Industrial Hygiene Overview for Chemists and Chemical Managers

Application Note

Atomic Absorption

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Introduction

The primary purpose of this industrial hygiene (IH) overview is to provide basic information related to monitoring worker exposure to chemical contaminants in the workplace. It was prepared both as an introduction and as a brief reference to the major IH organizations and terminology pertinent for professional analysts and laboratory managers responsible for the analysis of IH samples. This is one of many supplements in the Agilent Instruments at Work series specifically dedicated to IH analyses.

Industrial Hygiene: Why Should the Analyst Care?

Passage and implementation of the Occupational Safety and Health Act (OSHAct) of 1970 has caused many analysts to become involved with industrial hygiene monitoring of worker exposure to numerous chemical substances in all types of industrial or occupational environments. Usually the analyst works directly with an industrial hygienist or environmental health engineer. However, many small companies concerned with the health of their employees and their legal responsibilities under the OSHAct may expect their chemical analyst to undertake the surveillance testing required by federal regulations. In either case, a familiarity with the various organizations and terms involved in industrial hygiene enhances the ability of the analyst to better understand and perform more fully the analytical tasks necessary for compliance with federal, state, and local regulations that have resulted from implementation of the OSHAct.

Industrial Hygiene: What is it?

Industrial hygiene is the science of protecting man's health by control of the work environment. Its threefold scope includes recognition of any work-related health hazard, evaluation of either its long-term or Short-term effects on a worker's health

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and well-being, and development of corrective procedures to eliminate or alleviate its adverse effects.

Generally, large companies employ industrial hygienists, environmental health engineers, and safety engineers to implement the IH monitoring and corrective procedures necessary to ensure maximum worker protection. Smaller companies often depend upon the services available from government agencies or retain IH consultants.

OSHAct: What's the Law?

The provisions of the OSHAct, which became effective April 28, 1971, apply to every employer engaged in interstate commerce in all fifty states, the District of Columbia, and all U.S. territories. Its declared Congressional purpose is:

> "To assure safe and healthful working conditions for working men and women; by authorizing enforcement of the standards developed under the act; by assisting and encouraging the States in their efforts to assure safe and healthful working conditions; by providing for research, information, education, and training in the field of occupational safety and health; and for other purposes."

Under the terms of this act, the federal government was authorized to develop and set mandatory occupational safety and health standards. The Department of Labor (DOL) became responsible for promulgating and enforcing the standards and the Department of Health, Education, and Welfare (DHEW) gained the responsibility for implementing educational and training programs.

The full scope of the act includes recognition, evaluation, and correction of any job-related health problem due to chemicals (liquid, dust, powder, fume, mist, vapor, or gas), physical energy (electromagnetic and ionizing radiations), extremes of noise, vibration, temperature, and pressure, biological entities (insects, molds, yeasts, fungi, bacteria, and viruses), and ergonomic stresses (monotony, repetitive motion, anxiety, fatigue).

The OSHAct specifies that monitoring programs be implemented by employers to protect workers from short term exposures to high concentrations of hazardous chemicals as well as long term chronic exposure to relatively low concentrations. Consequently, health standards often include both limits for daily doses or time weighted average concentrations over a work shift and limits for short durations of time. Employers must currently protect employees from overexposure to more than 400 substances (about seventy are inorganic) for which permissible exposure standards exists. Furthermore, employers must maintain accurate records of any employee exposure to any toxic substance covered by a standard. Severe penalties may result from failure to comply with these and other provisions of the OSHAct.

Organizations of Importance: Whom Should We Know?

The federal agencies and professional organizations of major importance for those involved with IH are listed in Table 1. The two main federal agencies are OSHA (Occupational Safety and Health Administration) and NIOSH (National Institute for Occupational Safety and Health).

