

Ownership Matrix	USQ # 2S-20-1251-S
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1.0 PURPOSE

The purpose of this procedure is to provide a written program setting forth procedures, equipment, personal protective equipment and work practices to protect employees from the health hazards presented by laboratory use of hazardous chemicals at the 222-S Laboratory Complex. This chemical hygiene plan fulfills the requirements of Occupational Safety and Health Standard 29 CFR Part 1910.1450, "Occupational Exposure to Hazardous Chemicals in Laboratories."

1.1 Scope

(18.1.3, 18.1.2 18.1.2, 18.1.4, 18.1.5, 18.1.9, 18.1.10, 18.1.11, 18.1.12, 18.1.13)

The OSHA 29 CFR 1910.1450 applies to all employees engaged in the laboratory use of chemicals and, where it applies, supersedes all other OSHA health standards in 29 Code of Federal Regulations (CFR) Part 1910, Subpart Z, "Toxic and Hazardous Substances," except for the following.

- The lower of OSHA's Permissible Exposure Limits (PEL) or American Conference of Governmental Industrial Hygienists (ACGIH) "2016 Threshold Limit Values (TLV) for Chemical Substances and Physical Agents, Biological Exposure Indices", shall not be exceeded without additional protective measures (i.e., personal protective equipment [PPE]).
- Where the action level is routinely exceeded, the exposure monitoring and medical surveillance requirements of the substance-specific OSHA standard shall apply if a separate standard exists.
- Prohibition of eye and skin contact where specified by any OSHA health standard shall be observed.
- If a chemical substance is produced for a user outside of the laboratory, compliance with the "Hazard Communication Standard" (29 CFR 1910.1200), including the requirements for preparation of GHS-SDSs/MSDSs and labeling, shall be ensured.

This plan addresses the following required elements as specified in the standard:

- Scope and Application
- Definitions
- Permissible Exposure Limits
- Employee Exposure Determination
- Protective Laboratory Practices
- Employee Information and Training
- Medical Consultation and Medical Examinations
- Hazard Identification
- Use of Respirators
- Particularly Hazardous Substances
- Recordkeeping.

This procedure also implements the essential elements of Integrated Environmental, Safety, and Health Management System (ISMS), Core Function 2 “Identify the Hazards” and Core Function 3, "Develop and Implement Hazard Controls" as referenced in:

- (WAI Hanford Laboratory [WHL] employees) WHL-MP-1009.
- (Washington River Protection Solutions, LLC [WRPS] employees) TFC-POL-16.

This chemical hygiene plan applies to all personnel who are engaged in any activities involving laboratory use of chemicals at the 222-S Laboratory Complex, regardless of company affiliation.

At the 222-S Laboratory Complex, WHL provides analytical services and testing, and WRPS provides Process Chemistry/Special Analytical Services/Organic Studies (PC/SAS/OS) services, laboratory infrastructure, maintenance, radiological control and facility operations support as the Tank Operations Contractor for the Department of Energy’s (DOE) Office of River Protection. TOC-AIA-LATS-00060, Administrative “Interface Agreement between Washington River Protection Solutions, LLC. (WRPS) and Wastren Advantage, Inc. for 222-S Laboratory Analytical Services and Testing,” provides a more detailed description of the interface agreements between WHL and WRPS. Where WHL and WRPS have different policies or procedures, each contractor’s policy or procedure will be identified.

The 222-S Laboratory Complex chemical hygiene plan is available on the WHL and WRPS Procedures web pages, and is accessible from both the WHL and WRPS main web pages. Both contractors’ main web pages are accessible from the Department of Energy’s Hanford Intranet web page at <http://www.rl.gov>.

Activities considered "laboratory use of chemicals" include chemical manipulations carried out on a laboratory scale and procedures or test plans using multiple chemicals in a laboratory setting.

Manufacturers must provide Safety Data Sheets (SDSs) for hazardous chemicals that are subject to the requirements of either 29 CFR 1910.1200 or 29 CFR 1910.1450. An OSHA compliant SDS must include the required provisions of the United Nations Globally Harmonized System of Classified and Labeling of Chemicals. SDSs are not required for products that are exempt from the requirements of both 29 CFR 1910.1200 and 29 CFR 1910.1450. For products purchased or discontinued prior to 6/1/2015, an MSDS is still acceptable. The term SDS/MSDS is used throughout this procedure and is in alignment with the Hanford SDS/MSDS System search tool.

This chemical hygiene plan does not apply to procedures or test plans that are part of a production process, maintenance activities, or operations-related activities that do not directly support laboratory analytical operations, even if such activities occur in the laboratory. When handling chemicals related to the above listed activities, refer to TFC-ESHQ-IH-C-02 for applicable requirements.

1.2 Policy
(18.1.11, 18.1.12)

The 222-S Laboratory Complex policy is to provide a work place that is safe for the employees and to prevent uncontrolled releases of chemicals to the environment.

The 222-S Laboratory Complex complies with OSHA, DOE orders, and Washington State Department of Ecology regulations, standards, and guidelines for safety in its laboratories, research facilities, and activities. The complex strives to keep employee exposures to chemicals as low as reasonably achievable and below the established Occupational Exposure Limits.

Safety and health policies can be found at the following:

- (WHL employees) WHL-POL-011
- (WHL employees) WHL-MP-1028
- (WHL employees) WHL-MP-1037
- (WRPS employees) TFC-POL-14
- (WRPS employees) TFC-PLN-47.

2.0 IMPLEMENTATION

This Procedure is effective on the date shown in the header.

3.0 RESPONSIBILITIES**3.1 222-S Laboratory Manager and WHL Laboratory Manager**
(18.1.4)

The 222-S Laboratory manager/delegate and the WHL Laboratory manager/delegate are responsible for providing a safe working environment for employees. This responsibility includes developing and implementing this chemical hygiene plan and overseeing programs to ensure that this plan has continued management support and adequate resources.

The 222-S Laboratory manager/delegate and the WHL Laboratory manager (or delegate) responsibilities include the following.

1. Appoints the chemical hygiene officer (CHO).
2. Reviews the laboratory activities and research operations to determine which jobs and procedures must be revised to incorporate safety and chemical hygiene measures for employee protection.
3. Ensures that the management personnel are following safety and health policies.
4. Ensures the work areas are inspected at least quarterly in accordance with ATS-310, Section 9.2.
5. Provides and documents the training of employees for the chemical hygiene plan and the safe handling of chemicals.

3.2 First-Line Laboratory Managers

(18.1.1, 18.1.4, 18.1.6, 18.1.7, 18.1.8, 18.1.9, 18.1.11, 18.1.12)

The first-line laboratory manager/delegate responsibilities include the following.

1. Ensures that the operations involving laboratory-use chemicals are controlled by a procedure or test plan according to the requirements of Section 4.0.
2. Ensure Employee Job Task Analysis (EJTA) reviews are completed and maintained in accordance with TFC-ESHQ-IH-C-17.
3. Ensures the employees are trained to the chemical hygiene plan and know how to safely handle chemicals before work begins.
4. Identifies the appropriate chemical storage locations.
5. Reviews and updates the laboratory procedures and test plans to incorporate the appropriate safety and health measures, as applicable to the first-line laboratory manager's organization.
6. Ensures the chemicals are managed in accordance with the requirements of:
 - AT5-LO-150-063
 - TOC-AIA-LATS-00060.
7. Is knowledgeable of the current requirements concerning regulated substances.
8. Ensures the protective equipment is available and processes are in place to ensure it is in working order.

3.3 Laboratory Employees

(18.1.3, 18.1.4, 18.1.11, 18.1.12)

Laboratory employees have the following responsibilities.

1. Follows approved laboratory procedures or test plans (see Section 4.0 for additional information on laboratory procedures).
2. Follows the requirements of this chemical hygiene plan.

NOTE: Labeling in accordance with AT5-LO-120-007 is not required on secondary containers of chemicals intended for use by laboratory personnel if the container is not left unattended, although labeling these containers is a good practice.

3. Maintains the labels on all containers of chemicals as required by AT5-LO-120-007.
4. Knows how to access and use SDS/MDS (Hanford website is <http://msnet.ms.rl.gov/msds/>).
5. Knows the emergency procedures, and participate in emergency drills.

6. Informs their manager of any potentially unsafe acts or conditions, including laboratory ventilation concerns, changed labels, or additional equipment needed for working safely.
7. Immediately informs their manager of any symptoms or signs of suspect exposure to chemicals.

3.4 Chemical Hygiene Officer (CHO) (18.1.1, 18.1.4, 18.1.12)

A single CHO is appointed to serve for the entire 222-S Laboratory Complex. Per TOC-AIA-LATS-00060, WHL provides chemical hygiene support.

