

SECTION 4:
OCCUPATIONAL HEALTH

4.1 OCCUPATIONAL EXPOSURE ASSESSMENT

The risk that an employee faces on the job is a function of the hazards present and his/her exposure level to those hazards. Exposure and risk assessment is therefore at the heart of all occupational health and industrial hygiene programs. The use of a systematic method to characterize workplace exposures to chemical, physical and biological agents is a fundamental part of this process. Once a thorough and organized characterization of employee hazard exposures has been completed, occupational health program resources can be more effectively allocated to reduce employee health risks. This includes better focus of training programs, improved execution of medical surveillance programs, effective purchase and implementation of control measures, and valuable data for program evaluation.

Exposure assessment supports all occupational health program elements, including the following important program areas:

- Education and Training
- Hazard Communication
- Epidemiology
- Exposure and Compliance Monitoring
- Medical Surveillance
- Radiation Safety
- Hearing Conservation
- Personal Protective Equipment
- Respiratory Protection
- Work Practice Controls
- Administrative Controls
- Engineering Controls
- Hazardous Material Management

National Park Service Occupational Exposure Assessment Policy

The National Park Service has adopted a strategy of comprehensive and systematic exposure assessment emphasizing characterization of all workplace exposures to chemical, physical and biological agents. Parks will establish a comprehensive program of worker exposure assessment using qualified Industrial Hygienists and park employees who have been trained as Workplace Monitors.

References

1. 29 CFR 1910 Subpart Z. Toxic and Hazardous Substances.
2. 29 CFR 1910 and 1926 Agent Specific Regulations.

3. Mulhausen, J.R and J. Damiano. 1998. A Strategy for Assessing and Managing Occupational Exposures. AIHA 349 pp.
4. ACGIH. 2002. Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.

Definitions

Employee Exposure is an exposure to chemical, physical or biological agents that occurs in the workplace regardless of the use of personal protective equipment.

Exposure Assessment is the qualitative or quantitative determination made by an industrial hygienist or other appropriately trained individual of an employee's exposure to a chemical biological or physical agent.

Negative Exposure Determination is the qualitative or quantitative determination made by an experienced industrial hygienist that an employee is not exposed at or above the action level. In many cases, this determination can be made without sampling data. A review of the chemical, physical, biological and toxicological characteristics of the material, quantity of use, frequency of use, conditions under which it is used and past experience with similar operations may be sufficient to characterize exposures to a workplace hazard. In other instances, sampling may be necessary to ascertain the extent of exposure. Sampling may also be required by regulation (e.g., asbestos and lead).

Positive Exposure Determination is the qualitative or quantitative determination made by an industrial hygienist that an employee is exposed at or above the action level for a chemical, biological or physical agent. Monitoring may be conducted to verify the determination.

Exposure Monitoring is the direct measurement of employee exposure using direct reading instrumentation or sample collection for analysis.

Industrial Hygiene is the science and art devoted to the anticipation, recognition, evaluation and control of environmental health hazards in the workplace.

Industrial Hygienist is a civil service General Schedule 690 Series employee or equivalent in the private sector.

Experienced Industrial Hygienist is a civil service General Schedule 690 Series employee GS-12 and above (or PHS O-4 or above) or any Certified Industrial Hygienist (CIH).

Workplace Monitor is an individual trained in exposure monitoring working under the direction of an industrial hygienist.

Occupational Exposure Limit (OEL) is an allowable concentration or intensity of a hazardous agent in the employee's immediate work environment over a given period of time. OELs are generally expressed as 8-hour time weighted averages (TWA) or as excursion or short-term exposure limits of 15 or 30-minute duration. The OELs used by NPS are the OSHA Permissible Exposure Limit (PEL) and the Threshold Limit Values published by ACGIH.

Action Level (AL) is the level of exposure, described as the concentration over a given period of time, at which exposure control measures must be implemented to reduce the potential for an unacceptable worker exposure. Action levels are prescribed by OSHA regulation for certain agents. In the absence of OSHA-prescribed ALs, NPS will use 50% of the PEL or TLV as the AL.

Comprehensive Exposure Assessment

A comprehensive exposure assessment program involves a continual process of collecting information, prioritizing controls and gathering follow-up information. Systematic procedures for conducting a comprehensive exposure assessment have been prescribed by the American Industrial Hygiene Association¹ and are described in detail by Mulhausen and Damiano². They are summarized below.

1. *Characterize Exposure:* Gather information to characterize the workplace, workforce and environmental agents. This may be accomplished as part of the job hazard analysis. This involves describing and evaluating the exposures present in the workplace and documenting them in an organized manner.
2. *Assess Exposure:* Assess exposures in the workplace relative to the information available on the workplace, workforce and environmental agents. Exposure monitoring is not essential to exposure assessment. Many occupational exposures can be assessed without monitoring data. Although traditional assessment strategies have emphasized personal monitoring to measure exposure to air contaminants and noise, modeling techniques are more widely accepted and may be required for prospectively assessing an exposure that has not yet begun. Qualitative assessments may be used to screen exposure risks and set priorities. Through this process, groups of similarly exposed workers will be defined [similar exposure groups (SEG)] and their exposure profile will be described. Judgments about the acceptability of each exposure profile are made based on estimated exposure level, severity of health effects and the uncertainty associated with the available information.

