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Occupational Safety and Health Administration

29 CFR Part 1910

Control of Hazardous Energy Source (Lockout/Tagout); Final Rule

DEPARTMENT OF LABOR

Occupational Safety and Health Administration

29 CFR Part 1910

[Docket No. S-012A]

BIN 1218-AA53

Control of Hazardous Energy Sources (Lockout/Tagout)

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

ACTION: Final rule.

SUMMARY: The Occupational Safety and Health Administration (OSHA) is issuing a standard detailing safety requirement for the control of hazardous energy as a new § 1910.147. This standard addresses practices and procedures that are necessary to disable machinery or equipment and to prevent the release of potentially hazardous energy while maintenance and servicing activities are being performed. The standard requires that lockout be utilized for equipment which is designed with a lockout capability except when the employer can demonstrate that utilization of tagout provides full employee protection. For equipment which was not designed to be locked out the employer may use tagout. In addition, the standard also supplements and supports the existing lockout related provisions contained elsewhere in the general industry standards by providing that comprehensive and uniform procedures be used for complying with those provisions. This standard applies to general industry employment under 29 CFR part 1910, but does not cover maritime, agriculture, or construction employment. The standard also does not cover oil and gas well drilling; the generation, transmission and distribution of electric power by utilities; and electrical work on electric conductors and equipment. These will be the subjects of separate rulemaking efforts.

The standard contains definitive criteria for establishing an effective program for locking out or tagging out energy isolating devices and requires training for authorized and affected employees. The standard requires the employer to implement the specified procedures, and to utilize effective control measures based on the workplace hazards that are encountered. OSHA expects that this standard will prevent approximately 122 fatalities, 28,400 lost workday injuries and 31,900 non-lost workday injuries a year.

This rule, § 1910.147, is being placed in Subpart J of part 1910. The present § 1910.147 is redesignated as § 1910.150 to allow for the new section.

DATES: This final standard shall become effective October 31, 1989, except for paragraphs (c)(4), (c)(7), and (f)(2), of § 1910.147 which contain information requirements currently under review at OMB. A document announcing the effective date of the recordkeeping portions will be published at a later date in the Federal Register.

ADDRESS: In accordance 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 S-4004, U.S. Department of Labor, 200 Constitution Avenue NW., Washington, DC 20210.

FOR FURTHER INFORMATION CONTACT: Mr. James F. Foster, Occupational Safety and Health Administration, Room N3649, U.S. Department of Labor, Washington, DC 20210, (202) 523-8148.

SUPPLEMENTARY INFORMATION: For additional copies of this standard contact U.S. Department of Labor, Occupational Safety and Health Administration, Office of Publications, Room N3101, Washington, DC 20210, (202) 523-9667.

I. Background

OSHA's General Industry standards, 29 CFR part 1910, were originally published in the Federal Register (36 FR 10466, May 29, 1971) pursuant to Section 6(a) of the Occupational Safety and Health Act of 1970 (the OSH Act) and became effective on August 27, 1971. Before their adoption as OSHA standards, these occupational safety and health standards were either national consensus standards or established Federal standards. Virtually all of the current lockout provisions in part 1910 which are affected by this standard were adopted under the section 6(a) procedure.

At the time of adoption of the original OSHA standards, there was no general, all-encompassing consensus standard or Federal standard for locking out, tagging out, or disabling of machines or equipment to protect employees when maintenance or servicing activities were being performed—a gap that this rulemaking addresses. However, OSHA did adopt various lockout-related provisions of consensus standards which had been developed for specific types of equipment. These provisions are not deleted by this rulemaking. Current lockout-related provisions in the General Industry Standards (29 CFR part 1910) are found in the following sections:

1910.178	Powered Industrial Trucks
1910.179	Overhead and Gantry Cranes
1910.181	Derricks
1910.213	Woodworking Machinery
1910.217	Mechanical Power Presses
1910.218	Forging Machines
1910.522	Welding, Cutting and Brazing
1910.261	Pulp, Paper and Paperboard Mills
1910.262	Textiles
1910.263	Bakery Equipment
1910.265	Sawmills
1910.272	Grain Handling
1910.399	Electrical

Note: See Ex. 13 for a detailed list of lockout provisions in the above standards. For further information involving the use of these provisions, refer to the discussion found in Section VI, Summary and Explanation of the Standard, addressing paragraph (a)(3)(ii).

The present OSHA regulations for locking out or tagging out machines and equipment, where they do exist, are not uniform coverage. Inconsistencies in these regulations exist between different equipment and industries, and between different types of equipment in the same industry. Some provisions in the OSHA standards require equipment to have the capability of being "locked out," without requiring such control to be utilized. OSHA feels that the lack of a general standard, and the incompleteness of the existing provisions, have contributed to the alarming number of injuries and fatalities that have occurred.

Since the inception of its enforcement program, OSHA, for the most part, has had to rely upon the use of the "General Duty Clause" (section 5(a)(1) of the Act) citation to ensure that employers provide safeguarding for their employees from the hazards involving the release of hazardous energy. This approach has met with only limited success, limited primarily upon the need for OSHA to prove, in the event of the contest of a section 5(a)(1) citation, that the hazard was a "recognized" hazard and that the hazard was causing or could cause death or serious physical harm. Because of these difficulties, and because of the need to fill a significant gap in the current coverage of part 1910, OSHA has been working since 1977 to gather sufficient information to enable the Agency to write a comprehensive standard for energy control in general industry.

In 1977, OSHA published a Notice in the Federal Register entitled "Machinery and Machine Guarding, Request for Information on Technical Issues and Notice of Public Meetings" (42 FR 1741, January 7, 1977) (Docket S-212). In this Notice, OSHA addressed the issue of lockout or tagout, including the general question of whether lockout should always be required when machinery is not in its normal operating mode, or whether alternative methods for employee protection, such as tagout,

should be permitted (42 FR 1807). The purpose of that Notice was to generate information for use in updating the OSHA machine guarding standards (Subpart O). Respondents to that Notice generally recognized the hazards to employees when maintenance and repair activities are undertaken, and the need to use lockout or tagout to control these hazards. There was, however, a considerable range of opinion regarding the effectiveness of either a lock, a tag, or a combination of these devices when they are used as safeguards.

The United Automobile, Aerospace and Agricultural Implement Workers of America (UAW) petitioned OSHA on May 17, 1979 (Docket S-012, [Ex. 2-3]) to establish an Emergency Temporary Standard (ETS) for locking out machinery and equipment. The petition stated that there existed a need to recognize the complexities of modern industrial equipment which use sources of energy other than electricity. It contained a discussion of the increasing need for locking out equipment to prevent that equipment from cycling without warning while it was being worked on, and related the importance of applying lockout procedures to systems using hydraulic or pneumatic power, to energy stored in springs and electrical capacitors, and to potential energy from suspended parts. Abstracts of case studies for fatalities involving 22 UAW members which were attributed to lockout-related causes since 1974 were submitted with the petition. OSHA also received other petitions and letters in support of the UAW petition from other labor organizations, including the AFL-CIO, Allied Industrial Workers, and the United Steelworkers of America.

OSHA responded to the UAW petition on September 11, 1979 [Ex. 2], declining to issue an ETS, but advising that OSHA was proceeding to draft an Advance Notice of Proposed Rulemaking (ANPR) addressing the subject, in which the public would be invited to comment on the major issues involved in the development of a standard.

OSHA published the ANPR for a standard on lockout/tagout in the **Federal Register** on June 17, 1980 (45 FR 41012) (Docket S-012). In that Notice, OSHA raised issues about whether or not a generic standard should be proposed; if so, what should be the scope and application of this lockout/tagout standard; what constituted the necessary and sufficient energy isolation methods and means; and whether there was a need for written procedures and documented employee training. There was not overwhelming support in the comments submitted to OSHA for a generic standard to cover all facets of the lockout/tagout problem. The comments did indicate, however, that a performance-oriented standard, offering enough flexibility to take current work practices into consideration, was desirable, and that requirements for documented procedures and employee training would have many advantages. The comments pertaining to securing energy isolating devices (the use of locks or tags) did not generate an overwhelming response strongly favoring either method. The comments received in response to that Notice were utilized in the development of the proposed standard published in the **Federal Register** on April 29, 1988 (53 FR 15496).

There were several other inputs into the development of the Proposed Rule: First, the National Institute for Occupational Safety and Health (NIOSH) provided considerable data to OSHA on this subject. NIOSH published a notice in the **Federal Register** entitled "Lockout and Interlock Systems and Devices: Request for Information" (45 FR 7006, January 31, 1980) (Docket S-012, [Ex. 2-1]) and provided OSHA with the responses to that Notice. As part of that project, NIOSH also published its "Guidelines for Controlling Hazardous Energy During Maintenance and Servicing" [Ex. 3-4]. Other important sources of information were a Bureau of Labor Statistics (BLS) Work Injury Report (WIR) survey entitled, "Injuries Related to Servicing Equipment" [Ex. 3-3] and two OSHA-directed studies—"Selected Occupational Fatalities Related to Lockout/Tagout Problems as Found in Reports of OSHA Fatality/Catastrophe Investigations" [Ex. 3-5], and "Occupational Fatalities Related to Fixed Machinery as Found in Reports of OSHA Fatality/Catastrophe Investigations" [Ex. 3-6]. Two further studies conducted by OSHA involved the compilation and analysis of OSHA Form 36 Preliminary Fatality/Catastrophe Event Reports [Ex. 3-7] and a compilation of OSHA section (5)(a)(1) citations [Ex. 3-8].

Of great assistance to OSHA in this undertaking was the publication on March 8, 1982, of the American National Standards Institute (ANSI) national consensus standard for lockout/tagout, ANSI Z244.1-1982, "American National Standard for Personnel Protection—Lockout/Tagout of Energy Sources—Minimum Safety Requirements" [Ex. 3-9]. This standard lists the uniform performance requirements for developing and utilizing a lockout or tagout procedure for the protection of employees from the unexpected energization, start-up of machines or equipment or release of stored energy during repair, maintenance, and associated activities. The consensus standard was utilized by OSHA as the primary basis for development of its proposed standard.

In July 1983, OSHA developed a preproposal draft of a standard for lockout/tagout [Ex. 3-10]. This draft was developed by utilizing all relevant materials available to OSHA at that time. This draft was distributed to associations, companies, unions and individuals which OSHA was able to identify as having an interest in the regulation. There were about 80 comments received in response to this preproposal draft. The commenters were generally in support of the effort to develop a safety standard for lockout or tagout; however, some commenters objected to the inclusion of a requirement for locking out during activities classified as "normal production operations." Comments from some sources favored the use of locks rather than tags to secure energy isolating devices, while others welcomed the more flexible approach of permitting the use of locks or tags. There was also considerable comment regarding the use of an Appendix. Many commenters wanted the information supplied in the Appendix moved into the body of the standard for enforceability. Others, however, wanted the Appendix material completely removed on the grounds that reference to it by the courts in contested cases would essentially make it mandatory.

The proposed standard was published in the **Federal Register** on April 29, 1988 (53 FR 15495). Interested persons were afforded 60 days to submit comments and/or request a hearing.

On August 9, 1988, OSHA published a Notice in the **Federal Register** (53 FR 29920) announcing the scheduling of a public hearing and an extension of the period for the submission of comments. The hearing was scheduled for September 22 and 23 in Washington, DC, and September 27 and 28 in Houston, Texas. The comment period was extended until September 22. On August 30, 1988, OSHA published another Notice in the **Federal Register** (53 FR 33149) changing the dates for the Houston, Texas segment of the hearing from September 27 and 28 to October 12 and 13.

There were 16 parties who participated in the public hearing which was presided over by Administrative Law Judge Jeffrey Tureck. During the later stages of the hearing, at the suggestion of several of the hearing

participants Judge Tureck established a post hearing comment period, allowing the submission of additional data and evidence through November 28, 1988, and the submission of final arguments and briefs through December 23, 1988. Based upon subsequent request of several of the hearing participants, the Administrative Law Judge extended the comment period until February 6, 1989. Judge Tureck certified the record of the hearing, including materials received in the post-hearing comment period on May 3, 1989.

The comments concerning the preproposal draft (Docket S-012), the special studies and other information used in the development of the proposal for this standard, the comments received in response to the publication of the proposed standard, the evidence adduced at the public hearing and the materials submitted in the post-hearing comment period, were all utilized in the development of this Final Rule.

II. Hazards

Whenever machines or equipment are utilized in industry, there are hazards not only to the employees who work with the machines or equipment but also to other employees who work or otherwise are in the immediate area. Moreover, when it is necessary to perform maintenance or servicing on machines or equipment, such activities generate additional, unique hazards due to the continued presence of the energy used by the machine or equipment to perform its production function. This energy can emanate directly from a power source or can be stored in the equipment itself.

OSHA believes that failure to control energy adequately accounts for nearly 10 percent of the serious accidents in many industries. The following accidents, taken from the NIOSH report entitled "Guidelines for Controlling Hazardous Energy During Maintenance and Servicing" [Ex. 4], are typical of these hazards and demonstrate the applicability of the pertinent provisions in the final standard.

1. An employee was cleaning the unguarded side of an operating granite saw. The employee was caught in the moving parts of the saw and pulled into a nip point between the saw blade and the idler wheel, resulting in fatal injuries. (Failure to shutdown or turn off the equipment to perform maintenance—1910.147(d)(2).)

2. An employee was removing paper from a waste hogger. The hogger had been shut down, but the conveyor feeding the hogger had not been. The employee climbed onto the machine, fell onto the conveyor, was pulled into the hogger opening, and was fatally crushed. There was no energy control procedure at this operation. (Failure to document and implement an effective energy control procedure—1910.147(c)(4).)

3. Two employees were repairing a press brake. The power had been shut off for 10 minutes. They positioned a metal bar in a notch on the outer flywheel casing so that the flywheel could be turned manually. The flywheel had not completely stopped. The men lost control of the bar, which flew across the workplace and struck and killed another employee who was observing the operation from a ladder. (Failure to control stored energy—1910.147(d)(6).)

4. An employee was partially inside an asphalt mixing machine, changing its paddles. Another employee, while dusting in the control room, accidentally hit a toggle switch which caused the door of the mixer to close, striking the first employee on the head and killing him. Electrical switches to activate the machine were not deenergized and air pressure to move the doors was not shut off. (Failure to isolate equipment from energy sources—1910.147(d)(3).)

5. An employee was setting up a vacuum forming machine for a run of violin cases. He leaned over the press and accidentally activated the starting switch. His head was crushed between an air cylinder and the frame hogger opening, and was fatally crushed. There was no energy control procedure at this operation. (Failure to document and implement an effective energy control procedure—1910.147(c)(4).)

6. A trainee employee was cleaning a flour batch mixer. The employee was reaching into the machine when another worker activated the wrong switch, thereby turning the machine on. The employee cleaning the flour batch mixer suffered fatal crushing injuries to his neck. There was an unwritten company procedure for locking out during all maintenance. The procedure was not followed. (Failure to document and implement an effective energy control procedure—1910.147(c)(4); failure to train employees adequately in lockout/tagout procedures—1910.147(c)(7).)

7. An employee was cleaning scrap from beneath a large shear when a fellow employee hit the control button activating the blade. The blade came down and decapitated the employee cleaning scrap. (Failure to isolate, lockout/tagout or otherwise disable all potential hazardous energy sources before attempting any repair, maintenance or servicing—1910.147(c)(2).)

Servicing and maintenance activities are necessary adjuncts to the industrial process. They are needed to maintain the ability of all machines, equipment or processes to perform their intended functions. Additionally, erection, installation, construction, set-up, changeover, and dismantling usually must be performed with the equipment deenergized. These types of operations can present the employee with the same types of hazards of unexpected activation, reenergization, or release of stored energy, therefore, they are addressed by this standard. Similarly, lubricating, cleaning, unjamming, and making minor adjustments and simple tool changes are activities which often take place during normal production operations, but which may expose employees to the unexpected activation of the equipment or to the unexpected release of the energy stored in the equipment. All of the above activities are considered to be "servicing and/or maintenance" for the purposes of this standard.

With regard to servicing and/or maintenance which takes place during "normal production operations," it is important to note that this standard is intended to work together with the existing machine guarding provisions of Subpart O of part 1910, primarily §§ 1910.212 (general machine guarding) and 1910.219 (guarding of power transmission apparatus). When a machine is being used for production, § 1910.212 requires that the point of operation be guarded. For example, when an employee is using a table saw to cut wooden parts, the employee would be protected by guards around the blade of the saw. If the employee needs to reach into the point of operation in order to adjust the work piece as part of the production process, § 1910.212 requires that the guarding protection be maintained. As long as guarding is not removed or bypassed, the lockout/tagout standard is not intended to apply to these types of situations. By contrast, using the same table saw, it may be necessary for the employee to remove a piece of wood which has become jammed against the blade of the saw. In doing so, the employee might need to bypass or remove the guard on the saw and reach into the point of operation. Although this action takes place "during" normal production operations, it is not actually production, but is servicing of the equipment to perform its production function. When such servicing may expose the employee to the unexpected activation of the machinery or equipment, or to the release of stored energy, this Final Rule will apply. If the servicing is performed in a way which

prevents such exposure, such as by the use of special tools and/or alternative procedures which keep the employee's body out of the areas of potential contact with machine components or which otherwise maintain effective guarding, this standard will not apply. Thus, lockout or tagout is not required by this standard if the employer can demonstrate that the alternative means enables the servicing employee to clean or unjam or otherwise service the machine without being exposed to unexpected energization or activation of the equipment or release of stored energy.

The above mentioned servicing and/or maintenance activities are currently being accomplished in general industry with varying degrees of safeguarding or protection for employees. This safeguarding or protection ranges from allowing the employee to conduct the servicing or maintenance activity which the machine or equipment is energized and operating (virtually no protection), to requiring that the machine or equipment simply be turned off or shut down, to providing for deenergization and lockout or tagout of the machine or equipment. OSHA believes that the least desirable situation is to allow employees to perform maintenance, repair, or service activities while the machine or equipment is energized and capable of performing its normal production function. The Agency recognizes that there are certain servicing operations which, by their very nature, must take place without deenergization, such as operational testing of machines or equipment. Locking out or tagging out cannot be performed during these operations, since both lockout and tagout require that equipment to be deenergized. Additionally, this standard does not apply when certain tasks are conducted during normal production operations such as repetitive minor adjustments or simple tool changes when these activities do not increase the risk of injury to employees. Conversely, operations such as cleaning and unjamming machines or equipment are covered by this standard when the employee is exposed to greater or different hazards than those encountered during normal production operations; it should be emphasized that this rule applies to cleaning and unjamming when an unexpected activation or release of energy could occur.

The vast majority of servicing or maintenance activities can safely be done only when the machine or equipment is not operating and is deenergized; therefore, these activities are covered by this standard.

Some servicing operations do not expose employees to hazards which would necessitate that a machine, equipment or process be deenergized and locked out or tagged out. However, practices such as reaching beyond guards during the cleaning of rollers of printing presses or the feed points of screw conveyors which the equipment is operating, violate the safety conditions set forth in § 1910.212 for normal production operations, and therefore such activities would be considered servicing activities under this rule.

Performance of maintenance or servicing activities on a machine or equipment that is in operation has the potential of exposing employees not only to contact with moving machinery components at the point of operation, but also to contact with other moving components, such as power transmission apparatus, and also increases the risk of injury due to the position the employee must assume and the need to remove, bypass or disable guards and other safety devices. In many cases, these activities expose the employee to the hazard of being pulled into the operating equipment when parts of the employee's body, clothing or the material or tools used for cleaning or servicing become entrapped or entangled in the machine or equipment mechanism. The use of extension tools or devices to permit the operator to stay outside these danger areas, while of some benefit in reducing direct employee exposure to the hazards of entanglement or entrapment, can, in itself, result in injuries to employees. This can occur, for example, when an employee is struck by the tools or devices that inadvertently come in contact with moving machine components, and are pulled from the employee's grasp.

However, shutting down a machine or equipment usually is not the total solution to the problem. Once the machine or equipment has been stopped, there remains the potential for employee injury from the unanticipated movement of a component of the machine or equipment, or from movement of the material being handled. This unanticipated movement can be caused either by the release of residual energy within the machine or equipment, or as the result of the conversion of potential energy to kinetic energy (motion). For example, residual energy can be manifested by the presence of springs under tension or compression, or by the presence of pressure (either above or below atmospheric) in systems containing gases or liquids.

Potential energy is considered to be a function of the height of an object above some datum plane. This datum plane is usually considered to be where that object would come to rest if the restraint holding the object were released, such as where the upper die in a punch press is positioned above the lower die. If the restraining device holding the upper die in place was to be removed, the potential energy of the upper die would be converted into kinetic energy (downward motion), resulting in the upper die being propelled downward, coming to rest on the lower die. This motion can cause a crushing, cutting, lacerating, amputating or fracture injury to an employee's arm, hand or some other part of the body which occupies the space between the dies.

OSHA believes that the most effective method to prevent employee injury caused by the unanticipated movement of a component of a machine or equipment, or of the material being handled, is either to dissipate or minimize any residual or potential energy in the system, or to utilize a restraining device to prevent movement. This can be accomplished by moving machine or equipment components to a point at which springs are at or near a neutral state, by moving components so that liquids or gases reach or approximate atmospheric pressure, and by blocking material or components or moving them to a point of minimum potential energy (moving components to a stable, resting position).

Further, even though the machine or equipment has been shut off, and even if residual energy has been dissipated, an accident can still occur if there is an inadvertent activation of that machine or equipment. Inadvertent activation can occur due to an error on the part of the employee who is conducting the maintenance or servicing activity, or by any other person. For example, the servicing employee can unintentionally cause the machine or equipment to start by shorting across electrical switches or by accidentally moving controllers (either electrical controls or valves) into the "on" or "operational" position.

An accident can also occur when another person who is not necessarily involved with the maintenance or servicing operation causes the activation of the machine or equipment being serviced. This can occur when a person uses the wrong controller and starts a machine or equipment that the employee did not intend to start. It can also occur when a person finds a machine or equipment not operating and

starts it, without knowing someone else is performing maintenance or service on it. This latter type of accident is more apt to occur when the machine or equipment is large and/or complex, and the employee who is conducting the servicing activity is at a part of the system which is some distance from or not visible from the controls. The generally accepted best means to minimize the potential for inadvertent activation is to ensure that all power to the machine or equipment is isolated, locked or blocked and dissipated at points of control, using a method that cannot readily be removed, bypassed, overridden or otherwise defeated. In the case of an electrically run machine, piece of equipment or process, this can be done by going back toward the original source of the power and shutting off a main switch or by disconnecting the electrical lines. OSHA believes that this action must be followed by the placement of some safeguard to prevent the reenergization of the circuit during the maintenance or servicing. To ensure that another employee will not attempt to restart the machine or equipment or to reenergize the circuit, there must be some assurance that all other employees know that the circuit is deenergized and must remain so. This can be accomplished by the utilization of a standardized procedure for deenergizing the system; by training employees to familiarize them with the restrictions of the procedure which apply to them; and by enforcing a prohibition on another employee removing or bypassing another's safeguard. Those employees whose job require them to opeate or use a machine or equipment that must have maintenance or servicing performed on it, must be aware that the machine or equipment is going to be stopped or shut down, and locked out or tagged out, and that they should not attempt to restart or reenergize it. Additional training is also needed for those employees who must utilize the procedure.

Even if all other protective measures are taken, accidents can still occur following the completion of the maintenance, repair or servicing activity, if the machine or equipment is reenergized and started before all guards and other safety devices have been replaced or reinstalled. Additionally, all tools and other foreign objects must be removed from the location and a check completed to ensure that no employees are in a place where the re-energization and starting of the machine or equipment will endanger them.

III. Accident Data

The collection of data on accidents resulting from a failure to utilize proper lockout or tagout procedures is hampered because many accidents are not reported; are reported only locally; or are reported and categorized under other causal factor categories (such as "caught-in" or "caught-between"). Incorrect or incomplete categorization is particularly true for lockout related accidents, since many of the injuries are grouped under the more commonly used classifications such as, burns, electrocutions, lack of machine guarding or equipment failure.

OSHA also recognizes that there has been some underreporting of accident data—either inadvertent or intentional. As a result, OSHA believes that the data available represent only a portion of the total injuries and fatalities that have occurred. However, OSHA believes that the accidents which have been recorded or reported and investigated or studied as being "lockout related" provide a graphic illustration of the extent of the problem, the causal factors, the distribution of accidents in industry, and the type and severity of injuries resulting from those accidents.

There have been several studies conducted to determine the magnitude and extent of the problem. These studies were conducted by: (a) The U.S. Department of Labor, Bureau of Labor Statistics; (b) OSHA's Office of Data Analysis (formerly Office of Statistical Studies and Analysis); (c) the National Institute for Occupational Safety and Health (NIOSH); (d) OSHA's Office of Experimental Programs; and (e) OSHA's Office of Mechanical Engineering Safety Standards. During the hearing, the UAW provided detailed data on fatalities and injuries (Tr. p. H216, H253), which they expanded upon in their post-hearing submission (Ex./ 3–49). The studies are discussed in the following paragraphs.

A. *Bureau of Labor Statistics Work Injury Report Study.* The first study examined by OSHA was the Work Injury Report Study entitled "Injuries Related to Servicing Equipment" (Ex. 3–3). This study is a compilation of reports of accidents and follow-up survey questionnaires sent out by the Bureau of Labor Statistics (BLS). The survey, conducted from August to November 1980, covered workers who were injured while cleaning, repairing, unjamming or performing other non-operating tasks on machines, equipment and electrical or piping systems. BLS identified accidents from 25 participating states, and mailed each of the injured employees a follow-up questionnaire containing inquiries about the specific details of his/her accident. There were 1,285 questionnaires sent out and 833 (approximately 65 percent) of the employees responded. Not all questions were responded to by all participants, since many of the questions related to situations which may not have been relevant to the circumstances of each injury. In some instances, many of the respondents also gave multiple responses to a single question.

Tables I through VI present tabulations of the results of the BLS Work Injury Report Study.

TABLE I.—INDUSTRY DISTRIBUTION—BY STANDARD INDUSTRIAL CLASSIFICATION (SIC) MAJOR DIVISION AND COMPANY SIZE

Industry	Workers	Percentages (1)
Total	833	100
Div A—Agriculture, forestry and fishing	12	1
B—Mining	1	
C—Construction	35	4
D—Manufacturing	619	74
E—Transportation and public utilities	19	2
F—Wholesale trades	57	7
G—Retail trades	31	4
H—Finance, insurance and real estate	8	1
I—Services	43	5
J&K—Others	8	1
SIZE OF THE COMPANIES AT WHICH ACCIDENTS OCCURRED		
Total	(2) 794	100
1 to 19 employees	159	20
20 to 49 employees	123	15
50 to 99 employees	120	15
100 to 499 employees	234	29
500 or more employees	158	20

(1) Due to rounding, percentages may not add to 100.

(2) The total of each table represent the number of respondents answering the pertinent question(s) of the survey.

TABLE II.—OCCUPATIONAL DISTRIBUTION

Occupation	Workers	Percent
Total	833	100
Operatives, excluding transport	373	45
Craft and kindred workers	281	34
Laborers, excluding farm	94	11
Service workers, excluding private household	19	2
Clerical and kindred workers	19	2
Managers and administrators	18	2
Professional, technical & kindred	12	1
Transport equipment operators	10	1
Farm laborers and supervisors	8	1
Nonclassified	4	(1)

(1) Less than .5.

Note.—Due to rounding, percentages may not add to 100.

TABLE III.—ACTIVITY OF TIME OF ACCIDENT

	Workers	Percent
WHAT WAS EMPLOYEE DOING?		
Total	833	100
Unjamming object(s) from equipment	250	30
Cleaning equipment	245	29
Repairing equipment	77	9
Performing maintenance (oiling, etc.)	34	4
Installing equipment	13	2
Adjusting equipment	99	12
Doing set-up work	57	7
Performing electrical work	29	3
Inspecting equipment	15	2
Testing material or equipment	2	(1)

(1) Less than 0.5 percent.

TABLE IV.—CIRCUMSTANCES OF INJURIES

	Workers	Percent (1)
HOW DID INJURIES OCCUR?		
Total	833	100
Injured by moving machine part	735	88
Injured by contact with energized electric parts	45	5
Injured by burners, hot liquids or other hazardous materials	29	3
Injured by falling machine parts	10	1
Other	14	2
WAS EQUIPMENT TURNED OFF BEFORE DOING TASK?		
Total	833	100
No	653	78
Yes	180	22
IF EQUIPMENT NOT TURNED OFF, REASON(S) GIVEN.		
Total	(2) 592	(2)
Worker felt it would slow down production or take too long	112	19
Not required by company procedure	69	12
Worker did not know how to	8	1
Did not think it necessary	209	35
Task could not be done with power off	209	35
Worker did not realize power was on	62	10
Other reasons	61	10
IF EQUIPMENT WAS TURNED OFF:		
a. What happened at the time of injury?		
Total	176	100
Injured employee accidentally turned equipment on	20	11
Co-worker accidentally turned equipment on	15	9
Co-worker turned equipment on, not knowing equipment was being worked on	56	32

TABLE IV.—CIRCUMSTANCES OF INJURIES—Continued

	Workers	Percent (1)
Equipment or material moved when jam-up cleared	9	5
Parts were still in motion (coasting)	30	17
Other reason	46	26
IF EQUIPMENT WAS TURNED OFF:		
b. Were additional steps taken to de-energize equipment?		
Total	(2) 160	(2)
No—not necessary	49	31
No—not required by company	23	14
No—would slow down production	8	5
No—worker did not have tools	4	2
No—other reason	20	13
No—reason not given	37	23
Disconnected main power	14	9
Tagged out equipment power controls	6	4
Locked out(3), installed blank flange or removed fuse	3	2
Disconnected electric line	5	3
Drained pressure or hazardous material	9	6
Other	11	6

(1) Due to rounding, percentages may not add to 100.

(2) Because more than one response is possible, the sum of the responses and percentages may not equal the total number of persons who answered the question.

(3) The two accidents which occurred after the equipment was locked out took place because (1) the lockout had been done to the wrong power line and (2) a second power line had been spliced into the wiring beyond the lockout.

TABLE V.—TRAINING

	Workers	Percent
WAS LOCKOUT INSTRUCTION PROVIDED EMPLOYEES?		
Total	554	100
Yes	214	39
No	340	61
IF INSTRUCTION PROVIDED, IN WHAT FORM?		
Total	273	100
Provided printed instructions	25	9
Procedures posted on equipment	37	14
Instruction given as part of on-the-job training	176	64
Formal training given at meeting, etc.	28	10
Other	7	3
WHEN WAS LOCKOUT INSTRUCTION GIVEN?		
Total	(1) 186	(1) 100
After the accident	15	8

TABLE V.—TRAINING—Continued

	Workers	Percent
One to six months before accident	36	19
Six months to a year before accident	28	15
Upon hiring	84	45
Over a year before accident	60	32

(1) Because more than one response is possible, the sum of the responses and percentages may not equal the total. Percentages are calculated by dividing each number of responses by the total number of persons who answered the question.