The CHO has the following responsibilities through direct responsibilities or supporting contracts:

1. Provides the technical assistance and guidance to all levels of management within both WRPS, as requested, and WHL in developing and implementing laboratory safety and chemical hygiene practices. Assist technical authorities to incorporate these practices into procedures, work plans, test plans, and other operations.
2. Knows the current requirements for chemical management, laboratory safety, chemical hygiene, labeling and storage of chemicals, waste management, and emergency response to chemical splashes or spills.
3. Ensures the Particularly Hazardous Substances (PHS) Listing is reviewed and updated at least annually with the updated report submitted for records processing.
4. Ensures a list of Particularly Hazardous Substances is available on the 222-S Laboratory/WHL webpage. This list shall be reviewed at least annually, and updated as needed.
5. Ensures the list of Reactive and Time Sensitive Chemicals is reviewed at least annually, and updated as needed, in accordance with the requirements of ATS-LO-150-062.
6. Ensures a list of Reactive and Time-Sensitive Chemicals is available on the 222-S Laboratory/WHL webpage.
7. Chairs the chemical hygiene committee, and seeks ways to improve the chemical hygiene program.
8. Calls periodic meetings of the chemical hygiene committee at least annually, more frequently, if needed.
9. Maintains the chemical hygiene committee documentation (record material).
10. Acts as the co-technical authority for this procedure.
11. Oversees the management of chemicals in accordance with requirements of ATS-LO-150-063.

12. Ensures that the appropriate assessments are performed and documented in accordance with the requirements of:
 - (WHL employees) WHL-MP-1020
 - (WRPS employees) TFC-PLN-10.

3.5 WRPS Chemical Hygiene Subject Matter Expert (SME) (18.1.1, 18.1.4, 18.1.11)

The WRPS chemical hygiene SME has the following responsibilities:

1. Provide oversight to the 222-S Laboratory Complex chemical hygiene plan and supporting contracts for WRPS.
2. Ensure the consistency between WRPS chemical management procedures and this chemical hygiene plan.
3. Participate on the chemical hygiene committee.
4. Act as the co-technical authority for this procedure.

3.6 Chemical Hygiene Committee (18.1.4)

The chemical hygiene committee has the following responsibilities.

1. Reviews and by majority consensus approves all non-editorial revisions to the course material of course 172545, “222-S Laboratory Complex Chemical Hygiene Plan.” Consideration should be given to the following:
 - The course material is consistent with the requirements of this chemical hygiene plan.
 - Handouts and exercises align with and support primary course objectives.
 - The course content provides an appropriate bridge between course 000071, “222-S Laboratory Complex Orientation and FEHIC”, and specific On the Job Training (OJT) (e.g., qualification cards and technical procedure training).
2. Evaluates laboratory practices and policies for compliance with this chemical hygiene plan and governing standards.
3. Publishes recommendations or findings to management in order to improve or correct the program.
4. Completes the annual review of the chemical hygiene plan, and update as needed.

The chemical hygiene committee shall be made up of the following personnel:

- CHO (Chair)
- WRPS chemical hygiene SME
- Industrial hygiene representative
- Environmental compliance representative
- Chemistry first-line manager/team lead
- Chemist
- Chemical technologist/engineering-scientific technician
- Radiological control representative
- Training representative
- Other personnel as necessary to address chemical hygiene plan issues.

3.7 Industrial Hygiene Representative(s)

(18.1.1, 18.1.3, 18.1.4, 18.1.5, 18.1.11, 18.1.12)

The industrial hygiene representatives are the WHL and/or WRPS Safety and Health representatives who are responsible for the following duties at the laboratory complex. TOC-AIA-LATS-00060 provides additional details on each company's responsibilities.

1. Supports the CHO and the chemical hygiene committee.
2. Reviews and approves the laboratory technical procedures, as required.
3. Initiates exposure monitoring if there is reason to believe the occupational exposure levels routinely exceed the action level (see Section 5.4).
4. Approves new chemical purchases and provides special labeling information or hazard control information, as needed.
5. Reviews and participates in hazard assessments in accordance with TFC-ESHQ-S_SAF-C-02.
6. Reviews and approves the hazard analyses for laboratory procedures and test plans, as required.

Steps in Section 4.0 may be performed in any order.

4.0 PROCEDURE

4.1 Technical Procedure Development

No one shall perform chemical-related laboratory operations in the 222-S Laboratory Complex unless controlled by an approved laboratory procedure or test plan.

Technical procedures, which are located on the 222-S Laboratory/WHL Procedures web pages, shall be developed, maintained, and controlled according to the requirements of:

- (WHL employees) WHL-312-11.16.
- (WRPS employees) ATS-310, Section 11.16

Test plans shall be developed and authorized in accordance with the requirements of:

- (WHL employees) WHL-312-11.16
- (WRPS employees) ATTS-310, Section 1.9.

4.2 Assess the Risk of Exposure and Chemical Reactions

(18.1.1, 18.1.4, 18.1.10, 18.1.11, 18.1.12, 18.1.13)

Plans and procedures that include the use of laboratory chemicals shall use the following steps to assess the risk of exposure and chemical reactions. These are the minimum evaluation requirements. Section 7.0 identifies additional provisions for work with Particularly Hazardous Substances (PHS). PHS are defined as carcinogens, reproductive toxins and chemicals with a high degree of acute toxicity.

1. Identify both the initial chemicals and, where feasible, the chemical products and the circumstances of use in the planned chemical process, as required by:
 - (WHL employees) WHL-312-11.16
 - (WRPS employees) ATTS-310, Section 1.9
 - (WRPS employees) ATTS-310, Section 11.16.1.
2. Consult sources of chemical hazard information, including, but not limited to, the SDS/MSDS. Other sources of chemical hazard information include:
 - “Bretherick’s Handbook of Reactive Chemical Hazards”
 - “Sax’s Dangerous Properties of Industrial Materials”
 - “The Merck Index”
 - “National Fire Protection Association (NFPA) Codes and Standards”
 - “National Toxicology Program, Report on Carcinogens.”

Links to additional online resources are located in ATTACHMENT B.

3. Evaluate the potential hazards associated with the plans and procedures using the following hazard analysis tools:
 - (WHL employees) Site Form No. A-6004-775 (laboratory worksite hazard analysis).
 - (WRPS employees) Site Form No. A-6004-101, WRPS Job Hazard Analysis Checklist, completed in accordance with TFC-ESHQ-S_SAF-C-02.

The analysis includes but may not be limited to:

- a. Evaluating potential hazards such as toxicity, flammability, corrosivity, reactivity, and instability, including possible routes of exposure
- b. Selecting appropriate measures to minimize exposure and risk using the control strategies specified in Section 5.0, including the identification of any PPE.
- c. Preparing for contingencies and emergencies that may be reasonably anticipated.

- d. Incorporating hazard information and controls into the procedure, as needed.
 - e. Requesting sampling and exposure assessment from appropriate industrial hygiene point of contact for all chemicals presenting a toxicity hazard, if the potential for exposure is above the Occupational Exposure Limit (OEL) as specified in Section 5.5.
4. Perform waste compatibility assessment, as required by ATS-310, Section 6.4.5.

5.0 CONTROL STRATEGIES

(18.1.1, 18.1.4, 18.1.10, 18.1.11, 18.1.12, 18.1.13)

The 222-S Laboratory has established and implemented a hazard prevention and abatement process. This process ensures all identified and potential hazards are prevented or abated in a timely manner. Controls are selected to mitigate or minimize risk of exposure to a hazard.

The hierarchy of controls that shall be used are:

1. Elimination or substitution of the hazards where feasible and appropriate.
2. Engineering controls where feasible and appropriate.
3. Work practices and administrative controls that limit worker exposures.
4. Personal protective equipment (PPE).

Appropriate controls shall be identified through the use of the hazard analyses tools in Section 3 and be incorporated into chemical and activity-specific procedures and plans. For PHS (occupational carcinogens, reproductive toxins, and chemicals with a high degree of acute toxicity), the additional controls identified in Section 7.0 must also be incorporated.

5.1 Substitution and Elimination Controls

Substitution or elimination of hazards are used when feasible, appropriate and approved. Changes must meet 222-S Complex and company requirements and any substitution or elimination of a hazard must comply with our procedures. This includes the requirement that laboratory use chemicals must be acquired from the Approved Chemical Supplier List (ACSL). Examples of such controls include but may not be limited to:

- Validate and adopt alternate methods that use less hazardous reagents
- Acquire pre-diluted or pre-prepared standards or reagents.

5.2 Engineering Controls

The primary engineering control used to minimize employee exposure to chemicals is properly designed, tested, and operating local general ventilation. Personnel shall use fume hoods, gloveboxes, or hot cells when called for by procedure, work plan, or test plan. Personnel shall not perform work in any fume hood, glovebox, or hot cell that does not meet established minimum operating parameters. Parameters are identified in activity or facility-specific procedures.

In general, airflow patterns within the laboratory provide a flow of air in occupied areas to direct contaminants away from the breathing zone of personnel. Specifically, the airflow is designed to flow from the corridors into laboratories and exhaust through the fume hoods. The 222-S

Laboratory ventilation system is designed to change laboratory room air a minimum of seven times per hour.

