

Appendixes

Appendix A.—Supplemental Information on OSHA and NIOSH

Other Reports on OSHA and NIOSH

The General Accounting Office (GAO) has examined a number of aspects of OSHA and NIOSH operations. It has reported on standards-setting activities of OSHA and the criteria-setting activities of NIOSH in two different reports (494,501) and generally criticized the slow pace of the development of new standards, and the lack of coordination between the two agencies. GAO has examined emergency temporary standards (495,496) and the procedures used by OSHA to grant employers variances from standards (497), and expressed concern that OSHA's activities were not sufficient to ensure worker health and safety. GAO has also criticized OSHA's management of its consultation program (505), OSHA's monitoring of State Programs (500), as well as the administration of NIOSH's HHE program (503).

GAO has reviewed OSHA's health inspections (502), its safety inspections (504), and the procedures used for scheduling complaint inspections (507), and was critical of several aspects of OSHA's inspection activity. GAO has in two reports criticized OSHA's data collection efforts, pointing to inadequacies in data on injuries and health hazards and OSHA's failure to use the information it collects through accident investigations (499,508). A 1984 GAO report examined OSHA's policies of encouraging the informal settlement of citations (511).

Mary Jane Belle, of the Congressional Research Service, prepared a report in 1981 on OSHA reform (530). She has also written and updated a Congressional Research Service Issue Brief on OSHA (533).

Crisis in the Workplace by Nicholas Ashford (30) and Bitter Wages by Joseph Page and Mary-Win O'Brien (361), provide accounts of some of OSHA's early history and present their evaluations of governmental activities. Other studies of occupational health and safety regulation are Robert Smith's *The Occupational Safety and Health Act* (44) and John Mendeloff's *Regulating Safety* (300). David P. McCaffrey, *OSHA and the Politics of Health Regulation* (290) gives a history and analysis of the health standards issued during OSHA's first decade, while Steven Kelman's *Regulating America, Regulating Sweden* (245) provides a comparison of OSHA and its Swedish counterpart. In his collection entitled *OSHA: History, Law, and Policy* (307), Benjamin W. Mintz provides numerous excerpts from primary source documents related to many of the important disputes about OSHA standards and

enforcement activity, employee rights, and the history of State programs,

Three other reports on OSHA are of special interest. Two were prepared by Presidentially appointed groups. The first, appointed by President Ford and often referred to as the MacAvoy Commission, examined OSHA's safety standards and recommended that OSHA issue performance standards(276). The second, an Interagency Task Force appointed by President Carter, made a large number of recommendations on OSHA inspection activity, creation of economic incentives for OSHA compliance, establishing cooperative programs, and reforming regulatory activity (228). In addition, two academic economists, Richard Zeckhauser and Albert Nichols, studied OSHA regulation at the request of the Senate Committee on Governmental Affairs, which published their report in 1978 (685),

OSHA Standards Issued After Rulemaking

As described in chapter 12, OSHA has the authority to issue new standards, and to modify or revoke existing standards using procedures specified in the Occupational Safety and Health Act (OSH Act). Tables A-1 and A-2 present details of the rule-making proceedings that have resulted in final standards during OSHA's first 13 years. These proceedings can begin with the receipt of a Criteria Document from NIOSH, the creation of an ad hoc advisory committee, or the publication of an Advance Notice of Proposed Rulemaking. Although, in theory, both of these latter two might occur in the same proceeding; in practice they have not. In fact, in recent years, OSHA has tended to use the Advance Notices, and has not used ad hoc advisory committees. (The exceptions are standards involving the construction industry, for which OSHA is required, by its own regulations, to consult with the standing Construction Safety Advisory Committee.) Moreover, in recent years, NIOSH has issued few criteria documents. Proceedings are now more likely to begin with a petition from an interested group, such as a union, for a standard,

The formal Notice of Proposed Rulemaking and publication of the Final Standard and statement of reasons are necessary steps in order to issue a standard. A public hearing is not essential, unless an interested party requests it. For major and controversial standards, a hearing is invariably requested.

Under section 6(f) of the OSH Act, “[a]ny person who may be adversely affected by a standard issued” by OSHA can challenge the standard in any of the U.S. Courts of Appeal. **A column in tables A-1 and A-2 indicate if any challenge occurred, the circuit in which it was filed, and the date of the decision.** Table A-3 lists the names and citations for these cases.

Finally, OSHA has for a number of its standards, taken formal steps to reconsider and revise standards that had been issued in final form. The last column of tables A-1 and A-2 **list these actions.**

OSHA Enforcement Activity

Tables A-4 to A-n present detailed information concerning inspection activity by OSHA since Fiscal Year 1973 and the State programs since Fiscal Year 1976. The data for these tables were provided by OSHA. Table A-4 provides the number of inspections, both for safety hazards and for health hazards. Table A-5 presents these inspections according to OSHA’s priority categories—fatality/catastrophe investigations, complaint inspections, programed inspections, and follow-up inspections. Table A-6 gives the numbers of inspections by major industry groups.

Tables A-7 to A-11 include information on the various types of violations issued by OSHA. The OSH Act specifies that penalties be imposed on employers for violations of standards. Except in the case of de minimus violations that have “no direct or immediate relationship to safety or health,” and other-than-serious violations, OSHA must issue a citation, propose a penalty, and set a “reasonable” abatement period.

A “serious” violation is issued for hazards that present a “substantial probability of death or serious physical harm” to employees. A fine of up to \$1,000 for each serious citation can be imposed. An other-than-serious violation is not explicitly defined in the Act, but it falls between serious and de minimus violations. These violations have also been termed “non-serious violations.” OSHA and OSHRC interpret other-than-serious violations to involve conditions that have a direct and immediate relationship to worker safety and health, but without a substantial probability of death or serious physical harm. Although a fine of up to \$1,000 could be imposed for these violations, in practice the proposed fines are substantially smaller.

“Willful” violations are defined as those that are “intentional and knowing, as distinguished from accidental, and display a careless or reckless disregard or plain indifference to the Act or its requirements.” (333). Employers will usually correct a hazard after being found in violation. Employers who subsequently are found to violate the same standard or a similar stand-

ard may be issued “repeated” violations. Fines of up to \$10,000 may be imposed for both willful and repeated violations. OSHA’s largest penalties usually involve an employer’s “failure to abate” or correct a hazard. The OSH Act authorizes penalties of up to \$1,000 for each day that the hazard continues beyond the day it was supposed to have been abated. In practice, these have been limited to a maximum of 10 days or \$10,000.

The Act also authorizes criminal prosecution in several situations: First, a willful violation that results in an employee’s death may be punished by criminal penalties including a fine of up to \$10,000, or 6 months imprisonment, or both. For a second conviction, these maximum penalties are doubled. There have been only a handful of these cases under the Act. In addition the Act provides for criminal penalties for OSHA officials who give an employer unauthorized advance notice of an inspection, and against anyone who falsifies OSHA-required records, or uses force to interfere with the work of an inspector, although there have not been any cases brought for these last three types. (For a more detailed discussion, see 307,333,408.)

In practice, penalties are substantially lower than the maximum penalty amounts outlined above, reflecting, in part, OSHA’s discretion in setting penalties. In proposing penalties, OSHA considers the gravity of the violation, the good faith of the employer, the size of the business, and the employer’s previous history of compliance.

Activities of Other Federal Agencies

OSHA and the 25 State Programs are directly responsible for ensuring the health and safety of most private sector workers in the U.S. However, workplace health and safety for some private sector workers are the responsibility of other Federal agencies. In general, health and safety conditions for most public sector workers are not directly regulated by OSHA, although State Programs, at least in theory, cover State and local employees in States with State Programs. Finally, the regulations issued by several other Federal agencies also affect job safety and health, even though workplace conditions are not the primary focus of these agencies.

The constellation of governmental bodies with workplace safety and health responsibilities is summarized in table A-12. The OSH Act directly regulates “employers,” who are defined as persons and businesses who have employees and are engaged in interstate commerce (Section 3(s)). This generally covers private sector employers, although anyone who is self-employed and who has no employees is not directly subject to OSHA regulation.

In addition, the occupational health and safety of some private sector employees is regulated by other agencies. Section 4(b)(1) of the OSH Act provides that the OSH Act does not apply to “working conditions” for which other agencies “prescribe or enforce standards or regulations affecting occupational safety or health.” These exclusions are, in some instances, for all aspects of occupational safety and health; in others only for certain hazards. For instance, the Mine Safety and Health Administration (MSHA) is responsible for all safety and health hazards associated with mining. The Nuclear Regulatory Commission, in contrast, is responsible for assuring that the workers under their jurisdiction are adequately protected from radiation exposure only; OSHA is responsible for all other workplace hazards.

The boundaries of authority are clear in some cases, while in others disputes have arisen. The Federal Aviation Administration (FAA) has requirements concerning the health and safety of flight crews, but coverage of aviation ground crews has been a focus of dispute between the FAA and OSHA.

Certain jurisdictional uncertainties have been resolved by agreements between OSHA and other agencies. The Department of Energy, through a letter of understanding, has responsibility to “prescribe and enforce occupational radiological and nonradiological safety and health standards” for the workers it covers. That 1974 agreement reaffirmed a 1964 letter of understanding between the then Atomic Energy Commission and the Department of Labor concerning responsibilities under the Walsh-Healey Act.

Recently, Congress temporarily transferred jurisdiction over stone and gravel quarries from the Mine Safety and Health Administration to OSHA for several months. Inspection authority for this industry has now returned to MSHA. Current and future jurisdictional disputes may be resolved through letters of understanding and inter-agency agreements, or through congressional and court actions.

The employees of the Federal Government, as well as of State and local governments, are not directly regulated by OSHA. However, Section 19 of the OSH Act requires that the head of each Federal agency provide an occupational safety and health program for agency employees that is “consistent with” the standards issued by OSHA. Three different Presidents have issued Executive Orders concerning the health and safety of Federal workers (Executive Order (E. O.) 11612, July 26, 1971; E.O. 11807, Sept. 28, 1974; E.O. 12196, Feb. 26, 1980). There is a Federal Advisory Council on Occupational Safety and Health, appointed by the Secretary of Labor, that consists of 16 members—8 representing Federal agencies, and 8 represent-

ing Federal employee labor organizations. OSHA also provides technical assistance to other Federal agencies concerning the health and safety of Federal workers.

The health and safety of State and local government employees is the responsibility of the States and localities that employ them. Any State that establishes a State Program must provide an occupational safety and health program for state and local employees that is “as effective as the standards” adopted for private sector workers. But State and local government employees in States without State Programs are not covered by this requirement.