TABLE VI.—ESTIMATED LOST WORKDAYS

Number of lost workdays	Workers	Percent
Total	793	100
No time lost	107	13
1 to 5 workdays lost	132	17
6 to 10 workdays lost	95	12
11 to 15 workdays lost	75	9
16 to 20 workdays lost	47	6
21 to 25 workdays lost	47	6
26 to 30 workdays lost	60	8
31 to 40 workdays lost	49	6
41 to 60 workdays lost	54	7
More than 60 workdays lost	41	5
No indication of number of lost workdays	86	11

B. *Analysis of 83 Fatality Investigations by OSHA's Office of Data Analysis.* The second study examined by OSHA was the compilation of data from 83 fatality investigations conducted by OSHA between 1974 and 1980. This report is entitled, "Selected Occupational Fatalities Related to Lockout/Tagout Problems as Found in Reports of OSHA Fatality/Catastrophe Investigations" [Ex. 3–5]. All of these accidents were identified as having been caused by failure to properly deenergize machines, equipment or systems prior to performing maintenance, repairs or servicing.

Tables VII through IX present tabulations of the results of the OSHA analysis of 83 fatality investigations.

TABLE VII.—CAUSAL FACTORS

Cause	Number	Percent
Total	83	100
Lack of adherence to safe work practices (no procedure or failure to follow procedure)	21	25
Accidental or inadvertent activation	29	35
Failure to deactivate	21	25
Equipment failure	7	8
Other	5	6

NOTE.—Due to rounding, percentages may not add to 100.

TABLE VIII.—NUMBER OF INJURY

Agent	Number	Percent
Total	83	100
Agitators and mixers	12	14
Rolls and rollers	11	13
Conveyors and augers	11	13
Saws and cutters	11	13
Hoists	8	10
Earth moving equipment	6	7
Crushers and pulverizers	4	5
Forges and presses	4	5
Electrical apparatus	4	5
Vehicles	3	4
Other	9	11

TABLE IX.—EMPLOYEE ACTIVITY

Activity	Number	Percent
Total	83	100
Conducting normally assigned duties	69	83
Conducting other duties	14	17

In analyzing the 83 fatality investigation reports and assigning causes to each accident, no attempt was made to draw conclusions or inferences beyond the information contained in the reports. For example, if the employee was killed in operating machinery, unless the report stated otherwise, the cause of the accident was considered to be failure to shut off the machine, rather than a combination of causal factors such as failure to shut off the machine, failure to lockout, failure to document adequate procedures, and failure to provide sufficient employee training. Additionally, if a machine was found to be running, it was assumed that the employee failed to shut off the machine rather than that another employee restarted the machine.

C. *Analysis of 125 Fixed Machinery Fatalities by OSHA's Office of Data Analysis.* A separate study by OSHA's Office of Data Analysis is entitled "Occupational Fatalities Related to Fixed Machinery as Found in Reports of OSHA Fatality/Catastrophe Investigations" [Ex. 3–6]. This study contained an analysis of investigative reports of 125 fatalities involving fixed machinery which occurred between 1974 and 1976, and which were investigated by OSHA. The primary causal factors under which the accidents were classified were operating procedures, accidental activation, lack of machine deactivation, equipment failure, and other causes.

The following is a tabulation of the results of this study.

TABLE X—CAUSAL FACTORS, OSHA ANALYSIS OF 125 FATAL ACCIDENTS

Causal factor	Number	Percent
Total	125	100
Failure to adhere to safe operating procedures	41	33
Accidental machine activation	31	25
Machine not deactivated	23	18
Equipment failure	21	17
Other	9	7

D. *National Institute for Occupational Safety and Health, Guidelines for Controlling Hazardous Energy During Maintenance and Servicing and Study of Hazardous Release of Energy Injuries in Ohio in 1983.* The next studies considered by OSHA were done by the National Institute for Occupational Safety and Health (NIOSH) [Ex. 4 and 2–80c]. In the first, fifty-nine out of a total of 300 accident reports were analyzed to illustrate situations in which adequate control of energy might have prevented the accidents. These case files were selected because they contained sufficient detail to enable NIOSH to evaluate the accidents and determine what countermeasures might have been available to prevent the accidents.

The report indicated that these types of accidents are preventable if effective energy control techniques are available, the workers are trained to use them, and management provides the motivation to ensure their use.

The following is a tabulation of the results of the first study.

TABLE XI.—CAUSAL FACTORS, NIOSH STUDY

Factor	Number	Percent
Total	59	100
Failure to de-energize machine or control energy	27	46
Accidental re-energization	25	42
Ineffective energy isolation	6	10
Disregarding residual energy	1	2

The NIOSH draft report, undated, entitled: "Study of Hazardous Release of Energy Injuries in Ohio in 1983." (Ex 2–80c).

This report contains information on 339 accidents which occurred in the state of Ohio in 1983. These accidents were selected because: (1) They fell into likely categories of industry, occupation, type of accident, source of injury and diagnosis of injury; (2) the worker's compensation claim narrative suggested applicability; and (3) questionnaire reponses by plant officials positively identified the injuries as resulting from an unexpected energy release during equipment repair, servicing or maintenance. The report defined an unexpected or unwanted release of energy "as when a press closes on an operator's hand or when steam escapes from a broken pressure line."

The "Ohio Study" was submitted by NIOSH in draft form. OSHA is not aware of whether the study results have since been finalized by NIOSH, or whether any further effort has been expended to follow-up on its findings. However, OSHA has evaluated the draft study and has determined that few definite conclusions can be drawn from the available data. For example, most of the injuries reported in the study (70%) occurred to production workers as a result of servicing which took place during normal production operations. Although the study indicated that firms where injuries occurred used tagout, it did not indicate whether either tagout or tagout procedures were applied in situations where production employees were performing servicing work, as well as maintenance employees. Without such information, it is not possible to determine whether the tagout procedure failed in situations where it was being applied, or whether tagout (or other type of employee protection, such as shutting down the equipment) was in use at the time of the accident. In addition, the study only considered the issue of locks versus tags, and did not evaluate the other elements of the lockout or tagout programs in place. As OSHA has emphasized, the adequacy of a program for the control of hazardous energy relies on much more than whether a lockout device or a tagout device issued on the energy isolating means. Therefore, the Agency has determined that the draft Ohio study raises many more questions than it answers, and that no solid conclusions can be drawn from the data provided to date. OSHA encourages NIOSH to continue its review and analysis of this study, and looks forward to receiving a final version of the study after a full evaluation and revision has been performed.

The following is a tabulation of the usable results of this study.

TABLE XII—TASK BEING PERFORMED AT TIME OF ACCIDENT

Task	Number	Percent
Unjamming object	84	25
Cleaning equipment	75	22
Repairing equipment	41	12
Adjusting equipment	41	12
Doing set-up work	27	8
Inspecting equipment	11	3

TABLE XII—TASK BEING PERFORMED AT TIME OF ACCIDENT—Continued

Task	Number	Percent
Testing equipment	9	3
Installing equipment	9	3
Electrical work	8	2
Other tasks	34	10
Total	339	100

TABLE XIII.—EQUIPMENT MODE WHEN INJURY OCCURRED

Equipment mode	Number	Percent
Production mode	230	70
Maintenance mode	99	30
Total	(1)329	100

(1) Ten respondents did not identify the equipment mode.

F. Analyses of Fatality/Catastrophe Reports and General Duty Clause Citations by OSHA's Offices of Experimental Programs and Mechanical Engineering Safety Standards.

There were two additional OSHA studies which were conducted jointly by the Office of Experimental Programs and the Office of Mechanical Engineering Safety Standards. These studies were compilations and analyses of OSHA Form 36 reports [Ex. 3–7] and OSHA 5(a)(1) citations [Ex. 3–8], respectively.

An OSHA Form 36 (Preliminary Fatality/Catastrophe Event Report) is prepared each time an Area Office is notified of a serious accident resulting either in a fatality or in serious injury to five or more employees that necessitates their hospitalization. This report is used to determine whether or not OSHA will conduct an investigation of the circumstances surrounding the accident. Since OSHA does not receive notification of all accidents resulting in a fatality or catastrophe, the total number of Form 36 reports received does not equal the total number of workplace fatalities and serious injuries which occurred during this study period. However, OSHA believes that the causes of, and the circumstances leading to, the accidents clearly demonstrate the nature and seriousness of lockout/tagout-related accidents.

The OSHA Form 36 study which analyzed data reported during the period 1982–1983 [Ex. 3–7], utilized a list of 443 fatalities. From these fatalities, all of which occurred in industries subject to the present regulations, it was determined that 36 (8.1 percent) would have been prevented by the use of an effective lockout or tagout procedure.

The second study [Ex. 3–8] used information developed by OSHA's Office of Mechanical Engineering Safety Standards which identified, categorized and recorded "general duty clause" (section 5(a)(1) of the OSHA Act) citations from 1979 to 1984. A general duty clause citation is issued when, during an inspection, a "recognized hazard" is detected which is causing or is likely to cause death or serious physical harm to an employee, but which is not addressed in an OSHA standard applicable to that industry.

The citations in the latter study have been broken down between maritime, construction, and general industry. The general industry citations were further subdivided to reflect the nature of the hazard which the citation addressed, such as hazardous materials or material handling. When there was special Agency interest in an industry or hazard, the citations were further broken down by industry sector (such as oil and gas well drilling).

From 1979 through 1984, 3,638 inspections were conducted which resulted in the issuance of general duty clause citations. Of these 3,638 inspections, there were 376 inspections in which the failure to control hazardous energy was cited. Hence, in approximately 10 percent of all inspections which resulted in the issuance of at least one General Duty clause citation, herein referred to as a 5(a)(1) citation, failure to lockout or tagout was identified. [Ex. 3–8]

The following is a tabulation of the breakdown of lockout citations by industry division.

TABLE XIV.—INDUSTRY PROFILE, OSHA 5(a)(1) LOCKOUT CITATIONS

Industry divisions	Number of citations	Percent
Total	376	100
A—Agriculture, forestry and fishing	2	.5
B—Mining	4	1.1
C—Construction	18	4.8
D—Manufacturing	310	82.4
E—Transportation and public utilities	11	2.9
F—Wholesale trades	14	3.7
G—Retail trades	5	1.3
H—Finance, insurance and real estate	0	0
I—Services	12	3.2
J—Public administration	0	0
K—Not otherwise classified	0	0
Unknown	0	0

Note.—Due to rounding, percentages may not add to 100.

At the hearing, the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America (UAW) testified that there were 74 fatalities which it referred to as "lockout fatalities," which had occurred to its members between 1979 and 1988 (Tr. H253). In response to requests at the hearing, the UAW provided additional information on these fatalities (Ex. 49E). (The number of "lockout fatalities" was revised to 72 in the post-hearing submission.) The post-hearing data reinforce OSHA's determination that fatalities from hazardous energy sources involve more than simply a failure to "lock out" machines or equipment. Of the 72 fatalities, UAW reported that there had been "inadequate training" in 49 cases (68%); "inadequate procedures" in 50 cases (69%); and "adequate, but unenforced procedures" in 19 cases (26%). Although OSHA agrees that lockout provides more security against reenergization of equipment than tagout, the Agency is convinced more than ever that there is much more to energy control than the question of lockout vs. tagout. The UAW data make a strong case for the need for OSHA to provide for proper energy control procedures and adequate training in those procedures.

In the proposal, OSHA estimated, based on BLS data, that lockout or tagout related fatalities represented 7% of the total number of occupational fatalities. In their post-hearing comment, the UAW indicated that for their workers, this figure is estimated to be 26%, and that OSHA should take this larger estimated percentage into account in its projections. The UAW also argued that its data base is larger than that used by OSHA, and that it is more reliable because of its national scope and inclusion of both large and small facilities. (Ex. 49A). OSHA appreciates the time and effort taken by the UAW in compiling such data and in submitting it to the rulemaking record. At the time of the proposal, the Agency acknowledged that its injury and fatality figures were likely to be understated for various reasons. Regardless of whose figures are used, there is little doubt that the failure to control hazardous energy sources exposes employees to a significant risk, and that this standard is necessary to reduce those risks.

IV. Basis for Agency Action

OSHA believes that there exists a sufficient body of data and information upon which a reasonable standard can be based to reduce the number of fatalities and injuries resulting from failure to utilize proper and adequate practices and procedures for the control of potentially hazardous energy. This position is based upon an analysis of the accident data available to OSHA, all of

which is in the docket of this rulemaking proceeding.

Most accident reports break down the relevant information in accordance with the classifications contained in the American National Standards Institute, ANSI Z16.2, "Method of Recording Basic Facts Relating to the Nature and Occurrence of Work Injuries" [Ex. 3–11]. These classifications are: The nature of the injury, part of the body, source of the injury, accident type, hazardous condition, agent of injury and unsafe act. Many accident reports are generated primarily to document the occurrence of accidents and concentrate on the information which is necessary to process workers' compensation claims. For this reason, they tend to emphasize information about the injury rather than the events and conditions which caused the accidents. Therefore, most of the pertinent information identifying the nature and extent of the problem of controlling hazardous energy was gathered by OSHA by conducting the special studies referred to above. Because of the limitation on the available data, no single study in itself can be expected to provide conclusive support for comprehensive regulation of energy hazards. However, the studies and other available data, when considered as a whole, clearly indicate not only the scope and extent of the problem, but also the need for a comprehensive standard. The studies are consistent in their demonstration of the causative factors involved in lockout-related accidents, and they provide strong evidence for the potential effectiveness of OSHA's Final Rule in dealing with those factors.

OSHA believes that the hazards associated with the failure to control hazardous energy are widespread. The following table indicates the distribution, by industry, of the accidents reported in the Bureau of Labor Statistics (BLS) Work Injury Report Study (WIR) and in the OSHA 5(a)(1) study citations discussed earlier.

TABLE XV.—INDUSTRY PROFILE, BLS WIR AND OSHA 5(a)(1) CITATIONS

Industry (by division)	BLS	Percent	5(a)(1)	Percent
Total	833	100	376	100
A—Agriculture, forestry and fishing	12	1	2	.5
B—Mining	1		4	1.1
C—Construction	35	4	18	4.8
D—Manufacturing	619	74	310	82.4
E—Transportation and public utilities	19	2	11	2.9
F—Wholesale trades	57	7	14	3.7
G—Retail trades	31	4	5	1.3
H—Finance, insurance and real estate	8	1	0	0
I—Services	43	5	12	3.2
Other or unknown	8	1	0	0

Although employees in almost every industrial division are exposed to the hazards associated with the unexpected energization or start up of machines or equipment, or by the unanticipated release of stored energy, the preponderance of the accidents and injuries occur in Manufacturing (Division D). It should also be noted that Services (Division I), includes many employers who perform maintenance on equipment in manufacturing and other sectors covered by Part 1910.

In addition to the accidents which could occur when maintenance or servicing is being conducted, OSHA also identified some accidents which could occur while employees are lubricating, cleaning, unjamming or adjusting machines or equipment. These activities differ from other activities which are conducted during normal operation in that these activities can lead to the unexpected release of energy and are usually done only on an as-required basis. When these activities are being conducted during normal operations, the machine guarding required by other OSHA standards (that is, § 1910.212 for point of operation guarding and § 1910.219 for power transmission apparatus guarding) may afford the necessary and sufficient protection for the employees performing those activities. However, in many instances the employee must either remove guards or other safety devices or work under unusual circumstances which would subject the employee to a different or greater risk than would be encountered during normal production operations. In those instances OSHA believes that the machine or equipment must, if possible, be shut down and locked or tagged out to protect the employee from injury.

As noted earlier, OSHA's has evaluated section 5(a)(1) citations that were issued for failure to control hazardous energy, and has determined that this area accounts for about 10 percent of the serious hazards not presently covered by a specific OSHA standard. The seriousness of the hazard to be addressed by this standard is highlighted by the fact that section 5(a)(1) citations are issued only for recognized hazards which cause or are likely to cause death or serious physical harm. Similarly, the OSHA Form 36, also discussed above, is initiated only when OSHA is notified of deaths or multiple hospitalizations. Further analysis of the lost workday data from the BLS WIR indicates that the severity of injuries from failure to control hazardous energy sources (an average of 24 lost workdays per lost time injury) is much higher than the national industry-wide average of 16 lost workdays [Ex. 14].

In developing this Final Rule, OSHA has estimated the total numbers of fatalities, lost-workday injuries, and minor injuries attributable to lockout-related accidents. These estimates were based on an extrapolation of the available national data sources discussed earlier [Ex. 3, 5, 6, 7]. From these data the number of preventable accidents was determined. OSHA believes that the Final Rule will prevent 85% of the total numbers of injuries or fatalities from exposure to hazardous energy in the workplace. The Agency estimates that approximately 31,900 minor (non-lost-workday) injuries; 28,400 lost-workday injuries; and 122 fatalities per year (based on 1984 accident levels) will be prevented by this standard. (see Section on Regulatory Impact Analysis below). These estimates were derived by identifying the percentage of accidents in various data sources which were determined to be lockout-related and applying those percentages to the number of accidents. It was determined that two percent of all nonfatal accidents and 7.1 percent of all fatalities occurring in general industry related to failure to adequately control hazardous energy. In addition, the data indicate that the risk of accidents and injuries is independent of the number of employees in a particular workplace. This finding is predicated upon the distribution by size of the companies which employed the injured employees surveyed in the BLS WIR. In the survey, almost as many respondents (392, or 49 percent) reported that they were employed at facilities of 100 or more employees as those who were employed at facilities of less than 100 employees (402, or 51 percent).

Based upon analysis of all of the aforementioned evidence, OSHA believes that the failure to control hazardous energy results in a significant risk to employees. Further, the data clearly demonstrate that the consequences of an accident involving failure to lockout or tagout are more severe in terms of lost workdays than the average industrial accident. OSHA also believes that a significant risk from hazardous energy extends across many segments of general industry.

OSHA has also analyzed the studies to determine the underlying causes of the conditions which existed when lockout related accidents occurred. From this information, OSHA developed a list of measures which would have prevented most of the accidents in the studies, and used this list to devleop its proposed standard. It should be noted that the studies vary widely in the quantity and quality of the information provided for the reported accidents (different methods of reporting, and incompleteness of the findings of the causes of the accidents, for example). Therefore, professional judgment was used in the interpretation of the results of the studies, in order to provide a comprehensive evaluation of the data and to correlate the information on accident causation. While the numbers and percentages from all studies do not necessarily agree, the studies all indicate the existence and seriousness of the problems, and provide valuable information as to measures that are necessary to correct the problems. Tables XVI through XX below cover what OSHA believes are the major causal factors in lockout-related accidents, and indicate the prevalence of such factors as reflected in the different accident studies.

TABLE XVI.—SERVICING ACCIDENTS OCCURRING WHILE EQUIPMENT IS OPERATING

Study (total considered)	Number	Percent
BLS WIR (833)	653	78
OSHA analysis of 83 fatalities (83)	54	65
OSHA report of fixed machinery (125)	23	18
NIOSH study (59)	27	46

The reasons most often given in the BLS WIR for not turning off equipment prior to servicing were that it would take too long or slow down production; it was not required by the employer; it was not necessary; or the task could not be done with the equipment off.

As pointed out in the Hazards section of this Notice, just shutting off a machine, equipment or process may not completely control the hazardous energy. Even after a machine, equipment or process is shut down, residual energy may still be present in the form of moving components, spring or hydraulic pressure, the force of items which have become jammed in machine parts, or the energy which is stored in machine, equipment, or system components due to their position (potential energy).

TABLE XVII.—ACCIDENTS DUE TO FAILURE TO ENSURE POWER OFF

Study (total considered)	Number	Percent
BLS WIR—Failure to check for power on (592)	62	10
OSHA analysis of 83 fatalities (83)	5	6
NIOSH study (59)	6	10

The Hazards section of this Notice also discussed the fact that even though the machine, equipment or process has been shut down, and the residual energy controlled or dissipated, an employee can still be injured if the machine, equipment or process is restarted by either that employee or another employee. Injury can occur when an employee inadvertently contacts switches, valves or other controllers or when an employee activates the equipment without recognizing the reason it was shut off, inadvertently exposing other employees to a hazard.

TABLE XVIII.—ACCIDENTS DUE TO INADVERTENT ACTIVATION

Study (total considered)	Number	Percent
BLS WIR (176)	91	52
OSHA analysis of 83 fatalities (83)	29	35
OSHA report on fatalities related to fixed machinery (125)	31	25
NIOSH (59)	25	42

Clearly, it is insufficient simply to shut off machinery to conduct repair, maintenance or servicing. OSHA believes that some means must be utilized to ensure that employees are safeguarded during those operations.

After servicing, there is also the need to ensure that all guards have been replaced, that all tools and other extraneous materials have been removed from the machine, equipment or process, and that reenergizing and starting normal productions operations will not subject an employee to an increased potential for injury. This is especially true when the maintenance, repair or service is conducted at or near an employee's workstation.

OSHA believes that many of the problems of de-energization and reenergization of machines or equipment can be reduced by the employer's development and utilization of a program which incorporates a program which incorporates a standardized procedure for servicing/maintenance operations. The procedure would outline the necessary steps to be taken to prepare for, conduct, and complete servicing of equipment, and the program would provide employees with an understanding of the procedure and the reasons why it must be followed. A program can provide the details to be followed in performing servicing operations safely (the procedure), together with the training and motivation needed to assure that employees understand and implement those details.

TABLE XIX.—ACCIDENTS ATTRIBUTABLE TO EMPLOYER NOT HAVING OR EMPLOYEES NOT UTILIZING A PROCEDURE

Study (total considered)	Number	Percent
BLS WIR (653)	482	74
OSHA report on fatalities related to fixed machinery (125)	41	33

OSHA believes that employee understanding and utilization of a standardized procedure are critical to the success of a lockout or tagout program. Without these elements and commitment from management, the effectiveness of the program can be seriously compromised. Proper training in the procedure, and explanation of how it works and why, are crucial to its implementation by the employees. Even though there can be no exact quantification of the effects of training employees, the BLS WIR Study gives an indication of the effect of the *lack* of training in the necessary measures to be taken in deenergizing machines or equipment (see Table XX below).

TABLE XX.—LOCKOUT TRAINING OF INJURED EMPLOYEES, SOURCE: BLS WIR (FROM 613 RESPONSES)

Type of training	Number	Percent
Printed instruction	25	4
Procedures posted on equipment	37	6
Training at job orientation, at meetings, or otherwise	211	34
No training	340	55

Of those injured employees who had received training, 15 stated that their training had occurred *after* their accident. Additionally, 60 employees stated that they had received their training more than a year prior to the accident. Even though training has been provided at some time during employment, the length of time between the receipt of the training and the accident is a limiting factor on any beneficial effect that has been derived from the training. In the Final Rule,

discussed below, OSHA recognizes the need for remedial or refresher training of those employees who must use the procedure, and that such retraining must be conducted at least annually.

Based upon an analysis of the rulemaking record, OSHA believes that the safe performance of activities such as repair, maintenance and servicing, requires the deenergization of machines or equipment whenever feasible. Further, in order to ensure that maintenance or servicing activities are conducted safely, a lockout or tagout procedure must be utilized. This procedure must call out the steps to be taken to deenergize the machine, equipment or process; to ensure that the deenergization is sufficiently complete; to dissipate or prevent the release of residual energy; to ensure that the machine, equipment or process cannot be reenergized accidentally or unexpectedly; and to ensure that the reenergization is accomplished safely. The establishment and utilization of this procedure must be coupled with sufficient initial and follow-up training to ensure the successful utilization of the procedure.

V. Major Issues

The evidence submitted to the record is summarized and evaluated in the following discussion of each major issue and in the Summary and Explanation of this Final Rule. The numbers in brackets refer to specific written comments (Ex. —) and to the transcript page number of the testimony presented at the public hearing (Tr. p. (W for Washington, DC and H for Houston, TX) —).

1. Should OSHA require the use of locks, locks and tags, or tags alone to control potentially hazardous energy?

The most vigorously contested issue was the need to use locks or tags as the primary means to prevent the accidental operation of energy isolating devices, such as electrical disconnects, hydraulic or pneumatic valves. The proposed standard did not establish definitive criteria for employers to use in making their choices of control measures, that is, the use of locks, tags or a combination of the two.

In general, a strong preference was evidenced in the comments and hearing testimony for locks. Many parties to this proceeding (Ex. 2-2, 2-12, 2-27, 2-29, 2-42, 2-44, 2-57, 2-63, 2-66, 2-67, 2-79, 2-98, 2-99, 2-103, 2-104, 2-106, 49, 50, 58, 59, 60, 62, 63, Tr. pg. W1-68, W1-71, W1-85, W1-138, W1-141, W1-143, W1-185, W1-192, W1-233, W1-241, W1-249, W2-80, W2-91, H30, H69, H96, H129, H136, H142, H149, H153) stated that the use of locks was the only acceptable means to control hazardous energy. Some of these commenters (Ex. 2-2, 2-44, 2-63, 2-79, 2-98) argued that the use of tags alone did not afford a minimum acceptable level of protection for employees since, as opposed to locks, they could be carelessly bypassed without major effort. Several commenters (Ex. 2-27, 2-29, 2-63, 2-104, Tr. pg. W1-75, H-225) stated that the unrestricted use of tags as the primary means of safeguarding employees during maintenance or servicing of machines and equipment would seriously erode the gains which had been achieved through past labor-management negotiations. Other commenters (Ex. 2-44, 2-57, 2-63, 2-79, 2-98, 2-99, Tr. pg. W1-71, W1-72, H-226) stated that tags were susceptible to being lost or damaged in use due to environmental conditions in the workplace or by contact by employees, materials or equipment moving or being moved about the workplace. These commenters stated that tags only "warn" and that they are a label, not a safety device. Other commenters (Ex. 2-106, Tr. pg. W1-72) stated a view that, the use of tags also promotes a false sense of security among employees and that the accident rate when tags alone are used is higher than when not using any safeguard.

One participant, an employee of Armco Steel (Tr. pg. W2-91), stated that his employer had discontinued the use of tags in favor of locks. He contended that the Company realized that the use of tags alone was not effective in preventing accidents.

Finally, several commenters (Ex. 2-42, 2-79, 2-98, 2-106, Tr. pg. W1-72, W1-138, W1-140, H98, H129, H163) stated that tags can be easily defeated by negligence or ignorance and that the use of tags will not deter the willful misconduct of the employee who would ignore the message of the tag, that is, not to reenergize or restart a machine or piece of equipment.

The record contains a significant body of evidence which indicates that the "one person, one lock, one key" concept enjoys wide acceptance across industry lines. For example, the United Auto Workers provided comments (Ex. 2-24, 20) and testimony (Tr. pg. H215-354) on the use of this concept in the automotive industry. Monsanto Company stated (Ex. 3-52, attachment II) that this form of lockout protection represented their basic approach to lockout/tagout. Monsanto indicated that tagout is only used in situations "where the work is relatively low hazard and the person is in control of the energy source," such as light switches, some valves, and some plug and cord connected equipment. Monsanto also noted that group lockout is used for equipment which requires a relatively large number of servicing workers, with a large number of points to be locked out.

On the other hand, several commenters (Ex. 2-33, 2-55, 2-94, 2-96, 2-102, 2-105, and Tr. pg. W1-144, H197) stated that their companies utilize a system of tags to ensure that equipment which has been shut down will not be reenergized or restarted. One of these commenters (Tr. pg. H198) stated that the tagout system utilized by his company is "well understood by all employees. In fact, we feel so strongly about our red/danger tag procedures that we require mandatory discipline for its violation." The company submitted its safety record as support for its assertion that its tagout program is effective. The employees of this company have worked over 488 million hours between January 1980 and September 1988 with only 130 lost time accidents. Of those 130 accidents, only one occurred which was marginally related to tagout. That one accident occurred because there was no valve to guard against the transfer of heat through another closed and tagged valve. Finally this commenter stated, "The key to safety is not in a specific device, be it tag or lock. [Safety] rather, lies in good procedures and careful training combined with assurance of accountability. If these three principles are in place, a system which uses tags only will adequately protect employees. A lockout requirement in addition to tagout will not assure greater safety." (Tr. pg. H199.)

Even 2 commenters (Ex. 2-67, Tr. pg. W1-75, W1-167), who spoke out against the use of tags admitted that there might be instances in which lockout would be either impractical or impossible. However, one commenter (Tr. pg. W1-97) stated that problems, such as the loss of computer memory by shutting off automated equipment, could be overcome. Retention of the computer memory could be accomplished by providing a separate energy source for the computer so that the energy used to power the movable portions of the mechanism could be shut off and locked out without affecting the computer memory. This commenter stated that other innovative means are possible for solving other similar problems.

Other commenters (Tr. pg. W1-139, W1-157) stated that there is no data available on accidents which have occurred when machines or equipment are tagged out.

Several commenters (Tr. pg. W1-105, W1-139, W1-164) suggested tagging should be used only with an increased

emphasis on training, supervision, controlled access and employer commitment.

Much of the testimony and comment received in this rulemaking has focused on whether the standard should require lockout as opposed to the proposed approach of allowing lockout or tagout. In a sense, it was unfortunate that attention was focused more on a single aspect of the standard, though it is certainly an important one, than on the standard taken as a whole. The proposed standard was intended to specify that the employer provide a comprehensive set of procedures for addressing the hazards of unexpected reenergization of equipment, and the use of locks and/or tags was intended to be only a single element of the total program. In order to provide adequate protection to employees, the Final Rule, as did the proposal, requires employers to develop and utilize a comprehensive energy control program consisting of the development and utilization or procedures and training of employees. The procedures must consist of steps for deenergization of equipment, isolation of the equipment from energy sources, and verification of deenergization before servicing and maintenance is performed on equipment, and the employees who either perform the servicing or maintenance or are affected by those operations must be properly trained in the energy control procedures which apply to their work.

It should be noted that locks and tags by themselves do not control hazardous energy. It is the isolation of the equipment from the energy source and the following of the established procedures for deenergization and reenergization of the equipment that actually controls the energy. Locks and/or tags are attached to the disconnects and other energy isolating mechanisms after the machine or equipment has, in fact, been isolated, in order to prevent them from being reenergized before the work has been completed. If the equipment has not been properly deenergized, and if proper procedures have not been followed, neither a lock nor a tag will provide protection.

The treatment of lockout vs. tagout presents OSHA with a difficult regulatory dilemma. On the one hand, if the issue were simply whether a lock or a tag will be better able to prevent equipment from being reactivated, there is no question that a lock would be the preferred method. Locks are positive restraints which cannot be removed (except through extraordinary means such as bolt-cutters) without the use of a key or other unlocking mechanism. By contrast, the limitations of tags used alone are self-evident: They do not serve as positive restraints on energy isolating devices, but are only warnings to employees that the equipment is not to be reenergized. Tags not fastened with a strong material can become detached from the energy isolating device by wind or other environmental conditions, and the legend on some tags can be rendered illegible if the tag becomes wet. Tags may not provide protection if there are affected employees who do not read English or who have not been properly trained in the tagging system and its implementation.