5.2.1 Laboratory Fume Hoods

The laboratory fume hood ventilation system operates to maintain the average exhaust flow velocity at the face of laboratory fume hoods, in accordance with guidance from ACGIH. The 222-S Laboratory fume hood performance testing program is documented in RPP-40939. It outlines testing requirements and frequency for the 222-S Laboratory. Formal scheduling and tracking systems are used to document appropriate testing. RPP-40939 also identifies the process to identify specific standards and requirements applicable to evaluating new or upgraded equipment.

Fume Hood Use will be performed in accordance with ATS-LO-161-003.

5.2.2 Hot Cells and Gloveboxes

Hot cell and glovebox ventilation operate to provide a differential pressure between the room and *the* work process or operation. Differential pressures and airflows of hot cells shall be monitored and controlled in accordance with ATS-310, Section 2.3. Differential pressures and airflows of gloveboxes shall be monitored and controlled in accordance with ATS-LO-161-108 or ATS-LO-161-183.

5.3 Chemical Hygiene Work Practices

1. Follow approved procedures or test plans.
2. Know the location of water for flushing, in case of exposure to hazardous materials. Locations of water include, but are not limited to, safety showers, eyewash stations, room sinks, etc.
3. Minimize chemical exposures.
4. Avoid inhalation and skin contact with chemicals. Wear appropriate and approved PPE (see Section 5.6).
5. Avoid spreading contamination from chemicals by removing outer layer of gloves after handling chemicals, if chemical contact is suspected.
6. Ensure adequate ventilation.
7. Do not apply mouth suction or pressure for any laboratory activity; use only the proper equipment.
8. To the extent feasible, use the most resistant containers, and check containers for signs of deterioration.
9. Use appropriate secondary containers such as chemical safety carriers when moving chemicals between storage locations or workstations.

10. Store chemicals in accordance with the recommendations of the manufacturer based on chemical compatibility, as specified by ATS-LO-150-063.
11. Know the hazards of the chemical before use. Review the SDS/MSDS or question chemists, management, or an industrial hygienist to ensure understanding. Attachment B lists several hyperlinks to web pages that contain additional information about chemical hazards.
12. DO NOT eat, drink, smoke, or perform other personal activities in laboratory work areas. In addition, do not store food, drink or smoking paraphernalia in laboratory work areas.
13. Do not bring potentially contaminated PPE, chemicals, or used glassware into areas such as offices, lunchrooms, and restrooms.
14. Maintain vigilance for unsafe acts and conditions.
15. Long hair must be restrained when working around rotating or moving equipment. Generally, it is a good practice to restrain hair when using chemicals.
16. Do not work alone within facility laboratories without the knowledge and approval of management. For additional requirements see:
 - ATS-310, Section 1.5
 - (WHL employees) WHL-MP-1035
 - (WRPS employees) TFC-OPS-OPER-C-68.
17. Working outside of normal day-shift hours including administrative work requires management approval and notification of the Stationary Operating Engineer (SOE) at 373-2435 or via the Public Address System for accountability purposes. For additional information, see ATS-310, Section 1.5.
18. Evacuate the work area immediately if an unwanted chemical reaction occurs or if a spill/release of hazardous chemicals occurs outside engineered controls. Notify facility operations manager (FOM) immediately.
19. Washing hands after exiting laboratory area is recommended.

5.4 Air Monitoring Requirements

(18.1.1, 18.1.4, 18.1.5)

OSHA 29 CFR 1910.1450 requires initial and periodic measurements of the employee's exposure if there is reason to believe that exposure levels for a substance routinely exceeds the action level. If an action level is not established by regulation, it will be established as 50% of the 8-hour Time Weighted Average (TWA) OEL. Management must notify the employee of the result within 15 working days after receipt of the monitoring results.

Supplemental exposure monitoring will be performed for new chemicals and/or processes not previously evaluated in RPP-33642, when there is reason to believe the change will result in an exposure level that routinely exceeds the action level of any regulated substance. Additionally,

exposure monitoring may be performed to address potential transient upset conditions at the direction of facility management. Conditions under which exposure monitoring is performed are established between the safety and health representative and representatives of the various work areas. Exposure monitoring shall be conducted in accordance with:

- TOC-AIA-LATS-00060
- (WRPS employees) TFC-PLN-34.

Exposure monitoring data shall be maintained in accordance with TFC-ESHQ-IH-STD-03.

5.5 Occupational Exposure Limits

(18.1.5, 18.1.10, 18.1.11, 18.1.12, 18.1.13)

At the 222-S Laboratory Complex, the maximum airborne concentration of a chemical to which a worker may be exposed is the lower of the OSHA PELs or the ACGIH TLVs. Airborne concentrations of chemicals may be present as a vapor, mist, or dust. This approach will ensure complying with the requirements of 10 CFR 851, which sets the legal limit for DOE contractors as the lower of the PELs or TLVs.

To ensure these exposure limits are not exceeded an administrative control level of 10% of the Occupational Exposure Limit (OEL) is used to determine if further information gathering is warranted to establish frequency and extent of subsequent monitoring and, along with other methods, to decrease uncertainty of exposure assessment.

If the exposure assessment determines that any substance may routinely exceed the action level, then additional medical surveillance, increased air monitoring (see Section 5.4), and Designated Area postings are required (see Section 7.0).

The use of an administrative control level is consistent with approaches taken by OSHA in the substance specific standards and is similar to the approach followed by the radiological protection program in limiting the occupational doses to as low as reasonably achievable (ALARA). This approach has been modeled after the process described in TFC-PLN-34.

OSHA's PELs can be found in 29 CFR 1910, Subpart Z.

5.6 Personal Protective Equipment

(18.1.1, 18.1.4, 18.1.5, 18.1.6, 18.1.7, 18.1.8, 18.1.9, 18.1.10, 18.1.11, 18.1.12, 18.1.13)

The Personnel Protective Equipment (PPE) must be inspected, prior to use, by the person wearing the equipment to determine that it is the designated PPE for the activity and it functions properly. Refer to TFC-ESHQ-S_IS-C-02, for specific inspection requirements. Any person using the PPE must be trained to know when it is required, what PPE is required, how to properly don that PPE, and any limitations of the PPE. It cannot be assumed that the PPE used to meet the requirements of a Radiological Work Permit (RWP) will meet the requirements for activities involving chemicals.

Any work or work areas requiring the use of PPE must be identified to the employee using signs, procedures, or training. Procedures or test plans shall specify when specific PPE is required. Examples include but are not limited to: lab coats, aprons, boots, additional or specialized gloves, arm sleeves, and full body suits. When working with or handling hazardous chemicals in a laboratory use setting, protection of exposed skin on legs, feet, arms and hands is required.

Additionally, specific laboratory locations may be posted as requiring arm and leg protection. At a minimum, arm protection will mean a long sleeved shirt.

If required for the PPE, the requirements of the American National Standards Institute (ANSI) must be met and be verified by the ANSI code mark or etching.

When using chemicals, the PPE shall be based on the following:

- Hazardous properties of the chemical (e.g., is it toxic, flammable, corrosive, carcinogenic, cryogenic, etc.)
- The physical properties of chemicals (e.g., gas, liquid, solid)
- The container condition (e.g., open, closed, material on exterior of container, container integrity, etc.)

Refer to TFC-ESHQ-S_IS-C-02, for additional requirements associated with PPE.

New types of PPE (e.g., gloves, face shields, etc.) not previously used at the laboratory must be evaluated and approved by both the CHO and the Industrial Hygienist prior to being placed into service.

5.6.1 Eye and Face Protection Requirements (18.1.6)

Eye protection is required for any type of work with or around chemicals, chemical products, or flying objects, such as fragments, large chips, particles, sand, or dirt. Protection, including prescription safety glasses, must conform to the specification of ANSI Z87.1, “American National Standard Practice for Occupational and Educational Personal Eye and Face Protection Devices and be marked accordingly.”

ATS-310, Section 9.4 establishes the minimum level of eye protection for performing work within the 222-S Laboratory Complex and the tasks and areas where supplemental eye protection is required.

Safety glasses with side protection that provide side impact resistance are the minimum level of eye protection.

Chemical splash goggles must be worn any time there is a reasonable risk of chemical splash or spray without mitigating factors. Chemical splash goggles shall have indirect ventilation and form a tight seal to the face. Chemical splash goggles must meet ANSI Z87.1 standards. Employees may use chemical splash goggles as a substitute for safety glasses. Face shields used in conjunction with safety glasses can be substituted for chemical splash goggles.

Face shields protect the eyes, face, and neck from chemical splashes and spray as well as flying particles.

- When a face shield is required, safety glasses must also be worn.
- Face shields are necessary any time there is a need to protect the face as well as the eyes in conditions where there is a reasonable risk of splash or spray of highly corrosive or

hazardous materials and there are no mitigating factors. Materials at extreme temperatures such as liquid nitrogen also require face shields.