Table 1. IH Agencies and Organizations

Acronym	Name and Description
OSHA	Occupational Safety and Health Administration: Government agency which establishes, promulgates, and enforces health standards; sets PELs
NIOSH	National Institute for Occupational Safety and Health: Governmental agency which performs research to establish criteria for health standards recommended in Criteria Documents; offers educational materials and programs; administers PAT Program (Proficiency Analytical Testing)
MSHA	Mine Safety and Health Administration: Similar to OSHA but limited to mining industries
ACGIH	American Conference of Governmental Industrial Hygienists: Professional association with membership limited to professional personnel in government agencies or educational institutions engaged in IH; sets TLVs
AIHA	American Industrial Hygiene Association: Non profit society for IH personnel; offers technical and topical IH information and training; administers Laboratory Accreditation Program

OSHA

Federal Agency

OSHA, a branch of the DOL under the Secretary of Labor, is primarily responsible for implementing the OSHAct. Its functions include promulgation of safety and health standards. It can also modify or revoke existing standards and compliance procedures. In addition, OSHA has the delegated authority to conduct inspections and investigations, issue citations for non compliance which include proposed penalties, require employers to maintain safety and health records, petition courts to restrain imminent danger situations, and approve or reject requests for state OSHA programs.

State Agencies

Although OSHA was originally set up as a federal agency, upon the approval of the Secretary of Labor, a number of states (see Table 2) have assumed full responsibility for implementation of the OSHAct. Consequently, employers, industrial hygienists, and analysts must determine whether they are subject to federal or state OSHA regulation. This is especially important in those states which may have more stringent standards and compliance procedures than those established by the federal OSHA.

Table 2. States Comprising Each OSHA Region

Region	States/Territories
1	Connecticut*, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont*
2	New Jersey, New York, Puerto Rico*, Virgin Islands*
3	Delaware, District of Columbia, Maryland*, Pennsylvania, Virginia*, West Virginia
4	Alabama, Florida, Georgia, Kentucky*, Mississippi, North Carolina*, South Carolina*, Tennessee*
5	Illinois, Indiana*, Minnesota, Michigan**, Ohio, Wisconsin
6	Arkansas, Louisiana, New Mexico*, Oklahoma, Texas
7	Iowa*, Kansas, Missouri, Nebraska
8	Colorado, Montana, North Dakota, South Dakota, Utah*, Wyoming**
9	Arizona, California**, Hawaii**, Nevada, Guam, American Samoa, Trust Territory of the Pacific Islands
10	Alaska**, Idaho, Oregon**, Washington**

*State which has separate agency to administer OSHAct activities

**State which has more stringent or more comprehensive compliance program than federal OSHA

Enforcement Powers

Employers must admit OSHA compliance officers for inspections even without advance notice. A search warrant may be required.

When violations are found, OSHA can issue citations and assess penalties of up to $1,000 per violation.

OSHA can inspect certain records such as those covering industrial inquiries and illnesses or analytical determinations.

Under conditions of "imminent danger" OSHA compliance officers can request the shutdown of an operation. If refused, the officer notifies employees of the hazard and the DOL can obtain court action to shut the operation down.

An independent Occupational Safety and Health Review Commission (OSHRC) rules on appeals from employers and employees for some OSHA actions. Only a court can invoke criminal penalties for OSHA violations.

Publications

OSHA provides a number of publications covering both general and specific aspects of occupational safety and health. The General Industry Standards and Interpretations (GISI) publication contains all job safety and health rules and regulations pertaining to industry in general. The chemical exposure standards are listed as Part 1910, Occupational Safety and Health Standards (see Table 3). These were originally published in the Federal Register (FR). They were subsequently published as Title 29 in the Code of Federal Regulations (CFR). If any conflict or inconsistency occurs between the two, however, the FR takes precedence as the official publication.

Table 3. Part 1910, Occupational Safety and Health Standards; Subpart Z Toxic and Hazardous Substances

Standard	Substance
1910.1000	Air Contaminants. (ACGIH 1968 TLVs)
1910.1001	Asbestos
1910.1002	Coal tar pitch volatiles; interpretation of term
1910.1003	4 Nitrobiphenyl
1910.1004	alpha Naphthylamine
1910.1005	4,4′ Methylene bis(2 chloraniline)
1910.1006	Methyl chloromethyl ether
1910.1607	3,3′ Dichlorobenzine (and its salts)
1910.1008	bis Chloromethyl ether
1910.1009	beta Naphthylamine
1910.1010	Benzidine
1910.1011	4 Aminodiphenyl
1910.1012	Ethyleneimine
1910.1013	beta Propiolactone
1910.1014	2 Acetylaminofluorene
1910.1015	4 Dimethylaminoazobenzine
1910.1016	N Nitrosodimethylamine
1910.1017	Vinyl Chloride
1910.1018	Inorganic arsenic
1910.1025	Lead
1910.1028	Benzene
1910.1029	Coke Oven Emissions
1910.1043	Cotton dust
1910.1044	1,2 dibromo 3 chloropropane
1910.1045	Acrylonitrile
1910.1046	Exposure to cotton dust in cotton gins

