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DOE-STD-6005-2001  
April 2001

# DOE STANDARD

## INDUSTRIAL HYGIENE PRACTICES



**U.S. Department of Energy**  
**Washington, D.C. 20585**

**AREA OCSH**

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### **FOREWORD**

1. This Department of Energy (DOE) Technical Standard was developed by the DOE Industrial Hygiene Coordinating Committee (IHCC), which is comprised of industrial hygiene representatives of DOE Program Offices and Operations Offices.
2. This standard was developed in coordination with the DOE Office of Worker Health and Safety (EH-5) and is available for use by all DOE components and their contractors.
3. Beneficial comments (recommendations, additions, deletions) and any pertinent data that may improve this document should be sent by letter or by using the Comment and Resolution Sheet (DOE F 1300.6) appearing at the end of this document to:

DOE Office of Worker Health and Safety (EH-5)

U.S. Department of Energy

Washington, D.C. 20585.

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### 1. SCOPE

This standard recommends industrial hygiene practices to support components of the Worker Protection Program required by Department of Energy (DOE) Order 440.1A, “Worker Protection Management for DOE Federal and Contractor Employees.” Further, it is consistent with and supports the principles and content of DOE P 450.4, “Safety Management System,” and DOE P 450.5, “Line Environment, Safety and Health Oversight” directives (i.e., Integrated Safety Management System, ISMS).

### 2. PURPOSE

The purpose of this standard is to assist DOE and its contractors in the development, implementation, and integration of recognized industrial hygiene practices within the overall worker protection program that are consistent with the policy objectives and requirements of DOE O 440.1A and ISMS. It gives practical guidance relating to the anticipation, recognition, evaluation, and control of occupational health hazards at DOE facilities. These basic principles may also be appropriate and useful for many transient activities like hazardous waste operations, environmental restoration operations, or scientific research and development activities. However, the short, dynamic nature of many of these activities may make traditional baselining and periodic reevaluations impractical; Paragraph 7 of this standard provides additional guidance for these situations.

### 3. APPLICABILITY

This technical standard applies to all DOE elements except for the activities specifically excluded in DOE O 440.1A, paragraph 3.c. Contractor compliance with this standard will be to the extent set forth in a contract and is also subject to the exclusions of DOE O 440.1A, paragraph 3.c. This standard also supports the industrial hygiene requirements specified in DOE O 5480.10A, “Contractor Industrial Hygiene Program,” where this directive has been incorporated into contracts.

### 4. REFERENCES

#### 4.1 Government Documents

##### 4.1.1 DOE Directives (Policy, Orders, Handbooks, and Technical Standards)

- a. DOE O 440.1A, “Worker Protection Management for DOE Federal and Contractor Employees.”
- b. DOE O 450.4. “Safety Management System Policy.”
- c. DOE O 450.5. “Line Environment, Safety and Health Oversight.”
- d. DOE G 440.1-1, “Worker Protection Management for DOE Federal and Contractor Employees Guide for Use with DOE Order 440.1.”
- e. DOE G 440.1-2, “Construction Safety Management Guide for Use with DOE Order 440.1.”
- f. DOE G 440.1-3, “Occupational Exposure Assessment, Implementation Guide for Use with DOE Order 440.1.”
- g. DOE G 440.1-4, “Contractor Occupational Medical Program Guide for Use with DOE Order 440.1.”
- h. DOE G 440.1-7, “Implementation Guide for Use with DOE N 440.1-7, Interim Chronic Beryllium Disease Prevention Program.”

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- i. DOE O 5480.10A, “Contractor Industrial Hygiene Program”
- 4.1.2 Other Government Documents
- a. U.S. Department of Labor, Occupational Safety and Health Administration, *Field Inspection Reference Manual*.
  - b. U.S. Department of Labor, Occupational Safety and Health Administration, *Technical Manual*.
  - c. U.S. Department of Labor, Occupational Safety and Health Administration, Title 29 Code of Federal Regulations, Part 1910, “Occupational Safety and Health Standards,” and Part 1926, “Safety and Health Regulations for Construction.”
  - d. U.S. Department of Labor, Occupational Safety and Health Administration, Title 29 Code of Federal Regulations, Part 1960, “Basic Program Elements for Federal Employee OSH Programs and Related Matters.”
- 4.2 Non-Government Documents
- a. American Conference of Governmental Industrial Hygienists (ACGIH), *Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices* (Latest edition).
  - b. American Conference of Governmental Industrial Hygienists, *Industrial Ventilation: A Manual of Recommended Practice* (Latest edition).
  - c. Joseph Damiano and John R. Mulhausen (Editors), *A Strategy for Assessing and Managing Occupational Exposures*, 2nd edition. American Industrial Hygiene Association (AIHA), Fairfax, VA (1998)
  - d. Salvatore R. DiNardi, (Editor), *The Occupational Environment — Its Evaluation and Control*, American Industrial Hygiene Association (AIHA), Fairfax, VA (1997)
  - e. American National Standards Institute, latest version of various standards including, but not limited to:
    - 1. ANSI Z 88.2, “Respiratory Protection”
    - 2. ANSI Z 88.6, “Physical Qualifications for Respirator Use”
    - 3. ANSI Z 117.1, “Safety Requirements for Working in Tanks and Other Confined Spaces”
    - 4. ANSI Z 136.1, “Safe Use of Lasers”
    - 5. ANSI Z 358.1, “Emergency Eyewash and Shower Equipment”
  - f. American Society of Heating, Refrigerating, and Air Conditioning Engineers, *ASHRAE Handbook and Product Directory*, volume on “Fundamentals.”

