REGULATORY REVIEW OF OSHA'S Grain Handling Facilities Standard [29 CFR 1910.272]

Pursuant to Section 610 of the Regulatory Flexibility Act
and
Section 5 of Executive Order 12866

Office of Program Evaluation
Occupational Safety and Health Administration

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REGULATORY REVIEW OF OSHA'S GRAIN HANDLING FACILITIES STANDARD [29 CFR 1910.272]

EXECUTIVE SUMMARY

Since OSHA promulgated its Grain Handling Facilities Standard in 1987, working in the grain industry is safer. Comments submitted to the Docket for this Section 610 Review from the Food and Allied Service Trades (FAST), AFL-CIO, stated "... since the promulgation of OSHA's standard in December 1987, explosions were reduced by 42 %, the number of injured was reduced by 60 % and the number killed was down by 70%" (Ex. 3-56). In its statement for the OSHA public meeting on this Section 610 Review, the National Grain and Feed Association (NGFA) described "an unprecedented decline in explosions, injuries and fatalities at grain handling facilities" since 1980 (Ex. 4). Furthermore, OSHA's own risk analysis has shown that, since the promulgation of the final Grain Handling Facilities Standard, the average number of annual grain suffocations has decreased by 44 percent.

Therefore, there are fewer fire and explosion-related fatalities occurring in the grain handling industry and fewer suffocations in grain, since the promulgation of OSHA's Grain Handling Facilities Standard. This Standard focuses on requirements for controlling grain fires, grain dust explosions, and hazards associated with entry into bins, silos, and tanks.

This regulatory review of the Grain Handling Facilities Standard meets the requirements of both Section 610 of the Regulatory Flexibility Act and Section 5 of Executive Order (EO) 12866. Under Section 610, this review examines whether the standard should be continued without change, rescinded, or amended to minimize any significant impact on a substantial number of small entities considering the continued need for the rule, comments and complaints received, complexity of the rule, whether the rule is duplicative and changes since its issuance. Under Section 5 of EO 12866, this review examines whether the standard has become unjustified or unnecessary as a result of changed circumstances, and whether the standard is compatible with other regulations or is duplicative or inappropriately burdensome in the aggregate. This review also ensures that the regulation is consistent with the priorities and the principles set forth in EO 12866 within applicable law, and examines whether the effectiveness of the standard can be improved. In order to assist OSHA in this review, OSHA requested public comments on these issues and held two public meetings (63 FR 34139, June 23, 1998).

The Section 610 Review of the Grain Handling Facilities Standard indicates that:

- There is a continued need for the rule. Workers continue to be at risk of death and injury from grain explosions, fires, and engulfments. Catastrophic grain explosions in the late 1970's focused national attention on hazards associated with the grain handling industry. This increased attention by both government and industrial entities led to safety improvements in the industry; OSHA's Grain Handling Facilities Standard maintains these improvements. In fact, analyses performed for this Section 610 Review indicate a 70% decrease in fatalities from grain explosions and a 44% decrease in suffocations, since the Grain Handling Facilities Standard was promulgated. On average, the Grain Handling Facilities Standard has prevented 5 deaths from explosions and 4.4 deaths from suffocations, each year. Many public commenters viewed the Grain Handling Facilities Standard as both needed and effective; no commenter indicated that the standard should be rescinded.

- The OSHA Grain Handling Facilities Standard has not had a negative economic impact on the grain handling industries, generally, or on small businesses in those industries. Data available to OSHA indicate that the small businesses in the grain handling industries remained economically competitive after OSHA issued the Grain Handling Facilities Standard. The number of small business firms and employment in small business firms, generally, did not decline, and the percentage of firms that were small businesses increased.

- The rule is not unduly complex. Section 610 of the Regulatory Flexibility Act requires OSHA to evaluate public comments and complaints received on a final rule. To meet this requirement, OSHA published a Federal Register notice, requesting comments on the Grain Handling Standard (63 FR 34139, June 23, 1998), and OSHA held two public meetings, soliciting comments. No public comment indicated that the standard was unduly or unreasonably complex.

- The Grain Handling Facilities Standard is not in regulatory conflict with other regulations. Some public comments suggested amendments be made to simplify the relationship between the Grain Handling Facilities Standard requirements for de-energizing equipment and for entry into confined spaces and the generic standards in those areas. Comments also suggested several other clarifications. OSHA is responding to those comments as discussed below under conclusions and recommendations.

- Technological improvements improved worker safety. Modernization of machinery, as well as improvement in the design of elevators and essential equipment, reduced worker risk. Comments made by industry representatives for both the Docket and the public meetings described the technological improvements made by the grain industry.

An Executive Order 12866 review of the Standard indicates that:

- The Grain Handling Facilities Standard remains both justified and necessary.

- The Grain Handling Facilities Standard is compatible with other OSHA standards and is not inappropriately burdensome in the aggregate.

- The Grain Handling Facilities Standard is compatible with the President's priorities and effective in achieving its mission.

Conclusions and Recommendations

Based on analyses performed for this 610 Review, OSHA concludes that the Grain Handling Facilities Standard should continue without major change. The Standard should not be rescinded because it is necessary to carry out statutory objectives to protect worker safety, and changes are not needed to minimize significant impact on a substantial number of small entities. Fatalities from grain explosions and suffocations have decreased greatly since promulgation of the Grain Handling Facilities Standard. Furthermore, testimony at the public meetings and written comments submitted to the OSHA Docket, as well as economic analysis, indicate no negative economic impact resulting from the Standard.

OSHA's analyses of accident reports on grain suffocations indicate that when the Grain Handling Facilities Standard is adhered to, grain suffocations do not occur. Therefore, additional outreach on the dangers of suffocation in grain and education on the entry requirements in the Grain Handling Facilities Standard would help to further decrease fatalities from suffocation in grain. As resources allow, OSHA should increase training and assistance in the dangers of grain suffocations, and notify representatives of the grain industry on the availability of such training. Emphasis will be made to compliance officers on these dangers and the importance of compliance with the Standard's entry requirements. Additionally, as resources allow, an OSHA booklet on the dangers of grain suffocation and the importance of compliance with the Standard could be developed.

Public comments for this Section 610 Review indicated some confusion among compliance officers over whether the 1/8 inch dust level requirement applies to grain mills (which it does not). Therefore, the OSHA training course for compliance officers should reinforce the fact that the 1/8 inch dust level requirement applies to grain elevators, but not to grain mills.

In response to comments, OSHA will be making or considering several amendments to clarify or simplify the Grain Handling Facilities Standard. These include incorporating a cross-reference to certain interpretations applicable to marine terminals and considering, as part of the Standards Improvement Project III, expanding the confined space requirements of the Grain Handling Facilities Standard to all areas of grain mills instead of having some areas covered by the more complex Confined Spaces Standard. As part of OSHA's project to update standards based on national consensus organization standards, OSHA will consider updating references to the National Fire Protection Association (NFPA) requirements incorporated in the Grain Handling Facilities Standard. OSHA will

also review existing interpretations and issue appropriate interpretations, as necessary, which will be posted on the OSHA website.

ACKNOWLEDGEMENTS

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INTRODUCTION AND NATURE OF THE REVIEW

In 1998, the Occupational Safety and Health Administration (OSHA) began a review of its Grain Handling Facilities Standard under Section 610 of the Regulatory Flexibility Act[1] and Section 5 of Executive Order (EO) 12866 on Regulatory Planning and Review.[2]

The purpose of a review under Section 610 of the Regulatory Flexibility Act:

> "(S)hall be to determine whether such rule should be continued without change, or should be rescinded, or amended consistent with the stated objectives of applicable statutes to minimize any significant impact of the rules on a substantial number of small entities."
>
> "The Agency shall consider the following factors:
>
> (1) The continued need for the rule;
>
> (2) The nature of complaints or comments received concerning the rule from the public;
>
> (3) The complexity of the rule;
>
> (4) The extent to which the rule overlaps, duplicates or conflicts with other Federal rules, and, to the extent feasible, with State and local governmental rules; and
>
> (5) The length of time since the rule has been evaluated or the degree to which technology, economic conditions, or other factors have changed in the area affected by the rule."

[1] 63 FR 34139 (June 23, 1998). For complete text of the Regulatory Flexibility Act, Section 610, 5 U.S.C. 601 *et seq.*, see Appendix I.

[2] For the text of EO 12866, see Appendix II.

The review requirements of Section 5 of EO 12866 require agencies:

> "To reduce the regulatory burden on the American people, their families, their communities, their State, local, and tribal governments, and their industries; to determine whether regulations promulgated by the [Agency] have become unjustified or unnecessary as a result of changed circumstances; to confirm that regulations are both compatible with each other and not duplicative or inappropriately burdensome in the aggregate; to ensure that all regulations are consistent with the President's priorities and the principles set forth in this Executive Order, within applicable law; and to otherwise improve the effectiveness of existing regulations."

To carry out these reviews, on June 23, 1998, OSHA asked the public for comments on all issues raised by these provisions (63 FR 34139). Specifically, OSHA requested comments on: the impacts of the rule on small businesses; the benefits and utility of the rule in its current form and, if amended, in its amended form; the continued need for the rule; the complexity of the rule; and whether, and to what extent, the rule overlaps, duplicates, or conflicts with other Federal, State, and local government rules. OSHA also asked for comments on new developments in technology, economic conditions, or other factors affecting the ability of covered firms to comply with the Grain Handling Standard. Furthermore, OSHA asked for comments on alternatives to the rule that would minimize significant impacts on small businesses, while achieving the objectives of the Occupational Safety and Health Act.

OSHA accepted written comments from June 23, 1998 through August 31, 1998.[3] OSHA also conducted two public meetings, on July 28 and July 31, 1998, in Chicago, Illinois and Washington, DC, respectively.[4] All documents and comments received relevant to the review, transcripts of the oral hearings, and documents discussed in this report are available at the OSHA Docket Office, Docket No. H-117C, Room N-3625, U.S. Department of Labor, 200 Constitution Avenue, N.W., Washington, DC 20210, Telephone (202) 693-2350.

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[3] Federal Register, Vol. 63, No. 120, Tuesday, June 23, 1998, pp. 34139-34140.

[4] Ibid.

CHAPTER I

NEED FOR A GRAIN HANDLING STANDARD

There are numerous, potentially deadly, safety and health hazards associated with grain handling operations. OSHA's Grain Handling Facilities Standard focuses on requirements for the control of fires, grain dust explosions, and hazards associated with entry into bins, silos, and tanks, as well as hazards associated with the release of hazardous energy from equipment. As asserted by the National Institute for Occupational Safety and Health (NIOSH) in the preamble for the Grain Handling Facilities Final Rule, the danger of fires and explosions is "ever present in the industry because of the physical characteristics of organic dust that is generated while handling and processing grain" (52 FR 49595). Furthermore, according to NIOSH, suffocation under silage or grain was the leading cause of grain-handling fatalities for the period 1985 through 1989.[5] Appendix III summarizes NIOSH recommendations for preventing suffocations under silage or grain.

Explosions

Grain dust explosions are often severe, involving loss of life and substantial property damage. In the last 40 years, there were approximately 600 explosions in grain handling facilities across the United States, which killed 250 people and injured more than 1000. As recently as June 8, 1998, the nation's deadliest explosion in 15 years at the DeBruce Grain Elevator in Wichita, Kansas, left seven people dead and ten others injured.[6] (See Table 1.)

National attention focused on the destructiveness of explosions in grain handling facilities when a series of explosions occurred in late 1977 and early 1978; in December 1977, alone, 59 deaths and 49 injuries resulted from five grain elevator explosions (52 FR 49592). These catastrophic grain explosions of the late 1970's led to increased national awareness of the hazards associated with the grain handling industry. Actions and research that began in the late 1970's, both inside and outside government, led to the promulgation of OSHA's Grain Handling Facilities Standard. This Standard requires various safety improvements.

The importance of the Grain Handling Facilities Standard in safeguarding the safety improvements made to the grain industry following the catastrophic explosions of the late 1970's was cited in public comments made during this 610 review. A commenter

[5] National Institute for Occupational Safety and Health (NIOSH); Safe Grain and Silage Handling; NIOSH Publication No. 95-109, Section 3 – Storage, p. 1

[6] Explosion of DeBruce Grain Elevator, Wichita, Kansas 8 June 1998; Grain Elevator Explosion Investigation Team (GEEIT); Commissioned by the U.S. Department of Labor, OSHA; 2001

observed that all fire and explosion statistics " ... show that since attention was attracted to the problem that the grain industry has experienced fewer losses" (Ex. 3-56B). The commenter further noted that in the grain industry (as in the underground coal mine industry) " ... high profile accidents led to stringent regulations supported by education" (Ex. 3-56B).

There are four conditions necessary for a grain dust explosion to occur: fuel (e.g., grain dust); heat (ignition source); confinement; and oxygen. Remove any one of these four conditions and an explosion is averted. Dust, whether it is in layers or suspended in air, is a constant fuel source and must be minimized to avoid explosions. According to Dr. Robert Schoeff, Professor Emeritus at Kansas State University, "Every time grain is handled from harvest to end use, there is breakage and scouring that creates dust."[7] Ignition sources[8] must be reduced, and the dangers of confined spaces eased with explosion venting.[9]

A grain dust explosion incident may include a series of explosions consisting of a primary explosion, followed by multiple secondary explosions. As explained in the preamble to the Grain Handling Facilities Final Rule, the primary explosion in a grain handling facility may result in shaking loose an additional amount of dust accumulations into the air, causing one or more secondary (or subsequent) explosions (52 FR 49592). Secondary grain dust explosions are by far the most devastating. A study by the National Academy of Sciences in the early 1980s found that secondary explosions accounted for 96% of the property loss, 85% of the fatalities, and 91% of the injuries associated with grain elevator explosions.[10]

Suffocations

After entering a grain storage structure, there are three different ways in which a worker may become caught or trapped in the grain: the collapse of bridged grain; the collapse of a vertical wall of grain, and entrapment in flowing grain.[11] Moving or flowing grain is

[7] Successful Farming; How Grain Dust Can Kill You. (Prevention of Grain Dust Explosion); Feb. 1998; www.findarticles.com/cf_o/m...le+of+the+grain+handling+industry+

[8] Ignition sources include sparks, welding and cutting operations, open flames, static electricity, overheated machinery, and unsafe electrical equipment.

[9] The basic principle of explosion venting is the provision of weak panels or doors into the wall of the protected vessel, which will open once the internal pressure rises due to an explosion. Vent ducts are generally required to vent the explosion to a safe area outside an occupied zone.

[10] W. Kauffman, University of Michigan, Statement at OSHA Rulemaking Hearings, June 12, 1984.

[11] Maher, George G.; North Dakota State University, NDSU Extension Service; Caught in the Grain!; AE-1102, December 1995.

involved in all three hazard situations.[12] Workers in grain storage structures may also be asphyxiated because of gases given off from spoiling grain.[13]

Stored grain which is moldy, high in moisture content, or in poor condition may stick together, forming a crust on the surface of the grain. This crust may give the false impression that the surface of the grain is safe to stand on; when, in fact, the worker can not tell if there is grain under the crust or not.[14] If grain below this surface crust is removed from the bin, a hollow cavity will be formed under the crusted grain on the surface.[15] This surface grain crust (also called a "bridge") over the hollow cavity is often not strong enough to support the weight of a person. If a worker steps on this crust in order to break it up (known as "walking down the grain") the worker can fall through the crust into the hollow cavity below and become buried in the grain.

Additionally, grain in poor condition can stick or cake in a large mass against bin walls. This mass of grain can collapse or "avalanche" down on workers who try to break it loose from below.[16] This avalanche of grain can result in crushing or suffocation.

Flowing grain is a very dangerous situation. This hazard is present when grain is flowing downward: in a bin; out of a rail car, truck; and in an auger-pit.[17] Flowing grain creates a strong suction action, and a person caught in flowing grain will be unable to swim, climb, or walk against the grain to get out of the bin; the person will be pulled down and can suffocate under the grain.[18]

Gases given off from spoiling grain can also result in suffocation. For example, carbon dioxide may collect above the surface of spoiled grain. If a worker falls through crusted grain and carbon dioxide has gathered under the crust, the worker may not be completely buried by the grain but can still die from lack of oxygen.[19] Also, gases may result in a

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[12] Ibid

[13] National Institute for Occupational Safety and Health (NIOSH); Safe Grain and Silage Handling; NIOSH Publication No. 95-109, Section 3 – Storage, p. 4

[14] Maher, George G.; North Dakota State University, NDSU Extension Service; Caught in the Grain!; AE-1102, December 1995.

[15] Ibid
[16] Ibid

[17] Ibid

[18] Ibid

[19] National Institute for Occupational Safety and Health (NIOSH); Safe Grain and Silage Handling; NIOSH Publication No. 95-109, Section 3 – Storage, p. 4

worker passing out and falling into the grain, thus becoming engulfed by grain and suffocating.

CHAPTER II

REGULATORY HISTORY AND REQUIREMENTS OF THE STANDARD

In 1978, discussions began at OSHA and Congressional hearings were held, regarding the development of a standard to protect grain handling workers. These discussions and hearings were prompted by the disastrous explosions that occurred in late 1977 and early 1978. Both grain workers and federal inspectors were killed in these explosions, and these explosions focused national attention on the hazards associated with grain handling facilities. The following represent some of the efforts prompted by the devastating series of grain elevator explosions that occurred in the late 1970's:

1. In 1978, at the request of the U.S. Department of Agriculture (USDA), the National Academy of Sciences (NAS) conducted an international symposium on grain elevator explosions. Following the symposium, OSHA requested NAS to establish a Panel on Causes and Prevention of Grain Elevator Explosions. This Panel investigated 14 different grain elevator explosions between 1979 and 1981. NAS published a series of documents on its findings.[20]

2. The deaths of 13 USDA inspectors who were killed in grain elevator explosions in 1977, prompted USDA to set up a special task force on grain elevator safety and explosions. The task force issued a report in 1979 which, among other information, included numerous recommendations for the prevention of grain explosions.

3. The National Grain and Feed Association (NGFA) issued guidelines in 1978 to assist its members in improving fire and explosion safety. NGFA also held several industry conferences resulting in publications on elevator design, elevator dust control, and retrofitting and constructing grain elevators. In 1978, NGFA also established the Fire and Explosion Research Council to continue research.

4. In 1979, a General Accounting Office (GAO) study on grain dust explosions

[20] The National Academy of Sciences completed four reports between 1980 and 1984: Investigation of Grain Elevator Explosions; Prevention of Grain Elevator and Mill Explosions; Pneumatic Dust Control in Elevators; and Guidelines for the Investigation of Grain Dust Explosions.

recommended that the U.S. Department of Labor evaluate the adequacy of the coverage for grain elevators in the OSHA general industry standards (29 CFR Part 1910).[21]

The following timeline presents important developments leading to the promulgation of OSHA's Grain Handling Standard in 1987 and its revision in 1996:

- On February 15, 1980, OSHA published a request for comments and information and notice of public meetings, concerning the safety and health hazards in grain handling facilities (45 FR 10732).

- In 1981, the Food & Allied Service Trades (FAST)[22] Department, AFL-CIO, petitioned OSHA to promulgate a rule regulating the build-up of explosive dust in grain elevators.[23]

- OSHA published a Notice of Proposed Rulemaking (NPR) on grain handling facilities (49 FR 996) in the Federal Register on January 6, 1984.