NIOSH

Federal Agency

NIOSH was established within the DHEW's Center for Disease Control (EDC) the Public Health Service to perform the research and educational functions specified by the OSHAct. More specifically, NIOSH is authorized to evaluate all available research data as well as conduct additional research and experimental programs to determine the effects of occupational exposure to chemical and physical hazards. Subsequently, NIOSH proposes to OSHA viable safety and health standards based upon the toxicological, epidemiological, and analytical evidence obtained. The proposals are given to OSHA in "Criteria Documents".

Criteria Documents are highly detailed publications (available from the DHEW) generated and intended by NIOSH to provide valid unbiased technical support for the recommended safety and health standards it proposes to OSHA. These publications summarize and derive from the critical evaluation of all the known, relevant, published or otherwise publicly available medical, biological, chemical, engineering, and trade information and data utilized to establish the proposed health standards.

They include a detailed discussion and literature review of the biological effects of exposure to a given substance, the recommended medical, work, and sanitation practices, monitoring and record keeping techniques, engineering controls and personal protection methods, as well as the recommended sampling and analytical methods for a given type or class of chemical compound, element, or substance. Upon completion of a criteria document by NIOSH, OSHA establishes and promulgates legal enforceable standards based upon the information and proposed standards contained in the document itself.

Training

In addition to its evaluation and research function, NIOSH, through its Division of Training and Manpower Development, offers IH training programs and courses that may substantially benefit analysts responsible for IH laboratories and analyses.

Publications

Another DHEW function carried out by NIOSH is publication of industry wide studies of worker exposure to materials, processes, and stresses which may cause health and disability problems. NIOSH also publishes annually a list of all known toxic substances and their toxic concentrations. In conjunction with this publication, NIOSH also determines whether any substance newly found in the work place has any potentially toxic effects. Analysts, industrial hygienists, and managers concerned about proposed standards often use these publications.

The NIOSH publication of greatest interest to IH analysts involved with the analytical methodology for sampling and analyzing a particular substance or group of substances is the NIOSH Manual of Analytical Methods (NMAM) which details about 450 different analytical procedures developed and/or evaluated by NIOSH chemists. Many are adaptations of procedures found in the literature and may periodically be modified as new developments in analytical methodology occur. Use of these methods to evaluate worker exposure to airborne contaminants is not mandatory. Any analytical method meeting the accuracy requirements for an OSHA standard may be utilized for IH monitoring purposes.

Method Classification

NIOSH classifies each NMAM procedure according to the quality and extent of the data supporting it. Table 4 lists the five classes that comprise a guide to the confidence NIOSH recommends one should place in them. Only a few methods are found in Class A. The majority are in Class B which require that the method be within +25% of the true value over the range 1/2 to 2 times the standard for 95% of the samples. Additional specifications may also be involved. Class C methods are neither officially recommended nor accepted by NIOSH although they are expected to be good methods that only require establishment of their accuracy and precision. Since a strong need in the field for some particular new or unevaluated method of analysis may occur, Classes D and E contain methods considered useful but not officially endorsed by NIOSH. Law currently requires none of the five classes of methods for IH monitoring of worker exposure to chemical substances. As published in the NMAM, however, these methods provide step by step instructions on how to sample and analyze for toxic chemicals in the workplace. They are, therefore, a good starting point for analysts needing a method for their particular IH application.

Table 4. NIOSH Classification of Analytical Methods

Classification	Analytical method
Class A	Recommended–an analytical method fully evaluated and successfully, collaboratively tested by a selected group of laboratories.
Class B	Accepted–an analytical method subjected to a thorough evaluation procedure in the NIOSH laboratory and found to be acceptable.
Class C	Tentative–an analytical method widely used and adopted or recommended by another government agency or one of several professional societies.
Class D	Operational–an analytical method partially evaluated which shows promise of being found acceptable.
Class E	Proposed–a new, untested analytical method.