A reasonable risk of chemical splash or spray is considered to exist under any of the following conditions:

- Working with highly corrosive substances. 29 CFR 1910.1200 defines corrosive chemicals as those chemicals that cause visible destruction of or irreversible alterations in living tissue by chemical action at the site of contact. Chemical substances such as dilute acids, bases, oxidizers, or reducing agents with a concentration of ≤ 5 percent are not highly corrosive.
- Pouring any chemical from or into containers where the height of any part of this transfer is above chest level.
- Mixing liquids that can expel container contents due to a physical or chemical reaction. Examples include diluting concentrated acids into water (exothermic) or adding acids to carbonate solutions (gas evolution).
- Total hand-poured quantity is greater than 5 liters.
- Working directly with pressurized or evacuated systems where the potential for chemical splash or spray is likely to occur. Working with any pressurized or evacuated systems constructed of glass should be considered as an operation where a chemical splash or spray is likely to occur.
- Working adjacent to someone else performing any of the above tasks.

Mitigating factors:

- A hood sash is between the face and the work.
- Other engineered barriers such as splash shields or component cabinets are between the face and the work.
- If the quantity being poured is of an amount that no material would reach the face. This does not include mixing of chemicals.
- The material being used is noncorrosive, nonirritating, and not pressurized.

5.6.2 Head Protection Requirements (18.1.7)

Head protection (hard hat) shall conform to the specifications of ANSI Z89.1, "American National Standard for Industrial Head Protection." Refer to TFC-ESHQ-S_IS-C-02, for additional requirements associated with head protection.

5.6.3 Foot Protection Requirements (18.1.8)

Protective footwear is not required for activities considered laboratory use of chemicals. Footwear is acceptable if it meets the following criteria:

- Fully encloses the foot
- Fully composed of a material such as leather or a comparable synthetic material
- Has non-skid soles.

If an exposure potential exists, additional chemical-resistant foot covering may be required. Protective footwear shall always be worn when moving or carrying the following sample carriers: pigs, mini-pigs, or hedgehogs. Protective footwear shall conform to the specifications of ASTM F2413-05, "Standard Specification for Performance Requirements for Foot Protection." Refer to TFC-ESHQ-S_IS-C-02 for additional requirements associated with protective footwear.

5.6.4 Hand Protection Requirements

Hand protection shall be provided to the employee and worn when there is a potential for injury due to exposure from chemicals, severe cuts or lacerations, severe abrasions, punctures, or extreme temperatures. Selection of hand protection shall be based on published product information, dexterity requirements, and the hazard exposure potential.

See ATTACHMENT A for additional guidance in selecting gloves to be used with common laboratory chemicals.

Refer to TFC-ESHQ-S_IS-C-02 for additional requirements associated with hand protection.

5.6.5 Respiratory Protection (18.1.4, 18.1.5)

When respiratory protection is required, the requirements and controls established in TFC-ESHQ-IH-STD-07 shall be followed.

5.7 Housekeeping

Housekeeping is essential for maintaining a safe work area. Minimize the amount of equipment, chemicals, and waste containers stored inside of the hood. Each employee is responsible for keeping his/her work area clean and neat. Housekeeping inspections will be performed in accordance with ATS-310, Section 9.2. Corrective actions will be initiated to resolve identified deficiencies. This includes avoiding any temporary blockage or interference of electrical disconnects, eyewashes, safety showers, or exit pathways.

6.0 LABORATORY-USE CHEMICALS

The laboratory has over 1,000 different chemical products, which, in total, may contain more than 500 different chemical compounds. Common laboratory-use chemicals include:

- Acids, such as sulfuric acid, hydrochloric acid, acetic acid, and nitric acid.

- Bases, such as sodium hydroxide, potassium hydroxide, and ammonium hydroxide.
- Oxidizers, such as 30% hydrogen peroxide solution, fuming nitric acid, sodium persulfate, and sodium nitrate.
- Flammable liquids, such as acetonitrile, methanol, ethanol, hexane, and toluene.
- Acute toxins, such as bromine, sodium fluoride, potassium dichromate, sodium cyanide, and nitrogen dioxide.
- Carcinogens, such as methylene chloride, or potassium dichromate.
- Reproductive toxins, such as toluene.

Laboratory-use chemicals, including those listed above may have one or more health or physical hazards associated with them. Because the laboratory has so many different chemical products, it is not feasible to list all the chemical products located at the laboratory in this document, nor is it possible to list all the physical and health hazards or the expected signs and symptoms of exposure associated with those chemicals. The list of chemicals used at the laboratory can be found on the WHL intranet webpage under WHL>Operations>Chemical Management>Chemical Inventory Reports.

Prior to using chemical products, personnel must ensure that they are familiar with the hazards associated with the type of chemical products being used and the expected signs or symptoms of exposure with that chemical class.

6.1 Identification of Chemical Hazards

(18.1.3, 18.1.4)

SDS/MSDS and chemical labels are among the best sources for identifying the hazards of laboratory chemicals. The health and physical hazards of chemicals can be identified on either the SDS/MSDS or the label through a combination of words, symbols, and numbers.

Common chemicals that can be encountered in the laboratory may include corrosive substances, flammable substances, oxidizing agents, carcinogens, reproductive toxins, and toxic substances.

See ATS-GD-1055, for definitions of various chemical hazards.

6.2 Recognizing the Signs and Symptoms of Exposure

(18.1.1, 18.1.3, 18.1.4)

Most chemicals at the laboratory fit into specific hazard classes, which have similar signs and symptoms associated with exposure. It is not feasible to individually list the signs and symptoms of exposure of all the chemicals present at the laboratory.

Employees must recognize that common symptomatic responses of the body, such as dizziness, light-headedness, nausea, irritating or burning sensations on skin or eyes, visible redness/rash, or unusual tastes (e.g., soapy, metallic, bitter, or pungent) are not normal and could be indicators of a suspect chemical exposure.

See ATS-GD-1055 for definitions of various chemical hazards and the common signs and symptoms of exposure associated with those chemical hazards.

7.0 WORKING WITH PARTICULARLY HAZARDOUS SUBSTANCES

(18.1.1, 18.1.4, 18.1.5, 18.1.10, 18.1.11, 18.1.12, 18.1.13)

This section identifies the requirements of laboratory-use chemicals identified by 29 CFR 1910.1450 as PHS. PHS are defined as chemicals with a high degree of acute toxicity, reproductive toxins, and carcinogens. TFC-ESHQ-IH-STD-11, does not apply to laboratory-use chemicals covered by this plan.

7.1 General Requirements

Procedures and test plans that include the use of PHS shall assess the potential for employee exposure. Specific consideration shall be given to the following elements, which shall be included where appropriate:

- Establishment of a Designated Area
- Use of containment devices such as fume hoods or gloveboxes
- Processes for safe removal of contaminated waste
- Decontamination processes

As chemicals are selected and acquired, written justification is provided for new chemicals that are PHS, as further outlined in 8.1. Any hazards associated with the use, location, and/or handling are further covered as part of the procedure/lab plan development process, which includes completion of a Hazard Analysis.

The determination of the need for control methods should be based on the following factors:

- Total amount of hazardous material to be used
- Properties (volatility, particle size)
- Proposed activity (heating, aerosol formation)
- Degree of the potential hazard.

7.2 Use of Containment Devices, Such as Fume Hoods or Gloveboxes

(18.1.2)

Where practicable, set up work areas in laboratory fume hoods or in other isolated systems (i.e., gloveboxes or hot cells) in order to prevent the release of material into external laboratory environment (i.e., laboratory room). No work with PHS shall be conducted in uncontained areas (i.e., the laboratory benchtop) if the action level, as described in Section 5.4) may be routinely exceeded or can reasonably be expected to be exceeded. All work with the following OSHA regulated carcinogens, when at or above the concentration listed in Table 1, shall be, at a minimum, in a laboratory fume hood.

Employees working with a carcinogen listed in Table 1, above the threshold concentration, shall wash their hands and arms upon completion of the assigned task or after exiting the Contamination Area (CA).

Employees working with a carcinogen listed in Table 1, above the threshold concentration in a Contamination Area (CA), shall change their outer gloves at the completion of task(s) before engaging in other activities.

Table 1. OSHA Regulated Carcinogens.

Carcinogens Listed in 29 CFR 1910.1003, "13 Carcinogens"	CAS¹ No.	Threshold Concentration (wt. or vol.)
4-Nitrobiphenyl	92-93-3	0.1%
alpha-Naphthylamine	134-32-7	1.0%
methyl chloromethyl ether	107-30-2	0.1%
3,3'-Dichlorobenzidine (and its salts)	91-94-1	1.0%
bis-Chloromethyl ether	542-88-1	0.1%
beta-Naphthylamine	91-59-8	0.1%
Benzidine	92-87-5	0.1%
4-Aminodiphenyl	92-67-1	0.1%
Ethyleneimine	151-56-4	1.0%
beta-Propiolactone	57-57-8	1.0%
2-Acetylaminofluorene	53-96-3	1.0%
4-Dimethylaminoazo-benzene	60-11-7	1.0%
N-Nitrosodimethylamine	62-75-9	1.0%

7.3 Establishment of a Designated Area (18.1.2)

Designated Areas (also called regulated areas by many OSHA substance specific standards) shall be set up in work areas where employee exposures could routinely exceed or be reasonably expected to exceed the action level (see Section 5.4). Unknowns and upset conditions are handled under Section 13.0.

