

LABORATORY SAFETY

1.0 SCOPE

This Performance Assessment Guide for Laboratory Safety will be used to carry out the oversight responsibility of the U.S. Department of Energy (DOE) Brookhaven Group. This guide was prepared to assist in conducting performance-based assessments of both DOE prime contractors and subcontractors to ensure that their laboratory safety program identify, disposition, and take corrective action on issues that affect satisfactory facility performance. The goals are to determine if a laboratory safety program has been established at the BNL level to maximize the effectiveness of respective activities/processes and to minimize the risk of economic loss or worker/public injury/illness consistent with the risk of the activity or process.

Laboratory safety assessments will be directed at prime contractors and subcontractors working at DOE sites. DOE line management must ensure that the BNL complies with DOE Orders and Federal and State regulations. Information developed from this assessment will determine the degree to which this is being done as well as the effectiveness of the BNL's program.

2.0 ATTRIBUTES AND LINES OF INQUIRY

This section provides lines of inquiry to help assess whether the BNL has implemented a program that ensures that laboratory safety requirements are incorporated into line activities. This section will be used to evaluate the BNL's line organization.

2.1 The BNL's training programs ensure that individuals working in laboratories receive appropriate laboratory safety training.

- Are the applicable regulations and standards that govern laboratory safety addressed or described in the training programs?
- Do the training programs adequately address laboratory safety concerns, requirements, and practices to be followed at the facility?
- Does the training clearly identify who has responsibility for implementing the BNL laboratory safety program?

- Have all employees at the BNL facility who may require training in laboratory safety been identified, including support personnel such as janitors?
- Are personnel who are in a position to detect and control performance of work involving BNL laboratory safety appropriately trained and instructed so that the required level of performance is maintained?
- Is BNL laboratory safety training provided on a periodic basis?
- Does a review of the training documentation show that the course content is comprehensive?
- Does the training program establish qualification requirements for the training instructors?
- When an employee's level of responsibility changes, is additional training required or provided?
- Do interviews with workers indicate that they understand the importance and application of laboratory safety at the BNL site laboratory facilities?
- Does the BNL site laboratory safety program specify special training or certification requirements for individuals working in a laboratory?
- Does the BNL laboratory safety training program include:
 - Information regarding the Chemical Hygiene Plan, including the locations and availabilities of copies of the plan?
 - Information regarding the location and proper use of available protective apparel and equipment?
 - A discussion of the physical hazards and health hazards associated with the particular work areas, as well as the protective measures that employees may take to mitigate these hazards?
 - Information on the permissible exposure limits for regulated substances and recommended exposure limits for other hazardous chemicals for which no OSHA standards apply?

- Information on the signs and symptoms associated with exposures to hazardous chemicals?
- Information on the location and availability of known reference materials, including Material Safety Data Sheets (MSDSs), on the hazards, safe handling, storage and disposal of hazardous chemicals in the workplace?
- Discussions of the methods and observations (including continuous monitoring procedures, visual appearances, or smells) that workers may use to detect the presence of hazardous chemicals?
- Do the receiving and storeroom personnel receive training regarding the hazards associated with chemical substances, handling equipment and procedures, protective apparel, and relevant regulations?

2.2 For laboratory uses of OSHA-regulated substances, the laboratory ensures that laboratory employees' exposure to such substances does not exceed permissible exposure limits (exposure limits reference those as specified in 29 CFR Part 1910, subpart Z, or NIOSH Registry of Toxic Effects of Chemical Substances).

- Are exposure levels determined through initial and periodic exposure monitoring and analyses of potential hazards?

2.3 The employee's exposure to any substance, regulated by a standard that requires monitoring, is monitored if there is a reason to believe that exposure levels for that substance routinely exceed the action level or permissible exposure. An action level is a concentration designated in 29 CFR 1910 for a specific substance, calculated as an 8-hour time-weighted average, which initiates certain required activities such as exposure monitoring and medical surveillance.

- Does the exposure monitoring program periodically measure the employee's exposure and comply with exposure monitoring provisions of the relevant standard when the measured exposure is above the action level or permissible exposure limit?
- Is termination of the employee's exposure monitoring performed in accordance with the relevant standard?
- Is the employee notified (in writing) of the periodic monitoring results within 15 working days after the results are received?

2.4 A Chemical Hygiene Plan to protect employees from health hazards associated with chemicals has been developed for using hazardous chemicals in the BNL laboratories, and is capable of maintaining exposures below specified limits.

- Is the Chemical Hygiene Plan readily available to employees and employee representatives?
- Does the Chemical Hygiene Plan include standard operating procedures relevant to safety and health considerations when BNL laboratory work involves the use of hazardous chemicals?
- Do these procedures include a discussion of things that are not to be done, as well as things that are?
- Does the Chemical Hygiene Plan include criteria that the employer will use to determine and implement control measures to reduce employee exposure to hazardous chemicals, including engineering controls, the use of personal protective equipment, and hygiene practices (see Section 4.0, "Guidance to Assessor")?
- Is particular attention given to the selection of control measures for chemicals that are known to be extremely hazardous?
- Do the BNL laboratories have well-ventilated storerooms and fume hoods, sinks with appropriate drain systems, eyewash fountains, and drench showers?
- Does the Chemical Hygiene Plan include a requirement that fume hoods and other protective equipment function correctly and that specific measures are taken to ensure the proper performance of this equipment (see Section 4.0, "Guidance to Assessor")?
- Do the BNL laboratories periodically appraise, and modify if necessary, chemical hygiene-related equipment (e.g., fume hoods, incinerators, ventilation systems, waste disposal systems)?
- Does the Chemical Hygiene Plan include—
 - The circumstances under which prior approval needs to be obtained from the laboratory management before commencing a specific operation, procedure, or evolution?
 - Provisions for medical consultation and medical examinations?

- Designation of personnel responsible for implementation of the Chemical Hygiene Plan, including assignment of a Chemical Hygiene Officer, and if appropriate, a Chemical Hygiene Committee?
- Provisions for additional employee protection from particularly hazardous substances, such as select carcinogens, reproductive toxins, and highly toxic substances?
- Does the plan establish designated use and storage areas, containment devices such as fume hoods or glove boxes, procedures for removing contaminated waste, and procedures for decontamination of equipment?
- Where use of respirators is necessary to maintain exposure below permissible exposure limits, is the appropriate respiratory equipment provided at no cost to the employee?
- Is the effectiveness of the Chemical Hygiene Plan reviewed and evaluated at least annually?

2.5 All employees who work with hazardous chemicals are provided with an opportunity to receive medical attention including any followup examinations the examining physician determines to be necessary.

- Is the opportunity for medical attention provided—
 - Whenever an employee develops signs or symptoms associated with a hazardous chemical to which the employee may have been exposed in the BNL laboratory?
 - Where exposure monitoring reveals an exposure level routinely above the action level, or permissible exposure limit, for a regulated substance that has exposure monitoring and medical surveillance requirements?
 - Whenever an event has occurred such as a spill, leak, explosion, or other abnormal occurrence that may result in overexposure to a hazardous substance?
- Are medical examinations and consultations performed by, or under the direct supervision of, a licensed physician without cost to the employee or without loss of pay, and at a reasonable time and place?

- If an employee was overexposed to a hazardous substance, was the examining physician provided necessary information in a timely manner (e.g., identification of hazardous substances involved in the exposure, conditions under which the exposure occurred, quantitative if possible, and a description of the signs and symptoms the employee experienced)?
- Does anyone whose work involves regular and frequent handling of toxicologically significant quantities of a chemical receive consultation from a qualified physician to determine individually the desirability for a regular schedule of medical surveillance?
- Are personnel trained in first aid available during working hours and is there an emergency room with medical personnel nearby? Have they received training in the control of potential exposure to bloodborne pathogens?
- After an employee is examined or consulted by a physician does the laboratory receive a written opinion from the physician that includes, as a minimum—
 - Recommendation for further medical followup?
 - Results of the medical examination and any associated tests?
 - Any medical condition revealed during the course of the examination that may place the employee at increased risk resulting from exposure to a hazardous chemical found in the workplace?
 - A statement that the employee has been informed by the physician of the results of the consultation or medical examination and the need for further examinations or treatment?
- Is it made certain that the physician's written opinion does not reveal specific findings of a diagnosis that are unrelated to the occupational exposure?
- Are accurate records maintained to document the measurements taken to monitor employee exposures and medical consultations or examinations and are these records made available to the employee and transferred with the employee (see Section 4.0, "Guidance to Assessor")?

2.6 Hazard identification shall include appropriate labels and MSDSs.

- Does the BNL laboratory ensure that labels on incoming containers of hazardous chemicals are not removed or defaced?
- Does the BNL laboratory maintain the MSDS received with incoming shipments of hazardous chemicals and ensure that these sheets are readily accessible to laboratory employees?
- Does the BNL laboratory identify the hazardous characteristics of chemical substances developed exclusively in the lab and ensure that appropriate employee training regarding these hazards is provided?
- If the composition of chemical by-products produced in the BNL laboratory is not known, are these by-products assumed to be hazardous and managed in accordance with the laboratory's Chemical Hygiene Plan?
- If the BNL laboratory produces chemical substances to be used by others outside the lab, are the substances properly labeled and are MSDSs prepared and shipped with the product?

2.7 Hot laboratories have properly designed primary confinement systems that usually consist of items such as hot cells, glove boxes, process piping, tanks, and fume hoods.

- Does a separate ventilation system or off-gas treatment system, with an appropriate air-cleaning capability (e.g., high-efficiency particulate air [HEPA] filters, in-line absorbers, or scrubbers), exist for the primary confinement system?
- Is the primary confinement ventilation system separate from secondary and tertiary systems?
- Is the primary confinement operating pressure maintained negative with respect to the secondary confinement system, and are procedures in place to specify what actions should be taken in the event of a primary confinement ventilation system upset?
- Are tanks within the primary confinement vented to an appropriate off-gas treatment system?
- Does a means exist to neutralize corrosive gases or particles from vats, scrubbers, and similar equipment in glove boxes, before the gases or particles reach the HEPA filters?

- Are exhaust prefilters and HEPA filters installed in such a manner as to facilitate filter changing and repairs?
- Do the exhaust systems have monitors that will provide an alarm if the concentration of the hazardous material in the exhaust exceeds the limits specified in the facility's OSR/TSR document?
- Do all exhaust outlets that may contain radiological contamination have two monitoring systems?

2.8 If the laboratory handles, stores, or makes use of hazardous chemicals, then the specific fire protection requirements of ANSI/NFPA 45 are in effect (see Section 4.0, "Guidance to Assessor"). (Laboratories excluded from these requirements are laboratories in health care facilities, pilot plants, laboratories that are primarily manufacturing plants, and laboratories in production facilities).

- Have appropriate fire hazard and explosion hazard classification codes (A, B, C, and I, II, IIIA, respectively) been established for the laboratory as defined in ANSI/NFPA 45 Chapter 2?
- Do the laboratory's fire protection systems meet the requirements defined in ANSI/NFPA 45 Chapter 4?
- If the laboratory is considered to contain an explosive hazard, has appropriate protection been provided in accordance with ANSI/NFPA 45 Chapter 5 to protect workers, laboratory property, and adjoining areas?
- Do the laboratory's ventilating systems meet the requirements established in ANSI/NFPA 45 Chapter 6?
- Do the laboratory's chemical storage, handling, and waste disposal procedures and processes address the requirements of ANSI/NFPA 45 Chapter 7?
- Does the laboratory handle compressed and liquefied gases in accordance with ANSI/NFPA 45 Chapter 8?
- Does the laboratory conduct operations (e.g., operations involving hazardous chemicals, chemical reactions, heating of flammable and combustible liquids, and distillation operations) in accordance with ANSI/NFPA 45 Chapter 9?

- If the laboratory uses refrigeration and cooling equipment, heating equipment, constant-temperature baths, pressure equipment, and/or analytical instruments, does this equipment meet the requirements of ANSI/NFPA 45 Chapter 9.
- Has the laboratory identified its various hazards in accordance with ANSI/NFPA 45 Chapter 10?

2.9 The implementation procedures of the laboratory safety oversight process cover various specific BNL laboratory oversight organization responsibilities.

- Do these documents include descriptions of approaches, resources, and time periods planned for the implementation of DOE O 231.1, DOE O 440.1A, and the DOE 5480 series Orders?
- Specifically, do the criteria for BNL laboratory selection at the facility ensure that candidates are able to meet environmental safety and health (ES&H) requirements?
- Have laboratory safety performance requirements for the BNL laboratory been incorporated into the Cost Plus Award Fee (CPAF) structure?
- Are the oversight organization's recommendations to BNL laboratory requests for variances from the DOE-prescribed OSHA standards, along with employee comments to these requests, submitted to the Director of Operational Safety (EP-32) within 30 days following receipt of the request?
- Has approval for all generic exemptions from ES&H requirements and responsibilities that are contained in DOE O 231.1, DOE O 440.1A, and the 5480 series DOE Orders been requested from the appropriate Cognizant Secretarial Official (CSO)?
- Have copies been provided to EH-1 of all prioritized recommendations for major ES&H upgrades and corrective actions that are included in the budget requests to the CSO?
- Are management appraisals of the ES&H programs of the subordinate field activities (operated by either Federal employees or BNL laboratory personnel) conducted at

least once every 3 years (reviews to establish BHG award fees are adjuncts to management appraisals, not a substitute for them)?

- How often are functional appraisals of the implementation of Laboratory Safety conducted by the BHG oversight organization and how does this compare with the scheduled intervals?
- Does the BNL laboratory oversight organization ensure that internal appraisals are performed at the operating level?
- Does the BNL laboratory oversight organization conduct formal, routine, and comprehensive safety and health self-assessments?
- Are formal compliance inspections performed periodically?
- Are these compliance inspections based on a sampling plan?
- Are the compliance inspections prioritized by the degree of safety hazard present in the activity and in the number of employees involved?

3.0 STANDARDS AND REQUIREMENTS

3.1 Specific DOE Orders and Standards.

- DOE O 231.1, "Environment, Safety, and Health Reporting."
- DOE O 232.1A, "Occurrence Reporting and Processing of Operations Information."
- DOE O 440.1A, "Worker Protection Management for DOE and Contractor Employees."
- DOE 2300.1B, "Audit Resolution and Followup."
- DOE 2321.1B, "Auditing of Programs and Operations."
- DOE 5700.6C, "Quality Assurance."

3.2 Title 10 CFR Requirements.

- 10 CFR 830.120, "Quality Assurance for DOE Nuclear Facilities."

3.3 OSHA Title 29 CFR Requirements.

- Title 29 CFR 1910.20, "Access to Employee Exposure and Medical Records."
- Title 29 CFR 1910.1450, "Occupational Exposure to Hazardous Chemicals in Laboratories."
- Title 29 CFR 1910, Subpart Z, "Toxic and Hazardous Substances."

3.4 American National Standards Institute Requirements.

- ANSI/NFPA 45, "Standard on Fire Protection for Laboratories Using Chemicals."

3.5 National Institute for Occupational Safety and Health.

- Registry of Toxic Effects of Chemical Substances.

4.0 GUIDANCE TO ASSESSOR

This assessment guide is intended to assist in conducting a performance assessment of laboratory safety. It is not to be considered as all-inclusive, inflexible, or limiting reasonable assessment concentration when lines of inquiry responses dictate that an area must be more thoroughly probed.

Regulatory requirements regarding a specific toxic and/or hazardous substance may be found in 29 CFR 1910, Sections 1000-1101. Specific information regarding hazard communication can be found in 29 CFR 1910.1200. Recommended guidance (non-mandatory) for the development of a laboratory's Chemical Hygiene Plan can be found in 29 CFR Appendix A to Section 1910.1450. The use of ANSI/NFPA 45, "Standard on Fire Protection for Laboratories Using Chemicals," requires the assessor to become familiar with this document since application of specific requirements is dependent on the particular conditions found at each laboratory. If the BNL laboratory uses hazardous chemicals, supporting documentation should reference this standard and indicate how to comply with its applicable portions.

The use of respiratory protection equipment must comply with the requirement of OSHA's respiratory protection standard 29 CFR 1910.134, which specifies factors such as selection, fit, use, and maintenance. Special attention should be paid to chemicals that are known to be extremely hazardous.

A hazards inventory is crucial to a successful Chemical Hygiene Plan. The employer's process to ensure that hazards are determined (including types, quantities, frequencies, and concentrations of

chemicals; conditions of use; routes of exposure; accidental release and reaction mechanisms, etc.) should be assessed.

The Chemical Hygiene Plan must address the determination of face velocities for fume hoods. An approved approach (such as found in the ACGIH's *Ventilation Handbook*) must be used to make this determination. However, a set velocity criterion need not be established.

Exposure records and the data analyses based on them are to be kept for 30 years. Medical records of employees who have worked for less than 1 year need not be retained after employment, but the employer must provide these records to the employee on termination of employment.