, and that the determination should be based on the ability of the team members to perform the investigation properly. Additionally, they stated that an employee representative may very well be selected to participate in the investigation; but, this should not be mandated by OSHA. OSHA is not requiring an employee representative on the process hazard analysis team or on



the incident investigation team. This issue has already been addressed in the discussion concerning final paragraph (c), employee participation.

The intent of OSHA is to assure that team members have the ability to properly perform the investigation promptly and that the employer have the flexibility to select team members (in consultation with employees and their representatives as described in paragraph (c)) that possess this ability. The Agency believes that this proposed paragraph adequately reflects this intent.

Additionally, the Agency believes that in cases where an incident involved a contract employer's work, then a contract employee should be involved in the investigation. Therefore, proposed paragraph (m)(3) has been revised to read as follows:

An incident investigation team shall be established and consist of at least one person knowledgeable in the process involved, including a contract employee if the incident involved work of the contractor, and other persons with appropriate knowledge and experience to thoroughly investigate and analyze the incident.

Proposed paragraph (m)(4) required a report to be prepared at the conclusion of the investigation which included, at a minimum, the date of the incident; date that the investigation began; a description of the incident; the factors that contributed to the incident; and, any recommendations resulting from the investigation.

A very small number of rule making participants (e.g., Ex. 3: 58, 64) contended that there was no benefit in specifying the date the investigation began. OSHA disagrees. The Agency wants to make sure that the investigation is initiated promptly. Consequently, it is important that the date of the incident, as well as the date that the investigation was initiated, are both specified.

OSHA did not receive any other negative comments with respect to the contents of the report specified by this proposed provision. Accordingly, proposed paragraph (m)(4) is included in the final rule as proposed.

Proposed paragraph (m)(5) required that the report be reviewed with all operating, maintenance, and other personnel whose work assignments are within the facility where the incident occurred. The purpose of this proposed provision is to assure that the report findings are disseminated to appropriate personnel, because the information contained in the report might be important in preventing similar incidents.

There was wide support for requiring dissemination of the information contained in the report to appropriate personnel. However, several rulemaking participants (e.g., Ex. 3: 57, 112, 121, 161) suggested changes to this proposed provision to better identify to whom this information should be disseminated. For example, a commenter for Kodak (Ex. 3: 33, p. 14) remarked:

OSHA should understand that there are large facilities, some number in the thousands of employees, where employees of various disciplines have no need to interact with one another. Most employees at these large facilities have no work relationship to other process activities outside their own work area and consequently have no need to be informed of information regarding a process or investigation they have no commitment to or responsibility for. We therefore, recommend the following statement for (m)(5):

"The report shall be reviewed with all appropriate personnel."

A commenter from CIBA-GEIGY (Ex. 3: 56, p. 2-3) said:

CIBA-GEIGY agrees that an incident which occurs in an operator's work area should be reviewed with all affected operators. However, this provision as specified by OSHA defines those operators which are affected, and this definition will not always be correct.

CIBA-GEIGY, therefore, recommends that the language be amended to read that the accident will be reviewed with those personnel who are directly involved with the operations in which the accident occurred.

Another commenter, who was from the ARCO Chemical Company (Ex. 3: 71, p. 31) asked OSHA to consider the following language:

The report shall be reviewed with all affected operating personnel who have a need to know and/or whose job tasks are relevant to the incident findings.

Additionally, a commenter from Vulcan Chemicals (Ex. 3: 101A, p. 5) stated:

Vulcan Chemicals recommends that this wording be changed to read:

The report shall be reviewed with all affected personnel whose job tasks are relevant to the incident findings.

After careful review of these comments, OSHA has decided to revise this proposed provision to more accurately identify to whom this information should be disseminated. Additionally, the Agency believes that the logical progression of an incident investigation is to address the report recommendations (discussed in proposed paragraph (m)(6)) before disseminating the information contained in the report to affected personnel.

Accordingly, proposed paragraph (m)(5) has been redesignated as

paragraph (m)(6) in the final rule, and has been revised to read as follows:

The report shall be reviewed with all affected personnel whose job tasks are relevant to the incident findings including contract employees when applicable.

Proposed paragraph (m)(6) required the employer to establish a system to promptly address the report findings and recommendations and to implement the report recommendations in a timely manner.

Many rulemaking participants (e.g., Ex. 3: 17, 26, 30, 33, 38, 45, 53, 59, 60, 81, 113; Ex. 128; Tr. 1124, 1811, 1938) disagreed that all of the report recommendations need to be implemented. It was contended that upon further evaluation, some recommendations may be inappropriate. These rulemaking participants suggested that the term "implemented" be replaced with such terms as "resolved", "addressed", or "respond." It was further suggested that resolution of the recommendations and findings be documented.

The Agency agrees that there may be situations where it is not necessary or appropriate to implement all of the report recommendations. It is the Agency's position, however, that it is necessary to document the resolution of the report findings and recommendations to assure that they have been adequately considered.

Accordingly, proposed paragraph (m)(6) has been redesignated as paragraph (m)(5) in the final rule, and has been revised to read as follows:

The employer shall establish a system to promptly address and resolve the report findings and recommendations. Resolutions and corrective actions shall be documented.

Paragraph (m)(7) of the proposal required incident investigation reports to be retained for five years in order to determine if an incident pattern develops or exists. A few rulemaking participants (e.g., Ex. 3: 97, 121) suggested that the investigation reports be retained for three years rather than five years. OSHA did consider a three-year retention period. However, the Agency believes it would be extremely useful if the report findings and recommendations were reviewed during the subsequent update or revalidation of the process hazard analysis. Consequently, the Agency believes it more appropriate to specify a five-year retention period to be consistent with paragraph (e) of the final rule, which requires the process hazard analysis to be updated or revalidated every five years. Therefore, proposed paragraph



(m)(7) is included in the final rule as proposed.

*Emergency Planning and Response:  
Paragraph (n)*

Proposed paragraph (n) required the employer to establish and implement an emergency action plan in accordance with the provisions contained in 29 CFR 1910.38(a). For information purposes the Agency also added a note that 29 CFR 1910.120 (a), (p) and (q) may also be applicable.

The Agency received little negative comment with respect to this proposed provision except with respect to the issue of drills discussed below. OSHA believes that the implementation of an emergency action plan is extremely important for plant sites which have processes covered by this standard because of the potential hazards posed by highly hazardous chemicals and the elements of the emergency action plan which must be implemented to preplan for emergencies involving these substances (including training) so that employees will be aware of, and execute, appropriate actions.

The emergency action plan requires, at a minimum, the implementation of, and training employees in, the following procedures:

Emergency escape procedures and emergency escape route assignments.

Procedures to be followed by employees who remain to operate critical plant operations before they evacuate.

Procedures to account for all employees after emergency evacuation has been completed;

Rescue and medical duties for those employees who are to perform them;

Preferred means of reporting fires and other emergencies; and

Names or regular job titles of persons or departments who can be contacted for further information or explanation of duties under the plan.

The emergency action plan also requires the establishment of a system to alert employees of an emergency. If the alarm system is to be used for alerting fire brigade members, or for some other purpose, a distinctive signal must be used for each purpose.

With respect to training, employers must review the emergency action plan with each employee initially when the plan is developed, whenever the employee's responsibilities or designated actions under the emergency action plan changes, and whenever the emergency action plan, itself, is changed.

OSHA believes that the preplanning and training required by the emergency action plan will assure the readiness of employees to respond appropriately and

safely to emergencies involving highly hazardous chemicals.

Additionally, as a part of emergency planning, OSHA is adding a provision that employers develop procedures to address small releases and spills, since it is not always obvious when such an event is, or is not, an emergency situation; and such an event may also warrant initiating an incident investigation.

The proposed paragraph concerning emergency planning and response was also the subject of one of the issues in the proposal (55 FR at 29159). The Agency asked whether or not drills or simulated exercises should be mandated by this proposed provision. Many participants addressed this issue and while the value of drills was expressed throughout this rulemaking record, most rulemaking participants who addressed this issue believed that drills should be recommended but not mandated (Ex. 3: 17, 26, 28, 29, 53, 59, 69, 80, 81, 109, 124, 156, 161).

The Agency has concluded that drills are certainly recommended, but OSHA believes that the employer is in the best position to assess the readiness of employees to respond correctly, to establish procedures for emergency action, including conducting drills or exercises when necessary. Additionally, OSHA believes that the subject of drills will be adequately addressed by the elements contained in the emergency action plan and applicable provisions of § 1910.120.

Paragraph (n) is included in the final rule as proposed except for the addition of a provision that requires establishment of procedures for handling small releases. Additionally, the note which made reference to the possible applicability of provisions contained in § 1910.120 has been added to the text of the provision.

*Compliance Safety Audits: Paragraph (o)*

This proposed paragraph contained provisions pertaining to an evaluation of an employer's process safety management system. OSHA believes that an audit with respect to compliance with the provisions contained in this section is an extremely important function. This is because it serves as a self-evaluation for employers to measure the effectiveness of their process safety management system. The audit can identify problem areas, and assist employers in directing attention to process safety management weaknesses.

Therefore, proposed paragraph (o)(1) required employers to certify that they have evaluated compliance with the

provisions of this section, at least every three years.

The concept of employers evaluating the effectiveness of their own process safety management system was endorsed, and widely supported, throughout this rulemaking process. However, there was some disagreement with the approach taken by OSHA in this proposed provision. Some rulemaking participants (e.g., Ex. 3: 71, 121) contended that paragraph (o) should focus more on evaluating the effectiveness of the process safety management system, rather than determining compliance with provisions contained in the standard. For example, a commenter from Kodak (Ex. 3: 33, p.2) remarked:

We are also concerned about the proposed Compliance Audit, which we suggest be retitled "Management Systems Audit." We agree that a periodic assessment is necessary, but it should be a review of the employer's entire process safety program, including elements that satisfy OSHA's requirements. It should not focus solely on the OSHA standard and must not be used for "compliance" purposes.

A commenter from Monsanto (Ex. 3: 64, p.11) stated:

Monsanto recommends that the title of this section be changed to "Management System Review". The focus should be an employer's review of its own process safety system, including compliance with this standard, not an employer's review of its compliance with this standard.

Other rulemaking participants (e.g. Ex. 3: 38, 119; Tr. 1014) suggested that the title of paragraph (o) be changed to "compliance audit" because it is more descriptive of the intent of this section. For example, a commenter from BP America (Ex. 3: 59, p.7) remarked:

BP America believes that paragraph (o) should be called "Compliance Audits" instead of "Compliance Safety Audits" to clarify the intent. The intent is to audit the Process Safety Management Program and is, therefore, an administrative audit, not a technical safety audit.

A commenter from IMCERA (Ex. 3: 158, p.7) stated:

OSHA should consider changing the title of Subpart (o) from "Compliance Safety Audit" to "Compliance Audit". The term "Compliance Audit" more accurately describes the intent of this section, which is designed to determine compliance with the provisions of the proposed rule.

The objective of proposed paragraph (o) is to assure that employers evaluate the effectiveness of their process safety management system as required by the standard. The Agency believes that an effective means of achieving this objective is by employers assuring that



the provisions contained in this standard are being met and in doing so, the employer will ascertain whether the procedures and practices required to be developed under the process safety management standard as adequate and being followed. Since this proposed paragraph contains provisions that focus on the means of achieving this objective, the Agency has decided to change the title of paragraph (o) of the final rule to "compliance audits" and to add wording to further clarify the intent of this provision.

Another concern expressed with respect to proposed paragraph (o)(1) was the requirement that audits be performed at least every three years. Some commenters (e.g., Ex. 3: 64, 70, 82; Ex. 143) asserted that every three years was too often and recommended a five year interval as an alternative.

OSHA disagrees. A five year interval between audits is too long. The Agency believes that it is necessary that audits be performed at least every three years in order to measure the effectiveness of the process safety management system. Accordingly, proposed paragraph (o)(1) has been retained in the final rule as proposed except for some additional clarifying language.

Proposed paragraph (o)(2) required that a team, comprised of at least one person knowledgeable in the process conduct the compliance audit. A few rulemaking participants (e.g., Ex. 3: 64, 71) remarked that it may not be necessary that the audit be performed by a "team." OSHA concurs. The Agency believes that it is important for the audit to be performed by at least one person knowledgeable in the process, but it is not necessary that it be performed by a team. Therefore, proposed paragraph (o)(2) has been revised in the final rule to read as follows:

The compliance audit shall be conducted by at least one person knowledgeable in the process.

Proposed paragraph (o)(3) required a report of the findings of the audit to be developed. There were no objections to the requirement that a report of the audit findings be developed. Therefore, proposed paragraph (o)(3) is contained in the final rule as proposed.

Proposed paragraph (o)(4) required the employer to promptly determine and document an appropriate response to each of the findings of the compliance audit, and certify that deficiencies have been corrected.

Some rulemaking participants (e.g., Ex. 38, 48, 64, 71, 158; Ex. 143) disagreed with the term "certify" and suggested that other terms such as

"document," "respond to," or "resolve" would be more descriptive of OSHA's intent.

The purpose of this proposed paragraph is to assure that employers determine an appropriate response to each of the report findings and if employers identify a deficiency that needs to be corrected, that they "document" the correction of the deficiency. Therefore, proposed paragraph (o)(4) is contained in the final rule as proposed except that the word "certify" has been replaced by the word "document."

Proposed paragraph (o)(5) required employers to retain the two most recent compliance audit reports, as well as the documented actions described in paragraph (o)(4) of this section. The purpose of this proposed provision is to focus on any continuing areas of concern that are identified through the compliance audits.

There were no objections to this proposed provision and it is contained in the final rule as proposed, except for minor editorial changes which were made to reflect the change in title of paragraph (o).

#### *Trade Secrets: Paragraph (p)*

A number of participants in the rulemaking expressed some concern that in the proposal OSHA did not appear to provide any trade secret protection (e.g., Ex. 3: 46, 48, 80, 89, 106A, 129; Ex. 53). One commenter suggested that OSHA might itself reveal trade secrets in that "items which include trade secret information collected by OSHA as a result of an inspection could be made public" (Ex. 128, p. 18). Others worried about the possibility that information could substantially affect the competitive position of an employer (Ex. 3: 71) and asked for some protection against unwarranted disclosure of such information (Ex. 3: 89).

As to concern that OSHA might itself reveal trade secret information, it should be noted that employers are amply protected under the U.S. Code, the Occupational Safety and Health Act and regulations promulgated under the Act. Federal law makes it a criminal offense for federal employees to disclose trade secret information that is not authorized by law (18 U.S.C. 1905). Section 15 of the Occupational Safety and Health Act (the Act) requires that all information reported to or obtained by a Compliance Safety and Health Officer (CSHO) in connection with any inspection or other activity which contains or which might reveal a trade secret to kept confidential. Such information shall not be disclosed except to other OSHA officials concerned with the

enforcement of the Act or, when relevant, in any proceeding under the Act. Other OSHA regulations further assure the protection of trade secrets (29 CFR 1903.7(b) and 1903.9). And the OSHA Field Operations Manual further emphasizes this point by stating "it is essential to the effective enforcement of the Act that the CSHO and all OSHA personnel preserve the confidentiality of all information and investigations which might reveal a trade secret" (III-58). Moreover, trade secret information is specifically excluded from disclosure under the Freedom of Information Act (5 U.S.C. 552(b)(4)).

As a general matter, OSHA believes that there are relatively few bona fide trade secrets among the information that is required to be gathered under this standard. However, the addition of provisions to protect trade secrets will give employers with legitimate trade secret concerns adequate protection, but require that they withhold information only on the basis of sound, legal justification.