However, the issue in this rulemaking is not merely on the use of lockout vs. tagout, but rather the use of locks and/or tags in a comprehensive program of energy control. As was noted in the preamble of the proposed rule (53 FR 15496, April 29, 1988), OSHA is aware of workplaces in which tagout systems are used with great effectiveness. In particular, various electric utilities and chemical plants report that they have used tagout in lieu of lockout successfully for many years (cf. Tr. H194–214; W2.2–3—2–39). In evaluating these industries, OSHA has determined that there are several factors which have contributed to their successful use of tagout programs: first, these companies have implemented detailed energy control procedures which are quite similar to those set forth in both the proposed and final lockout/tagout standard; second, they have established and utilized extensive training programs to teach their employees about their energy control procedures, including the use of tags and the importance of obeying them; third, these companies reinforce their training periodically. However, it is the fourth common element, discipline, which appears to be the most critical to the success of these programs; the companies with effective tagout programs apply various types of disciplinary action to both supervisors and employees who violate the tagout procedures.

OSHA believes that an effective tagout system needs all four of these elements to be successful. However, it is the fourth element, discipline, which is the most difficult to incorporate into a regulatory approach in the Final Rule. Not surprisingly, it also reflects the most serious limitation of tagout which does not arise with lockout. Because a tagout program does not involve positive restraints on energy control devices, it requires constant vigilance to assure that tags are properly applied; that they remain affixed throughout the servicing and maintenance of equipment; and that no employee violates the tag by reenergizing the equipment, either intentionally or inadvertently, before the tag is removed. By contrast, a lockout device, once applied, cannot inadvertently be removed, and cannot be removed intentionally by an unauthorized person except by the use of force.

In the Final Rule, OSHA has determined that lockout is a surer means of assuring deenergization of equipment than tagout, and that it should be the preferred method used by employees. However, the Agency also recognizes that tagout will nonetheless need to be used instead of lockout where the energy control device cannot accept a locking device. Where an energy control device has been designed to be lockable, the standard requires that lockout be used unless tagout can be shown to provide "full employee protection," that is, protection equivalent to lockout. These requirements will be discussed in detail in the summary and explanation of the standard, below.

The Agency believes that except for limited situations, the use of lockout devices will provide employees with a more secure and more effective means of assuring that equipment will not be reenergized while they are working on it. To the extent that equipment is capable of being locked out during servicing or maintenance, OSHA believes that it should be locked out. It should be noted, in this regard, that a number of General Industry standards, such as § 1910.305(j)(4) in Subpart S-Electrical, presently require electrical disconnects to large motors to be capable of being locked out.

According to OSHA's Regulatory Impact Analysis, approximately 90% of all electrical energy isolating devices (disconnects) and about ⅔ of all energy control valves are currently capable of being locked out. As previously discussed, the capability for lockout does not necessarily mean that the equipment has an actual hasp or other physical attachment point for a lock. For example, the use of chains can be an effective means of facilitating lockout of many types of valves, even if the valve does not have a specific locking point. Many examples of equipment which was made lockable with minor modifications have been provided to the record. For equipment of this type, OSHA believes that the lockout capability should be used in order to maximize the protection afforded by this standard.

OSHA also acknowledges that certain types of energy isolating devices currently in place are not capable of

being locked out. Such equipment would need to be replaced with or modified significantly to accept locking-type mechanisms in order to become capable of being locked out. This equipment constitutes a relatively small percentage of all equipment to be covered by this standard, and will primarily involve valves rather than electrical disconnects. OSHA believes that where equipment replacement and major equipment modification would be necessary for the equipment to accommodate a lockout device, such efforts are most effectively and efficiently achieved as part of the normal replacement cycle for the equipment, rather than through a specific requirement for retrofitting within a set time frame in this standard. OSHA believes that it is much more cost-effective and protective to design a locking capability into equipment than it is to perform a major retrofitting of that equipment solely to incorporate lockout, for several reasons. First, there are situations in which locking out of equipment can create other, and sometimes greater, hazards to employees. The retrofitting of such equipment for the sole purpose of incorporating a lockout capability would not necessarily deal with the additional hazards. By contrast, the incorporation of a lockout means into the design of new equipment is far less costly than modifying equipment which was not designed to be locked out. Third, incorporating a lockout capability into either new or overhauled equipment is a far less complex task from a technological standpoint, since the locking aspect is a small part of the overall design.

Surprisingly, although there was considerable evidence submitted on equipment for which lockout is currently being used, this rulemaking provided OSHA with little new information on the costs or feasibility of extending lockout requirements to equipment which is not currently capable of being locked out. Therefore, OSHA is unable to conclude with any degree of certainty that a requirement to retrofit all such equipment would be feasible, nor is the Agency able to determine the amount of time or resources that would need to be expended to achieve compliance. For such equipment, OSHA will allow employers to use the less restrictive tagout programs, but only until the equipment is replaced, or until major rehabilitation or modification is performed on it. At that time, the new, overhauled, or modified equipment must be equipped with lockout-capable energy isolating devices, and the energy control procedure for the servicing of that equipment must be revised to make use of that capability, except if the employer can demonstrate that tagout will provide equivalent protection.

OSHA is confident that this standard is a cost-effective approach to providing protection against hazardous energy sources. It recognizes that lockout is, in general, preferable to tagout as a method of assuring that deenergized equipment is not inadvertently or accidentally reenergized. It reqaires that the employer develop and implement an energy control program and procedure for servicing and maintenance of machinery and equipment, using lockout or its equivalent on the great majority of energy isolating devices, namely those which are currently capable of being locked out. For energy isolating devices which do not yet have a lockout capability, the standard allows the interim use of tagout, but lockout-capable energy isolating devices must be installed when that equipment is replaced or overhauled. The standard is written in performance-oriented language, providing considerable flexibility for employers to tailor their energy control programs and procedures to their particular circumstances and working conditions. OSHA is confident that this standard will greatly reduce the toll of injuries and fatalities which occur each year from the failure to control hazardous energy in general industry workplaces.

A critical element of this standard is the determination of whether an energy isolating device is "capable of being locked out." In its most limited sense, a device would be considered to be "capable of being locked out" either if it was designed with a hasp or other integral part to which or through which a lock could be affixed, or if it has a locking mechanism built into it. However, OSHA's use of the term for the purposes of this standard is somewhat broader, without being overly expansive. OSHA considers equipment to be capable of being locked out if the use of a locking mechanism will not require the employer to dismantle, rebuild, replace, or alter in a permanent way the energy control capability of the isolating device. For example, although some valves and other energy isolating devices are not designed with an integral means of being locked, they can be secured with chains, blocking braces or wedges, which then can be locked. Because extensive equipment modification is not needed in this situation, OSHA views this type of lockout to be both technologically and economically feasible. However, a specific energy isolating device is not considered as having the capability of being locked out if the device is installed within a single cabinet, enclosure or cutout box containing several other energy isolating devices or valves and where the only preventing access to the energy isolating device or valve can be locked out individually, tags must be used and must be attached to the specific energy isolating device and not simply attached to the cabinet or enclosure door or cover. By contrast, as noted earlier, some types of valves and disconnects would require total or partial replacement in order to provide the equipment with a lockout capability.

2. Should OSHA require employee participation in the development of lockout procedures and the training programs required by this standard?

There was considerable comment on the part of labor unions (Ex. 2–29, 2–44, 2–63, 60) and other commenters (Ex. 2–92, 2–97) that OSHA should require that employees and employee representatives participate in the formulation and implementation of lockout programs (compliance plans, procedures, persons to conduct inspections, education and training programs and materials). These commenters also stated that any comments by employee representatives should be incorporated into the training programs. One commenter (Ex. 2–63) stated, "The standard does not prescribe worker participation in program design and training which is essential to an effective program." Another commenter (Ex. 2–97) stated, "Procedures cannot be written in a vacuum and must be accepted by employees, training must be appropriate and up-to-date for the situation." Finally, one commenter (Ex. 2–97) stated, "An effective lockout program must provide for employee participation and their representatives in program design and training."

OSHA has determined that a specific provision dealing with employee participation in the development of the employer's lockout or tagout procedure is not necessary for the effective implementation of the Final Rule. For standards dealing with exposure to toxic substances and harmful physical agents under section 6(b)(5) of the OSH Act, section 8(c)(3) of the Act spells out specific requirements for employee involvement in compliance activity. In particular, it requires that employees or their representatives have the opportunity to observe air monitoring and to have access to monitoring records. By contrast, there is no such specific statutory mandate for the

present standard. Although OSHA agrees that active employee involvement may enhance understanding and cooperation, the Agency believes that it would be inappropriate to require such involvement in this standard. The standard sets out the procedures and steps which the employer must take to establish and implement an effective procedure for controlling hazardous energy, and under the OSH Act, it is the employer who is responsible for complying with the standard.

3. Should OSHA change the scope and application statements of this standard in this Final Rule to cover construction, maritime, agriculture, electric utility, and oil and gas well drilling industries?

In the Notice of Proposed Rulemaking for the standard on the control of hazardous energy sources (Lockout/Tagout) (53 FR 15496, 29 April 1988), OSHA proposed exempting the construction, maritime and agricultural industries. In the preamble of the proposed rule, OSHA explained that the exemption of these industries was based upon their unique situations and work practices which would unduly complicate the development of a generic energy control standard for general industry. For example, the longshoring and the construction industries are generally characterized by casual (short term) employment which may last just until the project for which the employees were hired is completed. The project may involve the erection of a single building or the loading or unloading of a single vessel. Even on longer duration construction projects, the various tasks, such as steel erection or brick laying, are usually of relatively short duration. One commenter (Ex. 2–80), in discussing the need for regulation of the construction industry, pointed out the difficulty of providing adequate training of a transient workforce. Likewise, the agricultural industries can be characterized as ones which have more rapidly changing employment. For example, agricultural harvesting (and its employment of migrant workers) and the use of harvesting machines are limited to those times when crops are ready to be harvested.

Of additional concern in the imposition of regulations in the construction industry is the uniqueness of the earthmoving equipment, such as lattice boom mobile cranes, front-end loaders, bulldozers, scrappers and dump trucks. As opposed to maintenance on automobiles, buses and over-the-road trucks where removal of the ignition key usually ensures that the engine can not be started and the vehicle may be worked upon, some of the maintenance of the above mentioned earth moving equipment involves the positioning of components, such as buckets, blades and machine body parts, which present extraordinary hazards to maintenance or servicing personnel. These hazards and the means to minimize the potential for injury to employees involve additional considerations, which were not adequately addressed during the course of the rulemaking proceeding.

Because of the unique nature of these industries, their respective workforces and working conditions, OSHA believes that this Final Rule might need considerable modification in order to provide optimal protection to employees. In particular, OSHA is concerned with the effectiveness of the basic approach of this standard when applied to a workforce which is highly transient. The energy control procedure may vary widely from one workplace to another, and an employee in construction, for example, may find him/herself in several workplaces during the course of a single year. Similarly, the Agency will evaluate means by which the training requirements of this standard could be modified to reflect these conditions.

The Agency currently intends to consult with the Advisory Committee for Construction Safety and Health (ACCSH) on a proposed lockout-tagout standard for construction under section 107 of the Construction Work Hours and Safety Standards Act (Construction Safety Act), 40 U.S.C. 333. In addition, for the maritime industry, OSHA intends to present these matters to the Shipyard Employment Standards Advisory Committee (SESAC) for consideration as part of that Committee's review of shipyard standards in part 1915.

OSHA has determined that the Final Rule will cover General Industry, but will not be expanded to cover construction, maritime and agriculture at this time. The Agency has inadequate information at this time on both the hazards of lockout or tagout and the appropriateness of this standard's approach in those industry sectors. However, the Agency will continue to review information on these sectors and will evaluate the need to initiate further rulemaking and will consider whether this Final Rule, or an appropriate modification of same, should be used as the basis for a proposal for construction, maritime and agriculture.

There are several commenters (Ex. 2–27, 2–49, 2–57, 2–76, 2–79, 2–99, 2–106, 60), who were opposed to exempting any industry. Their concern was that the hazards associated with failure to lockout during the maintenance or servicing of machines or equipment were not restricted to a single industry or group of industries. It is their contention that this standard should have universal application. On the other side of the question, there was one commenter (Ex. 2–58) who agreed with the exclusion of these industries.

It should be noted that OSHA's electrical standards for construction (29 CFR part 1926, subpart K), which were revised on July 11, 1986 (51 FR 25318), currently contain various requirements for deactivating equipment, deenergizing electrical circuits, and limiting employee access to energized parts in construction work (e.g., §§ 1926.403(j), 1926.416, 1926.417). Similarly, OSHA's shipyard and marine terminal standards (29 CFR parts 1915 and 1917, respectively) include many provisions which address deenergization of equipment during servicing of equipment on vessels and in marine terminals (e.g., §§ 1915.162–.165, 1915.181, 1917.48(i), 1917.151(b).

Based on its experience in regulating construction and maritime employment, OSHA believes that a generic energy control standard would likely be applied quite differently in these areas than in general industry. Further, the interrelationship between a generic rule and the specific provisions currently applicable to these industry sectors must be considered. In its consultations with its advisory committee on construction and shipyard employment, OSHA will seek guidance on whether a generic rule would be appropriate for these industries; on what areas in which such a rule should differ from the general industry standard being issued today; and on the reasons for any such differences.

OSHA is no less concerned with the safety of these other employees. However, delaying the promulgation of this generic, general industry standard to examine all the unique aspects of these other industries would further delay the promulgation of this standard. There were five commenters (Ex. 2–22, 2–26, 2–45, 2–52 and 2–81) who recommended the exclusion of the natural gas transmission industry from the scope of this standard. Their contention was that OSHA would be preempted under section (4)(b)(1) of the Act from enforcement of this standard since the U.S. Department of Transportation has regulations affecting the gas transmission industry. Section (4)(b)(1) of the Act states:

> Nothing in this Act shall apply to working conditions of employees with respect to which other Federal agencies and State agencies, acting under section 274 of the

Atomic Energy Act of 1954, as amended (42 U.S.C. 2021), exercise statutory authority to prescribe or enforce standards or regulations affecting occupational safety or health.

OSHA recognizes the possibility that its lockout or tagout standard may be preempted under section 4(b)(1) of the OSH Act by other Federal agency actions, such as regulations issued by the Department of Transportation's Division of Pipeline Safety. Section 4 (b)(1) provides that when another Federal agency exercises statutory authority over working conditions, that exercise of authority will preempt OSHA from covering those same working conditions. However, OSHA declines to incorporate a specific provision on preemption into this standard for two reasons: first, whether or not preemption takes place for a given working condition is a matter of law, to be evaluated in a case-by-case determination. Second, even in the event that preemption takes place, if the preempting agency were to choose to revoke its regulations or other exercise of authority, there would no longer be any preemption. Inclusion of a preemption provision by OSHA in a particular safety or health standard would inappropriately prevent OSHA from asserting its authority under the OSH Act in that situation.

There were five commenters (Ex. 2–21, 2–36, 2–40, 2–46 and 2–50–20), who discussed the application of this standard to the petroleum industry. Four of those commenters (Ex. 2–21, 2–36, 2–40 and 2–46) stated that OSHA should not try to "force fit" a machinery standard to process systems and piping networks; that OSHA should not expand the scope of the consensus standard; and that, if necessary, OSHA should develop a separate standard for process piping. (There was universal agreement on the part of these industry commenters that this standard did properly apply to the machinery elements of the process piping systems.) On the other hand, one commenter (Ex. 2–50) spoke out in favor of this OSHA standard to piping systems.

There were two commenters from the petroleum industry (Ex. 2–21 and 2–46) and one commenter from the chemical industry (Ex. 2–59) who objected to the use of a written lockout or tagout procedure as specified in the proposed Standard. These commenters stated that they use a work permit or work authorization system. The safe work permit checklist enclosed with one comment (Ex. 2–59) has provisions for the use of blinds and disconnecting pipes, and for extensive post isolating cleaning and testing. At the Houston segment of the hearing, the representative of the American Petroleum Institute acknowledged that the work authorization system was not inconsistent with the procedures set forth in the proposal. (Tr. p. H64). (OSHA agrees that a work permit checklist system or work authorization system could serve as the required written procedure as long as it meets the criteria for a procedure spelled out in this Final Rule.)

In their comments to the record, the American Petroleum Institute (API) restated their view that the lockout/tagout rule was not designed to regulate piping networks and process systems (Ex. 2–36). OSHA recognizes that the energy sources and control methods used in process hazards management are often quite different from those encountered with machinery and mechanical equipment. However, the Agency considers the basic approach of this standard to be appropriate for the control of all hazardous energy sources, including those discussed by API. Indeed, many, if not all, of the elements covered in the standard are addressed by the "work authorization procedures" commonly used throughout the petroleum and chemical industries. These procedures, which focus upon the issuance of work permits or permits for safe entry into piping systems, were acknowledged at the hearings to be consistent with the procedures set forth in the proposed rule. The primary area which warrants further explanation involves the different means used to isolate the energy in piping and process systems, and how they relate to the lockout or tagout requirements of this standard.

According to one commenter (Ex. 20), the procedural steps required for safe performance of process system maintenance are: (1) Deactivation, (2) removing contents, (3) isolation, (4) decontamination, (5) restraining, (6) verification, (7) control and (8) communication. In contrast, this standard sets forth five steps for lockout or tagout: (1) Equipment shutdown, (2) isolation, (3) lockout or tagout application, (4) stored energy restrictions, and (5) verification. However, these five steps encompass all elements of process system deenergization as well. For example, deactivation of a process system is analogous to equipment shutdown. Similarly, removing the contents of the piping system and isolation of the energy source can be compared to isolation and lockout or tagout of a machine or equipment, and decontamination and restraining in piping systems is essentially the same as restraining or minimizing the stored energy of machines and equipment. Finally, verification of the success of prior steps of a piping system isolation is the same as verification of proper implementation of the energy control program. OSHA acknowledges that when there are additional steps specific to the preparation for maintenance of piping systems, these steps would also need to be included in an employer's energy control program.

Based upon the foregoing comparison, OSHA believes that the imposition of the requirements of this standard (particularly the need for a standardized procedure) is not a "force fit" but the logical "tailoring" of the steps to a different type of equipment. Based upon the generic nature of this standard, OSHA recognizes that some modifications or "tailoring" of the requirements of this standard may be necessary, but the basic procedural provisions of the standard are designed to be used throughout general industry, in a wide range of applications.

Two commenters (Ex. 2–21 and 57) pointed out that some of the items listed in the definition of energy isolating devices (notably the blank flange and bolted slip blind) can require at least as much effort to remove as locks. These commenters pointed out that removal of these devices, when they are properly bolted in place, requires wrenches to disassemble the nuts and bolts holding the blank flange or blind. The use of these wrenches is comparable to using bolt cutters to remove a lock. Although the wrenches used for removing the nuts and bolts from the flanges may be more readily available with a piping system than a pair of bolt cutters in the average workplace, the time to remove the nuts and bolts would surpass the time to remove a lock. OSHA believes that this type of bolted system will provide comparable security against the release of hazardous energy in the system, even though a "lock" is not used. Based upon the above rationale, OSHA will consider bolted blank flanges or slip blinds to be an acceptable type of lockout/tagout device. As with all devices, these bolted systems must be used as part of a standardized, documented procedure, and they must meet the other requirements of the standard for lockout or tagout devices (that is, they must be durable, standardized, substantial and identifiable.)

If bolted flanges or slip blinds are used, a means must be devised so that each authorized employee can be identified as a participant in the project when he/she is working on it. For example, individual identification can be achieved by each authorized

employee hanging his/her tag on the blank flange or the slip blind when he/she starts work and removing his/her tag when he/she stops work. The tag in this case would supplement the locking mechanism of the bolts on the flanges or slip blinds.

The applicable consensus standard (ANSI Z244.1)(Ex. 9) has been reviewed for its applicability to process systems. It is clear from this review that this consensus standard was intended to apply to machines, equipment and processes. The definition of energy isolating device contains examples which include slip blinds, blank flanges, line valves and similar devices. These are devices used for energy isolation in piping systems.

OSHA believes that the employees working on the piping portions of processes deserve no less protection then when those same employees work on the mechanical components of the same systems. The advantage of writing this OSHA standard in performance language is to allow flexibility of compliance for all systems in which hazardous energy is or may be present. OSHA has used this approach to the formulation of this standard because of the wide range of energy control situations encountered throughout general industry.

OSHA also proposed to exclude from coverage of this standard certain installations under the exclusive control of electric utilities, as well as oil and gas well drilling operations. These industrial sectors were proposed to be exempted from this standard because lockout will be uniquely addressed for these industries in other proposed standards. In both cases, OSHA is actively working on projects to cover the special safety needs of these industries. (See 54 FR 4974, January 31, 1989 for the Proposed Standard on Electric Power Generation, Transmission, and Distribution.)

4. Should OSHA state the requirements of this final standard in performance language?

There were two commenters (Ex. 2-27, 2-29, and 2-91) who objected to the use of performance language in the proposed standard. Their objections were based upon the fact that, without specific requirements, employers would be allowed too much discretion in the means or methods that they utilize in complying with the standard.

There were 11 commenters (2-31, 2-34, 2-36, 2-37, 2-39, 2-46, 2-55, 2-57, 2-59, 2-62, 2-69, and 2-87) who favored the use of performance language in the standard. These commenters pointed out that the standard covers a vast segment of industry (both in size and type of companies) and type of operations. It is their contention that the use of performance language allows a degree of latitude to employers to "tailor" the required procedures, training requirements, and inspection parameters of the standard to fit the individual conditions present in their workplaces.

OSHA concurs with those commenters who stressed the need for flexibility in the standard. For example, the detail into which a procedure may have to go may vary depending upon the type of power the machine or equipment may utilize or the means used to isolate or block the machine or equipment from the source of power. The amount of detail in a procedure for shutting down a simple conveyor with a signal source of power, and single feed and discharge points, could be much less than the procedure for shutting down a long assembly line conveyor with multiple feed and discharge points, one which has many employees working about the conveyor. The use of multiple sources of power applied to the machine or equipment at multiple points would necessarily cause the complexity of the procedure to be enhanced.

Finally, the OSH Act, in discussing the promulgation of standards, states in the second sentence of section 6(b)(5), "Whenever practical, the standard promulgated shall be expressed in terms of objective criteria and of the performance desired."

Based upon the foregoing, OSHA has decided to retain the performance language in this final standard.

VI. Summary of Explanation of the Final Standard

There were 108 comments and 64 exhibits placed in the record of the Proposed Standard for the Control of Hazardous Energy Sources (Lockout/Tagout) (53 FR 15496, April 28, 1988) and 16 parties participated in the public hearing. There was general agreement on the need for a comprehensive standard (Exhibits (Exs.) 2-1, 2-3, 2-4, 2-5, 2-8, 2-9, 2-12, 2-13, 2-21, 2-27, 2-29, 2-34, 2-36, 2-38, 2-39, 2-40, 2-42, 2-50, 2-52, 2-53, 2-55, 2-59, 2-64, 2-69, 2-70, 2-72, 2-73, 2-74, 2-75, 2-77, 2-78, 2-79, 2-80, 2-85, 2-87, 2-91, 2-95, 2-98, 2-100, 2-105, 2-106) with the major discussion centering around the form and the content that the Final Rules should take.

As previously discussed (see section entitled "Major Issues" above) OSHA has determined that the use of lockout for the control of hazardous energy is the more positive means of ensuring employee safety. The fuse of tagout, in lieu of lockout, requires the addition of certain elements of the program and the reinforcement of others to provide full employee protection.

This standard requires the adoption and utilization of standardized procedures and the implementation of safe work practices for the control of potentially hazardous energy during servicing and maintenance activities. It also requires the training of employees in the use of these practices and procedures. An Appendix is provided to serve as an aid in complying with the requirements of this section.

In paragraph (a), OSHA defines the scope, application and purpose of this Standard for the control of hazardous energy (lockout or tagout). The standard covers servicing and maintenance in general industry where the unexpected energization or start-up of machines or equipment or the release of stored energy could cause injury to employees. This Final Rule does not contain specifications which must be followed in all circumstances, but, rather, provides flexibility for each employer to develop a program and procedure which meets the needs of the particular workplace and the particular types of machines and equipment being maintained or serviced.

In their post-hearing comment, (Ex. 60) the AFL-CIO suggest adding the word "processes" to the words "machinery" and "equipment," to clarify that the standard is intended to cover piping systems as well as machinery and equipment. As discussed earlier, OSHA agrees that processes are covered by the standard, although the Agency felt that the use of the term "equipment" in the proposal was broad enough to cover all types of equipment, including process equipment. Further, had process and piping equipment not been within the scope of the standard, it would have been unnecessary to include a separate provision for "hot tap" operations, which are performed almost exclusively on process and piping equipment. However, in response to the comments, and as discussed elsewhere in this preamble, OSHA has revised several of the proposed provisions in the standard to refer directly to piping and process hazards and some of the unique aspects of controlling those hazards in the context of this generic rule. For example, many servicing operations involving process equipment utilize blinds and blank flanges as means of controlling hazardous energy in the process system. These blinds and flanges can be bolted in place, a method of securing which does not involve an actual lock, but which would be of comparable or greater difficulty to defeat either intentionally or inadvertently. OSHA

believes that the bolting of blinds and flanges should be considered to be a "locking device" for the purposes of the standard, and has modified its proposed definition to reflect this determination. Since the standard requires locking devices to identify the person that affixes them, the employer will need to use a supplemental tagout device on the bolted blinds and flanges to meet this requirement.

For the reasons discussed in the section entitled, "Major Issues", above, OSHA has determined that the present rulemaking effort should be limited in scope to general industry. Development of appropriate requirements for the control of hazardous energy procedures for construction, maritime, and agricultural employments will be considered for future rulemaking proceedings.

Secondly, OSHA has determined that certain installations under the exclusive control of electric utilities, as defined in paragraph (a)(1)(ii)(B), are not to be covered by this rule. These installations are intended to be covered separately by a new section, § 1910.269, "Electric Power Generation, Transmission and Distribution," which OSHA proposed on January 31, 1988 (54 FR 4974). Because of the nature of these electrical utility operations, § 1910.269 will tailor the key provisions of this standard on lockout or tagout to meet the special safety needs of that industry. However, non-utility employers and workplaces that are engaged in the activities of power generation, transmission and distribution *are* covered by this standard and are not within the intended scope of § 1910.269. Whether or not this suggested demarcation is reasonable is an issue which will be dealt with in that rulemaking proceeding.

In their post-hearing comment (Ex. 55), the Edison Electric Institute (EEI) contended that the forthcoming power generation standard should cover the servicing and maintenance of mechanical and hydraulic equipment in power plants. If such equipment is either an integral part of, or inextricably commingled with, power generation processes or equipment, OSHA agrees that the power generation standard will apply instead of the generic lockout/tagout standard.

Further, OSHA states in paragraph (a)(1)(ii)(C) that exposure to electrical hazards from work on, near, or with conductors or equipment in electric utilization installations which is covered by Subpart S of Part 1910 also are excluded from coverage by this standard. OSHA intends coverage for this work to be provided instead in a separate rulemaking on "Electrical Safety Work Practices," which was proposed on November 30, 1987 (52 FR 45530) (new §§ 1910.331 through 1910.335) as an amendment to Subpart S. Those proposed sections have their own provisions for dealing with lockout/tagout situations, and for controlling employee exposure to hazardous electrical energy with the use of electrical protective equipment. They are based largely on a national consensus standard, NFPA 70E—part II, "Electrical Safety Requirements for Employee Workplaces."

Similarly, paragraph (a)(1)(ii)(D) excludes oil and gas well drilling and servicing installations from coverage by this rule. These installations are intended to be covered separately by a new § 1910.290, Oil and Gas Well Drilling and Servicing. A proposed § 1910.290 was published on December 28, 1983 (48 FR 57202). The Agency is currently developing a revised proposal to reflect the information in the rulemaking record, which was submitted in response to the initial proposal. The hazards involving lockout or tagout that are unique to oil and gas well drilling and servicing will be given a complete evaluation during that rulemaking process and appropriate steps will be taken to control them.

One commenter (Ex. 2–54) recommended the exclusion of the machine manufacturing industry from this Final Rule. This commenter contended that the inclusion of the word "constructing" in the definition of "servicing or maintenance" would seriously endanger the ability of machine manufacturers to perform the initial construction, assembly and manufacture of machines.

During the assembly of equipment, it is normally not connected to any external power source, except when a temporary connection is made to effectuate adjustment, testing or try-out. The nature of machine manufacturing normally only requires the connection to an external power source to move parts in order to allow for the construction. Once the system has been completely assembled, it is necessary to do final testing or try-out of the system. Energization of the entire system is generally necessary to accomplish the testing. The system is then connected to external power sources and the testing undertaken. If the tests are unsuccessful or further assembly work is needed, the equipment should be disconnected from the external power source and then the additional work conducted. It is during the time when the equipment is being alternately energized and deenergized that the energy control means are particularly significant.

OSHA believes that disconnection of a machine or equipment from external power sources, as with cord and plug connected equipment, is a satisfactory method of isolating the equipment from the source of energy. OSHA also recognizes that testing with the power on is often necessary to ensure the proper assembly and functioning of all components. OSHA believes that workers "constructing" machinery and equipment need the same safeguards as other emplolyees doing other servicing on maintenance operations. OSHA is, however, providing specific requirements in paragraph (f)(1) of this Final Rule for the safeguarding of employees during operations which require the alternate energization and deenergization of machines and equipment for testing and trouble shooting.

One commenter (Ex. 2–35) recommended that maintenance of medical equipment be excluded from this standard. This recommendation was predicated on the fact that maintenance and servicing of medical equipment is already covered by national consensus standards, that technical persons working on state-of-the-art medical equipment are highly trained professionals and that some equipment must be serviced while units are energized.

OSHA believes that national consensus standards, in and of themselves, do not ensure a safe and healthful workplace since they are not enforceable regulations. Compliance with specific provisions of such standards is voluntary except when OSHA incorporates then into its regulations. In addition, as previously discussed in this preamble even if the servicing employeee is highly trained, his/her safety during the servicing operation may well be dependent on the actions of persons who are not as well trained. Other employees, upon finding a machine or equipment not operating, may attempt to start the machines, not realizing that they may be subjecting themselves or others to an increased risk of injury.

In paragraph (a)(2)(i), the Final Rule states that the standard applies to servicing or maintenance of machines or equipment. These activities are defined in paragraph (b) to include activities such as constructing, installing, setting up, adjusting, inspecting, maintaining, repairing and servicing machines and equipment. These activities generally require the stoppage of the machine or equipment and the resulting

discontinuance of the production process. It is during these activities that the machine or equipment must be isolated from the energy source and the energy isolating device disabled. It is also during these activities that employees are exposed to the unexpected energization, startup or release of stored energy against which the control procedures established in this standard are designed to provide protection.

Proper accomplishment of most servicing requires that the machine or equipment be shut down or turned off. However, simply shutting down the machine or equipment has not proven to prevent accidents when there is an unexpected energization or start up of the machine or equipment or the release of stored energy. The control of this hazardous energy is accomplished through the use of a standardized procedure which requires the shutting off of the machine or equipment, locating the energy isolating device and isolating the machine or equipment from the energy source, locking or tagging out the energy isolating device, reducing or eliminating stored or residual energy and then verifying the effectiveness of the energy isolation.