- On April 17, 1984, OSHA published a notice announcing: the scheduling of public hearings to receive testimony on all aspects of the proposed grain handling facilities standard; the availability of a supplemental economic analysis; and a request for written comments on certain issues of special concern to OSHA (49 FR 15093).

- The OSHA Grain Handling Facilities Final Rule was published December 31, 1987 (52 FR 49592) with an effective date of March 30, 1988.

- On January 24, 1989, a ruling by the Fifth Circuit Court of Appeals, National Grain and Feed Association (NGFA) v. OSHA, 866 F.2d 717, generally upheld the Standard but stayed the 1/8-inch action level until the Agency reconsidered the costs. The Court remanded the standard for reconsideration of two issues: (1) the economic feasibility of the 1/8-inch action level for grain dust; and (2) possible alternatives to applying the action level only to

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[21] U.S. General Accounting Office. Grain Dust Explosions -- An Unsolved Problem, HRD-79-1, March 21, 1979, p. 27.

[22] FAST, AFL-CIO, through its affiliated unions, represents thousands of grain elevator and mill workers nationwide.

[23] Robert Harbrant, President, Food & Allied Service Trades Department, AFL-CIO, in a letter to Secretary of Labor Elizabeth Dole, September 27, 1981.

priority areas, including, at a minimum, the alternative of expanding the action level to the entire facility.

- On December 4, 1989 (54 FR 49971), OSHA published "a supplemental statement of reasons" in the Federal Register, concluding that the 1/8-inch action level for priority areas was economically feasible. On April 25, 1990, 903 F.2d 308, the Fifth Circuit accepted these conclusions and lifted the stay as of August 1, 1990.

- In response to the Court's January 1989 remand, OSHA issued an ANPR on December 10, 1990 (55 FR 50722), requesting comments on the possibility of expanding the Standard beyond priority areas. Interested parties were given until March 11, 1991 to submit comments.

- On April 1, 1994 (59 FR 15339), OSHA announced, based on the expanded record, that it would not extend the 1/8-inch action level provision beyond priority areas.

- On March 8, 1996, OSHA amended its Grain Handling Standard to clarify requirements intended to provide protection for employees who enter flat storage structures (61 FR 9577).[24] This amendment assured protection against engulfment, mechanical, and other hazards regardless of the point at which the employee enters the storage structure. The revised standard also requires that all mechanical, electrical, and pneumatic equipment that presents a danger to employees inside grain storage structures must be de-energized and disconnected, locked-out and tagged, blocked-off, or otherwise stopped by other equally effective means or methods. OSHA also adds a definition of "flat storage structure" to clarify its original intent as to the scope of the entry provisions of the standard.[25] The amendment to the final rule became effective April 8, 1996.

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[24] A "flat storage structure" is a grain storage building or structure that will not empty completely by gravity, has an unrestricted ground level opening for entry, and must be entered to reclaim the residual grain using powered equipment or manual means.

[25] Provisions in the 1987 OSHA Grain Handling Standard had protected employees from hazards while walking on or underneath accumulations of grain within a grain storage facility. However, it arguably did not apply to employees entering "flat storage buildings or tanks" unless entry is made from the top of the structure. OSHA intended the exception to apply only to entries that did not expose employees to atmospheric, engulfment, or entrapment hazards. The standard had assumed that hazards from entry into flat storage structures only arise when the entry is made from the top, because employees who enter in that manner would do so in order to stand or walk on the stored grain. The text of the standard did not directly address situations in which the same hazards would be encountered during entries from lower levels. Since the 1987 Grain Handling Standard was issued, OSHA learned that many entries take place from such levels lower than the top of the structure in facilities with dimensions of greater diameter than height.

- On November 8, 1996, OSHA issued a compliance directive, CPL 2-1.4C, "Inspection of Grain Handling Facilities," that contains inspection guidance for compliance officers. CPL 2-1.4 contains information on: the scope and application of the standard; emergency action plans; training; hot work permits; entry into grain storage structures; entry into flat storage structures; contractors; general housekeeping, priority housekeeping, and blowdown operations; grain and product spills; grate openings; filter collectors; preventive maintenance; emergency escape; continuous-flow bulk raw grain dryers; inside bucket elevators, belts, bearings, belt alignment, visual inspection of legs; and dust concentrations.

Scope of the Grain Handling Facilities Standard

The scope of the Grain Handling Facilities Standard contains requirements for the control of grain dust fires and explosions, and certain other safety hazards associated with grain handling facilities. It applies in addition to all other relevant provisions of Part 1910 (or Part 1917 at marine terminals).

Applicability of the Grain Handling Facilities Standard

The Grain Handling Facilities Standard applies to the following types of grain handling facilities: grain elevators, feed mills, flour mills, rice mills, dust pelletizing plants, dry corn mills, soybean flaking operations, and the dry grinding operations of soycake.

Requirements of the Grain Handling Facilities Standard

The following are requirements of the OSHA Grain Handling Facilities Final Standard:

Definitions.

- "Choked leg" means a condition of material buildup in the bucket elevator that results in the stoppage of material flow and bucket movement. A bucket elevator is not considered choked that has the up-leg partially or fully loaded and has the boot and discharge cleared allowing bucket movement.

- "Flat storage structure" means a grain storage building or structure that will not empty completely by gravity, has an unrestricted ground level opening for entry, and must be entered to reclaim the residual grain using powered equipment or manual means.

- "Fugitive grain dust" means combustible dust particles, emitted from the stock handling system, of such size as will pass through a U.S. Standard 40 mesh sieve (425 microns or less).

- "Grain elevator" means a facility engaged in the receipt, handling, storage, and shipment of bulk raw agricultural commodities such as corn, wheat, oats, barley, sunflower seeds, and soybeans.

- "Hot work" means work involving electric or gas welding, cutting, brazing, or similar flame producing operations.

- "Inside bucket elevator" means a bucket elevator that has the boot and more than 20 percent of the total leg height (above grade or ground level) inside the grain elevator structure. Bucket elevators with leg casings that are inside (and pass through the roofs) of rail or truck dump sheds with the remainder of the leg outside of the grain elevator structure, are not considered inside bucket elevators.

- "Jogging" means repeated starting and stopping of drive motors in an attempt to clear choked legs.

- "Lagging" means a covering on drive pulleys used to increase the coefficient of friction between the pulley and the belt.

- "Permit" means the written certification by the employer authorizing employees to perform identified work operations subject to specified precautions.

Emergency Action Plan

The employer shall develop and implement an emergency action plan meeting the requirements contained in 1910.38(a), which requires written plans for facilities with 11 or more employees and permits oral instructions for sites with 10 or fewer employees.

Training

The employer shall provide training to employees at least annually and when changes in job assignment will expose them to new hazards. Current employees and new employees prior to starting work, shall be trained in at least the following:

- General safety precautions associated with the facility, including recognition and preventive measures for the hazards related to dust accumulations and common ignition sources such as smoking; and,

- Specific procedures and safety practices applicable to their job tasks including but not limited to, cleaning procedures for grinding equipment, clearing procedures for choked legs, housekeeping procedures, hot work procedures, preventive maintenance procedures and lock-out/tag-out procedures.

Employees assigned special tasks, such as bin entry and handling of flammable or toxic substances, shall be provided training to perform these tasks safely. Training for an employee who enters grain storage structures includes training about engulfment and mechanical hazards and how to avoid them.

Hot Work Permit

The employer shall issue a permit for all hot work, with the following exceptions:

- Where the employer or the employer's representative (who would otherwise authorize the permit) is present while the hot work is being performed;
- In welding shops authorized by the employer; and
- In hot work areas authorized by the employer which are located outside of the grain handling structure.

The permit shall certify that the requirements contained in 1910.252(a) have been implemented prior to beginning the hot work operations. The permit shall be kept on file until completion of the hot work operations.

Entry Into Grain Storage Structures

The following requirements apply when employees are entering bins, silos, tanks, or other grain storage structures (except flat storage structures):

- The employer shall issue a permit for entering bins, silos, or tanks unless the employer or the employer's representative (who would otherwise authorize the permit) is present during the entire operation. The permit shall certify that the precautions contained in this paragraph (1910.272(g)) have been implemented prior to employees entering bins, silos or tanks. The permit shall be kept on file until completion of the entry operations.

- All mechanical, electrical, hydraulic, and pneumatic equipment which presents a danger to employees inside grain storage structures shall be deenergized and shall be disconnected, locked-out and tagged, blocked-off, or otherwise prevented from operating by other equally effective means or methods.

- The atmosphere within a bin, silo, or tank shall be tested for the presence of combustible gases, vapors, and toxic agents when the employer has reason to believe they may be present. Additionally, the atmosphere within a bin, silo, or tank shall be tested for oxygen content unless there is continuous natural air movement or continuous forced-air ventilation before and during the period employees are inside. If the oxygen level is less than 19.5%, or if combustible gas or vapor is detected in excess of 10% of the lower flammable limit, or if toxic

agents are present in excess of the ceiling values listed in Subpart Z of 29 CFR Part 1910, or if toxic agents are present in concentrations that will cause health effects which prevent employees from effecting self-rescue or communication to obtain assistance, the following provisions apply:

- o Ventilation shall be provided until the unsafe condition or conditions are eliminated, and the ventilation shall be continued as long as there is a possibility of recurrence of the unsafe condition while the bin, silo, or tank is occupied by employees.
- o If toxicity or oxygen deficiency cannot be eliminated by ventilation, employees

entering the bin, silo, or tank shall wear an appropriate respirator. Respirator use shall be in accordance with the requirements of 1910.134.

- "Walking down grain" and similar practices where an employee walks on grain to make it flow within or out from a grain storage structure, or where an employee is on moving grain, are prohibited.

- Whenever an employee enters a grain storage structure from a level at or above the level of the stored grain or grain products, or whenever an employee walks or stands on or in stored grain of a depth which poses an engulfment hazard, the employer shall equip the employee with a body harness with lifeline, or a boatswain's chair that meets the requirements of 1910 subpart D. The lifeline shall be so positioned, and of sufficient length, to prevent the employee from sinking further than waist-deep in the grain. Exception: Where the employer can demonstrate that the protection required by this paragraph is not feasible or creates a greater hazard, the employer shall provide an alternative means of protection which is demonstrated to prevent the employee from sinking further than waist-deep in the grain. When the employee is standing or walking on a surface which the employer demonstrates is free from engulfment hazards, the lifeline or alternative means may be disconnected or removed.

- An observer, equipped to provide assistance, shall be stationed outside the bin, silo, or tank being entered by an employee. Communications (visual, voice, or signal line) shall be maintained between the observer and employee entering the bin, silo, or tank..

- The employer shall provide equipment for rescue operations which is specifically suited for the bin, silo, or tank being entered.

- The employee acting as observer shall be trained in rescue procedures, including notification methods for obtaining additional assistance.

- Employees shall not enter bins, silos, or tanks underneath a bridging condition, or

where a buildup of grain products on the sides could fall and bury them.

Entry Into Flat Storage Structures

The following requirements apply when employees are entering flat storage structures:

- Each employee who walks or stands on or in stored grain, where the depth of the grain poses an engulfment hazard, shall be equipped with a lifeline or alternative means which the employer demonstrates will prevent the employee from sinking further than waist-deep into the grain. When the employee is standing or walking on a surface which the employer demonstrates is free from engulfment hazards, the lifeline or alternative means may be disconnected or removed.

- Whenever an employee walks or stands on or in stored grain or grain products of a depth which poses an engulfment hazard, all equipment which presents a danger to that employee (such as an auger or other grain transport equipment) shall be deenergized, and shall be disconnected, locked-out and tagged, blocked-off, or otherwise prevented from operating by other equally effective means or methods.

- "Walking down grain" and similar practices where an employee walks on grain to make it flow within or out from a grain storage structure, or where an employee is on moving grain, are prohibited.

- No employee shall be permitted to be either underneath a bridging condition, or in any other location where an accumulation of grain on the sides or elsewhere could fall and engulf that employee.

Contractors

The employer shall inform contractors performing work at the grain handling facility of known potential fire and explosion hazards related to the contractor's work and work area. The employer shall also inform contractors of the applicable safety rules of the facility. The employer shall explain the applicable provisions of the emergency action plan to contractors.

Housekeeping

The employer shall develop and implement a written housekeeping program that establishes the frequency and method(s) determined best to reduce accumulations of fugitive grain dust on ledges, floors, equipment, and other exposed surfaces.

In addition, the housekeeping program for grain elevators shall address fugitive grain dust accumulations at priority housekeeping areas. Priority housekeeping areas shall include at least the following:

- Floor areas within 35 feet (10.7 m) of inside bucket elevators;
- Floors of enclosed areas containing grinding equipment; and
- Floors of enclosed areas containing grain dryers located inside the facility.

The employer shall immediately remove any fugitive grain dust accumulations whenever they exceed 1/8 inch (.32 cm) at priority housekeeping areas, pursuant to the housekeeping program, or shall demonstrate and assure, through the development and implementation of the housekeeping program, that equivalent protection is provided.

The use of compressed air to blow dust from ledges, walls, and other areas shall only be permitted when all machinery that presents an ignition source in the area is shut-down, and all other known potential ignition sources in the area are removed or controlled.

Grain and product spills shall not be considered fugitive grain dust accumulations. However, the housekeeping program shall address the procedures for removing such spills from the work area.

Grate Openings

Receiving-pit feed openings, such as truck or railcar receiving-pits, shall be covered by grates. The width of openings in the grates shall be a maximum of 2 1/2 inches (6.35 cm).

Filter collectors

All fabric dust filter collectors which are a part of a pneumatic dust collection system shall be equipped with a monitoring device that will indicate a pressure drop across the surface of the filter.

Filter collectors installed after March 30, 1988 shall be located:

- outside the facility;
- in an area inside the facility protected by an explosion suppression system; or
- in an area inside the facility that is separated from other areas of the facility by construction having at least a one hour fire-resistance rating, and which is adjacent to an exterior wall and vented to the outside; the vent and ductwork shall be designed to resist rupture due to deflagration.

Preventive Maintenance

The employer shall implement preventive maintenance procedures consisting of:

- Regularly scheduled inspections of at least the mechanical and safety control equipment associated with dryers, grain stream processing equipment, dust collection equipment including filter collectors, and bucket elevators;

- Lubrication and other appropriate maintenance in accordance with manufacturers' recommendations, or as determined necessary by prior operating records.

The employer shall promptly correct dust collection systems which are malfunctioning or which are operating below designed efficiency. Additionally, the employer shall promptly correct, or remove from service, overheated bearings and slipping or misaligned belts associated with inside bucket elevators.

A certification record shall be maintained of each inspection, containing the date of the inspection, the name of the person who performed the inspection and the serial number, or other identifier, of the equipment that was inspected.

The employer shall implement procedures for the use of tags and locks which will prevent the inadvertent application of energy or motion to equipment being repaired, serviced, or adjusted, which could result in employee injury. Such locks and tags shall be removed in accordance with established procedures only by the employee installing them or, if unavailable, by his or her supervisor.

Grain Stream Processing Equipment

The employer shall equip grain stream processing equipment (such as hammer mills, grinders, and pulverizers) with an effective means of removing ferrous material from the incoming grain stream.

Emergency Escape

The employer shall provide at least two means of emergency escape from galleries (bin decks). The employer shall provide at least one means of emergency escape in tunnels of existing grain elevators. Tunnels in grain elevators constructed after March 1988 shall be provided with at least two means of emergency escape.

Continuous-Flow Bulk Raw Grain Dryers

All direct-heat grain dryers shall be equipped with automatic controls that:

- will shut-off the fuel supply in case of power or flame failure or interruption of air

movement through the exhaust fan; and,

- will stop the grain from being fed into the dryer if excessive temperature occurs in the exhaust of the drying section.

Direct-heat grain dryers installed after March 30, 1988 shall be located:

- outside the grain elevator;
- in an area inside the grain elevator protected by a fire or explosion suppression system; or
- in an area inside the grain elevator which is separated from other areas of the facility by construction having at least a one hour fire-resistance rating.

Inside Bucket Elevators

Bucket elevators shall not be jogged to free a choked leg. All belts and lagging purchased after March 30, 1988 shall be conductive. Such belts shall have a surface electrical resistance not to exceed 300 megohms. All bucket elevators shall be equipped with a means of access to the head pulley section to allow inspection of the head pulley, lagging, belt, and discharge throat of the elevator head. The boot section shall also be provided with a means of access for clean-out of the boot and for inspection of the boot, pulley, and belt.

The employer shall mount bearings externally to the leg casing, or provide vibration monitoring, temperature monitoring, or other means to monitor the condition of those bearings mounted inside or partially inside the leg casing. This requirement does not apply to bucket elevators which are equipped with an operational fire and explosion suppression system capable of protecting at least the head and boot section of the bucket elevator, or to bucket elevators which are equipped with pneumatic or other dust control systems or methods that keep the dust concentration inside the bucket elevator at least 25% below the lower explosive limit at all times during operations.

The employer shall equip bucket elevators with a motion detection device which will shut-down the bucket elevator when the belt speed is reduced by no more than 20% of the normal operating speed. This requirement does not apply to grain elevators having a permanent storage capacity of less than one million bushels, provided that daily visual inspection is made of bucket movement and tracking of the belt. Also, this requirement does not apply to bucket elevators which are equipped with an operational fire and explosion suppression system capable of protecting at least the head and boot section of the bucket elevator, or to bucket elevators which are equipped with pneumatic or other

dust control systems or methods that keep the dust concentration inside the bucket elevator at least 25% below the lower explosive limit at all times during operations.

The employer shall equip bucket elevators with a belt alignment monitoring device which will initiate an alarm to employees when the belt is not tracking properly, or provide a means to keep the belt tracking properly, such as a system that provides constant alignment adjustment of belts. This requirement does not apply to grain elevators having a permanent storage capacity of less than one million bushels, provided that daily visual inspection is made of bucket movement and tracking of the belt. Also, this requirement does not apply to bucket elevators which are equipped with an operational fire and explosion suppression system capable of protecting at least the head and boot section of the bucket elevator, or to bucket elevators which are equipped with pneumatic or other dust control systems or methods that keep the dust concentration inside the bucket elevator at least 25% below the lower explosive limit at all times during operations.

CHAPTER III

PROFILE OF THE GRAIN HANDLING INDUSTRY

Appendix IV describes the grain handling process and grain elevators. The majority of facilities covered by the standard are found in the five Standard Industrial Code (SIC) groups listed below:

2041 - Flour and other Grain Mill products
2044 - Rice Milling
2048 - Prepared Feeds and Feed Ingredients for Animals and Fowls, Not elsewhere classified
4221 - Farm Product Warehousing and Storage
5153 - Grain

The following, additional SICs have grain elevators that are also covered by the standard:

0723 - Crop Preparation Services for Market, except cotton ginning
2047 - Grain Processing
2075 - Oil Seed Processing

(The North American Industry Classification System (NAICS) has replaced the U.S. Standard Industrial Classification (SIC) system. NAICS replaces or revises some 60% of the previously available SIC industries. It provides 358 industries that the SIC did not identify, 390 that are revised from their SIC counterparts, and 422 that continue substantially unchanged. The first NAICS-based United States statistics are the 1997 Economic Census data. The analyses for this 610 Review used the SIC system so that data could be compared and also because the SIC system was the system used for the vast majority of the available data.)