All practical control strategies (see Section 5.0) shall be implemented prior to the establishment of a Designated Area.

Designated Areas shall be posted as "Restricted Access" in accordance with the requirements of ATS-310, Section 2.12.

Before exiting the Designated Area, employees are required to remove all PPE in a pre-designated collection area.

Upon exiting the Designated Areas, employees shall be required to:

- Wash hands, forearms, face, and neck before starting other activities or prior to eating, drinking, smoking, applying cosmetics, etc.
- After the last exit of the day, shower upon removal of contaminated clothing.

¹ Chemical Abstract Services

7.4 Safe Removal of Contaminated Waste

Prior to disposal, PPE, scrap, containers, debris, or other laboratory equipment contaminated with PHS shall be placed and stored in sealed bags or other closed containers designed to prevent dispersion of the PHS. These containers shall bear the warning labels appropriate to the applicable hazard(s).

All PHS shall be handled as hazardous waste according to the requirements of the following laboratory waste procedures:

- ATS-LO-100-151
- ATS-LO-110-129.

7.5 Contamination Protection and Decontamination

7.5.1 Contamination Control

1. All surfaces shall be maintained as free, as practicable, of visible accumulations of chemical contamination (i.e., any unwanted material that can be removed from surfaces by means, such as casual contact, wiping, brushing, or washing).
2. If contamination with the materials in Table 2 is reasonably anticipated to occur, procedures or test plans must include methods to control that contamination.

Table 2. Substance-Specific Contamination Control Requirements.

Substance	CAS No.
Inorganic Arsenic	Varies by Compound
Lead	Varies by Compound
Chromium (VI) Compounds	Varies by Compound
Cadmium	Varies by Compound
1,2-Dibromo-3-chloropropane	96-12-8
Acrylonitrile	107-13-1
Formaldehyde	50-00-0
4,4'-Methylenedianiline	101-77-9
Methylene Chloride	75-09-2
Beryllium	Varies by Compound

3. If leaks or spills are likely to occur, methods to detect exposure, including monitoring or visual inspections, shall be incorporated, as applicable, to the material being handled.
4. After using any PHS, employees shall wash their hands in a non-Designated Area prior to eating, drinking, smoking, applying cosmetics, etc. (see Section 7.3 for definition of Designated Areas).
5. When using PHS, personnel shall protect laboratory vacuum systems from contamination. Refer to ATS-LO-110-130 for additional requirements associated with using laboratory trap systems.

7.5.2 Decontamination

If methods to inactivate or treat the chemical component are available (e.g., water wash down of acrylonitrile), these methods shall be incorporated into procedures and test plans prior to cleaning equipment, performance of maintenance, or repair activities on contaminated equipment, or disposal of contaminated materials (including contaminated PPE).

7.5.3 Surface Cleaning

1. If vacuuming is used to clean up material, high-efficiency particulate air filters or other methods that prevent dispersing of the material shall be used.
2. Methods that should not be used to remove contamination if there is a potential that material can be dispersed include:
 - Compressed air
 - Blowing or shaking
 - Dry brushing, shoveling, or sweeping.

7.5.4 Equipment and Glassware Cleaning

1. For equipment and glassware, personnel shall follow the specific decontamination instructions (such as equipment specific operating procedures).
2. Refer to ATS-LO-190-141 for additional requirements.

7.6 Additional Controls

1. Ensure that less hazardous substitutes are evaluated for each PHS chemical acquired. Include this information with the written justification required for the acquisition of these chemicals.
2. For each PHS chemical ensure the container label clearly lists the specific PHS hazard(s), such as carcinogen, reproductive toxin or acute toxicity Category 1. Products that can be demonstrated as having no exposure potential do not require labeling.
3. Ensure employees have documented training appropriate to the use of any PHS. (See Section 11.0, Employee Information and Training).
4. Potential exposures for non-routine activities are identified through job hazard or job safety analysis or other similar processes.

8.0 CHEMICAL ACQUISITION, STORAGE, AND DISTRIBUTION

(18.1.3, 18.1.4)

Laboratory-use chemicals shall be acquired, received, stored, and disposed of in accordance with:

- ATS-LO-150-063
- TOC-AIA-LATS-00060.

Before any manufacturer provided laboratory-use chemicals are released for use at the 222-S Laboratory Complex, a SDS/MSDS MUST be available in the Hanford Site SDS/MSDS System (<http://www7.rl.gov/msds/> <http://msnet.ms.rl.gov/msds/>).

8.1 Acquisition of Chemicals

(18.1.1, 18.1.4, 18.1.10, 18.1.11, 18.1.12, 18.1.13)

All laboratory-use chemicals shall be acquired through the Standards Laboratory and be approved by the 222-S Laboratory Complex Chemical Management point of contact (POC). Additional procurement approvals are required by the above listed procedures for new laboratory chemicals, particularly hazardous substances, and certain high-risk chemicals.

1. New Chemicals. Laboratory-use chemicals that have not been ordered previously shall be approved by the industrial hygienist, environmental, and when applicable, radiological control and quality assurance, as described by ATS-LO-150-063.
2. Particularly Hazardous Substances. In accordance with ATS-LO-150-063 new laboratory-use chemicals that are occupational carcinogens, reproductive toxins, or chemicals with a high degree of acute toxicity shall have written justification for their acquisition. The following items must be considered during justification:
 - Does this material have an associated exposure limit (e.g., PEL, TLV, or OEL)?
 - Is there published acute toxicity data (e.g., Oral Rat LD50) for this material?
 - Can a lower concentration product be used?
 - Is the quantity of material to be acquired the smallest amount needed to perform the work?
 - Has the process where this substance is going to be used been defined in laboratory procedures or test plans?
 - Has the location where this work is going to be completed been identified?
 - Have methods to control surface contamination, including leaks and spills, been evaluated?
 - Is a plan available to ensure that the work area is decontaminated?
3. High-Risk Chemicals. Laboratory-use chemicals that may pose a higher hazard or risk when acquired in large quantities are specified in ATS-LO-150-063. These chemicals shall be acquired in accordance with the controls identified in ATS-LO-150-063.

8.2 Receipt of Chemicals

Chemicals delivered to the 222-S Laboratory Complex shall be received according to ATS-LO-150-063.

8.3 Storage of Chemicals (18.1.2, 18.1.9)

Chemicals should be stored in accordance with the recommendations of the manufacturer, such as those specified in the material's SDS/MSDS or container label, and according to their compatibility with other materials. This includes manufacturer's recommendations for temperature, moisture, and humidity control.

Incompatible chemicals must be appropriately segregated from each other. Refer to ATS-LO-150-063 for additional guidance.

At a minimum, the following groups of chemicals SHALL be stored separately:

- Oxidizers. Store away from flammable and combustible materials (e.g., ethanol, hexane, paper) and reducing agents (e.g., hydroxylamine hydrochloride, ChloramineT, etc.). Common oxidizers in the laboratory include 30% hydrogen peroxide solutions, potassium persulfate, and fuming nitric acid (also a corrosive).
- Flammable and combustible materials. Store flammable solids (e.g., metal powders, alkyl metals, and charcoal) separately from flammable liquids (e.g., ethanol, hexane and toluene). Flammable and combustible liquids should be stored in an area segregated for flammable liquids. Refer to ATS-310, Section 9.8 for additional requirements associated with the storage of flammable and combustible materials. Flammable and combustible liquids that require additional storage in refrigerators or freezers must be stored in those refrigerated units that conform to the requirements of NFPA 45.
- Corrosive materials. Store acids (e.g., nitric acid, hydrochloric acid, and sulfuric acid) separately from bases (e.g., sodium hydroxide and ammonium hydroxide). All corrosive materials should be stored away from flammable and combustible materials.

Some chemicals, such as glacial acetic acid (e.g., flammable and corrosive) or nitric acid (e.g., oxidizing and corrosive) require segregation from other chemicals with similar hazards due to their potential to be incompatible with other reagents with similar hazards.

Chemical storage locations must be kept clean and orderly, and all containers tightly covered or closed when not in use. When practicable, newly received chemicals will be rotated with existing stock in a first in, first out rotation. See ATS-GD-1055 for definitions of various chemical hazards.

8.4 Distribution and Movement of Chemicals (18.1.3)

Distribution of chemicals includes movement of chemicals within the 222-S Laboratory Complex and distribution of chemicals to users both within the 222-S Laboratory Complex and to groups outside the 222-S Laboratory Complex.

When moving chemicals within the 222-S Laboratory Complex, personnel shall place the container within an appropriate secondary containment or on an appropriate cart that would allow the safe movement of the container in order to prevent an accidental breakage. This requirement does not apply to working with a chemical in an immediate work area, a hood, or bench top. If the movement of the chemical is to a new storage location, Standards Laboratory personnel shall be notified in accordance with the requirements of ATS-LO-150-063.