There was one commenter (Ex. 2–80) who suggested that this standard should apply before, during, and after servicing or maintenance is performed. The use of this langauge could be interpreted as meaning the standard should apply at all times since before and after do not denote a beginning or an end. OSHA believes that the steps required by this standard are considered part of the servicing activity, regardless of whether they take place before or after the specific work on the equipment has been performed. Based on this interpretation, the final standard requires the control of hazardous energy only during servicing or maintenance is being conducted.

There are some activities which are properly classified as servicing or maintenance but which are often performed during normal production operations. These activities include lubricating, cleaning, unjamming, and making minor adjustments and simple tool changes. In the proposed standard, OSHA suggested excluding these operations (paragraph (a)(2)(iii) "when it is necessary to perform the activity with the machine energized and if the activity is performed using alternative measures which the employer can demonstrate are equally effective."

Two commenters (Ex. 2–44 and 2–80) stated that this exclusion was too broad and that there is difficulty in distinguishing between normal production operations and servicing or maintenance.

As discussed earlier, OSHA recognizes that machines and equipment present many hazards during their usage during normal production operations. These production hazards are addressed by the machine guarding standards, § 1910.212 (general machine guarding standard) and § 1910.219 (guarding power transmission apparatus). This standard is not intended to deal with these same hazards. However, if a servicing type activity happens to take place during production, such as unjamming the production equipment, the employee performing the servicing may be subjected to hazards which are not encountered as part of the production operation itself. These hazards are manifested when the employee must either remove or bypass guards or other safety devices, when the employee is required to place any part of his or her body into the point of operation of the machine or equipment, or where an associated danger zone exists during a machine operating cycle. In those circumstances, when there is potential for unexpected activation or energy release and the machine or equipment can be deenergized to perform the servicing, the standard requires that it be deenergized and be locked out or tagged out in accordance with the procedure required by this standard.

As was discussed in the preamble to the proposal, OSHA recognizes that some servicing operations must be performed with the power on; in these situations, it would not make sense to require lockout or tagout, which apply to deenergized equipment. The proposal contained a requirement that when servicing or maintenance must be performed with the equipment energized, the employer must use an alternative procedure which provides, in the language of the ANSI standard, "effective protection." Paragraph 6.8 of the ANSI Z244.1–1982 (Ex. 9) states in part:

> In the case of required minor adjustments where this (deenergization) is not feasible, or in the case of normal production operations, these activities shall be accomplished under the protection of specially designed control circuits, control equipment, and operating procedures, that provide proven effective protection for the affected personnel.

The proposed provision attracted considerable comment, particularly from the union participants, many of whom felt that it provided a "loophole" in the standard. OSHA believes that much of this concern was based on a fundamental misunderstanding of what this provision was intended to accomplish. For example, Mary Twedt, of the United Food and Commercial Workers (UFCW), (Tr. p. W1–183–1900) testified about a serious injury that she had incurred while clearing a jam in a bacon slicing machine. She indicated that she had switched the machine off, but that a co-worker had inadvertently reactivated it while her hand was in the machine. However, there was no indication that it was *necessary* to perform that unjamming operation with the power on. (In fact, since Ms. Twedt did turn the machine's power off to clear the jam, OSHA assumes that it was *not* necessary to have the equipment energized at that time). Further, if it *was* necessary to keep the energy on, the proposal would have required the employer to use an alternative procedure to lockout or tagout which would provide protection.

In the testimony at the Houston hearing, the UAW contended that the "exemption" for normal production operations was too broadly drawn, and that it would be a "loophole" in the standard. Representatives of the UAW testified that they felt that the provision was unnecessary. Their reasoning essentially was that if alternative methods were used to keep the employee out of the danger zone, there was nothing for the standard to cover, since the employee would not be exposed to the hazard. (Tr. p. H290–291). OSHA agrees in principle with this statement, but believes that the standard needs to cover these situations as well in order to provide comprehensive treatment of the hazards. The Agency also agrees that the proposed provision was not clear enough in indicating the types of operations which were covered by the standard, the types of operations which would not be covered by the standard, and the criteria to be applied to each situation. Therefore, the Agency has revised this provision in the Final Rule to deal with these problems.

In the Final Rule, OSHA is clarifying the intent behind the alternative provision for servicing or maintenance which takes place during normal production operations. The general rule is that servicing or maintenance, as defined in paragraph (b), must be performed under lockout or tagout in accordance with a written procedure established under this standard. Minor tool adjustments and changes or other minor servicing activities performed during normal production operations, are not covered by lockout or tagout requirements if the activities are routine, repetitive and integral to the production operation, provided that there is an

alternative means being used for employee protection in lieu of lockout or tagout which will provide effective protection to employees.

OSHA emphasizes that this standard is not intended to cover the types of minor adjustments and other activities which are inherent in the production process. The machine guarding standards in subpart O cover these types of operations. The proposed rule included an exception for these types of operations, but OSHA has determined that there were two significant problems with the exception as proposed. First, the Agency believes that the provision was too broad as to the types of servicing or maintenance which would be excluded from the coverage of this standard. Proposed paragraph (a)(2)(iii) used the phrase "servicing or maintenance which takes place during normal production operations, such as lubricating, cleaning, and making minor adjustments and simple tool changes" to describe activities which would not be covered by this standard. OSHA's intention was to exclude from coverage those actions which would otherwise fit within the definition of "servicing or maintenance," but which are actually routine, repetitive actions which are integral to the operation of the equipment for production, and which are necessary to allow production to proceed without interruption. However, the language of the proposal could have been read more broadly, to exclude from coverage certain servicing operations which should not be considered to be part of "normal" production, and which should be performed with the equipment deenergized. OSHA has revised the proposed exclusion to clarify the limitations of the standard, and to provide more guidance as to the types of servicing activities which must be performed under lockout or tagout. The second problem with the proposed exclusion was that it would have required the employer to demonstrate that it was necessary to perform the operation with the machine or equipment energized. The record reflects much concern about this provision, particularly with regard to the criteria to be applied in determining the necessity of having the equipment energized. OSHA emphasizes that this exclusion was intended to cover the types of routine, repetitive, minor adjustments which are integral to and necessary for the production process. The revised language in the Final Rule sets forth the criteria to be applied in determining whether a given servicing operation is covered by this standard, or whether it is to be considered a part of normal production operations, which require alternative means of protection.

Normal production operations, together with those minor servicing aspects which are also excluded from lockout or tagout coverage, continue to be covered by the machine guarding requirements of subpart O of part 1910. OSHA has provided several examples of the types of activities taking place during production which the Agency would consider to require lockout or tagout, as well as examples of those which would not. It must be emphasized that exclusion from lockout or tagout does not mean that the employer can avoid providing protection. As the exclusion itself makes clear, the employer must provide alternative measures which he/she can demonstrate will provide effective protection. This will generally involve compliance with OSHA's machine guarding requirements throughout the production process.

In evaluating servicing performed during normal production operations, the first question to be asked is whether employees must bypass guards or otherwise expose themselves to the potential unexpected release of hazardous energy. If no such exposure will occur, either because of the method in which the work is performed or because special tools, techniques, or other additional protection is provided, lockout or tagout is not required. If there is such exposure, the lockout or tagout requirements of this standard apply. However, if the servicing operation is routine, repetitive and must be performed as part of the production process, it is obvious that lockout or tagout cannot be performed, because these procedures would prevent the machine from economically being used in production. OSHA will continue to treat these operations as being covered by the general machine guarding requirements of subpart D. The employer must provide appropriate guarding to protect employees from points of operation, nip points, and other areas of the equipment where the employees might be endangered. The use of alternative protective methods to keep employees' bodies out of danger zones, such as specially designed servicing tools, remote oilers, and the like, would meet this requirement.

The Final Rule, as did the proposal, also recognizes that there are some servicing operations in industry which require the equipment to be energized at least at some point during the servicing, for the purpose of testing or positioning the machinery or equipment or the components thereof. Where the energization is limited to those times, and is not shown to be necessary for the entire servicing operation, such servicing will generally be covered by the lockout or tagout requirements of this standard, but with the implementation of the special procedures set forth in paragraph (f)(1) for the temporary removal of lockout or tagout only when the machine or equipment must be energized.

The concept behind both the proposed and final provisions on normal production operations was taken from the ANSI standard, which attempted to address situations in which it was necessary to keep equipment energized during servicing. It was clear to the ANSI committee, as it was and is to OSHA, that neither lockout nor tagout is possible in a situation when the equipment cannot be deenergized, because these efforts involve assurances that deenergization has been achieved and that the proper procedures and verifications of deenergization have been carried out. However, both ANSI and OSHA believe that even if lockout or tagout cannot be done, the employer must provide alternative procedures to lockout/tagout which will protect the employees doing the servicing under those conditions.

There are some situations in which lockout or tagout may not be effective or appropriate, and the standard does not require the use of lockout or tagout in these circumstances. In paragraph (a)(2)(iii), OSHA lists those situations where lockout or tagout provisions do not apply.

In the proposed paragraph (a)(2)(ii)(A), OSHA specified that the standard would not apply when employees are working on cord and plug type electrical equipment for which exposure to the hazards of unexpected energization, start-up, or release of stored energy of the equipment is effectively controlled by other measures. This exclusion would encompass the many varieties of portable hand tools that are found in the workplace, as well as cord and plug equipment which is intended for use at a fixed location.

There were 13 commenters (Ex. 2-14, 2-20, 2-27, 2-34, 2-38, 2-40, 2-44, 2-63, 2-76, 2-29, 2-80, 2-97 and 2-105) on the issue of the proposed exemption for cord and plug connected equipment. Four of these commenters (Ex. 2-44, 2-63, 2-79 and 2-97) stated that the requirements of this standard should apply to all situations (i.e., OSHA should not allow an exemption for cord and plug connected equipment). Two commenters (Ex 2-27 and 2-76) suggested that the standard should apply when the plug is

not near the employee or if it could be plugged in without the employee's knowledge. Two commenters (Ex. 2–38 and 2–40) recommended expanding the scope of this exception to all small machinery or to those pieces of equipment for which the energy isolating device is in the control of the employee performing the maintenance. One commenter (Ex. 2–39) concurred with the proposal as written while one commenter (Ex. 2–14) suggested spelling out the alternate measures which were necessary to eliminate the requirement for locking out the energy isolating device. One commenter (Ex. 2–20) concurred with the exception as long as the employee who is doing the maintenance removes the plug and that employee does so only to do the maintenance.

Based upon the arguments put forward by each of the above commenters, OSHA has decided that the lockout/tagout requirements of the standard will not apply to cord and plug connected equipment if the equipment is unplugged and the plug is in the exclusive control of the employee who is performing the servicing or maintenance of that equipment. Because this employee would control the plug, he/she would be able to prevent the equipment from becoming reenergized during the servicing operation.

Paragraph (a)(2)(ii)(B) proposed that the use of lockout/tagout procedures would not apply to "hot tap" operations when continuity of service or process operation is essential, and complete shutdown of the system impractical, provided that documented procedures and special equipment are used by the employer which will provide proven effective protection for employees. This provision was intended by OSHA to address the petroleum industry's concern (Ex. 16) for the handling of "hot tap" operations commonly used in their facilities, although it might also address other similar operations.

The "hot tap" procedure is employed in repair, maintenance, and service activities, and involves the cutting and welding of equipment (pipelines, vessels or tanks) under pressure in order to install connections or appurtenances. It is commonly used to replace or add sections of pipeline without the interruption of service for air, gas, water, steam and petrochemical distribution systems. Special metal cutting and welding equipment and specific operating procedures are used to limit explosion hazards. The operation may be performed by in-house maintenance personnel or by outside contractors.

The use of "hot tap" procedures appears to avoid several safety risks which would otherwise arise in servicing equipment which is under pressure. First, process shutdowns and start-ups with equipment of this nature pose extreme hazards of explosions and fires due to the complexities and interrelationships among process components. For example, during start-up it is necessary to purge pipelines of air, water and/or inert gases before hydrocarbons are introduced. Malfunctions or operator errors during purging could easily create explosive mixtures in the equipment. In other instances, process shutdowns and start-ups can result in rapid condensation within the process equipment and may cause "water hammers," which are sudden pressure changes that can shake, vibrate and stress equipment to the extent that the pipeline breaks or connection leaks develop. Finally, a third class of hazard avoided is one created by the much higher level of worker activity required during a complete process shutdown or start-up. This may result in more extensive worker exposure to the hazards of the shutdown or start-up procedure, and in greater potential for injury than would be involved in performance of "hot tap"-type activities, in which fewer employees would be exposed.

The OSHA standard, as proposed, stipulated that hot tap operations would be exempt from the requirements of the standard if the employer could demonstrate that: (1) Continuity of service is essential; (2) shutdown of the system is impractical; and (3) documented procedures and special equipment are utilized which will provide effective protection for employees. In the preamble and the Appendix to the proposed rule, OSHA referred to the American Petroleum Institute's (API) publication, "Procedures for Welding or Hot Tapping on Equipment Containing Flammable," Publication 2201, Second Edition, November 1978, (Ex. 3–16). Reference to this document was intended to serve as an illustration of an acceptable procedure. It should be noted that the API procedure applies only to piping, vessels and tanks containing flammable liquids, gas or combustible material.

OSHA's intent in proposing this exception from the requirements of this standard was to allow, in certain cases, a particular type of work (the hot tap) in a limited number of cases (that is, when continuity of service is essential and shutdown is impractical) while providing for an acceptable level of safety for employees. Without this exception to the requirements of this standard, a hot tap operation could not be conducted since the standard would otherwise require machine or equipment shut down and lockout or tagout of energy isolating devices to perform servicing or maintenance.

There were eight commenters (Ex. 2–20, 2–21, 2–22, 2–27, 2–70, 2–76, 2–80 and 2–81) to this proposed requirement. One commenter (Ex. 2–20) suggested that the first two criteria listed above (that continuity of service is essential and shut down is impractical) are unnecessary and should be eliminated from the final rule. Three commenters (Ex. 2–21, 2–22 and 2–81) recommended eliminating the exception entirely. One commenter (Ex. 2–70) proposed the elimination of the need to use special tools. There were two commenters (Ex. 2–27 and 2–80) who encouraged OSHA to be more specific and to detail exact training requirements and work practices for workers involved in hot tap operations. Finally, one commenter (Ex. 2–76) expressed agreement with this concept as proposed.

OSHA believes that employees performing hot tap operations should have comparable protection to workers performing other servicing or maintenance of machines or equipment. OSHA also believes that these operations should be allowed to be conducted when certain limited conditions exist, such as when continuity of service is essential and system shut down is impractical. By specifying these limitations the employer would be prohibited from conducting these operations simply as an expedient. The need for continuity of service would be illustrated by the pipeline containing a petroleum product where stopping the flow of the product and draining the pipeline could introduce an additional danger to employees since the concentration of the gaseous product remaining in the pipe, when mixed with air, could fall within the explosive range of the product, thereby threatening an employee with serious injury if that employee would attempt to weld on the pipe. In this case, shut down may not be practical because shutting down the system may prove more hazardous than allowing the continued operation of the system while the hot tap operation is being conducted. Another example would be when a large storage tank with a hazardous substance is punctured or otherwise penetrated. There is obviously little or no time available to continue the service (store the substance) and shut down the system (drain the tank). In this case, the hot tap operation could be safely and

properly conducted if a documented procedure and the required equipment are used so that they provide effective protection for employees.

In paragraph (a)(3), OSHA sets forth the manner in which the employer is required to protect employees from injuries that could result from the unexpected energization or start up of machines or equipment, or the release of stored energy, when they are engaged in servicing or maintenance activities. This standard requires the development of a program centered around the utilization of a standardized procedure and the training of employees in their role in the successful use of that procedure.

Paragraph (a)(3)(i) specifies that the control of hazardous energy be accomplished by the use of a standardized procedure for affixing the appropriate lockout or tagout devices to energy isolating devices and by otherwise disabling equipment. The steps to be followed by the employer to accomplish this goal are set forth in paragraphs (d)(1) through (d)(5).

In paragraph (a)(3)(ii), OSHA states that the intention of the standard is not to replace existing specific OSHA lockout and/or tagout provisions, but to supplement and support these provisions with the requirement for establishing a procedure and with the requirement for training employees in the energy control program. The following listing indicates a number of OSHA standards which currently impose lockout-related requirements:

Powered Industrial Trucks

1910.178(q)(5)(i)

Overhead and Gantry Cranes

1910.179(g)(5)(ii)
1910.179(g)(5)(iii)
1910.179(g)(5)(i)
1910.179(l)(2)(i) (b), (c), (d)

Derricks

1910.181(f)(2)(i)(c)
1910.181(f)(2)(i)(d)

Woodworking Machinery

1910.213(a)(10)
1910.213(b)(5)

Mechanical Power Presses

1910.217(b)(8)(i)
1910.217(d)(9)(iv)

Forging Machines

1910.218(a)(3)(iii)
1910.218(d)(2)
1910.218(e)(1)(iii)
1910.218(f)(2) (i), (ii)
1910.218(a)(3)(iv)
1910.218(e)(1)(ii)
1910.218(f)(1) (i), (ii), (iii)
1910.218(g)(2)

Forging Machines (continued)

1910.218(h)(2)
1910.261(i)(1)
1910.218(j)(1)
1910.218(h)(5)
1910.218(i)(2)

The standards listed above provide limited coverage of machinery, equipment and industries and do not address lockout or tagout issues or methodology in any detail. For example, none of the existing standards cover the need for a procedure or for more than one or two procedural steps pertaining to the actual application or release of energy control measures. The current provisions also do not address the basic requirements contained in the standard which are needed to support and coordinate the implementation of control measures such as the selection of hardware, communications, periodic inspections, and assignment of duties. Additionally, the need to document a procedure, or to train employees engaged in the relevant activities, is not explicitly required by any of the present regulations. A typical example of this limited coverage is found in the following provisions for mechanical power presses:

Section 1910.217(b)(8)(i). A main power disconnect switch capable of being locked only in the off position shall be provided with every press control.

Section 1910.217(d)(9)(iv). The employer shall provide and enforce the use of safety blocks for use whenever dies are being adjusted or repaired in the press.

A general review of these and other lockout and lockout related provisions in OSHA's § 6(a) standards would seem to indicate that the consensus groups which originally developed these standards had either of two primary concerns in mind. Those concerns involve the need either (1) to provide equipment with the physical means or capability to isolate energy sources during maintenance and repair activities; or (2) to make a choice of the control measures (locks or tags) which were to be provided and used on the specific machine, equipment or process covered by the standard.

The first category of provisions, while requiring the equipment to have the capability of being locked out, does not necessarily require that such control be accomplished. For example, § 1910.213(b)(5) states, "On each machine operated by electrical motors, positive means shall be provided for rendering such controls or devices inoperative while repairs or adjustments are being made to the machines they control." As another example, § 1910.218(e)(1)(ii) states, "Air hammers shall have a shutoff valve as required by paragraph (d)(2) of this section and shall be conveniently located and distinctly marked for ease of identification." These provisions are specific in nature as they apply to the machines and equipment regulated and are primarily design oriented. For the most part, they address the importance assigned to the proper installation of equipment with regard to the arrangement of electrical and mechanical components. They do not, however, address the use of these components directly, nor do they establish a procedure for assuring that they are, in fact, used. This standard supplements these provisions and does not conflict with their requirements. The equipment required by this category of current rules will be used as part of the servicing procedures set out in the Final Rule. For these reasons, OSHA did not propose any change in provisions in this category as they currently appear in part 1910. Provisions of similar content are:

1910.179(g)(5) (i), (ii), (iii)
1910.217(b)(8)(i)
1910.218(e)(1)(iii)
1910.218(j)(i)
1910.261(k)(2)(ii)
1910.263(l)(8)(iii)
1910.213(a)(10)
1910.218(a)(3)(iii)
1910.218(h)(2)
1910.252(c)(1)(i)
1910.262(c)(1)
1910.265(c)(26)(v)

The second category of provisions involves those which mandate the specific use of lockout, tagout or other energy control devices for certain machines, equipment or industries. The category addresses the application of locks, locks or tags, locks and tags, and in some cases the use of blocks, to control potentially hazardous energy.

An example of provisions used to specify the use of locks for a control measure is found in § 1910.179(1)(2)(i)(c) which states, "The main or emergency switch shall be open and locked in the open position." Provisions of similar content are sections:

1910.181(f)(2)(i)(c)
1910.218(f)(1)(i)
1910.218(h)(5)
1910.218(i)(2)
1910.262(n)(2)
1910.262(q)(2)
1910.263(l)(3)(iii)(b)
1910.218(d)(2)
1910.218(f)(2)(i)
1910.218(i)(1)
1910.261(b)(4)
1910.262(p)(1)

Section 1910.261(j)(4)(iii) which states: "When cleaning, inspecting, or other work requires that persons enter the beaters, all control devices shall be locked or tagged out, in accordance with paragraph (b)(4) of this section." Provisions of similar content are sections:
1910.261(g)(2)
1910.261(j)(5)(iii)
1910.261(g)(19)(iii)

An example of provisions used to specify the use of locks combined with tags is found in § 1910.261(g)(15)(i) which states: "Valves controlling lines leading into a digester shall be locked out and tagged. The keys to the locks shall be in the possession of a person or persons doing the inspecting or making repairs." A provision of similar content is found in § 1910.261(f)(6)(i).

An example of provisions used to specify the use of blocks to control hazardous energy is found in § 1910.217(d)(9)(iv) which states: "The employer shall provide and enforce the use of safety blocks for use whenever dies are being adjusted or repaired in the press." Provisions of similar content are sections:
1910.218(f)(2)(ii)
1910.218(a)(3)(iv)
1910.265(c)(13)
1910.218(f)(1)(iii)
1910.261(b)(4)

The groups of provisions found in this second category, and others similar to them covering potentially hazardous energy, are also not replaced by the final lockout or tagout standard. These provisions selectively require the use of the most effective devices for isolating and securing energy sources. This standard will supplement these other provisions in much the same way as with the first category in that it requires the establishment of procedures for energy controls, and the training of employees in these procedures.

In summary, this standard focuses primarily on procedures—procedures that are necessary to provide effective control when dealing with potentially hazardous energy sources. Where current standards require the use of specific measures, those standards are supplemented and not replaced by the procedures and training requirements of this Final Rule.

This standard is also intended to interact with any new or revised standards which may be promulgated in the future to address the use of specific control measures on an individual basis. Selection of the specific method of control, at that time, will reflect a thorough evaluation of the extent of exposure to the hazard; the risk of injury involving that particular machine, equipment, or industry, and the feasibility of applying a particular method of control. This standard requires that procedures be followed to implement the required control as part of a total package including training and education.

In paragraph (b), OSHA is adopting a number of definitions to clarify the meaning, intent and purpose of certain terms contained in this standard. In the proposed standard, all but five of the definitions were consistent with those published by the American National Standards Institute (ANSI) in their consensus standard, ANSI Z244.1–1982. The five definitions that were added covered the terms "energized," "setting up," "normal production operations," "hot tap," and "servicing or maintenance." In the Final Rule, OSHA has changed six of the proposed definitions, has added two definitions and deleted one.

The definitions of affected and authorized employees, as proposed, received considerable comment. As proposed, the definition of each was:

Affected employee. A person, other than the authorized employee, whose job includes activities covered by this standard as set forth in paragraph (a)(2) of this section.

Authorized employee. A qualified person to whom the authority and responsibility to perform a specific lockout and/or tagout assignment has been given by the employer.

Eight of the eleven commenters who discussed these definitions recommended either combining the two (Ex. 2–5, 2–28, 2–32 and 2–85) or revising them for clarity (Ex. 2–34, 2–74, 2–76 and 2–89). One commenter (Ex. 2–20) suggested changing the definitions to include supervisors while one commenter (Ex. 2–50) suggested changing "qualified" to "competent" based upon the dictionary definition of each of these terms. One commenter (Ex. 2–75) said that the definitions were satisfactory as stated.

Based upon the confusion which each of these definitions have created, OSHA is revising both definitions to identify each type or class of person. This differentiation is based upon their role in the control of energy (the action which they must either take or not take during the servicing or maintenance of machines or equipment) and the knowledge or information which they must possess regarding locking out or tagging out energy isolating devices.

OSHA has determined that the definitions of "authorized employee" and "affected employee" need to be clarified to reflect more accurately the person's involvement in the use of lockout or tagout. If an employee must utilize the energy control procedure, that employee is considered to be an "authorized employee." By contrast, an "affected employee" is one who does not perform the servicing or implement the energy control procedure, but whose responsibilities are performed in an area in which the energy control procedure is implemented and servicing operations are performed under that procedure. The affected employee does not need to know how to perform lockout or tagout, nor does that employee need to be trained in the detailed implementation of the energy control procedure. Rather, the affected employee need only be able to recognize when the energy control procedure is being implemented, to identify the locks or tags being used, and to understand the purpose of the procedure and the importance of not attempting to start up or use the equipment which has been locked out or tagged out. The definition of "affected employee" also recognizes that an affected person and an authorized person may be one and the same person when a machine operator or user must also perform servicing or maintenance on the machine or equipment. In this case, the employee must have the requisite knowledge of an authorized employee.

The proposed definition of "authorized employee" appeared to limit that term to a particular person who has responsibility for the overall implementation of an energy control procedure. Many comments indicated that this took protection away from individual employees who had responsibilities under the procedure but were not actually in charge of its full implementation (Ex. 2–32, 2–34, 2–40, 74, and 2–85). OSHA agrees that as long as an employee is involved in performing an element of servicing and maintenance which is covered by the energy control procedure, that employee should be considered an "authorized employee" for the purpose of this standard. This is particularly important in the context of the requirement in paragraph (d)(3) of the standard, which requires the authorized person to affix a personal lockout or tagout device on the energy isolating device as part of the energy control procedure. The revised definition assures that when a servicing task is performed by a team or group of employees, each employee who is directly exposed to the hazards of the servicing operation will have the responsibility to affix his/her personal lockout or tagout device before beginning the work and to remove it

when he/she completes the work. In addition, as discussed below, paragraph (c)(5)(ii)(D) of the Final Rule provides additional accountability by requiring such lockout and tagout devices to identify the authorized person responsible for applying them.

In the proposed standard, OSHA defined the term "energized" to refer to the connection of equipment to an energy source (mechanical, electrical, hydraulic, etc.) which has not been isolated. There was one commenter (Ex. 2-76) who recommended including language for stored energy.

Based upon an evaluation of the way which this term is used in the standard, OSHA has changed the definition to indicate that energized means connected to an energy source or containing residual or stored energy. OSHA has dropped the phrase "which has not been isolated" because connection to an energy source means that the machine or equipment has not been isolated.

In this final standard, OSHA has amended the proposed definition of "energy source" to eliminate the phrase, "that is capable of causing injury to employees." The definition becomes, in essence, that an energy source is a source of energy. If an energy source does not have the capability of causing injury to employees, it is not "hazardous energy" within the scope of this standard. As used in the standard, an energy source includes the means of transmission of the energy from its true source to the energy isolating device. Therefore, isolating a machine or equipment from an energy source means utilizing an energy isolating device to interrupt the flow of energy from the means of transmission of the energy to the machine or equipment.

The identification of "energy sources," as defined in this proposal, is complicated by three very important considerations: (1) Energy is always present in machinery, equipment or processes; (2) energy is not necessarily dangerous; and (3) danger is only present when energy may be released in quantities or at rates that would harm an employee. Generally speaking, however, potentially hazardous energy sources are defined as those that can cause injury to employees working in, on, or around machines or equipment.

The energy sources identified in this standard require a more detailed discussion. "Energy," as used in this document means mechanical motion; potential energy due to pressure, gravity, or springs; electrical energy; or thermal energy resulting from high or low temperature. Some energy sources can be turned on and off, some can be dissipated, some can be eliminated, and some can only be controlled. These concepts will be addressed throughout the discussion of energy control procedures in this Final Rule. The following brief analysis of energy sources may provide the reader with a better understanding of the provisions of this standard.

1. Mechanical motion can be linear translation or rotation, or it can produce work which, in turn, produces changes in temperature. This type of energy can be turned off or left on.

2. Potential energy can be due to pressure (above or below atmospheric) as in hydraulic, pneumatic, or vacuum systems, or it can be due to springs or gravity. Potential energy manifested as pressures or in springs can be dissipated or controlled; it cannot be turned off or on.

3. Electrical energy refers to generated electrical power or static electricity. In the case of generated electricity, the electrical power can be turned on or turned off. Static electricity cannot be turned off; it can only be dissipated or controlled.

4. Thermal energy is manifested by high or low temperature. This type of energy is the result of mechanical work, radiation, chemical reaction, or electrical resistance. It cannot be turned off or eliminated; however, it can be dissipated or controlled.

The definition for "normal production operations" noted that these were operations which enable the machine or equipment to perform its intended production functions. These functions would be carried out by employees with the machine or equipment energized.

There were two comments (Ex. 2-29 and 2-80) who discussed this definition. One commenter (Ex. 2-29) contended the minor repairs, adjustments and operations should be considered servicing and maintenance rather than normal production operations. The other commenter (Ex. 2-80) suggested that the language of the Final Rule more clearly differentiate between normal production operations and servicing and maintenance.

As evidenced throughout this rulemaking proceeding, the line between "normal production operations" and "servicing or maintenance which takes place *during* normal production operations" is not always evident. The coverage of these activities, in simplest terms, is as follows: Normal production operations are covered by the machine guarding requirements in subpart O of part 1910. If servicing or maintenance is performed during normal production operations without the removal or bypassing of the machine guarding required by subpart O, this standard does not apply. Servicing or maintenance which occurs during normal production operations is covered by this Final Rule only if employees must bypass guards or otherwise place part of their bodies into an area in which they are exposed to the unexpected energization or activation of the equipment. If the employee is not exposed in this manner, such servicing or maintenance during normal production is not covered by this Final Rule. OSHA believes that the following examples will illustrate the types of activities which will come within each set of requirements.

In a printing shop, when a printing press is being used to produce printed materials, there is often the need to make minor adjustments such as to correct for paper misalignment while the press is running. This is a part of the production process, and is subject to the machine guarding requirements. The use of remote control devices will keep the employees from reaching beyond the machine guards. In addition, the use of inch (or jog) devices will permit machine speed control for test purposes. By contrast, however, printing presses may jam, requiring the employee to bypass the machine guards in order to reach the area of the jam and clear it. Although the need to unjam the machine comes about during normal production operations, it is a servicing activity which involves employee exposure to unexpected activation of the machine or release of energy, and as such, is covered by this Final Rule.

In a machine shop, a milling machine machine operator must adjust the flow of coolant oil to parts being milled while the cutting tool is in operation. This operation, which is part of the normal production process for the machine, is covered by the machine guarding requirements. Guarding must be provided to keep the employee's body away from nip points and other points of operation. If it becomes necessary to adjust the movement of the long-bed milling machine worktable where the isolating hydraulic cut-off valve is not in exclusive control of the person making the adjustment, and this requires the employee to place any part of his/her body in an area which was otherwise required to be guarded, this Final Rule would apply. If this step is performed without the employee having to bypass the guarding or otherwise expose his/her body to the potential release of energy or the unexpected activation of the milling machine, this Final Rule would not apply.