## 5. INDUSTRIAL HYGIENE PRACTICES

Recognized and appropriate industrial hygiene practices should be integrated into an overall Worker Protection Program such as that defined in DOE O 440.1A, “Worker Protection Management for DOE Federal and Contractor Employees.”



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A worker protection program that is fully implemented and consistent with DOE O 440.1A should adequately protect the health of DOE and DOE contractor workers. It should also ensure the collection, validation, and maintenance of appropriate industrial hygiene information at government-owned or -leased facilities and operations.

An effective worker protection program encompasses the concept of prudent avoidance of worker exposure to any occupational hazard. Prudent avoidance involves minimizing the number of individuals at risk of exposure, minimizing individual worker's potential for exposure, and controlling all exposures to chemical and physical agents within established occupational exposure limits and as low as practical.

Sections 5.1 through 5.11, respectfully, address the 11 industrial hygiene program functional elements identified in Attachments 1 and 2 of DOE O 440.1A. Section 6 presents unifying concepts for requirements contained in other Orders that have a bearing on industrial hygiene practices. Section 7 provides some general guidance for applying industrial hygiene practices to non-routine, dynamic, and/or transient work operations.

The technical terminology used in this standard is consistent with and sourced from Reference d., cited in Section 4.2., of this standard.

### 5.1 Initial or Baseline Industrial Hygiene Surveys

DOE and contractor line management are required to ensure that initial (or baseline) surveys are conducted of all work areas or operations to identify and evaluate potential worker health risks. [Reference: DOE O 440.1A, paragraph 4.I (2); Attachment 1, paragraph 5.a; and Attachment 2, paragraph 18.a.]

An effective worker protection program needs to include documented initial and periodic evaluations of all workplaces for the purposes of anticipating, identifying, evaluating, and controlling occupational health hazards. Such evaluations should be comprehensive, documented in accordance with Section 5.4, and should:

- a. Describe the work or task performed
- b. Identify the potentially exposed workers
- c. Identify and describe potential sources of hazardous agents
- d. Evaluate the controls used to prevent or minimize exposure
- e. Assess the level(s) of exposure
- f. Include a conclusion, with rationale, whether the identified agent(s), their use(s), and the potential exposures they cause pose a hazard to workers (i.e., generate a positive or negative exposure assessment)
- g. Recommend additional controls for hazardous agents where necessary
- h. Recommend the scope and frequency of further exposure monitoring, as appropriate.

Note: The minimum set of hazardous agents generally to be considered are those identified in the ACGIH *Threshold Limit Values for Chemical Substances and Physical Agents* and applicable Occupational Safety and Health Administration (OSHA) regulations.

A comprehensive set of industrial hygiene evaluations, also known as the comprehensive industrial hygiene survey, can be generated by a single survey effort covering all work areas and operations or be the compilation of evaluations of these areas conducted over a period of

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time. The first complete evaluation of each operation is usually considered its “baseline” and is used for comparison with the results of future evaluations and exposure monitoring. The comprehensive survey ensures that all areas and operations are evaluated by an industrial hygienist and those evaluations are documented and accessible for future use by cognizant line management and worker health and safety professionals. Baselines must be updated periodically with the frequency of updates being determined by risk and variability of operations.

To promote the integration of worker protection efforts, the following groups or information resources should be consulted/ utilized when planning industrial hygiene evaluations and/or considering exposure controls:

- a. Other worker protection staff (e.g., industrial safety professionals, health physicists)
- b. Occupation medical staff
- c. Environmental protection staff
- d. Line management
- e. Workers and worker representatives
- f. Existing chemical and hazard inventories
- g. Applicable written worker protection programs such as, respiratory, hazard communication, ergonomics, lead, beryllium, confined space, and hearing conservation
- h. Injury and illness logs/databases and trending tools like the Computerized Accident/Incident Reporting System (CAIRS) and Occurrence Reporting Binned Information Trending Tool (ORBITT)/ Occurrence Reporting and Processing System (ORPS).

