

Industrial Hygiene: Exposure Assessment Strategy, Surveying, and Monitoring Guidelines

Department: Chemical and General Safety

Program: Industrial Hygiene

Owner: Program Manager

Authority: ES&H Manual, Chapter 5, Industrial Hygiene¹

Exposure Assessment Strategy

SLAC is committed to controlling exposures to chemical and physical hazards within recommended exposure guidelines or consensus standards through the development and implementation of an exposure assessment strategy. The overall approach links job hazard analysis and mitigation (JHAM), area hazard analysis (AHA), exposure assessment, and medical surveillance with prevention and control to reduce the risk of exposure and prevent adverse health effects. The industrial hygiene group uses pre-established and approved methods and rationale to characterize and monitor workers' potential exposures to chemical and physical hazards. The exposure assessment strategy applies to all activities (including design, construction, operation, maintenance, decontamination, decommissioning, and environmental restoration activities) performed by SLAC personnel.

The goal of SLAC's exposure assessment strategy is to protect workers by controlling potential exposures to less than 10 percent of the *occupational exposure limits (OELs)*. The OEL is defined as the more protective limit of either Occupational Safety and Health Administration (OSHA) *permissible exposure limits (PELs)* or American Conference of Governmental Industrial Hygienists (ACGIH) *threshold limit values (TLVs)*.

The industrial hygiene group performs risk-based evaluations of new or modified processes involving chemical and physical hazards and performs baseline exposure assessments. These and other assessments, along with written reports, are located in the Industrial Hygiene Document Database.² The industrial hygiene group also reviews JHAMS and AHAs in conjunction with baseline assessments to ensure accuracy and thoroughness.

An industrial hygienist will consider the following parameters during a risk-based industrial hygiene assessment:

- Type of hazard (chemical, physical, and biological)
- Toxicity
- Quantity in use
- Duration of use
- Past monitoring data
- Established occupational exposure models

1 SLAC *Environment, Safety, and Health Manual* (SLAC-I-720-0A29Z-001), Chapter 5, "Industrial Hygiene", http://www-group.slac.stanford.edu/esh/hazardous_substances/industrial_hygiene/policies.htm

2 Industrial Hygiene Document Database, <http://134.79.80.221:2004/>

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- Employee input (such as complaints or the presence of odor)
- Professional judgment and experience

SLAC's exposure assessment process is depicted by the following flow chart.