Some commenters (e.g., Ex. 3: 76, 112) suggested that OSHA adopt the definition of "trade secret" used in the Hazard Communication standard; others, such as ARCO, suggested a more expansive (e.g., Ex. 3: 71, 106A) or more limited (e.g., Ex. 147) definition. OSHA has reviewed the definition of "trade secret" that is used in the Hazard Communication standard (29 CFR 1910.1200) and has decided to incorporate that definition of trade secret into the final standard. The Agency believes that this definition of trade secret is broad enough to offer adequate protection to employers with legitimate trade secrets, it is consistent with that used in the Restatement of Torts, and it has the additional advantage of being uniform with that used in the Hazard Communication standard so that many employers are already familiar with it. The final rule also incorporates Appendix D of the Hazard Communication standard which contains criteria to be used in determining whether material meets the definition of trade secret.

Some commenters (e.g., Ex. 3: 46, 80, 112) believed that trade secret information should be handled in the process safety management standard under the procedures set forth in the Hazard Communication standard. The United Steelworkers of America submitted for consideration a new draft section for trade secrets (Ex. 147, p.16-17). After reviewing these approaches and several others (see, for example, Ex. 3: 53), the Agency has decided that the best way of resolving the issue is to



adopt language that will clearly indicate the accessibility and the procedures for obtaining trade secret information under the final rule. Arguably the trade secret provisions (§ 1910.1200(i)) of the Hazard Communication standard alone would take care of access to all trade secret information pertinent to the process safety management rule; however some may feel that their application might be limited to chemical identity information. In order to clarify its intent, OSHA has specifically stated in the final rule that the employer must make all relevant information available to those individuals involved in carrying out various information using and compiling activities required by the final rule regardless of whether the information in question is considered a trade secret or not. This is vital to the effective operation of the process safety management rule. It is questionable as to how useful a compliance safety audit or a process hazard analysis could be if some of the information necessary to their completion were denied or delayed. The language is written in this way to emphasize the right to access this information. However, the employer may take reasonable steps, such as those described in the Hazard Communication standard, to protect against the unauthorized disclosure of trade secrets to unauthorized third persons. Such steps include the signing of a confidentiality agreement.

OSHA believes that employees and their representatives also may have the need to access such information. The final rule assures employees access to the process hazard analysis and other information required to be developed under the standard. Under certain circumstances, however, it might be appropriate to substitute more general information or to require some sort of a balancing of the need to know the information with the need to protect the employer. Therefore, the Agency is incorporating into the final rule the access procedures that were developed under the Hazard Communication standard with the exception of § 1910.1200(i)(13). Section 1910.1200(i)(13) provides "[n]othing in this paragraph shall be construed as requiring the disclosure under any circumstances of process or percentage of mixture information which is a trade secret." That section is not being incorporated into the process safety management trade secret provisions in recognition of the fact that employees are entitled to certain process information under the process safety management standard and this process information may at times contain trade

secret information. There is no reason why the Hazard Communication information access provisions will not work well for information contained in the process hazard analysis and other documents that contain trade secrets. Employers bear the burden of demonstrating that their trade secret claim is bona fide. The Agency will evaluate the appropriateness of that substantiation in the event that an employer denies a legitimate request for disclosure of the trade secret and a complaint is subsequently made to OSHA.

#### IV. Statutory Considerations

##### Introduction

Section 3(8) of the Act provides:

The term "occupational safety and health standard" means a standard which requires conditions, or the adoption or use of one or more practices, means, methods, operations, or processes, reasonably necessary or appropriate to provide safe or healthful employment and places of employment.

28 U.S.C. 652(8).

In two recent cases, reviewing courts expressed concern that OSHA's interpretation of this and other provisions of the Act pertaining to safety rulemaking could lead to overly costly or under-protective safety standards. In *International Union, UAW v. OSHA* 938 F.2d 1310 (D.C. Cir. 1991), the District of Columbia Circuit rejected substantive challenges to the lockout/tagout standard and denied a request that enforcement of that standard be stayed, but it also expressed concern that OSHA's interpretation of the Act could lead to safety standards that are very costly and only minimally protective. In *National Grain & Feed Ass'n v. OSHA*, 866 F.2d 717 (5th Cir. 1989), the Fifth Circuit concluded that Congress gave OSHA considerable discretion in structuring the costs and benefits of safety standards, but, concerned that the grain dust standard might be under-protective, directed OSHA to consider adding a provision that might further reduce significant risk of fire and explosion.

It is, of course, beyond doubt that OSHA rulemakings involve a significant degree of agency expertise and policy-making discretion to which reviewing courts must defer. See e.g., *Building & Constr. Trades Dep't, AFL-CIO v. Brock*, 838 F.2d 1258, 1266 (D.C. Cir. 1988); *Industrial Union Dep't, AFL-CIO v. American Petroleum Inst.*, 448 U.S. 607, 655 n. 62 (1980). At the same time, the agency's technical expertise and policy-making authority must be exercised within parameters. The lockout/tagout and grain handling standard decisions

sought from OSHA more clarification on the question of parameters. In light of those decisions, OSHA believes it would be useful to state its view of the limits of its safety rulemaking authority and to explain why the agency is confident that its interpretive views have in the past and will continue in the future to avoid regulatory extremes.

Stated briefly, the OSH Act requires that before promulgating any occupational safety standard, OSHA demonstrate based on substantial evidence in the record as a whole that: (1) The proposed standard will substantially reduce a significant risk of material harm; (2) compliance is technologically feasible in the sense that the protective measures being required already exist, can be brought into existence with available technology, or can be created with technology that can reasonably be developed; (3) compliance is economically feasible in the sense that industry can absorb or pass on the costs without major dislocation or threat of instability; and (4) the standard employs the least expensive protective measures capable of reducing or eliminating significant risk. In addition, proposed safety standards must be compatible with prior agency action, be responsive to significant comment in the record, and to the extent allowed by statute, be consistent with applicable Executive Orders. These elements set the parameters for safety rulemaking and a decision-making framework for developing a rule within the parameters.

##### A. Congress Concluded That OSHA Regulations are Necessary To Protect Workers From Occupational Hazards and That Employers Should Be Required To Reduce or Eliminate Significant Workplace Health and Safety Threats

At section 2(a) of the Act, Congress announced its determination that occupational injury and illness should be eliminated as much as possible. "The Congress finds that occupational injury and illness arising out of work situations impose a substantial burden upon, and are a hindrance to, interstate commerce in terms of lost production, wage loss, medical expenses, and disability compensation payments." 29 U.S.C. 651(a). Congress therefore declared "it to be its purpose and policy \* \* \* to assure so far as possible every working man and woman in the Nation safe \* \* \* working conditions" \* \* \*. 29 U.S.C. 651(b).

To that end, Congress instructed the Secretary of Labor to adopt existing federal and consensus standards during the first two years after the Act became



effective and, in the event of conflict among any such standards, to "promulgate the standard which assures the greatest protection of the safety or health of the affected employees." 29 U.S.C. 655(a). Congress also directed the Secretary to set mandatory occupational safety standards, 29 U.S.C. 651(b)(3), based on a rulemaking record and substantial evidence, 29 U.S.C. 655(b)(2), that are "reasonably necessary or appropriate to provide safe \* \* \* employment and place of employment." When promulgating permanent safety or health standards that differ from existing national consensus standards, the Secretary must explain "why the rule as adopted will better effectuate the purposes of this Act than the national consensus standard." 29 U.S.C. 655(b)(8). Correspondingly, every employer must comply with OSHA standards and, in addition, "furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees." 29 U.S.C. 654(a).

"Congress understood that the Act would create substantial costs for employers, yet intended to impose such costs when necessary to create a safe and healthful working environment. Congress viewed the costs of health and safety as a cost of doing business. \* \* \* Indeed, Congress thought that the financial costs of health and safety problems in the workplace were as large as or larger than the financial costs of eliminating these problems." *American Textile Mfrs. Inst. Inc. v. Donovan*, 452 U.S. 490, 519-522 (1981) ("ATMI") (emphasis in original). "[T]he fundamental objective of the Act [is] to prevent occupational deaths and serious injuries." *Whirlpool Corp. v. Marshall*, 445 U.S. 1, 11 (1980). "We know the costs would be put into consumer goods but that is the price we should pay for the 80 million workers in America." S. Rep. No. 91-1282, 91st Cong., 2d Sess. (1970); H.R. Rep. No. 91-1291, 91st Cong., 2d Sess. (1970), reprinted in Senate Committee on Labor and Public Welfare, Legislative History of the Occupational Safety and Health Act of 1970, (Committee Print 1971) ("Leg. Hist.") at 444 (Senator Yarborough). "Of course, it will cost a little more per item to produce a washing machine. Those of us who use washing machines will pay for the increased cost, but it is worth it, to stop the terrible death and injury rate in this country." *Id.* at 324; see also 510-511, 517.

[T]he vitality of the Nation's economy will be enhanced by the greater productivity

realized through saved lives and useful years of labor.

When one man is injured or disabled by an industrial accident or disease, it is he and his family who suffer the most immediate and personal loss. However, that tragic loss also affects each of us. As a result of occupational accidents and disease, over \$1.5 billion in wages is lost each year [1970 dollars], and the annual loss to the gross national product is estimated to be over \$8 billion. Vast resources that could be available for productive use are siphoned off to pay workmen's compensation and medical expenses. \* \* \*

Only through a comprehensive approach can we hope to effect a significant reduction in these job death and casualty figures.

*Id.* at 518-19 (Senator Cranston).

Congress considered uniform enforcement crucial because it would reduce or eliminate the disadvantage that a conscientious employer might experience where inter-industry or intra-industry competition is present. Moreover, "many employers—particularly smaller ones—simply cannot make the necessary investment in health and safety, and survive competitively, unless all are compelled to do so." Leg. Hist. at 144, 854, 1188, 1201.

Thus, the statutory text and legislative history make clear that Congress conclusively determined that OSHA regulations are necessary to protect workers from occupational hazards and that employers should be required to reduce or eliminate significant workplace health and safety threats.

B. As Construed by the Courts and by OSHA, the Act Sets a Threshold and a Ceiling for Safety Rulemaking That Provide Clear and Reasonable Parameters for Agency Action

OSHA has long followed the teaching that section 3(8) of the Act requires that before it promulgates "any permanent health or safety standard, [it must] make a threshold finding that a place of employment is unsafe—in the sense that significant risks are present and can be eliminated or lessened by a change in practices." *Industrial Union Dep't, AFL-CIO v. American Petroleum Inst.*, 448 U.S. 607, 642 (1980) (plurality) ("*Benzene*") (emphasis in original). When, as frequently happens in safety rulemaking, OSHA promulgates standards that differ from existing national consensus standards, it must explain "why the rule as adopted will better effectuate the purposes of this Act than the national consensus standard." 29 U.S.C. 655(b)(8). (National consensus and existing federal standards that Congress instructed OSHA to adopt summarily within two years of the Act's inception provide reference points

concerning the least an OSHA standard should achieve. 29 U.S.C. 655(a).)

As a result, OSHA is precluded from regulating insignificant safety risks or from issuing safety standards that do not at least lessen risk in a significant way. OSHA must also respond rationally to similarities and differences among industries or industry sectors. See *Building and Constr. Trades Dep't, AFL-CIO v. Brock*, 838 F.2d 1258, 1272-73 (D.C. Cir. 1988).

OSHA has also long accepted that "any standard that was not economically or technologically feasible would *a fortiori* not be 'reasonably necessary or appropriate' under the Act. See *Industrial Union Dep't v. Hodgson*, [499 F.2d 467, 478 (D.C. Cir. 1974)] ('Congress does not appear to have intended to protect employees by putting their employers out of business.')." *American Textile Mfrs. Inst. Inc.*, 452 U.S. at 513 n. 31; *American Iron and Steel Inst. v. OSHA*, 939 F.2d 975, 980 (D.C. Cir. 1991) [a standard is economically feasible even if it portends "disaster for some marginal firms," but it is economically infeasible if it "threaten[s] massive dislocation to, or imperil[s] the existence of," the industry].

By stating the test in terms of "threat" and "peril," the Supreme Court made clear in ATMI that infeasibility begins short of industry-wide bankruptcy. OSHA itself has placed the line considerably below industry-wide bankruptcy. See, for example, ATMI, 452 U.S. at 527 n. 50; 43 FR 27360 (June 23, 1978) (proposed 200  $\mu\text{g}/\text{m}^3$  PEL for cotton dust did not raise serious possibility of industry-wide bankruptcy, but impact on weaving sector would be severe, possibly requiring reconstruction of 90 percent of all weave rooms. OSHA concluded that the 200  $\mu\text{g}/\text{m}^3$  level was not feasible for weaving and that 750  $\mu\text{g}/\text{m}^3$  was all that could reasonably be required). See also 54 FR 29245-248 (July 11, 1989); *American Iron & Steel Institute*, 939 F.2d at 1003 (OSHA raised engineering control level for lead in small nonferrous foundries to avoid the possibility of bankruptcy for about half of small foundries even though the industry as a whole could have survived the loss of small firms).

OSHA standards must also be cost-effective in the sense that the protective measures being required must be the least expensive measures capable of achieving the desired end. ATMI, at 514 n. 32; *Building and Constr. Trades Dep't AFL-CIO v. Brock*, 838 F.2d 1258, 1269 (D.C. Cir. 1988). (Although the cotton dust and lead rulemakings involved health standards, the economic



feasibility ceiling established therein applies equally to safety standards. The feasibility boundary is the same for health and safety rulemaking since it comes from section 3(8), which governs all permanent OSHA standards.)

OSHA gives additional consideration to financial impact in setting the period of time that should be allowed for compliance, allowing as much as ten years for compliance phase-in. See *United Steelworkers of Am. v. Marshall*, 647 F.2d 1189, 1278 (D.C. Cir. 1980), cert. denied, 453 U.S. 913 (1981). In addition, OSHA's enforcement policy takes account of financial hardship on an individualized basis. OSHA's Field Operations Manual provides that, based on an employer's economic situation, OSHA may extend the period within which a violation must be corrected after issuance of a citation. CPL 2.45B, Chapter 3 E6d(3)(a) (Dec. 31, 1990).

To reach the necessary findings and conclusions, OSHA must conduct rulemaking to determine, based on substantial evidence, the qualitative and, if possible, quantitative nature of the risk with and without regulation, technological feasibility of compliance, availability of capital to the industry, the extent to which capital was required for other purposes, the industry's profit history, the industry's ability to absorb costs or pass them on to the consumer, the impact of higher costs on demand, and the impact on competition with substitutes and imports. See ATMI at 2501-2503; American Iron & Steel Institute generally.

OSHA's powers are further circumscribed by the independent Occupational Safety and Health Review Commission, which provides a neutral forum for employer contests of citations issued by OSHA for noncompliance with health and safety standards. 29 U.S.C. 659-661 (noted as an additional constraint in Benzene at 652 n. 59).

OSHA rulemaking is thus constrained first by the need to demonstrate that the standard will substantially reduce a significant risk of material harm, and then by the requirement that compliance is technologically capable of being done and not so expensive as to threaten economic instability or dislocation for the industry. Within these parameters, further constraints such as the need to find cost-effective measures and to respond rationally to all meaningful comment militate against regulatory extremes. Finally, it is axiomatic that significant departures from prior practice must be justified. *International Union, UAW v. Pendergrass*, 878 F.2d 389, 400 (D.C. 1989). In the twenty years since enactment, OSHA has promulgated numerous safety standards,

standards that provide benchmarks for judging risks, benefits, and feasibility of compliance in subsequent rulemakings. (OSHA's Hazardous Waste Operations and Emergency Response Standard, for example, required use of existing technology and well accepted safety practices to eliminate at least 32 deaths and 18,700 lost workday injuries at a cost of about \$153 million per year. 54 FR 9311-9312 (March 6, 1989). The excavation standard also drew on existing technology and recognized safety practices to save 74 lives and over 800 lost workday injuries annually at a cost of about \$306 million. 54 FR 45954 (Oct. 31, 1989). OSHA's Grain Handling Facilities standard relied primarily on simple housekeeping measures to save 18 lives and 394 injuries annually, at a total net cost of \$5.9 to \$33.4 million. 52 FR 49622 (Dec. 31, 1991).)