(See also DOE G 440.1-1, Section 4.3.2; DOE G 440.1-2, Sections 4.3 and 4.8.1; DOE G 440.1-3, Section 4.3; DOE G 440.1.4, Sections 4.2 and 4.3.3.2; and DOE G 440.1-7, Sections IV.1, IV.2, and IV.3.)

### 5.2 Coordination with Planning and Design Staff.

DOE and contractor line management are required to coordinate planning and design activities with industrial hygiene personnel to anticipate and control health hazards that proposed facilities and/or operations would introduce. [Reference DOE O 440.1A, paragraph 4.j (1); Attachment 1, paragraph 5.b; and Attachment 2, paragraphs 10.a and 18.b.]

#### 5.2.1 Conceptual Design Phase.

Review at the conceptual design phase, the earliest phase of the project, is critical. This is the phase when line management will most benefit from industrial hygiene input and when the role of the industrial hygienist in the process is most easily established. Specific design questions to be answered include:

- a. To what extent can a system be designed to require minimum maintenance in order to minimize exposures to maintenance personnel?
- b. To what extent can the process be conducted in a closed system in order to minimize exposures to workers and others in the vicinity?

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- c. Can the process be operated automatically or remotely in order to minimize worker contact with the hazard?
- d. Can the system be designed in an ergonomically appropriate manner?
- e. Can the process be designed to make use of less hazardous materials?
- f. How can the process be designed to employ the best available control technology for capturing and properly disposing of hazardous materials and minimizing pollution (see Sect. 5.5.1)?

(See also DOE G 440.1-1, Section 4.4.1; DOE G 440.1-2, Sections 4.2, 4.5, and 4.7; DOE G 440.1-3, Section 4.4.2; and DOE G 440.1-4, Section 4.2.)

### 5.2.2 Initial Design Phase.

Proper initial design is the most cost-effective way to control hazards. The industrial hygiene staff should participate with line management in:

- a. Planning and design of new processes and/or use of new materials
- b. Planning and reviewing plans for new construction, demolition, modification, or remodeling of existing processes
- c. Evaluations of the effectiveness of proposed environmental control equipment
- d. Approval of procedures for use of control equipment
- e. Approval of new operations and maintenance procedures.

Industrial hygiene design/plan reviews should solicit and include input from affected organizations, professional and technical disciplines, and supervisors and workers knowledgeable about and/or impacted by the new operations and/or materials.

Professional/technical disciplines may include occupational medicine, epidemiology, ergonomics, occupational safety, audiology, fire protection, radiation protection, environmental protection, facility maintenance, operations, and engineering.

### 5.3 Periodic Reassessments.

DOE and contractor line management are required to ensure that periodic resurveys and/or exposure monitoring are conducted, as appropriate.

[Reference: DOE O 440.1A, Attachment 1, paragraph 5.c; and Attachment 2, paragraph 18.c.]

The frequency that evaluations are updated should be proportional to the risk presented by the hazard(s), the variability of the operation, the operation frequency, and the type and dependability of the controls limiting exposures. As a general rule:

- a. Industrial areas/activities (e.g., fabrication or processing operations, craft shops) should be evaluated at least annually, and more often if appropriate and/or when potentially serious health hazards are present.
- b. Newly introduced or modified operations should be evaluated before starting or resuming operations, or when significant changes are made in adjacent work areas.
- c. Frequently changing work sites/operations (e.g., research and development facilities, construction sites, hazardous waste cleanup activities, decommissioning operations) should be evaluated as often as necessary to reliably characterize health risks.

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- d. Occupied work areas initially determined to have no significant hazards (e.g., administrative offices and other low-hazards facilities) should be evaluated at least once every three years or in accordance with applicable regulatory requirements.
- e. Unoccupied buildings should be evaluated initially and when their mission changes.

In addition to these periodic evaluations, additional evaluations may be performed in response to employee concerns or reported occurrences, injuries, or illnesses. DOE and contractor line management should also conduct a sufficient number of worksite inspections to determine compliance with standards and program requirements. The frequency and scope of such inspections will depend on the size, complexity, and nature of the operations of the worksite.

(See also DOE G 440.1-2, Section 4.8.1; and DOE G 440.1-3, Section 4.4.3.)

### 5.4 Exposure Assessment Documentation.

DOE and contractor line management are required to ensure that worker exposure assessments for chemical, physical, and biological agents and ergonomic stressors are documented and records maintained. Further, the results of these exposure assessments must be promptly communicated to the workers and supervisors who perform the tasks evaluated, and to the organization(s) responsible for effecting any needed corrective actions, such as operations, engineering or maintenance, as well as to affected disciplines such as occupational medicine, epidemiology, industrial safety, radiation protection, fire protection, and environmental protection, as appropriate.