In addition, several other Federal agencies can take actions that affect worker health and safety. The Environmental Protection Agency (EPA) regulates pesticides under the Federal Insecticide, Fungicide, and Rodenticide Act and regulates toxic substances under the Toxic Substances Control Act. In either case, EPA actions to allow, limit, or prohibit the use of particular substances may affect employee health and safety. In fact, in many cases, the exposed workers may be the group most affected by these actions. This may also happen with actions taken by the Consumer Product Safety Commission in regulating hazardous consumer products.

Comparison of Protective Levels

The NIOSH list in *Summary of NIOSH Recommendations for Occupational Health Standards* contains recommendations for a total of 163 hazardous substances and work conditions. There are 74 substances which have no complications, and these are included on the comparison list. There are also 11 groups of 71 separate substances for which NIOSH has made recommendations. Only 43 of these, however, were conducive to comparison. In addition, there are six substances in three classes which OSHA or ACGIH treat separately, but NIOSH treats the same. These are cadmium, which OSHA separates into dust and fume; PCBs, which are divided by the percent of chlorine present; and the explosive nitro compounds, nitroglycerin and ethylene glycol dinitrate. Finally, 10 NIOSH recommendations cover exposures to general categories of toxic substances or harmful physical agents, while 5 others cover hazardous working conditions. These are described in chapter 12, but because most of them are not easily compared on a numerical basis, they were excluded from this comparison. Thus the total number of Protective Levels compared equals 74 plus 43 plus 6 or 123.

Table A-13 presents the numerical Protective Levels from OSHA, NIOSH, and ACGIH that were com-

pared. Alternative chemical names are not used in table A-13. In most cases, the name used is the one NIOSH uses. Abbreviations have been included in most cases for those substances which have them, and, in fact, some substances are seldom referred to by their chemical names, abbreviations being more convenient. In this table, all protective levels are listed in mg/m^3 (milligrams substance/cubic meter of air). Generally, the protective levels in the actual recommendations and standards are given in ppm (parts per million) or mg/m^3 or both. For convenience and ease of comparison, all ppm concentrations were converted to mg/m^3 using the formula:

$$(\text{MW} \times (\text{X}) \text{ ppm})/24.45 = \text{Y} \text{ mg}/\text{m}^3$$

(at 25°C and 760 mm Hg pressure, where MW = Molecular Weight).

Table A-13 lists 123 toxic and hazardous substances and the corresponding Time-Weighted Average (TWA) and Ceiling permissible exposure limits for each substance that are recommended by NIOSH and ACGIH, and mandated by OSHA. The 123 chemicals included in the comparison are all those that appear on the NIOSH list that also appear on either the OSHA or ACGIH lists. The names of the NIOSH list substances that were left out for various reasons are listed in the Notes (No. 36).

When there is only one exposure limit in a protective level the word "none" in small letters indicates which exposure limit is not part of the standard. For example, "none" under the NIOSH Ceiling Limit for carbaryl means that the NIOSH recommendation does not have a Ceiling exposure limit for carbaryl, but it does have a TWA exposure limit. When there is no

recommendation or standard for a particular substance, the word "NONE" is capitalized and present in both exposure limit columns.

Approaches differ among OSHA, NIOSH and ACGIH. For example, many of NIOSH's recommendations are based on a 10-hour workday and not an 8-hour workday as are OSHA's PELs. For this comparison, it was assumed that this difference would have only a negligible effect on the level of protection.

For most substances, NIOSH recommends only one TLV (98 cases out of 131), either a TWA or a Ceiling Limit, but not both. OSHA has only one PEL, an 8-hour TWA, for most of the substances it covers. On the other hand, ACGIH recommends both a TWA and a Ceiling TLV in over half of the cases included in this comparison (73/131). With differing specifications concerning the type of Protective Level, it can be difficult to compare them. In addition, recommendations that no exposure be allowed for carcinogens is often not reflected in the numerical levels recommended by an organization.

There are also differences in defining specific substances since some descriptions are more inclusive than others. For example, ACGIH has four TLVs for asbestos (one for each type), while NIOSH has a single protective level. A similar problem occurs if the substances being compared are not exactly the same, or if related substances are grouped differently, then the standards limiting exposure will differ. An example of this is the different exposure limits for soluble chromium, insoluble chromium, chromous salts, and chromic acid. These are detailed in the notes to table A-13.

Table A-1.—Dates of Completed OSHA Rulemakings for Health Standards

OSHA regulation ^a	NIOSH recommendation (criteria document)	Advisory committee (first meeting)	Emergency standard ^b (ETS)	Advance notice of proposed rulemaking (ANPR)	Notice of proposed rulemaking	Hearings (beginning day or month)	Federal Register (vol. and starting p.)	Final standard	Section 6(f) legal challenge to final rule—(court and date of decision) ^c	Formal reconsideration
1. Asbestos	0 / 21/72	02/03/72	12/07/71	none	01/12/72	none	06/07/72 37:3155	D.C. Cir. (04/15/74)	see footnote (d) below	
2. Fourteen carcinogens	none	06/25/73	05/03/73	none	07/16/73	09/73	01/29/74 39:3756	3d Cir. (08/26/74); 3d Cir. (12/17/74)	MOCA ^d standard deleted 08/20/76	
3. Vinyl chloride	03/11/74	none	04/05/74	none	05/10/74	06/25/74	10/04/74 39:35890	2d Cir. (01/31/75)	none	
4. Coke oven emissions	02/28/73	08/74	none	none	07/31/75	11/04/75	10/22/76 41:46742	2d Cir. (03/28/78)	none	
5. Benzene	07/24/74	none	05/03/77	none	05/21/77	07/19/77	02/10/78 43:5918	5th Cir. (10/05/78); S.Ct. (07/02/80)	standard deleted 06/19/81; request for information 07/08/83	
6. DBCP	09/02/77	none	09/09/77	none	11/01/77	12/13/77	03/17/78 43:11514	none	none	supplemental statement (risk assessment) 01/14/83
7. Arsenic (inorganic)	11/08/74	none	none	none	01/21/75	04/08/75	05/05/78 43:19584	9th Cir. (09/13/84)	see footnote (e) below	
8. Cotton dust	09/26/74	none	none	2/27/74	12/28/76	04/05/77	06/23/78 43:27350	D.C. Cir. (10/24/79); S.Ct. (06/17/81)	none	
9. Acrylonitrile	09/29/77	none	01/17/78	none	01/17/78	03/21/78	10/03/78 43:45762	none	none	
10. Lead	01/05/73	none	none	none	10/03/75	03/15/77	11/14/78 43:52952	D.C. Cir. (08/15/80)	See footnote (f) below; see also #14 below	
Cancer Policy	none	none	none	none	10/04/77	05/16/78	° /22/80 45:5001	5th Cir. (pending)	ANPR published 01/05/82; administrative stay of candidate list 01/04/83	
12. Access to employee exposure and medical records	none	none	none	none	07/21/78	12/05/78	05/23/80 45:35212	5th Cir. (05/16/84)	proposal to modify rule 07/13/82	
13. Occupational noise exposure/hearing conservation amendment	08/ 4/72	02/2 /74	none	none	10/24/74	06/23/75	01/16/81 46:4078	4th Cir. (1 / /07/84)	see footnote (g) and #16 below	
14. Lead—reconsideration of respirator fit-testing requirements	none	none	none	none	05/19/81	09/22/81	/ 2/82 7:51-10	none	none	
15. Coal tar pitch volatiles—modification of interpretation ^h	09/77	none	none	none	none	05/28/82	01/21/83 48:2764	none	none	
16. Hearing conservatory reconsideration	—	—	—	none	08/21/81	03/23/82	03/08/83 48:9738	4th Cir. /07/84)	none	
17. Hazard communication (labeling)	1974	09/19/74	none	01/28/77	03/19/82 ⁱ	06/15/82	01/25/83 48:53280	3d Cir. (pending)	none	
18. Ethylene oxide	—	—	—	01/26/81	04/21/83	07/19/83	06/22/84 49:25734	D.C. Cir. (pending)	none	

^aGenerally, these regulations are standards issued after rulemaking under the authority of Section 6(b) of the OSHA Act. In 1982, OSHA also issued a regulation expressly authorizing OSHA compliance officers to use personal sampling devices during workplace inspections. Because this only applies to OSHA's inspection authority, it is not included in this table. See *Federal Register* 47:53478 (12/10/82).

^bIn addition to those listed, OSHA also issued an ETS for a group of 21 pesticides on May 1, 1973. The emergency standards for the fourteen carcinogens, benzene, acrylonitrile, pesticides, and asbestos (1983) were the subjects of legal challenges. See table A-3 for the citations to these cases. The emergency standards for asbestos (1971), vinyl chloride, and DBCP were not challenged.

^cSee table A-3 for the complete citations to these cases.

^dOSHA first proposed to revise the asbestos standard on Oct. 9, 1975. On Nov. 4, 1983, it issued an ETS, but this was vacated by 5th Circuit Court of Appeals on March 7, 1984. OSHA published a new proposal on Apr. 10, 1984 and hearings on this began in June 1984.

^eCourt decisions on the cotton dust standard also include: S. Ct. (Oct. 6, 1980) affecting the warehousing industry; 5th Cir. (Nov. 14, 1980) affecting the cotton ginning industry. Administrative stays have been issued for waste processing and utilization (Sept. 1, 1978), warehousing and classing (July 29, 1980), and knitting industries (Feb. 4, 1983). The D.C. Circuit vacated the standard for the cotton seed oil industry. Formal reconsiderations on the cotton dust standard include: Deleted standard (June 10, 1981) for cotton ginning, ANPR (Feb. 9, 1982), proposed rule (June 10, 1983).

^fLead—Formal Reconsideration Supplemental Statement of Reasons (Jan. 21, 1981); ANPR (Apr. 21, 1981); Revised Supplemental Statement of Reasons and Amendment of Standard (Dec. 11, 1981). In addition, in 1981, OSHA has on several occasions delayed implementation of several provisions of the lead standard, particularly those involving the trigger levels for medical removal protection.

^gOSHA deferred the effective date of the hearing conservation amendment from Apr. 15, 1981 to Aug. 21, 1981, when major portions of the standard went into effect. The administrative stay was continued on other provisions to allow reconsideration. See #16 above.

^hThe first proposal for Hazard Communication was published Jan. 16, 1981 and then was withdrawn Feb. 12, 1981.

ⁱThe criteria document, but NIOSH issued a "Special Occupational Hazard Review" in 1977 and a "Current Intelligence Bulletin" in 1981 for ethylene oxide.

^j1,2-dibromo-3-chloropropane.

