



*One Team. One Culture.*

## **Administrative Procedure**

# **PRC-PRO-SH-17916**

## **Industrial Hygiene Exposure Assessments**

Revision 4, Change 3

Published: 02/26/2019

Effective: 02/26/2019

Program: Occupational Safety and Industrial Hygiene

Topic: Occupational Safety and Industrial Health

Technical Authority: Robinson, Roby

Alternate Technical Authority: Zane, Robert

Functional Manager: Robinson, Roby

## **Use Type: Administrative**



- Solid Waste Operations Complex :  
**Screening Determination Performed: (Screening/Determination Performed (no issues))**  
GCX-8 (SWOC-18-023)  
**Screener:** Geary, Daniel
- Canister Storage Building/Interim Storage Area :  
**Categorical Exclusion:** GCX-8 (Not in Safety Basis Compliance Matrices)  
**Screener:** Covey, Lori
- Central Plateau Surveillance and Maintenance :  
**Categorical Exclusion:** GCX-8 (Not in Safety Basis Compliance Matrices)  
**Screener:** Waller, Mitchell
- Waste Encapsulation Storage Facility :  
**Categorical Exclusion:** GCX-8 (Not in Safety Basis Compliance Matrices)  
**Screener:** Covey, Lori
- 100 K Facility :  
**Categorical Exclusion:** GCX-8 (Not in Safety Basis Compliance Matrices)  
**Screener:** Williams, James
- Plutonium Finishing Plant :  
**Categorical Exclusion:** GCX-8 (Not in Safety Basis Compliance Matrices)  
**Screener:** King, Jeffrey
- Transportation :  
Excluded from USQ  
**Exclusion Reason:**  
N/A per Section 1.3.
- 324 Facility :  
**Categorical Exclusion:** GCX-7 (Minor Change)  
**Screener:** Enghusen, Mark

**JHA:** Administrative

**Periodic Review Due Date:**09/28/2022

Rev. 4, Chg. 3

## Change Summary

### Description of Change

Clarify language about the IH Work Permit. Revise records capture table

## Industrial Hygiene Exposure Assessments

Published Date: 02/26/19

Effective Date: 02/26/19

### TABLE OF CONTENTS

1.0	INTRODUCTION .....	2
1.1	Purpose .....	2
1.2	Scope .....	2
1.3	Applicability .....	2
1.4	Implementation .....	2
2.0	RESPONSIBILITIES .....	2
3.0	PROCESS.....	3
3.1	IH Screening Processes (Optional) .....	3
3.1.1	IH Screening for Activities.....	3
3.1.2	IH Screening for Chemicals.....	3
3.2	IH Exposure Assessment (IHEA) .....	4
3.3	IH Sample Plan .....	10
3.4	IH Technical Evaluation .....	12
3.5	IH Work Permit.....	13
4.0	FORMS .....	15
5.0	RECORD IDENTIFICATION .....	15
6.0	SOURCES .....	16
6.1	Requirements.....	16
6.2	References.....	16
6.3	Other Basis Documents.....	16
6.4	Developmental References .....	17

### List of Tables

Table C-1. OSHA-Specific Carcinogens with Vertical Standards.....	23
Table C-2. OSHA-Regulated Carcinogens .....	23
Table D-1. General Guidelines to Remediate Hazardous Biological Agents .....	26
Table D-2. Personal Protective Equipment Selection Guidelines for Cleanup of Hazardous Biological Agents.....	26
Table D-3. Disinfectant Selection Disinfectant Classes Listed in Order of Organism Susceptibility .....	27

### List of Appendixes

Appendix A - Glossary .....	18
Appendix B - Statistical Evaluation of Exposure Data .....	20
Appendix C - Recommended Controls for Carcinogens and Teratogens .....	22
Appendix D - Recommended Controls for Biological Agents.....	25
Appendix E - Recommended Evaluation of Ventilation Controls.....	28

## Industrial Hygiene Exposure Assessments

Published Date: 02/26/19

Effective Date: 02/26/19

### 1.0 INTRODUCTION

#### 1.1 Purpose

This procedure provides a process for conducting and documenting Industrial Hygiene Exposure Assessments (IHEA) to support CH2M HILL Plateau Remediation Company (CHPRC)-directed work activities. This procedure also provides guidance for the processes of hazard evaluation and identification of controls.