#### C. The PSM Standard Meets the Statutory Criteria

In promulgating the Clean Air Act Amendments of 1990, Congress conclusively determined that "a process safety standard designed to protect employees from hazards associated with accidental releases of highly hazardous chemicals in the workplace" is necessary and that the standard must, at a minimum, require employers to adopt fourteen specified planning, procedure and training safety measures. Public Law 101-549 (Nov. 15, 1990), reprinted at 29 U.S.C.A. 655 note (Supp. 1991). For the reasons explained in detail throughout this statement of findings and conclusions, the standard's fourteen planning, procedure and training requirements, when fully implemented, reduce the risk of catastrophic fire and explosion (330 fatalities and 1,917 injuries/illnesses annually) by 80 percent. This constitutes a substantial reduction of significant risk of material harm. Compliance is technologically feasible because the standard's requirements are already being implemented to some extent. Compliance is economically feasible because all regulated sectors can readily absorb or pass on compliance costs during the standard's first five years, and economic benefits will exceed compliance costs thereafter. The standard's costs, benefits, and compliance requirements are consistent with the Clean Air Act Amendments, as well as with other OSHA safety standards. OSHA considered and responded to all substantive comments on their merits; OSHA evaluated all suggestions for their impact on worker safety, their feasibility, their cost effectiveness, and their consonance with

the OSH Act and the Clean Air Act Amendments.

#### V. Summary of Regulatory Impact and Regulatory Flexibility Analysis, International Trade Impact Analysis, and Environmental Impact Assessment

##### Introduction

OSHA has created a new standard within Subpart H, Hazardous Materials, to deal with the risks involved in the storage, handling and processing of highly hazardous materials. The standard—referred to as process safety management, or PSM—emphasizes the application of management controls, rather than specific engineering guidelines, when addressing the risks associated with handling or working near hazardous chemicals. Implementation of process safety management programs and procedures will enable affected establishments to prevent the occurrence, and minimize the consequences, of significant releases of toxic substances, as well as fires, explosions and other types of catastrophic accidents.

The benefits of implementing PSM include the prevention of accidental fatalities, injuries and illnesses, and the avoidance of physical property damage. Furthermore, the standard will contribute to enhanced productivity due to fewer process disruptions and accidental shutdowns and decreased labor turnover as workers perceive a safer work environment; lead to more efficient utilization of space, labor and equipment in the wake of programmatic plant reviews; promote an integrated approach to process design, construction, operation, and maintenance, with process safety as the central focus of concern; reduce loss of raw materials and inadvertent waste generation; and increase product quality. Savings in these areas are expected to offset direct costs of compliance. OSHA also anticipates significant improvements in ergonomic and other chronic health and safety problems—including low-level exposure to toxic substances—through compliance with the PSM standard.

In response to recent catastrophic accidents in the petrochemical industry, OSHA in 1990 initiated the Special Emphasis Program in Petrochemical Industries (PETROSEP), whose purpose is to determine whether management systems governing safety and health procedures for maintenance activities, contractor activities, and operations are in place to control risk. The largest firms in SIC 2821, Plastic Materials and Resins, SIC 2869, Industrial Organic



Chemicals, Not Elsewhere Classified, and SIC 2911, Petroleum Refining, are the subject of the program. The PETROSEP program focuses the attention of plant managers and contractors on the need to integrate the PSM philosophy into the safety culture of the worksite.

Executive Order 12291 (46 FR 13197) requires that a regulatory impact analysis be prepared for any proposed regulation that meets the criteria for a "major rule"; that is, one that would result in an annual impact on the economy of \$100 million or more, have a major increase in cost or prices for consumers, individual industries, federal, state or local government agencies, or geographic regions, or have significant adverse effects on competition, employment, investment, productivity, innovation, or the ability of United States-based enterprises to compete with foreign-based enterprises in domestic or export markets. In addition, the Regulatory Flexibility Act (5 U.S.C. 601, *et seq.*) requires analysis of whether a regulation will have a significant economic impact on a substantial number of small entities.

Consistent with these requirements, OSHA has prepared this Regulatory Impact and Regulatory Flexibility Analysis for § 1910.119, Process Safety Management of Highly Hazardous Chemicals. The Regulatory Impact Analysis is a critical part of OSHA reasoning both on issues arising under the OSH Act and under the Executive Order. OSHA has explicitly relied on the RIA to support this final Process Safety Management rule. As a result of this analysis OSHA has determined that promulgation of § 1910.119 will constitute a major rule.

#### *Affected Industries and Current Compliance*

Based on a report prepared by Kearney/Centaur [Ex. 5] and a follow-up review of national chemical databases, OSHA has determined that 24,939 establishments in 127 industry subgroups will be affected by the PSM standard. The population at risk is an estimated 3.0 million workers (2.37 million plant employees and 653,000 contract employees) and is found throughout manufacturing, particularly in Standard Industrial Classification (SIC) code 28, Chemicals and Allied Products, SIC 37, Transportation Equipment, and SIC 34, Fabricated Metal Products, Except Machinery and Transportation Equipment. In addition to manufacturing, natural gas liquids (SIC 1321), farm product warehousing (SIC 4221), electric, gas, and sanitary services (SIC 49) and wholesale trade

(SICs 50 and 51) contain workers at risk. The extent of the impact will vary by industry depending on current practice, the number of processes, and the quantities of highly hazardous materials on site.

OSHA excluded from this final impact analysis establishments in California, Delaware and New Jersey, where process safety management statutes have already been enacted. In these three states the compliance burden is unaffected by the federal rule.

OSHA estimated current practices with the provisions of the process safety management rule using OSHA survey data, survey data compiled by a major chemical engineering magazine, and data in the rulemaking record. For all industries affected by the proposed rule, none are currently in full compliance, although compliance is greater than 75 percent among some establishments for some specific provisions. Generally, larger firms have a higher current compliance rate than smaller firms, but for many industries the compliance-rate differences by establishment size are not substantial.

#### *Nonregulatory Environment*

The primary objective of OSHA's process safety management standard is to reduce the number of employee fatalities and injuries associated with catastrophic releases of hazardous substances. OSHA believes that the PSM standard will eliminate to a considerable degree the risks which workers experience in the establishments falling within the scope of the rule.

The Agency examined the nonregulatory approaches for promoting the implementation of safety management programs, including (1) economic forces generated by the private market system, (2) incentives created by workers' compensation programs or the threat of private suits, and (3) related activities of private agencies. Following this review, OSHA determined that the need for government regulation arises from the significant risk of job-related injury or death caused by inadequate practices for preventing catastrophic accidents which currently exist in the industry. Private markets fail to provide enough safety and health resources due to the lack of information on risk, immobility of labor, and externalization of part of the social costs of worker injuries and deaths. Workers' compensation systems do not offer an adequate remedy because premiums do not reflect specific workplace risk and liability claims are restricted by statutes preventing employees from suing their employers.

While certain voluntary standards exist, their scope and approach fail to provide adequate protection for all workers. Thus, OSHA has determined that a federal standard is necessary.

#### *Technological Feasibility and Costs of Compliance*

OSHA reviewed the process safety management practices currently in place across industry as well as the recommended practices of industry trade associations and standards-setting organizations. On the basis of substantial current compliance found by OSHA and its consultants, widespread familiarity with the concepts and procedures of PSM, and the availability of technical consultation within and outside the affected sectors, OSHA has determined that the final rule for managing process hazards is technologically feasible.

OSHA estimated the costs of compliance with the PSM standard using information from the rulemaking record and from a report prepared under contract by Kearney/Centaur in 1990 [Ex. 5]. Most of the activities required by the PSM standard involve personnel time to develop programs and procedures, train employees, and carry out inspection activities. Capital costs will be incurred by firms when process hazard analyses and pre-startup safety reviews uncover the need to redesign processes and/or change equipment in order to reduce risks.

Consistent with the implementation schedule for completing initial process hazard analyses under Paragraph (e) of the standard, OSHA estimated compliance costs for two five-year periods. OSHA estimates that \$888.7 million in direct annualized costs will be required to comply with the standard during each of the first five years following implementation of the rule. Of this annual cost, \$470.8 million (53 percent) are attributed to Paragraph (e), Process Hazard Analysis, and \$179.1 million (20 percent) to Paragraph (1), Management of Change. Annualized compliance costs during Years 6-10 will be \$405.8 million. The decline in costs is largely related to the completion of process hazard analyses for existing operations.

Implementation of process safety management should generate cost savings in the forms of improved worker productivity, reduced incidence of property damage, diminished probability of lost production, and reduced employee turnover. Based upon an analysis by Kearney/Centaur, OSHA estimates that the value of annual PSM-related cost savings will be \$719.9



million in Years 1-5 and \$1.44 billion in Years 6-10. Subtracting the value of the cost savings from the annualized direct costs gives adjusted compliance costs of \$168.8 million in Years 1-5. Cost savings are expected to exceed direct costs for most industry groups in Years 6-10. OSHA believes the true economic cost of the standard is best reflected by the adjusted costs. Furthermore, the estimate may understate the true cost savings, in that insurance, administrative, and societal cost savings associated with accident prevention are not included in the assessment.

#### Benefits

OSHA anticipates that full compliance with the PSM standard will lead to fewer catastrophic fires, explosions, releases of hazardous substances and other types of serious accidents. It is expected that many minor incidents will be prevented as well. Using data from the OSHA Integrated Management Information System database and applying an adjustment based upon the analysis of Charles River Associates [Ex. 10] and Kearney/Centaur [Ex. 5], OSHA estimated the baseline number of fatalities and injuries/illnesses linked to the PSM standard for the period 1983-90. For the eight-year period, an average of 330 fatalities and 1,918 injuries/illnesses per year were associated with major accidents involving hazardous materials (these totals exclude fatalities and injuries in California, New Jersey and Delaware). Using an average risk-reduction estimate of 40 percent for Years 1-5 implementation phase, OSHA estimates that 132 fatalities and 767 catastrophic injuries/illnesses (including 250 lost-workday injuries) will be avoided annually through compliance with the standard. In Years 6-10, a risk reduction of 80 percent is projected, with 264 fatalities and 1,534 injuries/illnesses (including 500 catastrophic lost-workday injuries) avoided, annually.

In addition to the health and safety benefits from preventing catastrophic incidents, reductions in injuries and illnesses related to minor process disruptions are anticipated, as well as reductions in the long-run risks posed by occasional releases of toxic vapors and gases and by the physical hazards of poor process design.

#### Economic Impact and Regulatory Flexibility Analysis

OSHA assessed the potential economic impact of the PSM standard separately on large and small establishments and has determined that none of the major industry groups would experience a significant economic

burden as a result of the standard. If affected large establishments added the entire cost of compliance to the price of their final good, OSHA estimates that the average price increase would not exceed 0.07 percent during the ten-year period of analysis, based on the ratio of gross compliance costs to average establishment revenue. The maximum price increase in any major industry sector would be 0.7 percent. On the other hand, if all direct compliance costs were absorbed internally (and not passed forward to final customers), OSHA estimates that the average reduction in profits among large firms (20 or more employees) would approximate 1.2 percent.

While a few industry groups might experience profit reductions above 5 percent under the no-cost-pass-through scenario, the large-firm impact on the majority of affected major industry groups would be less than 3 percent of profit.

As required by the Regulatory Flexibility Act of 1980, OSHA assessed the economic burden faced by small establishments. For Years 1 through 5, the average ratio of direct cost to revenue for firms with fewer than twenty employees would be 0.23 percent. If small firms were to absorb the direct cost of regulation in full, profit reductions would average 3.4 percent for the first five years of implementation. Since profit impacts of less than 6 percent would be felt by the majority of small establishments under this scenario (zero cost offsets), OSHA has determined that the standard is economically feasible for small firms.

#### International Trade

OSHA is aware that the European and East Asian economic communities are introducing the concept of process safety management among their member countries. In time, European and Asian firms adopting PSM programs will experience the range of implementation costs estimated in this RIA for American firms. OSHA anticipates that as PSM becomes widespread throughout American industry, the productivity benefits and other cost-savings resulting from the rule could improve the competitiveness of American businesses.

During the implementation schedule, the standard is not likely to have a significant adverse effect on international trade because of the small magnitude of any price increase that would be required for passing forward compliance costs. As indicated above, the maximum price increases generated from the standard would be less than 0.3 percent for the majority of affected

establishments. Thus, no measurable impact on foreign trade is expected.

#### Environmental Assessment

The PSM standard has been reviewed in accordance with the requirements of the National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4321 *et seq.*), the regulations of the Council on Environmental Quality (CEQ) (40 CFR part 1500), and DOL NEPA Procedures (29 CFR part 11). The provisions of the standard focus on the reduction and avoidance of incidents involving toxic releases, fires and explosions. Consequently, no major negative impact is foreseen on air, water or soil quality, plant or animal life, the use of land or other aspects of the environment. OSHA believes that compliance with the standard will result in positive environmental effects in the form of fewer releases of toxic liquids, solids and gases into the air, soil and water.

#### VI. Federalism

This regulation has been reviewed in accordance with Executive Order 12612 (52 FR 41865, October 30, 1987) regarding Federalism. This Order requires that agencies, to the extent possible, refrain from limiting state policy options, consult with states prior to taking any actions which would restrict state policy options, and take such actions only when there is clear constitutional authority and the presence of a problem of national scope. The Order provides for preemption of state law only if there is a clear Congressional intent for the Agency to do so. Any such preemption is to be limited to the extent possible.

Section 18 of the Occupational Safety and Health Act (OSH Act) expresses Congress' clear intent to preempt state laws relating to issues on which Federal OSHA has promulgated safety and health standards. Under the OSHA Act, a state can avoid preemption only if it submits, and obtains Federal approval of a plan for the development of such standards and their enforcement. Occupational Safety and health standards developed by such State Plan-States must, among other things, be at least as effective in providing safe and healthful employment and places of employment as the Federal standards. Where such standards are applicable to products distributed or used in interstate commerce, they may not unduly burden commerce and must be justified by compelling local conditions (see section 28(c)(2) of the OSH Act).

The Federal final standard on process safety management of highly hazardous chemicals addresses hazards that are not unique to any one state or region of



the country. Nonetheless, states with occupational safety and health plans approved under section 18 of the OSHA Act will be able to develop their own state standards to deal with any special problems which might be encountered in a particular state. Moreover, because this standard is written in general, performance-oriented terms, there is considerable flexibility for state plans to require, and for affected employers to use, methods of compliance which are appropriate to the working conditions covered by the standard.

In brief, this proposed rule addresses a clear national problem related to occupational safety and health in general industry. Those states which have elected to participate under section 18 of the OSHA Act are not preempted by this standard, and will be able to address any special conditions within the framework of the Federal Act while ensuring that the state standards are at least as effective as that standard. State comments were considered prior to promulgation of this final rule.

#### VII. State Plan States

The 25 States and Territories with their own OSHA approved occupational safety and health plans must adopt a comparable standard within six months of the publication date of this final standard. These 25 States and Territories are: Alaska, Arizona, California, Connecticut (for State and local government employees only), Hawaii, Indiana, Iowa, Kentucky, Maryland, Michigan, Minnesota, Nevada, New Mexico, New York (for State and local government employee only), North Carolina, Oregon, Puerto Rico, South Carolina, Tennessee, Utah, Vermont, Virginia, Virgin Islands, Washington, and Wyoming. Until such time a state standard is promulgated, Federal OSHA will provide interim enforcement assistance, as appropriate, in these states.