Covered workplaces may also be found in other SICs where grain elevators are not the primary business. If a facility has a grain elevator onsite that receives, handles, stores and ships (including transfer to another part of the facility) a bulk, raw, agricultural commodity, the standard applies to the grain elevator there, too. An example of this type of facility is a grain elevator used in support of a brewery. (The important factor is that a bulk, raw, agricultural commodity enters the facility, is handled and stored, and then leaves the facility in the same form.)

The major sectors affected by the Grain Handling Facilities Final Standard are grain elevators and grain mills. For the final standard, grain elevators with similar economic and other characteristics were grouped into the following industry segments: country elevators; inland elevators; high-throughput inland terminal elevators; and export terminal elevators. The grain processing segments affected by the final standard include

feed mills, flour mills, rice mills, dry corn mills, and dust pelletizing plants. The final standard also applies to facilities involved in soybean flaking operations and dry soycake grinding operations. (See 52 FR 49619.)

Grain Elevators

Grain elevators are concentrated in the following SICs, and these were the grain elevator SICs evaluated for the final standard:

- SIC 0723: Crop Preparation Services for Market, Except Cotton Ginning
- SIC 4221: Farm Product Warehousing and Storage
- SIC 5153: Grain and Field Beans

There were four main types of grain elevators classified in OSHA's 1987 Regulatory Impact Analysis for the Grain Handling Facilities Final Standard:

- Country Elevators - There were about 13,200 country elevators at the time the final rule was promulgated. Country elevators were defined as those elevators with a storage capacity of less than 2 million bushels and a throughput ratio of less than three. At the time of the final rule, total storage capacity of all country elevators was determined to be approximately 7.1 billion bushels, and employment was estimated to be 70,800 full-time equivalent employees (52 FR 49620). Since promulgation of the final rule in 1987, no parallel estimates of the total number of country elevators and the workers they employ have been available.

  Country elevators primarily provide storage and purchasing services to farmers in their immediate areas. They may also provide services such as grain cleaning, drying, and blending (collectively known as grain conditioning) (52 FR 49620).

  At the time the final rule was promulgated, the country elevator business was highly competitive and localized. The operations were primarily owned by individual family corporations or partnerships, farmer cooperatives, or large companies that own a network of facilities (52 FR 4960).

- Inland-Terminal Elevators - These elevators are those with a storage capacity of more than 2 million bushels. They function primarily as seasonal long-term storage facilities. At the time the final rule was promulgated, there were about 450 inland-terminal elevators, with total storage capacity of approximately 1.5 billion bushels, or 3.4 million bushels per facility. The total employment in this sector was estimated to be 6,100 full-time equivalent employees, or about 12.4 full-time employees and 8.3 part-time employees per establishment. (See 52 FR 49620.)

At the time the final rule was promulgated, many inland-terminal elevators had become obsolete because of elevator capacity limitations, difficulty in complying with air pollution control and other regulations, and changes in rail handling capabilities. In other instances, firms made substantial investments in order to upgrade older facilities to meet the new operating requirements. (See 52 FR 49620.)

- High-Throughput Inland Terminal Elevators - The operators of high-throughput terminal elevators are essentially grain merchandisers who provide few storage or drying services. These elevators are low-margin operations, and their profits are based on the ability to assemble grain at the least cost and to direct it toward profitable markets with minimum transportation costs. (See 49 FR 49620.)

  At the time the final rule was promulgated, there were about 250 high-throughput inland elevators in the U.S. with a total storage capacity estimated at 887.5 million bushels. They generally have storage capacities that are greater than 2 million bushels and almost all have storage capacities ranging from .5 million to 7 million bushels. (See 52 FR 49620.)

  At the time the final rule was promulgated, there was a estimated average of 13.6 full-time employees and 6.1 part-time employees per establishment. Total employment was estimated at 3,700 full-time equivalent employees in this sector.

- Export Terminal Elevators - At the time the final rule was promulgated, there were about 75 export terminals in the United States. These typically had large storage capacities and high-throughput ratios and were located in areas where they could provide access for ships and barges for the export market. At the time the final rule was promulgated, the total storage capacity of export elevators was estimated at 370.5 million bushels. (See 52 FR 49620.)

  At the time the final rule was promulgated, it was estimated that an export elevator would employ an average of 55.4 full-time employees and 11 part-time employees. There were also an estimated 4,350 full-time equivalent employees in this sector at the time the final rule was promulgated. (See 52 FR 49620.)

In the years before and after the promulgation of the Grain Handling Facilities Final Rule, the number of off-farm storage facilities decreased while the capacity of off-farm storage facilities increased. According to the U. S. Department of Agriculture (USDA), there were nearly 10,000 off-farm grain storage facilities in the country in 1999, with storage capacity of more than 8 billion bushels. (See Table 2.) While the number of storage facilities decreased by 34% from 1977 to 1999, the off-farm storage capacity increased by approximately 28% during the same time period.

Average grain production in the United States between 1988 and 1998 was greater than the average grain production between 1977 and 1987. (See Table 3.)

Grain Mills

There were three major types of grain mills evaluated for the Grain Handling Facilities Final Rule: prepared feeds and feed ingredients (SIC 2048); oil seed processing (SIC 2075); and grain processing (SICs 2041,2044, and 2047).

- SIC 2048: Prepared Feeds and Feed Ingredients

The prepared feeds and feed ingredients sector is primarily engaged in the manufacture of animal feeds. Feed mills grind and process grain, grain byproducts, and oilseed meals in the production of animal feeds. (See 52 FR 49620.) At the time the final rule was promulgated, there were slightly more than 9,000 feed mill facilities in the United States (1984 data). Also, during this period, about 900 mills produced over 50,000 tons per year, 2,000 mills produced between 15,000 and 49,999 tons per year, and 6,100 mills produced up to 14,999 tons per year. (See 52 FR 49620.)

There were an estimated 98,500 workers employed at feed mills at the time the final rule was promulgated. The average small feed mill had 5.03 full-time employees and 1.60 seasonal part-time employees who worked about 10 weeks per year. Large feed mills employed 24.19 full-time employees and 2.86 seasonal employees 10 weeks per year. (See 52 FR 49620.)

Many mills are attached to country elevators, and therefore, many employees work in both elevators and mills. At the time the final rule was promulgated, OSHA estimated that 90 percent of the employees in small and medium-sized mills were included in its estimate of the number of employees in country elevators. Therefore, 57,353 of the estimated 63,726 full-time equivalent employees of small and medium-sized mills would also have been country elevator employees. (See 52 FR 49620.)

- SIC 2075: Oil Seed Processing

As explained in the preamble for the Grain Handling Facilities Final Rule, soybean oil mills produce diverse products for various uses. The soybean processing industry includes establishments primarily engaged in the manufacture of soybean oil, and byproduct cake and meal. (See 52 FR 49620.)

At the time the final rule was promulgated, the National Soybean Processors Association (NSPA) reported that about 80 processing plants operated in the Unites States during 1984. According to NSPA, at that time, there were about 25 production employees per facility. (See 52 FR 49620.)

- SICs 2041, 2044, and 2047: Grain Processing

This sector includes: flour mills (SIC 2041); rice mills (SIC 2044); and dog, cat, and other pet food mills (SIC 2047).

At the time the final rule was promulgated, Census of Manufacturers data for 1985 showed there were 360 flour mills with 11,400 production employees and 70 rice mills with 4,400 production employees. There were also 285 dog, cat, and other pet food plants with 12,800 production employees. (See 52 FR 49620.)

CHAPTER IV

IMPACTS OF OSHA'S GRAIN HANDLING FACILITIES STANDARD ON EXPLOSIONS, FATALITIES AND INJURIES

The Grain Handling Facilities Standard contains provisions that address several safety hazards. The hazards these provisions address include: fires; explosions; toxic substance and oxygen deficiences from entry into bins, silos, or tanks; release of hazardous energy from equipment; and engulfment by grain in bins, silos, or tanks. [Note that the promulgation of the Grain Handling Facilities Standard preceded OSHA's generic standards for the Control of Hazardous Energy Source (29 CFR 1910.147) published September 1, 1989 and the Permit-required Confined Spaces (29 CFR 1910.146) published January 14, 1993.] The standard was also expected to have the additional benefit of reducing occupationally-related lung disease by reducing the amount of grain dust inhaled by workers. Furthermore, the requirement for grates on openings, in order to keep foreign objects out of the grain flow, could also prevent workers' body parts from entering augers.

This Chapter will present risk reduction analyses focusing on two end points: 1.) injuries and fatalities from grain dust explosions; and 2.) suffocations which result when a worker is engulfed or crushed by grain. Limited resources do not allow us to analyze all of the standard's benefits. These endpoints have been selected for this Section 610 review's risk reduction analysis because accessible data exist for these endpoints. Furthermore, a reduction in fatalities from suffocations and reductions in both injuries and fatalities from explosions are primary and substantial benefits anticipated from the promulgation of the Standard.

As will be presented in this Chapter, since the promulgation of OSHA's Grain Handling Facilities Standard, fatalities from explosions and suffocations have decreased. Furthermore, in comparing these risks over time, it is important to note that the number and capacity of off-farm storage facilities has changed since 1977. Specifically, as Table 2 shows, the number of facilities has been decreasing while the rated off-farm storage capacity has been increasing. Because of this, grain in these larger capacity storage facilities must be turned over more often; the higher turn-over of grain in the facilities means the grain is moved faster and more often. Since explosions and suffocations occur when grain is being moved (e.g., movement stirs up grain dust, workers may enter grain bins to loosen grain that is not flowing), there may be more potential now than in earlier years for explosions and suffocations to occur. However, as this chapter will show, the number of explosions has not increased, and the number of fatalities from explosions and suffocations has decreased.

In OSHA's Regulatory Impact Analysis (RIA) for the 1987 Grain Handling Facilities Final Rule, United States Department of Agriculture (USDA) data were available on injuries and fatalities from grain explosions, and fatality data on suffocations were estimated from various sources. However, for this risk reduction analysis, suffocation data from OSHA's IMIS (Integrated Management Information System) database were available and were used. A detailed description of how the IMIS database was used is presented below, in this Chapter.

Explosions

New Technologies

As discussed in Chapter I, the catastrophic grain explosions in the late 1970's lead to increased government, industry, and public awareness of the need for safety improvements in grain handling facilities. Greater safety awareness also led to the development of new technologies. In its statement for OSHA's Public Meeting to Review the Grain Handling Facilities Standard (29 CFR 1910.272) on July 28, 1998, a representative of the National Grain and Feed Association (NGFA) described industry research efforts that resulted from these catastrophic explosions. According to NGFA, among the knowledge gained by this research were technological advances, including: revolutionized design, layout, and construction of grain handling facilities, (most notably, grain handling equipment, particularly the bucket elevator, which is now located outside the main structure in new and renovated facilities); development of fundamental techniques to successfully vent bucket elevators, grain bins, galleries and tunnels; and development of a new portable suppression device to extinguish a fire or explosion at its earliest stages in bucket elevators.[26] NGFA further stated that "overall, there has been little change in the general physical characteristics of grain elevators since the standard was published in 1988, with the exception that the industry has clearly installed and implemented a substantial amount of safety equipment and implemented better operating practices that have contributed strongly to improved safety."[27]

Risk Analysis and Calculations for Explosions

As stated in public comments for this 610 review, "Within the United States, The Federal Grain Inspection Service of the Department of Agriculture has maintained the most accurate records concerning explosions occurring in grain handling facilities".[28]

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[26] Statement of the National Grain and Feed Association at the Occupational Safety and Health Administration Public Meeting to Review the Grain Handling Facilities Standard (29 CFR 1910.272) Chicago, Illinois; July 28, 1998; p. 5 (OSHA Docket No. H-117C, Ex. 4)

[27] Ibid, p. 9

[28] C. W. Kauffman, K. R. Mestrich, R. P. Regan, T. H. Seymour, "Dust Explosions in the U.S. Grain Industry - The Effects of Research, Regulations, and Education," p. 2 (OSHA Docket No. H-117C, Ex. 3-

Therefore, this 610 review risk analysis, as well as OSHA's RIA for the 1987 Grain Handling Facilities Standard, used explosion data and explosion-related injury and fatality data obtained from the U.S. Department of Agriculture (USDA). See Table 1.

The decline in explosions and explosion-related injuries and fatalities since the development and promulgation of the 1987 Grain Handling Facilities Standard was cited by both labor and industry representatives in public comments for this 610 review. Using the USDA data found in Table 1, comments submitted to the OSHA Docket from the Food and Allied Service Trades (FAST), AFL-CIO, stated " ... since the promulgation of OSHA's standard in December 1987, explosions were reduced by 42 %, the number of injured was reduced by 60 % and the number killed was down by 70%".[29] In addition, FAST commented that the Grain Handling Facilities Standard "has been a resounding success in controlling deadly explosions and other serious safety hazards in the grain industry".[30] On average, the Standard has prevented 5 deaths each year from grain dust explosions; as Table 1 shows, the pre-regulatory average is 7.3 deaths each year from explosions, and the post-regulatory average is 2.3 deaths each year from explosions.

In its statement for the OSHA public meeting, NGFA described "an unprecedented decline in explosions, injuries and fatalities at grain handling facilities" since 1980.[31] Figure 1 shows data on the average number of explosions, injuries, and fatalities at grain handling facilities, presented by NGFA in its statement for the OSHA public meeting, for the period 1977/78 through 1997.[32] According to NGFA, the data in Figure 1 were compiled by Kansas State University and USDA's Grain Inspection, Packers and Stockyards Administration. NGFA presented the data in Figure 1 as averages for the indicated five-year periods, beginning with the explosions that occurred in December 1977; the "1977/78" time period includes explosions, injuries, and fatalities from December 1977 through December 1978.[33] Also, according to NGFA, these data were "adjusted to remove facilities not covered by the standard, such as toy, candy and sugar manufacturing facilities".[34]

56B)

[29] Letter submitted to the OSHA Docket, dated August 31, 1998, from the Food and Allied Services Trades, AFL-CIO (OSHA Docket No. H-117C, Ex. 3-56)

[30] Ibid

[31] Statement of the National Grain and Feed Association at the Occupational Safety and Health Administration Public Meeting to Review the Grain Handling Facilities Standard (29 CFR 1910.272) Chicago, Illinois; July 28, 1998; p. 2 (OSHA Docket No. H-117C, Ex. 4)

[32] Ibid

[33] Ibid

[34] Ibid

Figure 1[35]
All Grain Handling Facilities Covered by the Standard
(average for the indicated time period)

STATISTIC	1977/78-1982	1983-1987	1988-1992	1993-1997
Explosions	25	18	11	14
Injuries	50	19	7	11
Fatalities	20	3	2	1

According to the NGFA, the data presented in Figure 1 "show that, between the 1977/78-1982 and 1993-1997 periods, explosions declined by 44%, injuries by 78% and fatalities by 95% at all grain handling facilities".[36]

NGFA also analyzed data for grain elevators only, since grain elevators are required by the Standard to meet more stringent housekeeping standards. Figure 2 shows the data from Figure 1 that is applicable only to grain elevators.

Figure 2[37]
Grain Elevators Only
(average for the indicated time period)

STATISTIC	1977/78-1982	1983-1987	1988-1992	1993-1997
Explosions	21	12	8	6
Injuries	47	10	7	4
Fatalities	19	2	2	1

According to NGFA, the data in Figure 2 show that "grain elevators clearly follow the same pattern as other types of grain handling facilities. Namely, between the 1977/78-1982 and 1993-1997 periods, explosions declined by 71%, injuries by 91% and fatalities by 95% at grain elevators. It is indisputable that great strides have been made in reducing the incidence and severity of fires and explosions at grain handling facilities since the late 1970's. The record of improvement in reducing the risk of personal injury and equipment damage from grain dust explosions is unprecedented".[38]

Figure 3 shows the data from Figure 1, divided into the years before and the years after the Grain Handling Facilities Standard was issued. Clearly, there is a decrease in the average number of explosions, injuries, and fatalities since issuance of the Grain Handling Facilities Standard. It is clear to OSHA that when OSHA and NGFA began

[35] Ibid

[36] Ibid, p. 3

[37] Ibid

[38] Ibid

publishing information on the control of grain dust explosions and later when OSHA issued its proposed Grain Handling Facilities Standard, some elevators began instituting controls without waiting for the final Grain Handling Facilities Standard to be issued. Issuance of the final Standard completed the process of requiring upgraded controls to reduce deaths from grain dust explosions and suffocations.

Figure 3
All Grain Handling Facilities Covered by the Standard
(average for the indicated time period)

STATISTIC	1977/78-1987	1988-1997
Explosions	21	12
Injuries	34	9
Fatalities	11	1

The above statistics illustrate what was previously stated in this 610 Review; namely, the catastrophic grain explosions of the late 1970's led to increased national awareness of the hazards associated with the grain handling industry, and actions and research that began in the late 1970's led to the promulgation of OSHA's Grain Handling Facilities Standard.

Suffocations

The analysis below will show that, in the years since the promulgation of the Grain Handling Facilities Standard, the average number of annual grain suffocations has decreased by over 40 percent, compared to the estimated average number of annual grain suffocations presented in OSHA's Regulatory Impact Analysis (RIA) for the Grain Handling Facilities Standard Final Rule. This analysis will also indicate that when the requirements of the Grain Handling Facilities Standard are complied with, suffocations in grain do not occur.

Database for Suffocations

In OSHA's RIA for the 1987 Grain Handling Facilities Final Rule, OSHA estimated that an average of 10 employees suffocate annually in grain storage bins. This estimate was based on several sources and included suffocation data reported from 1977 to 1981 for the 27 states which were under Federal OSHA jurisdiction; data were not available from states which ran their own occupational safety and health programs (i.e., "State-Plan-States").

When the RIA for the 1987 Final Rule was developed, complete fatality data from OSHA's IMIS (Integrated Management Information System) database were not available. Now, the IMIS database contains information on over 2.5 million inspections. The information is continually being updated with new data originating from OSHA Federal and state enforcement offices.

Since 1984, statistics from the IMIS database have included all states except: Michigan (which began reporting health inspections in 1989 and safety inspections in 1989); Washington (which began reporting all inspections in 1990); and California (which began reporting all inspections in 1990.) (Also, note that California was under Federal jurisdiction from approximately 1987 to 1989.) The suffocation risk analysis for this Section 610 Review is based on suffocation fatalities reported in OSHA's IMIS database. Therefore, because the IMIS database was not very complete until about 1984, the suffocation data used for this Section 610 Review analysis starts in 1984.

The information sources used to determine the suffocation fatalities, which are recorded on the IMIS database, were the Accident Investigation Summaries (OSHA-170 form); these Accident Investigation Summaries result from OSHA accident inspections. For this risk analysis, OSHA examined only suffocation fatalities, not injuries. Due to the severity of the hazard, most complete engulfments in grain result in death. Partial engulfments which do not result in death usually do not result in injury either and often go unreported. Furthermore, all fatalities and three or more injuries which result in overnight hospitalizations are required by Federal OSHA to be reported by employers in states under OSHA's jurisdiction. However, State-Plan-States may have different reporting requirements for injuries (e.g., California reports more injuries than some other states). Therefore, the most reliable and accurate data in the IMIS database for grain entrapments are the fatality data.