Industrial Hygiene Exposure Assessment (IHEA) documentation, with hazard evaluation and control considerations, provides the framework to support safe work, as described in PRC-PRO-WKM-12115, *Work Management*, and is a tool for the Industrial Hygienist (IH) to consistently characterize, document, and control exposure to occupational health hazards, including carcinogens.

#### 1.2 Scope

The IHEA process identifies and evaluates anticipated biological, chemical, ergonomic, and physical agent hazards potentially present in products, materials, equipment and wastes associated with CHPRC-directed work activities. IHEA is the process used to develop and assess control measures, and to maintain occupational exposures as low as practicable.

This procedure does not address the following exposure hazards:

- Radiological hazards covered under 10 CFR 830, *Nuclear Safety Management*;
- Bloodborne pathogens covered under 29 CFR 1910.1030, *Bloodborne Pathogens*;
- Facility/process exposure hazards and controls addressed through design engineering.

#### 1.3 Applicability

This procedure is applicable when conducting and documenting IHEAs to support CHPRC work activities.

#### 1.4 Implementation

This procedure is effective on the date published. Existing IHEAs may continue to be used but must be revised to meet the requirements of this procedure during their next scheduled review.

### 2.0 RESPONSIBILITIES

Responsibilities associated with this procedure are identified in the process steps.

## Industrial Hygiene Exposure Assessments

Published Date: 02/26/19

Effective Date: 02/26/19

### 3.0 PROCESS

The IHEA process may involve development and use of multiple supporting documents, including:

- Industrial Hygiene (IH) Screening Form
- IH Exposure Assessment (IHEA)
- IHEA Worksheet Form
- IH Sample Plan
- IH Technical Evaluation
- IH Work Permit

### 3.1 IH Screening Processes (Optional)

An IHEA may be generated for any activity with potential biological, chemical, physical or ergonomic agent hazards. Two optional screening processes also identify when an IHEA is required:

1. Site Form A-6007-295, *Industrial Hygiene Hazard Screening Form*, identifies when an IHEA, or other hazard evaluation document, is required to support a work activity. This form is intended as a communication tool between the Industrial Hygienist and the Responsible Manager. Use of this form may not suit the needs of all CHPRC projects and is not required. The purpose of the *IH Hazard Screening Form* is to identify potential exposure hazards during initial work planning. If the *IH Hazard Screening Form* will be used, then follow direction in 3.1.1.
2. Where use of chemicals is involved, Site Form A-6005-592, *Chemical Product Screening Form* (retained by the Facility Chemical Custodian), also identifies when an IHEA is required. If the *Chemical Product Screening Form* will be used, then follow direction in 3.1.2.

#### 3.1.1 IH Screening for Activities

Actionee	Step	Action
IH Professional	1.	COMPLETE the <i>Industrial Hygiene Hazard Screening Form</i> (Site Form A-6007-295) to determine if an IHEA, or other hazard evaluation, is required.
	2.	COMMUNICATE hazard screening results to the Responsible Manager (RM) and/or Work Planner, AND PROVIDE the applicable required documentation indicated on the <i>IH Hazard Screening Form</i> .
	a.	Retain the <i>Industrial Hygiene Hazard Screening Form</i> (Site Form A-6007-295) in the work instructions and manage in accordance with PRC-PRO-WKM-12115, <i>Work Management</i> .

#### 3.1.2 IH Screening for Chemicals

Actionee	Step	Action
IH Professional	1.	REVIEW the <i>Chemical Product Screening Form</i> (Site Form A-6005-592) to determine if an IHEA is required.

## Industrial Hygiene Exposure Assessments

Published Date: 02/26/19

Effective Date: 02/26/19

### 3.2 IH Exposure Assessment (IHEA)

IHEA is a process for identifying and evaluating potential exposure hazards from biological, chemical, ergonomic and physical agents. Under the IHEA process, a negative exposure determination is as important to discuss and document, as exposure to hazards of occupational significance.