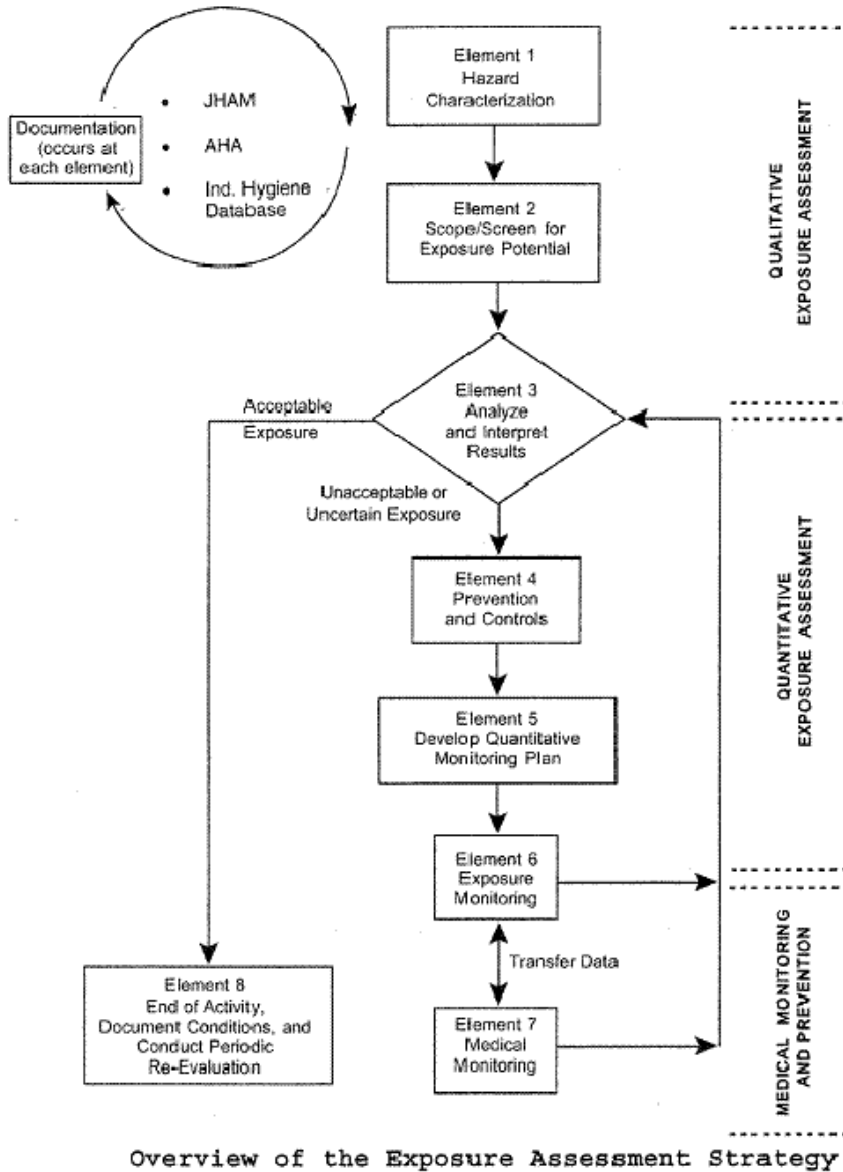


Figure 1 Exposure Assessment Flow Chart³

3 Based on Department of Energy Implementation Guide for Use with DOE Order 440.1, "Occupational Exposure Assessment" (DOE G 440.1-3), <http://www.directives.doe.gov/pdfs/doe/doetext/neword/440/g4401-3.html>

Qualitative Exposure Assessment

Considerations

Qualitative exposure assessment is an integral part of job hazard analysis and work planning processes. During the development and annual review of JHAMs and AHAs, line managers and supervisors will include qualitative exposure assessment of chemical, physical, and biological hazards.

The qualitative exposure assessment includes an evaluation of potential exposures via inhalation, ingestion, dermal contact, physiological interactions, and ergonomic factors. The predominant exposure determinants and events (such as frequency, magnitude, and variability of exposure and tasks; route of exposure; potentials for short-duration tasks and exposures [acute] and long-term or frequently repeated tasks and exposures [chronic]; and the adequacy and potential for failure of engineering and work practice controls) should be considered and documented as a part of the qualitative exposure assessment.

Minor or No Risk of Exposure

If the qualitative exposure assessment indicates a minor or no risk of exposure, no further action (such as quantitative monitoring or the implementation of prevention and control measures) is required. One example of a minor or no exposure risk may include the review of a baseline exposure assessment (from the Industrial Hygiene Document Database⁴) for a similarly exposed group that shows a measured concentration of the material that is less than 10 percent of the applicable occupational exposure limit. Another example could be where a tested, ventilated laboratory hood is properly used for the effective capture of an approved, airborne hazardous material.

For unacceptable exposure risk (estimated to be above 10 percent of the OEL), or if exposure risk is uncertain, a quantitative exposure assessment is required, and implementation of prevention and control methods may be indicated.

Guidance for Line Managers

Following an industrial hygiene survey, results and recommendations are sent to supervisors in the form of a written report. Line managers and supervisors should incorporate these recommendations when revising JHAMs and AHAs. Copies of industrial hygiene reports are available in the Industrial Hygiene Document Database.⁵

Periodic Reassessment

The SLAC industrial hygiene group will conduct risk-based qualitative reassessments of existing operations at SLAC on a biannual basis, so that each work area will be re-evaluated at least once every two years. For quality control purposes and to ensure an accurate depiction of the potential hazard, the industrial hygiene group must review associated JHAMs and AHAs during recurring industrial hygiene surveys and provide corrective feedback as needed.