#### List of Subjects in 29 CFR Part 1910

Explosive, Flammable liquids and gases, Hazard analysis, highly hazardous chemicals, Hazardous materials, Occupational safety and health, Safety, Process hazard analysis, Pyrotechnics.

#### Authority

This document has been prepared under the direction of Dorothy L. Strunk, Acting Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, 200 Constitution Avenue, NW., Washington DC 20210.

Accordingly, pursuant to sections 4, 6, and 8 of the Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655,

657); Section 304, Clean Air Act Amendments of 1990 (Pub. L. 101-549, Nov. 15, 1990, reprinted at 29 U.S.C. 655 Note (Supp. 1991)); Secretary of Labor's Order No. 1-90 (55 FR 9033); and 29 CFR part 1911, 29 CFR part 1910 is amended as set forth below.

Signed at Washington, DC, this 14th day of February, 1992.

Dorothy L. Strunk,

Acting Assistant Secretary of Labor.

### PART 1910—OCCUPATIONAL SAFETY AND HEALTH STANDARDS

1. The authority citation for Subpart H of Part 1910 is revised to read as follows:

Authority: Secs. 4, 6, 8, Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); Secretary of Labor's Order No. 12-71 (36 FR 8754), 8-76 (41 FR 25059), 9-83 (48 FR 35736) or 1-90 (55 FR 9033), as applicable.

Sections 1910.103, 1910.106, 1910.107, 1910.108, 1910.109, 1910.110, 1910.111 and 1910.119 are also issued under 29 CFR part 1911.

Section 1910.119 is also issued under Sec. 304, Clean Air Act Amendments of 1990 (Public Law 101-549, Nov. 15, 1990, reprinted at 29 U.S.C. 655 Note (Supp. 1991)).

Section 1910.120 is also issued under Sec. 126, Superfund Amendments and Reauthorization Act of 1986 as amended (29 U.S.C. 655 note), 5 U.S.C. 553, and 29 CFR part 1911.

2. Section 1910.109 is amended by revising paragraph (k) to read as follows:

#### § 1910.109 Explosives and blasting agents.

(k) *Scope.* (1) This section applies to the manufacture, keeping, having, storage, sale, transportation, and use of explosives, blasting agents, and pyrotechnics. The section does not apply to the sale and use (public display) of pyrotechnics, commonly known as fireworks, nor the use of explosives in the form prescribed by the official U.S. Pharmacopeia.

(2) The manufacture of explosives as defined in paragraph (a)(3) of this section shall also meet the requirements contained in § 1910.119.

(3) The manufacture of pyrotechnics as defined in paragraph (a)(10) of this section shall also meet the requirements contained in § 1910.119.

A new § 1910.119 and appendices A through D to § 1910.119 are added to read as follows:

#### § 1910.119 Process safety management of highly hazardous chemicals.

*Purpose.* This section contains requirements for preventing or minimizing the consequences of

catastrophic releases of toxic, reactive, flammable, or explosive chemicals. These releases may result in toxic, fire or explosion hazards.

(a) *Application.* (1) This section applies to the following:

(i) A process which involves a chemical at or above the specified threshold quantities listed in Appendix A to this section;

(ii) A process which involves a flammable liquid or gas (as defined in 1910.1200(c) of this part) on site in one location, in a quantity of 10,000 pounds (4535.9 kg) or more except for:

(A) Hydrocarbon fuels used solely for workplace consumption as a fuel (e.g., propane used for comfort heating, gasoline for vehicle refueling), if such fuels are not a part of a process containing another highly hazardous chemical covered by this standard;

(B) Flammable liquids stored in atmospheric tanks or transferred which are kept below their normal boiling point without benefit of chilling or refrigeration.

(2) This section does not apply to:

(i) Retail facilities;

(ii) Oil or gas well drilling or servicing operations; or

(iii) Normally unoccupied remote facilities.

(b) *Definitions.* *Atmospheric tank* means a storage tank which has been designed to operate at pressures from atmospheric through 0.5 p.s.i.g. (pounds per square inch gauge, 3.45 Kpa).

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

*Catastrophic release* means a major uncontrolled emission, fire, or explosion, involving one or more highly hazardous chemicals, that presents serious danger to employees in the workplace.

*Facility* means the buildings, containers or equipment which contain a process.

*Highly hazardous chemical* means a substance possessing toxic, reactive, flammable, or explosive properties and specified by paragraph (a)(1) of this section.

*Hot work* means work involving electric or gas welding, cutting, brazing, or similar flame or spark-producing operations.



*Normally unoccupied remote facility* means a facility which is operated, maintained or serviced by employees who visit the facility only periodically to check its operation and to perform necessary operating or maintenance tasks. No employees are permanently stationed at the facility.

Facilities meeting this definition are not contiguous with, and must be geographically remote from all other buildings, processes or persons.

*Process* means any activity involving a highly hazardous chemical including any use, storage, manufacturing, handling, or the on-site movement of such chemicals, or combination of these activities. For purposes of this definition, any group of vessels which are interconnected and separate vessels which are located such that a highly hazardous chemical could be involved in a potential release shall be considered a single process.

*Replacement in kind* means a replacement which satisfies the design specification.

*Trade secret* means any confidential formula, pattern, process, device, information or compilation of information that is used in an employer's business, and that gives the employer an opportunity to obtain an advantage over competitors who do not know or use it. Appendix D contained in § 1910.1200 sets out the criteria to be used in evaluating trade secrets.

(c) *Employee participation.* (1) Employers shall develop a written plan of action regarding the implementation of the employee participation required by this paragraph.

(2) Employers shall consult with employees and their representatives on the conduct and development of process hazards analyses and on the development of the other elements of process safety management in this standard.

(3) Employers shall provide to employees and their representatives access to process hazard analyses and to all other information required to be developed under this standard.

(d) *Process safety information.* In accordance with the schedule set forth in paragraph (e)(1) of this section, the employer shall complete a compilation of written process safety information before conducting any process hazard analysis required by the standard. The compilation of written process safety information is to enable the employer and the employees involved in operating the process to identify and understand the hazards posed by those processes involving highly hazardous chemicals. This process safety information shall include information pertaining to the

hazards of the highly hazardous chemicals used or produced by the process, information pertaining to the technology of the process, and information pertaining to the equipment in the process.

(1) *Information pertaining to the hazards of the highly hazardous chemicals in the process.* This information shall consist of at least the following:

- (i) Toxicity information;
- (ii) Permissible exposure limits;
- (iii) Physical data;
- (iv) Reactivity data;
- (v) Corrosivity data;
- (vi) Thermal and chemical stability data; and
- (vii) Hazardous effects of inadvertent mixing of different materials that could foreseeably occur.

Note: Material Safety Data Sheets meeting the requirements of 29 CFR 1910.1200(g) may be used to comply with this requirement to the extent they contain the information required by this subparagraph.

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

- (A) A block flow diagram or simplified process flow diagram (see Appendix B to this section);
- (B) Process chemistry;
- (C) Maximum intended inventory;
- (D) Safe upper and lower limits for such items as temperatures, pressures, flows or compositions; and,
- (E) An evaluation of the consequences of deviations, including those affecting the safety and health of employees.

(ii) Where the original technical information no longer exists, such information may be developed in conjunction with the process hazard analysis in sufficient detail to support the analysis.

(3) *Information pertaining to the equipment in the process.* (i) Information pertaining to the equipment in the process shall include:

- (A) Materials of construction;
- (B) Piping and instrument diagrams (P&ID's);
- (C) Electrical classification;
- (D) Relief system design and design basis;
- (E) Ventilation system design;
- (F) Design codes and standards employed;

(G) Material and energy balances for processes built after May 26, 1992; and,

(H) Safety systems (e.g. interlocks, detection or suppression systems).

(ii) The employer shall document that equipment complies with recognized

and generally accepted good engineering practices.

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

(e) *Process hazard analysis.* (1) The employer shall perform an initial process hazard analysis (hazard evaluation) on processes covered by this standard. The process hazard analysis shall be appropriate to the complexity of the process and shall identify, evaluate, and control the hazards involved in the process. Employers shall determine and document the priority order for conducting process hazard analyses based on a rationale which includes such considerations as extent of the process hazards, number of potentially affected employees, age of the process, and operating history of the process. The process hazard analysis shall be conducted as soon as possible, but not later than the following schedule:

(i) No less than 50 percent of the initial process hazards analyses shall be completed by May 26, 1994;

(ii) No less than 50 percent of the initial process hazards analyses shall be completed by May 26, 1995;

(iii) No less than 75 percent of the initial process hazards analyses shall be completed by May 26, 1996;

(iv) All initial process hazards analyses shall be completed by May 26, 1997.

(v) Process hazards analyses completed after May 26, 1987 which meet the requirements of this paragraph are acceptable as initial process hazards analyses. The process hazard analyses shall be updated and revalidated, based on their completion date, in accordance with paragraph (e)(6) of this section.

(2) The employer shall use one or more of the following methodologies that are appropriate to determine and evaluate the hazards of the process being analyzed.

- (i) What-If;
- (ii) Checklist;
- (iii) What-If/Checklist;
- (iv) Hazard and Operability Study (HAZOP);
- (v) Failure Mode and Effects Analysis (FMEA);
- (vi) Fault Tree Analysis; or
- (vii) An appropriate equivalent methodology.

(3) The process hazard analysis shall address:

- (i) The hazards of the process;



(ii) The identification of any previous incident which had a likely potential for catastrophic consequences in the workplace;

(iii) Engineering and administrative controls applicable to the hazards and their interrelationships such as appropriate application of detection methodologies to provide early warning of releases. (Acceptable detection methods might include process monitoring and control instrumentation with alarms, and detection hardware such as hydrocarbon sensors.);

(iv) Consequences of failure of engineering and administrative controls;

(v) Facility siting;

(vi) Human factors; and

(vii) A qualitative evaluation of a range of the possible safety and health effects of failure of controls on employees in the workplace.

(4) The process hazard analysis shall be performed by a team with expertise in engineering and process operations, and the team shall include at least one employee who has experience and knowledge specific to the process being evaluated. Also, one member of the team must be knowledgeable in the specific process hazard analysis methodology being used.

(5) The employer shall establish a system to promptly address the team's findings and recommendations; assure that the recommendations are resolved in a timely manner and that the resolution is documented; document what actions are to be taken; complete actions as soon as possible; develop a written schedule of when these actions are to be completed; communicate the actions to operating, maintenance and other employees whose work assignments are in the process and who may be affected by the recommendations or actions.

(6) At least every five (5) years after the completion of the initial process hazard analysis, the process hazard analysis shall be updated and revalidated by a team meeting the requirements in paragraph (e)(4) of this section, to assure that the process hazard analysis is consistent with the current process.

(7) Employers shall retain process hazards analyses and updates or revalidations for each process covered by this section, as well as the documented resolution of recommendations described in paragraph (e)(5) of this section for the life of the process.

(f) *Operating procedures* (1) The employer shall develop and implement written operating procedures that provide clear instructions for safety conducting activities involved in each

covered process consistent with the process safety information and shall address at least the following elements.

(i) *Steps for each operating phase:*

(A) Initial startup;

(B) Normal operations;

(C) Temporary operations;

(D) Emergency shutdown including the conditions under which emergency shutdown is required, and the assignment of shutdown responsibility to qualified operators to ensure that emergency shutdown is executed in a safe and timely manner.

(E) Emergency Operations;

(F) Normal shutdown; and,

(G) Startup following a turnaround, or after an emergency shutdown.

(ii) *Operating limits:*

(A) Consequences of deviation; and

(B) Steps required to correct or avoid deviation.

(iii) *Safety and health considerations:*

(A) Properties of, and hazards presented by, the chemicals used in the process;

(B) Precautions necessary to prevent exposure, including engineering controls, administrative controls, and personal protective equipment;

(C) Control measures to be taken if physical contact or airborne exposure occurs;

(D) Quality control for raw materials and control of hazardous chemical inventory levels; and,

(E) Any special or unique hazards.

(iv) *Safety systems and their functions.*

(2) Operating procedures shall be readily accessible to employees who work in or maintain a process.

(3) The operating procedures shall be reviewed as often as necessary to assure that they reflect current operating practice, including changes that result from changes in process chemicals, technology, and equipment, and changes to facilities. The employer shall certify annually that these operating procedures are current and accurate.

(4) The employer shall develop and implement safe work practices to provide for the control of hazards during operations such as lockout/tagout; confined space entry; opening process equipment or piping; and control over entrance into a facility by maintenance, contractor, laboratory, or other support personnel. These safe work practices shall apply to employees and contractor employees.

(g) *Training.* (1) *Initial training.* (i) Each employee presently involved in operating a process, and each employee before being involved in operating a newly assigned process, shall be trained in an overview of the process and in the operating procedures as specified in

paragraph (f) of this section. The training shall include emphasis on the specific safety and health hazards, emergency operations including shutdown, and safe work practices applicable to the employee's job tasks.

(ii) In lieu of initial training for those employees already involved in operating a process on May 26, 1992, an employer may certify in writing that the employee has the required knowledge, skills, and abilities to safely carry out the duties and responsibilities as specified in the operating procedures.

(2) *Refresher training.* Refresher training shall be provided at least every three years, and more often if necessary, to each employee involved in operating a process to assure that the employee understands and adheres to the current operating procedures of the process. The employer, in consultation with the employees involved in operating the process, shall determine the appropriate frequency of refresher training.

(3) *Training documentation.* The employer shall ascertain that each employee involved in operating a process has received and understood the training required by this paragraph. The employer shall prepare a record which contains the identity of the employee, the date of training, and the means used to verify that the employee understood the training.

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

(2) *Employer responsibilities.* (i) The employer, when selecting a contractor, shall obtain and evaluate information regarding the contract employer's safety performance and programs.

(ii) The employer shall inform contract employers of the known potential fire, explosion, or toxic release hazards related to the contractor's work and the process.

(iii) The employer shall explain to contract employers the applicable provisions of the emergency action plan required by paragraph (n) of this section.

(iv) The employer shall develop and implement safe work practices consistent with paragraph (f)(4) of this section, to control the entrance, presence and exit of contract employers and contract employees in covered process areas.



(v) The employer shall periodically evaluate the performance of contract employers in fulfilling their obligations as specified in paragraph (h)(3) of this section.

(vi) The employer shall maintain a contract employee injury and illness log related to the contractor's work in process areas.

**(3) Contract employer responsibilities.**

(i) The contract employer shall assure that each contract employee is trained in the work practices necessary to safely perform his/her job.

(ii) The contract employer shall assure that each contract employee is instructed in the known potential fire, explosion, or toxic release hazards related to his/her job and the process, and the applicable provisions of the emergency action plan.

(iii) The contract employer shall document that each contract employee has received and understood the training required by this paragraph. The contract employer shall prepare a record which contains the identity of the contract employee, the date of training, and the means used to verify that the employee understood the training.

(iv) The contract employer shall assure that each contract employee follows the safety rules of the facility including the safe work practices required by paragraph (f)(4) of this section.

(v) The contract employer shall advise the employer of any unique hazards presented by the contract employer's work, or of any hazards found by the contract employer's work.

(i) *Pre-startup safety review.* (1) The employer shall perform a pre-startup safety review for new facilities and for modified facilities when the modification is significant enough to require a change in the process safety information.