An employee is operating a machine which applies and seals a clear plastic

sheet around a packaged product. There is a blade on the machine which cuts the plastic sheets, and this blade must be cleaned off periodically during the production process. Since the process must be stopped to clean off the blade, one could argue that this operation is more in the nature of servicing or maintenance than normal production; on the other hand, since it must be performed frequently during production, one might also argue that it was actually part of the production process. Because of the dovetailing of the requirements of this standard and the machine guarding requirements of subpart O, protection must be provided, regardless of whether the above operation is considered to be production or servicing. If it is production, the employee must be provided with guarding to protect him/her from the dangers of contacting the blade with part of his/her body; the cleaning would need to be done with special tools and procedures to provide the necessary protection. However, if it is servicing, and the employee is exposed to the point of operation which is otherwise required to be guarded, the lockout or tagout provisions of this standard would apply.

The definition of normal production operations has been simplified to state the normal production operations are the utilization of a machine or equipment to perform its intended production function. Anything that is done to prepare a machine or equipment to operate, such as setting up or changing the blade on a power saw, would not be included in the utilization of the machine or equipment and would be classified as servicing or maintenance rather than normal production operations. OSHA believes that this definition complements the definition of "servicing or maintenance" in this Final Rule. Further, these two definitions together help to provide a dividing line between the requirements of this standard and the safeguards already required for normal production operations by the general machine guarding standards in subpart O of part 1910 (§ 1910.212 and § 1910.219). Whereas the definition of servicing or maintenance includes those activities which require an employee to remove or bypass guards or other safety devices or to otherwise expose himself/herself to hazardous machine elements, the standards for machine guarding offer protection when the machine is being used in the manner in which it was designed and intended to be used, that is, when the machine or equipment is used to perform its intended production function.

OSHA has also amended the definition of setup to limit that activity to preparing a machine or equipment to perform its intended function. As proposed, setup involved placing a machine or equipment into an operational mode which could have included activities such as turning it on. Many types of machines and equipment can be turned on or started without doing what is commonly thought of and referred to as setup work.

The definition of lockout/tagout as proposed has been changed in the Final Rule to two separate definitions. This was done to clarify the fact that a lockout device, when properly applied, prevents operation of the energy isolating device whereas a tagout device indicates that the energy isolating device and the machine or equipment should not be operated.

OSHA has eliminated the definition of qualified person from this Final Rule. This was done because OSHA believes that this standard adequately specifies the type of training which is necessary and appropriate to prepare any person to perform the tasks involved in the employer's energy control program. The Final Rule requires that both authorized employees and affected employees be trained in and understand those things which are necessary for the employee to know in order to do the lockout or tagout safely. Paragraph (c)(7)(i)(A) requires that authorized employees receive training in the recognition of the applicable hazardous energy sources, the type and magnitude of the energy available in the workplace and in the procedure to be used for energy isolation and control. Additionally, paragraph (c)(7)(v) requires that, before the machine or equipment is turned off, the authorized employee knows the type and magnitude of the energy to be controlled, the hazards involved with such energy, and the procedure to be used for controlling the energy.

The development and documentation of energy control procedures is of little use unless the employer requires all authorized employees to utilize the procedures that have been provided whenever they are servicing or maintaining machines or equipment. In general, whenever lockout or tagout is used in accordance with this standard, each employee performing servicing or maintenance shall affix and remove, as necessary, an individual and identifiable lock or tag on the energy isolating device as part of the energy control procedure. To meet these requirements, paragraph (c)(1) requires the employer to ensure that hazardous energy control procedures have been implemented for all activities covered by this standard, and are being complied with by the employees. Methods for evaluating and maintaining the proper implementation of these procedures are provided in two other paragraphs of the standard: paragraph (c)(6), which addresses periodic inspection for observing employee compliance with the procedures; and paragraph (c)(7), which covers initial and periodic follow-up training to develop and maintain the knowledge and skills needed by employees for the safe application and removal of energy controls.

Paragraphs (c)(2) of this standard contains a discussion of the conditions under which either lockout or tagout may be utilized. OSHA makes a distinction between the method of controlling the energy (the type of energy control devices utilized) based primarily upon whether or not the energy isolating device was designed to accommodate a lockout device.

As discussed in the major issues section of this preamble, OSHA recognizes that there are many important elements of any energy control program, and that the choice of lockout versus tagout is just one of these elements. Further, OSHA also acknowledges that in isolation, the attachment of a lockout device to an energy isolating device, will provide greater protection against reactivation that an attachment of a tagout device. However, the issue to be resolved in this rulemaking is not the simple question of whether a lock is more protective than a tag. Rather, the Agency must address a series of related questions involving not only the effectiveness of lockout or tagout, but the feasibility and cost implications of requiring one method or the other in all energy control programs.

The record is replete with comments and testimony on the superiority of lockout to tagout as a means of securing energy isolating devices. However, there are also considerable data in the record on programs which use only tags and appear to be effective in doing so. In addition, whereas there is much information on equipment currently in place which has been designed to accept lockout devices, there is a dearth of data indicating the extent to which equipment across general industry would need to be retrofitted or modified to give it the capability to be locked out. There is little question that there is a significant hazard which needs to be addressed by an OSHA standard, but OSHA must regulate in the face of much conflicting evidence on the issues of feasibility and effectiveness. Under these circumstances, the Agency has

reached several conclusions. First, as a general rule, lockout must be implemented as part of the overall energy control program for equipment which is "capable of being locked out." The term "capable of being locked out" is defined in the standard. Equipment which is designed with a hasp or other attachment which can be locked, or which incorporates a locking mechanism, is obviously considered to be "capable of being locked out." However, other equipment without such a *designed-in* locking capability may still be considered "capable of being locked out," but only if lockout can be achieved without the need to dismantle, rebuild or replace the energy isolating device, or permanently alter its energy control capability. Second, for equipment which is capable of being locked out, OSHA recognizes that employers may, nonetheless, wish to implement a tagout program instead of lockout. OSHA will allow the use of tagout programs under these conditions only if the employer can demonstrate that the complete program will, when using tagout devices attached to the energy isolating devices, provide full employee protection. In most cases, in order for OSHA to consider a tagout program to be sufficiently protective, the elements of such a program will need to be very detailed and intensive, and will necessitate far more commitment and day-to-day vigilance to make it work than will a lockout program. This is necessary because a tag serves only as a warning and not as a positive restraint on hazardous energy. The Final Rule establishes criteria which OSHA will evaluate in determining whether a given tagout program does, in fact, provide full employee protection. Thus, when equipment is capable of being locked out, OSHA anticipates that it will be easier for employers to use that capability than to bypass it in favor of a tagout program. Third, for equipment which is not "capable of being locked out," OSHA has determined that the employer's energy control program shall use either lockout or tagout. In making this determination, the Agency recognizes the efforts of many employers, as reflected in various comments and testimony, to retrofit their equipment to accept lockout devices. However, for equipment which would require significant modification to make it capable of being locked, such actions are necessarily taken on a case-by-case basis. Despite the Agency's efforts to acquire data in this area throughout the course of the rulemaking, there is still inadequate information in the record to allow OSHA to make a determination on the overall costs or feasibility of modifying such equipment to accept lockout devices. Accordingly, for such equipment, the standard allows the use of lockout or tagout as part of the energy control program. Fourth, and perhaps most critical, OSHA reemphasizes that the selection of lockout or tagout is only one element of the overall energy control program. Locks and tags do not deenergize equipment; they are attached after the equipment is deenergized. The actual deenergization must be accomplished using a carefully—developed and implemented set of procedures, combined with adequate training of both affected and authorized employees. Therefore, in determining the protectiveness of the standard, it is necessary to look at the *entire* standard, and not just at portions of it in isolation. OSHA is confident that the interrelationship between the different requirements of the standard will result in effective protection to employees during the performance of equipment servicing and maintenance operations.

Although OSHA has determined that lockout is, in general, a safer means of assuring deenergization of equipment than tagout, the Agency has also determined that the record provides inadequate evidence on which to support the extension of lockout to all machinery and equipment throughout general industry. Two points must be emphasized in this regard: First, the standard is a "generic" one, and as such, will apply to virtually all types of machines and equipment in use in American industry today. The designs range from the simplest to the most complex, from the oldest to the newest, and from the most worker-intensive to the most automated. Despite this determined effort to obtain the necessary information in the course of this rulemaking, OSHA has been unable to develop the type and quality of evidence on the available technology and the impacts on the affected industries which would support a finding that lockout is feasible throughout general industry. It is not possible, based on the current record, to develop a reasonable estimate of the amount of equipment modification that would be necessary throughout industry to provide such equipment with the capability of accepting lockout devices. Secondly, OSHA is concerned about whether such existing equipment could be modified for lockout without the possibility of creating greater hazards to employees as a result of the modifications. This latter concern was shared by the State of Virginia's special Task Force on lockout/tagout in General Industry, which is made up of representatives from major employer and employee associations and major industries in that State. The Task Force recommendations to OSHA, which were submitted to the record by the Virginia AFL–CIO, provided that where some kind of modification would have to be made to equipment in order to accommodate a lock, the standard should only require a tagout procedure. (Ex. 13A).

OSHA acknowledges that there are significant problems involving the use of tagout devices, as discussed above. However, the Agency also recognizes that where equipment is not designed to accept a lockout device, tagout will need to be used, even though it does not provide the same assurance that the equipment will not become energized during servicing or maintenance. What becomes important in such situations, therefore, is for the standard to address as many of the weaknesses of tagout as possible, and to impose more stringent requirements which improve the capability of a tagout program to provide effective employee protection. In developing the Final Rule, OSHA has considered the major shortcomings of the use of tagout, as discussed in the comments and testimony, and has revised the proposed requirements to focus on appropriate means by which these shortcomings can be avoided or minimized. In particular, the Final Rule requires tagout devices to be considerably stronger and more durable than provided for in the proposal. The revised provisions on tagout are intended to deal with the problem of tagout devices deteriorating when they become wet or when they are exposed to a corrosive atmosphere. The final standard also requires the tagout device to have a much stronger means of attachment which cannot simply be twisted off or unwound from the energy isolating device. The record clearly indicates that the tag must remain securely affixed throughout the servicing operation in order to serve as an effective warning device. The use of flimsy attachments makes it too easy for an unauthorized employee to remove the device, either intentionally or inadvertently. As noted earlier, there is also testimony presented at the hearings about situations in which tags have become dislodged from their attachment point by environmental conditions such as wind and rain. Perhaps the greatest limitation of tagout is that it does not actually secure the energy isolating device and prevent the equipment from being reenergized. In lockout, the

presence of a servicing employee's locking device on a piece of equipment will prevent another employee from activating that equipment, even if that other employee does not understand the energy control procedure. By contrast, tagout is highly dependent on human factors, and requires constant vigilance to ensure that tagout devices are not bypassed. In addressing this limitation, OSHA is requiring additional training for employees who work with tagout or who work in areas in which tagout is used. Such training must be provided on at least an annual basis. Further, the training program must incorporate information which emphasizes the problems involved with the use of tagout, to make employees aware of why they must not deviate from the requirements of the tagout program. In addition, the standard requires that the employer's energy control procedure incorporate provisions for monitoring and enforcing the proper use of tagout. OSHA has determined that these strengthened requirements will greatly enhance the protection which can be provided by tagout programs under the Final Rule.

Paragraph (c)(2)(i) states that either lockout or tagout may be used when the energy isolating devices are not considered "capable of being locked out," as defined in the standard. This paragraph allows the employer to choose either system in this limited circumstances. If the employer wishes to perform modifications of the equipment to accommodate a locking device, OSHA encourages such modifications, but as noted above, the standard does not require them.

In paragraph (c)(2)(ii), OSHA requires the use of lockout if the energy isolating devices are "capable of being locked out." However, an employer may use a tagout program for this equipment, but only if the employer can demonstrate that his/her tagout program provides "full employee protection." The term "full employee protection" is set forth in paragraph (c)(3), and is discussed more fully below. In brief, "full employee protection" in this context means that where equipment is capable of being locked out, the tagout program must be shown to provide equivalent safety to lockout for such equipment. This requirement also states that the attachment of a tagout device must be at the same point as a lockout device would have been attached.

An employer who chooses to use tagout in this situation must demonstrate that tagout will provide full employee protection, as explained in paragraph (c)(3). The employer must obviously demonstrate that the tagout program meets all tagout-related requirements which are spelled out in the standard, such as proper materials and construction of the tagout devices, the durability of the tag, and the capability of the attachment means to prevent the unauthorized or accidental removal of the tagout device. However, as noted earlier, OSHA does not believe that a tagout program which simply meets the requirements of the standard will be as protective as a lockout program, even though the tagout requirements have been strengthened considerably from the proposal. In order for the employer to demonstrate that a tagout program is as protective as lockout for a lockable piece of equipment, that employer will need to show additional elements which bridge the gap between lockout and tagout. OSHA believes that these elements will need to be evaluated by the Agency on a case-by-case basis. As discussed in paragraph (c)(3)(ii), the employer must consider additional measures which will further enhance the safety of the tagout program, such as the removal of an isolating circuit element, the locking of a controlling switch, or the opening of an additional disconnecting device. By requiring that the employer made a showing of the effectiveness of tagout in situations which are otherwise amenable to lockout, the standard assures that each type of control (lockout or tagout) will provide an acceptable level of safety for those employees who must perform the servicing or maintenance on the machine or equipment. Based upon the range of variations which are possible in different situations, OSHA believes that the comparative effectiveness of any particular energy control program can be made only after examination and evaluation of the factors present at each point of application.

Several parties contended that because of statistical limitations and due to underreporting, the use of an authorized and affected employees to determine the thoroughness of their training and their knowledge of the energy control program. Although the company data would certainly be reviewed by the Agency, it would be only one element of the overall determination. Further, OSHA anticipates that if energy control-related accidents have occurred, whether or not they have been reported, the employees in the facility would have knowledge of the circumstances surrounding those accidents, weaknesses in the procedure which may have contributed to the accidents, and any steps which the employer has taken since the accident to deal with the problem.

In response to OSHA's requests for additional information, NIOSH provided additional sugggestions on elements to be included in a tagout procedure in the event that lockout would not be implemented. (Ex. 50). NIOSH agreed with OSHA that management involvement is critical for both lockout and tagout procedures. NIOSH recommended that tagout procedures be documented (written) and should include the supervisory and enforcement duties and the disciplinary actions to be implemented when the procedure is not followed. Other elements recommended, such as training and hazard isolation, were quite similar to those already included in this rule. Most of the items recommended by NIOSH have been incorporated into the Final Rule in some form.

Although OSHA has serious concerns about the feasibility of retrofitting existing equipment to be lockout-capable, the Agency has different concerns about what is to de done when such equipment is replaced, when new equipment is installed, or when major modifications or renovations are performed to existing equipment. OSHA believes that the optimal time to incorporate lockout capability is where this capability is programmed into the design of the equipment in the first instance. For example, much of today's automated and computerized equipment contains programmed instructions in computer memory which can be lost if the equipment is totally deenergized. If the equipment were designed and built either with a back-up energy source, or by the splitting of the incoming energy for computer memory and mechanical functions, with the mechanical function power supply being lockable, or with other means of maintaining the memory while allowing the mechanical elements to be deenergized and locked out, servicing or maintenance could be performed safely on the deenergized equipment without losing the programming for its proper operation. The implementation of such control methods would, in OSHA's judgment, be a relatively small element in terms of both design and cost when compared to the overall design and construction costs of the equipment.

Accordingly, paragraph (c)(2)(iii) of the Final Rule requires that new equipment ordered or purchased after the effective date of this standard, and existing equipment which otherwise undergoing extensive repair, renovation or modifications, must be provided with a capability of being locked out if such

design is feasible. This provision will assure that even if current equipment is not designed to be locked out, future generations of such equipment will have a lockout capability. Under the requirements of this Final Rule, this equipment will then be subject to the requirement to use lockout except when a tagout system can be shown to be equally effective. OSHA anticipates, however, that the designing of lockout capability into new equipment will encourage the employer to utilize that capability in the energy control program, rather than relying on tagout.

In paragraph (c)(4), OSHA requires that employers develop, document and utilize procedures for the control of potentially hazardous energy, and that the procedures clearly and specifically outline the steps to be followed, techniques to be used, and measures to be applied by the employer to assure that the procedure is used. OSHA also specifies that the employer ensure that the control measures are used by employees whenever they might be exposed to injury from the unexpected energization or start up of machines or equipment or the release of stored energy.

There were four commenters (Ex. 2–36, 2–58, 2–70 and 2–87) to this requirement for the development and utilization of a procedure. Two of these commenters (Ex. 2–36 and 2–70) objected to the use of the word "specific" when defining the elements of the procedure while one commenter interpreted the requirement as mandating a generalized procedure for each plant, as well as a specific procedure for every machine or piece of equipment. The last commenter on this issue (Ex. 2–87) suggested the standard make it clear that it may not be necessary to have multiple procedures. This commenter also alluded to the fact that the standard should require a determination that a need to control hazardous energy exists and how this should be done before work begins.

In this final standard, OSHA has retained the word "specific" when detailing the elements of the procedure. This was done to emphasize the need to have a detailed procedure, one which clearly and specifically outlines the steps to be followed. Overgeneralization can result in a document which has little or no utility to the employee who must follow the procedure. However, whereas the procedure is required to be written in detail, this does not mean that a separate procedure must be written for each and every machine or piece of equipment. Similar machines and/or equipment (those using the same type and magnitude energy) which have the same or similar types of controls can be covered with a single procedure.

The written energy control procedure required by this standard need not be overly complicated or detailed, depending on the complexity of the equipment and the control measures to be utilized. For example, if there is a single machine with a single energy source that must be isolated, and the control measure chosen is simple, such as opening an electrical disconnect and locking out that energy source during servicing, the written procedure could be very simple. The steps set forth in the standard can be incorporated into the procedure with very little detail, reflecting the lack of complexity of the control measure. In addition, the employer's procedures may not need to be unique for a single machine or task, but can apply to a group of similar machines, types of energy and tasks if a single procedure can address the hazards and the steps to be taken satisfactorily.

OSHA believes that because of the need to follow the steps in the energy control procedure carefully and specifically, and the number of variables involved in controlling hazardous energy, a documented procedure is necessary for most energy control situations. However, the Agency has determined that in certain limited situations, documentation of the procedure will not add markedly to the projections otherwise provided by the standard. These situations incorporate several common elements: First, there is a single source of hazardous energy which can be easily identified and isolated, and there is no potential for stored or residual energy in the equipment. This greatly simplifies the procedure for controlling the energy, since the single energy source is all that need to be isolated. Second, the isolation and locking out of that single energy source will totally deenergize and deactivate the machine or equipment. There are no collateral sources of energy which need to be addressed. Third, a full lockout of the energy source is achieved by a single lockout device which is under the exclusive control of the authorized employee performing the servicing or maintenance. As used in this provision, exclusive control means that the authorized employee is the only person who can affix or remove the device. The authorized employee follows all steps necessary for deenergizing the equipment, verifying the deenergization, performing the work, and reenergizing the equipment upon completion of servicing. Because the energy control elements are simple, with a single energy source being locked out and no other potential sources of unexpected activation or energization, the authorized employee can perform them without referring to a written document. Fourth, while the equipment is locked out, the servicing or maintenance cannot expose other employees to hazards. For example, shutdown and lockout of a conveyor cannot cause jams or other hazards at other conveyors which feed into the conveyor being serviced.

The exception is intended to apply to situations in which the procedure for deenergization, servicing, and reenergization can be carried out without detailed interactions of energy sources, machines, and employees. For example, a motor in a small machine shop is wired into a single electrical disconnect, with no other energy source, and the motor does not present the hazards of stored or residual energy. When the motor needs repair, the authorized employee can isolate the motor from the single energy source and lock it out, using his/her personal lockout device on the disconnect, in accordance with the procedures set forth in the standard. Under these conditions, and provided that no other employees are exposed to hazards from the servicing operation, the servicing may be performed without the need to document the energy control procedure.

When all of the conditions for the exception are met, the standard does not require the employer to document the energy control procedure. However, if the employer, in utilizing this exception, has an accident involving the machinery or equipment, in which the unexpected release of hazardous energy is a factor, this indicates the need for more formal treatment of the energy control procedure, and documentation then becomes necessary.

It should also be noted that a small business does not necessarily have small energy control problems. Much complex machinery and equipment can be found in workplaces with few employees, especially in highly-automated companies. From the standpoint of the safety to be achieved from development of and compliance with a written energy control procedure, there is nothing to indicate that a small employer needs a written procedure any less than a large employer. As discussed earlier, the available data clearly domonstrate the need for written procedures to control hazardous energy. For example, the BLS Work Injury Reports (WIR) (Ex. 3–3) indicated that printed instructions or posted

procedures had been provided to only 62 of 554 injured employees responding on this issue in the survey (See Table V, in section III of this preamble). The WIR results also clearly demonstrate the lack of differentiation of injuries based on size of establishment. Half of the total number of injuries took place in establishments of under 100 employees: Approximately 35 percent of the total number of injured employees responding to the survey were injured at workplaces with fewer than 50 employees, and another 15 percent occurred where there were between 50 and 99 employees (See Table I, in section III of this preamble). Therefore, with the limited exception discussed above, OSHA has determined that the requirements for written procedures are appropriate for all employers covered by this standard, regardless of size. The complexity of an employer's procedure will depend on the complexity of the energy control problem in the specific facility, and not on anything unique to or inherent in the number of employees or size of the facility.

It is nonetheless imperative that the employee who is performing the maintenance or servicing (who must utilize the energy control procedure) understands the hazards of the work and how to control them. It is for this reason that paragraph (c)(7)(vi) (which is also discussed below) requires, before the machine or equipment is even turned off, that the authorized employee have knowledge of the type and magnitude of the energy, the hazards of the energy to be controlled, and the procedure to be used.

The Appendix provides employers and employees with an example of a simple lockout procedure. Where appropriate, this procedure may be used as written in the Appendix by simply filling in the blanks. This procedure is not considered unique and can be applied with considerable flexibility to groups of machines or tasks. It may also be used as a guide to develop a more specific or detailed lockout or tagout procedure. The sample would need only minor changes to methods, procedures and/or text to be acceptable for many different workplace situations.

The standard, by being written in performance language, also addresses situations in which there is a need for entirely unique lockout/tagout procedures. There may be situations which might require the entire procedure to be unique for its purpose (one of a kind) in dealing with the hazards, or the employer may only need to provide a supplement to the general procedure. For some applications, the supplement could be in the form of a check list used for gaining access to the machine or equipment and for returning it to service. The check list might address the number and locations of the energy isolating devices in order to guarantee total deenergization. In most cases, if the procedure itself takes the form of a check list, this check list would need to reflect the necessary order of energy isolation and device application.

In paragraphs (c)(5) (i) and (ii), OSHA requires that the employer provide the necessary protective materials and hardware such as locks, tags, chains, adapter pins, etc., for attachment to the energy isolating devices. The standard also requires that the devices be unique to the particular use (the only ones authorized for the purpose); that they be durable, standardized and substantial; and that they identify the user.

There were three commenters (Ex. 2–28, 2–67 and 2–80) who commented on the employer providing the necessary protective materials and hardware. One commenter (Ex. 2–28) suggested eliminating the requirement for the employer to provide the needed lockout or tagout materials or hardware. OSHA disagrees with this contention. Whereas other types of protective equipment, such as safety shoes, may be of a personal nature, the protective materials and hardware used to lockout or tagout is more machine or equipment oriented. The employer is ultimately in the best position, based upon his/her knowledge of the construction and configuration of the plant, facility and/or the type of equipment, to judge or determine the type and quantity or number of items needed in that plant or facility to effectuate the control of energy during servicing or maintenance of the machines or equipment. If the employer orders the necessary hardware, he/she can ensure that the hardware complies with the provisions of the standard (that is, that the hardware is durable, standardized, substantial and identifiable). The purchase of a larger number of those materials and hardware can also result in an overall cost savings if enough of a particular item or several items are ordered in quantity.

One of the other commenters (Ex. 2–67) recommended eliminating the need for the employer to provide tags since tags should be used only when the equipment design does not allow lockout. OSHA has previously discussed the use of tags as an acceptable energy control measure under this standard. The final commenter (Ex. 2–80) recommended changing "securing or blocking" to "blocking and/or securing, to emphasize that there may be situations when the use of a combination of energy control techniques are necessary." OSHA believes that the standard already provides for situations in which more than one energy control method is necessary. The purpose of the standard as stated in paragraph (a)(2) is to require employers to establish and utilize procedures for disabling machines or equipment in order to prevent injury to employees. What is necessary and appropriate to control hazardous energy in a given situation is one the determinations which the employer must make when implementing the program. This final standard recognizes that it may be necessary to use several different means of controlling energy simultaneously to control a particular operation.

The standard utilizes performance language in imposing the above requirements. OSHA believes that the obligations imposed by paragraphs (c)(5) (i) and (ii) are not overly restrictive or complicated. To meet the requirement in paragraph (c)(5)(i) to supply protective equipment and hardware, the employer can either issue devices to each employee responsible for implementing energy control measures, or can exercise the option of simply having a sufficient quantity of the devices on hand at any given time and assign or distribute them to employees as the need arises. As noted earlier, all authorized employees will need to have these devices available to attach to energy isolating devices whenever they perform servicing or maintenance using the energy control procedure.

The proposed standard specified that lockout or tagout devices be singularly identified, shall be the only devices used for controlling hazardous energy, shall not be used for other purposes, and shall be durable, standardized, substantial, and identifiable. This requirement remains substantially unchanged in the Final Rule. Three commenters (Ex. 2–53, 2–64 and 2–70) objected to not allowing energy control devices to be used for other purposes. This restriction was proposed, and is being adopted to ensure that the sight of a distinctive lock or tag will provide a constant message of the use that the device is being put to and the restrictions which this device is intended to convey. If lockout or tagout devices are used for other purposes, they can lose their significance in the workplace. For the energy control procedure to be effective, these devices must have a single meaning to employees: "Do not energize the equipment when such a device is affixed to it."

In paragraph (c)(5)(ii)(A) OSHA proposed that lockout or tagout devices be durable. There was no specific comment on this provision. In order to overcome some of the concerns of commenters to the use of tags, OSHA is adding in the Final Rule that tagout devices must be constructed and printed so that exposure to weather or other environmental conditions which exist in the workplace will not cause the tag to become unserviceable and/or the message on the tag to become illegible. For any sign, tag or other message bearing item, the message must remain legible for the employees to be able to ascertain the meaning and intent of the message.

In paragraph (c)(5)(ii)(B) OSHA is requiring that lockout or tagout devices be standardized in one of the following criteria: color, shape, size, print or format, in order that they be readily identificable and distinguished from other similar devices found in the workplace. In addition, the final rule adds a requirement for the use of a standardized print and format for tagout devices. This is done to ensure that the tagout devices, which rely exclusively on employee recognition for their effectiveness, will be so unique as to minimize the chances of their being misidentified or their message misinterpreted.

In paragraph (c)(5)(ii)(C) OSHA requires that lockout or tagout devices be substantial enough to minimize the possibility of premature removal. The standard requires that lockout devices be substantial enough to prevent their removal without the use of excessive force or unusual techniques. Tagout devices and their means of attachment are similarly required to be constructed so that the potential for inadvertent or accidental removal is minimized. Tag attachment means are further required to be attachable by hand, and to be of strength equivalent to a one-piece non-releasable, self locking cable tie. These additional requirements are being imposed to ensure that tags do not become disconnected or lost during use, thereby negating their effectiveness.

In item (d), OSHA requires that lockout or tagout devices identify the employee who applies the device or devices. This requirement is similar to the proposal. Identification of the user provides an additional degree of accountability to the overall program. It enables the employer to inspect the application of the energy control procedure and determine which employees are properly implementing its requirements. If locks or tags are not being properly attached by an employee, identification on the locks and tags will enable the employer to locate that employee and correct the problem promptly, including additional training, as necessary. For other employees, this requirement will enable them to determine at a glance which authorized employees are performing a given servicing operation. It puts them on notice that if questions arise about the servicing or the energy control procedure, the persons listed on the lockout and tagout devices are the appropriate persons to ask. The authorized employee has the additional assurance that other employees know of his/her involvement in the servicing, and that only he/she is allowed to remove the device.

There were three commenters (Ex. 2–21, 2–36 and 2–62) who objected to having to mark or identify locks. These commenters claimed that identifying a lockout device with a particular employee was unnecessary. OSHA believes that knowing who applied a lockout device to a machine or equipment can save time and lives. If an employee, upon completing a job, forgets to remove a lockout device, the identity of the employee can be immediately determined and the employee made available to complete the procedure. If that employee cannot be located, it is possible that he/she is still working on the equipment. It would then be possible to check out the area and assure that the employee and others are out of the danger area before the device is removed. Marking a lockout or tagout device is a simple way of identifying the person who applies it, and can prevent the inadvertent reenergization or reactivation of equipment before that employee has been located and has moved clear of the equipment. Thus, marking the identity of the employee who uses a lockout or tagout device is an appropriate safeguard.

Marking of the lockout or tagout devices can also promote a sense of security in employees, in that each device is the individual employee's device, used only for his or her protection. This sense of identity also can be used to encourage willing utilization of the energy control procedure. When an employee can identify with a part of the program he/she controls for his/her own protection, that employee will likely be an active participant in making the program work.

In paragraph (c)(5)(iii), OSHA states that the legend (major message) on tagout devices must warn against hazardous conditions if the equipment is re-energized. Five examples of major message are provided in paragraph (c)(5)(iii): Do Not Start, Do Not Open, Do Not Close, Do Not Energize, and Do Not Operate. OSHA recognizes, however, that these messages may not be sufficient to cover all conditions involving hazardous energy control. For that reason, the above stated legends are only examples of what must be stated. The use of graphics, pictographs or other symbols to convey the message which the tag represents serves the same purpose as the written message and therefore would be acceptable to OSHA. Additionally, the use of danger tags would have to meet the requirements of § 1910.145.

There were 8 commenters (Ex. 2–20, 2–32, 2–36, 2–41, 2–53, 2–62, 2–70 and 2–74) who discussed the requirement contained in (c)(5)(iii). Three of the commenters (Ex. 2–36, 2–53 and 2–62) suggested elimination of the wording in the requirement "shall warn against hazardous conditions if the equipment is re-energized." This is a statement of the purpose of the tag. The significance of this message is imparted through the training of employees and enforcement of the program. The backbone of a tagout system is that when a tagout device is placed on an energy isolating device, it informs employees that the energy isolating device is not to be turned on or otherwise moved to a position which will allow the flow of energy. The printed message on the tag provides information about what the tag stands for and what it prohibits, and indicates the name of the employee who affixed it to the energy isolating device.