Table A.2.—Dates of Completed OSHA Rulemakings for Safety Standards

OSHA regulation	Advisory Committee	Emergency temporary standards (ETS)	Advance notice of proposed rulemaking (ANPR)	Notice of proposed rulemaking	Hearings (beginning day or month)	Final standard	Federal register (vol. and starting p.)	Section 6(f) legal challenge to final rule—(court and date of decision) ^c	reconsideration
1. miscellaneous amendments for construction	yes	none	none	09/28/71	11/10/71	02/17/72	37-3512	none	none
2. Cranes/derricks (load indicators)	yes	none	none	09/28/71	11/10/71	07/14/72	37-13763	none	none
3. Roll-over protective structures (construction)	yes	none	none	10/29/71	12/13/71	04/05/72	37-6837	none	none
4. Miscellaneous amendments for construction	yes	none	none	07/29/72	none	11/16/72	37-24345	none	none
5. Power transmission and distribution	yes	none	none	05/10/72	06/27/72	11/23/72	37-24880	none	none
6. Scaffolding, pump jack scaffolding, and roof catch platforms	yes	none	none	06/07/72	07/26/72	12/02/72	37-25712	none	none
7. Lavatories for industrial employment	none	none	none	07/15/72	11/08/72	05/03/73	38-10930	2nd Cir. (10/04/73)	deleted portion of standard (04/28/75)
8. Trucks, cranes, derricks, and indoor general storage	none	none	none	09/14/72	none	06/01/73	38-1437	none	none
9. Temporary flooring—skeleton steel construction	yes	none	none	01/16/74	none	07/02/74	39-24360	none	none
10. Mechanical power presses ("no hands in dies")	none	none	none	03/14/72	05/13/74	12/03/74	39-4184	2d Cir. (12/3/75)	revised standard and reasons (09/17/76)
11. Telecommunications	none	none	none	08/28/73	10/24/73	03/26/75	40-13435	none	none
12. Roll-over protective structures for agricultural tractors	2/20/72	none	none	02/04/75	06/13/74	04/25/75	40-18253	none	none
13. Industrial slings	none	none	none	08/30/73	none	06/27/75	40-27367	3d Cir. (02/1/76)	deleted portion of standard (03/30/76)
14. Guarding of farm field equipment, farmstead equipment, and cotton gins	2/19/72	none	none	02/08/74	08/22/74	03/09/76	41-10190	none	none
15. Ground-fault protection	yes	none	none	04/07/75	12/09/75	12/21/76	41-55685	D.C. Ct. of Appeals (06/28/78)	reaffirmed standard (10/13/78)
16. Commercial diving operations ^d	08/76	06/15/76 ^e	none	11/05/76	12/16/76	07/21/77	42-37650	5th Cir. (07/16/79)	deleted portion of standard; see also #23 below
17. Standards revocation	none	none	none	12/13/77	none	10/24/78	43-49726	none	none
18. Servicing multi-piece rim wheels	none	none	none	04/24/79	none	01/29/80	45-6706	none	see #25 below
19. Fire protection	none	none	none	12/22/78	08/28/79	09/21/80	45-60656	none	none
20. Guarding of low-pitched roof perimeters during the performance of built-up roofing work	yes	none	none	08/17/79	none	1/14/80	45-75618	none	none
21. Design safety standards for electrical standards	none	none	none	09/25/79	05/06/80	5/16/81	46-4034	none	none
22. Latch-open devices (on gasoline pumps)	none	none	none	03/30/82	none	09/07/82	47-39161	none	none
23. Diving exemptions	none	none	08/17/79	02/26/82	06/29/82	11/26/82	47-53357	D.C. Ct. of Appeals (01/17/84)	none
24. Marine terminals	06/74	none	none	01/16/81	05/25/82	07/05/83	48-30886	D.C. Ct. of Appeals (pending)	none
25. Servicing of single-piece and multi-piece rim wheels	none	none	none	1/2/82	none	02/03/84	49-4338	none	none
26. Revocation of advisory "should" and repetitive standards	none	none	none	05/28/82	none	02/10/84	49-5318	none	none

^aEmergency, these requirements are standards issued after rulemaking under the authority of section 6(b) of the USM Act. In addition, OSHA has rewritten two groups of standards which were reformed in 1979 (see Federal Register 44, 8577, 02/09/79) and the shipyard requirements were consolidated in 1982 (see Federal Register 47, 16984, 04/20/82).

^bSafety standards concerning construction are reviewed by the standing Advisory Committee for Construction Safety and Health. These are indicated with the notation "yes" in this column. For the ad hoc advisory committees convened only for one specific standard, the date given is for their first meeting.

^cSee table A-3 for the complete citations to these cases.

^dNIOSH published the equivalent of a criteria document. Recommended Operating and Medical Standards for Commercial Divers, Aug. 16, 1976.

^eThe ETS for diving was the subject of a legal challenge. See table A-3.

Table A-3.—Court Cases Involving OSHA Health Standards*

- Access to Employee Exposure and **Medical Records**—*Louisiana Chemical Association et al. v. Bingham et al.*—Fifth Circuit Court of Appeals remanded this case to the U.S. District Court for the Western District of Louisiana 657 F. 2d 777 (5th Cir., 1981). District Court affirmed the standard, 550 F. Supp 1136 (1982); Fifth Circuit Court of Appeals affirmed, without opinion, the decision of the District Court (May 16, 1984).
- Acrylonitrile—*Vistron v. OSHA* (6th Cir., Mar. 28, 1978), emergency temporary standard contested, request for stay of standard was denied, 6 OSCH 1483. The petition for review was then withdrawn.
- Arsenic (Inorganic)—*ASARCO Inc. et al. v. OSHA*, 746 F.2d 483 (9th Cir., Sept. 13, 1984)—Court remanded arsenic standard to OSHA (Apr. 7, 1981). After OSHA developed a risk assessment to comply with the Supreme Court's ruling in the Benzene case, the Ninth Circuit Court of Appeals affirmed the arsenic standard.
- Asbestos—*Industrial Union Department, AFL-CIO v. Hodgson*, 499 F.2d 467, (D.C. Cir., Apr. 15, 1974)—Affirmed OSHA's 1972 asbestos standard.
- Asbestos—*Asbestos Information Association/North America v. OSHA*, 727 F.2d 415 (5th Cir., Mar. 7, 1984)—Vacated the emergency temporary standard issued on Nov. 4, 1983.
- Benzene—*American Petroleum Institute v. OSHA*, 581 F.2d 493 (5th Cir., Oct. 5, 1978); *Industrial Union Department, AFL-CIO v. American Petroleum Institute*, 448 U.S. 807 (Supreme Court, July 2, 1980)—Both the 5th Circuit Court of Appeals and the Supreme Court vacated the OSHA benzene standard, although for different reasons.
- Cancer Policy—*American Petroleum Institute, et al. v. OSHA, et al.*, Nos. 80-3018, et al. (5th Cir., pending).
- Coke **Oven Emissions**—*American Iron & Steel Institute v. OSHA*, 577 F.2d 825 (3d Cir., Mar. 28, 1978)—Third Circuit Court of Appeals largely affirmed the Coke Oven Emissions standard. The Supreme Court agreed to review this decision, but the request for review was withdrawn before the case could be heard. 448 U.S. 917 (1980)
- Cotton Dust—*AFL-CIO v. Marshall*, 617 F.2d 636 (D.C. Cir., Oct. 10, 1979); *American Textile Manufacturers Institute, Inc. v. Donovan*, 452 U.S. 490 (June 17, 1981)—D.C. Court of Appeals and the Supreme Court both upheld the major requirements of the cotton dust standard as applied to the textile industry.
- Cotton Dust**—*Cotton Warehouse Association v. Marshall*, 449 U.S. 809 (Oct. 6, 1980)—Supreme Court granted a petition for review and vacated the decision of the court of appeals with respect to the warehousing and classing segments of the industry.
- Cotton Dust**—*Texas Independent Ginners Association v. Marshall*, 630 F.2d 398 (5th Cir., November 14, 1980)—Vacated cotton dust standard as applied to cotton ginning operations.
- Ethylene Oxide**—*Public Citizen Health Research Group, et al. v. Aucter*, 554 F. Supp. 242 (D.C. District Court, Jan. 5, 1983). *Public Citizen's Health Research, et al., v. Aucter, et al.*, 702 F.2d 1150 (D.C. Cir., Mar. 15, 1983)—Public Citizen requested a court order compelling OSHA to issue an emergency temporary standard. The District Court decided to issue such an order. The case was appealed to the D.C. Court of Appeals, which refused to order that an emergency temporary standard be issued, but did order that OSHA expedite its section 6(b) rulemaking.
- Fourteen Carcinogens**—*Dry Color Manufacturing Association v. Department of Labor*, 486 F.2d 98 (3d Cir., Oct. 4, 1973)—Vacated the emergency temporary standard for two of the fourteen carcinogens.
- Fourteen Carcinogens-Synthetic Organic Chemical Chemical Manufacturers Association v. Brennan*, 503 F.2d 1155 (3d Cir., Aug. 26, 1974)—Affirmed standard for ethyleneimine under the 14 Carcinogens standard (SOCMA I). A petition for rehearing was denied Oct. 6, 1975. The Supreme Court denied a request for review, 420 U.S. 973 (Mar. 17, 1975).
- Fourteen Carcinogens-Synthetic Organic Chemical Manufacturers Association v. Brennan, 506 F.2d 385 (3d Cir., Dec. 17, 1974)—Third Circuit Court of Appeals vacated the standard for MOCA (1 of the 14 carcinogens) (SOCMA II). The Supreme Court denied a request for review. *Oil, Chemical and Atomic Workers International Union, AFL-CIO v. Dunlop*, 423 U.S. 830 (Oct. 6, 1975).**
- Hazard Communication (Labelling)**—*United Steelworkers of America, Public Citizen, State of Massachusetts, Fragrance Materials Association, People of the State of Illinois, Flavor & Extract Manufacturing Association, State of New York v. Aucter*, Nos. 83-3554, 83-3561, 83-3565, 84-3066, 84-3087, 84-3093, 84-3117, 84-3128 (3d Cir., pending).
- Occupational Noise Exposure/Hearing Conservation Amendment**—*Forging Industry Association v. Sec. of Labor No. 83-1232* (4th Cir., Nov. 7, 1984)—Fourth Circuit Court of Appeals vacated the Hearing Conservation Amendment.
- Lead-United Steelworkers of America v. Marshall*, 647 F.2d 1189 (D.C. Cir., Aug. 15, 1980)—The D.C. Court of Appeals affirmed the lead standard in part, but directed OSHA to determine the feasibility of engineering controls for 38 industries and occupations. The Supreme Court denied a request for review *Lead Industries Association, Inc. v. Donovan*, 453 U.S. 913 (1981)
- Pesticides—*Florida Peach Growers Association, Inc. v. Department of Labor*, 489 F.2d 120 (5th Cir., Jan. 9, 1974)—The Fifth Circuit Court of Appeals vacated the emergency temporary standard for pesticides.
- Vinyl Chloride**—*Society of the Plastics Industry, Inc. v. OSHA*, 509 F.2d 1301 (2d Cir., Jan. 31, 1975)—The Second Circuit Court of Appeals affirmed the vinyl chloride standard. The Supreme Court denied a request for review *Firestone Plastics Co. v. U.S. Department of Labor* 421 U.S. 992 (May 27, 1975).