(2) The pre-startup safety review shall confirm that prior to the introduction of highly hazardous chemicals to a process:

(i) Construction and equipment is in accordance with design specifications;

(ii) Safety, operating, maintenance, and emergency procedures are in place and are adequate;

(iii) For new facilities, a process hazard analysis has been performed and recommendations have been resolved or implemented before startup; and modified facilities meet the requirements contained in management of change, paragraph (l).

(iv) Training of each employee involved in operating a process has been completed.

(j) *Mechanical integrity.* (1) *Application.* Paragraphs (j)(2) through

(j)(6) of this section apply to the following process equipment:

(i) Pressure vessels and storage tanks;

(ii) Piping systems (including piping components such as valves);

(iii) Relief and vent systems and devices;

(iv) Emergency shutdown systems;

(v) Controls (including monitoring devices and sensors, alarms, and interlocks) and,

(vi) Pumps.

(2) *Written Procedures.* The employer shall establish and implement written procedures to maintain the on-going integrity of process equipment.

(3) *Training for process maintenance activities.* The employer shall train each employee involved in maintaining the on-going integrity of process equipment in an overview of that process and its hazards and in the procedures applicable to the employee's job tasks to assure that the employee can perform the job tasks in a safe manner.

(4) *Inspection and testing.* (i) Inspections and tests shall be performed on process equipment.

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

(iii) The frequency of inspections and tests of process equipment shall be consistent with applicable manufacturers' recommendations and good engineering practices, and more frequently if determined to be necessary by prior operating experience.

(iv) The employer shall document each inspection and test that has been performed on process equipment. The documentation shall identify the date of the inspection or test, the name of the person who performed the inspection or test, the serial number or other identifier of the equipment on which the inspection or test was performed, a description of the inspection or test performed, and the results of the inspection or test.

(5) *Equipment deficiencies.* The employer shall correct deficiencies in equipment that are outside acceptable limits (defined by the process safety information in paragraph (d) of this section) before further use or in a safe and timely manner when necessary means are taken to assure safe operation.

(6) *Quality assurance.* (i) In the construction of new plants and equipment, the employer shall assure that equipment as it is fabricated is suitable for the process application for which it will be used.

(ii) Appropriate checks and inspections shall be performed to assure that equipment is installed properly and

consistent with design specifications and the manufacturer's instructions.

(iii) The employer shall assure that maintenance materials, spare parts and equipment are suitable for the process application for which they will be used.

(k) *Hot work permit.* (1) The employer shall issue a hot work permit for hot work operations conducted on or near a covered process.

(2) The permit shall document that the fire prevention and protection requirements in 29 CFR 1910.252(a) have been implemented prior to beginning the hot work operations; it shall indicate the date(s) authorized for hot work; and identify the object on which hot work is to be performed. The permit shall be kept on file until completion of the hot work operations.

(l) *Management of change.* (1) The employer shall establish and implement written procedures to manage changes (except for "replacements in kind") to process chemicals, technology, equipment, and procedures; and changes to facilities that affect a covered process.

(2) The procedures shall assure that the following considerations are addressed prior to any change:

(i) The technical basis for the proposed change;

(ii) Impact of change on safety and health;

(iii) Modifications to operating procedures;

(iv) Necessary time period for the change; and,

(v) Authorization requirements for the proposed change.

(3) Employees involved in operating a process and maintenance and contract employees whose job tasks will be affected by a change in the process shall be informed of, and trained in, the change prior to start-up of the process or affected part of the process.

(4) If a change covered by this paragraph results in a change in the process safety information required by paragraph (d) of this section, such information shall be updated accordingly.

(5) If a change covered by this paragraph results in a change in the operating procedures or practices required by paragraph (f) of this section, such procedures or practices shall be updated accordingly.

(m) *Incident investigation.* (1) The employer shall investigate each incident which resulted in, or could reasonably have resulted in a catastrophic release of highly hazardous chemical in the workplace.

(2) An incident investigation shall be initiated as promptly as possible, but not



later than 48 hours following the incident.

(3) An incident investigation team shall be established and consist of at least one person knowledgeable in the process involved, including a contract employee if the incident involved work of the contractor, and other persons with appropriate knowledge and experience to thoroughly investigate and analyze the incident.

(4) A report shall be prepared at the conclusion of the investigation which includes at a minimum:

- (i) Date of incident;
- (ii) Date investigation began;
- (iii) A description of the incident;
- (iv) The factors that contributed to the incident; and,
- (v) Any recommendations resulting from the investigation.

(5) The employer shall establish a system to promptly address and resolve the incident report findings and recommendations. Resolutions and corrective actions shall be documented.

(6) The report shall be reviewed with all affected personnel whose job tasks are relevant to the incident findings including contract employees where applicable.

(7) Incident investigation reports shall be retained for five years.

(n) *Emergency planning and response.* The employer shall establish and implement an emergency action plan for the entire plant in accordance with the provisions of 29 CFR 1910.38(a). In addition, the emergency action plan shall include procedures for handling small releases. Employers covered under this standard may also be subject to the hazardous waste and emergency response provisions contained in 29 CFR 1910.120 (a), (p) and (q).

(o) *Compliance Audits.* (1) Employers shall certify that they have evaluated compliance with the provisions of this section at least every three years to verify that the procedures and practices developed under the standard are adequate and are being followed.

(2) The compliance audit shall be conducted by at least one person knowledgeable in the process.

(3) A report of the findings of the audit shall be developed.

(4) The employer shall promptly determine and document an appropriate response to each of the findings of the compliance audit, and document that deficiencies have been corrected.

(5) Employers shall retain the two (2) most recent compliance audit reports.

(p) *Trade secrets.* (1) Employers shall make all information necessary to comply with the section available to those persons responsible for compiling the process safety information (required

by paragraph (d) of this section), those assisting in the development of the process hazard analysis (required by paragraph (e) of this section), those responsible for developing the operating procedures (required by paragraph (f) of this section), and those involved in incident investigations (required by paragraph (m) of this section), emergency planning and response (paragraph (n) of this section) and compliance audits (paragraph (o) of this section) without regard to possible trade secret status of such information.

(2) Nothing in this paragraph shall preclude the employer from requiring the persons to whom the information is made available under paragraph (p)(1) of this section to enter into confidentiality agreements not to disclose the information as set forth in 29 CFR 1910.1200.

(3) Subject to the rules and procedures set forth in 29 CFR 1910.1200(i)(1) through 1910.1200(i)(12), employees and their designated representatives shall have access to trade secret information contained within the process hazard analysis and other documents required to be developed by this standard.

#### Appendix A to § 1910.119—List of Highly Hazardous Chemicals, Toxics and Reactives (Mandatory)

This Appendix contains a listing of toxic and reactive highly hazardous chemicals which present a potential for a catastrophic event at or above the threshold quantity.

CHEMICAL name	CAS*	TQ**
Acetaldehyde	75-07-0	2500
Acrolein (2-Propenal)	107-02-8	150
Acrylyl Chloride	814-68-6	250
Allyl Chloride	107-05-1	1000
Allylamine	107-11-9	1000
Alkylaluminums	Varies	5000
Ammonia, Anhydrous	7664-41-7	10000
Ammonia solutions (>44% ammonia by weight)	7664-41-7	15000
Ammonium Perchlorate	7790-98-9	7500
Ammonium Permanganate	7787-36-2	7500
Arsine (also called Arsenic Hydride)	7784-42-1	100
Bis(Chloromethyl) Ether	542-88-1	100
Boron Trichloride	10294-34-5	2500
Boron Trifluoride	7637-07-2	250
Bromine	7726-95-8	1500
Bromine Chloride	13863-41-7	1500
Bromine Pentafluoride	7789-30-2	2500
Bromine Trifluoride	7787-71-5	15000
3-Bromopropyne (also called Propargyl Bromide)	106-96-7	100
Butyl Hydroperoxide (Tertiary)	75-91-2	5000
Butyl Perbenzoate (Tertiary)	614-45-9	7500
Carbonyl Chloride (see Phosgene)	75-44-5	100
Carbonyl Fluoride Cellulose Nitrate (concentration > 12.6% nitrogen)	9004-70-0	2500
Chlorine	7782-50-5	1500
Chlorine Dioxide	10049-04-4	1000

CHEMICAL name	CAS*	TQ**
Chlorine Pentafluoride	13637-83-3	1000
Chlorine Trifluoride	7790-91-2	1000
Chlorodiethylaluminum (also called Diethylaluminum Chloride)	96-10-8	5000
1-Chloro-2,4-Dinitrobenzene	97-00-7	5000
Chloromethyl Methyl Ether	107-30-2	500
Chloropicrin	76-06-2	500
Chloropicrin and Methyl Bromide mixture	None	1500
Chloropicrin and Methyl Chloride mixture	None	1500
Cumene Hydroperoxide	80-15-9	5000
Cyanogen	460-19-5	2500
Cyanogen Chloride	506-77-4	500
Cyanuric Fluoride	675-14-9	100
Diacetyl Peroxide (Concentration >70%)	110-22-5	5000
Diazomethane	334-88-3	500
Dibenzoyl Peroxide	94-36-0	7500
Diborane	19287-45-7	100
Dibutyl Peroxide (Tertiary)	110-05-4	5000
Dichloro Acetylene	7572-29-4	250
Dichlorosilane	4109-96-0	2500
Diethylzinc	557-20-0	10000
Diisopropyl Peroxydicarbonate	105-64-6	7500
Dilaluroyl Peroxide	105-74-8	7500
Dimethyldichlorosilane	75-78-5	1000
Dimethylhydrazine, 1,1-	57-14-7	1000
Dimethylamine, Anhydrous	124-40-3	2500
2,4-Dinitroaniline	97-02-9	5000
Ethyl Methyl Ketone Peroxide (also Methyl Ethyl Ketone Peroxide; concentration >60%)	1338-23-4	5000
Ethyl Nitrite	109-95-5	5000
Ethylamine	75-04-7	7500
Ethylene Fluorohydrin	371-62-0	100
Ethylene Oxide	75-21-8	5000
Ethyleneimine	151-56-4	1000
Fluorine	7782-41-4	1000
Formaldehyde (Formalin)	50-00-0	1000
Furan	110-00-9	500
Hexafluoroacetone	684-16-2	5000
Hydrochloric Acid, Anhydrous	7647-01-0	5000
Hydrofluoric Acid, Anhydrous	7664-39-3	1000
Hydrogen Bromide	10035-10-6	5000
Hydrogen Chloride	7647-01-0	5000
Hydrogen Cyanide, Anhydrous	74-90-8	1000
Hydrogen Fluoride	7664-39-3	1000
Hydrogen Peroxide (52% by weight or greater)	7722-84-1	7500
Hydrogen Selenide	7783-07-5	150
Hydrogen Sulfide	7783-06-4	1500
Hydroxylamine	7803-49-8	2500
Iron, Pentacarbonyl	13463-40-6	250
Isopropylamine	75-31-0	5000
Ketene	463-51-4	100
Methacrylaldehyde	78-85-3	1000
Methacryloyl Chloride	920-46-7	150
Methacryloyloxyethyl isocyanate	30674-80-7	100
Methyl Acrylonitrile	126-98-7	250
Methylamine, Anhydrous	74-89-5	1000
Methyl Bromide	74-83-9	2500
Methyl Chloride	74-87-3	15000
Methyl Chloroformate	79-22-1	500
Methyl Ethyl Ketone Peroxide (concentration >60%)	1338-23-4	5000
Methyl Fluoroacetate	453-18-9	100
Methyl Fluorosulfate	421-20-5	100
Methyl Hydrazine	60-34-4	100
Methyl Iodide	74-88-4	7500
Methyl Isocyanate	624-83-9	250
Methyl Mercaptan	74-93-1	5000
Methyl Vinyl Ketone	79-84-4	100
Methyltrichlorosilane	75-79-6	500
Nickel Carbonyl (Nickel Tetracarbonyl)	13463-39-3	150



CHEMICAL name	CAS*	TQ**	CHEMICAL name	CAS*	TQ**	CHEMICAL name	CAS*	TQ**
Nitric Acid (94.5% by weight or greater).....	7697-37-2	500	Perchloryl Fluoride .....	7616-94-6	5000	Sulfuric Anhydride (also called Sulfur Trioxide).....	7446-11-9	1000
Nitric Oxide.....	10102-43-9	250	Peroxyacetic Acid (concentration >60% Acetic Acid; also called Peroxyacetic Acid).....	79-21-0	1000	Tellurium Hexafluoride .....	7783-80-4	250
Nitroaniline (para Nitroaniline).....	100-01-6	5000	Phosgene (also called Carbonyl Chloride).....	75-44-5	100	Tetrafluoroethylene .....	116-14-3	5000
Nitromethane .....	75-52-5	2500	Phosphine (Hydrogen Phosphide).....	7803-51-2	100	Tetrafluorohydrazine.....	10036-47-2	5000
Nitrogen Dioxide.....	10102-44-0	250	Phosphorus Oxychloride (also called Phosphoryl Chloride).....	10025-87-3	1000	Tetramethyl Lead .....	75-74-1	1000
Nitrogen Oxides (NO; NO <sub>2</sub> ; N <sub>2</sub> O <sub>4</sub> ; N <sub>2</sub> O <sub>3</sub> ).....	10102-44-0	250	Phosphorus Trichloride.....	7719-12-2	1000	Thionyl Chloride.....	7719-09-7	250
Nitrogen Tetroxide (also called Nitrogen Peroxide).....	10544-72-8	250	Phosphoryl Chloride (also called Phosphorus Oxychloride).....	10025-87-3	1000	Trichloro (chloromethyl) Silane .....	1558-25-4	100
Nitrogen Trifluoride.....	7783-54-2	5000	Propargyl Bromide.....	106-96-7	100	Trichloro (dichlorophenyl) Silane .....	27137-85-5	2500
Nitrogen Trioxide.....	10544-73-7	250	Propyl Nitrate.....	627-3-4	2500	Trichlorosilane.....	10025-78-2	5000
Oleum (65% to 80% by weight; also called Fuming Sulfuric Acid).....	8014-94-7	1000	Sarin.....	107-44-8	100	Trifluorochloroethylene.....	79-38-9	10000
Osmium Tetroxide.....	20816-12-0	100	Selenium Hexafluoride.....	7783-79-1	1000	Trimethoxysilane.....	2487-90-3	1500
Oxygen Difluoride (Fluorine Monoxide).....	7783-41-7	100	Stibine (Antimony Hydride).....	7803-52-3	500			
Ozone.....	10028-15-8	100	Sulfur Dioxide (liquid).....	7446-09-5	1000			
Pentaborane.....	18624-22-7	100	Sulfur Pentafluoride.....	5714-22-7	250			
Peroxyacetic Acid (concentration >60% Acetic Acid; also called Peroxyacetic Acid).....	79-21-0	1000	Sulfur Tetrafluoride.....	7783-60-0	250			
Perchloric Acid (concentration >60% by weight).....	7601-90-3	5000	Sulfur Trioxide (also called Sulfuric Anhydride).....	7446-11-9	1000			
Perchloromethyl Mercaptan.....	594-42-3	150						

\*Chemical Abstract Service Number.