In order to obtain the suffocation fatality reports from the IMIS database, six runs of the IMIS database were performed, using each of the following keywords: grain*; suffocat*; entrap*; suffo*; engulf*; and asphyx*. The symbol "*" is used to catch all fatality reports on the IMIS that are keyed with the letters preceding the "*". Six runs were performed in order to obtain as many grain suffocation fatality reports as possible. The six runs selected a total of 1551 fatalities due to suffocation. These cases were reviewed to determine which were grain suffocations. The fatalities determined to be grain suffocations were then further examined to determine which were covered under the Grain Handling Facilities Standard. Finally, 93 suffocations from 1984 through 1999 were determined to be covered under the Grain Handling Facilities Standard.

Table 4 shows the number of suffocations and their related SIC codes, found on the IMIS database for each year from 1984 through 1999. Some of the SICs listed in Table 4 were not included in the 8 major grain handling SICs evaluated for the Grain Handling Facilities Standard. This is because information from IMIS fatality accident reports was used to determine the number of suffocations, irrespective of the SIC recorded on the reports. There was one fatality for each accident, except for two events, where there were two fatalities, each. As explained above, suffocations from every State-Plan-State may not have been recorded in the IMIS for the years 1984 through 1990, and suffocations which occurred in the years 2000 and 2001 are not included on Table 4. Table 5 shows these 93 suffocations, broken down by the number of monthly suffocations reported for each year, from 1984 through 1999.

Risk Analysis for Suffocations

Each of these 93 suffocation accident reports from the IMIS database was examined to determine, if possible, the factors which contributed to the fatality and whether these factors indicated a weakness in the Grain Handling Facilities Standard or lack of compliance with the Standard. The circumstances leading to the fatality could not be determined from 43% of the IMIS fatality accident reports. Equipment/machinery which was not turned-off was stated to be a factor in 34% of the suffocation fatalities. A body harness and lifeline was stated not to be present in 34% of these IMIS fatality accident reports. Only 4% of the IMIS fatality accident reports stated that a body harness and lifeline were present; in one case the worker disconnected the body harness, and in another case, there was too much slack in the lifeline. Only 16% of the IMIS fatality accident reports stated that the worker who died was not alone; in most of these cases, only a second person was present, and he was there for reasons other than as a safety precaution to help prevent entrapments. No IMIS fatality accident report stated that a fatality occurred when all requirements in the Grain Handling Facilities Standard were met.

These 93 IMIS fatality accident reports were also examined to determine the age and sex of the victims, as well as the grain most often implicated in these fatalities. All fatalities were males. The ages ranged from 14 years-old to 71 years-old; the average age was 40 years-old. The grain involved in the suffocation was not identified in 31 IMIS fatality accident reports (34%). Corn was the grain most often implicated in the suffocation deaths; twenty-six IMIS fatality accident reports (29%) stated that the victim suffocated in corn. This finding is supported by a 1998 study of entrapments and suffocations at commercial grain facilities, where corn was also the grain most often implicated in suffocation deaths[39] In a telephone interview with one of the study's authors, he stated that corn was most often implicated, not only because the United States produces more corn than other grains, but also because the nature of corn is to be stored at higher moisture. As previously discussed, moisture may result in grain sticking or caking to the sides of a storage bin, and entrapments and suffocations have occurred when workers enter such bins to loosen the grain.

Risk Calculations for Suffocations

In OSHA's RIA for the 1987 Grain Handling Facilities Standard, the estimated average of 10 suffocations each year was derived by dividing the estimated total number of suffocations (50) by the number of years (1977 to 1981 = 5 years). Using the data from the IMIS database, if the number of grain suffocations determined for 1984 through 1999

[39] S. A. Freeman, K. W. Kelley, D. E. Maier, et al., "Review of Entrapments in Bulk Agricultural Materials at Commercial Grain Facilities," Journal of Safety Research, Summer 1998, Vol. 29, No. 2, pp. 123-134.

(93) is divided by the number of years (16), grain suffocation fatalities average 5.8 annually, a marked decrease from the estimated average of 10 annual suffocations, given in the RIA. Furthermore, for the years since the promulgation of the Grain Handling Facilities Standard (1988 through 1999), the average is 5.6 suffocations, annually. Therefore, in the years since the promulgation of the Grain Handling Facilities Standard, the average number of annual grain suffocations has decreased by 44 percent.

As with the reduction in deaths from grain dust explosions, the reduction in deaths from suffocations began to occur in the early to mid-1980's, with the publication of various government and industry guidelines, and OSHA's proposed Grain Handling Facilities Standard. The decrease in fatalities was taken further and made permanent by the final Grain Handling Facilities Standard.

OSHA's suffocations risk analysis using the IMIS database is supported by the results of the 1998 published study referred to above.[40] Using mostly newspaper clippings, the 1998 study of commercial grain facilities found an average of 5 fatalities annually, for the years 1988 through 1995.[41] To compare, using the IMIS accident fatality reports only for 1988 through 1995, the same years used in the 1998 study, an annual average of 5.5 suffocation deaths is found. Additionally, in the 1998 study of commercial grain facilities, an annual rate of 4.3 suffocation fatalities per 10,000 commercial grain facilities was estimated for the years 1988 through 1995.[42] Using the IMIS fatality accident reports for that same period (1988 through 1995), an estimated 4.4 suffocation fatalities per 10,000 commercial grain facilities occurred annually.

Compliance, Enforcement, and Violation History

The OSHA Training Institute offers a comprehensive training course for compliance officers conducting inspections of grain handling facilities. Furthermore, in June 1998, OSHA and the USDA and its Farm Service Agency (FSA) entered into a "Memorandum of Understanding" (MOU) "to address the referral of information regarding possible hazards associated with grain dust accumulation found during the course of warehouse examinations conducted by FSA employees at grain warehouses in the United States." This MOU states that during a warehouse examination, if a FSA warehouse examiner sees an accumulation of grain dust which may put the quality or quantity of the stored warehouse product at risk, the FSA examiner is to report those grain dust accumulations to the warehouse manager for corrective action; the grain dust accumulations are reported for corrective action in a Memorandum of Adjustments. The Memorandum of Adjustment is part of the warehouse examination report, and FSA provides the

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[40] Ibid

[41] Ibid.

[42] Ibid

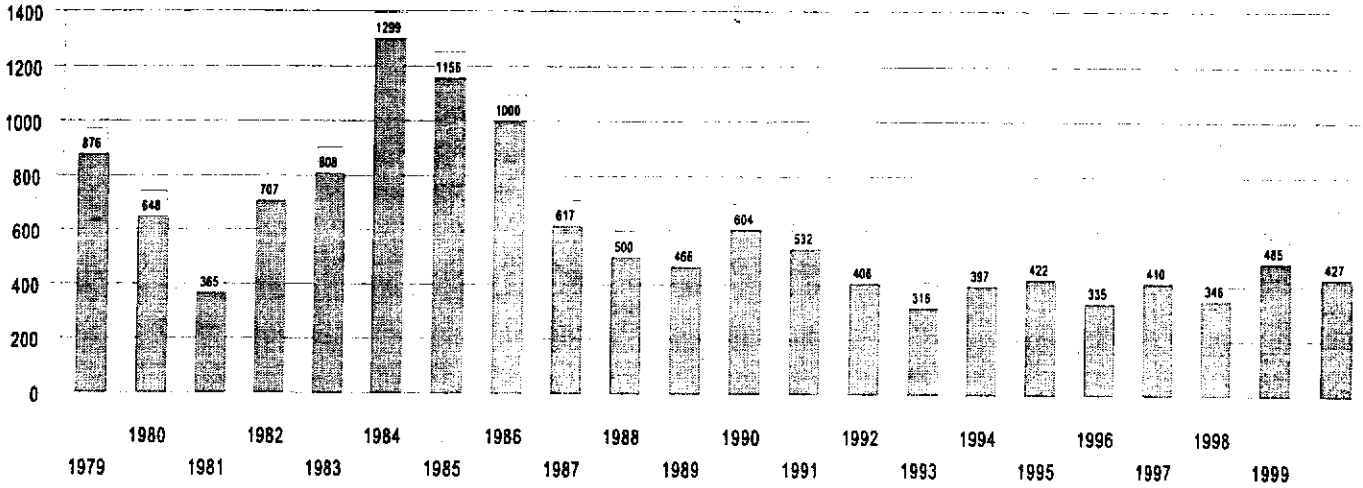
appropriate OSHA Regional Administrator with copies of all Memoranda of Adjustments. The FSA informs the warehouse operator that the OSHA Regional Administrator is also being informed of the grain dust conditions in the warehouse.

Number of Inspections Conducted

Table 6 shows the number of inspections conducted in each of these SICs for the 22 year period from 1979 to 2000. The inspection numbers include those performed by State-Plan-States. The date of the inspection is based on the date of the opening conference (i.e., when the Federal or State OSHA inspector initiated the inspection.) Since 1979, 4,280 inspections have been conducted in SIC 5153 - Grain, and 4,217 inspections have been conducted in SIC 2048 - Prepared Feeds and Feed Ingredients for Animals and Fowls, not elsewhere classified. This is followed by 1,543 inspections conducted in SIC 0723 - Crop Preparation Services for Market and 1,215 inspections in SIC 2041 - Flour and other Grain Mill Products, and 1,029 inspections conducted in SIC 4221. Together, these five SIC groups account for the majority (94%) of the inspections in SICs where grain elevators are present. e 6 and Figure 4 also show the number of inspections conducted in SICs with grain elevators for each calendar year. If one compares the number of inspections conducted prior to the issuance of the grain handling facilities standard in 1987 with the number conducted since, it is apparent that the OSHA inspection activity has declined since the standard was issued. In the period from 1979 through 1987 the average annual number of inspections was 830.7. Since the standard was issued through to the year 2000, the average number of inspections in SICs with grain elevators was 434.3.

Figure 4

Inspections in SICs with Grain Handling Facilities



Enforcement Review

OSHA reviewed its enforcement of the Grain Handling Facilities Standard to determine how enforcement and compliance assistance could be improved. This review asked the following questions:

- How often is the average grain elevator inspected?

For the period 1995-2000, very few Federal and State OSHA inspections were conducted at the same establishment. A query of the inspections conducted in five SICs (2041 - Flour and other Grain Mill products; 2044 - Rice Milling; 2048 - Prepared Feeds and Feed Ingredients for Animals and Fowls, Not elsewhere classified; 4221 - Farm Product Warehousing and Storage; and, 5153 - Grain) showed that, of the 287 inspections conducted in both Federal and State-Plan-States with opening conference dates between January 1, 1995 and December 31, 2000, 27 were repeat inspections of the same facility. (Safety and health inspections of the same facility at the same time were not included in this count, nor were follow-up inspections.)

As Figure 5 shows, the penetration rate for the eight SICs that are likely to have grain handling facilities is 4%, meaning that 4% of establishments are inspected by either Federal or State OSHA each year. Other standards are also cited during inspections of these facilities.

Figure 5

Facilities and Number of Facilities Inspected in 8 SIC's with Grain Elevators

SIC	Number of Establishments (Source U.S. Census)[43]	Number of Federal and State Inspections - CY2000	Penetration Rate (Establishments/Establishments Inspected)
2041	392	33	33/391 = 8.4%
2044	69	3	3/69 = 4.3%
2048	1,555	89	89/1,555 = 5.7%
4221	488	44	44/488 = 9.0%
5153	6,518	111	111/6,518 = 1.7%
0723	1,224	108	108/1,224 = 8.8%
2047	192	29	29/192 = 15.1%
2075	122	10	10/122 = 8.2%
Total	10,560	427	427/10,560 = 4.0%

[43] U.S. Census Number of Firms, Number of Establishments, Employment, Annual Payroll and Receipts by Employment Size of the Enterprise for the United States, 1997
1997 was the last year that contained information by SIC.

- How many small businesses were inspected?

During the period 1988-1998, there were 795 inspections conducted where the employer had 500 or more employees; there were a total of 5201 inspections during this time period. Therefore, 15.3% of all inspections were conducted at larger firms (as defined by the Small Business Administration) during this time period. These firms were major corporations, such as Conagra, Quaker Oats, and Archer Daniels Midland.

- How many of the facilities where engulfment (grain suffocation) fatalities occurred had been inspected previously by OSHA?

Of the 91 inspections of engulfment fatalities from 1984 to 1999, 66 of the establishments had never before had an OSHA inspection. Of those 25 establishments which were inspected previously, about half (12) of the inspections were conducted more than three years prior to the fatal accident. Of the remaining 13 establishments inspected previously, five were complaint inspections and three were either records check only inspections or were denied entry or the establishment was out of business at the time.

CHAPTER V

IMPACT ON SMALL BUSINESS

The OSHA Grain Handling Facilities Standard has not had a negative economic impact on the grain handling industries generally or on small businesses in those industries. As discussed above, it has provided the benefits it was designed to achieve, by reducing injuries and deaths from explosions, fires, engulfments, and other hazards such as entry and the release of hazardous energy from equipment.

The grain storage handling and processing industries are impacted economically by many factors which have far greater economic impacts than the Grain Handling Facilities Standard. These include grain prices and production, both domestic and foreign, exports, weather, U.S. farm policies, technological developments and others.[44]

Overall Economic Impacts

Since the Grain Handling Facilities Standard was issued in 1987, overall industry sales and profits have increased. [45] This is illustrated by comparing the 1987 (the year before the standard took effect) and 1997 sales and profit figures in the three SICs most impacted by the standard. In SIC 5153, Grain and Bean Trade, sales went from $73.5 billion to $120.3 billion and profits went from $1.5 billion to $2.2 billion. In SIC 4221, Farm Product Storage, sales went from $586 million to $673 million and profits went from $28 million to $32 million. In SIC 2048, Prepared Feeds, sales went from $8.87 billion to $19.2 billion and profits went from $160 million to $403 million. See Table 7. (These three SICs account for approximately 80% of citations under the Grain Handling Facilities Standard.)

There has been a continuous reduction in the number of storage facilities since 1977. However, storage capacity has fluctuated, growing from 1977 to 1989, declining until 1995 and then stabilizing at a level 25% higher than 1977 levels. See Table 2. These changes are explained to a great extent by technology improvements which increase productivity. High speed grain terminals can move grain more efficiently and require fewer facilities and capacity.[46]

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[44]See for example, " High-Speed Grain Terminals Bode Change for Rural U.S." Wall Street Journal, December 26, 2001, p. B2.

[45]There have been changes in available data series since the standard was issued and most recently there has been a switch from the SIC system to the NAIC system. Consequently this analysis can not always be consistent in the years used or source of numbers.

[46]Ibid., fn.36

The number of firms in the grain elevator SIC's (723, 4221, 5153) has been reduced much less than the number of facilities. From 1990 to 1996 the number of firms has only been reduced by 10% reflecting a modest amount of consolidation in the industry. See Table 8; please note that data for Tables 8 and 12 were not available before 1990 and that Table 8 is a summary of the data presented in Table 12. The continuing economic health in the industry is reflected by the increase in employment in the industry while productivity was increasing. See Table 9.

The number of firms in the Grain Mill SIC's (2041, 2049, 2097, 2048, 2079) has increased from 1990 to 1996. See Table 8. Employment has dropped slightly in that period. See Table 10. Overall the grain handling and processing industries have shared continuous economic health since the OSHA Grain Handling Facilities final rule was issued. Sales and profits have increased substantially in that period. Overall the number of firms and employment has not changed substantially, though there has been some relatively small fluctuations in the various affected SIC's.

Impacts on Small Businesses

The main purpose of Section 610 of the Regulatory Flexibility Act (RFA) is to minimize any significant economic impact of the rule on a substantial number of small entities in a manner consistent with the stated objectives of applicable statues ...." This chapter discusses the overall impact of the Grain Handling Facilities Standard on small businesses. It demonstrates that small businesses have continued to prosper since the regulation was issued. Earlier chapters have shown that the fewer workers have died or been injured from grain explosions, fires and engulfments, that being the goal of the applicable statute, the OSH Act. The following chapter discusses the more detailed requirements of Section 610 of the RFA.

The grain handling industry, like many industrial sectors, is a mix of large, medium, and small businesses. According to the Small Business Administration (SBA), companies in the grain processing industry (SICs 2041, 2044, 2047), Prepared Feed and Feed Ingredients Mills (2048), and the Oil Seed Processing Mills (SIC 2075) are classified as small businesses if they employ 500 workers or less. For two grain elevator SICs, Crop Preparation Services for Market, Except Cotton Ginning (SIC 0723) and Farm Product Warehousing and Storage (SIC 4221), SBAs small business classification depends upon the annual revenue generated by the companies in these SICs. Within SIC 0723, a company's revenues must be $5 million or less and $18.5 million or less within SIC 4221, for classification as small business by the SBA. The SBA considers grain elevators within Grain and Field Beans (SIC 5153), which have 100 employees, or less, small businesses.

Small businesses showed continued economic strength after OSHA issued the Grain Handling Facilities Standard at the end of 1987. Despite some consolidation in the industry, the percentage of businesses which are small by SBA definition have increased, in some cases substantially. From 1990 to 1996, the percentage of business which are small remained at 99% in SIC 5153 (Grain and Field Beans); increased from 91% to 92% in SIC 2041 (Flour Mill Products); from 81 to 88% in SIC 2044 (Rice milling) and there were similar increases in other SICs. See Table 11. This increase in the percentage of firms which are small businesses indicate that the smaller firms still successfully compete against the larger firms and remain economically viable after the issuance of the Grain Handling Standard.

The data on number of firms by employee size also demonstrates the continuous competitiveness of effected small business after OSHA issued the Grain Handling Facilities Standard. From 1990 - 1996, in the major grain elevator SICs (723, 4221, 5153), the number of firms in the 100 - 499 employee category increased about 12% , remained almost the same in the 20 - 99 category and decreased about 14% in the 1 - 19 category. From 1990 - 1996, in the major grain mill SICs (2041, 2044, 2042, 2048, 2079), the number of firms with 1-19 employees increased slightly, the number of firms with 20 - 99 increased by 14% and the number with 100 - 499 employees decreased 15%. See Table 8 and the more detailed data in Table 12.

These data indicate that broken down by size categories, there were small fluctuations, but overall, the number of smaller firms in the various employment categories increased as often as they decreased. This evidence suggests that smaller firms remained economically competitive and viable.

Further evidence that small businesses remained economically competitive after the Grain Handling Facilities Standard was issued is indicated by the employment data. Small business (1 - 499 employees) in the major grain handling SICs had no reduction in employment from 1990 - 1996, employment being approximately 73,000 in both years. In the major grain mill SICs, employment in small businesses declined slightly in that period from 29,000 to 28,000. See Tables 9, 10, 13, and 14.

The data available to OSHA indicate that the small businesses in the grain handling industries remained economically competitive after OSHA issued the Grain Handling Facilities Standard. The number of small business firms and employment in small business firms, generally, did not decline, and the percentage of firms that were small businesses increased.