[Reference: DOE O 440.1A, paragraph 4.f(7); Attachment 1, paragraph 5.d; and Attachment 2, paragraphs 6.g and 18.d.; see also DOE G 440.1-3, “Occupational Exposure Assessment.”]

#### 5.4.1 Maintenance of Records.

DOE and contractor line management must ensure written hazard assessment and control records are developed and maintained for all potentially hazardous work operations and activities. This includes assessments where no significant worker exposures are expected or determined. This latter case is important since new exposure effects may be identified and retrospective health concerns can only be addressed by documented assessment records. Consequently, assessments for operations determined to have no significant exposure potential (i.e., “negative exposure”) should be appropriately documented for historical purposes following the standard protocol for all surveys. Because of the significance of the information contained in these records, it is crucial that the persons assigned this task be appropriately trained. Critical records should be reviewed and approved by the senior industrial hygienist or designate. All such record keeping must comply with the requirements of 29 CFR 1910.1020, any applicable DOE directives, and/or applicable OSHA hazard-specific or expanded health standards, as well as any applicable requirements imposed by the Americans with Disabilities Act, the Privacy Act of 1974, the Freedom of Information Act, or any other applicable law.

#### 5.4.2 Content of Records.

In general, worker exposure assessments and control record should document the following operational, administrative, personnel, hazard, sampling/exposure measurement, and hazard control information:

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- a. Description of the operation and associated work activities/tasks, including the identity of management/supervisory personnel responsible for the operation.
- b. Inventory of types and sources of potential health hazards (e.g., chemical, physical, or biological agents and ergonomic stressors).
- c. Description of the extant exposure hazard controls (e.g., engineering, administrative, work practice, personal protective equipment) and the results of any supporting measurements or performance data relating to their effectiveness or efficiency.
- d. Description/explanation of any significant environmental conditions/factors that could affect worker exposure potential, and/or exposure sampling or measurements.
- e. Identification of potentially exposed personnel (note: see Paragraph k.1., below, "Monitoring/Sampling Data Record" concerning privacy protections), including the rationale employed in selecting specific workers to monitor/sample; include frequency and duration of potential worker exposures, as appropriate.
- f. A technical description of the exposure assessment strategy and monitoring/sampling protocol(s) used, and the identification of the applicable industrial hygiene standard(s).
- g. The results of all exposure monitoring/sampling measurements (see Paragraph k, below, for guidance on the content of "Monitoring/Sampling Data Record").
- h. Interpretation of all monitoring/sampling results and other measurements relating to the worker exposure assessment, relative to established standards; rationale for estimates of exposure levels should be provided (e.g., statistical variability, application of SAE), as appropriate; personal exposure levels should be expressed in appropriate measurement parameters to compare against recognized occupational exposure standards, e.g., 8-hour time-weighted average (TWA) concentration, short-term exposure level (STEL), peak or ceiling concentration, or average sound pressure level, dBA.
- i. Description of any recommended, additional control measures, including engineering, administrative or work practice controls, and/or use of personal protective equipment, to reduce worker exposures to within acceptable exposure levels and as low as practicable.
- j. Where applicable, a detailed schedule (including for regular progress reports) for the implementation of any required health hazard prevention and control measures, including any long-term abatement and interim control measures.
- k. Monitoring/Sampling Data Record: at a minimum, should include the following types of information:
  1. Unique identifiers - keyed to but different from personal identifiers - for each employee sampled or, where representative monitoring is performed, for all employees represented by the monitoring results. Identifiers must not compromise personal privacy.
  2. Type, location, date, duration, and number of samples taken; sample identification numbers and sample chain of custody record.

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3. Sampling instrument calibration data or reference links to same.
4. Sampling and analytical methods and protocols used (e.g., those specified by OSHA or NIOSH or other equivalent methods)
5. Applicable sampling and analytical error (SAE).
6. Measurement confidence limits (per statistical assumptions/analysis)
7. Analytical laboratory used
8. Applicable occupational exposure limits/industrial hygiene standards.
9. Supporting data and assumptions (e.g., consideration of respiratory protection [see Section 5.8] or other PPE attenuation factors).
10. Calculated or estimated worker exposure level(s) relative to applicable occupational standards. Note: where personal protective equipment, such as respirators, hearing protectors, etc., was used by workers to attenuate exposures, the documented record should report the measured or estimated, unattenuated level(s) of potential personal exposure, along with the type and protection/attenuation factor of the PPE worn (see Section 5.8 concerning the reporting of results when respiratory protection is used).