If an agent is evaluated and found NOT to pose a hazard of occupational significance, then a partial IHEA summarizing hazard evaluation criteria (e.g., Key Elements #1-4) may be sufficient documentation. If an agent is evaluated and found to pose a potential hazard of occupational significance, then review and documentation of all Key Elements is required. IHEAs are managed with version controls. When additional chemicals are added to a work scope, or new hazards may be introduced, the IHEA is revised.

Hazards of occupational significance include, but are not limited to:

- Exposure above an Administrative Control Level (ACL), typically set to 10% of the Occupational Exposure Limit (OEL) for chemicals;
- Significant exposure from skin absorption, or skin/eye damage due to contact can occur;
- There is a potential for a significant exposure relative to the Short Term Exposure Limit (STEL) or Ceiling (C) limit;
- The agent is a skin or respiratory sensitizer;
- The agent is a carcinogen;
- The agent poses a clearly-recognized potential exposure hazard, such as Hantavirus, or
- The agent adversely affects reproductive health.

IHEA documentation requirements are considered “met” using the following agent-specific hazard evaluations, as conducted in accordance with their applicable procedure/regulations:

- Office Ergonomic Evaluation, per PRC-PRO-SH-40463, *Ergonomics*;
- Hanford Confined Space Hazard Identification, per DOE-0360 *Hanford Site Confined Space Procedure (HSCSP)*;
- Asbestos (Initial) Exposure Assessment, per 29 CFR 1926.1101 (f)(2);
- Asbestos (Negative) Exposure Assessment, per 29 CFR 1926.1101 (f)(2)(iii);
- Beryllium Hazard Assessment per DOE-0342-001, *Hanford Site Beryllium Work Permit (BWP) and Hazard Assessment Procedure*;
- Heat Stress Evaluation, per PRC-PRO-SH-121, *Heat Stress Control*.

## Industrial Hygiene Exposure Assessments

Published Date: 02/26/19

Effective Date: 02/26/19

### Key IHEA Elements

The key elements considered in IHEA are described below. The *Industrial Hygiene Exposure Assessment* Form (Site Form A-6007-296) addresses the key elements and may be used to document the review, or the key elements may be addressed and documented in an equivalent free-form style, at the discretion of the Project Industrial Hygienist (PIH).

#### 1. General Information

- Facility description, location of work;
- Scope of work activities.

#### 2. Hazard Identification

- List all the (IH) hazardous agents and sources associated with the work.

#### 3. Hazard Evaluation -- Develop a rationale as to whether or not the hazardous agent(s) pose an exposure hazard to the worker(s) based on:

- Exposure frequency and duration;
- Quantity and/or concentration (e.g., chemical/biological) and/or intensity (e.g., physical/ergonomic) of the hazardous agent(s);
- Health effects from exposure to the hazardous agent(s);
- Exposure potential based on the hazardous agent(s) and route of entry;
- Conditions that could increase the exposure potential;
- Exposure potential based on environmental conditions and engineering controls.

#### 4. Potentially Exposed Workers

- List potentially-exposed workers to each hazardous agent having an exposure potential of occupational significance;
- As feasible, identify Similar Exposure Groups (SEGs) for each hazardous agent having an exposure potential of occupational significance;
- As applicable, review and summarize previous relevant Site Wide Industrial Hygiene Database (SWIHD) sampling and monitoring surveys.

#### 5. Sampling and Monitoring

- Identify required sampling and monitoring for agents having an exposure potential of occupational significance;
- Develop a sampling plan in the IHEA or use a sampling plan form (A-6005-784 for Soil and Groundwater, or A-6007-395).
- Identify chemical agents to be sampled by the Name and/or Chemical Abstract Society (CAS) number, and identify the analytical method/number.