Court Cases Involving OSHA Safety Standards

- Lavatories for Industrial Employment-Associated industries of New York State, Inc. v. Department of Labor, et al.**, 487 F.2d 342 (2d Cir., Oct. 4, 1973)—The Second Circuit Court of Appeals vacated the OSHA lavatory standard.
- Mechanical Power** *Presses-AFL-CIO v. Brennan*, 530 F.2d 109 (3d Cir., Dec. 31, 1975)—The Third Circuit Court of Appeals remanded to OSHA for a new statement of reasons and then affirmed OSHA's changes to the "no hands in die" standard.
- Commercial Diving Operations**—*Taylor Diving and Salvage*

Table A-3.—Continued

<p>v. U.S. <i>Department of Labor</i> 537 F.2d 819 (5th Cir.,1976)—Court issued an indefinite stay of the ETS for commercial diving.</p> <p>Commercial Diving Operations— Taylor Diving and Salvage v. U.S. Department of Labor 599 F.2d 622 (5th Cir., July 16, 1979)—Vacated the medical requirements section (29 CFR 1910.411) of the final standard for commercial diving.</p> <p>Diving Exemptions-United Brotherhood of Carpenters and Joiners of America, AFL-CIO v. U.S. Department of Labor, No. 82-2509, D.C. Cir., Apr. 4, 1984)-After oral argument, court remanded case to OSHA for additional information.</p> <p>Ground-Fault Protection--National Constructors Association v. Marshall 581 F.2d. 960 (D.C. Cir., June 28, 1978)—The</p>	<p>Court of Appeals for the D.C. Circuit remanded the record to OSHA with specific instruction to consult the Advisory Committee.</p> <p>Fire Protection-Fim Equipment v. Marshall 679 F.2d 679 (7th Cir., May 27, 1982)-case was dismissed for lack of standing. Request for rehearing was denied (July 22, 1962).</p> <p>Industrial Slings--Bethlehem Steel Corp. v. Dunlop 540 F.2d, 157 (3d Cir., Feb. 11, 1976)—Vacated one paragraph of the standard (29 CFR 1910.184) and remanded the standard to the Secretary of Labor.</p> <p>Marine Terminals--National Grain and Feed Association (D.C. Cir., pending).</p>
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“NOTES: F.2d—Federal Reporter, Second Series.
U. S.—U.S. Supreme Court Reports.
F. Supp.—Federal Supplement.

Table A-4.-Safety and Health Inspections

Fiscal year	Federal OSHA:					
	Establishment inspections (number)	Safety inspections (number)	Safety inspections (percent)	Health inspections (number)	Health inspections (percent)	Employees covered by inspections (number)
1973	48,409	45,225	93.4 % ⁰	3,184	6.6%	5,440,303
1974	77,142	73,189	94.9	3,953	5.1	6,448,067
1975	80,978	75,459	93.2	5,519	6.8	6,180,881
1976	90,482	82,885	91.6	7,597	8.4	6,601,729
1977	60,004	50,892	84.8	9,112	15.2	5,285,946
1978	57,278	46,621	81.4	10,657	18.6	4,522,582
1979	57,734	46,657	80.8	11,077	19.2	4,262,749
1980	63,404	51,565	81.3	11,839	18.7	3,690,993
1981	56,994	46,236	81.1	10,758	18.9	2,672,129
1982	52,818 ^a	43,609	82.6	9,209	17.4	2,235,823
1983	58,516 ^b	48,269	82.5	10,247	17.5	2,925,049
1984 (Oct. -Mar.)	30,606 ^c	25,086	82.0	5,520	18.0	1,552,120

Fiscal year	State programs:					
	Establishment inspections (number)	Safety inspections (number)	Safety inspections (percent)	Health inspections (number)	Health inspections (percent)	Employees covered by inspections (number)
1976 ^d	166,612	144,780	86.9	21,832	13.1	7,078,294
1977	143,469	130,643	91.1	12,826	8.9	6,000,009
1978	122,761	112,446	91.6	10,255	8.4	5,739,574
1979	107,636	99,509	92.4	8,127	7.6	4,932,303
1980	106,191	98,829	93.1	7,288	6.9	4,340,266
1981	108,376	99,303	91.6	9,073	8.4	4,404,364
1982	92,942	84,570	91.0	8,372	9.0	3,464,146
1983	103,879 ^e	93,406	89.9	10,473	10.1	3,818,287
1984 (Oct. -Mar.)	51,072 ^f	46,065	90.2	5,007	9.8	1,858,114

^aDoes not include 8,444 "Records Review" inspections in fiscal Year 1982.
^bDoes not include 1(),402 "Records Review" inspections in fiscal Year 1983.
^cDoes not include 4,9s4 "Records Review" inspections during the first 6 months (Oct. -Mar.) Of fiscal year 1984.
^dNo data available prior to '9"
^eState data does not include 2,554 "Records Reivew" inspections in fiscal Year 1983.
^fState dat. does not include 1,383 ' , Records Review" inspections during the first 6 months (Oct.-Mar.) of fiscal year 1964.

SOURCE' Office of Technology Assessment, based on data supplied by OSHA.

Notes to Tables A-4 Through A-11.—State Program Data

Fiscal Year	States included in totals
1976	AK, AZ, CA, CO, CT, HI*, IN*, IA, KY, MD, MI, MN, NV*, NM*, NC, OR, PR*, SC, TN, UT, VT, VI, VA*, WA, WY*
1977	AK, AZ, CA, CO, CT, HI, IN, IA, KY, MD, MI, MN, NV, NM, NC, OR, PR*, SC, TN, UT, VT, VI, VA, WA, WY
1978	AK, AZ, CA, CO*, CT, HI, IN, IA, KY, MD, MI, MN, NV, NM, NC, OR, PR*, SC, TN, UT, VT, VI, VA, WA, WY
1979	AK, AZ, CA, CT, HI, IN, IA, KY, MD, MI, MN, NV, NM, NC, OR, PR*, SC, TN, UT, VT, VI, VA, WA, WY
1980	AK, AZ, CA, CT, HI, IN, IA, KY, MD*, MI, MN*, NV, NM*, NC*, OR, SC, TN, UT, VT, VI, VA*, WA, WY
1981	AK, AZ, CA, CT, HI, IN, IA, KY, MD, MI, MN, NV, NM, NC, OR, SC, TN, UT, VT, VI*, VA, WA, WY
1982	AK, AZ, CA, CT, HI, IN*, IA*, KY*, MD, MI, MN*, NV, NM, NC, OR*, SC*, TN, UT*, VT, VA, WA, WY
1983	AK, AZ, CA, CT, HI, IN, IA, KY, MD, MI, MN, NV, NM, NC, OR, PR, SC, TN, UT, VT, VI, VA, WA, WY
1984	AK, AZ, CA, CT, HI, IN, IA, KY, MD, MI, MN, NV, NM, NC, OR, PR, SC, TN, UT, VT, VI, VA, WA, WY

*One or more quarters of data missing from totals.

Table A-5-Types of Inspection

<i>Federal OSHA</i>								
Fiscal year	Establishment inspection (number)	Fatality/ catastrophe (number)	Fatality/ catastrophe (percent)	Complaint (number)	Complaint (percent)	Programed (number)	Programed (percent)	
1973	48,409	2,454	5.1%	6,618	13.7%	32,207	66.5%	
1974	77,142	2,221	2.9	6,415	8.3	56,384	73.1	
1975	80,978	1,885	2.3	7,161	8.8	56,560	69.8	
1976	90,482	1,923	2.1	9,217	10.2	68,451	75.7	
1977	60,004	1,781	3.0	19,415	32.4	24,855	41.4	
1978	57,278	2,086	3.6	21,518	37.6	20,239	35.3	
1979	57,734	2,281	4.0	20,041	34.7	23,735	41.1	
1980	63,404	2,300	3.6	16,044	25.3	33,390	52.7	
1981	56,994	2,221	3.9	13,353	23.4	36,018	63.2	
1982	52,818	1,884	3.6	6,766	12.8	42,601	80.7	
1983	58,516	1,472	2.5	6,493	11.0	48,949	83.6	
1984 (Oct.-Mar.)	30,606	706	2.3	3,566	11.7	25,535	83.4	

State programs									
Fiscal year	Establishment inspection (number)	Fatality/ catastrophe (number)	catastrophe (percent)	Complaint (number)	Complaint (percent)	Programed (number)	Programed (percent)	Follow-up (number)	Follow-up (percent)
1976	166,612	4,278	2.6%	13,966	8.4%	119,120	71.5%	29,216	17.5%
1977	143,469	3,652	2.5	14,404	10.0	101,571	70.8	23,842	16.6
1978	122,761	4,609	3.8	15,467	12.6	81,762	66.6	20,923	17.0
1979	107,636	5,181	4.8	15,285	14.2	70,762	65.7	16,408	15.2
1980	106,191	5,264	5.0	13,823	13.0	72,899	68.6	14,168	13.3
1981	108,376	5,259	4.9	14,365	13.3	75,839	70.0	12,858	11.9
1982	92,942	4,663	5.0	10,721	11.5	68,100	73.3	9,455	10.2
1963	103,879	5,366	5.2	11,623	11.2	78,796	76.0	8,094	7.8
1984 (Oct.-Mar.)	51,072	2,849	5.6	5,754	11.3	39,085	76.5	3,384	6.6

SOURCE: Office of Technology Assessment, based on data supplied by OSHA.

Table A-6.—Inspections by Industry

Fiscal year	<i>Federal OSHA</i>						Other Industries (number)	Other Industries (percent)	
	Establishment inspections (number)	Construction (number)	Construction (percent)	Maritime (number)	Maritime (percent)	Manufacturing (number)			Manufacturing (percent)
1973	48,409	13,246	27.4%	7,811	6.1%	21,871	45.2%	5,481	11.3%
1974	77,142	26,820	34.8	5,457	7.1	33,541	43.5	11,324	14.7
1975	80,978	23,395	28.9	2,229	2.8	36,773	45.4	18,581	22.9
1976	90,482	23,639	26.1	1,647	1.8	39,566	43.7	20,630	22.8
1977	60,004	15,561	25.9	1,368	2.3	31,290	52.1	11,785	19.6
1978	57,278	14,561	25.4	1,335	2.3	29,969	52.3	11,413	19.9
1979	57,734	17,798	30.8	1,450	2.5	27,428	47.5	11,058	19.2
1980	63,404	26,317	41.5	1,078	1.7	27,189	42.9	8,820	13.9
1981	56,994	25,922	45.5	1,096	1.9	22,576	39.6	7,400	13.0
1982	52,818	29,313	55.5	848	1.6	18,030	34.1	4,627	8.8
1983	58,516	34,020	58.1	849	1.4	19,054	32.5	4,583	7.8
1984 (Oct.-Mar.)	30,606	18,217	59.5	362	1.2	9,234	30.2	2,783	9.1

State programs

Comparable data for State programs are not readily available

SOURCE: Office of Technology Assessment, based on data supplied by OSHA.