Three of the commenters (Ex. 2–32, 2–41 and 2–70) commented on the language of the proposal "and shall include the legends: * * * or similar language." Two of the commenters (Ex. 2–32 and 2–70) suggested amending the wording of the phrase to say, "and shall include the following legends: * * *" The proposal was intended to require that tags have some type of commonly used message which would serve to prohibit an employee from bypassing or disregarding the tag. The items listed (that is, "Do Not Start", "Do Not Open" etc.) were intended not to be an all inclusive or complete list of the possibilities but rather, to give an indication of the type of prohibitive major message which the tag could contain. Clearly, whatever language is chosen for the message of the tag must coincide with the prohibited action. Further, employees must know and understand that the tag really means "do not touch," regardless of the type of equipment or hazard involved.

Due to the severity of the risks associated with a lapse in the

implementation of the energy control system, paragraph (c)(6) requires that periodic inspections be performed at least annually in order to verify and to ensure that the energy control program is being properly utilized. One method for meeting the performance requirements in this paragraph would be to use random audits and planned visual observations to determine the extent of employee compliance. Another would include modifying and adopting ordinary plant safety tours to suit this purpose.

The periodic inspection is intended to assure that the energy control procedures continue to be implemented properly, and that the employees involved are familiar with their responsibilities under those procedures. A significant change in this requirement from the proposal involves the activities of the person performing the inspections. The inspector, who is required to be an authorized person not involved in the energy control procedure being inspected, must be able to determine three things: first, whether the steps in the energy control procedure are being followed; second, whether the employees involved know their responsibilities under the procedure; and third, whether the procedure is adequate to provide the necessary protection, and what changes, if any, are needed. The inspector will need to observe and talk with the employees in order to make these determinations. The Final Rule provides some additional guidance as to the inspector's duties in performing periodic inspections, to assure that he or she obtains the necessary information about the energy control procedure and its effectiveness. Where lockout is used, the inspector must review each authorized employee's responsibilities under the procedure with that employee. This does not necessarily require separate one-on-one meetings, but can involve the inspector meeting with the whole servicing crew at one time. Indeed, group meetings can be the most effective way of dealing with this situation, because it reinforces the employees' and that they need to follow the procedure carefully. Where tagout is used, the inspector's review of responsibilities extends to affected employees as well, because of the increased importance of their role in avoiding accidental or inadvertent activation of the equipment or machinery being serviced. OSHA believes that these reviews, which will need to be performed on at least an annual basis during the periodic inspections, will assure that employees follow and maintain proficiency in the energy control procedure, and that the inspector will be better able to determine whether changes are needed.

A related change from the proposal is found in the certification provision in paragraph (c)(6)(ii) of the Final Rule. In addition to the operation, date of inspection, and name of inspector, the Final Rule also requires identification of the employees included in the inspection. This change provides for the inspector to indicate which employees were involved with the servicing operation being inspected, in order to assure that these employees have had the opportunity to review their responsibilities and demonstrate their performance under the procedure.

Inspections must be made by an authorized employee other than one implementing the energy control procedure being inspected. The inspections must be designed and conducted to correct any deviations uncovered. In addition, the employer must certify that they have been performed. These inspections are intended to provide for immediate feedback and action by the employer to correct any inadequacies observed.

These inspections are intended to ensure that the energy control procedure has been properly implemented and to provide an essential check on the continued utilization of the procedure.

Some commenters (cf. Ex. 2–4, 2–39) suggested that the standard require employee participation in these inspections. However, the employer has the obligation of assuring proper utilization of the energy control procedure under the standard, and the periodic inspection is a means of assuring that such compliance is taking place. If an inspection reveals flaws in the implementation of the procedure, it is the employer who must make changes in the procedure, provide retraining to employees, and take other steps to make sure that the problems are corrected. Therefore, OSHA does not believe that a requirement for employee involvement in these inspections is necessary under the OSH Act. It should be noted that the standard requires such inspections to be performed by an authorized employee other than one implementing the particular procedure. Because the inspector is also an authorized employee, he/she will have the necessary knowledge to evaluate the effectiveness of the procedure being inspected, and to report back to the employer with regard to necessary corrective measures.

In this final standard, OSHA has retained the requirement for a periodic inspection (at least annually) to ensure that the energy control procedure required by this standard is being followed. Inspections must be done by authorized employees and are intended to identify and correct any deviations or inadequacies observed. The final standard retains the requirement for the inspections to be conducted by authorized employees, in order to assure that the work. (See paragraph (b) of the standard and the explanation of paragraph (c)(7) below.)

OSHA believes that periodic inspections by the employer are necessary to ensure continued compliance with the procedure. Therefore, this requirement remains unchanged.

In paragraph (c)(7), OSHA specifies that the employer provide effective initial training, periodic retraining, and certification of such training of employees. OSHA considers these requirements to be of critical importance in helping to ensure that the applicable provisions of the hazardous energy control procedure(s) are known, understood and strictly adhered to by employees.

As it is the case with the other provisions of this generic rule, OSHA believes that the training program under this standard needs to be performance oriented, in order to deal with the wide range of workplaces covered by the standard. However, in order to provide adequate information, any training program under this standard will need to cover at least three areas: The employer's energy control program, the elements of the energy control procedure which are relevant to the employee's duties, and the requirements of this Final Rule. The details will necessarily vary from workplace to workplace, and even from employee to employee within a single workplace, depending upon the complexity of the equipment and the procedure, the employee's job duties and their responsibilities under the energy control program, and other factors. Paragraphs (c)(7)(i) (A), (B), and (C) of the standard establish the amount of training that is required for the three groups of employees: "authorized" employees, "affected" employees, and all "other" employees. The relative degree of knowledge required by these three employee groups is in descending order, with the requirements for authorized employees demanding the most effort in training. Because authorized employees are charged with the responsibility for implementing energy control procedures, it is important that they receive training in recognizing and understanding all potentially hazardous energy sources

that they might be exposed to during their work assignments, and that they also be trained in the use of adequate methods and means for the control of such energy sources. These employees are the ones authorized to implement the energy control procedure and to perform servicing of the machine or equipment. Therefore, they need extensive training in aspects of the procedure and its proper utilization, together with all relevant information about the equipment being serviced.

The training OSHA requires for "affected employees" is less stringent than that for "authorized employees," simply because affected employees do not perform servicing or maintenance operations which are performed under an energy control procedure. Affected employees are important to the overall protection provided in the energy control program, however, because such employees work in areas where the program is being utilized by authorized employees. It is vital to the safety of the authorized employees that the affected employees recognize lockout or tagout devices immediately, that they know about the purpose of those devices, and, most importantly, that they know not to disturb the lockout or tagout devices or the equipment to which the devices are affixed. Therefore, the standard requires that affected employees be instructed in these matters. The instruction needs to be sufficient to enable the employees to determine if a control measure is in use. The instruction also needs to make affected employees aware that disregarding or violating the prohibitions imposed by the energy control program could endanger their own lives, or the lives of coworkers. Considerable latitude is given to employers in the development and implementation of the required training for both authorized and affected employees.

There was considerable comment on the training of the different classes of employees based upon the definitions and duties of the different employees as enumerated in the proposed standard. Five commenters (Ex. 2–5, 2–32, 2–44, 2–67 and 2–74) objected to different training for authorized and affected employees while 10 commenters (Ex. 2–28, 2–36, 2–39, 2–42, 2–46, 2–55, 2–58, 2–70, 2–73 and 2–85) objected to training "other" employees. One commenter (Ex. 2–27) suggested expanding the training to coincide with the training requirements of other OSHA standards.

The training requirements for the different classes or types of employees as they are defined in this final standard are performance oriented, thereby providing the employer with considerable flexibility in how the training should be conducted. The employer is permitted to use whatever method he/she feels will best accomplish the objective of the training.

OSHA also requires in paragraph (c)(7)(i)(C) that all other employees shall be instructed about the restrictions imposed upon all employees by the energy control program. This instruction as the employer's lockout/tagout procedure can be conveyed during new employee orientation sessions, by the use of employee handbooks, or through regularly scheduled safety meetings. The training of employees other than authorized and affected employees is considered by OSHA to be essential since other employees working in the plant or facility have been known to have turned on the power to a machine or equipment on which another employee is performing a servicing or maintenance activity. Inadvertent and intentional activation of machines or equipment by employees other than those working on the machine or equipment is not limited to affected employees. The training requirements for these other employees are minimal, essentially required only that these employees know what the energy control program does and that they are not to touch any locks, tags or equipment covered by this program.

In paragraph (c)(7)(ii), OSHA is establishing a requirement for additional training for all employees in plants or facilities where tagout is the preferred method of energy control. The need for this additional or supplemental training for employees in those facilities is based upon the fact that the use of tagout relies upon the knowledge of the employees and their adherence to the limitation imposed by the use of tags. Several commenters who use tagout programs stated in their comments and testimony (cf Ex. 47, 52, Tr. p. W2–5, W2–27 and H199–207) that tagout can only be effective when the program provides for extensive training and reinforcement of the elements of the tagout procedures.

In paragraph (c)(7)(iii), OSHA requires that periodic retraining be provided for authorized employees *at least annually*. This retraining may need to be conducted more frequently, that is, whenever and inspection under paragraph (c)(6) reveals, or whenever the employer has reason to believe, that there are deviations from or inadequacies in the energy control procedure.

Many participants and commenters (Ex. 2–29, 2–44, 2–57, 2–63, 2–97, 50, 52, 60, 62, Tr. p. W1–55, W1–165, W1–208, W1–263, W2–83, H85, H159, H166) suggested that the basic requirement for retraining should provide for the training to be conducted on a regular basis at specified minimum intervals. These commenters pointed out the fact that although the proposal said that the retraining shall be periodic, the criteria for conducting the training was based solely upon the periodic inspection or the employer having reason to believe that there were program problems.

The above comments and testimony clearly indicated that the "periodic" training in the energy control procedure needs to be provided at a minimum stated interval, rather than relying solely upon the employer's periodic inspection. Based on many current training programs, including those throughout the automobile industry it was argued that annual retraining would provide adequate assurance that employees understand their duties under abilities to carry out the energy control procedure.

There were 13 commenters (Ex. 2–20, 2–32, 2–36, 2–39, 2–41, 2–43, 2–44, 2–52, 2–62, 2–69, 2–70, 2–74 and 2–87) who suggested limiting retraining to those individuals and in those instances when there is an identified problem. These commenters reasoned that retraining should not be required unless there is some indication to the employer that it is needed.

OSHA believes that the effectiveness of training diminishes as the time from the last training session increases. Without the imposition of a requirement for periodic retraining of the employees who are critical to the success of the energy control program, that is, the persons who must utilize the procedure, the overall effectiveness of the energy control program will diminish over an extended period of time. The Agency has determined that the proposed provision, i.e., simply relying upon the finding of a problem with the program to trigger the retraining program, does not properly address the problem. Retraining is intended to provide for continued proficiency, and not merely to remedy situations in which such proficiency has been found wanting.

In addition to the periodic retraining as discussed above, additional retraining is to be conducted whenever a problem is identified during periodic inspections, or whenever the employer has reason to believe that there are problems with the energy control procedure itself or with its implementation. This retraining should be more concentrated or more encompassing than the routine retraining, based upon the severity of

the problem encountered with the use of the energy control program in the workplace.

OSHA is of the opinion that full and uniform utilization of an energy control procedure is necessary in order for that procedure to maintain its effectiveness. Every effort should be made during the periodic inspection performed under paragraph (c)(6) to determine whether or not the procedure is being used properly. If deviations are observed, retraining in accordance with paragraph (c)(7)(iii)(B) would be required. However, retraining could be triggered by events separate from the finding of a periodic inspection. For example, an employee working with an energy control procedure might be injured in the course of his duties, or there might be a "near miss," where no one is actually injured, but where the energy control program has failed nonetheless. If a subsequent investigation indicates that an employee failed to operate within the guidelines of the control procedure, retraining would be required.

In addition, the investigation might also reveal that the procedure itself was not adequate. Such inadequacies in the procedure could be the result of using a general procedure that does not handle effectively a specific application, or they may arise because changes have been made to the equipment or process that did not take the existing energy control procedure into consideration. In such cases when changes to the energy control procedure must be made, the employer is required to retrain employees in the new or revised procedures in accordance with paragraph (c)(7)(iii)(B).

In the Final Rule, when lockout is being implemented, OSHA is limiting the annual retraining requirement to authorized employees. These are the employees who must implement the energy control procedure, and their protection is the primary consideration under this standard. Because their safety requires them to follow the steps of the procedure precisely, these employees must be properly trained, and that training must be reinforced to assure their continued proficiency. By contrast, affected employees are not provided with annual retraining under this standard when lockout is used. In these situations, affected employees are initially trained about the energy control procedure and its implementation, and the relevance of that procedure to his/her work. Under lockout conditions, the essential element of the affected employee's training is a simple one: Locks are not to be defeated or bypassed, and locked out equipment must remain deenergized. This message is reinforced whenever the affected employees work in an area where energy control procedures are being implemented, because paragraph (c)(9) of the standard requires that such employees be notified before the energy control devices are applied. Further, when a lockout device is attached to a piece of equipment by an authorized employee, an affected employee should not be able to remove the lock, and thus will not have the potential of placing the authorized employee in danger.

By contrast, however, paragraph (c)(7)(iv) of the Final Rule requires that when tagout is used, both authorized and affected employees must be retrained annually in the use of the tagout system. This additional training is necessary because of the inherent difficulties of tagout systems as opposed to lockout: The use of tags relies uniquely upon the knowledge and training of the employees involved, and the continued reinforcement of the meaning of the tags. In a lockout system, even if an affected employee has not been adequately trained, the lock will prevent that employee from reenergizing the equipment. Tags, on the other hand, can be inadvertently or intentionally bypassed or ignored by an affected employee, because the tags do not actually prevent the activation of the tagged and equipment. Employees operating under a tagging system must be constantly vigilant, and their awareness of the importance of the tagout device must be frequently reinforced. OSHA believes that when tagout is used, retraining must be provided on at least an annual basis, in order to maximize its effectiveness.

Paragraph (c)(7)(v) requires that employers certify that the training required by this standard has been provided. This requirement is unchanged from the proposal. Certifications are intended to cover both the initial training and the periodic retraining. In addition to certifications, the employer must be able to demonstrate that the training includes all elements of the energy control procedure which are directly relevant to the duties of the employee. The adequacy of the training can be evaluated by the employer, employee, and OSHA alike, by comparing the elements of the training to the elements of the procedure, which is required to be in written form.

Several commenters recommended that there be a "record," rather than a "certification," that training has been performed (cf, Ex. 2-39, 2-62 and 2-69). OSHA believes that a written certification serves the same purpose, while minimizing the paperwork burden on employers. It should be noted that the certification is not intended as a means of evaluating the completeness or efficacy of the training; it only provides an indication that training has been performed. The quality and content of the training are not evaluated through the certification of performance. As noted earlier, the standard sets forth the elements which must be included in the training for the employees. In evaluating whether an employee has been adequately trained, OSHA will examine the employee's responsibilities under the energy control program in relation to the elements of the standard.

OSHA proposed in paragraph (c)(6), that energy isolating devices used for the control of potentially hazardous energy sources, including valves, be marked or labeled to identify the equipment supplied and the energy type and magnitude, unless they are positioned and arranged so that these elements are evident, and that the devices only be operated by authorized employees. OSHA reasoned that employees working with energy control procedures need adequate information about the hazards of the equipment that they are servicing, and they must be certain that the equipment they are working on is the same equipment that was intended to be disabled. They should feel confident that they have secured the correct energy control devices and are protected from the hazards of inadvertently working on energized equipment.

The proposed identification requirement of paragraph (c)(6)(i) would have applied to all energy isolating devices, including devices which control hydraulic, pneumatic, steam, and similar energy sources by the use of valves or similar devices to isolate and block energy flow. It would also have applied to the valves used in pipeline network process operations, such as those found in petroleum and chemical operations.

The proposed requirement for marking or labeling energy isolating devices to identify the equipment supplied and the type and magnitude of the energy, received considerable comment. Eleven commenters (Ex. 2-14, 2-20, 2-28, 2-32, 2-39, 2-51, 2-52, 2-53, 2-58, 2-68 and 2-70) questioned the need to specify the magnitude of the energy while two commenters (Ex. 2-32 and 2-34) questioned the ability to mark valves, etc. when the material and the magnitude of the energy contained in the material conveyed could be almost continuously variable. Seven commenters (Ex. 2-21, 2-34, 2-39, 2-46,

2–61, 2–69 and 2–70) suggested removing the requirement. Five commenters (Ex. 2–22, 2–44, 2–52, 2–58 and 2–59) proposed allowing the use of drawings, schematics, temporary tags or work permits to serve as an alternative to marking or labeling energy isolating devices. Two commenters (Ex. 2–39 and 2–62) recommended that training of qualified persons would supply the information rather than marking the energy isolating devices.

OSHA has determined that the marking or labeling of energy isolating devices is not reasonably necessary for the effectiveness of the energy control program. When employees need to know details on energy sources for protection under the standard, the energy control procedure is required to spell out this information, and the training must incorporate it, as well. For example, authorized employees, in order to perform their servicing or maintenance duties under the energy control procedure, are required to know the type and magnitude of the energy sources which must be controlled. The marking or labeling of the sources themselves will not provide the authorized employees with any additional information. Second, as far as affected or other employees are concerned, their role in the energy control program is essentially to understand what the program is designed to accomplish, and to recognized that when they see an energy isolating device with a tag and/or lock on it, they are not to touch the equipment, regardless of what the type and magnitude of the energy might be. OSHA believes that marking the equipment with this information would not enhance the protection of these employees, because their compliance with the energy control procedure does not depend upon knowledge of these details.

Accordingly, OSHA has eliminated the proposed requirement for marking or labeling energy isolating devices. In its place, OSHA is incorporating a specific requirement in paragraph (c)(7)(i)(A) that authorized employees be trained in the recognition of applicable hazardous energy sources, the type and magnitude of the energy available in the workplace, and in the methods and means necessary for energy isolation and control. OSHA further requires in paragraph (c)(7)(vi) that authorized employees must know the type and magnitude of the energy, the hazards of the energy to be controlled and the method or means to control the energy even before the machine or equipment is turned off. OSHA believes that employee knowledge of this information is essential to ensure that the correct energy control devices are used on the proper energy isolating devices and in the proper manner. This provision requires the employee to have that specific information prior to deenergizing the equipment, in order to control the energy and render the machine or equipment safe to work on. OSHA does recognize that the physical shutdown of the machine or equipment can be accomplished by either the authorized or affected employee.

The new paragraph (c)(8) requires that lockout or tagout be performed only by authorized employees. These are the only employees who are required to be trained to know in detail about the types of energy available in the workplace and how to control the hazards of that energy. Only properly trained and qualified employees can be relied on to deenergize and to properly lockout or tagout machines or equipment which are being serviced or maintained, in order to ensure that the work will be accomplished safely.

In paragraph (c)(9), OSHA requires that whenever lockout or tagout control might directly affect another employee's work activities, the employer or authorized employee must notify the affected employee before taking any action to apply or to remove lockout or tagout devices.

There were four commenters (Ex. 2–20, 2–21, 2–64 and 2–74) who discussed this provision. One commenter (Ex. 2–20) recommended that the notification occur after removal of the energy control device while one person (Ex. 2–21) suggested that the "qualified" persons not be required to notify affected employees of the energy control device removal, particularly in emergency repair conditions. Finally, two commenters (Ex. 2–64 and 2–74) insisted that the requirement was unnecessary, especially since employees must be trained and the lockout or tagout effectively prevents machine or equipment energization.

OSHA believes that this requirement is an essential component of the total energy control program. Notification of affected employees when lockout or tagout is going to be applied provides the perfect opportunity for the employer or authorized employee who notifies them of the impending interruption of the normal production operation to remind them and reinforce the importance of the restrictions imposed upon them by the energy control program.

OSHA believes that these measures are important to ensure that employees who operate or use machines or equipment do not unknowingly attempt to reenergize those machines or equipment that have been taken out of service and deenergized for the performance of activities covered by this standard. The lack of information regarding the status of the equipment could endanger both the servicing employees and the employees attempting to reenergize or operate the equipment. Such notification is also needed after servicing is completed to assure that employees know when the control measures have been removed. Without such information, employees might mistakenly believe that a system is still deenergized and that it is safe to continue working on or around it.

This standard for the control of hazardous energy is a "generic" standard, and is written largely in terms of the procedures and performance to be achieved. OSHA does not consider it practical to prescribe specific definitive criteria for each possible use of energy control measures in such a wide ranging standard. However, the Agency believes that the standard will enable the user to make a choice of the most effective control measure involving the use of locks or tags, or a combination of the two devices for securing energy isolating devices. (As discussed above, paragraph (c) of the standard provides criteria for the selection of such devices.)

The main thrust of the standard is to mandate the development, documentation and implementation of control procedures, and this is to be accomplished as outlined in paragraph (d) of the standard. The employer is given considerable flexibility in developing a control program, and such a program will be evaluated by OSHA compliance officers to determine whether it meets all the criteria in this standard.

Although the Final Rule notes the Agency preference for lockout, this standard does not impose lockout requirements in all cases for reasons discussed earlier. OSHA intends to address the need for and the feasibility of more specific lockout or tagout requirements for particular types of equipment or processes on an individual basis, as appropriate, in future rulemakings. This will involve revision of existing standards and promulgation of new ones, as necessary. (Examples of current provisions in the OSHA standards which contain specific lockout/tagout requirements can be found in the previous discussion of proposed paragraph (a)(3)(iii).)

Paragraph (d) of both the proposal and Final Rule provides that five

separate and distinct steps be followed in meeting the procedural requirements of paragraph (c)(1) (Procedure) and the application of energy control (lockout or tagout) measures, and that the actions be taken in the sequence presented. Paragraph (d)(1) requires that in preparation for shutdown of machinery or equipment, the authorized employee must know about the type and magnitude of the energy, the hazards involved, and the means of controlling them. Paragraph (d)(2) then requires that the machine or equipment be turned off or shut down by an authorized employee according to the established procedures. This is the starting point for all subsequent actions necessary to put the machine or equipment in a state that will permit employees to work on it safely.

In many operations, activation of an electrical push-button control or the movement of a simple throw switch (electrical, hydraulic, or pneumatic) to the "stop" or "off" mode is sufficient to meet this provision. In other cases, however, such as those found typically in a refining or chemical process, there are control devices that do not necessarily address an "off-on" or "start-stop" condition (i.e., level controls, pressure controllers, etc.). In these instances, a series of predetermined steps may be necessary to achieve a shutdown of the machine or equipment.

One commenter (Ex. 2–28) suggested that any qualified (trained) employee be allowed to shut down or turn off machines or equipment. Another commenter (Ex. 2–41) suggested allowing machine operators to shut down or turn off the equipment. OSHA is aware that although an authorized employee would usually have the necessary knowledge and capability to shut down machines or equipment, a machine or equipment operator or user should also be in a position and know how to shut down the machine or equipment he/she is utilizing. In many cases, allowing a machine or equipment operator or user to shut it down when something goes wrong may save time and money, and may possibly avoid an accident. In many cases, the affected employee may be infinitely more familiar with the shutdown procedure for a machine or equipment, and would be able to accomplish the shutdown more rapidly and safely than an authorized person who does not work with that particular machine or equipment every day.

In the event that a machine or equipment malfunctions, the wise and prudent thing to do in most cases is to require that the machine or equipment be immediately shut down. Shutting down a machine or equipment is analogous to stopping the production operation. Contrary to the opinion of one commenter (Ex. 2–71) who stated that OSHA should not mandate equipment shut down as the mandatory first step of the procedure, OSHA believes that stopping the machine's production function is the necessary and appropriate first step in the procedure. This commenter suggested that some machinery should have components moved to a safe position before shutting off the power. OSHA believes that the necessary first step is to interrupt the production process to allow non-servicing (affected) personnel to move clear of the machinery or equipment. Once this is done and employees are not exposed to a hazard, the machine or equipment can be restarted by the authorized employee under the guidelines of paragraph (f)(1) when necessary to allow positioning of the machine or equipment, or components thereof.

Following shutdown of the machine or equipment as outlined in (d)(2), paragraph (d)(3), as the next step in the procedure, provides that energy isolation devices be physically located and operated in such a manner as to isolate the machine or equipment from the energy source(s). For example, once an electrical push-button control has been utilized to stop the movement of machine or equipment parts as the first step of the shutdown procedure, isolation can then be accomplished by ensuring that the push-button circuitry cannot be supplied with additional electrical energy. For such equipment, the isolation requirement can be accomplished by the employee's actions in tracing the path from the control toward the energy source until he/she locates the energy isolating device, and moving the energy isolating device control lever to the "safe," "off," or "open" position. Performing these actions will prevent the reintroduction of energy to the push-button circuitry and will isolate the operating control and the machine or equipment from the energy source.

One commenter (Ex. 2–41) suggested that OSHA add the restriction that only authorized employees be allowed to either locate and operate or supervise the operation of energy isolating devices. Instead of adding individual restrictions to each of the procedural steps of the standard, OSHA has added a new paragraph (c)(8) to the final standard which requires that all steps of the procedure except initial shutdown of the equipment as provided in paragraph (d)(1) be performed only by authorized employees. Since the use of lockout or tagout is presumed by OSHA to be individual protection, identification and operation of the energy isolating devices must be done only by the authorized employees who are applying the locks or tags under the procedures.

As the fourth step in the procedure, paragraph (d)(4) provides that action be taken to secure the energy isolating devices in a "safe" or "off" position. This paragraph requires that appropriate and effective lockout or tagout devices be affixed to each energy isolating device by the authorized employee, and that they be attached so as to prevent reactivation of the machine or equipment.

Where no specific standard presently requires the use of lockout versus tagout, paragraph (d)(4) requires the employer to select an appropriate and effective method, in accordance with the criteria set forth in paragraph (c)(2) above. OSHA is of the opinion that, as a general rule, when it is feasible, the physical protection offered by the use of a lock, when supported by the information provided on a tag used in conjunction with the lock, provides the greatest assurance of employee protection from the release of hazardous energy. OSHA has discussed in the section entitled "Major Issues" the arguments for the use of lockout and tagout.

Paragraph (d)(5) provides that the next step taken in the energy control procedure is to determine the presence of, and relieve, disconnect and/or restrain all potentially hazardous, stored or residual energy in the machine or equipment. Up to this point, the purpose of following all the steps of the procedure has been to enable the employee to isolate and block the source of energy feeding the machine or equipment to be worked on, at a point beyond which it can not be bypassed. However, energy can very easily be trapped in a system downstream from an energy isolating device, or can be present in the form of potential energy from gravity or from spring action. Stored or residual energy of this sort cannot be turned on or off; it must be dissipated or controlled.

When energy may still be present in a system that has been isolated from the energy source, this paragraph requires that energy to be controlled before an employee attempts to perform any work covered by the scope of the standard. Compliance with this provision might require, for example, the use of blocks or other physical restraints to immobilize

the machine, machine components, or equipment where necessary for control of the hazard. In the case of electrical circuits, grounding might be necessary to discharge hazardous energy. Hydraulic or pneumatic systems might necessitate the use of bleed valves to relieve the pressure.

There were four commenters (Ex. 2–32, 2–71, 2–74 and 2–80) who discussed the requirement for the release or restraint of stored or residual energy. One commenter (Ex. 2–71) pointed out that there are several types of stored or potential energy which only the concept of zero mechanical state (ZMS) adequately covers. Examples of these hazards are machinery components which run on a cam or other concentric. For this type of machinery, the cam or concentric dictates the motion of the component or pivotal machine components which could be set in motion by inadvertent employee contact.

ZMS is the concept which was originally developed to simplify the requirements for disabling sophisticated machines and processes by reducing the possibility of mechanical movement to a minimum. The concept of ZMS is spelled out in the ANSI Z241.1–1975 American National Standard Safety Requirements for Sand Preparation, Molding and Coremaking in the Sand Foundry Industry. (Ex. 2–71). ZMS specifies that every power source that can produce movement of a machine member must be locked out.

OSHA has reviewed this aforementioned consensus standard and believes that adoption of this OSHA standard will better effectuate the purposes of the OSH Act. The OSHA standard requires the adoption and utilization of a complete program for the control of hazardous energy, including energy sources not specifically addressed by the ANSI Z241.1 standard. Further, OSHA believes that the energy control procedures established in this final rule are consistent in most respects with those of ANSI Z241.1.

The Final Rule addresses these and other hazards of stored or residual energy in a performance manner. Rather than trying to determine all of the potential manners in which this energy can be stored or retained in machines, equipment and the materials being utilized in the production process, as noted earlier, OSHA requires in paragraph (d)(1) that the authorized employee must have knowledge of the energy, its hazard and how to control it (including stored or residual energy). This paragraph (d)(4) requires the stored or residual energy to be relieved, disconnected, restrained or otherwise rendered safe as part of the energy control procedure.

One commenter (Ex. 2–74) suggested adding the phrase, "unless stored mechanical energy is a necessary element in the equipment or process." OSHA has answered this objection by requiring in this provision that stored or residual energy must be rendered safe before the servicing or maintenance may be conducted. OSHA believes that if stored or residual energy is hazardous, something must be done to protect the employees.

One commenter (Ex. 2–80) said that OSHA should consider a block, chain or other instrument used for restraining stored or residual energy to be a type of energy isolating device which does not require a lock or tag. Although OSHA defines a block as a form of energy isolating device, the requirement for the use of locks or tags is separate and distinct from the requirement for restraining stored or residual energy and the addition of a lock or tag, in most cases, would not materially add to the effectiveness of the block.

One commenter (Ex. 2–32) suggested making it clear that the stored or residual energy is only that which is downstream from the energy isolating device. OSHA acknowledges that the standard is intended to control energy as it relates to the energy isolating device and the machine or equipment being serviced, and that the only stored or residual energy addressed by the standard is that which could reenergize that equipment or be released while the servicing operation is being performed.

In paragraph (d)(4)(ii) the standard requires that verification of isolation shall be continued until the servicing or maintenance is completed when the possibility of the reaccumulation of stored energy exists. There was one commenter (Ex. 2–32) who stated that no work should be allowed to proceed until there is assurance that reaccumulation of stored energy cannot occur.

OSHA believes that this requirement of the standard should remain as proposed since there is no manner to ensure that some leakage or drainage of energy or energy containing substances, such as supercooled or cryogenic fluids, can occur. In the case of one of those substances being present in a piping, containment or transport system, a certain amount of leakage may occur without endangering employees. However, if servicing or maintenance must be performed on such a system, the standard requires the employer to continue to verify the isolation of energy sources which may be hazardous, in order to assure that such leakage does not approach a dangerous level. This may involve means such as continuous monitoring for the displacement of oxygen or the buildup of the concentration of the substance toward the lower explosive limit of the substance, such as could occur with a hydrogen system.

In paragraph (d)(6), as the sixth step in the energy control procedure, the authorized employee must ensure that the previous steps of the procedure have been taken to isolate the machine or equipment effectively. This must be done prior to starting the servicing or maintenance work. The authorized employee needs to verify that the machine or equipment has been turned off or shut down properly as required by paragraph (d)(2) of this standard; that all energy isolating devices were identified, located and operated as required by paragraph (d)(3); that the lockout or tagout devices have been attached to energy isolating devices as required by paragraph (d)(4); and that stored energy has been rendered safe as required by paragraph (d)(5).