Distribution of chemicals from the 222-S Laboratory must be coordinated through the Standards Laboratory and shipped in accordance with TFC-PLN-58.

When distributing to entities outside of the 222-S Laboratory Complex, a copy of the appropriate SDS/MSDS for each chemical, standard or reagent must be provided, and the chemical must be labeled in accordance with Section 9.2.

9.0 SIGNS AND LABELS (18.1.3, 18.1.4, 18.1.5, 18.1.9)

9.1 Signs

All laboratories shall prominently display signs with the following information.

- Laboratory Complex Facility Emergency Response Boards (FERB) shall display all emergency telephone numbers, including the phone numbers of the Building Emergency Director (BED). Typically, FOM assumes the role of BED in a declared emergency.
- Equipment location signs shall indicate safety showers, eyewash stations, first aid stations, fire protection equipment, and exits.
- Refrigerators and freezers in laboratory areas shall be marked for its intended use (e.g., chemical storage, sample storage, flammable liquid storage, etc.).
- Signs in Designated Areas shall be posted in accordance with the requirements of ATS-310, Section 2.12.
- Refer to TFC-ESHQ-S-STD-18 for additional guidance in the posting and design of signs.

9.2 Labels

1. Ensure each chemical container used or stored at 222-S Laboratory has a legible, prominently displayed label with the chemical identification and health and safety information as a minimum. Labels are not required on containers (e.g., flasks and beakers) that are intended only for the immediate use by the laboratory personnel and are not left unattended; however, labeling even these containers is a good practice. Containers that are in the process of being analyzed are exempt from this requirement.
2. Standards Laboratory personnel shall follow the requirements of LO-120-001 when labeling standards and reagents.
3. When labeling secondary containers used in the laboratory, personnel shall follow the requirements of ATS-LO-120-007.
4. When distributing to entities outside of the 222-S Laboratory Complex, each chemical container must be labeled in accordance with the requirements of 29 CFR 1910.1200 and [TFC-ESHQ-IH-C-02](#).

10.0 WASTE GENERATION

Before generating waste at the 222-S Laboratory Complex, the responsible chemist or technical authority will evaluate all impacts in accordance with:

- ATTS-310, Section 6.3
- ATTS-310, Section 6.4
- ATTS-310, Section 6.4.5
- ATTS-LO-100-151
- ATTS-LO-110-129.

11.0 EMPLOYEE INFORMATION AND TRAINING

(18.1.1, 18.1.318.1.2, 18.1.4)

Training requirements shall be met through facility chemical hygiene training, the Hanford General Employee Training (HGET), the 222-S Laboratory Complex facility orientation and facility emergency response course (Facility Emergency & Hazard Information Checklist [FEHIC]) course, and the procedure-specific training, such as employee qualification cards and on-the-job training (OJT). This training shall include the following:

- Information on methods and observations that may be used to detect the presence or release of a chemical
- Physical and health hazards of chemicals in the work place
- Measures employees can take to protect themselves from these hazards including personal avoidance of routine exposures and training on the general classes of chemicals likely to be encountered.
- Training on new procedures and test plans shall include information on hazards and methods to protect employees from exposure to those hazards.

Training shall be provided at the time of an employee's initial assignment to a work area where chemicals are present and prior to assignments involving new exposure situations. The HGET and FEHIC training require annual refresher training. Significant revisions to procedures are communicated through OJT, required reading assignments, or other means, as determined by the procedure technical authority.

This chemical hygiene plan, the documents referenced in this plan, chemical hygiene plan training, and OJT provide the necessary hazard communication information to meet OSHA requirements.

Training to technical procedures including OJT will be performed in accordance with:

- (WHL employees) WHL-312-5.07
- (WRPS employees) ATTS-310, Section 5.7.

Training records are documented in accordance with:

- (WHL employees) WHL-312-5.01
- (WRPS employees) TFC-BSM-IRM_DC-C-02.

12.0 MEDICAL CONSULTATION AND EXAMINATIONS (18.1.3, 18.1.4)

12.1 Conditions Warranting Additional Medical Consultation or Examinations

Employees who work with chemicals shall be provided an opportunity to receive appropriate medical consultation or examination, including follow-up examinations when determined necessary by the examining physician, under the following situations:

- A spill, leak, exposure, or other event has occurred that may have resulted in suspect personnel exposure to a hazardous concentration of a chemical
- Exposure monitoring revealed the air concentration of a chemical is routinely above the action level (see Section 5.5)
- Personnel develop signs or symptoms associated with exposure to a chemical
- Personnel believe they have had a pre-1998 exposure to hazardous agents.

For additional requirements associated with responding and reporting exposures and accidents, refer to:

- (WHL employees) WHL-312-10.02
- (WRPS employees) TFC-ESHQ-S_CMLI-C-02.

For additional requirements associated with laboratory use of chemicals containing beryllium or beryllium compounds, refer to:

- (WHL employees) WHL-MP-1043
- (WRPS employees) WRPS does not perform beryllium analyses subject to the requirements of 29 CFR 1910.1450.

12.2 Information Provided to Physician

The following information will be provided, if available, to the physician by WRPS and/or WHL:

- The identity of the chemical(s) to which the employee may have been exposed
- A description of the conditions under which the exposure occurred, including quantitative exposure data
- A description of the signs and symptoms that the employee may be experiencing.

Additional information related to medical monitoring or surveillances can be found in

- (WHL employees) WHL-MP-1028
- (WRPS employees) TFC-ESHQ-IH-C-17.

12.3 Physician Response Requirements (18.1.4)

The Hanford health care provider is responsible for providing the physician's written opinion.

When medical consultation or attention is required because of exposure or suspected exposure to toxic materials, the examining physician's written opinion shall include the following items as required by 29 CFR Part 1910.1450:

1. Recommendations for medical follow-up.
2. Results of the medical examination and any associated tests.
3. Any medical condition revealed during the examination that may place the employee at an increased health risk if exposed to a chemical found in the work place.
4. Statement that the physician has informed the employee of the results of the consultation or medical examination and any medical condition that may require further examination or treatment.

13.0 SPILLS AND ACCIDENTS

13.1 Emergency Plan Requirements

Laboratory chemical-related spills and accidents are addressed in the FEHIC training, which is required annually. Elements that must be addressed include the following:

- Chemical contamination in the eye
- Skin contact with chemicals
- Ingestion of chemicals
- Inhalation
- Chemical spills within the laboratory
- Emergency training.

Emergency actions that are unique to a particular chemical shall be included in the chemical-specific procedures and test plans. In general, if skin comes in contact with a hazardous material, flush the affected area for 15 minutes while removing contaminated clothing, and call 911 or 509-373-0911 (from a cellular phone) for emergency assistance. For hydrofluoric acid exposures, flush for 5 minutes; then continually apply calcium gluconate gel until emergency help arrives.

13.2 Spills

If a chemical spill occurs outside of engineering and procedural controls, personnel must respond by:

1. SWIM (Stop, Warn Others, Isolate Area, Minimize Exposure).
 - a. Stop all associated work and equipment not required for safe operation.
 - b. Warn others in adjacent areas.
 - c. Isolate the area around the spill.
 - d. Minimize exposure.
2. Personnel must be in a safe, upwind location.
3. The FOM is notified of chemical spills at 373-2435.
4. Refer to 222S-AOP-115 for additional actions.

13.3 Methods to Detect Spills or Releases

In the absence of real-time monitoring, laboratory employees should rely on their senses to detect spills or releases. Below are some general questions that employees can ask themselves to determine if there has been a spill or release of chemicals.

- Has the container tipped over?
- Are there any liquids or solids that have accumulated around the chemical container?
- Does the container have residue on it?
- Does the container or its labeling show signs of deterioration, such as cracking, yellowing or brittleness?
- Is the container or area around the container damp, tacky, slippery, or sticky?
- Is there an unusual smell or odor near the container or in the storage area? Is there an unfamiliar or new noise, such as hissing or rattling, around the container?
- Have the radiation levels suddenly elevated?

Laboratory employees should also rely on the symptomatic responses of their body, such as:

- Do you feel dizzy, light-headed, or nauseated?
- Is there an irritating or burning sensation around the eyes, nose or mouth?
- Is there an unusual soapy, metallic, bitter, or pungent taste in the mouth?

14.0 CORRECTIVE ACTION

Incidents, accidents, and occurrences will be documented and managed in accordance with the following documents:

- (WHL employees) WHL-312-9.04
- (WRPS employees) TFC-ESHQ-Q_C-C-01.

15.0 ANNUAL REVIEW (18.1.4)

An annual review of the chemical hygiene plan shall be performed by members of the chemical hygiene committee.

15.1 Annual Review Elements

1. Review of the chemical hygiene plan for accuracy with current conditions and compliance with Hanford Site and OSHA requirements.
2. Documentation of the results of this evaluation.

