

**PHYSICS DIVISION  
CHEMICAL HYGIENE PLAN**

2008

Prepared by

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## PURPOSE

The purpose of the Physics Division's Chemical Hygiene Plan is to define the Division's program to implement control methodologies that prevent unacceptable exposure to hazardous chemicals in the Division's laboratories

## SCOPE

This plan applies to laboratory operations using hazardous chemical in relatively small quantities. The rooms designated as laboratories by the Physics Division are the following:

Building 203			Building 208
F102	G150	H174	B101
F118	H114	R154	
F130	H126	M025	
F142	H134		
G018	H166		

For operations involving chemicals and not designated as laboratories, 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 shall also apply, and in the event of conflicts shall supersede the provisions of this plan.

## OBJECTIVE

The objective of this plan is to promote the improvement of laboratory health and safety by insuring that the proper procedures and training and a written chemical hygiene plan are in place 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. To obtain a copy of the OSHA standard, see Tom Mullen, the Division's Chemical Hygiene Officer. On the Web, it is available at:

[http://www.access.gpo.gov/nara/cfr/waisidx\\_99/29cfr1910a\\_99.html](http://www.access.gpo.gov/nara/cfr/waisidx_99/29cfr1910a_99.html)

## 1. **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, the laboratory environment or to the public.

### 1.1. 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.

### 1.2. 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.

### 1.3. 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.

### 1.4. 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.

## 2. **Levels of Responsibility**

2.1. The Division Director holds organizational responsibility for providing continuing support for the chemical hygiene activities and the health and safety of laboratory employees.

2.2. The Site Chemical Hygiene Officer provides site-wide coordination and support for Division Chemical Hygiene Officers.

2.3. The Division Chemical Hygiene Officer's responsibilities are outlined in section 3.0

2.4. The Laboratory Supervisor has overall responsibility for chemical hygiene in the laboratory. The Laboratory Supervisor must:

- a) Insure that employees know and follow the chemical hygiene rules
- b) Make sure protective equipment is available and in working order
- c) Make sure training and information has been provided. This includes insuring that Material Safety Data Sheets are readily available for substances used in the laboratory.
- d) Provide regular chemical hygiene and housekeeping inspections.
- e) Know the current legal requirements concerning regulated substances.
- f) Determine the required levels of protective apparel and equipment.
- g) Insure that facilities are adequate for any new hazard introduced into the laboratory.
- h) Work with laboratory management, the Division Chemical Hygiene Officer and laboratory employees to develop and implement appropriate hygiene policies and practices.
- i) Monitor the procurement, use, and disposal of chemicals used in the laboratory. Insure such procurement, use and disposal is recorded in the Laboratory's Chemical Management System.
- j) Help project directors develop precautions and adequate facilities, as they apply to the OSHA Laboratory Standard.
- k) Maintain compliance with this Chemical Hygiene Plan.

2.5. The laboratory worker must:

- a) Plan and conduct each operation in compliance with the established procedures and good personal hygiene practices.
- b) Place warning signs and labels on chemical containers, equipment or areas where special or unusual hazards are in use.

### **3. Physics Division Chemical Hygiene Officer (Division CHO)**

3.1. The Division's Chemical Hygiene Officer is Tom Mullen in Room R210. Tom's phone number is 2-2879, and his cell phone number is (630) 461-6723.

- 3.2. The Division CHO's role/function is to provide technical guidance in the development and implementation of the provisions of the Chemical Hygiene Plan. The Division CHO will:
- a) Work with administrators and employees to develop and implement appropriate chemical hygiene policies and practices.
  - b) Monitor the procurement, use and disposal of chemicals used in the Division, in conjunction with lab supervisors.
  - c) Review and approve operations as stated in the Chemical Hygiene Plan that require the approval process.
  - d) Provide oversight on implementation of the Chemical Hygiene Plan.
  - e) Help project directors develop precautions and adequate facilities, as they apply to the OSHA Laboratory Standard.
  - f) Know the current legal requirements concerning regulated substances and maintain appropriate reference sources.
  - g) Review, evaluate and update the Division's Chemical Hygiene Plan.