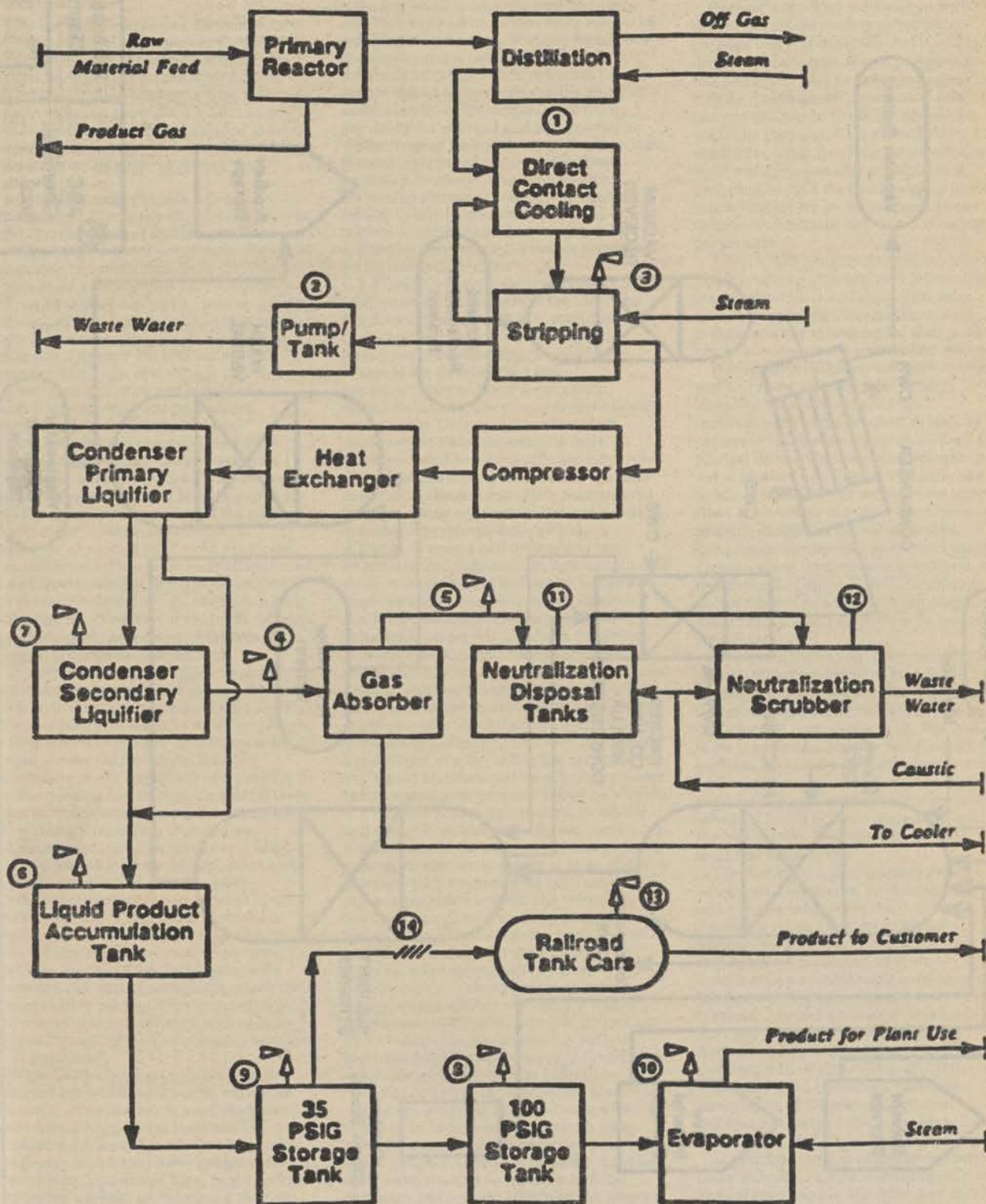
\*\*Threshold Quantity in Pounds (Amount necessary to be covered by this standard).

**Appendix B to § 1910.119—Block Flow Diagram and Simplified Process Flow Diagram (Nonmandatory)**

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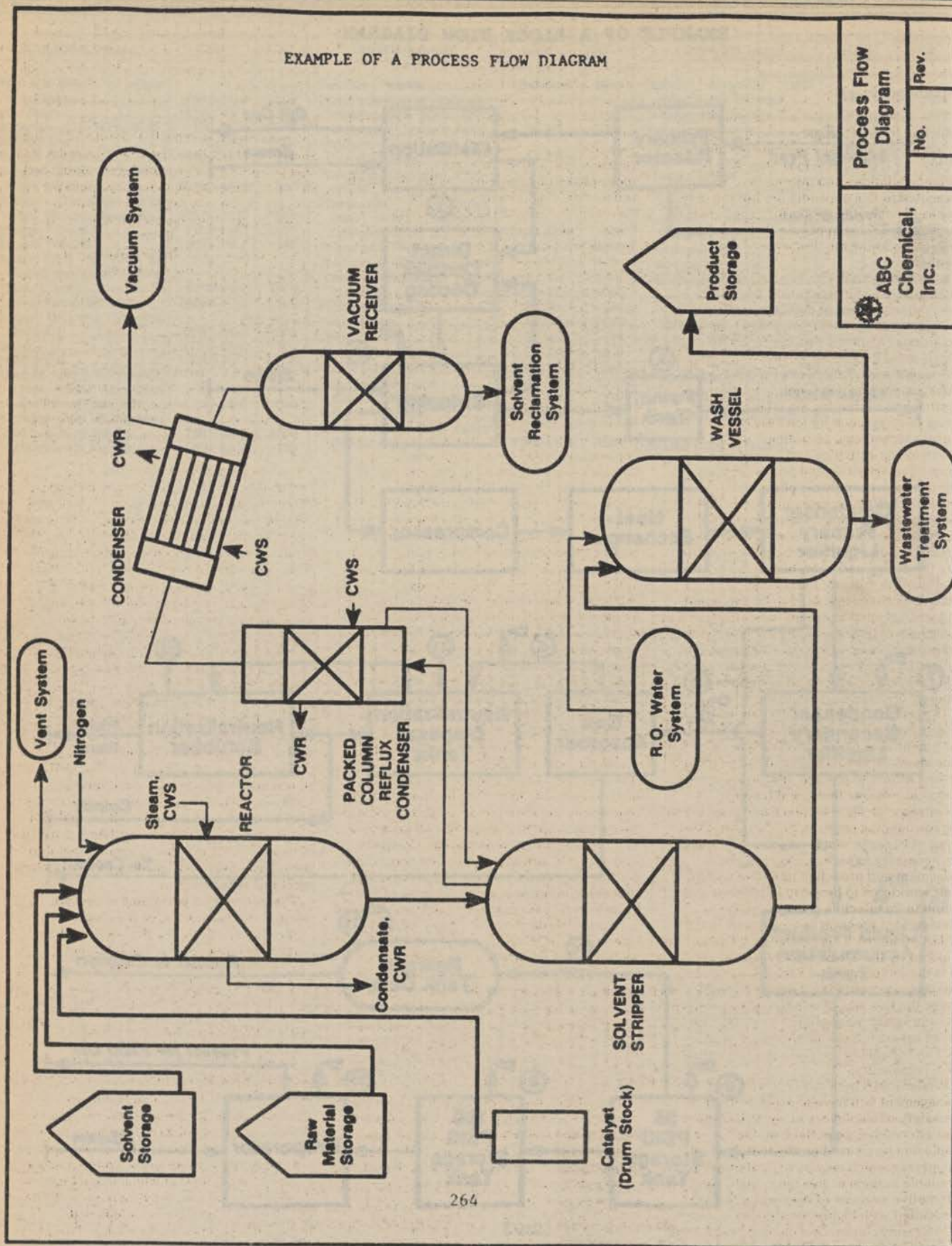


EXAMPLE OF A BLOCK FLOW DIAGRAM





EXAMPLE OF A PROCESS FLOW DIAGRAM



ABC Chemical, Inc.	Process Flow Diagram	
	No.	Rev.



### Appendix C to § 1910.119—Compliance Guidelines and Recommendations for Process Safety Management (Nonmandatory)

This appendix serves as a nonmandatory guideline to assist employers and employees in complying with the requirements of this section, as well as provides other helpful recommendations and information. Examples presented in this appendix are not the only means of achieving the performance goals in the standard. This appendix neither adds nor detracts from the requirements of the standard.

**1. Introduction to Process Safety Management.** The major objective of process safety management of highly hazardous chemicals is to prevent unwanted releases of hazardous chemicals especially into locations which could expose employees and others to serious hazards. An effective process safety management program requires a systematic approach to evaluating the whole process. Using this approach the process design, process technology, operational and maintenance activities and procedures, nonroutine activities and procedures, emergency preparedness plans and procedures, training programs, and other elements which impact the process are all considered in the evaluation. The various lines of defense that have been incorporated into the design and operation of the process to prevent or mitigate the release of hazardous chemicals need to be evaluated and strengthened to assure their effectiveness at each level. Process safety management is the proactive identification, evaluation and mitigation or prevention of chemical releases that could occur as a result of failures in process, procedures or equipment.

The process safety management standard targets highly hazardous chemicals that have the potential to cause a catastrophic incident. This standard as a whole is to aid employers in their efforts to prevent or mitigate episodic chemical releases that could lead to a catastrophe in the workplace and possibly to the surrounding community. To control these types of hazards, employers need to develop the necessary expertise, experiences, judgement and proactive initiative within their workforce to properly implement and maintain an effective process safety management program as envisioned in the OSHA standard. This OSHA standard is required by the Clean Air Act Amendments as is the Environmental Protection Agency's Risk Management Plan. Employers, who merge the two sets of requirements into their process safety management program, will better assure full compliance with each as well as enhancing their relationship with the local community.

While OSHA believes process safety management will have a positive effect on the safety of employees in workplaces and also offers other potential benefits to employers (increased productivity), smaller businesses which may have limited resources available to them at this time, might consider alternative avenues of decreasing the risks associated with highly hazardous chemicals at their workplaces. One method which might be considered is the reduction in the

inventory of the highly hazardous chemical. This reduction in inventory will result in a reduction of the risk or potential for a catastrophic incident. Also, employers including small employers may be able to establish more efficient inventory control by reducing the quantities of highly hazardous chemicals on site below the established threshold quantities. This reduction can be accomplished by ordering smaller shipments and maintaining the minimum inventory necessary for efficient and safe operation. When reduced inventory is not feasible, then the employer might consider dispersing inventory to several locations on site. Dispersing storage into locations where a release in one location will not cause a release in another location is a practical method to also reduce the risk or potential for catastrophic incidents.

**2. Employee Involvement in Process Safety Management.** Section 304 of the Clean Air Act Amendments states that employers are to consult with their employees and their representatives regarding the employers efforts in the development and implementation of the process safety management program elements and hazard assessments. Section 304 also requires employers to train and educate their employees and to inform affected employees of the findings from incident investigations required by the process safety management program. Many employers, under their safety and health programs, have already established means and methods to keep employees and their representatives informed about relevant safety and health issues and employers may be able to adapt these practices and procedures to meet their obligations under this standard. Employers who have not implemented an occupational safety and health program may wish to form a safety and health committee of employees and management representatives to help the employer meet the obligations specified by this standard. These committees can become a significant ally in helping the employer to implement and maintain an effective process safety management program for all employees.

**3. Process Safety Information.** Complete and accurate written information concerning process chemicals, process technology, and process equipment is essential to an effective process safety management program and to a process hazards analysis. The compiled information will be a necessary resource to a variety of users including the team that will perform the process hazards analysis as required under paragraph (e); those developing the training programs and the operating procedures; contractors whose employees will be working with the process; those conducting the pre-startup reviews; local emergency preparedness planners; and insurance and enforcement officials.

The information to be compiled about the chemicals, including process intermediates, needs to be comprehensive enough for an accurate assessment of the fire and explosion characteristics, reactivity hazards, the safety and health hazards to workers, and the corrosion and erosion effects on the process equipment and monitoring tools. Current material safety data sheet (MSDS) information can be used to help meet this

requirement which must be supplemented with process chemistry information including runaway reaction and over pressure hazards if applicable.

Process technology information will be a part of the process safety information package and it is expected that it will include diagrams of the type shown in Appendix B of this section as well as employer established criteria for maximum inventory levels for process chemicals; limits beyond which would be considered upset conditions; and a qualitative estimate of the consequences or results of deviation that could occur if operating beyond the established process limits. Employers are encouraged to use diagrams which will help users understand the process.

A block flow diagram is used to show the major process equipment and interconnecting process flow lines and show flow rates, stream composition, temperatures, and pressures when necessary for clarity. The block flow diagram is a simplified diagram.

Process flow diagrams are more complex and will show all main flow streams including valves to enhance the understanding of the process, as well as pressures and temperatures on all feed and product lines within all major vessels, in and out of headers and heat exchangers, and points of pressure and temperature control. Also, materials of construction information, pump capacities and pressure heads, compressor horsepower and vessel design pressures and temperatures are shown when necessary for clarity. In addition, major components of control loops are usually shown along with key utilities on process flow diagrams.

Piping and instrument diagrams (P&IDs) may be the more appropriate type of diagrams to show some of the above details and to display the information for the piping designer and engineering staff. The P&IDs are to be used to describe the relationships between equipment and instrumentation as well as other relevant information that will enhance clarity. Computer software programs which do P&IDs or other diagrams useful to the information package, may be used to help meet this requirement.

The information pertaining to process equipment design must be documented. In other words, what were the codes and standards relied on to establish good engineering practice. These codes and standards are published by such organizations as the American Society of Mechanical Engineers, American Petroleum Institute, American National Standards Institute, National Fire Protection Association, American Society for Testing and Materials, National Board of Boiler and Pressure Vessel Inspectors, National Association of Corrosion Engineers, American Society of Exchange Manufacturers Association, and model building code groups.

In addition, various engineering societies issue technical reports which impact process design. For example, the American Institute of Chemical Engineers has published technical reports on topics such as two phase flow for venting devices. This type of



technically recognized report would constitute good engineering practice.

For existing equipment designed and constructed many years ago in accordance with the codes and standards available at that time and no longer in general use today, the employer must document which codes and standards were used and that the design and construction along with the testing, inspection and operation are still suitable for the intended use. Where the process technology requires a design which departs from the applicable codes and standards, the employer must document that the design and construction is suitable for the intended purpose.

**4. Process Hazard Analysis.** A process hazard analysis (PHA), sometimes called a process hazard evaluation, is one of the most important elements of the process safety management program. A PHA is an organized and systematic effort to identify and analyze the significance of potential hazards associated with the processing or handling of highly hazardous chemicals. A PHA provides information which will assist employers and employees in making decisions for improving safety and reducing the consequences of unwanted or unplanned releases of hazardous chemicals. A PHA is directed toward analyzing potential causes and consequences of fires, explosions, releases of toxic or flammable chemicals and major spills of hazardous chemicals. The PHA focuses on equipment, instrumentation, utilities, human actions (routine and nonroutine), and external factors that might impact the process. These considerations assist in determining the hazards and potential failure points or failure modes in a process.

The selection of a PHA methodology or technique will be influenced by many factors including the amount of existing knowledge about the process. Is it a process that has been operated for a long period of time with little or no innovation and extensive experience has been generated with its use? Or, is it a new process or one which has been changed frequently by the inclusion of innovative features? Also, the size and complexity of the process will influence the decision as to the appropriate PHA methodology to use. All PHA methodologies are subject to certain limitations. For example, the checklist methodology works well when the process is very stable and no changes are made, but it is not as effective when the process has undergone extensive change. The checklist may miss the most recent changes and consequently the changes would not be evaluated. Another limitation to be considered concerns the assumptions made by the team or analyst. The PHA is dependent on good judgement and the assumptions made during the study need to be documented and understood by the team and reviewer and kept for a future PHA.

The team conducting the PHA need to understand the methodology that is going to be used. A PHA team can vary in size from two people to a number of people with varied operational and technical backgrounds. Some team members may only be a part of the team for a limited time. The team leader needs to be fully knowledgeable in the proper

implementation of the PHA methodology that is to be used and should be impartial in the evaluation. The other full or part time team members need to provide the team with expertise in areas such as process technology, process design, operating procedures and practices, including how the work is actually performed, alarms, emergency procedures, instrumentation, maintenance procedures, both routine and nonroutine tasks, including how the tasks are authorized, procurement of parts and supplies, safety and health, and any other relevant subject as the need dictates. At least one team member must be familiar with the process.