This step of the procedure may involve a deliberate attempt to start up equipment which should not be capable of activation because of the application of the energy control devices. It is an action intended to assure the employee that energy from the main power source has been effectively isolated, that residual or stored energy has been blocked and that injury could not result from inadvertent activation of the operating controls. Another means of testing the machine or equipment is by the use of appropriate test instrumentation. This method would be appropriate for use in cases involving electrical circuits and equipment, for example, where verification of isolation could be accomplished by using a voltmeter to determine that there is no electrical energy available to the machine. Similar test equipment can be utilized to test for the presence of other energy types and sources.

OSHA also considers the use of visual inspection procedures to be of critical importance throughout the lockout or tagout procedures. Visual inspection can confirm that switches, valves, breakers, etc. have been properly moved to and secured in the "off" or "safe" position. Observing the position of the electrical main power disconnect switch can, for example, confirm that the switch is either in the "off" (open) or "on" (closed) position. Visual inspection can also verify whether or not locks and other protective devices have been applied to the control points in a manner that would present the unsafe movement of the switches or valves. Finally, a

visual inspection can be used to verify that isolation has taken place by determining that all motion has stopped and that all coasting parts such as flywheels, grinding wheels, saw blades, etc., have come to rest.

OSHA emphasizes that in order to verify that hazardous energy has been isolated, the authorized employee may need to use a combination of the above methods. The appropriate combination will depend upon the type of machinery or equipment involved, the complexity of the system, and other factors.

Paragraph (e) requires that certain actions be taken by authorized employees before lockout or tagout devices are removed from energy isolating devices. These actions are intended to ensure that: (1) The machine or equipment has been returned to an effective operating condition; (2) any employees who might be exposed to injury due to the process of restoring energy are made aware that such process is to begin; and (3) those employees having the responsibility for removal of the devices have been identified together with the specific conditions necessary for the procedures to take place.

One commenter (Ex. 2–70) contended that the requirements of paragraph (e) were unduly burdensome and impractical in large plants where numerous employees may be working. OSHA does not believe that this is the case. When servicing or maintenance is done on a large machine or complex system of equipment by a large number of employees, the machine or equipment would probably be operationally intact before the work begins. When the work is completed, paragraph (e)(1) merely requires that before the equipment is reenergized, the employees who did the servicing or maintenance work complete the job by replacing guards and other machinery components and cleaning up after themselves. Paragraph (e)(2) then requires a check for safe location of employees and notification that the equipment is to be reenergized. A simple procedure to follow to verify that the work area and the machinery is ready to be used for its production function is for a foreman, supervisor or leadman (whoever is in charge) to ask the workmen if they are done and then to spot check to ensure that all appears ready to resume normal operations.

Because each servicing employee will have his/her own lockout or tagout device attached to the energy isolating device during the servicing operation, the person in charge of the servicing operation will first determine whether all such devices have been removed by the servicing employees. This is an essential step in the procedure, and paragraph (e) requires that a final verification be performed to ensure that it is safe to reenergize the equipment after servicing is completed. Further, a check on the satisfactory completion of the work can also ensure that the machine or equipment will not be damaged by its start up. Although the purpose of the final check is to protect employees, it can also prevent needless downtime of the machine or equipment because the servicing or maintenance was not done correctly and/or completely the first time.

Paragraph (e)(1) requires that the workplace area around the machine or equipment be inspected to ensure that nonessential items have been removed and that equipment components are operationally intact. This step ensures that tools, machine parts and materials have been removed, and that mechanical restraints, guards and other machine parts have been replaced before returning the machine or equipment to its operational mode. Depending on the complexity of the machinery and the type and degree of servicing performed, visual inspection alone might be sufficient to meet this requirement, or there might have to be additional measures such as check lists and other administrative procedures.

One commenter (Ex. 2–28) suggested the elimination of the words "nonessential items" from this requirement and to substitute words which indicate that the only things that must be removed are those machines which could cause injury to employees or damage to items. OSHA believes that the cleanup requirement must of necessity be a broad one, since virtually any extraneous item in the servicing area could cause injury to employees if the machinery or equipment were to be reenergized before such items are removed. Further, OSHA believes that the cleanup process should not involve an evaluation of whether each item in the area could or could not cause injury. If an item does not have to be in the servicing area after the servicing is completed, OSHA believes that the prudent step is to assure that it is removed before the equipment is reenergized. Accordingly, paragraph (e)(1) is not being changed from the proposal.

In paragraph (e)(2), OSHA proposed that the work area be checked to be sure that employees are clear of the machine or equipment before energy is restored to it. This determination will usually include a visual inspection, and depending on the scope of the operation and the equipment involved, may involve the use of administrative procedures and warning devices such as horns, bells or buzzers.

There was one commenter (Ex. 2–28) who discussed this requirement. This commenter suggested that the terms "work area" and "all employees" were vague and misleading. OSHA believes that the "work area" for servicing will depend upon many factors, such as the type of equipment being serviced, the type of energy involved, and the extent of the servicing operation. OSHA's intent is that the work area include any area in the immediate vicinity of the machine or equipment being serviced, in which employees might be endangered by the startup process. Because of the broad scope of this standard, it is not possible to define with greater specificity what this area will encompass for any given workplace or servicing operation. The employer is in the best position to evaluate the equipment in the workplace, and to make a determination of areas where employees may be exposed to the hazards of the machinery or equipment.

It cannot be overemphasized that employees performing tasks on deenergized equipment may be exposed to hazards involving serious injury or death if the status of the lockout or tagout control can be changed without their knowledge. For this reason, OSHA requires in paragraph (e)(3) that lockout or tagout devices be removed by the employees who applied them. The proposal considered whether an exception should be provided for two types of situations in which the device may be removed under the direction of an authorized employee using specific procedures. Paragraph (e)(3)(i), as proposed, would have permitted other authorized employees to remove a lockout or tagout device when the employee who applied the lockout or tagout device is not available to remove it. This provision was intended to cover situations such as those that might arise from the sudden sickness or injury of an employee, key loss, or other emergency conditions. Proposed paragraph (e)(3)(ii) would have permitted use of the exception for unique operating activities involving complex systems, where the employer could demonstrate that it was not feasible to have the device removed by the employee applying it. This was intended to provide flexibility in operations similar to that where the removal of a lockout or tagout device at a remote electrical transmission or distribution system location was required and the process was controlled by a written procedure that uses an authorized employee operating from a central control point to communicate

instructions to employees working in the field.

There were 9 commenters (Ex. 2–29, 2–32, 2–44, 2–50, 2–57, 2–58, 2–59, 2–63 and 2–70) who discussed allowing exceptions to the rule requiring that lockout devices have to be removed by the employees who applied the devices. Two commenters (Ex. 2–29 and 2–44) stated that the exceptions as written were too broadly drawn and would nullify the standard. Several commenters (Ex. 2–32, 2–57 and 2–63) claimed that allowing any exceptions would be unsafe. In contrast, there were four commenters (Ex. 2–50, 2–58, 2–59 and 2–70) who suggested that the exception should be more flexible so that the employer has more leeway, such as allowing the existence of either, rather than both, of the two conditions spelled out in proposed paragraphs (e)(3)(i) and (e)(3)(ii) to trigger the exception.

In paragraph (e)(3) of this Final Rule, OSHA is requiring that as a general rule, the authorized employee who affixes a lockout or tagout device is the only one allowed to remove it. OSHA believes that each such employee must have the assurance that the device is in his/her control, and that it will not be removed by anyone else except in an emergency situation. The entire energy control program in this standard depends upon each employee recognizing and respecting another employee's lockout or tagout device. The servicing employee relies upon the fact that he/she applied the device, and assumes that it will remain on the equipment while he/she is exposed to the hazards of the servicing operation.

OSHA can envision very few instances which would justify one employee's removal of another's lockout or tagout device. However, in a true emergency, and not merely because the employee is not available, the employer may be able to demonstrate a need to remove an employee's lockout or tagout device. An exception to paragraph (e)(3) of the final rule is being provided to allow for such situations, and is discussed further below. OSHA emphasizes that removal of a personal lockout or tagout device by another person may not be based on convenience or simple unavailability of the employee. If a lockout or tagout device is attached, it is assumed that the employee who attached that device is engaged in servicing the equipment to which the device is attached, and that person is exposed to the hazards of reenergization. Therefore, as a general matter, the protection of that employee requires that he/she have complete control over his/her lockout or tagout device. Some modification of the general rule is warranted in the case of transfer of authority between shifts, as discussed in paragraph (f)(4) below, and to a limited extent in group lockout or tagout, as discussed in paragraph (f)(3) below, both of which involve coordination of activities between servicing employees.

Under the exception to paragraph (e)(3), the employer may direct the removal of a lockout or tagout device by another employee only if the energy control program incorporates specific procedures and training for that purpose, and only where the employer can demonstrate that the alternative procedure will provide equivalent safety to having the employee remove his/her own device. The procedure must include, at a minimum, the following items: First, verification that the authorized employee is not at the facility; second, making all reasonable efforts to contact that employee to inform him/her that his/her device has been removed; and third, ensuring that employee knows of that device removal before he/she resumes work at the facility. These steps are necessary to ensure that the employee who is protected by the device is not exposed to energy hazards either at the time of its removal or afterwards.

Paragraph (f)(1) requires that the employer develop and utilize a procedure that establishes a sequence of actions to be taken in situations where energy isolating devices are locked out or tagged out and there is a need for testing or positioning of the machine or equipment or components thereof. These actions are required in order to maintain the integrity of any lockout or tagout protection for the servicing employees. It is also necessary in order to provide optimum safety coverage for employees when they have to go from a deenergized condition to an energized one and then return the system to lockout or tagout control. It is during these transition periods that employee exposure to hazards is high, and a sequence of steps to accomplish these tasks safely is needed.

Paragraph (f)(1) prescribes a logical sequence of steps to be followed in situation where energy isolating devices are locked out or tagged out, and when there is a need to test or position the machine, equipment or components thereof. The steps offer necessary protection to employees when they are involved in this activity. The procedure is clear-cut and should require little or no explanation other than the contents of the standard itself.

It should be pointed out that OSHA is allowing the removal of the lockout or tagout devices and the reenergization of the machine or equipment only during the limited time necessary for the testing or positioning of the machine, equipment or component thereof. This paragraph does not allow the employer or employee to disregard the requirement for locking out or tagging out during the other portions of the servicing or maintenance operation. This exception is only a temporary measure to be used only to accomplish a particular task for which energization is essential.

In paragraphs (f)(2) (i) and (ii), the final standard requires that whenever outside servicing personnel are engaged to perform any of the activities covered by this standard at a plant or facility, the employer at that facility must inform the authorized representatives of the servicing organizations (contractors, service representatives, etc.) of the lockout or tagout procedures used by the facility. The standard also requires the plant or facility employer to verify that the procedures to be used by outside service representatives are at least as protective of his/her employees as the procedures used in the plant or facility, and that the employees in the plant or facility understand the restrictions or prohibitions of the contractor's procedure and the energy control program of the outside servicing organizations.

These requirements are necessary when outside personnel work on machines or equipment because their activities have the same or greater potential for exposing employees to servicing hazards as would exist if the employer's own employees were performing the work. These hazards can pose a threat to both the outside service representatives and the employees in the plant or facility.

The outside servicing personnel would certainly be expected to know about the specific equipment being serviced, but they might not be familiar with the energy control procedures being used in the particular workplace. Similarly, the employees at the worksite might be familiar with the procedures being used by their own employer, but they might not know what to do if the contractor has a procedure which differs from their own. If such procedures were not coordinated, each group of employees might be endangered by the actions of the other, even if each one followed its own procedures.

This standard is intended to ensure that both the employer and the outside service personnel are aware that their interaction can be a possible source of

injury to employees and that the close coordination of their activities is needed in order to reduce the likelihood of such injury. OSHA sees the proper utilization of these provisions, when they are understood and agreed upon, as a way to prevent misunderstandings by either plant employees or outside service personnel regarding the use of lockout or tagout procedures in general, and with regard to the use of specific lockout or tagout devices that are selected for a particular application.

There were several commenters (Ex. 2–3, 2–41, 2–58 and 2–67) who suggested OSHA require outside contractors to use the same procedures as used in the plant or facility that the work is being done. OSHA believes that it might adversely affect the safety of employees if the standard were to require them to comply with a procedure which is unfamiliar to them and differs from their usual practices under their own employer's energy control program. Further, by allowing each employee to use the procedure that he/she is familiar with, there is greater assurance that the employees will willingly use the procedure.

When different procedures are being used by the contractor and the facility employer, the standard requires each employer to determine the impacts of the other employer's procedure on his/her own employees, and to assure that those employees are protected as effectively under the other procedure as they would be under their own procedure. For example, if there are elements of the contractor's procedure which need to be explained to the facility employees, or if there are other steps needed to assure their safety under that procedure, the facility employer must provide these employees with adequate support and information to provide the necessary protection.

Several commenters (Ex. 2–35, 2–39, 2–40, and 2–69) recommended specifying that the plant or facility employer require compatibility of procedures. Because of the wide range of potential programs and procedures to be developed under this standard, OSHA considers that a requirement for full compatibility of procedures would be difficult, if not impossible, to implement with any degree of consistency. However, OSHA believes that if each employer provides the necessary information on his/her energy control procedure to the other employer whose employees are affected by that procedure, both employers will be able to evaluate the different procedures and determine what information needs to be provided to their respective employees. Accordingly, paragraph (f)(3) of the Final Rule requires that the plant or facility manager inform the outside contractor about the lockout or tagout procedures used in the facility; that the plant or facility employer assure that the contractor's procedure provide equivalent protection to the plant employees; and that the employees in the facility understand and comply with the instruction and prohibition of the procedures.

The requirement for coordination between the contractor and the on-site employer is intended to deal with the potential for either one's employees to create or compound the hazards to which the other's employees are exposed. Regardless of the degree of coordination required by paragraph (f)(2), each covered employer, whether contractor or on-site employer, has an independent obligation under the OSHA Act to provide the protection under the standard for his/her own employees.

The facility owner must look at various aspects of the contractor's energy control program to assure that his/her employees are not placed at an increased risk. For example, is the contractor's means of notifying the affected employees of the pending lockout or tagout as thorough as the facility employer's? Is the procedure for identifying the energy isolating devices as exhaustive or complete as the facility employer's? Is the method of lockout or tagout used by the contractor recognized and respected by the facility's employees? Does the contractor's procedure take into account the possibility of reaccumulation of stored energy (if that is a potential problem)? Does the contractor's procedure for removal of lockout or tagout devices and reenergization and startup of the machine or equipment provide for employee notification and ensuring the equipment is safe before startup? If any of the steps in the contractor's procedures fail to cover significant or essential conditions of the workplace which could adversely affect the safety of the facility employees, action must be taken by the facility employer to minimize the potential for injury to his/her employees.

Proposed paragraph (f)(3) contained a series of provisions dealing with group lockout. In brief, group lockout involves the performance of servicing or maintenance activities when more than one employee is engaged in the servicing operation, using a group lockout device, with an authorized employee directly responsible for the performance of the overall servicing. The proposed requirement for group lockout specified that the authorized employee would have a primary lock, which is affixed when the equipment is deenergized, and is removed when the job is completed. It did not provide for the use of individual locks or tags by the individual employees in the group. The proposal would have allowed this system, with the authorized employee being responsible for the safety of all the employees in the group, if that program provided the same degree of safety as personal lockout or tagout.

Based on the record (Ex. 2–27, 2–29, 2–32, 2–44, 2–63, 2–99, 2–106, 51, 56, 60, Tr. pg. W1–142), OSHA has reexamined the issue of group lockout and has concluded that an additional element is necessary for the safety of the servicing employees: each employee in the group needs to be able to affix his/her personal lockout or tagout system device as part of the group lockout. This is necessary for several reasons: first, the placement of a personnal lockout or tagout system device enable that employee to have a degree of control over his/her own protection, rather than having to depend completely upon other people; second, the use of a personal device will enable each servicing employee to verify that the equipment has been properly deenergized in accordance with the energy control procedure, and to affix his/her device to indicate that verification; third, the presence of an employee's lockout or tagout system device will inform all other persons, including the other servicing employees and supervisors, that the employee is still working on the equipment; fourth, as long as that device remains attached, the authorized person in charge of the group lockout or tagout knows that the job is not completed and that it is not safe to reenergize the equipment; and, fifth, the servicing employee will continue to be protected by the presence of his/her device until he/she removes it. The authorized employee in charge of the group lockout or tagout does not remove the group lockout device until each employee in the group has removed his/her personal device, indicating that employees are no longer exposed to the hazards from the servicing operation. OSHA is convinced that the use of individual lockout or tagout system devices to supplement the group lockout device is necessary for the safety of the servicing employees.

The proposed rule contained several general elements for group lockout, including provision on primary responsibility and coordination of work forces. These elements are carried forward in the Final Rule. The requirement for the use of personal

lockout or tagout devices will only enhance the overall effectiveness of these provisions, because the authorized employee in charge of the group lockout will be better able to evaluate the status of the servicing operation, as well as to determine which, if any, of the servicing employees are working on the equipment at a particular time.

OSHA requires in paragraph (f)(3) that when a crew, craft, department or other *group* lockout or tagout device is used, it must provide the authorized and affected employees with a degree of protection that is equivalent to the use of *personal* lockout or tagout procedures. As in the case of other forms of lockout or tagout protection, the employer who uses a group lockout or tagout system must develop a procedure which encompasses the elements set forth in paragraph (c)(4).

Paragraph (f)(3) identifies requires several key provisions which must be included in all group lockout or tagout procedures. If a single lockout device or set of lockout devices (often referred to as "operations locks") are utilized to isolate the machine or equipment from the energy sources, each authorized employee is afforded a means to utilize his/her personal lockout or tagout devices so that no single employee has control of the means to remove the group lockout or tagout devices while employees are still servicing or maintaining the machine or equipment. This can be accomplished by the use of a lockout or other similar appliance. Once the machine or equipment is locked out, the key is placed into the lockbox and each authorized employee places his/her lockout or tagout device on the box. When each individual completes his/her portion of the work, that person removes his/her lockout or tagout device from the lockbox. Once all personal lockout or tagout devices have been removed, the key for the group lockout devices for the machine or equipment can be used to remove that group lockout device. This method provides protection for all employees working under the protection of a particular group lockout or tagout device. When more than one group is involved, another authorized person might need to maintain responsibility for coordination of the various lockout control groups in order to ensure continuity of protection and to coordinate workforces.

In addition to designating and assigning responsibility to authorized employees, paragraph (f)(3) requires the employer to develop and implement procedures for determining the exposure status of individual crew members and for taking appropriate measures to control or limit that exposure.

These provisions are seen by OSHA as requiring at least the following steps:

1. Verification of shutdown and isolation of the equipment or process before allowing a crew member to place a personal lockout or tagout device on an energy isolating device, or on a lockout box, board, or cabinet;

2. Ensuring that all employees in the crew have completed their assignments, removed their lockout and/or tagout devices from the energy isolating device, the box lid or other device used, and are in the clear before turning the equipment or process over to the operating personnel or simply turning the machine or equipment on.

3. Providing the necessary coordinating procedures for ensuring the safe transfer of lockout or tagout control devices between other groups and work shifts.

The special coverage of paragraph (f)(3) recognizes the importance of group lockout and/or tagout devices used under conditions in which the safety of all employees working in the group is dependent on how those devices are used. For that reason, it involves a closer examination of the conditions, methods and procedures needed for effective employee protection.

OSHA also believes that by requiring each servicing employee to attach his/her own device in group servicing operations, it becomes possible to extend coverage of group servicing activities under paragraph (f)(3) beyond lockout, as envisioned by the proposal, to cover tagout, as well. This would primarily involve equipment which has not been designed to accept a lockout device. OSHA believes that when a group lockout or tagout procedure is properly implemented, it adds an additional element of protection to servicing employees: the authorized employee in charge of the group servicing operation applies a group lockout or tagout device to the equipment being serviced, and each servicing employee attaches a personal lockout or tagout device to the group device. These individual devices are removed by the employees who applied them, leaving the group device attached. These employees, by clearing the equipment and removing their own devices, indicate that they are no longer exposed to the hazards of the servicing operation. The authorized employee in charge of the group servicing operation then verifies that all elements of the group servicing have, in fact, been completed, and that it is safe to reenergize the system, before he/she removes the group device. Thus, the additional step provides further assurance that reenergizing the equipment will not endanger employees. Expanding group procedures to encompass tagout as well as lockout will extend the additional protection to operations which would otherwise be permitted under this standard to use tagout devices instead of lockout.

One of the most difficult problems to be dealt with by this standard involves the servicing and maintenance of complex equipment, particularly when the work extends across several workshifts. Under the basic approach taken by this standard, each servicing employee is responsible for the application and removal of his/her own lockout or tagout device. However, the record indicates that the servicing of some complex equipment may take days or weeks, and that in some cases, hundreds of lockout or tagout devices may be necessary. EEI (Ex. 56) noted that in some major maintenance operations, it can take a day or more just to apply lockout/tagout devices to all energy isolating devices. CMA (Ex. 56) explained that in a chemical plant, certain "turn-around" jobs may require the locking or tagging of a hundred or more energy isolation devices and require 25 or more employees to perform the servicing.

Paragraph (f)(4) of this Final Rule requires that specific procedures be utilized to ensure continuation of lockout or tagout protection for employees during shift or personnel changes in order to provide for an orderly transfer of control measures, and to be certain that the machine or equipment is continuously maintained in a safe condition. As with group lockout or tagout, this task is accomplished as part of the procedures that are defined in performance language in paragraph (c)(4). Paragraph (f)(4) requires specific procedures whenever transfer of control measures is necessary. The underlying rationale for these provisions, whereby hazardous energy control responsibility is transferred, is for the maintenance of uninterrupted protection for the employees involved. It is therefore considered essential that lockout or tagout devices be maintained on energy isolating devices throughout the transition period.

Basically, the transfer of responsibility can be accomplished by the on-coming shift employees accepting control of the system involved prior to the release of control by the off-going employees. Also, the procedures, whether they necessitate the use of simple control measures or the more

detailed use of logs and check lists to accomplish an orderly transfer, are to be followed by an assurance that the system is indeed safe for employees to continue working. This assurance involves action by the authorized or supervisory employee responsible for the transfer to verify the continued isolation of energy in the system.

There was considerable discussion at the hearings with regard to proposed paragraph (f)(4), concerning the need to ensure continued protection during shift or personnel changes. This paragraph was intended to provide protection for servicing operations which extend over more than one shift, usually involving from a few to large numbers of employees on each shift. OSHA attempted to provide a means of assuring that there is no gap in coverage between the off-going employee's removal of his/her lockout or tagout device and the on-coming employee's attachment of his/her own device. Several participants at the hearings testified as to methods used in their facilities to deal with this situation. EEI, for example, (Tr. pg. W2–22–2–26) testified that for complex jobs involving large numbers of energy control devices and many employees on different shifts, member companies use work permits which must be reauthorized at the beginning of each shift. The lockout/tagout devices which are attached to the energy control means at the start of the job are not removed between shifts. Before beginning work, the on-coming shift employees walk through the equipment and verify that the equipment has been deenergized and that proper procedures have been followed. Another system, involving an "operations lock," was endorsed by representatives of API (Ex. 57, Tr. pg. H 40) and OCAW (Tr. pg. H69–70). An "operations lock," essentially a type of group lockout device, is the first lock attached to the equipment when the equipment is deenergized, and it is the last lock removed when the job is completed. Each servicing employee attaches his/her personal lockout/tagout device while working on the equipment, and removes the device when the job is completed, or when leaving for the day. OSHA believes that when properly implemented, either of these methods can provide adequate assurance to the on-coming employee that the equipment is safe to work on.

Perhaps the most critical element of assuring continuity of protection is providing the individual employee with an opportunity to verify that the equipment has been deenergized. Even more than in the case with individual lockout or tagout, the on-coming employee should not have to depend on the actions of another employee or supervisor, particularly one who has left the workplace for the day, for assurance that it is safe to work on the machinery or equipment. The group lockout provisions in paragraph (f)(4) of the Final Rule contain what OSHA believes to be the necessary safeguards for these situations. To the extent that the procedures described by EEI, API, and OCAW provide for individual verification that the equipment has been properly deenergized, and to the extent that the procedures allow for the servicing employee to attest to that verification in accordance with the standard, OSHA believes that such procedures would comply wth the Final Rule. In the case of the type of complex servicing operation described by EEI, involving large numbers of energy isolation devices, large numbers of servicing employees, and multiple shifts, OSHA acknowledges that the removal and replacement of the lockout/tagout devices each shift could be overly burdensome. In these situations, the use of the work permit, with each employee signing on and off the equipment, combined with the employees walking down the equipment to ensure continued deenergization prior to beginning work, would be an acceptable approach to compliance with group lockout/tagout and shift transfer provisions of the standard.

Because the person applying the lockout or tagout device is generally the one being protected by that device, it is essential that the device not be removed by anyone else except in emergencies. When an employee transfers servicing duties to an employee on the next shift, and the equipment is to remain deenergized throughout the shift change, it should not be an undue burden to establish a procedure under paragraph (f)(4) for the off-going employee to transfer his/her authority to the on-coming employee. In situations where the off-going employee removes his/her lockout or tagout device before the on-coming employee arrives, the procedure could allow for the off-going employee to apply a tagout device at the time he/she removes his/her device, indicating that the lock had been removed, but that the machine or equipment had not been reenergized. The on-coming employee would verify that the system was still deenergized, and would remove the interim tag and substitute his/her lockout device. This would assure that the continuous protection is maintained from one shift to another. When tagout devices are used, it would be possible to use a tag with space for the off-going employee to sign off, giving the date and time, and for the on-coming employee to sign on, also giving the date and time. Each employee would verify the deenergization and energy isolation for his/her own protection before signing onto the tag.

VII. Regulatory Impact Analysis

Introduction

Executive Order 12291 (46 FR 13193, February 17, 1981) requires that a regulatory analysis be conducted for any rule potentially having major economic consequences on the national economy, geographical regions, individual industries, or levels of government. Consistent with these requirements, (OSHA) has prepared a Regulatory Impact Analysis (RIA) for this Final Rule. The analysis includes: A profile of the potentially affected firms and employees; a description of regulatory and nonregulatory alternatives; an analysis of the technological feasibility of the rule; and a study of the potential social benefits, economic costs, and environmental impacts that may result from full compliance with the rule.

The complete analysis, as summarized in this section, is based on data and information provided by the Eastern Research Group (ERG) in a study entitled, "Industry Profile Study of a Standard for Control of Hazardous Energy Sources Including Lockout/Tagout Procedures" [Ex. 15]. Additional information was obtained from comments submitted to OSHA in response to the proposed rule and a supplemental ERG report [Ex. 21].

The Secretary has determined that this action is a "major action" as defined by section 3(b) of Executive Order 12291 as it will have an annual effect on the economy of $100 million or more. The Regulatory Impact Analysis is available for inspection and copying in the rulemaking docket.

Affected Industries

The Final Rule will affect most employment covered by OSHA under Part 1910 except: (1) Those activities that are specifically excluded from coverage such as certain work on plug and cord type electrical equipment; and (2) employment for which OSHA has or is in the process of providing separate coverage under a different Subpart or Part, such as the oil and gas field services industry. OSHA has estimated that the rule will affect activities in some 1.7 million establishments

employing approximately 39 million workers.

To analyze the differing effects of the rule, OSHA has divided the affected industries into a high-impact group, a low-impact group, and a zero or negligible-impact group. The high-impact group consists of all manufacturing industries. In 1984, approximately 20 million workers were employed in 340,451 high-impact establishments.

Firms classified as low-impact include those in transportation; utilities; wholesale trade; retail food stores; and several service industries, including personal services, business services, automotive repair, miscellaneous repair, and amusement services. OSHA has estimated that approximately 19 million workers were employed in 1.4 million low-impact establishments in 1984.

The negligible-impact group consists of industries that ERG determined had little potential for a lockout or tagout-related accident. Retail trade, finance, insurance, real estate, service, and public administration firms not classified in the high or low-impact sectors were included in this group.

The Agency's analysis focuses on the potential regulatory effects to high- and low-impact firms.

Population at Risk

As noted, some 39 million workers are employed in industries that may be affected by the Final Rule. All such workers have the potential for being injured due to inadequate or non-existent use of lockout or tagout. In estimating the number of workers at risk from exposure to hazardous energy, OSHA classified "at-risk" occupations in the Final Rule as those being held by individuals who would actually perform lockout or tagout activities. Although this approach tends to underestimate the number of workers who could benefit from promulgation of a lockout or tagout rule, it does provide a good measure of the number of workers who will have to alter their work patterns to comply with the rule. Thus, it is an appropriate method for estimating the costs of the rule. Based on the ERG study [Ex. 15, p. 3–35], OSHA has determined that two million workers in high-impact industries, and one million workers in low-impact industries, are employed in occupations where the unexpected energization or start-up of machines or equipment or release of stored energy could cause injury to employees. The risk appears to be the greatest for those workers employed as craft workers, machine operators, and laborers. Certain types of machinery, such as packaging and wrapping equipment, along with printing presses and conveyors, are associated with a high proportion of the accidents.

Significance of Risk

The installation, assembly, service, repair, maintenance, change over, and disassembly of machines, equipment, and systems are activities integral to most industrial processes. During these activities, however, accidents often result from the inadvertent energization or movement of machinery or equipment.

The ERG study [Ex. 15, p. 6–27, 6–48] estimated that two percent of all workplace injuries, and 7.1 percent of all fatal occupational accidents, occur as a result of inadequate or nonexistent lockout or tagout procedures in industries regulated under this Final Rule. Based on these percentages, the Agency has estimated that in 1984 there were 144 fatalities, 33,432 lost workday injuries, and 37,561 non-lost workday injuries that occurred due to inadequate lockout or tagout procedures in the affected industries. Assuming that these types of accidents grow proportionately with the average level of employment, approximately 1,530 fatalities, 352,965 lost workday injuries, and 396,560 non-lost workday injuries would occur during the next 10 years in the absence of a lockout or tagout standard.

The accidents commonly resulting from inadequate or nonexistent lockout or tagout activities tend to be significantly more severe that the average occupational injury. Injuries typically include fractures, lacerations, contusions, amputations, and puncture wounds. The ERG study [Ex. 15, p. 6–52] estimated that such injuries cause workers to lose an average of 24 workdays. By way of comparison, the 1981 Bureau of Labor Statistics' Occupational Injuries and Illnesses Study [Ex. 18] reports that the average lost time occupational injury involves 16 lost workdays.

Based upon the aforementioned evidence, OSHA has determined that the failure to control hazardous energy results in a significant risk to employees. Since the private market fails to provide an adequate level of safety for workers servicing and maintaining equipment, the Agency has examined various regulatory and nonregulatory alternatives, including tort litigation, distribution of information, workers' compensation, and industry self-regulation. The Agency has concluded that the standard would reduce risk in an optimal manner.