Table A-7.—Inspections With Violations; Inspections Contested

Fiscal year	Establishment inspections (number)	Inspections with serious violations		Inspections with willful violations		Inspections with repeat violations		Inspections with other-than-serious violations		Inspections contested	
		(number)	(percent)	(number)	(percent)	(number)	(percent)	(number)	(percent)	(number)	(percent)
1973	48,409	1,535	3.2%	18	0.0%	41	0.1%	23,814	49.2%	1,355	2.7%
1974	77,142	2,735	3.5	58	0.1	495	0.6	48,024	62.3	2,447	3.2
1975	80,978	3,335	4.1	104	0.1	1,175	1.5	50,985	63.0	3,188	3.9
1976	90,482	5,930	6.6	153	0.2	200	2.4	59,091	65.3	5,007	5.5
1977	60,004	11,000?	18.5	169	0.3	2,356	3.9	31,126	51.9	4,209	7.0
1978	57,278	14,620	25.5	428	0.7	2,191	3.8	25,257	44.1	5,414	9.6
1979	57,734	16,624	28.8	587	1.0	2,243	3.9	25,068	43.4	6,693	11.6
1980	63,404	19,358	30.5	595	0.9	2,021	3.2	27,366	43.2	7,390	11.7
1981	56,994	16,237	28.5	241	0.4	1,318	2.3	26,717	46.9	8,582	6.3
1882	52,818	12,852	24.3	86	0.2	810	1.5	26,187	49.6	1,470	2.8
1963	58,516	14,886	25.4	105	0.1	1,032	1.7	30,472	52.0	1,142	1.9
1964 (Oct.-Mar.)	30,806	8,156	26.7	65	0.2	610	2.0	15,201	48.7	584	1.9

State Programs

Fiscal year	Establishment inspections (number)	Inspections contested (number)	Inspections contested (percent)
1876	166,612	8,277	3.8%
1977	143,469	5,024	3.5
1878	122,761	4,703	3.8
1979	107,636	5,171	4.8
1860	106,191	4,308	4.1
1981	108,376	4,452	4.1
1862	92,942	3,292	3.5
1983	103,878	3,322	3.2
1964 (Oct.-Mar.)	51,072	1,686	3.3

Comparable data for state programs are not readily available

SOURCE: Office of Technology Assessment, based ON data supplied by OSHA.

Table A-8.—Violations by Type

Fiscal year	<i>Federal OSHA</i>							<i>State programs</i>						
	Serious violations (number)	Willful violations (number)	Repeat violations (number)	Other-than-serious violations (number)	Other-than-serious violations with penalty (number)	Total all violations (number)		Serious violations (number)	Willful violations (number)	Repeat violations (number)	Other-than-serious violations (number)	Other-than-serious violations with penalty (number)	Total all violations (number)	
1973	1,767	20	80	141,623	52,535	143,490								
1974	3,111	108	913	286,032	98,594	290,164								
1975	4,047	176	2,327	306,329	95,616	312,879								
1976	7,790	207	4,514	367,279	110,431	379,790								
1977	20,794	231	4,347	156,137	15,402	181,509								
1978	32,989	711	4,195	96,170	3,664	134,065								
1979	37,545	970	3,882	85,776	2,363	128,173								
1980	44,350	1,027	3,482	83,147	1,891	132,006								
1981	32,143	523	2,177	76,518	1,147	111,361								
1982	22,522	111	1,251	73,233	742	97,117								
1983	26,292	150	1,561	83,732	2,009	111,735								
1984 (Oct.-Mar.)	14,907	88	908	40,541	298	56,444								
1976	6,010	119	6,338	416,055	119,330	422,065								
1977	9,966	142	7,195	342,179	54,282	352,145								
1978	21,979	112	5,383	298,569	24,512	320,548								
1979	28,923	159	4,662	246,519	16,745	275,442								
1980	28,446	193	3,898	214,803	11,110	243,249								
1981	29,724	215	4,002	205,014	10,658	234,738								
1982	21,813	112	2,937	172,506	5,962	194,319								
1983	27,192	172	3,587	198,892	4,684	229,843								
1984 (Oct.-Mar.)	13,385	88	1,902	93,073	2,428	108,348								

SOURCE: Office of Technology Assessment, based on data supplied by OSHA.

Table A-9.—Percentage Distribution of Violations

<i>Federal OSHA</i>						
Fiscal year	Total all violations (number)	Serious violations (percent)	Willful violations (percent)	Repeat violations (percent)	Other-than-serious violations (percent)	Other-than-serious violations with penalty (percent)
1973	143,490	1.2%	0.0%	0.1%	98.7%	36.6%
1974	290,164	1.1	0.0	0.3	98.6	34.0
1975	312,879	1.3	0.1	0.7	97.9	30.6
1976	379,790	2.1	0.1	1.2	96.7	29.1
1977	181,509	11.5	0.1	2.4	86.0	8.5
1978	134,065	24.6	0.5	3.1	71.7	2.7
1979	128,173	29.3	0.8	3.0	66.9	1.8
1980	132,006	33.6	0.8	2.6	63.0	1.4
1981	111,361	28.9	0.5	2.0	68.7	1.0
1982	97,117	23.2	0.1	1.3	75.4	0.8
1983	111,735	23.5	0.1	1.3	74.9	1.7
1984 (Oct.-Mar.)	56,444	26.4	0.1	1.6	71.8	0.5

<i>State programs</i>						
Fiscal year	Total all violations (number)	Serious violations (percent)	Willful violations (percent)	Repeat violations (percent)	Other-than-serious violations (percent)	Other-than-serious violations with penalty (percent)
1976	422,065	1.4%	0.0%	1.5%	98.6%	28.3%
1977	352,145	2.8	0.0	2.0	97.2	15.4
1978	320,548	6.9	0.0	1.7	93.1	7.6
1979	275,442	10.5	0.1	1.7	89.5	6.1
1980	243,249	11.7	0.1	1.6	88.3	4.6
1981	234,738	12.7	0.1	1.7	87.3	4.5
1982	194,319	11.2	0.1	1.5	88.8	3.1
1983	229,843	11.8	0.1	1.6	86.5	2.0
1984 (Oct.-Mar.)	108,348	12.4	0.1	1.7	85.9	2.2

SOURCE: Office of Technology Assessment, based on data supplied by OSHA.

Table A-10.—Total Proposed Penalties

Fiscal year	Federal USMA						Total penalties collected ^a (dollars)
	Serious penalties (dollars)	Willful penalties (dollars)	Repeat penalties (dollars)	Failure to abate penalties (dollars)	Other-than-serious penalties (dollars)	Total penalties (dollars)	
1973	1,114,937	116,100	107,904	81,833	2,339,218	3,759,992	
1974	1,792,061	292,195	225,914	154,095	4,053,018	6,517,283	
1975	2,189,846	446,721	530,754	381,682	3,991,375	7,540,378	
1976	4,244,531	637,762	932,778	781,833	4,626,169	11,223,043	
1977	6,039,780	690,800	1,053,085	773,537	937,439	9,494,641	
1978	9,406,461	2,460,327	1,799,512	829,249	322,210	14,817,759	
1979	10,256,108	3,637,291	1,666,055	1,023,773	221,194	16,804,421	
1980	11,301,487	3,331,606	1,664,652	1,257,232	208,218	17,763,195	
1981	6,724,971	1,914,298	836,457	526,221	103,531	10,105,478	
1982	4,396,899	484,354	400,178	169,662	63,463	5,514,556	
1983	4,645,850	683,235	540,541	384,186	149,376	6,403,188	
1984 (Oct.-Mar.)	2,783,716	437,993	370,666	209,556	30,177	3,832,108	

Fiscal year	State programs						Total penalties collected ^a (dollars)
	Serious penalties (dollars)	Willful penalties (dollars)	Repeat penalties (dollars)	Failure to abate penalties (dollars)	Other-than-serious penalties (dollars)	Total penalties (dollars)	
1976	2,522,890	430,214	727,800	766,433	3,892,393	6,415,283	
1977	2,921,754	353,218	721,969	954,000	2,126,456	5,048,210	
1978	4,610,529	355,523	1,060,287	1,267,645	1,665,914	6,276,443	
1979	6,925,293	456,156	1,170,743	1,049,838	1,242,639	8,167,932	
1980	7,056,566	693,343	985,647	674,843	924,403	7,980,969	
1981	6,276,557	678,577	1,802,737	933,254	796,261	7,072,818	
1982	4,377,598	352,369	676,836	1,396,656	604,681	4,982,279	
1983	4,542,914	535,399	685,413	618,140	651,498	7,033,364	
1984 (Oct.-Mar.)	2,359,324	356,855	384,335	285,391	335,365	3,721,270	

^aPenalties collected in a year do not directly relate to penalties proposed in that year.

SOURCE: Office of Technology Assessment, based on data supplied by OSHA.

Not readily available

Table A-11.--Average Proposed Penalties

Federal OSHA						
Violations						
Fiscal year	Serious (average penalty)	Willful (average penalty)	Repeat (average penalty)	Other-than- serious (average penalty)	Average penalty per inspection	Average penalty per violation
1973	631	5,805	1,349	45	78	26
1974	576	2,706	247	41	84	22
1975	541	2,538	228	42	93	24
1976	545	3,081	207	42	124	30
1977	290	2,990	242	61	158	52
1978	285	3,460	429	88	259	111
1979	273	3,750	429	94	291	131
1980	255	3,244	478	110	280	135
1981	209	3,660	384	90	177	91
1982	195	4,364	320	86	104	57
1983	177	4,555	346	74	179	257
1984 (Oct.-Mar.) . .	187	4,977	408	101	211	68

State programs						
Violations						
Fiscal year	Serious (average penalty)	willful (average penalty)	Repeat (average penalty)	Other-than- serious (average penalty)	Average penalty per inspection	Average penalty per violation
1976,	420	3,615	115	33	39	15
1977,	293	2,487	100	39	35	
1978,	210	3,174	197	68	51	20
1979,	239	2,869	251	74	76	30
1980,	248	3,592	253	63	75	33
1981,	211	3,156	450	75	65	30
1982,	201	3,146	230	101	54	26
1963,	167	3,112	191	139	68	31
1984 (Oct.-Mar.) . .	176	4,055	213	138	73	34

SOURCE: Office of Technology Assessment, based on data supplied by OSHA.