16.0 DEFINITIONS

Chemical. For the purpose of this plan, chemical means any element, chemical compound, or mixture of elements and/or compounds that is hazardous according to the definitions of the Occupational Safety and Health Administration (OSHA) and/or the National Fire Protection Association (NFPA), as addressed in applicable NFPA documents including but not limited to NFPA 1, "Fire Code" and NFPA 45, "Standard on Fire Protection for Laboratories Using Chemicals."

Chemical Hygiene Officer. Per 29 CFR 1910.1450, "chemical hygiene officer means an employee who is designated by the employer, and who is qualified by training or experience, to provide technical guidance in the development and implementation of the provisions of the chemical hygiene plan. This definition is not intended to place limitations on the position description or job classification that the designated individual shall hold within the employer's organizational structure."

Chemical Hygiene Plan. Per 29 CFR 1910.1450, "chemical hygiene plan means a written program developed and implemented by the employer which sets forth procedures, equipment, personal protective equipment and work practices that (i) are capable of protecting employees from the health hazards presented by hazardous chemicals used in that particular workplace and (ii) meets the requirements of paragraph (e) of 29 CFR 1910.1450."

Chemical Acquisition. This includes the actual purchasing of chemicals or any other means of acquiring chemicals such as borrowing from another Hanford facility or receiving free chemical products from vendors.

Chemicals with a high degree of acute toxicity. This includes any chemical with a GHS classification of acute toxicity, category 1 or 2, or specific target organ toxicity (single exposure), category 1.

Laboratory use per 29 CFR 1910.1450, Laboratory use of hazardous chemicals means handling or use of chemicals in which all of the following conditions are met:

- Chemical manipulations are carried out on a laboratory scale
- Multiple chemical procedures or chemicals are used
- The procedures involved are not part of a production process, or in any way simulate a production process
- Protective laboratory practices and equipment are available and in common use to minimize the potential for employee exposure to hazardous chemicals.

Particularly Hazardous Substances. Per 29 CFR 1910.1450 Particularly Hazardous Substances (PHS) are defined as carcinogens, reproductive toxins and chemicals with a high degree of acute toxicity.

See ATS-GD-1055 for additional chemical hygiene plan related definitions.

17.0 RECORDS

The following records are generated during the performance of this plan and are maintained by WHL in accordance with WHL-MP-1005:

- Chemical hygiene committee meeting minutes
- Particularly Hazardous Substances Listing.

Records taken to monitor employee exposures shall be maintained in accordance with the requirements of TFC-ESHQ-IH-STD-03.

Records associated with employee's medical consultation and examinations (including tests or written opinions) shall be maintained by Hanford health care provider, as required by their contractual responsibilities.

18.0 SOURCES

18.1 Requirements

18.1.1 10 CFR Part 851, "Worker Safety and Health Program."

18.1.2 29 CFR 1910.1003, "13 Carcinogens (4-Nitrobiphenyl, etc.)."

18.1.3 29 CFR Part 1910.1200, "Hazard Communication."

18.1.4 29 CFR Part 1910.1450, "Occupational Exposure to Hazardous Chemicals in Laboratories."

18.1.5 29 CFR 1910, Subpart Z, "Toxic and Hazardous Substances."

18.1.6 ANSI Z87.1, "American National Standard for Occupational and Educational Personal Eye and Face Protection Devices."

- 18.1.7 ANSI Z89.1, "American National Standard for Industrial Head Protection."
- 18.1.8 ASTM F2413-05, "Standard Specification for Performance Requirements for Foot Protection."
- 18.1.9 NFPA 45, "Standard on Fire Protection for Laboratories Using Chemicals."
- 18.1.10 TFC-PLN-47, "Worker Safety and Health Program."
- 18.1.11 TFC-POL-16, "Integrated Safety Management System Policy."
- 18.1.12 WHL-MP-1028, "WHL Health and Safety Plan."
- 18.1.13 WHL-MP-1032, "ISMS Implementing Documents Matrix."

18.2 References

- 18.2.1 222-S-AOP-115, "Response to Reported Odors or Spill Events." TOC-AIA-LATS-00060, "Administrative Interface Agreement between Washington River Protection Solutions, LLC. (WRPS) and Wastren Advantage, Inc. for 222-S Laboratory Analytical Services and Testing."
- 18.2.2 ACGIH, "TLVs and BEIs, Threshold Limit Values for Chemical Substances and Physical Agents, Biological Exposure Indices, American Conference of Governmental Industrial Hygienists, Cincinnati, Ohio."
- 18.2.3 ATS-310, Section 1.5, "Entry Control."
- 18.2.4 ATS-310, Section 1.9, "Laboratory Test Planning."
- 18.2.5 ATS-310, Section 1.39, "Assessment Program."
- 18.2.6 ATS-310, Section 2.12, "Restricted and Limited Access Area Signage."
- 18.2.7 ATS-310, Section 2.3, "Operational Requirements."
- 18.2.8 ATS-310, Section 5.7, "Technical Procedure Training."
- 18.2.9 ATS-310, Section 6.3, "222-S Laboratory Complex PCB Waste Management."
- 18.2.10 ATS-310, Section 6.4, "222-S Laboratory Complex Waste Management Program."
- 18.2.11 ATS-310, Section 6.4.5, "Waste Stream Fact Sheet Development and Issuance (Pre-designation of Waste)."
- 18.2.12 ATS-310, Section 9.2, "Safety Inspection Programs."
- 18.2.13 ATS-310, Section 9.4, "222-S Laboratory Complex Eye Protection Requirements."
- 18.2.14 ATS-310, Section 9.8, "Control of Flammable Liquid Storage Cabinets."

- 18.2.15 ATS-310, Section 11.12, "Shift Turnover and Minimum Staffing Guidelines for 222-S Laboratory Complex."
- 18.2.16 ATS-310, Section 11.16, "Technical Procedure Control Process."
- 18.2.17 ATS-310, Section 11.16.1, "222-S Laboratory Technical Procedure Writing and Formatting Guide."
- 18.2.18 ATS-GD-1055, "Common Definitions Associated with Chemical Hygiene and Chemical Management."
- 18.2.19 ATS-LO-100-151, "Laboratory Waste Generation."
- 18.2.20 ATS-LO-110-129, "Generation of Nonradioactive Waste and Recyclable Materials."
- 18.2.21 ATS-LO-110-130, "Vacuum Trap Setup and Operation."
- 18.2.22 ATS-LO-120-007, "Proper Labeling of Secondary Containers at 222-S Complex."
- 18.2.23 ATS-LO-150-062, "Management of Reactive and Time-Sensitive Chemicals in the Laboratory."
- 18.2.24 ATS-LO-150-063, "Chemical Management for the 222-S Laboratory Complex."
- 18.2.25 ATS-LO-161-003, "Fume Hood Use in the 222-S Laboratory."
- 18.2.26 ATS-LO-161-108, "222-S Laboratory Routine Operating Parameters for Lab 1C Shielded Gloveboxes."
- 18.2.27 ATS-LO-161-183, "222-S Laboratory Operation of the 11A Glovebox."
- 18.2.28 ATS-LO-190-141, "Decontaminate Equipment."
- 18.2.29 Bretherick's Handbook of Reactive Chemical Hazards, 1995 or current edition, Butterworth-Heinemann LTD.
- 18.2.30 IARC International Agency for Research on Cancer (IARC) Monographs on the Evaluation of Carcinogenic Hazard to Humans, (<http://monographs.iarc.fr/>).
- 18.2.31 "Sax's Dangerous Properties of Industrial Materials," Lewis, Richard J., Sr 12th ed., John Wiley & Sons, 2012.
- 18.2.32 LO-120-001, "Labeling of Standards and Reagents by Standards Laboratory Personnel."
- 18.2.33 NFPA 1, "Fire Code."
- 18.2.34 NFPA 704, "Standard System for the Identification of Hazards of Materials for Emergency Response."