Furthermore, as mentioned in previous chapters, on June 23, 1998 (63 FR 34139), OSHA asked the public for comments on the Grain Handling Facilities Standard, including impacts of the Standard on small businesses. OSHA also conducted two public meetings, on July 28 and July 31, 1998, in Chicago, Illinois and Washington, DC, respectively, requesting comments on the impact of the Grain Handling

Facilities Standard on small businesses. OSHA received no complaints from small businesses on the overall impact of the Standard on small businesses.

Consequently, OSHA concludes that the Grain Handling Standard should be continued without major change and should not be rescinded. It is necessary to carry out the statutory objectives of protecting workers from grain fires, explosions, engulfments, and other hazards, such as entry and the release of hazardous energy from equipment, and major changes are not needed to minimize significant impact on a substantial number of small entities. However, based on comments, OSHA will make or consider several modifications to simplify or make more cost effective compliance.

CHAPTER VI

SECTION 610 REVIEW OF THE STANDARD

Section 610 of the Regulatory Flexibility Act directs agencies to review impacts of regulations on small businesses. Chapter V discussed the overall impact of the Grain Handling Facilities Standard on small firms and found no negative impact.

Section 610 also provides that agencies should specifically consider five areas in reviewing the impact of a regulation on small businesses.[47] This Chapter discusses the impact of the Grain Handling Facilities Standard in those five areas, which are:

1. The continued need for the Grain Handling Facilities Standard.
2. The concerns about the complexity of the rule.
3. The extent to which the rule overlaps, duplicates, or conflicts with other Federal rules, and to the extent feasible, with State and local governmental rules.
4. The degree to which technology, economic conditions, and other factors have changed to affect the Grain Handling Facilities Standard.
5. The nature of complaints and comments received by OSHA about the Grain Handling Facilities Standard.

Continued Need for the Rule

There is a continued need for the rule. Workers continue to be at risk of death and injury from grain explosions, fires, engulfments, and other hazards such as entry and the release of hazardous energy from equipment. Catastrophic grain explosions in the late 1970's focused national attention on hazards associated with the grain handling industry. This increased attention by both government and industrial entities led to safety improvements in the industry; OSHA's Grain Handling Facilities Standard maintains and increases these improvements. In fact, analyses performed for this Section 610 Review indicate a decrease in fatalities from grain explosions and suffocations since the Grain Handling Facilities Standard was promulgated.

Many public commenters viewed the Grain Handling Facilities Standard as both needed and effective; no commenter indicated that the standard should be rescinded. The decline in explosions and explosion-related injuries and fatalities since the development and promulgation of the 1987 Grain Handling Facilities Standard was cited by both labor and industry representatives in public comments for this 610 Review. Using the USDA data found in Table 1, comments submitted to the OSHA Docket from the Food and Allied Service Trades (FAST),

[47] Regulatory Flexibility Act §610 (b) (1).

AFL-CIO, stated " ... since the promulgation of OSHA's standard in December 1987, explosions were reduced by 42 %, the number of injured was reduced by 60 % and the number killed was down by 70%".[48] In addition, FAST commented that the Grain Handling Facilities Standard "has been a resounding success in controlling deadly explosions and other serious safety hazards in the grain industry".[49] In its statement for the OSHA public meeting, NGFA described "an unprecedented decline in explosions, injuries and fatalities at grain handling facilities" since 1980.[50]

Complexity of the Rule

The rule is not unduly complex. As previously mentioned and discussed in detail below, Section 610 of the Regulatory Flexibility Act requires OSHA to evaluate public comments and complaints received on a final rule. To meet this requirement, OSHA published a Federal Register notice, requesting comments on the Grain Handling Facilities Standard (63 FR 34139, June 23, 1998), and OSHA held two public meetings, soliciting comments. No public comment indicated that the standard was unduly or unreasonably complex.

Extent to which the Rule Overlaps, Duplicates, or Conflicts with other Rules

The Grain Handling Facilities Standard is not in regulatory conflict with other regulations. Some public comments suggested amendments be made to simplify the relationship between the Grain Handling Facilities Standard requirements for de-energizing equipment and for entry into confined spaces and the generic standards in those areas. In response to comments, OSHA will be making or considering several amendments to clarify or simplify the Grain Handling Facilities Standard. These include incorporating a cross-reference to certain interpretations applicable to marine terminals and considering, as part of the Standards Improvement Project III, expanding the confined space requirements of the Grain Handling Facilities Standard to all areas of grain mills instead of having some areas covered by the more complex Confined Spaces Standard. As part of OSHA's project to update standards based on national consensus organization standards, OSHA will consider updating references to the National Fire Protection Association (NFPA) requirements incorporated in the Grain Handling Facilities Standard. Comments also suggested several other clarifications. OSHA is responding to those comments as discussed below in the Public Comments section.

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[48] Letter submitted to the OSHA Docket, dated August 31, 1998, from the Food and Allied Services Trades, AFL-CIO (OSHA Docket No. H-117C, Ex. 3-56)

[49] Ibid

[50] Statement of the National Grain and Feed Association at the Occupational Safety and Health Administration Public Meeting to Review the Grain Handling Facilities Standard (29 CFR 1910.272) Chicago, Illinois; July 28, 1998; p. 2 (OSHA Docket No. H-117C, Ex. 4)

Changes in Technology, Economic Conditions, and other Factors

As discussed in Chapter I, the catastrophic grain explosions in the late 1970's lead to increased government, industry, and public awareness of the need for safety improvements in grain handling facilities. Greater safety awareness also led to the development of new technologies. Technological improvements improved worker safety. Modernization of machinery and improvement in the design of elevators and essential equipment reduced worker risk. In its statement for OSHA's Public Meeting to Review the Grain Handling Facilities Standard (29 CFR 1910.272) on July 28, 1998, a representative of the National Grain and Feed Association (NGFA) described industry research efforts that resulted from these catastrophic explosions. According to NGFA, among the knowledge gained by this research were technological advances, including: revolutionized design, layout, and construction of grain handling facilities, (most notably, grain handling equipment, particularly the bucket elevator, which is now located outside the main structure in new and renovated facilities); development of fundamental techniques to successfully vent bucket elevators, grain bins, galleries and tunnels; and development of a new portable suppression device to extinguish a fire or explosion at its earliest stages in bucket elevators.[51] NGFA further stated that "overall, there has been little change in the general physical characteristics of grain elevators since the standard was published in 1988, with the exception that the industry has clearly installed and implemented a substantial amount of safety equipment and implemented better operating practices that have contributed strongly to improved safety".[52]

Public Comments

As required by the Regulatory Flexibility Act, OSHA invited public comment on the Section 610 review of the rule by publishing a Federal Register notice requesting comments on the Grain Handling Facilities Standard (63 FR 34139, June 23, 1998). Also, two public meetings were held, one in Chicago on July 28, 1998 and another in Washington, DC on July 31, 1998.

OSHA opened public docket H-117C to hold this solicited information. A total of 63 commenters provided information to the docket. In addition to remarks from OSHA representatives, one witness, a representative from the National Grain and Feed Association (NGFA), made a statement at the public meeting in Chicago on July 28, 1998. At the public meeting in Washington, D.C. on July 31, 1998, two witnesses from the NGFA and one witness from the American Feed Industry

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[51] Statement of the National Grain and Feed Association at the Occupational Safety and Health Administration Public Meeting to Review the Grain Handling Facilities Standard (29 CFR 1910.272) Chicago, Illinois; July 28, 1998; p. 5 (OSHA Docket No. H-117C, Ex. 4)

[52] Ibid, p. 9

(AFI) made statements. Transcripts of the meetings are in the record as Exhibits 13x and 12x, respectively.

Representatives from both the grain industry and labor unions cited the Grain Handling Facilities Standard as useful in reducing grain explosions, fatalities and injuries. The Food and Allied Service Trades (FAST), AFL-CIO, stated " ... since the promulgation of OSHA's standard in December 1987, explosions were reduced by 42 %, the number of injured was reduced by 60 % and the number killed was down by 70%".[53] In addition, FAST commented that the Grain Handling Facilities Standard "has been a resounding success in controlling deadly explosions and other serious safety hazards in the grain industry".[54] In its statement for the OSHA public meeting, NGFA described "an unprecedented decline in explosions, injuries and fatalities at grain handling facilities" since 1980.[55] Additionally, in its statement NGFA noted that the Grain Handling Facilities Standard may also "prove helpful to facilities that do not have access to educational material ...."[56]

No one who commented on this 610 Review believed the Grain Handling Facilities Standard should be rescinded, and no evidence was presented of economic hardship resulting from implementation of the Grain Handling Facilities Standard. The following are public comments, received on specific issues relating to the Grain Handling Facilities Standard. Some of these comments are from the National Grain and Feed Association (NGFA). However, the NGFA stated it did not advocate changing the Grain Handling Facilities Standard at this time (Ex. 4, p. 8).

Control of Hazardous Energy. Although the main objective of the Grain Handling Standard is to prevent fires and explosions, the standard also provides worker protection from hazards associated with entry into bins, silos, tanks, and other grain storage structures and entry into flat storage structures in which mechanical, electrical, hydraulic, and pneumatic equipment presents a danger to employees inside grain storage structures. Equipment must be disconnected, locked-out and tagged, blocked-off, or otherwise prevented from operating by some other equally effective means or methods. In addition, the provisions addressing preventive maintenance procedures requires the employer to implement procedures for the use of locks which will prevent the inadvertent application of energy or motion to equipment being repaired, serviced, or

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[53] Letter submitted to the OSHA Docket, dated August 31, 1998, from the Food and Allied Services Trades, AFL-CIO (OSHA Docket No. H-117C, Ex. 3-56)

[54] Ibid

[55] Statement of the National Grain and Feed Association at the Occupational Safety and Health Administration Public Meeting to Review the Grain Handling Facilities Standard (29 CFR 1910.272) Chicago, Illinois; July 28, 1998; p. 2 (OSHA Docket No. H-117C, Ex. 4)

[55] Ibid, p. 8

[56]

adjusted, which could result in employee injury. Such locks must be removed in accordance with established procedures only by the employee installing them or, if unavailable, by his or her supervisor. Two commenters (Ex.3-59, 4) pointed out differences between the provisions of the Grain Handling Standard covering hazardous energy sources, 1910.272 (g)(1)(ii) and (h)(2)(i) and the Control of Hazardous Energy standard, 1910.147. According to the commenters, the standards differ because the Control of Hazardous Energy Standard allows the employer to lock out or tag out energy sources, the Grain Handling Facilities Standard requires the energy sources to be locked out and tagged out.

At the time that the Grain Handling Facilities standard was promulgated on December 31, 1987 (52 FR 49592-49631), the existing OSHA standards did not adequately address hazards associated with the servicing and maintenance of machines and equipment in which the unexpected energization or start up of machines or equipment, or release of stored energy would injure workers. Therefore, when developing the Grain Handling Facilities Standard, OSHA was concerned about these hazards as they occurred when entering bins, silos and tanks in grain handling facilities, and the final standard contained requirements to both lock out and tag out mechanical, electrical, hydraulic, and pneumatic equipment. Another provision, (l)(4) of the Grain Handling Facilities Standard, covered equipment being repaired, serviced, or adjusted, which could result in employee injury. These lock out provisions were crafted by OSHA based upon the best available evidence in the grain handling facilities rulemaking record.

On September 1, 1989, OSHA promulgated the Control of Hazardous Energy (Lockout/Tagout) Standard that covered servicing and maintenance of machines and equipment in which the unexpected energization or start up of the machines or equipment could cause injury to employees (54 FR 36644-36696). The standard applied to most general industry conditions. This standard preferred the use of lock out devices over the use of tags. OSHA determined that lockout is a surer means of assuring deenergization of equipment than tagout, and that it should be the preferred method used. Tags were permitted if an energy-isolating device purchased prior to the Standard was not capable of being locked out; thus, OSHA acknowledged a feasibility constraint to this Standard as it applied to a wide range of industries. However, the Lockout/Tagout Standard required all new equipment to be capable of Lockout. In grain handling facilities, OSHA determined that it was feasible to use locks and required tags to be used, in addition.

On March 8, 1996 OSHA amended the Grain Handling Facilities Standard to expand the scope to include flat storage structures, regardless of their point of entry (47 FR 9578 – 9584). The expansion applied to lock out and tag out provisions. This rulemaking did not identify problems associated with locking out and tagging out machinery and equipment in grain handling facilities.

OSHA's response: There is no conflict between the Grain Handling Standard and Control of Hazardous Energy Standard, but there are differences. The lockout

provisions of the Grain Handling Facilities Standard are the provisions applicable to facilities covered by the Grain Handling Facilities Standard. The generic Control of Hazardous Energy Standard does permit the use of tagout for old equipment not capable of being locked out, but requires lockout for all equipment capable of lockout and all new equipment. Since lockout has proved feasible for grain elevators for the past 15 years and is safer, there does not seem to be adequate reason to amend the Grain Handling Facilities Standard by allowing the use of tags instead of locks to control the release of hazardous energy. Locks are feasible engineering controls in grain handling facilities. The lockout provisions, which are supplemented by tags, have been protective of employees in the grain handling industry.

If OSHA were to amend the Grain Handling Facilities Standard to make it uniform with the Control of Hazardous Energy Standard, OSHA would have to consider all of the differences between the standards, and not limit the issues to the use of tags. In addition, because the grain provisions have been effective for grain, OSHA would have to consider whether general lock out/tag out provisions would be as protective and what other burdens they might create.

Permit Required Confined Spaces: Other features of the 1987 Grain Handling Facilities Standard are provisions to protect workers against hazardous atmospheres when workers enter certain confined spaces: bins; silos; or tanks. See 1910.272 (g). These hazards were addressed in the Grain Handling Facilities Standard because of risks associated with entering confined spaces and the lack of adequate OSHA standards in 1987 to cover these hazards. However, the confined space provisions of the Grain Handling Facilities Standard only applied to entry into bins, silos, and tanks. There are other confined spaces hazards in grain handling facilities that also pose risks to workers, but these were not covered by the 1987 Standard.

On January 14, 1993, OSHA promulgated a Permit-required Confined Spaces Standard for general industry (58 FR 4462 – 4563) codifed as 29 CFR 1910.146. The standard provides a regulatory framework for entry into those confined spaces that pose special dangers, such as toxic, explosive or asphyxiating atmospheres. This standard has more detailed requirements than the entry into confined spaces provisions of the Grain Handling Facilities Standard.

Two comments point out that the grain handling industry must comply with two different entry into confined spaces standards (Ex. 3-69, 3-6). The Grain Handling Facilities Standard applies to entry into bins, silos, tanks, and other grain storage structures [1910.272(g)]. The Permit-Required Confined Spaces standard applies to entry into other confined spaces, such as scale hoppers, boot pits and rail hopper cars. The commenters suggest that OSHA should change the standards so that the grain handling provisions apply to all confined spaces in the grain handling industry. This would reduce confusion and regulatory overlap.

OSHA's response: There is no regulatory conflict because it is clear which operations are covered by the Grain Handling Facilities Standard and which are

covered by the Confined Spaces Standard. However, a small degree of confusion might be created because some operations in a grain handling facility would be covered by one standard and some operations would be covered by another standard. As requested by the commenters, OSHA will consider this issue as part of the Standards Improvement Project III for safety standards, which is mentioned in the Regulatory Agenda.

The Marine Terminal Standards: The National Grain and Feed Association requested that OSHA should incorporate an OSHA/NGFA settlement agreement on the Marine Terminal Standard into the Grain Handling Facilities Standard (Ex. 4).

> "Portions of the Marine Terminal standard (29 CFR 1917) are generally applicable to grain elevators engaged in waterside activities, such as loading ships or barges. In July 1985, the NGFA and OSHA entered a settlement agreement (OSHA Instruction CPL 2.66) in which OSHA clarified the applicability of 29 CFR 1917 to these types of facilities. OSHA stated in the July 1997 Federal Register announcing changes to 29 CFR 1917 that: 'OSHA has made no substantive changes to those sections of the Marine Terminal Standard that were part of this agreement.' We think incorporating the NGFA/OSHA agreement into the Grain Handling Facilities standard (29 CFR 1910.272) would be beneficial because it would improve the compatibility between the standards, both of which regulate grain elevators."

OSHA's response: The Settlement Agreement is lengthy and publicly available on the OSHA website and elsewhere. As part of a current project to correct various out-of-date references in the Code of Federal Regulations (CFR), OSHA will amend the Grain Handling Facilities Standard to include a cross-reference to CPL 2.66, the Settlement Agreement for Marine Terminals.

An exemption for feed mills to the written housekeeping program requirements: The American Feed Industry Association recommended that the feed mills be exempted from the Grain Handling Facilities provision for a written housekeeping program (Ex. 3-17). AFIA considers OSHA's housekeeping requirements duplicative of the Food and Drug Administration's Current Good Manufacturing Practices (CGMP). Furthermore, the AIA believes that their modernization in feed mills today will result in adequate control of dust.

OSHA's Response: The CGMP and the OSHA housekeeping provisions have two different purposes. The purpose of the CGMP is to achieve a degree of quality control of the feed product. The purpose of the OSHA housekeeping provision is to reduce the chance of an explosion by limiting the fuel for the explosion. However, if AFIA is correct in stating that the CGMP will achieve housekeeping to the quality required by OSHA, then their work is done. If a feed mill can meet OSHA standards by meeting the CGMP, then the CGMP can be used to document compliance with the OSHA standard. OSHA will not require extra paperwork to meet the standard. To the extent that modernization of

equipment in feed mills will maintain acceptable levels of dust as defined by OSHA, the feed mills will have less, or no, cleaning to do to achieve the OSHA standard. They would comply with the OSHA standards and would have no other housekeeping obligations. The housekeeping obligations would be minimal.

Redundant Sections Within the Grain Handling Facilities Standard: One commenter (Ex. 3-1) suggested that OSHA reorganize the standard because it is redundant to existing general industry standards. The commenter suggested moving the following: 1910.272(f), Hot Work Permits, to the Welding, Cutting and Brazing Standard at 1910.252; 1910.272 (g), Entry into Grain Storage Structures, to the Permit Required Confined Spaces Standard at 1910.146; and the 1910.272(j), Housekeeping, to the Walking-Working Surfaces Standard at 1910.22.

OSHA's Response: OSHA developed the Grain Handling Facilities Standard to address and emphasize regulatory attention to some of the major hazards in grain handling facilities. When the standard was promulgated there was no redundancy with general industry standards. Hot work permits are not required by the welding, cutting and brazing standard; there was no confined space standard; and 1910.22 is a general housekeeping standard that had proven ineffective in controlling pervasive dust conditions in grain handling facilities. After 15 years of administering the Grain Handling Facilities Standard, OSHA believes that there is very little redundancy, that there is value in having a Grain Handling Facilities Standard which is relatively complete in itself, and that the success of the Grain Handling Facilities Standard are reasons for not making speculative changes.

Use performance based provisions for housekeeping: One commenter (Ex. 3-1) suggested that OSHA remove provisions that require employers to produce a hard copy document on housekeeping. The comment stated that the 1/8" grain dust limit is the important criteria for housekeeping.