Table A-12.—Occupational Safety and Health: Coverage of Workers

Agency	Type of workers covered	Number of workers covered	Basis for agency authority	Comments
<i>Department of Labor</i>				
Occupational Safety and Health Administration (OSHA) and State Programs approved by OSHA	All employees and working conditions except: Federal employees, and those covered by other governmental agencies according to other statutes	75,031 ,000 ^a (1979 estimate)	Occupational Safety and Health Act of 1970	In some cases, another Federal agency is responsible for only certain aspects of safety and health, and the same workers may be covered by OSHA for the remaining aspects (see e.g., NRC in this table)
Mine Safety and Health Administration (MSHA)	Coal, metal and nonmetal mining workers. All employees on mine property are covered	467,095 (1, 2 preliminary estimate) ^b	Federal Mine Safety and Health Act of 1977	
<i>Department of Transportation:</i>				
Bureau of Motor Carrier Safety (BMCS) (Federal Highway Administration)	Employees in, on, or about motor vehicles engaged in interstate commerce	Approximately 4.5 million ^c	Interstate Commerce Act	Does not include workers in repair garages, or workers on loading docks, who are all covered by OSHA
Federal Aviation Administration (FAA)	All flight crews; ground crews and mechanics during some activities	Approximately 170,000 ^d	Federal Aviation Act of 1956	Coverage of ground crews is the focus of a dispute between the FAA and OSHA
Federal Railroad Administration (FRA)	All operating employees, i.e., employees on rolling stock plus certain railroad yard employees	143,617 (1979 preliminary estimate) ^e	Federal Railroad Safety Act of 1970	
U.S. Coast Guard.	Seamen on Coast Guard-inspected and certificated vessels	About 100,000 ^f (1963 estimate)	The Marine Safety Laws	OSHA has jurisdiction over shipyard workers and longshoremen
<i>Other Federal Agencies:</i>				
Department of Energy (DOE).	Employees in Government-owned contractor operator (GOCO) facilities, e.g., those involved in research in nuclear energy, weapons research and production, production of enriched uranium.	116,323 ^g (1962 estimate)	Atomic Energy Act of 1954, as amended	DOE has adopted OSHA's health and safety regulations; DOE does not cover employees during initial construction of facilities
Nuclear Regulatory Commission (NRC)	Workers exposed to radiation hazards from materials licensed by the NRC, including: 1) source material (uranium and thorium); 2) special nuclear material (material capable of being fissioned); 3) by-products of a) fission; and b) tailings from uranium ore processing	327,350 ^h (1979 estimate)	Atomic Energy Act of 1954, as amended	NRC covers only radiation hazards; OSHA is responsible for all other safety and health aspects. NRC licenses State plans in some States, similar to OSHA State Programs

Table A-12.—Occupational Safety and Health: Coverage of Workers-Continued

Agency	Type of workers covered	Number of workers covered	Basis for agency authority	Comments
Federal Government departments and independent agencies	Each covers its own federally-employed workers.	6,271,736 ^(fiscal year 1962)	Occupational Safety and Health Act of 1970	Agency programs must be "consistent with" occupational safety and health standards promulgated by OSHA
Environmental Protection Agency	Mixers, loaders, and applicators of pesticides; farm field workers		Federal Insecticide, Fungicide, and Rodenticide Act	For mixers, loaders and applicators, protection from pesticide exposure is through labeling requirements. OSHA has jurisdiction for other health and safety aspects of these jobs.

^aOffice of Statistical Studies and Analysis, OSHA. Includes all private-sector employees covered directly by Federal OSHA and State Programs.

^bPersonal communication, MSHA, Mar. 3, 1983.

^cPersonal communication, BMCS.

^dPersonal communication, Air Transport Association and Regional Airline Association

^eYearbook of Statistics, *Facts*, June 1980.

^fPersonal communication, U.S. Coast Guard.

^gDOE, Rep@ of *Employment and Labor Turnover*, Sept. 30, 1982.

^hNRC, *Occupational Radiation Exposure, Twelfth Annual Report, 1979* (1982).

ⁱU.S. Department of Labor, *Federal Compliance Activity Report*, Jan. 4, 1983.

SOURCE: Office of Technology Assessment.

Table A-13. -Analyses of OSHA, NIOSH, and ACGIH Protective Levels

Substance (notes) (36)	OSHA TWA mg/m ³	OSHA ceiling mg/m ³	NIOSH TWA (1) mg/m ³	NIOSH ceiling mg/m ³	ACGIH TWA mg/m ³	ACGIH ceiling mg/m ³
Acetylene (10)	2,662	none	none	2,662	NONE	NONE
Acrylamide (35)	0.3	none	0.3	none	0.3	0.6
Acrylonitrile (11)	4.3	21.7	none	8.7	4.5	none
Aldrin/Dieldrin (12,27,35)	0.25	none	0.15	none	0.25	0.75
Alkanes: (14)						
Pentane	2,945	none	350	1,800	1,800	2,250
Hexane	1,800	none	350	1,800	180	none
Heptane	2,000	none	350	1,800	1,600	2,000
Octane	2,350	none	350	1,800	1,450	1,800
Allyl chloride	3	none	3.1	9.3	3	6
Ammonia		none	none	34.8		27
Antimony	0.5	none	0.5	none	0.5	none
Arsenic, inorganic compounds	0.01	none	none	0.002	0.2	none
Asbestos (9).....	2	10	0.1	0.5	2	none
Asphalt (petroleum) fumes	NONE	NONE	none	5		10
Benzene (2,16)	32	80	none	3.2	30	75
Benzoyl peroxide	5	none	5	none	5	none
Benzyl chloride	5	none	none	5	5	none
Beryllium (2,16)	0.002	0.005	0.0005	none	0.002	none
Boron trifluoride (13,15)	none	3	NONE	NONE	none	3
Cadmium, fume (2,23)	0.1	0.3	0.04	0.2	0.05	0.2
dust (2,23)	0.2	0.6	0.04	0.2	0.05	0.2
Carbaryl	5	none	5	none	5	10
Carbon black (18)	3.5	none	3.5	none	3.5	
Carbon dioxide (17)	9,000	none	18,000	54,000	9,000	27,000
Carbon disulfide (2)	62	93	3	30	30	none
Carbon monoxide	55	none	40	229	55	330
Carbon tetrachloride (2,16)	63	157	none	12.6	30	125
Chlorine	none	3	none	1.45	3	9
Chloroform (15,16)	none	240	none	9.78	50	225
Chloroprene (35)	90	none	none	3.6	45	none
Chromium (VI), water soluble(3)	0.5	none	0.025	0.05	0.05	none
Chromium (VI), insoluble (3)	1	none	0.001	none	0.05	none
Coal tar products (5)	0.2	none	0.1	none	0.2	none
Cotton dust(6)..	0.2	none	0.2	none	0.2	none
Cresol	22	none	10	none	22	none
Cyanide (17,35)	5	none	none	5	5	none
DDT (26,37,35)		none	0.5	none	1	3
1,2-dibromo-3-chloropropane (DBCP) (16,34)	0,0096	none	none	0.1	none	none
Diisocyanates:						
Toluene-2,4-diisocyanate (15)	none	0.14	0.035	0.14	0.04	0.15
Diphenylmethane diisocyanate (13,15)	none	0.2	0.05	0.2	none	0.2
Isophorene diisocyanate	NONE	NONE	0.045	0.18	0.09	none
Dinitro-ortho-cresol (35)	0.2	none	0.2	none	0.2	0.6
Dioxane (35).....	360	none	none	3.6	90	360
Epichlorohydrin (35)	20	none	2	19	10	20
Ethylene dibromide (2)	154	230	none	1	none	none
Ethylene dichloride (2)	202	405		8	40	60
Ethylene oxide (27,37)	90	none	90	135	2	none
Fibrous glass, (dust) (29)	15	none	5	none	10	none
Fluorides, inorganic(2)	2.5	none	2.5	none	2.5	none
Formaldehyde (2,13,16)	3.7	6	none	1.2	1.5	3
Furfuryl alcohol	200	none	200	none	40	60
Glycidyl ethers:						
Allylglycidyl ether (15)	none	45	none	45	22	44
n-Butyl glycidyl ether	270	none	none	30	135	none
Di-2,3-epoxypropyl ether (diglycidyl ether) (DIE)	none	2,8	none	1	0.5	none
Isopropyl glycidyl ether	240	none	none	240	240	360
Phenylglycidyl ether (PAGE)	60	none	none	5	6	none