### 5.4.3 Notification.

DOE and contractor line management must provide the results of personal measurements to affected employees in a timely manner (e.g., within 10 working days of receipt of the results) or as otherwise required. Monitoring results must be provided that are in a format consistent with OSHA's requirements in 29 CFR 1910 or with other applicable occupational health standards. Exposure monitoring results should be reported to workers both with and without respiratory protection factors applied, and both sets of numbers should be explained.

### 5.4.4 Accredited Laboratories.

The American Industrial Hygiene Association (AIHA) has an established laboratory accreditation program for specific hazardous substances. All industrial hygiene samples should be analyzed by a laboratory accredited by the AIHA for the substance class of interest (metals, organics, etc.). Samples may be analyzed by a non-AIHA accredited laboratory for the substance class of interest when AIHA accreditation is not available for that substance class (e.g., dioxin, polychlorinated biphenyls, and many pesticides) or when cost, transportation, or other factors make use of an AIHA-accredited laboratory impractical. (Note: The reason for using a non-accredited laboratory should be fully documented in the exposure assessment record). Non-accredited laboratories should be requested to provide copies of their quality assurance program descriptions and results of their quality reviews.

It is important for the industrial hygienist to consult with the analytical laboratory staff. Preliminary consultation between the industrial hygienist and the analytical laboratory serves a variety of purposes and can affect the quality of the analyses as well. Such consultation can ensure that the appropriate sampling and analytical techniques are used, can help with scheduling and turn-around time of analyses, can identify potential problems and special requirements, and can provide industrial hygienists with background information for use during sampling.

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Communication between the industrial hygienist and the analytical laboratory should include:

- a. Description of the process being sampled.
- b. Description of any health problems experienced by exposed workers.
- c. Goal of the sampling (i.e., how the data will be used).

(See also DOE G 440.1-1, Section 4.3.2; DOE G 440.1-3, Section 4.4.2; and DOE G 440.1-7, Sections IV.3.3.1 and IV-7.)

### 5.5 Prevention and Control Measures.

DOE and contractor line management are required to utilize appropriate engineering, administrative, work practice, and/or personal protective control methods to limit hazardous exposures to acceptable levels. [Reference: DOE O 440.1A, paragraph 4.j; Attachment 1, paragraph 5.e; and Attachment 2, paragraphs 10 and 18.e.]

Often, there are several alternative approaches to preventing or controlling hazardous exposures. In such cases, front-line workers and supervisors are often the most knowledgeable about which options would be the most effective. Such worker involvement can help in identifying useful prevention and control measures, promote communication about the rationale behind the choice of a particular alternative, and encourage worker acceptance of the decision. Based on this input, the senior industrial hygienist should recommend to facility management the best prevention and control measures for reducing/minimizing the hazardous exposures of employees.

#### 5.5.1 Hierarchy of Controls.

DOE and OSHA require that control measures be prioritized in accordance with the following hierarchy of controls:

- a. Engineering controls:
  1. Change to a less hazardous process or substitute a less hazardous material or piece of equipment.
  2. Isolate or enclose the process or operation to prevent worker exposure to hazardous agents.
  3. Use mechanical ventilation or other engineered controls to prevent or reduce worker exposure to hazardous agents.

- b. Work practice and administrative controls that limit worker exposures:

Although administrative controls can minimize worker exposures, they are often unreliable and difficult to implement. For this reason, engineering controls are preferable to administrative and work practice controls.

1. Develop work practices and procedures (e.g., standard operating procedures, limited access, and showering and changing clothes) to reduce/minimize hazardous exposures.
2. Maintain administrative controls (e.g., schedule hazardous activities during periods when few employees are present).

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- c. Personal protective equipment:
  - 1. Use personal protective equipment (PPE)(also see Sect. 5.8 of this standard).
  - 2. Use of PPE is generally considered the last line of defense because it places the burden of hazard control directly on the worker. Its use should be limited to:
    - a. The period necessary to install, evaluate or repair engineering controls.
    - b. Work situations such as maintenance and repair activities and hazardous waste and emergency response operations in which engineering controls are not feasible.
    - c. Work situations in which engineering controls and supplemental work practice controls are not sufficient to reduce exposures to or below occupational exposure limits.
    - d. Emergency or escape situations.

(See also DOE G 440.1-1, Section 4.4.1; DOE G 440.1-2, Sections 4.5 and 4.8.2; and DOE G 440.1-7, Section 4.3.3.)

### 5.6 Worker Training and Involvement.

DOE and contractor line management are required to provide worker hazard training and to encourage employee involvement. [Reference: DOE O 440.1A, paragraphs 4.f(5), 4.h, and 4.k; Attachment 1, paragraphs 1.b(1)(b) and 5.f; and Attachment 2, paragraphs 11 and 18.f.]