Proficiency Analytical Testing

NIOSH also provides IH laboratories with a quality assurance service called the Proficiency Analytical Testing (PAT) Program. The primary objective of this service is to assist participating laboratories in improving analytical performance. An additional associated objective is to determine the analytical competence of a laboratory using the conventional IH analytical procedures recommended by NIOSH as well as unspecified or unconventional methods. Upon enrollment in the program, a laboratory receives and analyzes bimonthly samples utilizing its normal operational procedures. NIOSH evaluates the results, compares them statistically with those from other laboratories for the same type of samples, and notifies each laboratory of their performance relative to the others. Due to budgetary and manpower constraints, participation in the NIOSH PAT Program is limited to the laboratory types listed in Table 5.

Table 5. Laboratories eligible for PAT Program

Laboratory	Description
Government	(local, state, and federal)
University	(public and private)
Private	providing analytical services under government contract
Private	participating in the Laboratory Accreditation Program of the American Industrial Hygiene Association

A number of alternatives to the PAT Program exist for ineligible laboratories wanting proficiency testing as a part of their overall laboratory quality assurance program. They can, for example, send duplicate samples to private accredited laboratories as a check against their own results. This, of course, is not as statistically favorable.

As another alternative, analysts concerned with quality assurance may obtain reliable reference standards for internal quality control from the National Bureau of Standards (NBS). Over 900 Standard Reference Materials are available.

Other unrestricted testing programs operated by the federal government for environmental or chemical proficiency may also be valuable for some IH laboratories. The CDC and the Environmental Protection Agency (EPA) provide programs in chemistry (including blood lead) and air analysis. The appropriate agency (listed in Table 7) should be contacted for further information. Although IH analysts may utilize one or more of these alternative approaches, the NIOSH PAT program is the only government program designed specifically for proficiency testing in IH laboratories.

MSHA

The Federal Mine Safety and Health Act of 1977 set up the Mine Safety and Health Administration (MSHA) in the DOL under the Secretary of Labor to replace the Interior Department's Mine Enforcement and Safety Administration (MESA). In structure and function, MSHA is analogous to OSHA, but its jurisdiction is limited to the mining industry. It also depends on NIOSH for Criteria Documents to establish mining safety and health standards.

ACGIH

The American Conference of Governmental Industrial Hygienists (ACGIH) is a professional association organized in 1938 with membership limited to professional personnel in governmental agencies or educational institutions engaged in occupational safety and health programs. Its importance to IH analysts derives from its publication of Threshold Limit Values (TLVs) for chemical substances in workroom air. The 1968 TLVs for worker exposure to air contaminants (section 1910.1000 in Table 3) were adopted as the standards promulgated under the OSHAct and remain in force now except for a few amendments, additions, and deletions. Although the conference is not an official government agency, this professional organization generates much IH terminology and many of the established or recommended health standards and practices.

AIHA

The American Industrial Hygiene Association is a non profit society for persons engaged in occupational safety and health activities. Although mainly comprised of industrial hygienists, its membership also includes toxicologists, physicians, chemists, physicists, and engineers. Four types of member-

ship grades are offered depending upon the applicant's education, experience, and level of IH involvement.

AIHA offers technical and topical IH information through its monthly and bimonthly publications as well as its series of manuals and guides. In addition, it sponsors periodic workshops, seminars, and courses throughout the U.S. AIHA also continually maintains informational and training programs in cooperation with OSHA and NIOSH and serves as a resource for IH standards and guidelines.

A major AIHA function, designed primarily to assist IH laboratories in achieving and maintaining the highest possible level of professional performance, is its Laboratory Accreditation Program. The stringent criteria for acceptance into the program include specific definition of laboratory facilities, personnel qualifications, quality control procedures, as well as detailed filing and record keeping procedures for tracking sample throughput and equipment calibration. Accreditation also includes regular laboratory evaluations based upon on site visitation of the laboratory and laboratory participation in the NIOSH PAT program.

Exposure Limits: What are the Standards?