Table A-13.--Analysis of OSHA, NIOSH, and ACGIH Protective Levels

Substance (notes) (36)	OSHA TWA mg/m ³	OSHA ceiling mg/m ³	NIOSH TWA (1) mg/m ³	NIOSH ceiling mg/m ³	ACGIH TWA mg/m ³	ACGIH ceiling mg/m ³
Hydrazines: (16)						
Hydrazine (16,35)	1.3	none	none	0.04	0.1	none
1,1-Dimethyl hydrazine (16,35),	1	none	none	0.15		2
Phenyl hydrazine (16,35)	22	none	none	0.6	20	45
Methyl hydrazine (13,15,16,35).	none	0.35	none	0.08	none	0.35
Hydrogen fluoride (2)						
Hydrogen fluoride (2)	2.45	none	2.5	5	2.5	5
Hydrogen sulfide (2,17)						
Hydrogen sulfide (2,17)	none	16	none	15	14	21
Hydroquinone						
Hydroquinone	2	none	none	2		4
isopropyl alcohol						
isopropyl alcohol.	980	none	984	1,968	9 2	1,225
Ketones:						
Acetone						
Acetone	2,400	none	590	none	1,780	2,375
Methyl ethyl ketone (MEK)						
Methyl ethyl ketone (MEK)	590	none	590	none	590	885
Methyl n-propyl ketone						
Methyl n-propyl ketone	700	none	530	none	700	875
Methyl n-butyl ketone						
Methyl n-butyl ketone	410	none	4	none	20	none
Methyl n-amyl ketone						
Methyl n-amyl ketone	465	none	465	none	235	465
Methyl isobutyl ketone						
Methyl isobutyl ketone.. . . .	410	none	200	none	205	300
Methyl isoamyl ketone (20)						
Methyl isoamyl ketone (20)	NONE	NONE	230	none	240	none
Diisobutyl ketone						
Diisobutyl ketone	290	none	140	none	150	none
Cyclohexanone						
Cyclohexanone	200	none	100	none	100	400
Mesityl oxide						
Mesityl oxide...		none	40	none	60	100
Diacetone alcohol						
Diacetone alcohol.	240	none	240	none	240	360
Isophorone (13)						
Isophorone (13)	140	none	23	none	none	25
Lead, inorganic (33)						
Lead, inorganic (33)	0.05	none	0.1	none	0.15	0.45
Malathion						
Malathion	15	none	15	none	10	none
Mercury, inorganic (2,4,24)						
Mercury, inorganic (2,4,24).	0.1	none	0.05	none	0.1	none
Methyl alcohol						
Methyl alcohol...	260	none	262	1,048	260	310
4,4-Methylene-bis-2-chloroaniline (MOCA) (8,27)						
4,4-Methylene-bis-2-chloroaniline (MOCA) (8,27)..	NONE	NONE	0.003	none	0.22	none
Methyl parathion						
Methyl parathion	NONE	NONE	0.2	none	0.2	0.6
Methylene chloride (2,19)						
Methylene chloride (2,19)	1,736	3,476	261	1,740	350	1,740
Nickel carbonyl (27)						
Nickel carbonyl (27)	0.007	none	0.007	none	0.35	none
Nickel, inorganic and compounds						
Nickel, inorganic and compounds	1	none	0.015	none	0.1	0.3
Nitric acid						
Nitric acid	5	none	5	none	5	10
Nitrides:						
Acetonitrile						
Acetonitrile	70	none	34	none	70	105
Tetramethyl succinonitrile						
Tetramethyl succinonitrile.	3	none	none	6	3	9
Nitrogen, oxides NO: (15)						
Nitrogen, oxides NO: (15)	none	9	none	1.8	6	10
(Nitric oxide) NO:						
(Nitric oxide) NO:	30	none	30	none	30	45
Nitroglycerin (15,16)						
Nitroglycerin (15,16)	none	2	none	0.1	0.5	
Ethylene glycol dinitrate (15)						
Ethylene glycol dinitrate (15).	none	1	none	0.1	0.3	0.6
Parathion						
Parathion	0.1	none	0.05	none	0.1	0.3
Phenol						
Phenol	19	none	20	none	19	38
Phosgene						
Phosgene	0.4	none	0.4	0.8	0.4	none
Polychlorinated biphenyls: (35)						
Chlorodiphenyl (42%)						
Chlorodiphenyl (42%)	1	none	0.001	none	1	2
Chlorodiphenyl (54%)						
Chlorodiphenyl (54%)		none	0.001	none	0.5	1
Refined petroleum solvents (7)						
Refined petroleum solvents (7).	2,950	none	350	1,800	NONE	NONE
Silica (quartz, respirable dust)						
Silica (quartz, respirable dust)	0.098	none	0.05	none	0.1	none
Sodium hydroxide (13)						
Sodium hydroxide (13)	2	none	none	2	none	2
Sulfur dioxide						
Sulfur dioxide	3	none	1.3	none	5	10
Sulfuric acid						
Sulfuric acid....	1	none	1	none	1	none
1,1,2,2-Tetrachloroethane (35)						
1,1,2,2-Tetrachloroethane (35)		none	6.87	none	7	35
Tetrachloroethylene (2)						
Tetrachloroethylene (2).	679	1,358	339	678	335	1,340
Thiols: (21)						
Butyl mercaptan						
Butyl mercaptan	35	none	1.8	none	1.5	none
Methyl mercaptan (15)						
Methyl mercaptan (15)	none	20	1	none	1	none
Ethyl mercaptan (15)						
Ethyl mercaptan (15).	none	25	1.3	none	1	3
Tin, organic compounds						
Tin, organic compounds	0.1	none	0.1	none	0.1	0.2
o-Toluidine (35)						
o-Toluidine (35)	22	none	none	0.02	9	none
Toluene (2,17)						
Toluene (2,17)...	753	1,129	375	750	375	560
1,1,1-Trichloroethane						
1,1,1-Trichloroethane	1,900	none	none	1,190	1,900	2,450
Trichloroethylene (2)						
Trichloroethylene (2)	536	1,072	134	none	270	1,080

Table A-13.—Analysis of OSHA, NIOSH, and ACGIH Protective Levels—Continued

Substance (notes) (36)	OSHA TWA mg/m ³	OSHA ceiling mg/m ³	NIOSH TWA (1) mg/m ³	NIOSH ceiling mg/m ³	ACGIH TWA mg/m ³	ACGIH ceiling mg/m ³
Tungsten: (31)						
insoluble compounds	NONE	NONE	5	none	5	10
soluble compounds	NONE	NONE	1	none	1	3
Vanadium, as V ₂ O ₅ (dust) (15,32)	none	0.5	none	0.5	0.5	none
(fume) (15,32)	none	0.1	none	0.05	0.05	none
Ferrovandium (32)	1	none	1	none	1	3
Vinyl acetate	NON E	NONE	none	15	30	80
Vinyl halides: (22)						
Vinyl bromide	NONE	NONE	none	4	20	none
Vinyl chloride	2.5	13	none	2.55	10	none
Vinylidene chloride	NONE	NONE	none	4	20	80
Xylene (17)	435	none	434	868	435	655
Zinc oxide (fume)	5	none	5	15	5	10

SOURCE Office of Technology Assessment

- NIOSH TWA recommendations are based on up to a 10-hour exposure unless otherwise indicated.
- Under OSHA regulations, the ceiling levels for these substances are labeled "Acceptable Ceiling Concentration." In addition, for each of these chemicals there is an "Acceptable Maximum Peak above the acceptable ceiling concentration for an 8-hour shift," which lists a third concentration level and maximum duration. Details can be found in table Z-2 in the OSHA Standards (29 CFR 1910.1000).
- Chromium (VI)**—There are several ways to separate chromium (VI) compounds into different classifications. The difficulty in comparing the recommendations and standards is that each organization uses different classifications. Chromium (VI) can be classified carcinogenic or not, soluble and insoluble, salts, and chromates. Chromic acid is chromium (VI) oxide and includes aqueous solutions thereof. The OSHA standard for chromium (VI) separates chromium into "soluble chromic and chromous salts" and "metal and insoluble salts," both having different PELs. These values can be found in OSHA table Z-2. There is a different PEL for chromic acid and chromates. The 1975 NIOSH criteria document for chromium (VI) revises the 1973 recommendations for Chromic acid, Chromic acid (or chromic acid anhydride) is an oxide of chromium (VI) and is classified as a noncarcinogenic chromium (VI). Under NIOSH recommendations, there are two recommended standards for chromium (VI). One standard addresses occupational exposure to a group of noncarcinogenic, but otherwise hazardous, chromium materials, while the other standard covers occupational exposure to other chromium materials that are associated with an increased incidence of lung cancer. However, there is no practical means of distinguishing between these two groups on the basis of chemical analysis of airborne materials. Until the airborne chromium in a particular workplace is demonstrated to be of the noncarcinogenic type, all airborne chromium is considered to be carcinogenic. ACGIH recommends two standards for chromium (VI) by separating the compounds into "water soluble" and "certain water insoluble" compounds which are labeled carcinogenic. However, the TLV is the same for both types. This comparison table deals with this ambiguity by listing two standards for chromium (VI): water soluble (non-carcinogenic), and insoluble, metal and salts (carcinogenic). Under the OSHA category, only the chromium values in the table Z-1 are used; chromic acid in table Z-2 is ignored.
- Mercury** Under the OSHA standards, mercury is listed in table Z-2. The PEL for mercury is 1 mg/10 m³. This is equal to 0.1 mg/m³.
- Coal Tar Products**—Protective Levels for coal tar products, or coal tar pitch volatiles, are misleading and difficult to compare because the methods of measuring exposure levels differ among OSHA, NIOSH, and ACGIH. The OSHA PEL addresses the benzene soluble fraction (anthracene, BaP, phenanthrene, acridine, chrysene and pyrene), as does the ACGIH recommended TLV. The NIOSH recommendation pertains to the cyclohexane extractable fraction. The comparison table contains all the protective levels but direct comparison is not applicable in this case.
- Cotton Dust**—OSHA standards for cotton dust are set out in 1910.1043 of the standards. There are three different standards for three major processes, yarn manufacturing, dashing and weaving, and all other operations. The PEL for yarn manufacturing is the most stringent, and this is the protective level that the comparison table lists. NIOSH has only one standard for cotton dust (described as lint-free cotton dust). ACGIH also recommends just one standard for "lint-free dust." According to all three standards (OSHA, NIOSH, and ACGIH), measurement of the exposure level is by the vertical elutriator cotton dust sampler.
- Refined petroleum solvents**—OSHA lists these substances simply as "petroleum distillates (naphtha)." The NIOSH recommendation controls exposure to petroleum ether, rubber solvent, varnish makers' and painters' naphtha, mineral spirits, Stoddard solvents and kerosene. The assumption is that the recommendation for these substances are equivalent and are measured the same way.
- 4,4'-Methylene-bis(2-chloroaniline)**—The OSHA standard for 4,4'-methylene-bis-2-chloroaniline (MOCA), section 1910.1005, was deleted from the OSHA standards on August 28, 1976. Both NIOSH and ACGIH recommend TWA protective levels for MOCA.
- Asbestos**—OSHA, NIOSH, and ACGIH measure asbestos concentration by the number of fibers longer than 5 micrometers per cubic centimeter of air; e.g., 2 fibers/cc > 5µm in length. In the comparison table the numbers are listed under mg/m³ for easy comparison, but they have not been converted to mg/m³. OSHA and NIOSH have one standard for asbestos, while ACGIH divides asbestos into four types with different recommendations for each. However, the standard for chrysotile (the most common) is used in the table. The rest of the ACGIH list contains amosite (0.5 fibers/cc > 5µm in length), crocidolite (0.2 fibers/cc > 5µm in length), and other forms (2 fibers/cc > 5µm in length). ACGIH does not indicate whether this is a TWA or ceiling TLV recommendation; in the comparison table it is placed under TWA.
- Acetylene**—The OSHA PEL for acetylene is not in the OSHA health standards list (29 CFR 1910.1000) but the NIOSH summary booklet does list one; this is the protective level used in the comparison table. There is an added note under the OSHA PEL, "10 percent of lower exposure limit," with no further explanation. The NIOSH recommendation for acetylene says, "Occupational exposure to airborne acetylene shall be controlled so that no employees will be exposed to acetylene at a concentration in excess of 2,500 ppm. This is not the same as an 'acceptable ceiling concentration.'" However, to allow some comparison among standards, the recommended TLV is in the ceiling column. ACGIH classifies acetylene as a simple asphyxiant; a TLV is not recommended because the limiting factor is the available oxygen. ACGIH accompanies the description of simple asphyxiants with warnings, including the additional fact that several simple asphyxiants present an explosive hazard.
- Acrylonitrile**—The OSHA PEL for acrylonitrile is in section 1910.1000 of the OSHA standards. In addition to the TWA and ceiling PELs, the standard states that "the employer shall assure that no employee is exposed to skin contact or eye contact with liquid acrylonitrile." ACGIH classifies acrylonitrile as a human carcinogen with an assigned TLV.
- Aldrin/Dieldrin**—NIOSH recommends an exposure level, the lowest reliably detectable level, 0.15 mg/m³ TWA by NIOSH validated method. All three organizations indicate that skin contact is to be avoided.
- The TLVs under ACGIH for the following chemicals are absolute ceiling limits, the concentration of which should not exceed the ceiling limit even instantaneously: boron trifluoride, diphenylmethane diisocyanate (MDI), methyl hydrazine, isophorone, sodium hydroxide, and formaldehyde. This fact should be taken into consideration when doing a direct comparison among recommendations and standards.
- Alkanes**—The NIOSH recommendation, unlike OSHA's or ACGIH's, have a protective level for mixtures of alkanes: no employee shall be exposed to individual C₅-C₈ alkanes or mixtures of these alkanes at ceiling concentrations greater than 1,800 mg/m³ as determined over a sampling time of 15 minutes.
- Under OSHA standards, the following substances have only ceiling PELs. Exposure to these chemicals "shall at no time exceed the ceiling level given for that material." The chemicals regulated in this way are: boron trifluoride, chlorine, chloroform, methylene-bisphenylisocyanate (MDI), toluene-2,4-diisocyanate, allylglycidyl ether (AGE), diglycidyl ether (EXE), methyl hydrazine, nitroglycerin, ethylene glycol dinitrate, nitrogen dioxide, thyl mercaptan, methyl mercaptan, and vanadium (dust and fume).
- Long maximum exposure**—The NIOSH recommendation for benzene and carbon tetrachloride lists the maximum time limit for exposure to concentrations at or above the ceiling limit as 60 minutes (not the usual 15 minutes). Other maximum time limits for exposure to concentrations at or above the NIOSH ceiling limit are as follows: beryllium (130 minutes), formaldehyde (30 minutes), hydrazines (120 minutes), chloroform (60 minutes), dibromochloropropane (30 minutes), and nitroglycerin (20 minutes).
- Short Maximum Exposure**—Under the NIOSH recommendation, the maximum time limit is 5 minutes for worker exposure to concentrations of ammonia at or above the acceptable ceiling limit. Other maximum time limits for exposure to concentrations