## Industrial Hygiene Exposure Assessments

Published Date: 02/26/19

Effective Date: 02/26/19

**NOTE:** *Agents and analytical methods identified in SWIHD dropdown menus reflect the agents/analytical methods currently approved under CHPRC laboratory analysis contracts.*

- Contact the SWIHD Administrator if the agent or analytical method is not identified in SWIHD dropdown menus, OR
  - The OS&IH Programs manager if the agent or analytical method is not listed on current laboratory contracts.
  - Identify decisions that will be made based on sample results, e.g., if results exceed an OEL then request sample re-analysis to verify the result.
6. Engineering and Administrative Controls
- Identify the hierarchy of controls used or required to control the hazard(s), e.g., where feasible use engineered controls first, followed by administrative controls.
  - Determine if ventilation surveys or other means of testing engineered controls are required, and conduct surveys as needed.
7. Personal Protective Equipment (PPE)
- Identify the PPE required to control the hazards;
  - If using respiratory protection (air-purifying), determine the change-out schedule for respirator cartridges using the manufacturer's service life calculator and attach to the IHEA.
8. Training and Medical Surveillance
- Identify required training and medical surveillance.
9. Frequency of IHEA Re-evaluation
- Identify the IHEA Review Cycle based on exposure potential:
    - 1 year review – agents at or above an OEL or having the potential for serious health effects;
    - 2 year review – agents at or above an Action Level (50% OEL);
    - 3 year review – agents below the Action Level;
    - N/A – for IHEAs that are generated for a single, non-recurrent activity.
10. Signatures--Identify the PIH and the Peer Reviewer, and dates of approval.

The *IHEA Worksheet*, Site Form A-6007-448 is an optional form which may be used to evaluate exposure risk for a single agent or Chemical of Potential Concern (COPC). The form is ideally suited to evaluate chemical mixtures to determine which, if any, of the individual constituents pose an exposure risk of occupational significance. IHEA worksheet(s), if used, should be attached to the IHEA.

Exposure controls are applied to reduce the potential for exposure, and are required when exposures are anticipated to reach or exceed 50% of an OEL, or, when there is a clearly recognized potential hazard requiring controls, such as potential exposure to Hantavirus.

For IHEAs that require sampling and monitoring, an integral part of the process is reviewing collected data to verify exposures do not exceed what was anticipated, that exposure groups

## Industrial Hygiene Exposure Assessments

Published Date: 02/26/19

Effective Date: 02/26/19

are identified correctly, and/or to determine when sampling may be curtailed. Using descriptive statistics, a dataset may be evaluated to validate a SEG designation, or used to predict potential health outcomes (Refer to Appendix B, Statistical Evaluation of Exposure Data).

<i>Actionee</i>	<i>Step</i>	<i>Action</i>
IH Professional	1.	OBTAIN an IHEA number from the SWIHD Administrator <u>AND NOTE</u> the IHEA number on the <i>Industrial Hygiene Exposure Assessment</i> (Site Form A-6007-296 or equivalent).
	2.	PREPARE an <i>Industrial Hygiene Exposure Assessment</i> . <ol style="list-style-type: none"> <li><u>IF</u> deemed appropriate by the PIH, <u>THEN PREPARE IHEA Worksheets</u> (A-6007-448) to assist with exposure risk evaluation (optional step).</li> <li><u>IF</u> chemical products/materials will be used in accordance with the manufacturer's intended purpose, <u>THEN REVIEW</u> hazard information on the Safety Data Sheet (SDS) for the IHEA.               <ul style="list-style-type: none"> <li><u>IF</u> product/materials will NOT be used in accordance with the manufacturer's intended purpose, <u>THEN IDENTIFY</u> how hazard information to be used in the IHEA is determined.</li> </ul> </li> <li>DEFINE the exposure group(s) of potentially-exposed workers.</li> <li>NOTE biological, chemical, ergonomic, and physical agent parameters used to evaluate hazards, such as:               <ul style="list-style-type: none"> <li>Chemical Agent Parameters – CAS Number, Vapor Pressure, Percent (%) of agent in product/material, Flash Point, Boiling Point, Lower Explosive Limit, Specific Gravity, pH, State of Matter, the most stringent OEL, Route of Entry, Odor Threshold, Special Notation(s) from the American Conference of Governmental Industrial Hygienists (ACGIH®), and/or notable Globally Harmonized System (GHS) statements;</li> <li>Physical Agent Parameters – Sources, type of noise/energy, intensity of energy, noise and solvent exposure together, the most stringent OEL, GHS statements and/or other notable physical agent properties.</li> <li>Biological Agent Parameters – Size of affected area, type of biologic agent, agent dispersion, the Centers for Disease Control recommendations, and/or other notable biological agent properties.</li> <li>Ergonomic Agent Parameters – Repetitive motion, range of motion, use of force, affected body area, distance between user and work, ACGIH TLVs, and/or other notable ergonomic properties.</li> </ul> </li> </ol>