## **4. Exposure Assessment and Reduction**

### 4.1. Hazard Identification

- a) Sufficient information about the hazardous and toxic properties of chemicals must be obtained to allow safe handling. Typically, this information is obtained from the chemical's Material Safety Data Sheet (MSDS). Chemicals presenting an unusual or severe exposure hazard may require notification or approval by the Division CHO as specified in section 4.3.1
- b) 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 the ANL ESH Manual, Chapter 4-1, Hazard Communication, for proper labeling practices.
- c) A known chemical, produced in a laboratory, shall be evaluated by reviewing the available literature to determine if it is a hazardous chemical. All unknown chemicals must be treated as hazardous substances.

- d) Material Safety Data Sheets (MSDS's) must be readily available for all chemical substances. MSDS's for many chemicals are available at the Industrial Hygiene web site and various other web sites on the internet for reference. MSDS for ANL chemicals can be obtained at: <https://www.cms.anl.gov/>

If the MSDS for a chemical is not available at one of those locations, a copy of it must be maintained near the location of the chemical's use.

If an MSDS is received which is not in the ANL Chemical Management System, a copy must be forwarded to EQO Industrial Hygiene, Bldg 200, L172 or to Tom Mullen for inclusion in the CMS.

- e) An ANL Material Safety Data Sheet (MSDS), ESH-207, is required for hazardous chemicals produced at ANL-E and shipped to other locations on and off site. Hazardous chemicals and chemical mixtures are those meeting the definitions in the OSHA Hazard Communication Standard, 29 CFR 1910.1200. Chemicals produced at ANL-E shall be considered hazardous unless shown, as a result of a documented hazard evaluation, to be nonhazardous. A hazard warning label is also required.

The form template can be found at the ANL forms page:

<http://www.aim.anl.gov/forms/index.html>

Typically the ANL Fire Dept is listed as the emergency contact as they are available 24 hours a day, 7 days a week. Be sure they get a copy of any new ANL MSDS and that it is provided to EQO Industrial Hygiene for inclusion in the ANL Chemical Management System MSDS module. The Division Chemical Hygiene Officer and EQO Industrial Hygiene must be consulted for review of a new MSDS before it is sent off site.

- f) The Division CHO will make hazard information available for highly acutely toxic, "select carcinogens," and reproductive hazards regulated by the OSHA Laboratory Standard. This information will be in the form of MSDS' or reprints from appropriate reference sources. If this information is not available on receipt of the substance, contact the Division CHO before handling the chemical. All other hazardous chemical information should already be available on MSDS' or product labels

#### 4.2. Chemical Procurement, Distribution and storage

- a) Procurement

- **Chemicals must not be ordered through AMOS.** All chemicals must be ordered through Elizabeth Rizzo. She will properly register the chemicals in the Laboratory's Chemical Management System.
- Before ordering a chemical, ask Tom Mullen, the Division Chemical Hygiene Officer, if the chemical is available (for free) through the Chemical Management System's excess stock of new chemicals.
- Before a chemical is received, information on proper handling, storage and disposal must be known to those who will be involved with it. Do not accept any container that does not have an adequate identifying label. If a Laboratory supplied bar code is not present in the chemical's shipping container, contact Tom Mullen, the Division CHO. He will supply one.
- The Division CHO will coordinate the maintenance of an inventory of chemicals and chemical products through the Laboratory's Chemical Management System.

b) Laboratory Storage

- Chemical storage within the laboratories must be kept to reasonable quantities consistent with work in progress. Outdated and unneeded chemicals must be disposed of through Waste Management. When discarding empty chemical containers, remove the Laboratory bar code and send it to the Division CHO. This will remove you as owner of the chemical.
- Chemicals which have a useable life must be dated by the manufacturer or upon receipt in the laboratory or may be tracked using the Laboratory's expiration dated chemicals report in the Chemical Management System. Refer to the ESH Manual, Chapters 4-1, Hazard Communication and 4-3, Chemical and Laboratory Safety for information.
- Flammable and combustible liquids must be stored in accordance with the ANL ESH 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 5 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.
- Chemical storage in fume hood work areas is not acceptable, except where highly volatile and/or noxious materials are in



containers which may not be vapor tight and where placement in the hood does not interfere with proper hood operation.