Technological Feasibility

The Final Rule is written in performance-based language that permits firms to develop lockout or tagout procedures that are most appropriate for their specific machines and equipment. Based on data gathered during ERG site visits, OSHA has determined that some firms of all sizes and types are already in full compliance with the Final Rule. As this rule would not require the development of new technologies or significant equipment modifications, OSHA has determined that all provisions of the standard are technologically feasible.

Costs of Compliance with the Rule

OSHA has estimated the cost of full compliance with the standard based on the most cost-effective methods of implementing the Final Rule. The Agency estimates that 72.5 percent of all energy isolating devices are lockable (90 percent of the electrical disconnects and 66.7 percent of the valves) and will be locked out under the Final Rule, while the remaining 27.5 percent are not lockable and will be tagged out. Thus, the Agency has concluded that promulgation of the rule will cost 631,000 establishments a total of $214.3 million during the first year of implementation and $135.4 million in subsequent years.

The costs of complying with the standard can be briefly summarized by category. For locks, tags, and other hardware, the first-year cost is estimated to be $18.5 million, and the annual recurring costs amount to $8.9 million. For voluntary equipment modification to facilitate lockout or tagout, the first-year cost is estimated at $27.0 million, with no annual recurring costs. In terms of work practice modifications, the first-year cost and the annual recurring costs are $102.7 million each. For planning and implementing lockout or tagout procedures, the first-year cost is calculated at $35.2 million, and the annual recurring costs are estimated at $21.0 million. For employee training, the first-year cost is $31.0 million, and the annual recurring costs are $3.6 million.

OSHA also has estimated the average costs per establishment for firms not currently using adequate lockout or tagout procedures. First-year compliance costs for establishments in manufacturing industries, which are classified as high-impact firms, would range from $120 per firm for very small establishments (those having less than 20 employees) to $28,172 for large establishments (those having more than 250 employees). Industries categorized as low-impact would incur first-year costs of approximately $169 per firm. First-year costs of the standard by SIC code for the high and low-impact

industries are summarized in Table XXIV.

TABLE XXIV.—FIRST YEAR COST OF THE STANDARD FOR THE CONTROL OF HAZARDOUS ENERGY SOURCES BY SIC

[millions $]

SIC code	Industry name	Cost
	High impact industries	
20	Food and kindred products	10.8
21	Tobacco manufacturers	0.5
22	Textile mill products	7.2
23	Apparel and other finished products	2.0
24	Lumber and wood products, except furniture	3.6
25	Furniture and fixtures	2.4
26	Paper and allied products	5.9
27	Printing, publishing, and allied industries	14.1
28	Chemicals and allied products	8.2
29	Petroleum, refining, and related industries	1.4
30	Rubber and miscellaneous plastics products	6.0
31	Leather and leather products	1.1
32	Stone, clay, glass, and concrete products	4.1
33	Primary metal industries	10.1
34	Fabricated metal products, except machinery and transportation equipment	13.3
35	Machinery, except electrical	18.1
36	Electrical and electronic machinery, equipment, and supplies	13.3
37	Transportation equipment	14.9
38	Measuring, analyzing, and controlling instruments	2.9
39	Miscellaneous manufacturing industries	2.3
	Low impact industries	
Div. E	Transportation	9.5
Div. E	Communications	23.7
Div. E	Utilities	4.4
Div. F	Wholesale trade	13.7
Div. G	Retail trade	1.2
Div. I	Services	19.0
Total cost to high and low impact industries.		*214.3

*Total may not add due to rounding.
Source, OSHA, ORA, April, 1989.

Benefits of the Final Rule

OSHA has estimated the total number of accidents that the Final Rule would have prevented in 1984, assuming full compliance by all affected firms and workers. As as conservative estimate, the Agency assumed that only 85 percent of those accidents identified as caused by inadequate or nonexistent lockout or tagout procedures would actually be prevented under this rule. It was assumed that 15 percent of the noted accidents may still occur even if both employees and employers are complying fully with the rule (e.g., a block used to hold the weight of a suspended machine component may fail). Based on the above assumptions, OSHA has estimated that the Final Rule would have prevented approximately 122 fatalities, 28,416 lost workday injuries, and 31,926 non lost workday injuries in 1984.

Cost-Effectiveness

OSHA has calculated the cost per fatality avoided by the standard as one measure of its efficacy. Overall, for both low-impact and high-impact industries, the compliance costs of the standard are estimated to amount to about $1.2 million per fatality avoided. If compliance costs are further adjusted to reflect the additional economic benefits expected to accrue to employers (e.g., less lost production time, less administrative preparing insurance claims and accident reports, and less inefficiency related to replacing injured workers), the cost per fatality avoided falls to $0.19 million. However, this calculation only includes fatalities, and does not take into account the costs or benefits for the avoidance of employee injuries. If injuries were included in the calculations, cost per injury prevented would be extremely low. Thus, the Agency has concluded that the lockout or tagout rule will reduce the number of occupational fatalities and injuries in a cost-effective manner.

Economic Effects

OSHA has determined that full compliance with the standard will have a minor negative impact on the profits of the affected firms because, on average, compliance costs will equal no more than 0.05 percent of operating costs and 2.2 percent of net income for any size establishment. Neither the gross national product (GNP), the level of international trade, the price of consumer goods, nor the level of employment will be significantly affected. Based on these estimates, the Agency has concluded that the economic effects of the rule will be negligible, and thus neither the stability nor the profitability of any particular industry or size firm will be at issue as a consequence of the promulgation of the final standard.

VIII. Regulatory Flexibility Certification

In accordance with the Regulatory Flexibility Act of 1980 (5 U.S.C. 601 et seq.), OSHA must assess the potential economic impact of its standards to determine whether they will impose significant costs upon a substantial number of small entities. "Significance" is determined by the impact upon small firms' profits, market share, and financial viability. In particular, OSHA must determine whether its rules will have a relatively greater negative effect on small entities than on large entities.

To assess the impact of this rule on small entities, the Agency has estimated the total cost of compliance per establishment for firms not currently practicing lockout or tagout. First-year costs would range from $120 for very small firms (those having fewer than 20 employees; to $1,737 for small firms (those having 20 to 99 employees) to $28,172 for large firms (those having 250 employees or more) [Ex. No. 17, p. VI–43]. The cost of compiling with the Final Rule will depend primarily on the number of workers employed by a firm and the number of maintenance and servicing tasks required annually—factors that typically depend upon the scale of operation of a company. Thus, based on the above estimates, the costs of the Final Rule will be proportional to the size of the firm and no significant differential impact is expected.

OSHA also has compared the costs of compliance with small entities' total costs of production. The Agency has determined that the cost of full compliance with the rule will equal no more than 0.05 percent of an average small or very small firm's operating costs, and no more than 2.2 percent of an average small firm's net income [Ex. 17, p. VII–6].

As the costs of compliance for small and very small firms are proportional to the size of the firm, and would represent such a small component of the overall cost of the facilities, OSHA certifies that the Final Rule will not have a significant impact upon a substantial number of small entities. The Regulatory Flexibility Assessment of this rule is available for inspection and copying in the rulemaking docket.

IX. Environmental Assessment

This Final Rule 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 Guidelines of the Council on Environmental Quality (CEQ) (40 CFR part 1500), and Department of Labor NEPA Procedures (29 CFR part 11). As a result of this review, the Acting Assistant Secretary for OSHA has determined that the rule will have no significant environmental impact.

The Final Rule focuses on the reduction of accidents and injuries by means of the utilization of specific work practices, procedures, and training. This proposal would not have an impact on air, water, or soil quality, plant or animal life, the use of land, or any other aspects of the environment. As such,

this proposal can therefore be categorized as an excluded action according to subpart B, § 11.10, of the DOL NEPA regulations.

X. Paperwork Reduction Act

This section contains a collection of information requirements in paragraphs § 1910.147(c)(4), (c)(7) and (f)(2) which pertain to the development and utilization of a written energy control procedure and the training of employees in that procedure. The paperwork requirements contained in this rule will be submitted to the Office of Management and Budget (OMB) for approval.

XI. International Trade

Increases in the price of domestically manufactured goods in general result in an increase in the demand for imports, and a decrease in the demand for exports. The magnitude of this impact depends on the relevant demand elasticities and the magnitude of the price changes. While the final standard may result in slightly higher prices of manufactured goods, the estimated magnitude of this increase is so small that the Agency has concluded that any resultant impact on foreign trade will be negligible.

XII. Federalism

This Final Rule has been reviewed in accordance with Executive Order 12612 (52 FR 41685, 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 occupational safety and health standards. Under the OSH 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 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 18(c)(2) of the OSH Act).

The Federal standard on control of hazardous energy sources addresses hazards which 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 OSH 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 Final 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 OSH Act are not preempted by this standard, and will be able to deal with any special conditions within the framework of the Federal Act, while ensuring that the State standards are at least as effective as that standard.

XIII. State Plan Standards

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 the final standard. These 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 employees only), North Carolina, Oregon, Puerto Rico, South Carolina, Tennessee, Utah, Vermont, Virginia, Virgin Islands, Washington, and Wyoming. Until such time as a State standard is promulgated, Federal OSHA will provide interim enforcement assistance, as appropriate, in these States.

XIV. Effective Date

In developing the Final Rule, OSHA has considered whether a delayed effective date is necessary for any of the provisions of the standard. Since the Final Rule does not require extensive retrofitting or major modifications of existing equipment, the Agency believes that 60 days is adequate time for employers to obtain the necessary hardware (primarily lockout and tagout devices). This amount of time should also be adequate for the development of the energy control program and procedures required by the standard. The record indicates that many industries with highly complex equipment, such as the automotive, chemical, and petroleum industries, have already implemented lockout or tagout procedures which would need to be modified little, if at all, to meet the standard. For those employers who will need to develop new procedures to comply with the standard, the standard provides considerable guidance to assist in that development process. Appendix A to the Final Rule sets forth an example of a simple procedure which can be tailored to the individual workplace in situations involving a single energy source. OSHA believes that many employers, particularly small businesses, will be able to use this procedure by filling in the blanks with the necessary information. For more complex situations, a more complex procedure may be necessary. During this rulemaking, interested parties submitted a wide range of procedures and information on their implementation to the rulemaking record, and these materials are available for review and copying in OSHA's Docket Office.

XV. List of Subjects in 29 CFR Part 1910 1910

Lockout; Tagout; Control of hazardous energy sources; Deenergize; Training; Occupational safety and health; Occupational Safety and Health Administration; Safety.

XVI. Authority

This document was prepared under the direction of Alan C. McMillan, Acting Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor 200 Constitution Ave., NW., Washington, DC 20210.

Accordingly, pursuant to sections 4, 6(b), 8(c) and 8(g) of the Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657), Secretary of Labor's Order No. 9–83 (48 FR 35736), and 29 CFR part 1911, 29 part 1910 is hereby amended as set forth below.

Signed at Washington, D.C., this 28th day of August 1989.

Alan C. McMillan,

Acting Assistant Secretary of Labor.

29 CFR Part 1910 is amended as follows:

PART 1910—OCCUPATIONAL SAFETY AND HEALTH STANDARDS

1. The authority citation for Subpart J of Part 1910 is revised to read as follows:

Authority: Section 4, 6 and 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) or 9–83 (48 FR 35736), as applicable. Sections 1910.141, 1910.142 and 1910.147 also issued under 29 CFR part 1911.

§ 1910.150 [Redesignated From 1910.147]

2. Section 1910.147 is redesignated as § 1910.150.

3. A new § 1910.147 and Appendix to § 1910.147 are added to read as follows:

§ 1910.147 The control of hazardous energy (lockout/tagout).

(a) *Scope, application and purpose*—(1) *Scope.*

(i) This standard covers the servicing and maintenance of machines and equipment in which the *unexpected* energization or start up of the machines or equipment, or release of stored energy could cause injury to employees. This standard establishes minimum performance requirements for the control of such hazardous energy.

(ii) This standard does not cover the following:

(A) Construction, agriculture and maritime employment;

(B) Installations under the exclusive control of electric utilities for the purpose of power generation, transmission and distribution, including related equipment for communication or metering; and

(C) Exposure to electrical hazards from work on, near, or with conductors or equipment in electric utilization installations, which is covered by Subpart S of this part; and

(D) Oil and gas well drilling and servicing.

(2) *Application.* (i) This standard applies to the control of energy during servicing and/or maintenance of machines and equipment.

(ii) Normal production operations are not covered by this standard (See Subpart O of this Part). Servicing and/or maintenance which takes place during normal production operations is covered by this standard only if;:

(A) An employee is required to remove or bypass a guard or other safety device; or

(B) An employee is required to place any part of his or her body into an area on a machine or piece of equipment where work is actually performed upon the material being processed (point of operation) or where an associated danger zone exists during a machine operating cycle.

Note: *Exception to paragraph (a)(2)(ii):* Minor tool changes and adjustments, and other minor servicing activities, which take place during normal production operations, are not covered by this standard if they are routine, repetitive, and integral to the use of the equipment for production, provided that the work is performed using alternative measures which provide effective protection (See Subpart O of this Part).

(iii) This standard does not apply to the following.

(A) Work on cord and plug connected electric equipment for which exposure to the hazards of unexpected energization or start up of the equipment is controlled by the unplugging of the equipment from the energy source and by the plug being under the exclusive control of the employee performing the servicing or maintenance.

(B) Hot tap operations involving transmission and distribution systems for substances such as gas, steam, water or petroleum products when they are performed on pressurized pipelines, provided that the employer demonstrates that (*1*) continuity of service is essential; (*2*) shutdown of the system is impractical; and (*3*) documented procedures are followed, and special equipment is used which will provide proven effective protection for employees.

(3) *Purpose.* (i) This section requires employers to establish a program and utilize procedures for affixing appropriate lockout devices or tagout devices to energy isolating devices, and to otherwise disable machines or equipment to prevent unexpected energization, start-up or release of stored energy in order to prevent injury to employees.

(ii) When other standards in this part require the use of lockout or tagout, they shall be used and supplemented by the procedural and training requirements of this section.

(b) *Definitions applicable to this section.*

Affected employee. An employee whose job requires him/her to operate or use a machine or equipment on which servicing or maintenance is being performed under lockout or tagout, or whose job requires him/her to work in an area in which such servicing or maintenance is being performed.

Authorized employee. A person who locks or implements a tagout system procdure on machines or equipment to perform the servicing or maintenance on that machine or equipment. An authorized employee and an affected employee may be the same person when the affected employee's duties also include performing maintenance or service on a machine or equipment which must be locked or a tagout system implemented.

"Capable of being locked out." An energy isolating device will be considered to be capable of being locked out either if it is designed with a hasp or other attachment or integral part to which, or through which, a lock can be affixed, or if it has a locking mechanism built into it. Other energy isolating devices will also be considered to be capable of being locked out, if lockout can be achieved without the need to dismantle, rebuild, or replace the energy isolating device or permanently alter its energy control capability.

Energized. Connected to an energy source or containing residual or stored energy.

Energy isolating device. A mechanical device that physically prevents the transmission or release or energy, including but not limited to the following: A manually operated electrical circuit breaker; a disconnect switch; a manually operated switch by which the conductors of a circuit can be disconnected from all ungrounded supply conuctors and, in addition, no pole can be operated independently; a slide gate; a slip blind; a line valve; a block; and any similar device used to block or isolate energy. The term does not include a push button, selector switch, and other control circuit type devices.

Energy source. Any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal, or other energy.

Hot tap. A procedure used in the repair, maintenance and services activities which involves welding on a piece of equipment (pipelines, vessels or tanks) under pressure, in order to install connections or appurtenances. It is commonly used to replace or add sections of pipeline without the interruption of service for air, gas, water, steam, and petrochemical distribution systems.

Lockout. The placement of a lockout device on an energy isolating device, in accordance with an established procedure, ensuring that the energy isolating device and the equipment being controlled cannot be operated until the lockout device is removed.

Lockout device. A device that utilizes a positive means such as a lock, either key or combination type, to hold an energy isolating device in the safe position and prevent the energizing of a machine or equipment.

Normal production operations. The utilization of a machine or equipment to perform its intended production function.

Servicing and/or maintenance. Workplace activities such as constructing, installing, setting up, adjusting, inspecting, modifying, and maintaining and/or servicing machines or equipment. These activities include lubrication, cleaning or unjamming of machines or equipment and making adjustments or tool changes, where the employee may be exposed to the *unexpected* energization or startup of the equipment or release of hazardous energy.

Setting up. Any work performed to prepare a machine or equipment to perform its normal production operation.

Tagout. The placement of a tagout device on an energy isolating device, in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tagout device is removed.

Tagout device. A prominent warning device, such as a tag and a means of attachment, which can be securely fastened to an energy isolating device in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tagout device is removed.

(c) *General*—(1) *Energy control program.* The employer shall establish a program consisting of an energy control procedure and employee training to ensure that before any employee performs any servicing or maintenance on a machine or equipment where the unexpected energizing, start up or release of stored energy could occur and cause injury, the machine or equipment shall be isolated, and rendered inoperative, in accordance with paragraph (c)(4) of this section.

(2) *Lockout/tagout.* (i) If an energy isolating device is not capable of being locked out, the employer's energy control program under paragraph (c)(1) of this section shall utilize a tagout system.

(ii) If an energy isolating device is capable of being locked out, the employer's energy control program under paragraph (c)(1) of this section shall utilize lockout, unless the employer can demonstrate that the utilization of a tagout system will provide full employee protection as set forth in paragraph (c)(3) of this section.

(iii) After October 31, 1989, whenever major replacement, repair, renovation or modification of machines or equipment is performed, and whenever new machines or equipment are installed, energy isolating devices for such machines or equipment shall be designed to accept a lockout device.

(3) *Full employee protection.* (i) When a tagout device is used on an energy isolating device which is capable of being locked out, the tagout device shall be attached at the same location that the lockout device would have been attached, and the employer shall demonstrate that the tagout program will provide a level of safety equivalent to that obtained by using a lockout program.

(ii) In demonstrating that a level of safety is achieved in the tagout program which is equivalent to the level of safety obtained by using a lockout program, the employer shall demonstrate full compliance with all tagout-related provisions of this standard together with such additional elements as are necessary to provide the equivalent safety available from the use of a lockout device. Additional means to be considered as part of the demonstration of full employee protection shall include the implementation of additional safety measures such as the removal of an isolating circuit element, blocking of a controlling switch, opening of an extra disconnecting device, or the removal of a valve handle to reduce the likelihood of inadvertent energization.

(4) *Energy control procedure.* (i) Procedures shall be developed, documented and utilized for the control of potentially hazardous energy when employees are engaged in the activities covered by this section.

Note: *Exception:* The employer need not document the required procedure for a particular machine or equipment, when all of the following elements exist: (1) The machine or equipment has no potential for stored or residual energy or reaccumulation of stored energy after shut down which could endanger employees; (2) the machine or equipment has a single energy source which can be readily identified and isolated; (3) the isolation and locking out of that energy source will completely deenergize and deactivate the machine or equipment; (4) the machine or equipment is isolated from that energy source and locked out during servicing or maintenance; (5) a single lockout device will achieve a locked-out condition; (6) the lockout device is under the exclusive control of the authorized employee performing the servicing or maintenance; (7) the servicing or maintenance does not create hazards for other employees; and (8) the employer, in utilizing this exception, has had no accidents involving the unexpected activation or reenergization of the machine or equipment during servicing or maintenance.

(ii) The procedures shall clearly and specifically outline the scope, purpose, authorization, rules, and techniques to be utilized for the control of hazardous energy, and the means to enforce compliance including, but not limited to, the following:

(A) A specific statement of the intended use of the procedure;

(B) Specific procedural steps for shutting down, isolating, blocking and securing machines or equipment to control hazardous energy;

(C) Specific procedural steps for the placement, removal and transfer of lockout devices or tagout devices and the responsibility for them; and

(D) Specific requirements for testing a machine or equipment to determine and verify the effectiveness of lockout devices, tagout devices, and other energy control measures.

(5) *Protective materials and hardware.* (i) Locks, tags, chains, wedges, key blocks, adapter pins, self-locking fasteners, or other hardware shall be provided by the employer for isolating, securing or blocking of machines or equipment from energy sources.

(ii) Lockout devices and tagout devices shall be singularly identified; shall be the only devices(s) used for controlling energy; shall not be used for other purposes; and shall meet the following requirements:

(A) *Durable.* (*1*) Lockout and tagout devices shall be capable of withstanding the environment to which they are exposed for the maximum period of time that exposure is expected.

(*2*) Tagout devices shall be constructed and printed so that exposure to weather conditions or wet and damp locations will not cause the tag to deteriorate or the message on the tag to become illegible.

(*3*) Tags shall not deteriorate when used in corrosive environments such as areas where acid and alkali chemicals are handled and stored.

(B) *Standardized.* Lockout and tagout devices shall be standardized within the facility in at least one of the following criteria: Color; shape; or size; and additionally, in the case of tagout devices, print and format shall be standardized.

(C) *Substantial*—(*1*) *Lockout devices.* Lockout devices shall be substantial enough to prevent removal without the use of excessive force or unusual techniques, such as with the use of bolt cutters or other metal cutting tools.

(*2*) *Tagout devices.* Tagout devices, including and their means of attachment, shall be substantial enough to prevent inadvertent or accidental removal. Tagout device attachment means shall be of a non-reusable type, attachable by hand, self-locking, and non-releasable with a minimum unlocking strength of no less than 50 pounds and having the general design and basic characteristics of being at least equivalent to a one-piece, all-environment-tolerant nylon cable tie.

(D) *Identifiable.* Lockout devices and tagout devices shall indicate the identity of the employee applying the device(s).

(iii) Tagout devices shall warn against hazardous conditions if the machine or equipment is energized and shall include a legend such as the following: *Do Not Start. Do Not Open. Do Not Close. Do Not Energize, Do Not Operate.*

(6) *Periodic inspection.* (i) The employer shall conduct a periodic inspection of the energy control procedure at least annually to ensure that the procedure and the requirements of this standard are being followed.

(A) The periodic inspection shall be perfomed by an authorized employee other than the ones(s) utilizing the energy control procedure being inspected.

(B) The periodic inspection shall be designed to correct any deviations or inadequacies observed.

(C) Where lockout is used for energy control, the periodic inspection shall include a review, between the inspector and each authorized employee, of that employee's responsibilities under the energy control procedure being inspected.

(D) Where tagout is used for energy control, the periodic inspection shall include a review, between the inspector and each authorized and affected employee, of that employee's responsibilities under the energy control procedure being inspected, and the elements set forth in paragraph (c)(7)(ii) of this section.

(ii) The employer shall certify that the periodic inspections have been performed. The certification shall identify the machine or equipment on which the energy control procedure was being utilized, the date of the inspection, the employees included in the inspection, and the person performing the inspection.

(7) *Training and communication.* (i) The employer shall provide training to ensure that the purpose and function of the energy control program are understood by employees and that the knowledge and skills required for the safe application, usage, and removal of energy controls are required by employees. The training shall include the following:

(A) Each authorized employee shall receive training in the recognition of applicable hazardous energy sources, the type and magnitude of the energy available in the workplace, and the methods and means necessary for energy isolation and control.

(B) Each affected employee shall be instructed in the purpose and use of the energy control procedure.

(C) All other employees whose work operations are or may be in an area where energy control procedures may be utilized, shall be instructed about the procedure, and about the prohibition relating to attempts to restart or reenergize machines or equipment which are locked out or tagged out.

(ii) When tagout systems are used, employees shall also be trained in the following limitations of tags:

(A) Tags are essentially warning devices affixed to energy isolating devices, and do not provide the physical restraint on those devices that is provided by a lock.

(B) When a tag is attached to an energy isolating means, it is not to be removed without authorization of the authorized person responsible for it, and it is never to be bypassed, ignored, or otherwise defeated.

(C) Tags must be legible and understandable by all authorized employees, affected employees, and all other employees whose work operations are or may be in the area, in order to be effective.

(D) Tags and their means of attachment must be made of materials which will withstand the environmental conditions encountered in the workplace.

(E) Tags may evoke a false sense of security, and their meaning needs to be understood as part of the overall energy control program.

(F) Tags must be securely attached to energy isolating devices so that they cannot be inadvertently or accidentally detached during use.

(iii) Employee retraining.

(A) Retraining shall be provided for all authorized and affected employees whenever there is a change in their job assignments, a change in machines, equipment or processes that present a new hazard, or when there is a change in the energy control procedures.

(B) Additional retraining shall also be conducted whenever a periodic inspection under paragraph (c)(6) of this section reveals, or whenever the employer has reason to believe, that there are deviations from or inadequacies in the employee's knowledge or use of the energy control procedures.

(C) The retraining shall reestablish employee proficiency and introduce new or revised control methods and procedures, as necessary.

(iv) The employer shall certify that employee training has been accomplished and is being kept up to date. The certification shall contain each employee's name and dates of training.

(8) *Energy isolation.* Implementation of lockout or the tagout system shall be performed only by authorized employees.

(9) *Notification of employees.* Affected employees shall be notified by the employer or authorized employee of the application and removal of lockout devices or tagout devices. Notification shall be given before the controls are applied, and after they are removed from the machine or equipment.

(d) *Application of control.* The established procedure for the application of energy control (implementation of lockout or tagout system procedures) shall cover the following elements and actions and shall be done in the following sequence:

(1) *Preparation for shutdown.* Before an authorized or affected employee turns off a machine or equipment, the authorized employee shall have knowledge of the type and magnitude of the energy, the hazards of the energy to be controlled, and the method or means to control the energy.

(2) *Machine or equipment shutdown.* The machine or equipment shall be turned off or shut down using the procedures required by this standard. An orderly shutdown must be utilized to avoid any additional or increased hazard(s) to employees as a result of equipment deenergization.

(3) *Machine or equipment isolation.* All energy isolating devices that are needed to control the energy to the machine or equipment shall be physically located and operated in such a manner as to isolate the machine or equipment from the energy source(s).

(4) *Lockout or tagout device application.* (i) Lockout or tagout devices shall be affixed to each energy isolating device by authorized employees.

(ii) Lockout devices, where used, shall be affixed in a manner to that will hold the energy isolating devices in a "safe" or "off" position.

(iii) Tagout devices, where used, shall be affixed in such a manner as will clearly indicate that the operation or movement of energy isolating devices from the "safe" or "off" position is prohibited.

(A) Where tagout devices are used with energy isolating devices designed with the capability of being locked, the tag attachment shall be fastened at the same point at which the lock would have been attached.

(B) Where a tag cannot be affixed directly to the energy isolating device, the tag shall be located as close as safely possible to the device, in a position that will be immediately obvious to anyone attempting to operate the device.

(5) *Stored energy.* (i) Following the application of lockout or tagout devices to energy isolating devices, all potentially hazardous stored or residual energy shall be relieved, disconnected, restrained, and otherwise rendered safe.

(ii) If there is a possibility of reaccumulation of stored energy to a hazardous level, verification of isolation shall be continued until the servicing or maintenance is completed, or until the possibility of such accumulation no longer exists.

(6) *Verification of isolation.* Prior to starting work on machines or equipment that have been locked out or tagged out, the authorized employee shall verify that isolation and deenergization of the machine or equipment have been accomplished.

(e) *Release from lockout or tagout.* Before lockout or tagout devices are removed and energy is restored to the machine or equipment, procedures shall be followed and actions taken by the authorized employee(s) to ensure the following:

(1) *The machine or equipment.* The work area shall be inspected to ensure that nonessential items have been removed and to ensure that machine or equipment components are operationally intact.

(2) *Employees.* (i) The work area shall be checked to ensure that all employees have been safely positioned or removed.

(ii) Before lockout or tagout devices are removed and before machines or equipment are energized, affected employees shall be notified that the lockout or tagout devices have been removed.

(3) *Lockout or tagout devices removal.* Each lockout or tagout device shall be removed from each energy isolating device by the employee who applied the device. *Exception to paragraph (e)(3):* When the authorized employee who applied the lockout or tagout device is not available to remove it, that device may be removed under the direction of the employer, provided that specific procedures and training for such removal have been developed, documented and incorporated into the employer's energy control program. The employer shall demonstrate that the specific procedure provides equivalent safety to the removal of the device by the authorized employee who applied it. The specific procedure shall include at least the following elements:

(i) Verfication by the employer that the authorized employee who applied the device is not at the facility;

(ii) Making all reasonable efforts to contact the authorized employee to inform him/her that his/her lockout or tagout device has been removed; and

(iii) Ensuring that the authorized employee has this knowledge before he/she resumes work at that facility.

(f) *Additional requirements.* (1) *Testing or positioning of machines, equipment or components thereof.* In situations in which lockout or tagout devices must be temporarily removed from the energy isolating device and the machine or equipment energized to test or position the machine, equipment or component thereof, the following sequence of actions shall be followed:

(i) Clear the machine or equipment of tools and materials in accordance with paragraph (e)(1) of this section;

(ii) Remove employees from the machine or equipment area in accordance with paragraph (e)(2) of this section;

(iii) Remove the lockout or tagout devices as specified in paragraph (e)(3) of this section;

(iv) Energize and proceed with testing or positioning;

(v) Deenergize all systems and reapply energy control measures in accordance with paragraph (d) of this section to continue the servicing and/or maintenance.

(2) *Outside personnel (contractors, etc.).* (i) Whenever outside servicing personnel are to be engaged in activities covered by the scope and application of this standard, the on-site employer and the outside employer shall inform each other of their respective lockout or tagout procedures.

(ii) The on-side employer shall ensure that his/her personnel understand and comply with restrictions and prohibitions of the outside employer's energy control procedures.

(3) *Group lockout or tagout.* (i) When servicing and/or maintenance is performed by a crew, craft, department or other group, they shall utilize a procedure which affords the employees a level of protection equivalent to that provided by the implementation of a personal lockout or tagout device.

(ii) Group lockout or tagout devices shall be used in accordance with the procedures required by paragraph (c)(4) of this section including, but not necessarily limited to, the following specific requirements:

(A) Primary responsibility is vested in an authorized employee for a set number of employees working under the protection of a group lockout or tagout device (such as an operations lock);

(B) Provision for the authorized employee to ascertain the exposure status of individual group members with regard to the lockout or tagout of the machine or equipment and

(C) When more than one crew, craft, department, etc. is involved, assignment of overall job-associated lockout or tagout control responsibility to an authorized employee designated to coordinate affected work forces and ensure continuity of protection; and

(D) Each authorized employee shall affix a personal lockout or tagout device to the group lockout device, group lockbox, or comparable mechanism when he or she begins work, and shall remove those devices when he or she stops working on the machine or equipment being serviced or maintained.

(4) *Shift or personnel changes.* Specific procedures shall be utilized during shift or personnel changes to ensure the continuity of lockout or tagout protection, including provision for the orderly transfer of lockout or tagout devices between off-going and oncoming employees, to minimize exposure to hazards from the unexpected energization, start-up of the machine or equipment, or release of stored energy.

Note: The following Appendix to § 1910.147 services as a non-mandatory guideline to assist employers and employees in complying with the requirements of this section, as well as to provide other helpful information. Nothing in the Appendix adds to or detracts from any of the requirements of this section.

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