OSHA's response: A performance-oriented provision specifies a goal, but does not specify the means of reaching that goal. For the Grain Handling Facilities Standard, the goal is to reduce dust accumulations, but specific means of reaching that goal are not mandated. This provides flexibility, so that employers can utilize the method(s) best suited for reducing dust accumulations at their particular facility.

OSHA agrees with the commenter that the 1/8" limit is a performance-based standard that directly affects safety by reducing the amount of fuel for an explosion. However, this 1/8" requirement is limited to specified priority housekeeping areas. OSHA also believes that the written housekeeping program is a performance-oriented approach to regulation. The written program applies to ways to meet the 1/8" dust goal in the specified priority housekeeping areas. However, the written housekeeping program must be developed and implemented for the entire facility.

The rulemaking record shows that unions, grain elevator operators, employees, and trade associations did agree on the importance of implementing a housekeeping program. In addition, the Grain Handling Facilities standard has been successful. OSHA believes that this provision should be maintained as promulgated.

Whole (or essentially whole) grain is not a concern for explosions: A commenter stated that whole (or essentially whole) grain that is spilled onto surfaces does not contribute to an explosion hazard. Rather it is surface, dust accumulations, which can be suspended in the air, that may contribute to an explosion. (Ex. 3-1). They recommended that the wording in the Grain Handling Standard, or in the "Housekeeping" section of the Walking Working Surfaces Standard, be specific enough to elaborate the real concerns and distinguish between whole or mostly whole grains, and the real hazards which are embodied in "grain dust."

OSHA's response: The Grain Handling Facility Standard, itself, contains the response to this commenter. The standard contains a definition of dust subject to the housekeeping provisions of the standard. The standard states at 29 CFR 1910 (c) (2):

> "Fugitive grain dust" means combustible dust particles, emitted from the stack handling system, of such size as will pass through a U.S. Standard 40 mesh sieve (425 microns or less).

The Standard also states that grain and product spills are not to be considered fugitive grain dust accumulations. (However, the housekeeping program is to address procedures for removing such spills from work areas.) A thorough discussion of the issue is found in the preamble to the standard, at 52 FR 49601. In brief, although there is some disagreement about the upper limit of dust particle size in relation to explosion sensitivity, evidence contained in the record demonstrates that larger or coarser particles (ranging up to 425 microns) can contribute to an explosion. Further, OSHA is concerned with dust fires as well as dust explosions. An accumulation of dust, consisting of dust particles which are 425 microns or smaller in size, not only can contribute to an explosion, but also can be the source of a fire.

The differences in application of the standard to grain elevators and mills: One commenter stated that there was some confusion on the differences in the applicability of the standard 's provisions to grain elevators and to mills (Ex. 3-1). The commenter also objected to the exceptions given to mills from certain provisions of the standard.

OSHA's response: OSHA does not believe the standard is confusing in excepting mills from certain provisions of the standard. 1910.272(b)(2) clearly states that "Paragraphs (o), (p), and (q) of this section apply only to grain elevators." This means that these sections do not apply to mills.

Further, 1910.272(j)(2) states that "in addition, the housekeeping program for grain elevators shall address fugitive grain dust accumulations at priority housekeeping areas." The standard then states that paragraphs (j)(2)(i) and

(j)(2)(ii) apply to housekeeping in priority housekeeping areas for grain elevators.

These exceptions are clear and straight forward.

In response to the differences in requirements for grain elevators and mills, OSHA thoroughly explained the reasons in the preamble to the grain standard at 52 FR 49597 – 49599. OSHA performed a quantitative risk analysis. The preamble states:

> OSHA has concluded from its risk analysis, and from information submitted to the record, that there is a significant risk of harm to employees working in grain elevators and mills. However, OSHA has also concluded that operational differences between mills and grain elevators, result in different and lower, but still significant risk for mills.
>
> In mills, grain handling rate capacities are generally lower than grain elevators. Bulk conveyors and bucket elevators are usually smaller and slower than those in grain elevators. Because of slower grain transfer speeds and less grain handled, dust generation tends to be less in mills than in grain elevators.

Federal and State OSHA compliance officers do not appear to be improperly applying the fugitive grain dust limit of 1/8" to feed mills. After reviewing inspections at feed mills for the year 2000, only one inspection improperly cited the fugitive grain dust limit of 1/8 inch, which, in fact, does not apply to feed mills. Although the applicability of the 1/8 inch grain dust limit to grain elevators, but not to grain mills, is already covered in the OSHA Training Institute grain handling facilities course for compliance officers, OSHA will emphasize this difference in requirement when teaching the course.

Changes to the fire safety requirements of the standards: The National Fire Protection Association (NFPA) recommended several changes to the standard concerning fire protection (Ex 3-46).

- In Appendix A, the Hot Work Permit Section repeats the information in 29 CFR 1910.272 (a) which incorporates NFPA 51B, *Cutting and Welding Processes* by reference. NFPA recommended directly referencing of NFPA 51B for the Hot Work Permit section.
- In appendix B, NFPA recommended that OSHA change the references of 61A through 61D to NFPA 61, *Fires and Dust Explosions in Agricultural and Food Products Facilities*.
- NFPA recommended that the fire safety requirements in the OSHA standard be replaced by adopting NFPA 61 in accordance with the legislative intent of the Technology Transfer Act of 1995, PL 104-113.

OSHA's response: OSHA will review these recommendations as part of its current project listed in the Regulatory Agenda to update OSHA standards based on national consensus standards which have been updated after OSHA adopted an earlier version.

The need to clarify the requirement for grate width dimension specifications: The American Feed Industry Association (AFIA) stated that the maximum grate width dimension of 2 ½ inches allowed by the standard at 1910.272 (i) will not accommodate bulky commodities, like cottonseed hulls and cobbed corn. (Ex. 3-37). AFIA suggests that OSHA clarify the requirement for grate wide dimension by allowing "equivalent protection" when the standard grate opening can't be used while receiving bulky commodities.

OSHA's response: OSHA's stated purpose of the grate width requirement was to prevent tramp metal from entering the grain stream where it could be a source of ignition for a fire or explosion. The rulemaking record contains objections to the need for the grates, and these concerns, as well as others, are addressed by OSHA in the preamble (52 FR 49614). The record does not show concern that the 2 ½ inch opening would be inadequate for the flow of certain commodities in the process.

For the Section 610 review, AFIA provided no evidence showing that the 2 ½ inch grate opening is too small for certain commodities. Further, the AFIA asks that "equivalent protection" to the 2 ½ inch grate opening be allowed for bulky commodities, but AFIA does not discuss what is meant by "equivalent protection." The preamble to the standard found that magnets to attract tramp metal did not provide equivalent protection compared to limiting the size of the grate opening.

With the information available at this time, OSHA cannot make clarifications or modifications to the standard, that resolve the bulky commodities/grate size opening issue raised by AFIA. In individual cases, employers may be able to show that the 2 ½ inches grate opening is infeasible for specific bulky commodities as a defense against the application of the Standard to their facility.

Listing AFIA as an Information Source in the Appendix: Appendix A to the Grain Handling Facilities standard provides information on how to comply with the standard, but poses no further obligations on the employers. Section 3 of Appendix A provides information on worker training, including a list of sources of training materials. The current Appendix A does not list AFIA as a source of training materials. AFIA requested that AFIA be included in the list of organizations from which employers can obtain training materials (Ex. 3-37).

OSHA's response: OSHA recognizes that AFIA has produced training materials relevant to the grain handling industry. However, OSHA is not prepared to make changes to the standard at this time. When OSHA commences the next standard's improvement project, OSHA will review the AFIA training materials and will consider making the changes recommended by NFPA.

The DeBruce Grain Elevator Explosion and OSHA's Enforcement of the Grain Handling Facilities Standard: After a decade of few annual fatalities from grain

elevator explosions, the DeBruce Grain Elevator in Wichita, Kansas exploded on June 8, 1998, killing 7 workers. A commenter felt that OSHA should review the DeBruce explosion to determine whether OSHA's current standard must be strengthened (Ex. 3-56). Furthermore, this commenter and another commenter felt that OSHA should launch a special emphasis enforcement program in the grain industry in the wake of the DeBruce tragedy (Ex. 3-5, 3-63).

OSHA response: OSHA opened an inspection of the DeBruce facility on June 8, 1998. OSHA issued numerous citations alleging violations of the Grain Handling Facilities Standard. The citations alleged: failure to remove fugitive grain dust accumulations when they exceeded 1/8 inch at priority housekeeping areas; failure to develop and/or implement a preventive maintenance program which regulated a schedule of preventative maintenance and inspections for equipment/machines used by employees at the facility; and failure to lubricate grain handling equipment. DeBruce contested the citations, and a Stipulation and Settlement Agreement was reached on February 8, 2001. In the Settlement, DeBruce did not admit to any wrongdoing or violations of an OSHA standard. However, DeBruce paid a fine of $685,000 associated with provisions of OSHA standards.

OSHA found violations of the Grain Handling Facilities Standard. DeBruce claims that they did not violate the standard. The fact is that the explosion occurred. In any case, OSHA recognizes that the existing Grain Handling Facilities Standard will reduce but not eliminate all risk of fires and explosions in grain handling facilities. OSHA stated in the preamble to the standard that the 1/8 inch action level is not a safe level for grain dust, but is based upon feasibility (52 FR 49611).

The DeBruce incident demonstrates the need for the Grain Handling Facilities Standard. It also points to the need for OSHA inspections; the DeBruce elevator was never inspected for conditions regulated by the Grain Handling Facilities Standard until after the explosion occurred.

Recommendations for Variation of the 1/8-Inch Dust Level Requirement: The Food and Allied Services Trades (FAST) and the National Grain and Feed Association (NGFA) took opposite positions on the suitability of the 1/8-inch action level specified by the standard for priority areas. FAST recommended lowering of the action level; NGFA commented that a more stringent dust level would be economically difficult for industry to meet and that the standard should place equal stress on other requirements of the standard for reducing dust levels (Ex. 3-56, 6).

OSHA response: There is a thorough discussion regarding the 1/8 inch dust level requirement in the preamble to the Grain Handling Facilities Final Rule (52 FR 49610-49611). At the time the final rule was promulgated, the 1/8 inch dust level requirement was considered an action level which could be measured and controlled, given feasibility constraints. No evidence has been presented to indicate that a feasibility analysis/determination today would be different from the

analysis/determination presented for the final rule. Therefore, OSHA does not intend to change or modify its 1/8 inch dust action level requirement at this time.

CHAPTER VII

EXECUTIVE ORDER 12866 REVIEW OF THE STANDARD

Executive Order 12866 on Regulatory Planning and Review states that agencies of the Federal government must review their existing significant rules "to determine whether any such regulations should be modified or eliminated so as to make the Agency's regulatory program more effective in achieving the regulatory objectives, less burdensome, or in greater alignment with the President's priorities and principles set forth in this Executive Order." This review focuses on four major points:

1. Whether the standard has become unjustified or unnecessary as a result of changed circumstances;
2. Whether standards are compatible with each other and not duplicative or inappropriately burdensome in the aggregate;
3. Whether the standard is consistent with the President's priorities;
4. Whether the effectiveness of the standard can be improved.

This review of the OSHA Grain Handling Standard, consistent with Executive Order 12866, finds that the Grain Handling Standard is both necessary and effective. There is no reason to make major modifications or eliminate it.

Whether the Grain Handling Standard Has Become Unjustified or Unnecessary as a Result of Changed Circumstances

The Grain Handling Standard remains both justified and necessary. Many comments submitted to the docket in response to this Section 610 review, including comments from companies and trade associations that initially opposed the standard, support continuing the standard in its present format. (See OSHA Docket H-117C, Exhibits 4, 3-56). These public comments submitted to the docket also indicate that the standard has been successful in protecting workers from explosions and fires due to grain dust. OSHA's fatality data from the IMIS database indicate that suffocations in grain have decreased since the promulgation of the Grain Handling Facilities Standard.

Whether the Grain Handling Standard is Compatible with Other Regulations and Not Duplicative or Inappropriately Burdensome in the Aggregate

The standard is compatible with other OSHA standards. In some cases, such as control of hazardous energy sources and the permit-required confined spaces, the Grain Handling Facilities Standard is different than general industry requirements. There is no regulation overlap. However, there are differences based on evidence in the rulemaking records. (See the detailed discussion above in Chapter VI under Public Comments where OSHA discusses several changes to simplify

compliance.) The standard is not inappropriately burdensome in the aggregate. It was technologically and economically feasible when promulgated, and this is still true; (see the detailed discussion in Chapter V).

Whether the Grain Handling Standard is Consistent With the President's Priorities

The Grain Handling Standard is consistent with the President's priorities. In 1970, concerned about the high rates of deaths, injuries, disabilities, and diseases associated with the workplace, Congress passed the Occupational Safety and Health Act (OSH Act). The OSH Act was passed by a bipartisan Congress "to assure so far as possible every working man and woman safe and healthful working conditions and to preserve our natural resources." OSHA was created to develop mandatory job safety and health standards and enforce them effectively.

The objective of Executive Order 12866, is to reform, and make more efficient the regulatory process. The regulatory process must be consistent with the President's priorities to enhance planning and coordination with respect to both new and existing regulations; to restore the integrity and legitimacy of regulatory review and oversight; and to make the process more accessible and open to the public.

The Grain Handling Facilities Standard is consistent with these priorities. This Standard has reduced occupational deaths and injuries in the industry, been feasible, and is now widely supported by industry and employees. The rules need to be reviewed periodically, written in plain language, and should allow flexibility to employers to continue to reduce hazards and avoid injury and illness as the workplace evolves. The Grain Handling Facilities Standard enables employers to comply with the standard, while developing and implementing new technology to not only reduce grain dust, but also improve industry productivity and profits at the same time.

Whether the Effectiveness of the Grain Handling Standard Can Be Improved

The Grain Handling Facilities Standard has been effective in maintaining and increasing improvements which have reduced the risk of fires, explosions, and suffocations. Comments submitted to the Docket for the Grain Handling Facilities Standard 610 Review, as well as statements presented at OSHA's public meetings, confirm this. Furthermore, an examination of OSHA's IMIS fatality accident reports from the IMIS database confirm that the Grain Handling Facilities Standard is successful in achieving its goal to reduce suffocations in grain, as well as deaths and injuries from fires and explosions at grain handling facilities.

Analysis of 1988 to 1998 violation data indicates that there are still a large number of violations in the grain handling industry associated with improper procedures for entry into grain storage structures. Other areas of numerous violations include training for employees and imparting information on potential

hazards to contractors by employers. Increased focus on training of employees and dissemination of information on risks and hazards associated with the grain handling processes, especially entry into grain storage structures, could further increase the effectiveness of the standard, as are several simplifications which are discussed in Chapter VI under Public Comments.

CHAPTER VIII

SUMMARY AND CONCLUSIONS

Summary

This regulatory review of the Grain Handling Facilities Standard, both the Section 610 of the Regulatory Flexibility Act review and the Section 5 of Executive Order (EO) 12866 review, finds a continued need for the OSHA Grain Handling Facilities Standard. No significant negative impacts on small businesses or, in fact, businesses of any size were identified. Furthermore, both trade associations and labor unions have stated that the Grain Handling Facilities Standard is effective in reducing injuries and deaths among grain handling workers.

The Standard is Justified and Necessary. There is Continuing Need For It.

If grain dust levels are not controlled and other actions taken, explosions, injuries, deaths, and millions of dollars in damage to facilities and equipment can result. Without proper precautions, workers will die from suffocation after being engulfed in grain. Comments to the Docket and at public meetings support the continuance of the standard; these comments indicate that the Grain Handling Facilities Standard remains both justified and necessary to provide the required worker protections from the hazards associated with the grain handling industry.

The Standard is Not Overly Complex or Inappropriately Burdensome.

During this solicitation and review of public comments, no comments indicated that the standard was overly complex or placed an inappropriate burden on the industry, or, in particular, on small business.

The Standard is Compatible With Other Regulations.

There were some requests from the public for clarification on perceived overlaps between requirements of the Grain Handling Facilities Standard and requirements in other OSHA standards (i.e. OSHA's standards for Control of Hazardous Energy Sources and Permit-Required Confined Space.) It is clear which requirements apply to grain handling facilities, and they have been effective. However, OSHA will be considering several simplifications to the Standard which are discussed in Chapter VI under Public Comments.

Technology in the Grain Handling Industry has Advanced, and the Economic Condition of the Industry is Strong.

A variety of workplace changes in the grain industry involving daily practice, control technology, and basic elevator design make the post-regulatory workplace

safer for workers. Modern explosion venting and suppression methods are increasingly in use. Increase in automation of day-to-day tasks and moving work out of elevators has also reduced potential hazards to workers. No significant impact on a substantial number of small businesses due to the Grain Handling Facilities Standard could be identified.

Conclusions and Recommendations

Based on analyses performed for this 610 Review, OSHA's Grain Handling Facilities Standard should continue without change or modification. Fatalities from grain explosions and suffocations have decreased greatly since promulgation of the Grain Handling Facilities Standard. Furthermore, testimony at the public meetings and written comments submitted to the OSHA Docket from industry and unions state that the standard should be retained and indicate no negative economic impact resulting from the Standard.

The suffocation risk analysis for this Section 610 review is based on suffocation fatalities reported in OSHA's Integrated Management Information System (IMIS) database. The information sources used to determine the suffocation fatalities were the Accident Investigation Summaries (OSHA-170 form) which result from OSHA accident inspections. Analyses of these IMIS accident reports on grain suffocations showed that the completeness of the report and/or the completeness of the information entered into the IMIS database varied. In fact, the circumstances leading to the suffocation fatality could not be determined from 43% of the IMIS accident reports. In order for analyses, such as the analyses conducted on grain suffocations for this 610 Review, to be as useful as possible, the information provided on the accident investigation reports and entered into the IMIS database must be as complete and comparable as possible. Because these reports are sometimes not complete enough to determine the causes of accidents, OSHA should examine ways to make the information both provided on the accident investigation reports and entered into the IMIS database as uniform and complete as possible.

OSHA's analyses of accident reports on grain suffocations indicate that when the Grain Handling Facilities Standard is adhered to, grain suffocations do not occur. Therefore, additional outreach on the dangers of suffocation in grain and education on the entry requirements in the Grain Handling Facilities Standard would help to further decrease fatalities from suffocation in grain. OSHA should increase training and assistance in the dangers of grain suffocations, and notify representatives of the grain industry on the availability of such training. Emphasis will be made to compliance officers on these dangers and the importance of compliance with the Standard's entry requirements. Additionally, an OSHA booklet on the dangers of grain suffocation and the importance of compliance with the Standard could be developed.