¹ AIHA. 1997. White Paper on a Generic Exposure Assessment Standard.

² Mulhausen, J.R. and J. Damiano. 1998. *A Strategy for Assessing and Managing Occupational Exposures*, 2nd Ed. AIHA Press.

Exposures may be judged as:

- *Unacceptable* — requiring the implementation of controls;
- *Acceptable* — no action is required but routine monitoring may be needed to validate the judgment or ensure that exposures do not become unacceptable; Or
- *Uncertain* — additional information is required to determine the acceptability of the exposure and it may involve modeling, exposure monitoring, biological monitoring or the development of toxicological or epidemiological data.

Exposure assessments will be conducted by experienced Industrial Hygienists.

1. *Gather Additional Information:* Implement prioritized exposure monitoring or the collection of more information on health effects so that uncertain exposure judgments can be resolved with higher confidence. Exposure monitoring may be conducted by a Workplace Monitor under the direction of an experienced Industrial Hygienist.
2. *Implement Health Hazard Controls:* Implement prioritized control strategies for unacceptable exposures.
3. *Reassess Exposure:* Periodically perform a comprehensive re-evaluation of exposures. Determine whether routine monitoring is required to verify that acceptable exposures remain acceptable.
4. *Communicate and Document Findings:* Communicate assessment results to workers and occupational health program managers in a timely manner. Fully document SEGs, their exposure profiles, judgments on the acceptability of exposures, all monitoring results and hazard control recommendations and control plans.

Compliance Monitoring

Compliance monitoring focuses on the maximum risk employee to determine whether exposures are above or below established limits. It will be conducted as required by agent-specific OSHA Regulation. Specific monitoring requirements for OSHA-regulated agents likely to be encountered by NPS employees are summarized in Table 1.

Table 1. OSHA Mandated Agent and Program — Specific Monitoring Requirements of note for NPS

AGENT	REFERENCE	EXPOSURE ASSESSMENT REQUIREMENTS
Lead	29 CFR 1926.62 29 CFR 1910.1025	Work shift & short-term monitoring of representative employees and tasks; Initial, quarterly, semi annually or annually; Objective data permitted
Asbestos	29 CFR 1910.1001 29 CFR 1926.1101	Initial exposure assessment prior to initiating work; Work shift & excursion monitoring; Daily & periodic depending on work classification; Objective data permitted
Inorganic Arsenic	29 CFR 1910.1018	Work shift monitoring; Quarterly or annually depending on concentration
Benzene	29 CFR 1910.1028 46 CFR 197.540	Work shift and short-term monitoring each job class and work area; Initial, semi annual and annual (time of year may be prescribed)
Cadmium	29 CFR 1910.1027 29 CFR 1926.1127	Work shift monitoring of representative employees and tasks; Initial and semi annually
13 Carcinogens	29 CFR 1910.1003	
Acrylonitrile	29 CFR 1910.1045	Work shift monitoring; Initial and monthly or quarterly depending on concentration
Ethylene oxide	29 CFR 1910.1047	Work shift & short-term monitoring each job class and work area; Initial, quarterly and semi annually
Formaldehyde	29 CFR 1910.1048	Work shift & short-term monitoring of representative employees and tasks; Initial, semi annual and annual; Objective data permitted for negative determination.
Butadiene	29 CFR 1910.1051	Work shift & short term monitoring of representative employees and tasks; Initial, quarterly, semi annual or annual; Object data permitted
Noise	29 CFR 1910.95	Area & personal monitoring to determine employee exposure
Respiratory Protection	29 CFR 1910.134	Exposure assessment that includes a reasonable estimate of employee exposure
HAZWOPRER	29 CFR 1910.120	Requires design of an exposure assessment program as part of the Site-Specific Safety and Health Plan
Laboratories	29 CFR 1910.1450	Requires a <i>Chemical Hygiene Plan</i> and an exposure assessment
Dip Tanks	1910.126	Requires evaluation of probable skin contact and effectiveness of airborne contaminant control measures
Abrasive Blasting	29 CFR 1910.94	Evaluation of dust hazards from abrasive blasting
Ionizing Radiation	29 CFR 1910.1096	Exposure assessment required

Implementation

Qualitative Exposure Assessment

Exposure monitoring is not always required to assess exposures. In many cases, occupational exposures can be assessed without monitoring data. Modeling techniques have become widely accepted and may be required to assess an exposure of an upcoming task.