- An inventory will be made of all chemicals at least bi-annually, in conjunction with the Chemical Management System. Any chemicals identified as unwanted or outdated should be disposed of properly.

#### 4.3. Laboratory Safe Operating Procedures

##### a) Working with Chemicals

This section provides some general and specific guidance on chemical handling. Additional requirements are included in the ANL Environment, Safety and Health Manual and the Division Safety Policy.

- Management will provide appropriate personal protective equipment, such as eye protection, chemical resistant gloves and respiratory equipment when necessary.
- Materials whose exposure limits have not been developed must be considered highly toxic if they have an LD50 of <500 mg/kg.
- 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.
- Review and concurrence of the Division CHO is required for the following procedures:
  - Work with highly toxic materials. As a general rule, this applies to those substances with exposure limits below 1 ppm or 0.5 mg/m<sup>3</sup> of air.
  - Work with Class 1 carcinogens (Refer to the ANL-E ESH Manual, Chapter 4.5, Chemical Carcinogens)
  - New projects using hazardous chemicals require pre-operation safety reviews. Consult the Physics Division Safety Policy and the ANL-E ESH Manual.

##### b) Laboratory Workplace Hygiene

Working with toxic and hazardous chemicals. This section contains general guidance to supplement the specific work procedures. See also Chapter 4.3 of the ANL-E ESH Manual, Laboratory and Chemical Safety.

- Personal Hygiene:
  - Avoid unnecessary exposure to chemicals by any route. Do not deliberately smell or taste chemicals.
  - Never pipette anything by mouth.
  - Do not eat, drink or smoke in areas where chemicals are present . These practices are prohibited.
  - Do not store food or beverages in storage areas and refrigerators used for laboratory operations. These practices are also prohibited.
- Avoid the release of toxic substances in cold rooms and warm rooms, since these contain recirculated atmospheres.
- Hazardous chemical use must be restricted to rooms having direct exhaust ventilation. Recirculation of air from chemical laboratories to other rooms is not acceptable.
- Ovens used for processing hazardous chemicals must be ventilated properly to control any hazardous emissions.
- Before starting any new operation,
  - Seek information and advice about hazards
  - Plan appropriate protective procedures
  - plan the positioning of equipment
- Take precautions to ensure that the discharge is directed safely or filtered when venting containers, or setting up containers with pressure relief joints or valves. Be sure to relieve gas pressure from cylinder regulators before disconnecting them. It is good practice to stand aside of the gage faces when opening regulator valves.
- 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
  - whose LC50 is less than 200 ppm
  - or, whose oral LD50 is less than 50 mg/kg.
- Assure that the plan for each laboratory operation includes plans and training for waste disposal. Apply waste minimization whenever feasible.
  - Know the location of eyewash and shower facilities for your laboratory. They are required in each laboratory where hazardous chemicals are used.
  - Use face shields, impermeable gloves and aprons, as appropriate, to avoid contact with chemicals. Safety glasses or chemical goggles are necessary in addition to face shields. Glove selection information is available from EQO Industrial Hygiene (2-3310) and at: [http://www.anl.gov/ESH/ih/glove\\_guide/index.htm](http://www.anl.gov/ESH/ih/glove_guide/index.htm). 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 libraries in Buildings 202, 205 and 223.
  - When diluting concentrated acid, add acid to the diluent. Use an ice bath, or have a cold water source available, to reduce the reactivity hazards from extremely exothermic acid/base reactions.
  - The date of receipt and date of opening must be recorded on containers of chemicals that could present a long term storage hazard; e.g., peroxide forming ethers. Refer to the ANL ESH Manual ([Chapters 4-1 Hazard Communication and 4-3 Chemical and Laboratory Safety](#)) for specific instructions on the use of these materials. A listing of date-sensitive compounds in your inventory (as set by you or automatically on ordering certain peroxide formers) can be obtained from the ANL Chemical Management System using the report: expire (Expiration-Dated Substance Report).
  - Special procedures may be required for certain extremely hazardous chemicals; e.g., hydrofluoric acid. Refer to the ANL ESH Manual ([Chapter 4-3 Chemical and Laboratory Safety](#))
  - 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.