## Industrial Hygiene Exposure Assessments

Published Date: 02/26/19

Effective Date: 02/26/19

<i>Actionee</i>	<i>Step</i>	<i>Action</i>
IH Professional	e.	IDENTIFY the control set to mitigate potential exposure hazards using the hierarchy of controls, and as needed, refer to Appendix C, "Recommended Controls for Carcinogens and Teratogens," and/or Appendix D, "Recommended Controls for Biological Agents," for guidance.
	f.	As needed, Consult Appendix E, "Recommended Evaluation of Ventilation Controls" to determine the adequacy of ventilation controls.
	g.	IDENTIFY <u>AND/OR</u> ATTACH additional or supporting documentation, such as the IHEA Worksheet, IH Sample Plan and/or specialized work permits or compliance plans.
	3.	FORWARD the IHEA to a peer reviewer for evaluation and concurrence.
IH Peer	4.	REVIEW the IHEA, PROVIDE an approval signature after the review is complete, <u>AND</u> RETURN to the IH Professional.
	a.	<u>IF</u> the IHEA cannot be approved as is, <u>THEN</u> WORK with the IH Professional who prepared the IHEA to resolve the concern.
IH Professional	5.	COMMUNICATE hazard controls to line management/planners using any of the following means: <ul style="list-style-type: none"> <li>• <i>Job Hazard Analysis Checklist</i> (Site Form A-6006-681), <u>or</u> <i>Job Hazard Analysis/Activity Hazard Analysis for Subcontractors</i> (Site Form A-6004-784), in accordance with PRC-PRO-WKM-079, <i>Job Hazard Analysis</i>, <u>OR</u></li> <li>• Language embedding the controls and requirements in the work package instruction, <u>OR</u></li> <li>• <i>IH Work Permit</i> (Site Form A-6007-313)(see Section 3.5).</li> </ul>
	6.	PROVIDE the signed original IHEA <u>OR</u> a clean electronic copy to the SWIHD Administrator.
SWIHD Administrator	7.	ENTER the IHEA into SWIHD.
IH Professional	8.	SEND a copy of the IHEA to the CHPRC Website Administrator for posting on the Project or OS&IH Website.
Website Administrator	9.	POST the IHEA to the Project or OS&IH Website.
OS&IH	10.	As applicable, COLLECT <u>AND</u> RECORD exposure data in accordance with PRC-PRO-SH-409.

## Industrial Hygiene Exposure Assessments

Published Date: 02/26/19

Effective Date: 02/26/19

Actionee	Step	Action
IH Professional	11.	<p>As feasible and relevant, VALIDATE exposures and controls after sufficient sample data is obtained, e.g., generally 6-12 samples (for additional information refer to Appendix B, "Statistical Evaluation of Exposure Data").</p> <ol style="list-style-type: none"> <li>a. DETERMINE the number of samples for each agent, the data range, the average and maximum values, <u>AND COMPARE</u> to the OEL to determine if controls are adequate.</li> <li>b. As needed, PERFORM statistical analysis of exposure data to determine if the exposure group meets the definition of a SEG, in accordance with Appendix B, and document results in the IHEA or NEA. <ol style="list-style-type: none"> <li>1) ATTACH the statistical evaluation to the IHEA or NEA.</li> </ol> </li> <li>c. REVISE IHEA information to show validation of a SEG and exposure controls, <u>OR REVISE</u> the definition of the exposure group and control set if sample statistics do not validate the SEG.</li> </ol> <p>12. IDENTIFY conclusions, such as if exposures were judged acceptable or unacceptable, or if more data are needed to resolve the assessment, <u>AND REVISE</u> the IHEA.</p> <ul style="list-style-type: none"> <li>• A diagnostic exposure assessment report should provide observations and conclusion about the sources of exposure and the effectiveness of controls.</li> <li>• An compliance exposure assessment should include an evaluation of personal sample times to verify the sample may be directly compared to an OEL, and should identify if representative sampling is performed, if required.</li> <li>• Interpretive remarks should be provided. Identify and reference all assumptions and models, if applicable.</li> </ul> <p>13. After the exposure is judged, REVIEW the Employee Job Task Analysis (EJTA) of individuals in an exposure group <u>AND DETERMINE</u> if updates are needed, in accordance with PRC-PRO-SH-52755, <i>Employee Job Task Analysis</i>.</p> <p>14. <u>WHEN</u> changes and/or a periodic review of the IHEA is required <u>THEN REVISE</u> the IHEA <u>AND OBTAIN</u> Peer Approval.</p> <p>15. PROVIDE the revised, signed original IHEA document <u>OR</u> a clean electronic copy to the SWIHD Administrator.</p>