Allowable or recommended worker exposure limits to chemical substances in the workplace are commonly indicated by the terms and abbreviations listed in Table 6. For most substances, these standards are listed as the weight of contaminant per volume of air in units of milligrams or micrograms per cubic meter of air or in parts per million. As defined by OSHA and the ACGIH, they refer to the conditions and concentrations of airborne contaminants to which most workers may be exposed without detrimental effect. The various conditions denoted by these exposure limits place constraints on the sampling and analytical procedures analysts must employ to successfully monitor airborne contaminant concentrations in industrial environments. Consequently, a thorough understanding of these terms should facilitate proper selection of the specific analytical methodology required for IH analyses.

Table 6. Exposure Limits for Air Contaminants

PEL:	PERMISSIBLE EXPOSURE LIMIT–Maximal contaminant concentration in milligrams or micrograms per cubic meter of air; legal exposure limit promulgated by OSHA
TLV:	THRESHOLD LIMIT VALUE–Limit recommended by ACGIH; similar to PEL but not always established as law by OSHA
TWA:	TIME WEIGHTED AVERAGE–Average exposure over 8 hour work shift or 40 hour workweek
STEL:	SHORT TERM EXPOSURE LIMIT–Maximal exposure for up to 15 minutes; (ACGIH term)
CEILING:	Contaminant concentration which should never be exceeded
PEAK:	Excursion concentration above ceiling permitted for very short time period (usually 5 or 10 minutes) at intervals of 2 hours or longer; specified by OSHA for about twenty substances
AL:	ACTION LEVEL–Cut off point for certain OSHA compliance activities; abbreviation seldom used

PEL

The maximal average concentration of an air contaminant to which a worker may be legally exposed per OSHA regulation is called the Permissible Exposure Limit or PEL. Although Title 29 CFR 1910.1000, Air Contaminants, which is also listed in OSHA's GISI publication, lists permissible exposures to toxic and hazardous substances without reference to the term PEL, later additions to the CFR and the FR do utilize this term. It is also frequently used in the field.

TLV

Industrial hygienists often refer to the Threshold Limit Values or TLVs published annually by the TLV committee of the ACGIH. These values indicate the maximum concentrations of substances in industrial air believed to cause no adverse effect on workers.

The terms TLV and PEL both refer to the same concept maximum worker exposure to a chemical contaminant, and indeed, they are sometimes used interchangeably. However, PEL as promulgated by OSHA indicates the legal exposure limit whereas TLV refers to the exposure recommended by the ACGIH. The TLVs for 1968, however, became official federal standards with passage of the OSHAct and were published in the FR (Vol. 36, No. 105, May 29, 1971). Section 29 CFR 1910.1000, Air Contaminants, is now comprised of the July 1, 1976 revision of these values. Although the ACGIH has added about 200 substances to that original TLV list, federal OSHA law does not currently cover them. Furthermore, many of the current TLV values differ from the OSHA values.

TWA

Both PELs and TLVs are generally stipulated as a Time Weighted Average (TWA) concentration over a normal 8 hour work shift or 40 hour workweek. Workers can usually be exposed repeatedly to this average concentration day after day with no ill effects. The TLV-TWA is one of three categories of TLVs specified by the ACGIH.

STEL

A second TLV category as defined by the ACGIH is the Threshold Limit Value Short Term Exposure Limit or TLV-STEL. This is the maximum concentration to which workers may be continuously exposed for a period up to 15 minutes. The conditions of an STEL also limit worker exposure to no more than four excursions per day with a minimum of 60 minutes between exposure periods at the STEL. In addition, the TLV-TWA must also not be exceeded.

CEILING

Some of the OSHA and ACGIH exposure limits may also stipulate that a ceiling exists for worker exposure. This is the concentration that may not be exceeded even instantaneously during the work shift. ACGIH specifies the Threshold Limit Value Ceiling (TLV-C) as its third TLV category. In both OSHA (29 CFR 1910.100, Table A-1, Air Contaminants) and ACGIH contaminant listings, the letter "C" precedes any material having this exposure limit. Frequently, however, due to the lack of sufficient analytical sensitivity for an "instantaneous" measurement, a 15 minute sampling period is utilized for ceiling measurements. Consequently, the phrase "15 minute ceiling" is often heard. Nevertheless, no excursions above the ceiling are permitted (in contrast to the TLV-STEL) and the 15 minute time interval refers only to a practical sampling consideration necessary to enable utilization of some specific analytical procedure.