- Wear appropriate protective apparel and gloves to prevent contact with allergens or substances of unknown allergenic activity (examples include diazomethane, isocyanates and bichromates.)
- Special care must be taken to minimize chemical exposure during pregnancy. Chemical handling operations during pregnancy require a review of work practice changes to accomplish this.
- Pregnant laboratory workers are requested to consult with the Medical Department at the earliest stage possible.
- Refer to the ANL ESH Manual, Chapter 4-5 Chemical Carcinogens for additional requirements for proper handling and documentation requirements connected with carcinogens.

#### 4.4. Employee Exposure Determination and Evaluation

- a) 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 airborne exposures may exceed established limits and whether dermal 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:
  - Physical and chemical properties of the compound or mixture.
  - Quantity used and frequency of use outside of a fume hood.
  - Open container vs. Covered systems and potential for airborne exposure.
  - Exposure controls currently in place.
  - Chemical stability of the compound.
  - Volatility or vapor pressure.
  - Established occupational exposure limits, such as OSHA Permissible Exposure Limit (PEL), ACGIH Threshold Limit Values (TLV) or AIHA Workplace Environmental Exposure Levels (WEEL)
  - Toxicological information on the substance.
  - Review of handling precautions and hazards indicated on the manufacturer's material safety data sheet.
- b) Initial review of exposure potential must be made by the laboratory supervisor. If there is concern about possible extent of exposures or a need for additional information, this should be sought from the Division CHO and Industrial Hygiene.

- c) Where the need is indicated, ESH-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.
- d) 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, Division CHO and Industrial Hygiene.

#### 4.5. Engineering Controls

- a) All laboratory fume hoods and glove boxes 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 air velocity; those for radioactive or higher toxicity materials (Class R) must maintain a minimum 125 fpm face velocity.
- b) 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.
- c) Hoods failing to meet the above test criteria will be tagged at the time of service. Hoods so tagged must be taken out of service until repaired, or posted as to restricted service, as approved by the Division CHO.

#### 4.6. Designated Areas

- a) When working with particularly hazardous substances, additional employee protection is necessary. A designated area (generally a fume hood, but a specifically designed laboratory also would apply) is assigned for use when handling Class 1 carcinogens. Refer to the ANL ESH 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/m<sup>3</sup> of air.
- b) Many exhaust ventilation systems are connected to the Central Surveillance System (CSS) which provides an alarm in case of flow failure. Any use of hoods with highly toxic materials (i.e.; LD50 of <500 mg/kg) and not connected to the CSS must be reviewed by the supervisor and Division CHO to determine the need for individual hood flow indicators.

- c) Special procedures for working in designated areas must be developed and must be approved by the Division CHO.
- d) Designate work areas must be posted indicating the potential hazard and the requirement to follow special work procedures established.
- e) The designated areas for the Physics Division in Building 203 are:
  - Room G-150
  - Room H-174
  - Room R-154
- f) The designated area for Physics Division in Building 208 is:
  - Room B-101

#### 4.7. Emergency Plan and Spill Control

- a) Spills, accidents, explosions, fires and similar incidents which have or may result in injury or significant property damage must be reported immediately by dialing 911.
- b) 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)
- c) Any chemical materials used or collected in a spill response incident must be held for proper disposal through Waste Management Operations. Spilled chemical, contaminated glassware or other containers must not be disposed of in trash receptacles.

## 5. Training Program

- 5.1. All new employees receive basic orientation in health and safety requirements and services of the Laboratory.
- 5.2. 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.
- 5.3. In addition, each employee who works with chemicals must be aware of the location of material safety data sheets (MSDS's) covering materials in the workplace.

- 5.4. Employees who work with chemicals in laboratories must also be aware of provisions of the OSHA Laboratory Standard. This will be accomplished by making available to each such employee:
  - a) A copy of the OSHA Laboratory Standard, 29 CFR 1910.1450.
  - b) A copy of this Chemical Hygiene Plan

Copies of the above documents are available at the [Physics Division's ESH Page](#).