Table 1
Number of Grain Dust-Related Explosions, Deaths, and Injuries
1958-1998

Year	Number of Explosions	Number of Fatalities	Number of Injuries	Year	Number of Explosions	Number of Fatalities	Number of Injuries
1958	10	2	27	1979	29	4	25
1959	10	3	18	1980	45	10	50
1960	12	4	18	1981	21	13	62
1961	10	0	17	1982	15	11	34
1962	9	3	51	1983	13	0	14
1963	14	3	30	1984	20	9	29
1964	8	3	22	1985	22	4	20
1965	9	2	5	1986	23	2	14
1966	14	2	22	1987	15	0	18
1967	17	1	14	1988	13	8	13
1968	16	12	38	1989	13	2	7
1969	6	4	13	1990	15	0	7
1970	10	1	14	1991	12	1	6
1971	10	4	14	1992	6	1	8
1972	8	7	23	1993	13	2	21
1973	8	2	10	1994	15	1	16
1974	15	13	37	1995	15	1	12
1975	9	4	19	1996	13	1	19
1976	22	22	82	1997	14	1	14
1977	31	65	87	1998	16	7	22
1978	20	8	46	**Total (1958-1998)**	**616**	**243**	**1018**
Average for Pre-Regulatory Years (1958-1987)					**15.7**	**7.3**	**29.1**
Average for Post-Regulatory Years (1988-1998)					**13.2**	**2.3**	**13.2**

Sources: 1. For 1958-1985, Table V-1 in the Final Regulatory Impact Analysis for the Standard on Grain Handling Facilities, OSHA, December 10, 1987.
2. For 1986 through 1998, the U.S. Department of Agriculture (USDA), Federal Grain Inspection Service (FGIS).

Table 2
Number and Capacity of Off-Farm Storage Facilities[1]

Year	Number of Facilities	Rated Off-Farm Storage Capacity[2] (in 1,000 bushels)
1999	9,995	8,087,250
1998	10,272	8,003,190
1997	10,605	7,961,340
1996	10,884	8,072,330
1995	11,285	8,301,060
1994	11,592	8,374,110
1993	11,866	8,486,500
1992	12,428	8,664,970
1991	12,825	8,911,220
1990	13,214	9,089,300
1989	13,517	9,384,430
1988	13,802	9,606,050
1987	13,889	9,610,590
1986	14,046	9,123,280
1985	13,921	8,113,670
1984	14,195	8,109,090
1983	14,706	7,900,030
1982	14,691	7,269,308
1981	14,944	7,173,080
1980	15,178	7,090,480
1979	15,363	6,984,960
1978	15,305	6,635,420
1977	15,037	6,310,307

Note: Data on the number of facilities and storage capacity is also available according to state.

Source:
1.U. S. Department of Agriculture, National Agricultural Statistics Service, Agricultural Statistics Board, "Grain Stocks," data faxed by Jerry Ramirez, July 17, 2000.
2.U. S. Department of Agriculture, National Agricultural Statistics Service, Agricultural Statistics Board, "Stocks of Grains, Oilseeds, and Hay - Final Estimates 1993-1998," data faxed by Jerry Ramirez, July 17, 2000.

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[1] Off-farm grain storage capacity includes all elevators, warehouses terminals, merchant mills, other storage, and oilseed crushers, which store grains, soybeans, sunflowers, or flaxseed.

[2] Capacity data exclude warehouses used to store only rice or peanuts, oilseed crushers processing only cottonseed or peanuts, tobacco warehouses, seed warehouses, and storages that handle only dry edible beans.

Table 3
Total Grain Production[1]

Year*	Production Million metric tons**
1998	349.4
1997	336.3
1996	335.5
1995	277.3
1994	355.6
1993	258.8
1992	352.7
1991	279.7
1990	312.1
1989	284.0
1988	206.3
1987	280.2
1986	315.1
1985	346.9
1984	314.6
1983	207.5
1982	332.9
1981	380.8
1980	269.7
1979	302.6
1978	276.2
1977	266.9

* Data were not available for 1999.

** The average, annual grain production for the years 1977-1987 were 299.4 million metric tons. The average, annual grain production for the years 1988-1998 were 304.3 million metric tons.

[1] United States Department of Agriculture, Agricultural Statistics, Chapter 1, "Statistics of Grain and Feed," Table 1-1. – Total Grain: Supply and disappearance, United States, 1989-1998, 1985-1994, and 1975-1989.

Table 4
Reported Grain Suffocations and Their Recorded SIC Codes
1984-1999

Year	# of Suffocations (SIC)	Total # of Suffocations
1999	2 (0211) 1 (2047) 1 (2041) 1 (4221)	5
1998	5 (5153) 1 (2048) 1 (0191)	7
1997	2 (4221) 3 (5153) 1 (2048)	6
1996	1 (4221) 1 (0115) 3 (5153)	5
1995	5 (5153)	5
1994	5 (5153) 2 (4221)	7
1993	3 (5153) 1 (2041)	4
1992	3 (2048) 1 (2041)	4
1991	1 (2044) 1 (0211) 1 (5153)	3
1990	4 (5153) 1 (0241) 2 (4221) 1 (2047)	8
1989	2 (5153) 1 (2048) 1 (0115) 1 (0723) 1 (4221)	6
1988	4 (5153) 1 (5191) 1 (4221) 1 (0723)	7
1987	1 (2048) 1 (2041) 3 (5153) 1 (4221)	6
1985	5 (5153) 1 (4221)	6
1984	1 (0191) 1 (2041) 1 (5153) 1 (4221) 1 (0134)	5

Total Number of Grain Suffocations for 1984-1999 = 93

Source: OSHA Integrated Management Information System (IMIS) database

Table 5
Number of Monthly Suffocations
1984-1999

Year 19_	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
99	1			2	1							1	5
98			1	1			1		1	1	2		7
97		1								2	2	1	6
96	2		1	1							1		5
95				1		2				1		1	5
94			1	1					2		2	1	7
93			2			1	1						4
92								2			1	1	4
91		2	1										3
90		1	1	1		1			1	2		1	8
89				1	1		1			2		1	6
88	2		1				1	1	1			1	7
87			1	1		1				2		1	6
86	1		1	2		1				2	2		9
85					2	1					2	1	6
84						1	1		1		2		5
Total	6	4	10	11	4	8	5	3	6	12	14	10	93

Source: OSHA Integrated Management Information System (IMIS) database

Table 6
Number of Inspections per Year in SIC's with Grain Handling Facilities

SIC	'79	'80	'81	'82	'83	'84	'85	'86	'87	'88	'89	'90	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00	Tot
2041	65	59	49	72	89	122	89	65	55	36	36	50	72	54	37	49	34	26	34	39	50	33	121
2044	22	10	4	17	11	36	13	22	17	3	12	20	5	6	11	12	9	5	5	3	8	3	232
2048	259	234	129	313	336	437	416	303	248	210	145	158	138	96	75	75	128	119	149	77	83	89	421
4221	28	29	18	18	45	130	112	104	37	28	38	44	35	35	35	34	34	23	37	41	80	44	102
5153	462	244	117	211	264	509	453	453	211	157	151	193	133	61	64	58	92	62	95	85	94	111	428
0723	19	29	26	52	26	38	40	28	35	57	60	103	120	124	87	132	93	76	63	88	139	108	1543
2047	0	0	0	0	0	0	0	0	0	0	13	29	20	21	0	30	25	19	18	12	23	29	239
2075	21	43	22	24	37	27	33	25	14	9	11	7	9	9	7	7	7	5	9	1	8	10	345
Total	876	648	365	707	808	1299	1156	1000	617	500	466	604	532	406	316	397	422	335	410	346	485	427	1310

Source: OSHA Integrated Management Information System (IMIS) database

Table 7
Sales and Profits for Selected* Major Grain Elevator and Grain Mill SICs

	1987		1997	
SIC	**Sales**	**Profits**	**Sales**	**Profits**
2048 Prepared Feeds and Feed Ingredients	$8.87 billion	$160 million	$19.2 billion	$403 million
4221 Farm Product Warehousing and Storage	$586 million	$28 million	$673 million	$32 million
5153 Grain and Field Beans	$73.5 billion	$1.5 billion	$120.3 billion	$2.2 billion

* SICs 5153 ([Wholesale Trade of] Grain and Field Beans) and 4221 (Farm Product Warehousing and Storage) appeared to be the dominant SICs for grain elevators, and 2048 ([Manufacture of] Prepared Feeds and Feed Ingredients for Animals and Fowls, Except Dogs and Cats) for the dominant SIC for grain mills. These SICs account for approximately 80% of citations under the Grain Handling Facilities Standard.

Profit Data: Net Profit After Tax, from Dun and Bradstreet's Industry Norms and Key Business Ratios

Sales/Revenue Data: U.S. Census Bureau, Economic Census

Table 8
Number of Firms in Major Grain Elevator and Grain Mill SICs by Number of Employees
1990 and 1996

Grain Elevator SICs (0723, 4221, 5153)

1990						1996					
1-19	20-99	100-499	Total 1-500	500+	Total 1-500+	1-19	20-99	100-499	Total 1-500	500+	Total 1-500+
4744	907	177	5828	91	5919	4062	876	198	5136	100	5236

Grain Mill SICs (2041, 2044, 2047, 2048, 2075)

1990						1996					
1-19	20-99	100-499	Total 1-500	500+	Total 1-500+	1-19	20-99	100-499	Total 1-500	500+	Total 1-500+
978	278	117	1373	134	1507	995	315	100	1410	120	1530

Source: Abstracted from Small Business Administration, Office of Advocacy (Firm Size Data Provided to SBA by Bureau of Census), 1990-1996 Four Digit SIC Data, http://www.sba.gov/advo/atats/int_data.html, downloaded August 6, 1999.

Table 9
Total Employment in Major Grain Elevators SICs
By Number of Employees
1990-1996

Year	SICs 0723, 4221, and 5153*				
	1-19 Employees	20-99 Employees	100-499 Employees	500+ Employees	Total Employment
1990	29,219	28,236	15,705	16,609	89,769
1991	27,891	27,991	17,549	14,867	88,298
1992	25,948	29,481	17,984	16,692	90,105
1993	27,418	29,604	19,277	15,472	91,771
1994	26,316	29,275	21,135	16,667	93,393
1995	25,032	29,584	19,099	19,504	93,219
1996	24,388	28,616	20,392	18,719	92,115

*723 - Crop Preparation Service for Market, Except Cotton Ginning
4221 - Farm Product Warehousing and Storage
5153 - Grain and Field Beans

Source: Small Business Administration, Office of Advocacy (Firm Size Data Provided to SBA by Bureau of Census), "1990-1996 Four-Digit SIC Data," http://www.sba.gov/advo/atats/int_data.hml>, downloaded August 6, 1999.

Table 10
Total Employment in Major Grain Mill SICs
By Number of Employees
1990-1996

Year	SICs 2041,2044,2047, 2048, and 2075*				
	1-19 Employees	20-99 Employees	100-499 Employees	500+ Employees	Total Employment
1990	6,470	9,692	13,284	43,666	73,112
1991	6,371	9,956	12,562	44,461	73,350
1992	6,723	11,046	13,666	43,275	74,710
1993	6,606	10,133	10,926	44,830	72,495
1994	6,341	9,445	11,456	45,431	72,673
1995	6,869	9,080	12,833	46,171	74,953
1996	6,502	10,481	11,112	39,598	67,693

Source: Small Business Administration, Office of Advocacy (Firm Size Data Provided to SBA by Bureau of Census), "1990-1996 Four-Digit SIC Data. http://www.sba.gov/advo/atats/int_data.html>, downloaded August 6, 1999.

*2041- Flour and Other Mill Products
2044 - Rice Milling
2047 - Dog and Cat Food
2048 - Prepared Foods N.E.C
2075 - Soybean Oil Mills

Table 11
Percentage of Small Businesses**
in Major Grain Handling Firms***
1990-1996

SIC	Description	% Small Business*	
		1990	1996
5153	Grain and Field Beans	99%	99%
2041	Flour and Other Grain Mill Products	91%	92%
2044	Rice Milling	81%	88%
2047	Dog and Cat Food	81%	85%
2048	Prepared Feeds and Feed Ingredients for Animals and Fowls, Except Dog and Cat Food	93%	94%
2075	Soybean Oil Mills	73%	81%

* The Small Business Administration considers firms with 500 or less employees in SICs 2041, 2044, 2047, 2048, and 2075 small business. For SIC 5153, SBA classifies firms with 100 employees or less as small business.

** SICs 0723 and 4221 are not included on this Table because small businesses in these two SICs are classified according to revenues, not according to the number of employees. Revenue figures for small businesses in these two SICs are available only for 1997.

*** Data are not available before 1990.

Source: Small Business Administration, Office of Advocacy (Firms Size Data Provided to SBA By Bureau of Census), "1990-1996 Four-Digit, http://www.sba.gov/advo/atats/int_data.html, downloaded August 6, 1999.

Table 12
Firms and Establishments in Major Grain Handling SICs By Number of Employees 1990-1996

SIC	1990				1991				1992				1993				1994				1995				1996			
	1-19	20-99	100-499	500+	1-19	20-99	100-499	500+	1-19	20-99	100-499	500+	1-19	20-99	100-499	500+	1-19	20-99	100-499	500+	1-99	20-99	100-499	500+	1-19	20-99	100-499	500+
723																												
Firms	496	171	73	23	504	166	75	26	529	186	74	29	576	186	84	28	565	177	93	30	548	181	84	37	558	185	80	37
Estab.	500	190	106	89	507	188	112	92	530	204	109	98	576	203	121	95	566	198	132	97	548	211	116	99	558	210	105	152
4221																												
Firms	385	87	24	19	365	87	23	18	332	87	26	20	317	71	22	14	304	67	23	18	307	77	20	21	333	66	21	20
Estab.	401	131	83	116	376	130	80	111	356	129	94	123	323	134	61	69	312	121	65	69	311	124	74	63	348	97	66	72
5153																												
Firms	3863	649	80	49	3663	638	80	49	3389	646	89	44	3649	679	89	44	3466	659	93	44	3267	660	93	44	3171	625	97	43
Estab.	4306	1495	548	1092	4075	1504	585	1047	3775	1590	537	1014	4017	1588	555	1025	3801	1574	563	1022	3597	1582	537	1099	3490	1528	518	1085
2041																												
Firms	141	37	26	20	144	34	24	21	155	45	25	16	149	37	21	22	147	40	25	22	146	39	24	19	180	37	23	21
Estab.	141	40	55	114	144	38	49	114	155	49	52	116	149	40	47	123	147	43	52	122	146	43	53	116	180	41	52	127
2044																												
Firms	20	13	5	9	19	12	6	8	15	16	4	8	20	15	5	9	21	13	7	8	21	16	7	7	21	22	6	7
Estab.	20	14	8	18	19	13	9	17	15	17	6	16	20	15	6	17	21	13	8	17	21	16	8	17	21	23	7	18
2047																												
Firms	46	29	17	21	54	26	17	17	48	30	19	18	56	17	16	21	51	17	16	19	50	16	18	19	61	26	18	19
Estab.	46	32	25	67	54	26	30	58	49	30	36	58	56	18	24	71	51	20	22	68	50	18	24	73	61	28	28	66
2048																												
Firms	739	197	66	70	730	209	68	68	771	220	65	65	810	226	61	61	799	209	60	61	783	198	58	61	698	227	49	63
Estab.	747	227	135	516	732	239	142	512	774	254	134	519	811	261	126	515	801	249	139	513	784	231	130	524	701	259	126	526
2075																												
Firms	32	2	3	14	30	4	3	14	34	6	3	14	24	3	2	12	23	2	3	12	21	3	5	11	35	3	4	10
Estab.	32	2	3	69	30	4	3	69	34	6	3	69	24	3	2	69	23	2	3	68	21	3	5	65	35	3	4	64
Total																												
Firms	5722	1185	294	225	5509	1176	296	221	5273	1236	305	214	5601	1234	300	211	5376	1184	320	214	5143	1190	309	219	5057	1191	298	220
Estab.	6193	2131	963	2081	5937	2142	1010	2020	5688	2279	971	2013	5976	2262	942	1984	5722	2220	984	1976	5478	2228	947	2056	5394	2189	906	2110

* Data are not available before 1990.

Source: Small Business Administration, Office of Advocacy (Firm Size Data Provided to SBA by Bureau of Census), "1990-1996 Four Digit SIC Data, <http://www.sba.gov/advo/atats/int_data.html>, downloaded August 6, 1999.

Table 13
Number of Employees in Firms Within Major Grain Elevator SICs
(SIC 723, 4221, and 5153)
1990-1996

SIC	0723				4221				5153				Total
	Crop Preparation Service for Market, Except Cotton Ginning				Farm Product Warehousing and Storage				Grain and Field Beans				
Year	1-19	20-99	100-499	500+	1-19	20-99	100-499	500+	1-19	20-99	100-499	500+	
1990	2,727	7,242	8,141	3,502	1,691	2,626	1,686	1,049	24,801	18,368	5,878	12,058	89,769
1991	2,751	7,020	9,442	3,070	1,585	2,647	1,763	984	23,555	18,324	6,344	10,813	88,298
1992	2,739	8,088	10,181	4,129	1,439	2,605	1,786	1,382	21,770	18,788	6,017	11,181	90,105
1993	2,902	7,475	12,015	3,997	1,521	2,255	1,452	959	22,995	19,874	5,810	10,516	91,771
1994	3,010	7,953	13,350	4,911	1,552	1,785	1,361	1,354	21,754	19,537	6,424	10,402	93,393
1995	2,859	7,763	10,819	5,836	1,450	2,159	1,762	879	20,723	19,662	6,518	12,789	93,219
1996	2,759	8,013	11,701	6,525	1,757	1,769	1,458	1,031	19,872	18,834	7,233	11,163	92,115

Source: Small Business Administration, Office of Advocacy (Firm Size Data Provided to SBA by Bureau of Census) "1990-1996 Four Digit SIC Data, <http://www.sba.gov/advo/atats/int_data.html>, downloaded August 6, 1999.

Table 14
Number of Employees in Major Grain Mill SICs
(SIC 2041, 2044, 2047, 2048, and 2075)
1990-1996

SIC	2041				2044				2047				2048				2075			
	Flour and Other Grain Mill Products				Rice Milling				Dog and Cat Food				Prepared Foods N.E.C.				Soybean Oil Mills			
Year	1-19	20-99	100-499	500+	1-19	20-99	100-499	500+	1-19	20-99	100-499	500+	1-19	20-99	100-499	500+	1-19	20-99	100-499	500+
1990	903	1,291	4,090	6,562	137	617	786	2,796	371	1,107	2,135	10,153	5,059	6,677	6,073	17,624	-	-	200	6,531
1991	983	1,218	4,068	7,025	-*	600	-	2,629	353	1,056	2,254	9,730	4,874	7,082	6,240	18,448	161	-	-	6,629
1992	1,032	1,568	4,488	6,447	98	716	598	2,364	351	1,137	2,517	9,552	5,047	7,406	5,882	17,912	195	219	181	7,000
1993	880	1,278	3,330	8,113	-	668	-	2,404	374	560	2,108	10,897	5,352	7,627	5,488	16,547	-	-	-	6,869
1994	832	1,302	3,774	7,653	-	522	-	2,377	400	705	2,112	11,020	5,109	6,916	5,229	17,856	-	-	341	6,525
1995	905	1,354	3,363	7,949	161	734	1,068	2,647	363	666	2,307	11,528	5,340	6,239	5,551	18,455	100	87	544	5,592
1996	1,137	1,229	3,150	9,446	140	1,013	989	2,436	348	1,016	2,424	10,879	4,684	7,223	4,549	16,837	193	-	-	-

*- indicates data not available.

Source: Small Business Administration, Office of Advocacy (Firm Size Data Provided to SBA by Bureau of Census) "1990-1996 Four Digit SIC Data, <http://www.sba.gov/advo/atats/int_data.html>, downloaded August 6, 1999.