PEAK

For about twenty substances, OSHA separately designates (Table Z-2 of 29 CFR 1910.1000) an "8 hour time weighted average" and an "acceptable ceiling concentration" which correspond to the TWA and ceiling definitions stated previously. However, most of these same substances also have an "acceptable maximum peak above the acceptable ceiling concentration for an 8 hour shift" designated for a specific time period. This "peak" concentration limit is essentially an allowed excursion value for these contaminants. For example, beryllium has a PEL-TWA of 2 $\mu g/m^3$ and an acceptable ceiling of 5 $\mu g/m^3$. However, exposures up to 25 $\mu g/m^3$ are permitted for a maximum of 30 minutes during an 8 hour work shift. This is the "peak" concentration limit.

ACTION LEVEL

OSHA believes employers should implement certain protective actions prior to exceeding PELs. Consequently, FR entries for certain substances, for example, arsenic, refer to an Action Level (AL) which is usually about one half the PEL value. This exposure level provides a cut off point for many compliance activities such as the continuous monitoring and medical surveillance requirements that are detailed in the CFR and the GISI. The AL concept provides, therefore, an objective means for employers to determine what additional actions they must take to remain in compliance with a standard.

Medical Surveillance: Is Biological Monitoring Required?

Means other than air sampling exist for monitoring worker exposure to toxic chemicals, namely, biological monitoring. The ACGIH has defined Biologic Limit Values (BLVs) for worker exposures determined by analysis of body fluids, tissues, and exhaled breath. A worker's overall exposure as well as individual and characteristic responses can be obtained. More specifically, exposures may be determined by measurement of (1) the amount of contaminant in blood, urine, hair, nails, and other body tissues and fluids; (2) the amount of metabolite(s) of the contaminating substance in these same tissues and fluids; (3) the amount of contaminant in exhaled breath. For some substances (for example, exposure to lead), biological monitoring is required by OSHA. The obligatory procedures are detailed in the FR. In general, the OSHAct provides:

"...where appropriate, any such standard promulgated under subsection 6 (b) shall prescribe the type and frequency of medical examinations or other tests which shall be made available, by the employer or at his cost, to employees exposed to such employment-related hazards in order to most effectively determine whether the health of such employees is adversely affected by such exposure."

Industrial hygienists, managers, and analysts responsible for IH monitoring should consult OSHA to determine whether law for a given industrial contaminant requires any specific medical surveillance provisions.

Summary and Conclusion

As a consequence of the OSHAct of 1970, numerous detailed regulations and analytical procedures associated with monitoring worker exposure to chemical contaminants in industrial environments have evolved. OSHA, the major governmental agency enforcing the occupational exposure regulations, obtains recommendations in the form of Criteria Documents from NIOSH, the federal organization that conducts research to establish standards and procedures for controlling and monitoring worker exposure to contaminants in industrial environments. In those states granted full responsibility for implementation of the OSHAct, more stringent and more comprehensive state level standards and regulations take precedence over federal ones. Although both federal and state OSHA agencies mandate and enforce standards for all industries, MSHA regulates the safety and health requirements for workers in the mining industry.

Exposure limits in the form of PELs, TLVs, and BLVs for over 600 industrial contaminants as well as the associated sampling and analytical methodology required for monitoring worker exposure to these contaminants constitutes a large body of information which industrial hygienists, managers, and analysts must obtain from various sources. OSHA and ACGIH provide publications containing exposure limit conditions and values. The Federal Register and the Code of Federal Regulations detail the provisions for environmental monitoring, record keeping, employee education and training, medical surveillance, hygiene facilities, and other requirements. OSHA provides copies of these upon request.

NIOSH offers regular training programs and materials, Criteria Documents, and an annual toxic substances list. The comprehensive analytical reference, the NIOSH Manual of Analytical Methods, a five volume set which details over 450 analytical procedures, provides analysts with step by step instructions enabling determination of worker exposure to OSHA regulated chemicals. These procedures are not, however, required by law and do not cover many of the substances for which ACGIH has established TLV exposure limits.

Membership in AIHA offers further access to IH information and training programs. In addition, the Laboratory Accreditation Program administered by AIHA assists IH laboratories in their effort to maintain a high level of performance. This includes participation in the NIOSH PAT Program although laboratories may implement alternative quality assurance procedures.