- 18.2.35 Personal Protective Equipment for Chemical, Biological, and Radiological Hazards: Design, Evaluation, and Selection, Gudin Dickson, Eva F., American Conference of Governmental Industrial Hygienists (ACGIH), February, 2012).
- 18.2.36 National Toxicology Program, Report on Carcinogens, "US Department of Health and Human Services, National Toxicology Program."
- 18.2.37 "Occupational Health Guidelines for Chemical Hazards, National Institute for Occupational Safety and Health (NIOSH) (<http://www.cdc.gov/niosh/docs/81-123/>)."
- 18.2.38 RPP-33642, "Airborne Chemical Monitoring Review for 222-S Laboratory."
- 18.2.39 RPP-40939, "222-S Laboratory Fume Hood Performance Testing Program."
- 18.2.40 TFC-BSM-IRM_DC-C-02, "Records Management."
- 18.2.41 TFC-ESHQ-IH-C-02, "Hazard Communication."
- 18.2.42 TFC-ESHQ-IH-C-17, "Employee Job Task Analysis."
- 18.2.43 TFC-ESHQ-IH-STD-03, "Exposure Monitoring, Reporting, and Records Management."
- 18.2.44 TFC-ESHQ-IH-STD-07, "Respiratory Protection."
- 18.2.45 TFC-ESHQ-IH-STD-11, "Carcinogen Control."
- 18.2.46 TFC-ESHQ-Q_C-C-01, "Problem Evaluation Request."
- 18.2.47 TFC-ESHQ-S_CMLI-C-02, "Injury and Illness Events."
- 18.2.48 TFC-ESHQ-S_IS-C-02, "Personal Protective Equipment."
- 18.2.49 TFC-ESHQ-S_SAF-C-02, "Job Hazard Analysis."
- 18.2.50 TFC-ESHQ-S-STD-18, "Safety Signs, Tags, Barriers, and Color Coding."
- 18.2.51 TFC-OPS-OPER-C-68, "Control of Working Hours."
- 18.2.52 TFC-PLN-34, "Industrial Hygiene Exposure Assessment Strategy."
- 18.2.53 TFC-PLN-47, "Worker Safety and Health Program."
- 18.2.54 TFC-PLN-58, "Chemical Management Plan."
- 18.2.55 TFC-POL-14, "WRPS Safety and Occupational Health."
- 18.2.56 The MERCK Index, "An Encyclopedia of Chemicals, Drugs and Biologicals, 12th edition or current edition, John Wiley & Sons."

- 18.2.57 TOC-AIA-LATS-00060, “Administrative Interface Agreement between Washington River Protection Solutions, LLC. (WRPS) and Wastren Advantage, Inc. for 222-S Laboratory Analytical Services and Testing.”
- 18.2.58 WHL-312-5.01, “Training Administration.”
- 18.2.59 WHL-312-9.04, “Corrective Action Management.”
- 18.2.60 WHL-312-10.02, “Reporting, Investigating, and Managing Health, Safety and Property/Vehicle Events.”
- 18.2.61 WHL-312-11.16, “Procedure Control and Use.”
- 18.2.62 WHL-MP-1005, “Records Management Program.”
- 18.2.63 WHL-MP-1009, “Integrated Environmental, Safety, and Health Management System Description for the 222-S Laboratory Analysis and Testing Services Contractor (ISMS).”
- 18.2.64 WHL-MP-1020, “Assessment Program.”
- 18.2.65 WHL-MP-1035, “Control of Working Hours and Working Alone.”
- 18.2.66 WHL-MP-1037, “Worker Safety and Health Program.”
- 18.2.67 WHL-MP-1043, “Beryllium Program.”
- 18.2.68 WHL-POL-011, “Health and Safety Policy.”

ATTACHMENT A – HAND PROTECTION

In laboratory-use, disposable gloves are intended to provide chemical protection against incidental splashes and must be changed immediately after unintended contact with any chemical. WRPS Health and Safety Inspection 1248, “222-S- Guidance on the selection of dermal PPE at the 222-S Laboratory” documents an internal evaluation of residual contact with chemicals in a fume hood at the 222-S Laboratory. The conclusions and recommendations for this evaluation are applicable to incidental splash protection for working with chemicals at the 222-S Laboratory.

During glove selection, consideration must be given to chemical (procedure safety section), radiological (RWP requirements), and physical hazards (Job Hazard Analysis [A-6004-101] / Laboratory Worksite Hazard Analysis [A-6004-775]).

Table A-1 below provides a starting point in identifying appropriate materials for hand protection in procedures where protection beyond incidental splash contact may be expected. The information is compiled from various manufacturer and industry sources.

For some of the glove materials, different glove thicknesses are shown to demonstrate chemical resistivity changes as the glove thickness changes. The disposable gloves (i.e., medical gloves) that are commonly used in the laboratory have a thickness of about 4 to 8 mil. Caution should be used when evaluating glove chemical resistivity data because much of the data published are for the thicker gloves and not for the disposable gloves. Particularly with organic materials, permeation of the glove may occur without noticeable deterioration.

If the chemical of concern is not listed or there is no recommended glove type for a listed chemical, contact the CHO and your industrial hygiene representative for assistance in determining appropriate hand protection. With regard to non-chemical hazards (e.g., cuts, punctures, abrasions, thermal, ergonomic), contact your industrial safety representative.

Table A-1. Hand Protection, Chemical Resistance Information.

Glove Types	Disposable (exam quality) (6-8 mil)			Reusable, (20 mil)		Silver Shield
	Nitrile	Latex	Vinyl	Neoprene	Latex	Laminate
Chemical Protective Material Type						
1,3-butadiene	E	N/A	N/A	N/A	N/A	E
Acetic acid	P	G	F	E	G	N/A
Acetone	P	G	P	F	G	E
Acetonitrile	P	F	P	P	F	N/A
Ammonium hydroxide, conc. (28-30% Ammonia)	P	F	E	E	F	N/A
Benzene	P	P	P	P	P	E
Butanol	F	E	F	E	E	N/A
Chloroform	P	P	P	P	P	E
Diethyl ether	P	P	P	F	P	E
Dimethyl mercury	P	P	P	P	P	E
1,4-Dioxane	P	F	P	P	F	N/A
Hexane	F	P	P	F	P	E

Table A-1. Hand Protection, Chemical Resistance Information. (cont.)

Glove Types	Disposable (exam quality) (6-8 mil)			Reusable, (20 mil)		Silver Shield
	Nitrile	Latex	Vinyl	Neoprene	Latex	Laminate
Chemical Protective Material Type						
Hydrochloric acid, 37%	F	E	P	G	E	E
Hydrofluoric acid, 30%	E	E	P	E	E	E
Hydrogen peroxide, 30%	G	E	P	G	E	N/A
Isooctane	G	P	P	G	P	N/A
Isopropanol	F	E	G	G	E	N/A
Methylene chloride	P	P	P	P	P	E
Methyl ethyl ketone (2-butanone)	P	F	P	P	F	N/A
Nitric acid 10%	G	E	P	E	E	N/A
Nitric acid, 70%	P	P	P	G	P	N/A
Phenol, 90%	P	F	F	E	F	E
Potassium hydroxide, 50%	E	E	P	E	E	N/A
Sodium hydroxide, 50%	E	E	P	G	E	E
Sulfuric acid, 95-98%	P	P	P	F	P	E
Tetrahydrofuran	P	P	P	P	P	E
Toluene	P	P	P	P	P	E

1. Honeywell North® Silver Shield® or approved equivalent

E, G: Excellent, Good - recommended

F: Fair - adequate, but not ideal

P: Poor - not recommended

N/A: data not available

ATTACHMENT B - LINKS TO ADDITIONAL ONLINE RESOURCES

The following web links provide additional information on subjects such as carcinogens, reproductive toxins, laboratory safety, etc. The web address listed below were current at the time this plan was released; however, they may or may not be current when accessed. The information posted on these web pages has not been verified and should be used for additional information only. Contact the chemical hygiene officer or the industrial hygienist for additional assistance with a chemical that may be indicated as having a high health or physical hazard.

Microsoft retired Internet Explorer in 2015. If you have difficulty accessing a site, try using Google Chrome, which is available from Software Distribution.

A.	Aggregated Computational Toxicology Resource (ACToR) – EPA’s online warehouse of all publicly available chemical toxicity data	https://actor.epa.gov
B.	Agency for Toxic Substances and Disease Registry (ATSDR)	https://www.atsdr.cdc.gov
C.	Centers for Disease Control and Prevention	https://www.cdc.gov/
D.	DOE Worker Safety and Health	https://energy.gov/ehss/worker-safety-and-health
E.	DOE Chemical Safety Program	https://energy.gov/ehss/chemical-safety-program
F.	Environmental Protection Agency	https://www.epa.gov/
G.	EPA Integrated Risk Information System (IRIS)	https://www.epa.gov/iris
H.	International Agency for Research on Cancer (IARC)	https://www.iarc.fr/
I.	Medical Dictionary Online	https://www.online-medical-dictionary.org/
J.	Safety Emporium MSDS Hyper Glossary	http://www.ilpi.com/msds/ref/index.html
K.	National Institute for Occupational Safety and Health	https://www.cdc.gov/niosh/
L.	National Toxicology Program (NTP)	https://ntp.niehs.nih.gov/
M.	New Jersey Right to Know Hazardous Substance Fact Sheets	https://www.nj.gov/health/workplacehealthandsafety/right-to-know/hazardous-substances/
N.	NIH PubChem	https://pubchem.ncbi.nlm.nih.gov/
O.	Occupational Safety & Health Administration	https://www.osha.gov/
P.	OSHA Hazard Communication	https://www.osha.gov/dsg/hazcom/index.html

ATTACHMENT B - LINKS TO ADDITIONAL ONLINE RESOURCES (cont.)

Q.	OSHA Occupational Chemical Database	https://www.osha.gov/chemicaldata/
R.	State of California's Office of Environmental Health Hazard Assessment, Proposition 65, Safe Drinking Water and Toxic Enforcement Act of 1986	https://oehha.ca.gov/proposition-65