The ideal team will have an intimate knowledge of the standards, codes, specifications and regulations applicable to the process being studied. The selected team members need to be compatible and the team leader needs to be able to manage the team, and the PHA study. The team needs to be able to work together while benefiting from the expertise of others on the team or outside the team, to resolve issues, and to forge a consensus on the findings of the study and recommendations.

The application of a PHA to a process may involve the use of different methodologies for various parts of the process. For example, a process involving a series of unit operations of varying sizes, complexities, and ages may use different methodologies and team members for each operations. Then the conclusions can be integrated into one final study and evaluation. A more specific example is the use of a checklist PHA for a standard boiler or heat exchanger and the use of a Hazard and Operability PHA for the overall process. Also, for batch type processes like custom batch operations, a generic PHA of a representative batch may be used where there are only small changes of monomer or other ingredient ratios and the chemistry is documented for the full range and ratio of batch ingredients. Another process that might consider using a generic type of PHA is a gas plant. Often these plants are simply moved from site to site and therefore, a generic PHA may be used for these movable plants. Also, when an employer has several similar size gas plants and no sour gas is being processed at the site, then a generic PHA is feasible as long as the variations of the individual sites are accounted for in the PHA. Finally, when an employer has a large continuous process which has several control rooms for different portions of the process such as for a distillation tower and a blending operation, the employer may wish to do each segment separately and then integrate the final results.

Additionally, small businesses which are covered by this rule, will often have processes that have less storage volume, less capacity, and less complicated than processes at a large facility. Therefore, OSHA would anticipate that the less complex methodologies would be used to meet the process hazard analysis criteria in the standard. These process hazard analyses can be done in less time and with a few people being involved. A less complex process generally means that less data, P&IDs, and

process information is needed to perform a process hazard analysis.

Many small businesses have processes that are not unique, such as cold storage lockers or water treatment facilities. Where employer associations have a number of members with such facilities, a generic PHA, evolved from a checklist or what-if questions, could be developed and used by each employer effectively to reflect his/her particular process; this would simplify compliance for them.

When the employer has a number of processes which require a PHA, the employer must set up a priority system of which PHAs to conduct first. A preliminary or gross hazard analysis may be useful in prioritizing the processes that the employer has determined are subject to coverage by the process safety management standard. Consideration should first be given to those processes with the potential of adversely affecting the largest number of employees. This prioritizing should consider the potential severity of a chemical release, the number of potentially affected employees, the operating history of the process such as the frequency of chemical releases, the age of the process and any other relevant factors. These factors would suggest a ranking order and would suggest either using a weighing factor system or a systematic ranking method. The use of a preliminary hazard analysis would assist an employer in determining which process should be of the highest priority and thereby the employer would obtain the greatest improvement in safety at the facility.

Detailed guidance on the content and application of process hazard analysis methodologies is available from the American Institute of Chemical Engineers' Center for Chemical Process Safety (see appendix D).

**5. Operating Procedures and Practices.** Operating procedures describe tasks to be performed, data to be recorded, operating conditions to be maintained, samples to be collected, and safety and health precautions to be taken. The procedures need to be technically accurate, understandable to employees, and revised periodically to ensure that they reflect current operations. The process safety information package is to be used as a resource to better assure that the operating procedures and practices are consistent with the known hazards of the chemicals in the process and that the operating parameters are accurate. Operating procedures should be reviewed by engineering staff and operating personnel to ensure that they are accurate and provide practical instructions on how to actually carry out job duties safely.

Operating procedures will include specific instructions or details on what steps are to be taken or followed in carrying out the stated procedures. These operating instructions for each procedure should include the applicable safety precautions and should contain appropriate information on safety implications. For example, the operating procedures addressing operating parameters will contain operating instructions about pressure limits, temperature ranges, flow rates, what to do when an upset condition



occurs, what alarms and instruments are pertinent if an upset condition occurs, and other subjects. Another example of using operating instructions to properly implement operating procedures is in starting up or shutting down the process. In these cases, different parameters will be required from those of normal operation. These operating instructions need to clearly indicate the distinctions between startup and normal operations such as the appropriate allowances for heating up a unit to reach the normal operating parameters. Also the operating instructions need to describe the proper method for increasing the temperature of the unit until the normal operating temperature parameters are achieved.

Computerized process control systems add complexity to operating instructions. These operating instructions need to describe the logic of the software as well as the relationship between the equipment and the control system; otherwise, it may not be apparent to the operator.

Operating procedures and instructions are important for training operating personnel. The operating procedures are often viewed as the standard operating practices (SOPs) for operations. Control room personnel and operating staff, in general, need to have a full understanding of operating procedures. If workers are not fluent in English then procedures and instructions need to be prepared in a second language understood by the workers. In addition, operating procedures need to be changed when there is a change in the process as a result of the management of change procedures. The consequences of operating procedure changes need to be fully evaluated and the information conveyed to the personnel. For example, mechanical changes to the process made by the maintenance department (like changing a valve from steel to brass or other subtle changes) need to be evaluated to determine if operating procedures and practices also need to be changed. All management of change actions must be coordinated and integrated with current operating procedures and operating personnel must be oriented to the changes in procedures before the change is made. When the process is shut down in order to make a change, then the operating procedures must be updated before startup of the process.

Training in how to handle upset conditions must be accomplished as well as what operating personnel are to do in emergencies such as when a pump seal fails or a pipeline ruptures. Communication between operating personnel and workers performing work within the process area, such as nonroutine tasks, also must be maintained. The hazards of the tasks are to be conveyed to operating personnel in accordance with established procedures and to those performing the actual tasks. When the work is completed, operating personnel should be informed to provide closure on the job.

**6. Employee Training.** All employees, including maintenance and contractor employees, involved with highly hazardous chemicals need to fully understand the safety and health hazards of the chemicals and processes they work with for the protection of themselves, their fellow employees and the

citizens of nearby communities. Training conducted in compliance with § 1910.1200, the Hazard Communication standard, will help employees to be more knowledgeable about the chemicals they work with as well as familiarize them with reading and understanding MSDS. However, additional training in subjects such as operating procedures and safety work practices, emergency evacuation and response, safety procedures, routine and nonroutine work authorization activities, and other areas pertinent to process safety and health will need to be covered by an employer's training program.

In establishing their training programs, employers must clearly define the employees to be trained and what subjects are to be covered in their training. Employers in setting up their training program will need to clearly establish the goals and objectives they wish to achieve with the training that they provide to their employees. The learning goals or objectives should be written in clear measurable terms before the training begins. These goals and objectives need to be tailored to each of the specific training modules or segments. Employers should describe the important actions and conditions under which the employee will demonstrate competence or knowledge as well as what is acceptable performance.

Hands-on-training where employees are able to use their senses beyond listening, will enhance learning. For example, operating personnel, who will work in a control room or at control panels, would benefit by being trained at a simulated control panel or panels. Upset conditions of various types could be displayed on the simulator, and then the employee could go through the proper operating procedures to bring the simulator panel back to the normal operating parameters. A training environment could be created to help the trainee feel the full reality of the situation but, of course, under controlled conditions. This realistic type of training can be very effective in teaching employees correct procedures while allowing them to also see the consequences of what might happen if they do not follow established operating procedures. Other training techniques using videos or on-the-job training can also be very effective for teaching other job tasks, duties, or other important information. An effective training program will allow the employee to fully participate in the training process and to practice their skill or knowledge.

Employers need to periodically evaluate their training programs to see if the necessary skills, knowledge, and routines are being properly understood and implemented by their trained employees. The means or methods for evaluating the training should be developed along with the training program goals and objectives. Training program evaluation will help employers to determine the amount of training their employees understood, and whether the desired results were obtained. If, after the evaluation, it appears that the trained employees are not at the level of knowledge and skill that was expected, the employer will need to revise the training program, provide retraining, or provide more frequent refresher training

sessions until the deficiency is resolved. Those who conducted the training and those who received the training should also be consulted as to how best to improve the training process. If there is a language barrier, the language known to the trainees should be used to reinforce the training messages and information.

Careful consideration must be given to assure that employees including maintenance and contract employees receive current and updated training. For example, if changes are made to a process, impacted employees must be trained in the changes and understand the effects of the changes on their job tasks (e.g., any new operating procedures pertinent to their tasks). Additionally, as already discussed the evaluation of the employee's absorption of training will certainly influence the need for training.

**7. Contractors.** Employers who use contractors to perform work in and around processes that involve highly hazardous chemicals, will need to establish a screening process so that they hire and use contractors who accomplish the desired job tasks without compromising the safety and health of employees at a facility. For contractors, whose safety performance on the job is not known to the hiring employer, the employer will need to obtain information on injury and illness rates and experience and should obtain contractor references. Additionally, the employer must assure that the contractor has the appropriate job skills, knowledge and certifications (such as for pressure vessel welders). Contractor work methods and experiences should be evaluated. For example, does the contractor conducting demolition work swing loads over operating processes or does the contractor avoid such hazards?

Maintaining a site injury and illness log for contractors is another method employers must use to track and maintain current knowledge of work activities involving contract employees working on or adjacent to covered processes. Injury and illness logs of both the employer's employees and contract employees allow an employer to have full knowledge of process injury and illness experience. This log will also contain information which will be of use to those auditing process safety management compliance and those involved in incident investigations.

Contract employees must perform their work safely. Considering that contractors often perform very specialized and potentially hazardous tasks such as confined space entry activities and nonroutine repair activities it is quite important that their activities be controlled while they are working on or near a covered process. A permit system or work authorization system for these activities would also be helpful to all affected employers. The use of a work authorization system keeps an employer informed of contract employee activities, and as a benefit the employer will have better coordination and more management control over the work being performed in the process area. A well run and well maintained process where employee safety is fully recognized will benefit all of those who work in the



facility whether they be contract employees or employees of the owner.

8. *Pre-Startup Safety.* For new processes, the employer will find a PHA helpful in improving the design and construction of the process from a reliability and quality point of view. The safe operation of the new process will be enhanced by making use of the PHA recommendations before final installations are completed. P&IDs are to be completed along with having the operating procedures in place and the operating staff trained to run the process before startup. The initial startup procedures and normal operating procedures need to be fully evaluated as part of the pre-startup review to assure a safe transfer into the normal operating mode for meeting the process parameters.

For existing processes that have been shutdown for turnaround, or modification, etc., the employer must assure that any changes other than "replacement in kind" made to the process during shutdown go through the management of change procedures. P&IDs will need to be updated as necessary, as well as operating procedures and instructions. If the changes made to the process during shutdown are significant and impact the training program, then operating personnel as well as employees engaged in routine and nonroutine work in the process area may need some refresher or additional training in light of the changes. Any incident investigation recommendations, compliance audits or PHA recommendations need to be reviewed as well to see what impacts they may have on the process before beginning the startup.

9. *Mechanical Integrity.* Employers will need to review their maintenance programs and schedules to see if there are areas where "breakdown" maintenance is used rather than an on-going mechanical integrity program. Equipment used to process, store, or handle highly hazardous chemicals needs to be designed, constructed, installed and maintained to minimize the risk of releases of such chemicals. This requires that a mechanical integrity program be in place to assure the continued integrity of process equipment. Elements of a mechanical integrity program include the identification and categorization of equipment and instrumentation, inspections and tests, testing and inspection frequencies, development of maintenance procedures, training of maintenance personnel, the establishment of criteria for acceptable test results, documentation of test and inspection results, and documentation of manufacturer recommendations as to meantime to failure for equipment and instrumentation.

The first line of defense an employer has available is to operate and maintain the process as designed, and to keep the chemicals contained. This line of defense is backed up by the next line of defense which is the controlled release of chemicals through venting to scrubbers or flares, or to surge or overflow tanks which are designed to receive such chemicals, etc. These lines of defense are the primary lines of defense or means to prevent unwanted releases. The secondary lines of defense would include fixed fire protection systems like sprinklers, water spray, or deluge systems, monitor guns, etc.,

dikes, designed drainage systems, and other systems which would control or mitigate hazardous chemicals once an unwanted release occurs. These primary and secondary lines of defense are what the mechanical integrity program needs to protect and strengthen these primary and secondary lines of defenses where appropriate.

The first step of an effective mechanical integrity program is to compile and categorize a list of process equipment and instrumentation for inclusion in the program. This list would include pressure vessels, storage tanks, process piping, relief and vent systems, fire protection system components, emergency shutdown systems and alarms and interlocks and pumps. For the categorization of instrumentation and the listed equipment the employer would prioritize which pieces of equipment require closer scrutiny than others. Meantime to failure of various instrumentation and equipment parts would be known from the manufacturers data or the employer's experience with the parts, which would then influence the inspection and testing frequency and associated procedures. Also, applicable codes and standards such as the National Board Inspection Code, or those from the American Society for Testing and Material, American Petroleum Institute, National Fire Protection Association, American National Standards Institute, American Society of Mechanical Engineers, and other groups, provide information to help establish an effective testing and inspection frequency, as well as appropriate methodologies.

The applicable codes and standards provide criteria for external inspections for such items as foundation and supports, anchor bolts, concrete or steel supports, guy wires, nozzles and sprinklers, pipe hangers, grounding connections, protective coatings and insulation, and external metal surfaces of piping and vessels, etc. These codes and standards also provide information on methodologies for internal inspection, and a frequency formula based on the corrosion rate of the materials of construction. Also, erosion both internal and external needs to be considered along with corrosion effects for piping and valves. Where the corrosion rate is not known, a maximum inspection frequency is recommended, and methods of developing the corrosion rate are available in the codes. Internal inspections need to cover items such as vessel shell, bottom and head; metallic linings; nonmetallic linings; thickness measurements for vessels and piping; inspection for erosion, corrosion, cracking and bulges; internal equipment like trays, baffles, sensors and screens for erosion, corrosion or cracking and other deficiencies. Some of these inspections may be performed by state or local government inspectors under state and local statutes. However, each employer needs to develop procedures to ensure that tests and inspections are conducted properly and that consistency is maintained even where different employees may be involved. Appropriate training is to be provided to maintenance personnel to ensure that they understand the preventive maintenance program procedures, safe practices, and the

proper use and application of special equipment or unique tools that may be required. This training is part of the overall training program called for in the standard.

A quality assurance system is needed to help ensure that the proper materials of construction are used, that fabrication and inspection procedures are proper, and that installation procedures recognize field installation concerns. The quality assurance program is an essential part of the mechanical integrity program and will help to maintain the primary and secondary lines of defense that have been designed into the process to prevent unwanted chemical releases or those which control or mitigate a release. "As built" drawings, together with certifications of coded vessels and other equipment, and materials of construction need to be verified and retained in the quality assurance documentation. Equipment installation jobs need to be properly inspected in the field for use of proper materials and procedures and to assure that qualified craftsmen are used to do the job. The use of appropriate gaskets, packing, bolts, valves, lubricants and welding rods need to be verified in the field. Also procedures for installation of safety devices need to be verified, such as the torque on the bolts on ruptured disc installations, uniform torque on flange bolts, proper installation of pump seals, etc. If the quality of parts is a problem, it may be appropriate to conduct audits of the equipment supplier's facilities to better assure proper purchases of required equipment which is suitable for its intended service. Any changes in equipment that may become necessary will need to go through the management of change procedures.