4 Industrial Hygiene Document Database, <http://134.79.80.221:2004/>

5 Industrial Hygiene Document Database, <http://134.79.80.221:2004/>

Quantitative Exposure Assessment

The industrial hygiene group performs surveys to assess potential employee exposures to hazardous materials and contaminants in the workplace. Hazard evaluation surveys often include some type of monitoring, such as air or wipe sampling, to measure the amount or concentration of the hazards.

Types of Monitoring

Personal Air Sampling

Industrial hygienists use personal air sampling to measure personnel exposure to airborne contaminants. Workplace air is sampled over an eight-hour period (or for the full work shift) and is representative of the individual's breathing zone. The industrial hygienist also observes and records general information about personnel work processes.

Area Air Sampling

Industrial hygienists use area air sampling to define the extent of contamination or to measure the effectiveness of engineering controls. The air sampler is placed in a fixed location in the work area or near the suspected source of the hazard.

Wipe Sampling

Industrial hygienists may use wipe sampling to measure surface contamination for selected hazardous materials. Wipe sampling may be used to confirm medical monitoring results when the main entry route of a chemical is through the skin or mouth.

Obtaining Monitoring

Industrial hygiene monitoring takes place as a result of the following.

Individual Requests

Personnel at SLAC should discuss industrial hygiene concerns with their supervisors then contact the industrial hygiene group to request monitoring.

The requestor or area manager must notify the industrial hygiene group of changes in their work area that involve ventilation, new machinery, or new chemical processes. The industrial hygiene group arranges for appropriate evaluation and monitoring of the work environment based on the proposed use and associated hazards of the chemicals or contaminants. To request a survey, contact the industrial hygiene group.

Chemical Purchases

The industrial hygiene group is notified when new chemicals are added to SLAC's chemical inventory.⁶ During procurement of a new chemical which raises a health concern, the industrial hygiene group may request to evaluate the storage and use of the chemical before approving the purchase.

6 "Chemical Management Services (CMS)", <http://www-group.slac.stanford.edu/esh/groups/cgs/cms/>

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Design Review

When new projects at SLAC are reviewed, the design review coordinator forwards packages involving chemicals and other contaminants to the industrial hygiene group for evaluation. The industrial hygiene group identifies any areas of concern, provides comments and recommendations for safe use, and may require monitoring before equipment start up.

OSHA-required Monitoring

SLAC regularly monitors the workplace for certain contaminants as required by the federal Occupational, Safety, and Health Administration (OSHA), such as lead, beryllium, asbestos, welding on paint, hydrogen cyanide and chromium mists during electroplating. Monitoring is required when industrial hygienists believe that occupational exposures may exceed the *administrative control level* of 10 percent of the *occupational exposure limit (OEL)* (see Section 3, “Definitions”, in Chapter 5).⁷ Once the exposure is quantified by an industrial hygienist, additional monitoring is required as outlined in the following table.

Table 1 OSHA-required Monitoring

Percentage of OEL	Industrial Hygiene Monitoring Frequency	Duration of Industrial Hygiene Monitoring at Specified Frequency
Greater than 100%	Continuously	Until controls reduce exposures to less than 100%
Between 50%–100%	Every six months	Until controls reduce exposures to less than 50%
Between 10%-50%	Biannually	Until controls reduce exposures to less than 10%
Less than 10%	No monitoring required	Until a change in the work environment or worker concern suggests that monitoring is required

⁷ SLAC *Environment, Safety, and Health Manual* (SLAC-I-720-0A29Z-001), Chapter 5, “Industrial Hygiene”, http://www-group.slac.stanford.edu/esh/hazardous_substances/industrial_hygiene/policies.htm