Line workers are the individuals most in contact with the hazards and, therefore, have a vested interest in the Worker Protection Program. As such, they can serve as a valuable resource and problem solvers. Workers who are properly trained and allowed to contribute and implement ideas are more likely to support them since they now have a personal stake in ensuring that rules and procedures are followed. Therefore, line workers should be directly involved with and participating in activities such as inspecting worksites, identifying hazards, selecting work practice controls, and serving on worker protection committees.

#### 5.6.1 Worker Protection Committee.

A Worker Protection Committee with the following provisions should be established at every site, where feasible:

- a. At least one member of the Worker Protection Committee should be the senior industrial hygienist or a staff industrial hygienist.
- b. The Committee should have access to industrial hygiene evaluation and control records (except for records containing personal identifiers).
- c. Committee members should disseminate health hazard prevention and control information to the organizational elements that they represent.

#### 5.6.2 Management Training.

DOE and contractor line management should ensure that cognizant line managers and supervisors are trained in:

- a. The purpose and content of the worker protection program and their role in and responsibilities for implementing DOE-prescribed industrial hygiene requirements,



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including ensuring that employees follow established requirements and procedures for avoiding or minimizing exposures to occupational health hazards.

- b. Recognition of occupational health hazards associated with the jobs assigned to employees working within their area of responsibility, the potential effects of those hazards on employee health, and the methods appropriate and required to control employee exposures.
- c. The industrial hygiene components of the worker protection program.

### 5.6.3 Worker Training.

DOE and contractor line management shall ensure that workers are trained in:

- a. Methods and observations that may be used to detect the presence of an occupational health hazard in the work area (e.g., use of continuous monitoring devices, visual appearance or odor of hazardous chemicals when being released).
- b. An understanding of the physical and health hazards of the chemicals, ergonomic stressors, and harmful physical and/or biological agents in the work area.
- c. Measures that workers can take to protect themselves from these hazards, including use of engineering controls, specific procedures, or other controls (such as appropriate work practices, emergency actions, and PPE).
- d. Details of the Chemical Hazard Communication (HAZCOM), Laboratory Chemical Hygiene Plan (CHP), or Hazardous Waste Operations and Emergency Response (HAZWOPER) program(s) developed by DOE or the contractor.
- e. Details of any applicable operations or hazard-specific training programs.

(See also DOE G 440.1-1, Sections 4.2 and 4.5; DOE G 440.1-2, Section 4.6; DOE G 440.1-3, Section 4.4.3; and DOE G 440.1-7, Sections III.2.4, IV.6, and Appendix E.)

### 5.7 Coordination with Other Worker Protection Staff.

DOE and contractor line management are required to coordinate industrial hygiene efforts with cognizant occupational medical, environmental protection, health physics, and work planning professionals. [Reference: DOE O 440.1A, Attachment 1, paragraph 5.g; and Attachment 2, paragraphs 18.g and 19.c(1)(a).]

Coordination must be established, maintained, and documented between the industrial hygiene staff and other worker protection and organizational functions in the facility to ensure the successful implementation and efficacy of the Worker Protection Program. These functions include, but are not limited to: occupational medicine, epidemiology, industrial safety, environmental protection, fire protection, health physics, purchasing, maintenance, engineering, operations, contracting, quality assurance, and employee groups and recognized bargaining units. For example, the senior industrial hygienist may recommend employees to be included in medical surveillance and should participate in the review of occupational exposure and medical surveillance data.

(See also DOE G 440.1-2, Section 4.2; DOE G 440.1-3, Sections 4.3, 4.4.2, 4.5.2.1, and 4.6.2; and DOE G 440.1-4, Section 4.7.1.)

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### 5.8 Respiratory Protection.

When respiratory protection is required, DOE and contractor line management must ensure that NIOSH-approved respirators are used. However, for certain specific DOE activities/situations, NIOSH-approved respirators may not exist. In such cases, DOE and contractor line management may request from EH approval to use respiratory protection that has been tested and accepted for specific applications by the Los Alamos National Laboratory Respirator Studies Program. [Reference: DOE O 440.1A, Attachment 1, paragraph 5.h; and Attachment 2, paragraphs 18.h.]

DOE and contractor line management are also required by DOE O 440.1A to follow the standards set forth in American National Standards Institute Z88.2, "Practices for Respiratory Protection."

When reporting occupational exposure levels to airborne contaminants, the exposure reported should clearly indicate the amount or concentration present in the ambient atmosphere and the type and protection factor of the respirator used.

(See also DOE G 440.1-4, Section 4.3.3.3; and DOE G 440.1-7, Section IV.4.3.3.3.2.)

### 5.9 Control of Carcinogens.

DOE and contractor line management are required to establish policy and procedures to mitigate the risk of exposure from identified and potential occupational carcinogens. [Reference: DOE O 440.1A, Attachment 1, paragraph 5.I; and Attachment 2, paragraph 18.i.]