10. *Nonroutine Work Authorizations.* Nonroutine work which is conducted in process areas needs to be controlled by the employer in a consistent manner. The hazards identified involving the work that is to be accomplished must be communicated to those doing the work, but also to those operating personnel whose work could affect the safety of the process. A work authorization notice or permit must have a procedure that describes the steps the maintenance supervisor, contractor representative or other person needs to follow to obtain the necessary clearance to get the job started. The work authorization procedures need to reference and coordinate, as applicable, lockout/tagout procedures, line breaking procedures, confined space entry procedures and hot work authorizations. This procedure also needs to provide clear steps to follow once the job is completed in order to provide closure for those that need to know the job is now completed and equipment can be returned to normal.

11. *Managing Change.* To properly manage changes to process chemicals, technology, equipment and facilities, one must define what is meant by change. In this process safety management standard, change includes all modifications to equipment, procedures, raw materials and processing conditions other than "replacement in kind". These changes need to be properly managed by identifying and reviewing them prior to implementation of the change. For example,



the operating procedures contain the operating parameters (pressure limits, temperature ranges, flow rates, etc.) and the importance of operating within these limits. While the operator must have the flexibility to maintain safe operation within the established parameters, any operation outside of these parameters requires review and approval by a written management of change procedure.

Management of change covers such as changes in process technology and changes to equipment and instrumentation. Changes in process technology can result from changes in production rates, raw materials, experimentation, equipment unavailability, new equipment, new product development, change in catalyst and changes in operating conditions to improve yield or quality. Equipment changes include among others change in materials of construction, equipment specifications, piping arrangements, experimental equipment, computer program revisions and changes in alarms and interlocks. Employers need to establish means and methods to detect both technical changes and mechanical changes.

Temporary changes have caused a number of catastrophes over the years, and employers need to establish ways to detect temporary changes as well as those that are permanent. It is important that a time limit for temporary changes be established and monitored since, without control, these changes may tend to become permanent. Temporary changes are subject to the management of change provisions. In addition, the management of change procedures are used to insure that the equipment and procedures are returned to their original or designed conditions at the end of the temporary change. Proper documentation and review of these changes is invaluable in assuring that the safety and health considerations are being incorporated into the operating procedures and the process.

Employers may wish to develop a form or clearance sheet to facilitate the processing of changes through the management of change procedures. A typical change form may include a description and the purpose of the change, the technical basis for the change, safety and health considerations, documentation of changes for the operating procedures, maintenance procedures, inspection and testing, P&IDs, electrical classification, training and communications, pre-startup inspection, duration if a temporary change, approvals and authorization. Where the impact of the change is minor and well understood, a check list reviewed by an authorized person with proper communication to others who are affected may be sufficient. However, for a more complex or significant design change, a hazard evaluation procedure with approvals by operations, maintenance, and safety departments may be appropriate. Changes in documents such as P&IDs, raw materials, operating procedures, mechanical integrity programs, electrical classifications, etc., need to be noted so that these revisions can be made permanent when the drawings and procedure manuals are updated. Copies of process changes need to be kept in an

accessible location to ensure that design changes are available to operating personnel as well as to PHA team members when a PHA is being done or one is being updated.

12. *Investigation of Incidents.* Incident investigation is the process of identifying the underlying causes of incidents and implementing steps to prevent similar events from occurring. The intent of an incident investigation is for employers to learn from past experiences and thus avoid repeating past mistakes. The incidents for which OSHA expects employers to become aware and to investigate are the types of events which result in or could reasonably have resulted in a catastrophic release. Some of the events are sometimes referred to as "near misses," meaning that a serious consequence did not occur, but could have.

Employers need to develop in-house capability to investigate incidents that occur in their facilities. A team needs to be assembled by the employer and trained in the techniques of investigation including how to conduct interviews of witnesses, needed documentation and report writing. A multi-disciplinary team is better able to gather the facts of the event and to analyze them and develop plausible scenarios as to what happened, and why. Team members should be selected on the basis of their training, knowledge and ability to contribute to a team effort to fully investigate the incident. Employees in the process area where the incident occurred should be consulted, interviewed or made a member of the team. Their knowledge of the events form a significant set of facts about the incident which occurred. The report, its findings and recommendations are to be shared with those who can benefit from the information. The cooperation of employees is essential to an effective incident investigation. The focus of the investigation should be to obtain facts, and not to place blame. The team and the investigation process should clearly deal with all involved individuals in a fair, open and consistent manner.

13. *Emergency Preparedness.* Each employer must address what actions employees are to take when there is an unwanted release of highly hazardous chemicals. Emergency preparedness or the employer's tertiary (third) lines of defense are those that will be relied on along with the secondary lines of defense which are used to prevent an unwanted release fail to stop the release. Employers will need to decide if they want employees to handle and stop small or minor incidental releases. Whether they wish to mobilize the available resources at the plant and have them brought to bear on a more significant release. Or whether employers want their employees to evacuate the danger area and promptly escape to a preplanned safe zone area, and allow the local community emergency response organizations to handle the release. Or whether the employer wants to use some combination of these actions. Employers will need to select how many different emergency preparedness or tertiary lines of defense they plan to have and then develop the necessary plans and procedures, and appropriately train employees in their emergency duties and

responsibilities and then implement these lines of defense.

Employers at a minimum must have an emergency action plan which will facilitate the prompt evacuation of employees due to an unwanted release of a highly hazardous chemical. This means that the employer will have a plan that will be activated by an alarm system to alert employees when to evacuate and, that employees who are physically impaired, will have the necessary support and assistance to get them to the safe zone as well. The intent of these requirements is to alert and move employees to a safe zone quickly. Delaying alarms or confusing alarms are to be avoided. The use of process control centers or similar process buildings in the process area as safe areas is discouraged. Recent catastrophes have shown that a large life loss has occurred in these structures because of where they have been sited and because they are not necessarily designed to withstand overpressures from shockwaves resulting from explosions in the process area.

Unwanted incidental releases of highly hazardous chemicals in the process area must be addressed by the employer as to what actions employees are to take. If the employer wants employees to evacuate the area, then the emergency action plan will be activated. For outdoor processes where wind direction is important for selecting the safe route to a refuge area, the employer should place a wind direction indicator such as a wind sock or pennant at the highest point that can be seen throughout the process area. Employees can move in the direction of cross wind to upwind to gain safe access to the refuge area by knowing the wind direction.

If the employer wants specific employees in the release area to control or stop the minor emergency or incidental release, these actions must be planned for in advance and procedures developed and implemented. Preplanning for handling incidental releases for minor emergencies in the process area needs to be done, appropriate equipment for the hazards must be provided, and training conducted for those employees who will perform the emergency work before they respond to handle an actual release. The employer's training program, including the Hazard Communication standard training is to address the training needs for employees who are expected to handle incidental or minor releases.

Preplanning for releases that are more serious than incidental releases is another important line of defense to be used by the employer. When a serious release of a highly hazardous chemical occurs, the employer through preplanning will have determined in advance what actions employees are to take. The evacuation of the immediate release area and other areas as necessary would be accomplished under the emergency action plan. If the employer wishes to use plant personnel such as a fire brigade, spill control team, a hazardous materials team, or use employees to render aid to those in the immediate release area and control or mitigate the incident, these actions are covered by § 1910.120, the Hazardous Waste Operations and Emergency Response



(HAZWOPER) standard. If outside assistance is necessary, such as through mutual aid agreements between employers or local government emergency response organizations, these emergency responders are also covered by HAZWOPER. The safety and health protections required for emergency responders are the responsibility of their employers and of the on-scene incident commander.

Responders may be working under very hazardous conditions and therefore the objective is to have them competently led by an on-scene incident commander and the commander's staff, properly equipped to do their assigned work safely, and fully trained to carry out their duties safely before they respond to an emergency. Drills, training exercises, or simulations with the local community emergency response planners and responder organizations is one means to obtain better preparedness. This close cooperation and coordination between plant and local community emergency preparedness managers will also aid the employer in complying with the Environmental Protection Agency's Risk Management Plan criteria.

One effective way for medium to large facilities to enhance coordination and communication during emergencies for on plant operations and with local community organizations is for employers to establish and equip an emergency control center. The emergency control center would be sited in a safe zone area so that it could be occupied throughout the duration of an emergency. The center would serve as the major communication link between the on-scene incident commander and plant or corporate management as well as with the local community officials. The communication equipment in the emergency control center should include a network to receive and transmit information by telephone, radio or other means. It is important to have a backup communication network in case of power failure or one communication means fails. The center should also be equipped with the plant layout and community maps, utility drawings including fire water, emergency lighting, appropriate reference materials such as a government agency notification list, company personnel phone list, SARA Title III reports and material safety data sheets, emergency plans and procedures manual, a listing with the location of emergency response equipment, mutual aid information, and access to meteorological or weather condition data and any dispersion modeling data.

**14. Compliance Audits.** Employers need to select a trained individual or assemble a trained team of people to audit the process safety management system and program. A small process or plant may need only one knowledgeable person to conduct an audit. The audit is to include an evaluation of the design and effectiveness of the process safety management system and a field inspection of the safety and health conditions and practices to verify that the employer's systems are effectively implemented. The audit should be conducted or lead by a person knowledgeable in audit techniques and who is impartial towards the facility or

area being audited. The essential elements of an audit program include planning, staffing, conducting the audit, evaluation and corrective action, follow-up and documentation.

Planning in advance is essential to the success of the auditing process. Each employer needs to establish the format, staffing, scheduling and verification methods prior to conducting the audit. The format should be designed to provide the lead auditor with a procedure or checklist which details the requirements of each section of the standard. The names of the audit team members should be listed as part of the format as well. The checklist, if properly designed, could serve as the verification sheet which provides the auditor with the necessary information to expedite the review and assure that no requirements of the standard are omitted. This verification sheet format could also identify those elements that will require evaluation or a response to correct deficiencies. This sheet could also be used for developing the follow-up and documentation requirements.

The selection of effective audit team members is critical to the success of the program. Team members should be chosen for their experience, knowledge, and training and should be familiar with the processes and with auditing techniques, practices and procedures. The size of the team will vary depending on the size and complexity of the process under consideration. For a large, complex, highly instrumented plant, it may be desirable to have team members with expertise in process engineering and design, process chemistry, instrumentation and computer controls, electrical hazards and classifications, safety and health disciplines, maintenance, emergency preparedness, warehousing or shipping, and process safety auditing. The team may use part-time members to provide for the depth of expertise required as well as for what is actually done or followed, compared to what is written.

An effective audit includes a review of the relevant documentation and process safety information, inspection of the physical facilities, and interviews with all levels of plant personnel. Utilizing the audit procedure and checklist developed in the preplanning stage, the audit team can systematically analyze compliance with the provisions of the standard and any other corporate policies that are relevant. For example, the audit team will review all aspects of the training program as part of the overall audit. The team will review the written training program for adequacy of content, frequency of training, effectiveness of training in terms of its goals and objectives as well as to how it fits into meeting the standard's requirements, documentation, etc. Through interviews, the team can determine the employee's knowledge and awareness of the safety procedures, duties, rules, emergency response assignments, etc. During the inspection, the team can observe actual practices such as safety and health policies, procedures, and work authorization practices. This approach enables the team to identify deficiencies and determine where corrective actions or improvements are necessary.

An audit is a technique used to gather sufficient facts and information, including

statistical information, to verify compliance with standards. Auditors should select as part of their preplanning a sample size sufficient to give a degree of confidence that the audit reflects the level of compliance with the standard. The audit team, through this systematic analysis, should document areas which require corrective action as well as those areas where the process safety management system is effective and working in an effective manner. This provides a record of the audit procedures and findings, and serves as a baseline of operation data for future audits. It will assist future auditors in determining changes or trends from previous audits.

Corrective action is one of the most important parts of the audit. It includes not only addressing the identified deficiencies, but also planning, followup, and documentation. The corrective action process normally begins with a management review of the audit findings. The purpose of this review is to determine what actions are appropriate, and to establish priorities, timetables, resource allocations and requirements and responsibilities. In some cases, corrective action may involve a simple change in procedure or minor maintenance effort to remedy the concern. Management of change procedures need to be used, as appropriate, even for what may seem to be a minor change. Many of the deficiencies can be acted on promptly, while some may require engineering studies or indepth review of actual procedures and practices. There may be instances where no action is necessary and this is a valid response to an audit finding. All actions taken, including an explanation where no action is taken on a finding, needs to be documented as to what was done and why.

It is important to assure that each deficiency identified is addressed, the corrective action to be taken noted, and the audit person or team responsible be properly documented by the employer. To control the corrective action process, the employer should consider the use of a tracking system. This tracking system might include periodic status reports shared with affected levels of management, specific reports such as completion of an engineering study, and a final implementation report to provide closure for audit findings that have been through management of change, if appropriate, and then shared with affected employees and management. This type of tracking system provides the employer with the status of the corrective action. It also provides the documentation required to verify that appropriate corrective actions were taken on deficiencies identified in the audit.

#### Appendix D to § 1910.119—Sources of Further Information (Nonmandatory)

1. Center for Chemical Process Safety, American Institute of Chemical Engineers, 345 East 47th Street, New York, NY 10017, (212) 705-7319.

2. "Guidelines for Hazard Evaluation Procedures," American Institute of Chemical Engineers; 345 East 47th Street, New York, NY 10017.



3. "Guidelines for Technical Management of Chemical Process Safety," Center for Chemical Process Safety of the American Institute of Chemical Engineers; 345 East 47th Street, New York, NY 10017.
4. "Evaluating Process Safety in the Chemical Industry," Chemical Manufacturers Association; 2501 M Street NW, Washington, DC 20037.
5. "Safe Warehousing of Chemicals," Chemical Manufacturers Association; 2501 M Street NW, Washington, DC 20037.
6. "Management of Process Hazards," American Petroleum Institute (API Recommended Practice 750); 1220 L Street, N.W., Washington, D.C. 20005.
7. "Improving Owner and Contractor Safety Performance," American Petroleum Institute (API Recommended Practice 2220); API, 1220 L Street N.W., Washington, D.C. 20005.
8. Chemical Manufacturers Association (CMA's Manager Guide), First Edition, September 1991; CMA, 2501 M Street, N.W., Washington, D.C. 20037.
9. "Improving Construction Safety Performance," Report A-3, The Business Roundtable; The Business Roundtable, 200 Park Avenue, New York, NY 10166. (Report includes criteria to evaluate contractor safety performance and criteria to enhance contractor safety performance).
10. "Recommended Guidelines for Contractor Safety and Health," Texas Chemical Council; Texas Chemical Council, 1402 Nueces Street, Austin, TX 78701-1534.
11. "Loss Prevention in the Process Industries," Volumes I and II; Frank P. Lees, Butterworth; London 1983.
12. "Safety and Health Program Management Guidelines," 1989; U.S. Department of Labor, Occupational Safety and Health Administration.
13. "Safety and Health Guide for the Chemical Industry," 1986, (OSHA 3091); U.S. Department of Labor, Occupational Safety and Health Administration; 200 Constitution Avenue, N.W., Washington, D.C. 20210.
14. "Review of Emergency Systems," June 1988; U.S. Environmental Protection Agency (EPA), Office of Solid Waste and Emergency Response, Washington, DC 20460.
15. "Technical Guidance for Hazards Analysis, Emergency Planning for Extremely Hazardous Substances," December 1987; U.S. Environmental Protection Agency (EPA), Federal Emergency Management Administration (FEMA) and U.S. Department of Transportation (DOT), Washington, DC 20460.
16. "Accident Investigation \* \* \* A New Approach," 1983, National Safety Council; 444 North Michigan Avenue, Chicago, IL 60611-3991.
17. "Fire & Explosion Index Hazard Classification Guide," 6th Edition, May 1987, Dow Chemical Company; Midland, Michigan 48874.
18. "Chemical Exposure Index," May 1988, Dow Chemical Company; Midland, Michigan 48874.

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