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APPENDIX I

THE REGULATORY FLEXIBILITY ACT – SECTION 610

The following relevant extract of text from the Regulatory Flexibility Act is taken from Title 5 of the United States Code, sections 601–612. The Regulatory Flexibility Act was originally passed in 1980 (P.L. 96-354) and was amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (P.L. 104-121).

§ 601. Definitions

For purposes of this chapter—

(1) the term "agency" means an agency as defined in section 551(1) of this title;

(2) the term "rule" means any rule for which the agency publishes a general notice of proposed rulemaking pursuant to section 553(b) of this title, or any other law, including any rule of general applicability governing Federal grants to State and local governments for which the agency provides an opportunity for notice and public comment, except that the term "rule" does not include a rule of particular applicability relating to rates, wages, corporate or financial structures or reorganizations thereof, prices, facilities, appliances, services, or allowances therefor or to valuations, costs or accounting, or practices relating to such rates, wages, structures, prices, appliances, services, or allowances;

(3) the term "small business" has the same meaning as the term "small business concern" under section 3 of the Small Business Act, unless an agency, after consultation with the Office of Advocacy of the Small Business Administration and after opportunity for public comment, establishes one or more definitions of such term which are appropriate to the activities of the agency and publishes such definition(s) in the Federal Register;

(4) the term "small organization" means any not-for-profit enterprise which is independently owned and operated and is not dominant in its field, unless an agency establishes, after opportunity for public comment, one or more definitions of such term which are appropriate to the activities of the agency and publishes such definition(s) in the Federal Register;

(5) the term "small governmental jurisdiction" means governments of cities, counties, towns, townships, villages, school districts, or special districts, with a population of less than fifty thousand, unless an agency establishes, after opportunity for public comment, one or more definitions of such term which are appropriate to the activities of the agency and which are based on such factors as location in rural or sparsely populated areas or limited revenues due to the

population of such jurisdiction, and publishes such definition(s) in the Federal Register;

(6) the term "small entity" shall have the same meaning as the terms "small business", "small organization" and "small governmental jurisdiction" defined in paragraphs (3), (4) and (5) of this section; and

(7) the term "collection of information"—

(A) means the obtaining, causing to be obtained, soliciting, or requiring the disclosure to third parties or the public, of facts or opinions by or for an agency, regardless of form or format, calling for either—

(i) answers to identical questions posed to, or identical reporting or recordkeeping requirements imposed on, 10 or more persons, other than agencies, instrumentalities, or employees of the United States; or

(ii) answers to questions posed to agencies, instrumentalities, or employees of the United States which are to be used for general statistical purposes; and

(B) shall not include a collection of information described under section 3518(c)(1) of title 44, United States Code.

(8) Recordkeeping requirement—The term "recordkeeping requirement" means a requirement imposed by an agency on persons to maintain specified records.

* * *

§ 610. Periodic review of rules

(a) Within one hundred and eighty days after the effective date of this chapter, each agency shall publish in the Federal Register a plan for the periodic review of the rules issued by the agency, which have or will have a significant economic impact upon a substantial number of small entities. Such plan may be amended by the agency at any time by publishing the revision in the Federal Register. The purpose of the review shall be to determine whether such rules should be continued without change, or should be amended or rescinded, consistent with the stated objectives of applicable statutes, to minimize any significant economic impact of the rules upon a substantial number of such small entities. The plan shall provide for the review of all such agency rules existing on the effective date of this chapter within ten years of that date and for the review of such rules adopted after the effective date of this chapter within ten years of the publication of such rules as the final rule. If the head of the agency determines that completion of the review of existing rules is not feasible by the established date, he shall so certify in a statement published in the Federal Register and may extend the completion date by one year at a time for a total of not more than five years.

(b) In reviewing rules to minimize any significant economic impact of the rule on a substantial number of small entities in a manner consistent with the stated objectives of applicable statutes, the agency shall consider the following factors—

(1) the continued need for the rule;

(2) the nature of complaints or comments received concerning the rule from the public;

(3) the complexity of the rule;

(4) the extent to which the rule overlaps, duplicates or conflicts with other Federal rules, and, to the extent feasible, with State and local governmental rules; and

(5) the length of time since the rule has been evaluated or the degree to which technology, economic conditions, or other factors have changed in the area affected by the rule.

(c) Each year, each agency shall publish in the Federal Register a list of the rules which have a significant economic impact on a substantial number of small entities, which are to be reviewed pursuant to this section during the succeeding twelve months. The list shall include a brief description of each rule and the need for and legal basis of such rule and shall invite public comment upon the rule.

APPENDIX II

INTRODUCTION AND SECTION 5 OF EXECUTIVE ORDER #12866 REGULATORY PLANNING AND REVIEW

INTRODUCTION

The American people deserve a regulatory system that works for them, not against them: a regulatory system that protects and improves their health, safety, environment, and well-being and improves the performance of the economy without imposing unacceptable or unreasonable costs on society; regulatory policies that recognize that the private sector and private markets are the best engine for economic growth; regulatory approaches that respect the role of State, local, and tribal governments; and regulations that are effective, consistent, sensible, and understandable. We do not have such a regulatory system.

With this Executive order, the Federal Government begins a program to reform and make more efficient the regulatory process. The objectives of this Executive order are to enhance planning and coordination with respect to both new and existing regulations; to reaffirm the primacy of Federal agencies in the regulatory decision-making process; to restore the integrity and legitimacy of regulatory review and oversight; and to make the process more accessible and open to the public. In pursuing these objectives, the regulatory process shall be conducted so as to meet applicable statutory requirements and with due regard to the discretion that has been entrusted to the Federal agencies.

Accordingly, by the authority vested in me as President by the Constitution and the laws of the United States of America, it is hereby ordered as follows:

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Sec. 5. Existing Regulations

In order to reduce the regulatory burden on the American people, their families, their communities, their State, local, and tribal governments, and their industries; to determine whether regulations promulgated by the executive branch of the Federal Government have become unjustified or unnecessary as a result of changed circumstances; to confirm that regulations are both compatible with each other and not duplicative or inappropriately burdensome in the aggregate; to ensure that all regulations are consistent with the President's priorities and the principles set forth in this Executive order, within applicable law; and to otherwise improve the effectiveness of existing regulations: (a) Within 90 days of the date of this Executive order, each agency shall submit to OIRA a program, consistent with its resources and regulatory priorities, under which the agency will periodically review its existing significant regulations to determine whether any such regulations should be modified or eliminated so as to make the agency's regulatory program more effective in achieving the regulatory objectives, less burdensome, or in greater alignment with the President's priorities and the principles set forth in this Executive order. Any significant regulations selected for review shall be included in the

agency's Annual Plan. The agency shall also identify any legislative mandates that require the agency to promulgate or continue to impose regulations that the agency believes are unnecessary or outdated by reason of changed circumstances.

(b) The Administrator of OIRA shall work with the Regulatory Working Group and other interested entities to pursue the objectives of this section. State, local, and tribal governments are specifically encouraged to assist in the identification of regulations that impose significant or unique burdens on those governmental entities and that appear to have outlived their justification or be otherwise inconsistent with the public interest.

(c) The Vice President, in consultation with the Advisors, may identify for review by the appropriate agency or agencies other existing regulations of an agency or groups of regulations of more than one agency that affect a particular group, industry, or sector of the economy, or may identify legislative mandates that may be appropriate for reconsideration by the Congress.

APPENDIX III

NIOSH RECOMMENDATIONS[1] FOR PREVENTING SUFFOCATIONS IN GRAIN

In order to prevent suffocations in grain, the National Institute for Occupational Safety and Health (NIOSH) has recommended that workers should never enter a silage or grain storage structure when it is being loaded or unloaded. Furthermore, in order to prevent unexpected operation, the power to all loading and unloading equipment should be shut off, locked, and tagged before workers enter the bin. NIOSH also suggested installing permanent ladders inside grain bins in case a worker enters a bin and unloading starts; if a ladder is present on the inside of the bin, the worker may be able to escape by climbing on the ladder. NIOSH did not believe that safety ropes placed in grain bins would be of any value; once a worker is thigh or waist deep in grain, data have indicated that the drag force is so great, the worker will not have the strength to hold on to the rope, and if the rope is hung from the center of the bin, as has been suggested, the drag force against the rope may be able to collapse the roof.

NIOSH also recommended that all surface crusts be broken up from outside the bin with either a weighted line thrown through the bin door or a wooden pole, since metal poles are an electrocution hazard. Furthermore, crusted grain can be broken up outside the bin by using mechanical agitation or vibration equipment. Also, material sticking to the sides of the bin should always be broken up from above the bin; workers should never enter the bin below the sticking or caked material in order to break it up.

If a worker must enter a grain bin, NIOSH has recommended that three people be involved in the procedure. All unloading equipment should be turned off, locked and tagged, and if a ventilation fan is in the bin, it should be used to ventilate the bin both before entry and for the period that the worker is in the bin. A safety belt or harness attached to a lifeline must be worn by a worker entering the storage structure. The second person stays at the entrance of the bin and should keep tension on the lifeline to make sure the worker in the bin does not go under the grain. A third person should stay on the ground to assist, if necessary.

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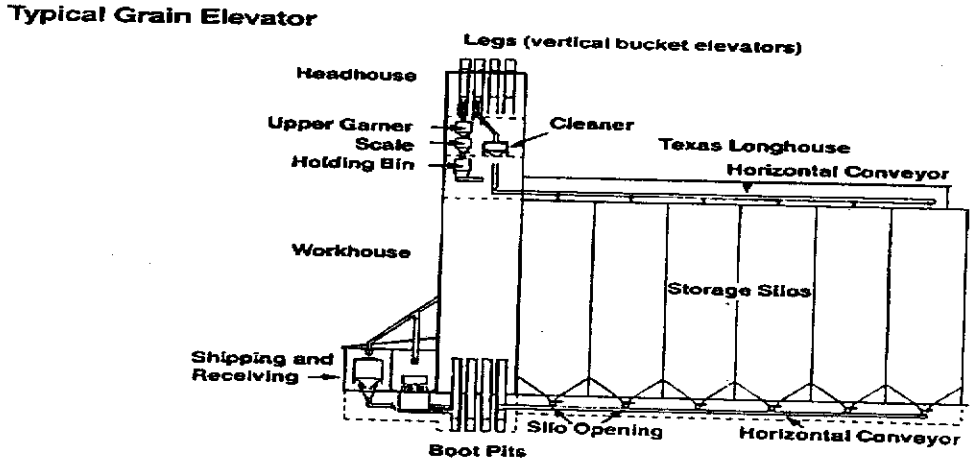
[1] National Institute for Occupational Safety and Health (NIOSH); Safe Grain and Silage Handling; NIOSH Publication No. 95-109, Section 3 – Storage

APPENDIX IV

THE GRAIN-HANDLING PROCESS AND GRAIN ELEVATORS[1]

A grain elevator has two sections: the workhouse and the storage bins or silos. The workhouse is several stories high and contains receiving, elevating, cleaning, weighing, and distributing equipment, as well as bins for holding, shipping, and mixing processes. The workhouse is usually a rectangular building located at one end of a bank of storage bins or between two banks of bins. It is connected to the bins by overhead walkways at bin top level as well as by underground tunnels. With a height of about 100 to 250 feet, the workhouse is usually 40 to 60 feet above the storage bins in order to accommodate the machinery and movement of the grain. The extended portion is called the headhouse because it houses the head pulleys of the bucket elevators. A one-story structure on the top of the bank of storage bins, which extends their length encloses a belt conveyor for moving grain from the workhouse to various bins. This structure is referred to as the Texas-house or long-house.[2] (See Figure 1.)

Figure 1



[1] Except where otherwise noted, based on National Academy of Sciences, ~~Prevention of Grain Elevators and Mill Explosions~~, National Academy Press, Washington, DC, 1982, pp. 15, 17.

[2] From U.S. General Accounting Office. ~~Grain Dust Explosions -- An Unsolved Problem~~, HRD-79-1, March 21, 1979, p. 5.

The main construction materials used in grain elevators are: 1) reinforced slip-formed concrete, which is commonly used for almost all large elevators, 2) wood or metal framing covered with metal sheathing in many smaller elevators, and 3) wood, either with or without the metal sheathing in some older facilities.[3]

Different elevators have different storage capacities, handling speeds, and equipment types. Grain may come to the elevator by train, truck, or barge. Some elevators have hydraulic truck lifts. It is also common to have trucks with hatches in the bottom of the trailers -- hopper bottom -- and self-dumping trucks. Railroad cars can also be hopper bottomed, tilted hydraulics, unloaded with power shovels, or front-end loaders. Barges are unloaded with mobile marine bucket elevators, vacuum systems, or power shovels.

When grain comes to an elevator it may need to be cleaned or dried. Elevators use machines called continuous flow column dryers or batch dryers to dry grain that is too wet. Cleaning is done with screens that are shaken mechanically or tilted so that the grain moves across them.

Grain is delivered to an elevator by truck, rail, or barge and is dumped into a pit that feeds a conveyor belt leading to the bottom of the leg, which is called the boot. The leg is an enclosed, vertical, endless-belt, bucket conveyor that elevates the grain and discharges it into the top of a garner. Grain is discharged from the bottom of the garner into a scale bin in batch lots and is weighed. The grain then flows out the bottom of the scale bin onto a belt conveyor that moves the grain to the top of a bin or silo. The first grain dumped into an empty silo may drop as much as 100 feet or more. Grain is unloaded from the bottom of the silo onto a conveyor belt that feeds into the boot of the leg. After being elevated grain may take one of several different paths (e.g., it may go through the weighing process again and be reloaded into a truck, rail car, or barge; it may be blended with grain from other silos and returned to a silo; or it may go to a drier). It should be noted that, except in rare instances, grain is elevated in the leg at least twice during the time it is in the elevator and the leg is always operating when grain is being moved within the elevator.

Most grain bins are gravity operated, pulling grain through the bottom for unloading and transporting. During this process the bucket elevator, or leg, is moving grain vertically along the grain stream.[4] The geometry of elevators and the method of distributing the grain within the elevator vary widely. Some elevators have legs external to the structure; some use inclined conveyor belts in place of legs, some distribute grain from a leg or inclined belt into a system of pipes (a distributor) leading to silos, thereby eliminating the gallery on top of the bins; some group the bins in a circle around the headhouse instead of placing them in a row; some extend

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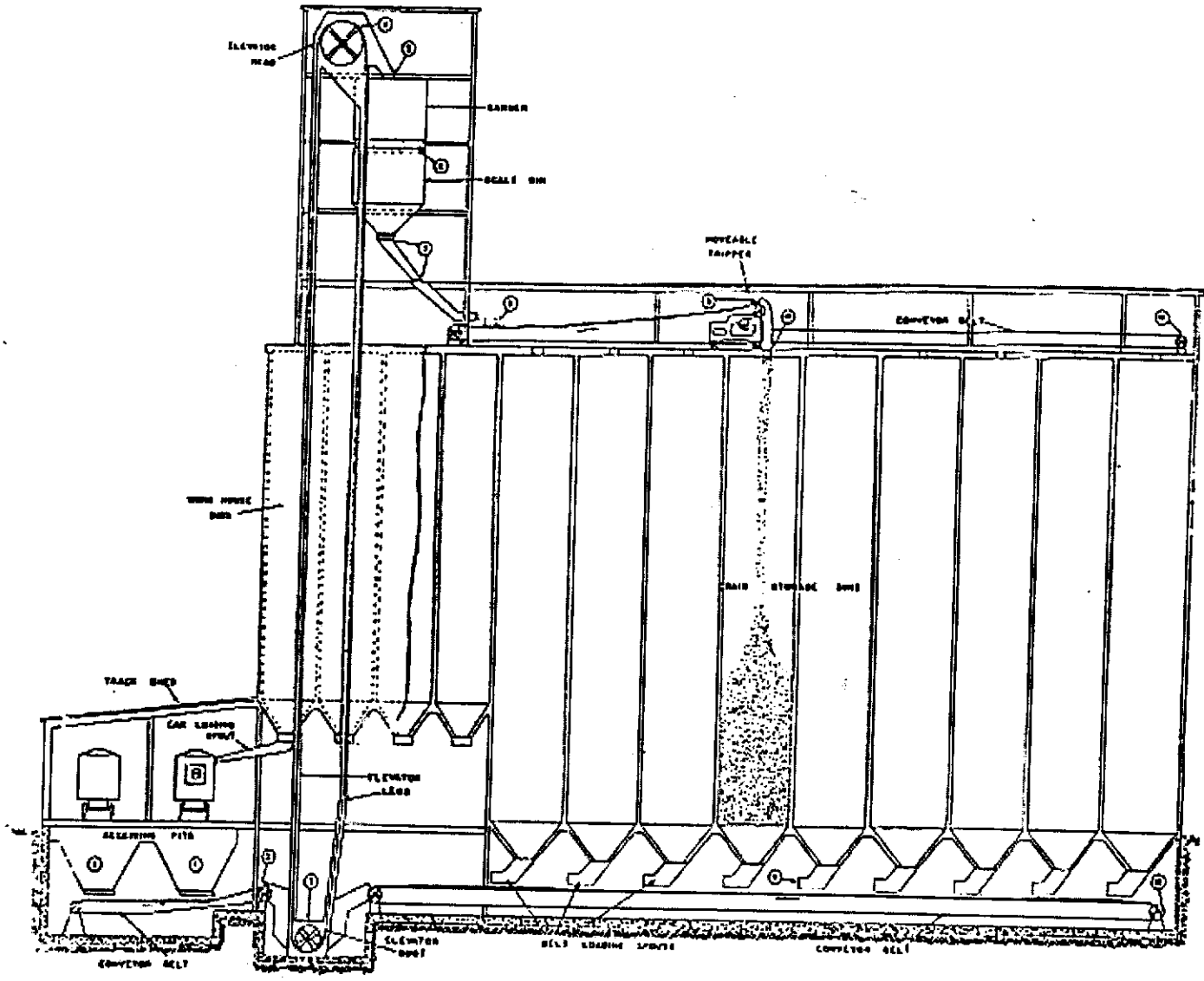
[3] U.S. Department of Agriculture, Office of the Special Coordinator for Grain Elevator Safety Security, ~~Prevention of Dust Explosions in Grain Elevators -- An Achievable Goal~~, January 1980, p. 31.

[4] Laura Wiedman, "A Clean Sweep," ~~Ohio Monitor~~, January 1987, p. 4.

bins on each side of the headhouse; and some have combinations of two or more of these and other features, even to the extent of having wood and concrete structures together in the same installation.

In addition to the grain-moving system in an elevator, most newer and some older elevators have a pneumatic dust control system. (See Figure 2 on next page for points in an elevator where dust clouds are likely to be emitted.) Airborne dust is collected at various points in the elevator to improve the working environment, to reduce the hazard of dust explosions, and to meet EPA requirements on ambient air quality. In some elevators, the dust is collected in a separate bin and offered for sale; in others, the dust is returned to the grain.

Figure 2



Diagrammatic section view of a terminal type grain elevator. Circled numbers indicate points at which dust clouds are likely to be emitted

Source: Mitre, "Causes and Prevention of Grain Elevator Explosions."