- 5.5. 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.

## **6. Medical Consultation and Evaluation**

- 6.1. Any employee who develops signs and symptoms indicating possible overexposure will be provided with medical attention. They must report to their supervisor and the ANL Medical Department in Building 201.
- 6.2. When and unusual occurrence, such as a spill, results in a potentially significant exposure Dial 911 to assure that prompt attention is received.
- 6.3. Where review by the Division CHO and/or Industrial Hygiene indicates that significant exposure could occur, a Medical Department consultation will be sought regarding the advisability of biological monitoring for the toxic substance or its metabolites.

## **7. Respirator Use**

- 7.1. 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.
- 7.2. all respiratory protective equipment selection and user training will be provided by Industrial Hygiene (2-4149). Retraining is required annually.
- 7.3. Respiratory protective equipment may not be purchased without prior approval of Industrial Hygiene.
- 7.4. For emergency response situations and where approximate levels of contaminants are unknown, self contained breathing apparatus (SCBA) use is

required. Only those who are currently trained in its use are authorized to use such equipment.

- 7.5. For additional procedures relating to use of respiratory protective equipment refer to the ANL ESH Manual, Chapter 12-2, Respiratory Protection

## **8. Waste Disposal / Waste Minimization Program**

- 8.1. Planning for waste disposal and minimization should be completed before purchasing a hazardous chemical.
- 8.2. 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.
- 8.3. Any chemical user is responsible to be sure that the ultimate fate of materials generated in the process or reaction can be safely and properly disposed. Each laboratory supervisor has the responsibility to ensure that waste chemicals are safely collected, identified and stored for disposal, and that Waste Management is fully advised of any known special methods or facilities required. Order quantities, use processes and possible reuse must all be considered in order to assure waste minimization.
- 8.4. Waste must be properly identified and packaged for pickup and disposal by Waste Management. Complete Form EMO-197, Chemical Waste Disposal Requisition, and send it to Waste Management to initiate the waste disposal process.

Note: Waste Management will only accept waste disposal requests if form EMO-197 is signed by an employee who has successfully completed Chemical Waste Certification Training.

- 8.5. If more than one hazardous chemical becomes waste in the same laboratory, and will be accumulated to be disposed of together, the owner of the chemicals must notify the Physics Division's ESH Engineer (2-2879), who will create a Satellite Accumulation Area to comply with the Argonne ESH Manual. The Satellite Accumulation Area will generally be eliminated once the waste is removed from the Division.

## **9. Record keeping**

- 9.1. Records of information and training provided under this plan must be provided to the Division CHO and the ESH Training Coordinator for inclusion in the sitewide employee training database.



- 9.2. Management will maintain records of medical consultation and examinations for 30 years beyond employee/employer separation.
- 9.3. the Division must include a listing of chemicals used in the Division utilizing the Laboratory's Chemical Management System.
- 9.4. The Site Chemical Hygiene Officer must maintain current records of exposure limits specified by OSHA in 29 CFR 1910, subpart Z.

## 10. Appendices

### 10.1. Hazardous Chemical Information Sources

The major health exposure chemical lists and reference sources are:

- 👉 OSHA Air Contaminants ([29 CFR 1910, subpart Z](#))
- 👉 OSHA Specifically Regulated Substances (29 CFR 1910.1001 - 1101)
- 👉 National Toxicology Program, latest Report on Carcinogens
- 👉 International Agency for Research on Cancer, latest volume on human carcinogens (groups 1, 2A and 2B)
- 👉 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
- 👉 Threshold Limit Values for Chemical Substances (TLV), American Conference of Governmental Industrial Hygienists, latest annual edition.
- 👉 Workplace Environmental Exposure Limit (WEEL), American Industrial Hygiene Association.
- 👉 [ANL Environment, Safety and Health Manual](#)
- 👉 ANL Comprehensive Emergency Management Plan
- 👉 [ANL Waste Handling Procedures Manual](#)
- 👉 ANL Waste Minimization Plan