- ▼ or above the acceptable NIOSH ceiling limit are as follows: carbon dioxide (10 minutes), cyanide (10 minutes), hydrogen sulfide (10 minutes), toluene (10 minutes), xylene (10 minutes).
18. Carbon black—NIOSH has two recommended TWAs for carbon black. When carbon black is in the presence of polycyclic hydrocarbon, the recommended TWA is 0.1 mg/m³. In all other exposures, the recommended TWA for carbon black is 3.5 mg/m³ and this is the value listed in the comparison table.
 19. Methylene chloride—Under the NIOSH recommendation for methylene chloride the ceiling (900 ppm) is to be lowered in the presence of carbon monoxide.
 20. Ketones—OSHA does not set a standard for Methyl isobutyl ketone.
 21. Thiol and mercaptan are synonyms. OSHA uses the name mercaptan and has standards for only three of these compounds. NIOSH labels them thiols and recommends standards for 16 thiols. In addition, NIOSH makes ● note that "mixtures of thiols are to be controlled by calculation of equivalent concentrations." The comparison table only contains the TLVs for the three thiols that are covered by all three organizations.
 22. Vinyl halides—in the summary of NIOSH Recommendations, vinyl halides are classified III one category; the note under the exposure limit states "as promulgated for vinyl chloride. In 29 CFR 1910.1017 with eventual goal of zero exposure." In the Joint NIOSH/OSHA Current Intelligence Bulletin 28 d Sept. 21, 1978, the vinyl halide exposure standards specify exposure limits for four vinyl halides monomers in addition to vinyl chloride: vinyl bromide, vinylidene chloride, vinylidene fluoride, and vinyl fluoride. (These are listed in the comparison table.) The NIOSH recommendation includes the suggestion that occupational exposure to vinyl bromide and vinylidene chloride be reduced to the lowest possible levels because they are suspected carcinogens. In the OSHA standards for toxic and hazardous substances there are no standards for these four vinyl halides, either singly or as a group. However, the summary of NIOSH recommendations lists the OSHA standard for vinyl halides as ● group as 1 ppm TWA and 5 ppm ceiling protective level. These are the protective levels used in the comparison table.
- ACGIH does ● have ● recommended exposure limit for vinyl halides as ● group but does have recommendations for two members of the group; vinyl bromide and vinylidene chloride. The ACGIH recommendation for Vinyl bromide carries an added warning that it has suspected carcinogenic potential for man.
23. Cadmium—The OSHA standards separate cadmium into dust and fumes, and five different PELs for each. The summary of NIOSH recommendations also separates cadmium into dust and fumes. However, comparing these recommendations to ACGIH TLVs is more difficult. ACGIH lists "cadmium, dusts and salts, as Cd" and "cadmium Oxide, fume, as Cd" and "production." Cadmium oxide fume has ● ceiling limit of 0.05 mg/m³ under ACGIH. The comparison table uses the protective levels for cadmium dust and salts for comparison to both OSHA and NIOSH protective levels.
 24. Mercury—NIOSH and OSHA have only one classification for mercury, which is "inorganic." ACGIH divides mercury into three categories, each with different TLVs; alkyl compounds, all forms except alkyl vapor, and aryl and inorganic compounds. In the comparison table, the exposure limit for aryl and inorganic compounds is used to compare with NIOSH and OSHA protective levels.
 25. Nickel—The OSHA standards label nickel as "metal and soluble compounds, n Ni." The summary of NIOSH recommendations describes nickel as "inorganic and compounds." ACGIH separates nickel into two groups, "metal" and "soluble compounds, as Ni." The latter classification is used in the comparison table.
 24. DDT—The NIOSH recommendation for DDT, as described in the summary of recommendations, reads as follows: "Lowest reliably detectable level; 0.5 μl/ml TWA by NIOSH validated method. Skin contact to be avoided."
 27. The following substances are labeled "special hazard review" by NIOSH: aldrin/dieldrin, benzene-based dyes, chrysene, DDT, ethylene oxide, ethylene thiourea, 4,4'-methylene-bis (2-chloroaniline), and nickel carbonyl.
 28. Nitriles—The summary of NIOSH recommendations notes, ● t the bottom of the list of nitrile recommendations, that "when present as mixtures or with other sources of cyanide, exposure to be considered additive and environmental limit to be calculated." NIOSH recommends TLVs for ten nitrile compounds; TWA values for six compounds and ceiling values for three compounds. OSHA and ACGIH set TLVs for only two nitrile compounds. The comparison table includes all three nitrile compounds for which NIOSH sets ceiling TLVs.
 29. Fibrous glass—The OSHA standard for fibrous glass is listed in the summary of NIOSH recommendations, but not in the OSHA standards. In the OSHA standard, fibrous glass is classified as "nuisance dust" and measured by respirable fraction. NIOSH classifies fibrous glass as "total fibrous glass." ACGIH simply classifies it as "fibrous glass dust."
 30. Silica—Standards and recommendations for silica are complex; usually utilizing formulas for different percentages of silica or quartz in respirable dust. The measure is usually μg/m³. In the comparison table, the "wont case" standard or 100% silica is used as the comparison among the three organizations. The NIOSH recommendation for silica is ● single TLV. OSHA and ACGIH TLVs for silica are calculated by ● formula, and the standard changes according to the percent quartz in respirable dust. The 198344 ACGIH recommendations no longer require that a formula be used to measure exposure, instead ACGIH has simplified the table to show numerical TLVs. In the OSHA standards, silica formulas for the standards are covered in table z-3.
 31. Tungsten-Ten ● re no OSHA standards for tungsten. NIOSH divides tungsten into four categories. Both NIOSH and ACGIH have recommendations for soluble and insoluble tungsten and these are included in the comparison table. NIOSH also recommends TLVs for "dust of cemented tungsten carbide that is 2 percent cobalt (0.1 mg/m³ TWA) and for "dust of cemented tungsten carbide that of 0.3 percent nickel (15 μg (nickel)/m³ TWA).
 32. Vanadium—The OSHA standards separate vanadium into vanadium pentoxide dust and fume (1/10), and ferovanadium dust which is listed separately in the OSHA table. NIOSH recommends the same standard for vanadium compounds (without further description), and metallic vanadium and vanadium carbide. The NIOSH recommended TLV for metallic vanadium is used in the comparison table under ferovanadium. ACGIH, like OSHA, classifies vanadium or vanadium pentoxide as respirable dust and fume, and ferovanadium.
 33. Lead—The OSHA standard for lead has ● TWA TLV. In addition, there is ● formula to determine the TLV for exposures over 8 hour, long. NIOSH has only a recommended ceiling limit. ACGIH describes lead exposures as inorganic fume and dust and recommends TWA and ceiling TLVs.
 34. 1,2-dibromo-3-chloropropane—The OSHA standard for DBCP can be found in section 1910.1044 of the OSHA standards. Eye contact and skin contact with DBCP are prohibited and to be ● olded. In addition, OSHA notes that it has been known to cause sterility in humans and is ● potential cancer risk. NIOSH recommends a ceiling protective level of 0.1 mg/m³ for a maximum of 30 minutes. ACGIH does not have ● recommended standard for DBCP.
 35. In the OSHA standards the following chemicals are listed indicating that skin contact to be avoided: acrylamide, aldrin/dieldrin, chlorodiphenyl (both 42 percent and 54 percent), chloroprene, cyanide, DDT, 1,1-dimethylhydrazine, dinitro-ortho-cresol, dioxane, epichlorohydrin, hydrazine, malathion, methylhydrazine, Nitroglycerin (both), phenyl hydrazine, parathion, phenol, 1,1,2,2-tetrachloroethane, o-toluidine.
 36. The following groups of hazards can be found in the NIOSH summary of recommendations, but they are not included in the comparison table: decomposition products of fluorocarbons, pesticide manufacturing and formulation, ultraviolet radiation, and waste anesthetic gases and vapors, ethylene thiourea, chrysene, and benzene-based dyes.
 37. In 1983 OSHA held hearing on ● proposed revision to its ethylene oxide standard. At those hearings NIOSH recommended that OSHA should set ● PEL lower than 0.1 ppm as an 8-hour TWA and 5 ppm as ● ceiling limit for ● period of 10 minutes. In June 1984, OSHA issued ● final standard of 1 ppm or 2 mg/m³ for an 8-hour TWA, but did not issue a ceiling limit. That revised recommendation and revised standard have not been incorporated in the table or the comparison.