#### 5.9.1 Application.

The chemical substances covered by these policies and procedures should be those identified as carcinogens as follows:

##### IARC

IARC-1 (carcinogenic to humans)

IARC-2A (probably carcinogenic to humans)

IARC-2B (possibly carcinogenic to humans)

##### NTP

NTP-1 (known to be a carcinogen)

NTP-2 (reasonably anticipated to be a carcinogen)

##### ACGIH

A1 (confirmed human carcinogen)

A2 (suspected human carcinogen)

##### OSHA

Carcinogen

For carcinogens with prescribed exposure limits, the policy and procedures should apply to operations where the industrial hygiene staff determines that controls are necessary to maintain occupational exposures below applicable exposure limits and as low as practical.

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### 5.9.2 Implementation.

A policy and procedures should be established and implemented to control occupational exposure to chemical carcinogens. For OSHA-regulated carcinogens, control procedures shall be implemented that, at a minimum, conform to the requirements of respective OSHA standards. For other carcinogens, control procedures shall be implemented that are consistent with the current ACGIH *Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices*. Controls will depend on the physical and chemical properties of the material, how it will be handled (specifically if the material will be handled in a way where it could be dispersed into the air or spread on surfaces), the quantity involved, and the duration and number of potential exposures. Generally, the following controls should be applied to the use and handling of chemical carcinogens.

- a. Written safety plans, standard operating procedures, and/or experimental protocols should be prepared to describe the use of chemical carcinogens and the methods used to control employee exposure. These documents should be reviewed and approved by the senior industrial hygienist prior to the initiation of an operation.
- b. Regulated areas should be established where chemical carcinogens are used (consistent with OSHA requirements, where applicable). The design and characteristics of these regulated areas should be appropriate to ensure that access is controlled and all carcinogenic materials are confined. A record should be maintained of all personnel working in regulated areas. Provisions should be made to ensure that contaminated air is not released into adjacent, non-regulated work areas or to the outside environment.
- c. Engineering control should be the primary method used to control employee exposure to carcinogens and to prevent the release of carcinogens into the workroom environment. All contaminated wastes and materials should be stored and disposed of using approved methods.
- d. Signs warning of the presence of chemical carcinogens should be posted at all entrances to regulated work areas. Appropriate labeling should be used on all chemical carcinogen containers and contaminated wastes to identify and warn of the carcinogenic hazard.
- e. Appropriate personal hygiene and work practices should be implemented, including use of protective clothing, shower facilities, change rooms, prohibition on eating, drinking, and smoking in regulated areas, and the use of non-permeable work surfaces, as feasible.
- f. Procedures should be established for emergency actions involving chemical carcinogens (e.g., cleanup of spills or accidental releases). Occurrences that could result in exposure of personnel or release to the environment should be investigated and, if appropriate, reported.

(See also DOE G 440.1-7, Section III.2.2.)

### 5.10 Use of Appropriate Standards.

DOE and contractor line management are required to use appropriate industrial hygiene standards. [Reference DOE O 440.1A, Attachment 1, paragraph 5.j; and Attachment 2, paragraph 18.j.]

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DOE O 440.1A contains a list of the DOE-prescribed Worker Protection standards. The senior industrial hygienist should also evaluate other references and consensus standards for possible incorporation into the Worker Protection Program as appropriate and prudent. Examples include, but are not limited to, the documents referenced in Sections 4.1 and 4.2.

(See also DOE G 440.1-7, Section III.2.2.)

### 5.11 Use of Qualified Staff.

DOE and contractor line management are required to use professionally qualified industrial hygienists to manage and implement the industrial hygiene functions of the Worker Protection Program. [Reference DOE O 440.1A, Paragraph 4.c; Attachment 1, paragraph 5.k; and Attachment 2, paragraphs 3 and 18.k.]

An effective Worker Protection Program must be supported by highly qualified and technically competent industrial hygienists. Cognizant management should ensure that its industrial hygiene staff:

- a. Is adequately trained and knowledgeable in the anticipation, recognition, evaluation, and control of occupational health hazards, and
- b. Are provided with the resources and support necessary to maintain and enhance proficiency in industrial hygiene through continued technical training, continuing education, and professional development activities (e.g., preparing for professional certification, attending professional seminars and conferences).

Because industrial hygienists have varying technical backgrounds, experience, academic education, and job-specific needs, their professional development and training programs should be individualized. Within the Worker Protection field, opportunities exist for cross-training among the various health and safety disciplines. For example, an organization may benefit from cross-training its industrial hygiene personnel in health physics, environmental protection, industrial safety, ergonomics and/or waste management, as well as by providing management training in administration, budgeting, and project/strategic planning.