Qualitative exposure assessment may be used initially to determine potential personnel exposures at or above the action level (AL). This determination is to be made by an industrial hygienist that is familiar with the operation or process being evaluated. A positive determination indicates there are personnel exposures above the AL. A negative determination indicates that, based on past sampling results or professional judgment, personnel exposures are not expected to exceed the AL under normal or foreseeable operating conditions. All negative determinations must be fully and accurately documented to support the decision. Initial exposure data could lead to the decision that there is insufficient information available for an immediate positive/negative determination. Further sampling or information gathering may be required to assess exposures. If additional sampling must be conducted, a monitoring plan should be developed.

Initial qualitative assessments should include the following:

- Description of operation, task, or process, including work practices and procedures, frequency and duration of operation and may include a diagram of the work area.
- List of all potentially hazardous materials used, stored, handled, or produced. Include a description of how they are used, amount on hand, and estimated consumption rates. A list of hazardous materials used at the facility will be available as a component of the Park's Hazard Communication Program.
- List of potential physical hazards, such as noise, heat, ionizing and non-ionizing radiation. Include a brief description of their sources.
- List of potential biological or infectious agents
- Direct reading screening measurements for each work area where applicable.
- Description and efficiency of existing controls. Include type of personal protective equipment (PPE), administrative controls, and engineering controls and evaluations of their effectiveness.
- The number of personnel assigned to each work operation/process (total, male and female).

This information may be organized using the attached form "Similar Exposure Group Characterization and Exposure Profile (Process/Task-Based Exposure Assessment)."

Monitoring Plans

An exposure monitoring plan must be completed for each operation, process or task that requires sampling. This could include sampling needed to characterize exposures that are at or above the AL or sampling required by regulation. The plan should also include assessments needed to document the adequacy of engineering controls such as the function of ventilation systems.

SIMILAR EXPOSURE GROUP CHARACTERIZATION AND EXPOSURE PROFILE (PROCESS/TASK-BASED EXPOSURE ASSESSMENT)		
Unit:	SEG Descriptor:	Date:
Shop or Task:		No. Persons Similarly Exposed

Agent	OEL	Action Level (A.L.)	Exposure Type Route ¹	Frequency/ Duration	Controls ²	PPE	Exposure Risk Rating ³	Confidence ⁴ (H,M,L)	Likely to Exceed A.L.?

1

Continuous or intermittent: inhalation; dermal, eye

2

Engineering and Administrative Controls

3

0=trivial; 4=100%OEL or high risk

4

Investigators confidence in exposure risk rating

Comments:	
Recommendations:	
Significant Tasks/Shops for Future Evaluation (Attach Monitoring Plan):	
Analyst, Billet/Position Title:	Date:

Attach any screening measurement results

PROCESS/TASK-BASED EXPOSURE ASSESSMENT
Unit: Your National Park

Date: 20 August 2003

Shop or Task: Road Maintenance: Workers operate Case 580, Operate back hoe and ditcher, apply cold patch asphalt paving to repair roadways; clean culverts using vacuum apparatus; do cold road crack sealing; Grade roads; operate sweeper behind tractor. Conduct bridge repair requiring cutting of stone facing material.

Potential Hazard	Std. Or OEL	Exposure Type Route ₁	Frequency/ Duration	Controls ₂	PPE	Exposure Risk Rating ₃	Confidence ₄ (H,M,L)
Hydraulic fluid		Dermal, splash eyes	Rare			1	H
Low VOC Cold Patch		Dermal	Infrequent 1/month			1	H
VOC's in "cut back" cold patch: Kerosene Gasoline Naphtha	100mg/m3 300ppm 300ppm	Inhalation				2	M
Silica	0.05 mg/m3 R	Inhalation	Infrequent			2	L

¹ Continuous or intermittent inhalation; splash; mech. contact, thermal, electrical, chemical, multiple

² Engineering and Administrative Controls

³ 0=trivial; 4=100%OEL or high risk/significant noncompliance

⁴ Investigators confidence in exposure risk rating

Comments: 1) Roadways are newly surfaced; therefore many tasks are rare or no longer done (such as line painting). 2) Most maintenance engineers rely on “cutback asphalts” (also known as “cold asphalt” or “cold mix”) as a temporary patch until hot asphalt can be applied. These cutback asphalts are made from forms of hot asphalt which have been blended with petroleum solvents or other “cutbacks”, (also called diluents) such as kerosene, gasoline or other naphtha-based products to prevent the asphalt from solidifying prior to application. This process allows the product to be stored, transported or bagged for long periods of time. Once applied, these diluents evaporate and the asphalt begins to harden. One 60 lb. bag of cold asphalt will usually contain between 3-5% (about 1 liter) of these cutbacks. When these liquid cutbacks evaporate, they release large amounts of volatile organic compounds (VOCs) into the atmosphere and provide a potential for overexposure. Use of Low VOC cold patch will greatly limit employee exposure to these compounds. 3) Dermal exposure is the more important route of exposure to Low VOC cold patch and cold crack seal.

Recommendations: 1) Use low VOC cold patch. 2) Conduct exposure monitoring to evaluate silica exposure during stone cutting and fitting tasks

Significant Tasks/Shops for Future Evaluation:

Analyst(s), Billet/Position Title(s): Your Industrial Hygienist

Date: