

CHEMICAL HYGIENE PLAN

High Energy Physics Division

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THE CHEMICAL HYGIENE PLAN REPRESENTS THE HIGH ENERGY PHYSICS DIVISION'S PLAN FOR MAINTAINING A SAFE CHEMICAL ENVIRONMENT AND MEETING LABORATORY POLICY GOALS ON STORAGE AND USE OF CHEMICALS.

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Purpose

The purpose of the Chemical Hygiene Plan is to establish and maintain a program in HEP to ensure that appropriate control methods are implemented to limit exposure to hazardous chemicals in HEP-related work areas and ensure the safe use of such chemicals when they are used.

Scope

This plan applies to workplace operations using hazardous chemicals in relatively small quantities. For operations involving chemicals in areas not designated as chemical work areas, all other OSHA standards in 29 CFR Part 1910, including exposure standards, continue to apply. In addition to provisions of this plan, the [ANL Environment, Safety and Health Manual, 4.3 Laboratory and Chemical Safety](#) also apply.

Objective

The work of the High Energy Physics Division ordinarily requires little or no use of hazardous chemicals. This plan is developed to provide for the occasional necessary use of such chemicals in a safe and environmentally secure manner. The Chemical Hygiene Plan shall be revised annually to reflect the divisional changes as necessary. This would also include the safety development and changes in regulations or interpretations.

The objective is to promote the improvement of laboratory health and safety by ensuring that the proper procedures, training, and a written chemical hygiene plan are in compliance with 29 CFR 1910.1450, "Occupational Exposure to Hazardous Chemicals in Laboratories" (also known as the OSHA Laboratory Standard), as well as other applicable regulations the Laboratory is required to follow.

General Principles

All chemicals, because of concentration, toxicity, flammability, carcinogenicity, or other characteristics, are potential health hazards. The intent of the Chemical Hygiene Plan is to provide guidelines for handling and using chemicals without causing harm to oneself, other employees, or to the laboratory environment.

a. *Minimize exposure.*

Even for substances with no known significant hazard, exposure should be minimized. When working with substances which present special hazards, special precautions should be taken. Engineering controls and personal protective equipment should be used to minimize exposures.

b. *Avoid underestimation of risk.*

One should assume that a mixture presents all the hazards of its components. One should assume that all substances of unknown toxicity are toxic.

- c. *Provide employee exposure assessment.*

Maintain employee exposure below the OSHA Permissible Exposure Limits (PEL) and other applicable exposure limits by informed exposure potential assessment and workplace exposure monitoring as appropriate.

- d. *Engineering controls.*

Control methods such as laboratory hoods, local exhaust ventilation, enclosures, wet methods, etc., will be applied in preference to primary dependence on personal protective equipment such as respirators.

Levels of Responsibilities

- Division Director - Is responsible for implementing Laboratory policy on and for providing continuing support for chemical hygiene activities affecting the health and safety of laboratory employees as these relate to the HEP Division.
- ES&H Administrator for HEP - Has oversight responsibilities for ES&H activities, including Chemical Hygiene.
- Site Chemical Hygiene Officer (SCHO) - The SCHO provides sitewide coordination and support for Division Chemical Hygiene Officers.
- Division Chemical Hygiene Officer (DCHO) - Technically qualified individual designated by division management. Responsibilities are outlined under HEP Chemical Hygiene Office. (Page 4)
- Supervisor. (Page 5)
- Laboratory worker. (Page 5)

Division Chemical Hygiene Officer

DCHO for HEP Division – Leon Reed, who may be contacted at 630-252-4478 (office) or 773-895-7575 (home).

DCHO Role/Function - Provide technical guidance in the development and implementation of the provisions of the Chemical Hygiene Plan. The DCHO will:

1. Works with administrators and employees to develop and implement appropriate

chemical hygiene policies and practices.

2. Monitors purchase orders in order to insure the proper MSDS's and training are available for new and ongoing projects.
3. Reviews and approves operations as stated in Divisional Chemical Hygiene Plan.
4. Provides oversight and implementation of the Chemical Hygiene Plan.
5. Conducts periodic audits of the HEP Chemical Hygiene Programs.
6. Helps project leaders develop precautions and adequate facilities, as they apply to Laboratory Standard for chemical use.
7. Understands the current legal requirements concerning the regulated substances and maintains appropriate reference sources.
8. Performs annual reviews to evaluate and update the HEPD Chemical Hygiene Plan to update the Plan to respond to changes in projects.

Supervisors - Maintains overall responsibility for chemical hygiene in the laboratory or general area of work.

1. Ensure that employees know and follow the chemical hygiene rules, make sure that protective clothing and equipment is available, equipment is in working order, and training and information have been provided. This includes assuring that Material Safety Data Sheets (MSDS) are readily available for substances used in the laboratory.
2. Ensure that records of training and information are maintained in an auditable form.
3. Provide regular chemical hygiene and housekeeping inspections.
4. Know the current legal requirements concerning regulated substances.
5. Determine the required levels of protective clothing and equipment.
6. Ensure that facilities are adequate for any new hazard introduced into the laboratory.
7. Work with division management, the DCHO, and other employees to develop and implement appropriate hygiene policies and practices.
8. Monitor the procurement, use, and disposal of chemicals used in the lab.

9. Help project leaders develop precautions and adequate facilities, as they apply to the OSHA Laboratory Standard for chemical use.
10. Maintain compliance to the Chemical Hygiene Plan.

Workers - Plan and conduct each operation involving chemical use in compliance with the established procedures and good personal hygiene practices.

Employees are responsible for placing warning signs and labels on chemical containers, equipment, or areas where special or unusual hazards are present.

1.0 Exposure Assessment (Hazards Identification)

- 1.1 Sufficient information about the hazardous and toxic properties of chemicals must be obtained to allow safe handling. Chemicals presenting an unusual or severe exposure hazard may require notification or approval by the DCHO, as specified in Section 4.0.
- 1.2 Good chemical labeling practices shall be observed and labels on incoming containers shall not be removed or defaced. When materials are transferred from their original containers, the container into which the material is placed shall be properly labeled. Refer to ANL Environment, Safety and Health Manual Chapter 4-1, "Hazard Communication".
- 1.3 A known chemical produced in a laboratory shall be evaluated, by reviewing the available literature, to determine if it is a hazardous chemical. An unknown chemical composition shall be treated as a hazardous substance.
- 1.4 If a current Material Safety Data Sheet, MSDS is not available, it shall be requested whenever a chemical product is ordered. An on-line database and central file collection of ANL MSDS are maintained by the Industrial Hygiene Section of EQO in Building 200. To obtain an MSDS or to get computer access to the database, call IH at 2-4674.
- 1.5 If a substance is produced by someone outside the laboratory, the chemical must have a hazard warning label and a Material Safety Data Sheet prepared, and provided to the user. Industrial Hygiene (Ext. 2-3310) and the DCHO must be consulted for review of a Material Safety Data Sheet before it is sent outside the Laboratory.
- 1.6 The DCHO will make hazard information available for highly acutely toxic chemicals, "select carcinogens," and reproductive hazards regulated by Laboratory Standard. This information will be in the nature of Material Safety Data Sheets

(MSDS), vendor supplied product information sheets, or reprints from appropriate reference sources. If this information is not available upon receipt of substance, contact the DCHO before handling

the chemical. All other hazardous chemical information should already be available on MSDS or product labels.

2.0 Chemical Procurement, Distribution, and Storage

- 2.1 Purchase order with chemicals and radioactive material must be approved by DCHO.

Before substance is received, information on proper handling, storage and disposal must be known to those who will be involved. Do not accept any container that does not have an adequate identifying label.

- 2.2 Any personnel obtaining samples from an outside source are personally responsible to notify the DCHO.
- 2.3 The HEP Division's chemical inventory is maintained by the ANL [Chemical Management System](#) (CMS). When chemicals are ordered through AMOS and IMPS, which are linked to the CMS, a bar code label is issued to each chemical. As chemicals are used, the bar code label is removed from the chemical container and deleted from the CMS.

3.0 Chemical Storage

- 3.1 Chemical storage within laboratories must be kept to reasonable quantities consistent with work in progress. Outdated and unneeded chemicals must be disposed of through Waste Management Operations (WMO). Consult the DCHO for details. For chemicals with a safety or performance-driven expiration date, the inventory record in the CMS should be revised to show the expiration date in the Expiration Date Field. When chemicals are ordered through PARIS or AMOS and identified as chemicals, the CMS automatically sets recommended expiration dates for those chemicals listed in the ESH Manual Chapter 4.3.10, "Chemical & Laboratory Safety". A standard report in the CMS on Date Sensitive Chemicals can be used to list all items dated to expire within the next month.
- 3.2 Chemicals which have a useable life must be dated by the manufacturer, or upon receipt in the laboratory. Refer to ANL Environment, Safety, and Health Manual Chapter 4.3, "Chemical and Laboratory Safety," for dating recommendations on others.
- 3.3 Flammable and combustible liquids must be stored in accordance with ANL Environment, Safety, and Health Manual Chapter 11-3, "Flammable and

Combustible Liquids." In general, flammable materials of 1 to 5 gallons must be stored in approved safety containers, and 25 to 60 gallons stored in UL-listed flammable storage cabinets. Flammable materials must not be stored in refrigerators unless they are approved as explosion proof.

- 3.4 Chemical storage in fumehood work areas is not acceptable, except where highly volatile/noxious materials are in containers which may not be vapor tight and where placement in the hood does not interfere with proper hood operation.
- 3.5 Cooperation with the DCHO on chemical inventory effort is required. This will be done at least annually; unwanted/outdated chemicals should be searched for and properly disposed of as part of this process.

4.0 Working with Chemicals

Below are listed the basic rules and principles to be observed when working with chemicals. Additional requirements are included in the ANL Environment, Safety and Health Manual. New Projects using hazardous chemicals require pre-operation safety review. Consult the ANL Environment, Safety and Health Manual.

- 4.1 Management will provide appropriate personal protective clothing and equipment, such as eye protection, chemical resistant gloves and respiratory equipment when necessary.
- 4.2 The laboratory worker is responsible to comply with policies and procedures on the use of personal protective equipment, and to remove contaminated equipment before leaving the use area.
- 4.3 Avoid unnecessary exposure to chemicals by any route. Do not deliberately smell or taste chemicals.
- 4.4 Avoid eating, drinking, and smoking in areas where chemicals are present.
- 4.5 Storage of food and beverages in storage areas and refrigerators used for laboratory operations is prohibited.
- 4.6 Hazardous chemical use must be restricted to rooms having direct exhaust ventilation.
- 4.7 Ovens used for baking off chemicals and oils must be ventilated properly to control particulate and gaseous emissions.
- 4.8 When venting containers, or setting up containers with pressure relief joints or valves, take precautions to ensure that the discharge is directly safely or filtered. Be sure to relieve gas pressure from cylinder regulators before disconnecting. It

is good practice to stand aside of the gauge faces when opening regular valves.

- 4.9 Use a fume hood for operations which might result in the release of toxic gases, vapors, or particulates. As a rule of thumb, engineering controls need to be used when handling any volatile substance with a TLV of less than 50 ppm, or the LC50 is less than 200 pp, or oral LD50 is less than 50 mg/kg.
- 4.10 Assure that the plan for each laboratory chemical operation includes plans and training for waste disposal. Apply waste minimization whenever feasible.
- 4.11 Know the location of eyewash and shower facilities for your work area; these are required in each work area where hazardous chemicals and cleaning solvents are used.
- 4.12 Use faceshields, impermeable gloves and aprons, as appropriate, to avoid contact with chemicals. Safety glasses or chemical goggles are necessary in addition to faceshields. Glove selection information is available from the Industrial Hygiene Section (Ext. 2-3310). To supplement specific procedure training provided by supervisors, refer also to the National Research Council's "Prudent Practices for Handling Hazardous Chemicals in Laboratories," available in the Building 200 library reference section.
- 4.13 Chemical use outside of a laboratory hood requires evaluation of the exposure potential of toxic materials which may cause air contamination and possible need for respiratory protection or other controls.
- 4.14 Wear appropriate protective clothing and gloves to prevent hand contact with allergens or substances of unknown allergenic activity.

4A.0 Definition of Highly Toxic Materials

Highly toxic materials apply to those substances with workplace exposure limits below 1 ppm or 0.5 mg/m³ of air.

Select Carcinogen - any chemical substance that meets one or more of the following criteria set forth by OSHA in 29 CFR 1910.1450, "Occupational Exposures to Hazardous Chemicals in Laboratories"(see Appendix A).

- It is regulated by OSHA as a carcinogen by means of a specific performance standard (29 CFR 1910.1001, and beyond).
- It is listed as "known to be carcinogenic" in the "Annual Report on Carcinogens" published by National Toxicology Program (NTP).
- It is listed under Group 1, Carcinogenic to Humans, in the latest edition of the

"International Agency for Research on Cancer (IARC) Monographs".

- It is listed in either Group 2A or 2B by IARC, or is listed as "reasonably anticipated to be carcinogenic" by NTP, and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria:
 - *after inhalation exposures of 6-7 hours per day, 5 days per week, over a significant portion of the animal's lifetime, to doses less than 10 mg/m³.*
 - *after repeated skin application of doses less than 300 mg/kg of the animal's body weight per week.*
 - *after oral exposures, to doses less than 50 mg/kg of body weight per day.*

Class 1 Carcinogens - ANL-E designation that includes a) carcinogens per OSHA regulations, including substance-specific carcinogen regulations; b) American Conference of Governmental Industrial Hygienists (ACGIH) A-Confirmed Human Carcinogen or A-Suspected Human Carcinogen; c) ethidium bromide. Note that ACGIH-A and A carcinogens are included by DOE requirement.

Class 2 Carcinogens - ANL-E designation of substances that form the balance of "select carcinogens" as defined by OSHA in 29 CFR 1910.1450 and that are not included in Class 1 criteria described previously.

- 4A.1** Carcinogen use and storage must be in conformance with Chapter 4.5 of ANL ES&H Manual. ALARA (As Low As Reasonably Achievable) inventory of carcinogens should be the Division's target to keep exposure low.
- 4A.2** The classification of Class 1 and 2 carcinogens is available on the packing slip generated at ANL. This information appears immediately below the identity of the product on the packing slip. Also identified are other classifications of importance related to other chemical properties, or other governmental regulations pertaining to the product.
- 4A.3** Areas that use carcinogens must be posted as such.
- 4A.4** Transport of carcinogenic materials outside storage areas, laboratory hoods, or glove boxes should occur in closed, unbreakable containers whenever feasible.
- 4A.5** Never pipette by mouth, eat, drink, smoke, chew gum, apply makeup, nor place anything in the mouth or eyes when handling carcinogens or when working in designated carcinogen areas.
- 4A.6** Use of sharp objects (i.e., hypodermic needles, syringes, scalpels) should be avoided when handling carcinogens to prevent exposure by puncture. Dispose of sharp objects contaminated with carcinogens into approved labeled waste containers to prevent accidental exposure by puncture wounds.

- 4A.7 Wear the appropriate personal protective equipment (PPE) for the job, including buttoned laboratory coats, aprons, respirators (if required), and protective gloves. Do not bring any PPE which may be contaminated outside the designated work area.
- 4A.8 OSHA Standards for occupational exposure to hazardous chemicals in laboratories can be found at WWW.OSHA.GOV. It is recommended that employees working with hazardous chemicals should read this document.

5.0 *Employee Exposure Determination and Evaluation*

Current and proposed uses of hazardous chemicals must be assessed as to the potential for workplace exposure. The criteria to be used in determining the adequacy of control include whether air-borne exposure can cause skin injury or absorption of toxic quantities. For materials which may have irreversible toxic effects or be classified as carcinogens, the concept of maintaining exposure as low as reasonably achievable (ALARA) should be followed. Factors to be considered in making the determination of exposure potential include:

- a. Physical and chemical properties of compound or mixture.
- b. Quantity used and frequency of use outside of fume hood.
- c. Open container vs. covered systems and potential for airborne exposure.
- d. Exposure controls currently in place.
- e. Chemical stability of the compound.
- f. Volatility or vapor pressure.
- g. Established occupational exposure limits, such as OSHA Permissible Exposure Limit (PEL), ACGIH Threshold Limit Values (TLV), or AIHA Workplace Environment Exposure Levels (WEEL).
- h. Toxicological information on the substance (MSDS).
- i. Review of handling precautions and hazards indicated on the manufacturer's material safety data sheet.

Initial review of exposure potential must be made by the supervisor. If there is concern about possible extent of exposures or a need for additional information, this should be sought from the DCHO and the Industrial Hygiene Section.

Where the need is indicated, EQO-Industrial Hygiene will provide onsite review and exposure determination measurements. Results of monitoring will be reported back to the supervisor within 15 working days of receipt of the laboratory results. Supervisors have a duty to report results in writing to affected employees, either by personal communication or by posting of the results.

When monitoring has demonstrated that permissible exposure limits may be exceeded, or readily achievable improvements can further reduce exposures, such improvements

will be implemented. Input on implementing these changes will be provided by the Laboratory Supervisor, DCHO, and ESH-Industrial Hygiene.

6.0 *Engineering Controls*

All laboratory fume hoods are to be tested at least annually by PFS- Building Maintenance personnel. Hoods designated for general chemical use (Class C) must maintain a minimum of 100 feet per minute (fpm) face velocity; those for radioactive or higher toxicity materials (Class R), must maintain 125 feet per minute (fpm) face velocity.

Any hoods not posted as being tested and meeting the above criteria within the past year must be brought to the attention of PFS-Building Maintenance by the laboratory supervisor.

Hoods failing to meet the above test criteria will be tagged at the time of service, and a written notice will be sent to the division office. Hoods so tagged must be taken out of service until repaired or posted as to restricted service, as approved by the DCHO.

7.0 *Designated Eating Areas*

When working with particularly hazardous substances, additional employee protection is necessary. A designated area (generally a fume hood, but could be a specifically designed laboratory) is assigned for use when handling Class 1 carcinogens. (Refer to ANL Environment, Safety, and Health Manual Chapter 4-5, "Chemical Carcinogens".) Designated areas are also appropriate for work with certain reproductive toxins and highly toxic substances, especially those with exposure limits below 1 ppm or 0.5 mg/m³ of air. The High Energy Physics Division has no designated areas at this time.

Many exhaust ventilation systems are connected to the Central Surveillance System (CSS) which provides an alarm in case of flow failure. Hoods using highly toxic materials and not connected to the CSS will be reviewed by the supervisor and DCHO to determine the need for individual hood flow indicators. Special procedures for working in designated areas must be developed and approved by the Division CHO and Site CHO.

Designated work areas must be posted indicating the potential hazard and the requirement to follow the special work procedures established.

8.0 *Emergency Plan/Spill Control*

Refer to the ANL Emergency Management Plan.

Chemical spills, accidents, explosions, fires, and similar incidents which have or may result in injury or significant property damage must be reported immediately using the

Laboratory's 911 Emergency System.

Chemical spills should not be cleaned up by laboratory personnel, unless proper supplies, training, and personal protective equipment have been previously provided. Non-emergency cleanup of identified materials can be requested from Waste Management Operations (2-5865).

Any chemical materials used or collected in a spill response incident must be held for proper disposal through Waste Management Operations. Spilled chemicals, contaminated glassware or other containers must not be disposed of in trash receptacles.

9.0 *Training Program*

All new ANL employees receive basic orientation in health and safety requirements and services of the Laboratory.

Supervisors have a duty to see that each employee is provided the necessary information and training on specific hazards of the materials they may work with.

In addition, each employee must be aware of the location of material safety data sheets covering materials in the workplace.

Employees must also be aware of provisions of the OSHA Laboratory Standard. This will be accomplished by making available to each supervisor and laboratory employee:

- a) The OSHA Laboratory Standard, 29 CFR 1910.1450.
- b) The Chemical Hygiene Plan for this division.

ESH will provide basic training classes on provisions of the OSHA Laboratory Standard and applicable sitewide health and safety programs. The Division will provide specific instructions regarding Division activities.

10.0 *Medical Consultation and Evaluation*

Any employee who develops signs and symptoms indicating possible over exposure to hazardous chemicals in the workplace will be provided with medical attention. The employee must notify his or her supervisor and report to the ANL Medical Department in Building 201.

When an unusual occurrence, such as a chemical spill, results in a potentially significant hazardous chemical exposure, a Dial 911 must be initiated to assure that prompt attention is received.

Where review by the DCHO and/or EQO-Industrial Hygiene indicates that significant

chemical exposure could occur, a Medical Department consultation will be sought regarding the advisability of biological monitoring for the toxic substance or its metabolites.

11.0 *Respirator Use*

Engineering controls such as laboratory hoods, enclosed operations, and lower toxicity substitute materials must be the first level of protection. Where engineering controls are not feasible, or for temporary operations, or where an additional level of protection is desired, respiratory protective equipment may be used. For further detailed information in respiratory protection, refer to the ES&H Manual, Chapter 12.2, pages 1-18.

All respiratory protective equipment selection and user training will be provided by Tony Juscius of EQO-Industrial Hygiene (Ext. 2-4149). Retraining is required annually.

Respiratory protective equipment may not be purchased without prior approval by ESH-Industrial Hygiene.

For emergency response situations and where approximate levels of contaminants are unknown, self-contained breathing apparatus (SCBA) use is required. Only persons who are currently trained in its use are authorized to use such equipment.

For additional procedures relating to use of respiratory protective equipment, refer to the ANL Environment Health and Safety Manual Chapter 3-3, "Respiratory Protective Equipment."

12.0 *Waste Disposal/Minimization*

Planning for waste disposal and minimization should be implemented before purchasing a hazardous chemical. At a minimum, all chemicals on inventory should be reviewed annually. Chemicals not needed should be disposed of through Waste Management.

Serious problems of air and water pollution, as well as serious hazards to facility personnel, may be created by improper handling of waste produced even by small laboratory operations.

It is the responsibility of any chemical user to be sure that the ultimate fate of materials generated in the process or reaction can be disposed of safely and properly. Each laboratory supervisor has the responsibility to ensure that waste chemicals are safely collected, identified, and stored for disposal, and that the DCHO is fully advised of any special methods or facilities required. Consideration must be made of the quantities ordered, use process, and possible reuse of chemicals in order to assure waste

minimization.

Waste must be properly identified and packaged for pickup and disposal by PFS-Waste Management Operations. Form EWM-197, "Chemical Waste Disposal Requisition," must be completed, checked by the Health Physics Group and then sent to Waste Management Operations to initiate the waste disposal process.

For additional guidance on waste disposal/minimization procedures refer to the ANL Waste Procedures Manual and the ANL Waste Minimization Plan.

13.0 *Records Keeping*

Records of information and training provided under the Plan must be provided by ES&H to the DCHO for inclusion in the sitewide employee training database.

Laboratory Management must maintain records of medical consultation and examinations for 30 years beyond employee/employer separation.

The DCHO must maintain a listing of chemicals and chemical products used in the Division. (See 2.3.)

The SCHO must maintain current records of exposure limits specified by OSHA in 29 CFR 1910, subpart Z.

14.0 *Transportation of Chemical on and off ANL-Site*

14.1 All chemicals to be shipped on or off site should be in compliance with the Transportation Safety Manual, Chapters 7, 8, and 9.

14.2 Other issues found in the Transportation Safety Manual which pertain to the shipment of chemicals such as:

- a. Site Specific Requirements (Chapter 5)
- b. Environment, Safety, and Health Methodology (Chapter 6)

should be reviewed before the shipping process begins.

15.0 *Reference Material Used for Developing the Chemical Hygiene Plan*

15.1 *Hazardous Chemical Information Sources* ***29 CFR Part 1910-Occupational Safety and Health Standards***

Teratogens identified in Thomas H. Shepard, Catalog of Teratogenic Agents, 6th Edition, Johns Hopkins Press, 1989.

NIOSH Registry of Toxic Effects of Chemical Substances, latest edition.

Dangerous Properties of Industrial Materials, N. Irving Sax, latest edition.

15.2 *Chemical Inventory*

A sitewide chemical inventory has been implemented through the CMS. Laboratories in the HEP Division having chemicals are as follows:

<u><i>Building 362</i></u>		<u><i>Building 366</i></u>
C-116	F-208	AWA Facility
C&E-256	E-132	Building Annex
E-264	E-116	366 General Laboratory
E-288	F-232	
F-116	F&B-216	
F-132	F-224	

15.3 *ANL Policies and Procedures*

- a. ANL Environment, Safety and Health Manual
- b. ANL Comprehensive Emergency Management Plan
- c. ANL Waste Handling Procedures Manual
- d. ANL Waste Minimization Plan

APPROVALS:

Division Chemical Hygiene Officer

Date

Division Director

Date

ANL Site Chemical Hygiene Officer

Date