The industrial hygiene elements of the worker protection program should be directed by a senior industrial hygienist with appropriate background and experience, who should report directly to a senior member of management. A senior industrial hygienist should be certified in the practice of industrial hygiene by the American Board of Industrial Hygiene (ABIH) or, at least, meet the eligibility requirements for ABIH certification. At a minimum, such individuals must have a college or university degree in industrial hygiene, a physical or biological science, or an engineering or technology field, plus special studies and training in the field of industrial hygiene, and no less than 5 years of full-time employment in the professional practice of industrial hygiene. (Contact the ABIH for detailed requirements for certification or eligibility for certification.)

(See also DOE G 440.1-1, Section 4.1.2.3; and DOE G 440.1-7, Section III.2.8.)

## 6. UNIFYING CONCEPTS

In addition to DOE O 440.1A, other DOE directives contain programmatic requirements that relate/apply to the industrial hygiene function. This section gives guidance for implementing industrial hygiene management practices consistent with those requirements.

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### 6.1 Self-Assessment.

Management should annually perform and document a self-assessment to ensure the effectiveness of the implementation of industrial hygiene practices and assure quality. Such self-assessments should include reviews of

- a. Adequacy and use of industrial hygiene resources.
- b. All exposure assessment records, including medical exposure data, audiometric testing records, illness and injury logs and supporting information, and any other records relevant to the maintenance of industrial hygiene functions.
- d. Compliance with applicable industrial hygiene requirements and established performance measures.
- e. Success in receiving and responding to employee occupational health concerns.
- f. Industrial hygiene evaluation records to assess progress in abating health hazards.
- g. All required written programs that include industrial hygiene elements (e.g., the hazard communication program and respiratory protection program).
- h. Training program effectiveness.

Management should correct any deficiencies identified by the program self-assessment in a timely manner.

(See DOE P 450.5, Line Environment, Safety and Health Oversight; and 10 CFR 830.120, Quality Assurance Requirements.)

### 6.2 Health Surveillance.

In order to support health surveillance activities required by DOE Order 440.1A, Attachment 2, paragraph 19.d(3), management should maintain the following records and supporting documentation in a manner that permits ready retrieval of information.

- a. Drawings and/or written descriptions of operations, processes and control systems, as outlined in the Content of Records section.
- b. Inventories of hazards.
- c. Exposure assessment data as outlined in the industrial hygiene evaluation Content of Records section.
- d. Industrial hygiene evaluation reports, including all records of corrective actions outlined in the Content of Records section.

(See also DOE G 440.1-3, Section 4.6.2; DOE G 440.1-4, Sections 4.3 and 4.6; and DOE G 440.1-7, Section IV.5.)

## 7. DEALING WITH NONROUTINE, TRANSIENT OR DYNAMIC WORK OPERATIONS

This standard describes industrial hygiene practices and strategies generally best suited to industrial sites and operations with repetitive or predictable work activities and exposure conditions. These same basic approaches may sometimes be appropriate and useful when applied to hazardous waste operations, environmental restoration operations, or research and development activities. However, where workplace operations and control and exposure conditions may vary and/or be of short, transient or dynamic nature, traditional baseline and periodic surveys may not be practical nor ensure an adequate level of exposure surveillance and control.

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Among the recognized, alternate protocols is the use of a review group to screen/assess all planned hazardous work activities and develop appropriate procedures and controls for specific work packages early in the work planning process. This review group includes multi-discipline, health and safety subject matter experts. The protocol involves the identification or development of controls, walk downs of the planned work area, and close cooperation between health and safety professionals and work planners. The screening process may also identify the need for additional/special work permits, exposure monitoring and/or surveillances.

Such practices result in an individualized industrial hygiene review for each non-routine work activity. This may provide a much higher level of involvement and more reliable hazard control for such activities than that provided by standard surveys, monitoring, and reports. A disadvantage of this approach is the potential loss of documentation afforded by the traditional comprehensive survey report to line management. With individualized work planning and hazard screening, exposure assessments are usually only implicit, that is, inferred from the utilized controls and their protective characteristics. Such inferred exposure estimates may be supplemented using qualitative or semi-quantitative grab and/or worst case sampling techniques, where feasible. The use of individual work packages typically does not result in comprehensive site-wide hazard inventories and some of the standard documentation listed in section 6.2 may not be available using the work project planning process.

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**CONCLUDING MATERIAL**

**Review Activity:**

**DOE**

EM

NE

EH

DP

SC

**Field Offices**

AL

ID

RL

OR

OAK

**Preparing Activity:**

DOE Industrial Hygiene

Coordination Committee

**Project Number:**

OCSH-0001

**Contractors**

SNL

Fluor Daniel Hanford

PNNL

LMITCO

ORNL

LLNL