The major IH organizations and sources of information which industrial hygienists, managers, and analysts should contact for IH information and assistance are listed in the next section. A more comprehensive listing [1] is available from the National Safety Council NSC). This publication is also recommended as a primary IH reference source for analysts and managers responsible for IH monitoring analyses.

IH Organization and Information Sources

General information about OSHA

- U.S. Department of Labor; Occupational Safety and Health Administration; Office of Information; Washington, D. C. 20210; (202) 523 8148
- Region 1 (CT, NH, ME, MA, NH, RI, VT); 16 18 North Street; I Dock Square; Boston, MA 02109; (617) 223 6712.
- Region 2 (NY, NJ, PR, VI); Room 3445; 1 Astor Plaza; 1515 Broadway; New York, NY 10036; (212) 944 3426.
- Region 3 (DE, DC, MD, PA, VA, WV); Gateway Bldg, Suite 2100; 3535 Market Street; Philadelphia, PA 19104; (215) 596 1201.
- Region 4 (AL, FL, GA, KY, MS, NC, SC, TN); 1375 Peachtree Street NE; Suite 587; Atlanta, GA 30309; (404) 881 3573.
- Region 5 (IL, IN, MN, MI, OH, WI); 230 South Dearborn Street; 32nd Floor, Room 3263; Chicago, IL 60604; (312) 353 2220.
- Region 6 (AR, LA, NM, OK, TX); 555 Griffin Square, Room 602; Dallas, TX 64106; (214) 767 4731.
- Region 7 (IA, KS, MO, NE); 911 Walnut Street; Room 3000; Kansas City, MO 64106; (816) 374 5861.
- Region 8 (CO, MT, ND, SD, UT, WY); Federal Building Room 1554; 1961 Stout Street; Denver, CO 80294; (303) 837 3883.
- Region 9 (CA, AZ, NV, HI, Guam, American Samoa, Trust Territory of the Pacific Islands); Bos 36017; 450 Golden Gate Avenue; San Francisco, CA 94012; (415) 556 0684.
- Region 10 (AK, ID, OR, WA); Federal Office Building Room 60023; 909 First Avenue; Seattle, WA 98174; (206) 442 5930.

OSHA Publications

OSHA Publications Distribution Office; U.S. Department of Labor OSHA; 200 Constitution Avenue, NW; Washington, D.C. 20210; (202) 523 6138.

General information about NIOSH and CDC

U.S. Department of Health, Education and Welfare; Public Health Service Center for 7 isease Control; National Institute for Occupational Safety and Health; 5600 Fishers Lane; Rockville, MA 20857; (301) 443 1530.

NIOSH Publications

NIOSH Publications; Robert A. Taft Laboratories; 4676 Columbia Parkway; Cincinnati, OH 45226; (513) 684 4287.

NIOSH training courses

NIOSH, Division of Training; Manpower Development; 4676 Columbia Parkway; Cincinnati, OH 45226; (513) 684 8225.

NIOSH PAT Program

NIOSH Chemical Reference Laboratory; R 3; 4676 Columbia Parkway, Cincinnati, OH 45226; (513) 684 4357.

General AIHA information

American Industrial Hygiene Association; 475 Wolf Ledges Parkway; Akron, OH 44221; (216) 762 7294.

AIHA Laboratory Accreditation Program

Coordinator of Laboratory Accreditation, AIHA.

General ACGIH information and Publications (TLVs)

Secretary Treasurer; ACGIH; P.O. Box 1937; Cincinnati, OH 45201; (513) 941 0178.

Standard Reference Materials

Office of Standard Reference Materials; Room B311, Chemistry Building; National Bureau of Standards; Washington, D.C. 20234; (301) 921 2045.

NSC Publications and Training Courses; OSHA Up to Date (Monthly)

National Safety Council; 444 North Michigan Avenue; Chicago, IL 60611; (312) 527 4800.

Newletters

(Chemical Regulation Reporter; Occupational Safety and Health Reporter); Bureau of National Affairs; 1231 25th Street, NW; Washington, D.C.20037; (202) 223 3500.

Reference

1. National Safety Council; Fundamentals of Industrial Hygiene; 2nd edition; Chicago, IL: NCS, 1979.

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