## Industrial Hygiene Exposure Assessments

Published Date: 02/26/19

Effective Date: 02/26/19

<i>Actionee</i>	<i>Step</i>	<i>Action</i>
SWIHD Administrator	16.	ENTER the revised IHEA into SWIHD.
IH Professional	17.	SEND a copy of the revised IHEA to the CHPRC Website Administrator for posting on the Project or OS&IH Website.
Website Administrator	18.	POST the revised IHEA to the Project or OS&IH Website.

### 3.3 IH Sample Plan

The IH Sample Plan (IHSP), required prior to collection of samples, identifies technical sampling and analytical information and helps identify decision outcomes based on sampling results. A CHPRC Soil and Groundwater/CPRM Industrial Hygiene Sample Plan (Site Form A-6005-784) or CHPRC Industrial Hygiene Sample Plan (Site Form A-6007-395) may be used to communicate sampling and analytical requirements, or the sample plan may be embedded within the IHEA.

<i>Actionee</i>	<i>Step</i>	<i>Action</i>
IH Professional	1.	OBTAIN an IHSP number from the SWIHD Administrator <u>AND NOTE</u> the IHSP number on the IHEA (Site Form A-6007-296 or equivalent).
	2.	IDENTIFY required sampling, monitoring, and analytical information using: <ul style="list-style-type: none"> <li>• CHPRC Industrial Hygiene Sample Plan, <u>OR</u></li> <li>• CHPRC Soil and Groundwater Industrial Hygiene Sample Plan, <u>OR</u></li> <li>• Sample Plan embedded in the IHEA.</li> </ul>
	3.	ESTABLISH a priority/schedule for sampling and monitoring activities.
	4.	IDENTIFY decisions and/or follow-up actions based on sample results, such as: <ul style="list-style-type: none"> <li>• If sample results exceed an OEL, request sample re-analysis and/or repeat sampling if feasible;</li> <li>• Release of an area if area sample results are below an applicable Clearance Level;</li> <li>• Cessation of monitoring if personal sample results are below an applicable Action Level.</li> </ul>

## Industrial Hygiene Exposure Assessments

Published Date: 02/26/19

Effective Date: 02/26/19

Actionee	Step	Action
<b>NOTE:</b> Most OSHA or National Institute of Occupational Safety and Health (NIOSH) sampling methods are written to sample chemical exposures that are above the agent Action Level or AL (e.g., 50% of the OEL). Sample volume may be adjusted by the IH when exposures are expected to be below the AL.		
IH Professional	5.	As needed, ADJUST the minimum sample volume to obtain meaningful sample results using the following formula to adjust the minimum sample volume, when the chemical agent concentration is expected to be below the AL:  <b>Minimum Sample Volume = <math>\frac{\text{Agent Limit of Detection or Reporting Limit}}{\text{Agent OEL} \times \text{Anticipated Fraction of the OEL}}</math></b> *in units of mg/m <sup>3</sup>
	6.	IDENTIFY reviewer(s) <u>AND FORWARD</u> for review and approval signatures.
IH Peer	7.	REVIEW the IHSP, PROVIDE an approval signature after the review is complete, <u>AND RETURN</u> to the IH Professional.  a. <u>IF</u> the IHSP cannot be approved as is, <u>THEN WORK</u> with the IH Professional who prepared the IHEA to resolve the concern.
IH Professional	8.	<u>WHEN</u> changes and/or a periodic review of the IHSP is required <u>THEN REVISE</u> the IHSP <u>AND OBTAIN</u> Peer Approval.
	9.	PROVIDE the original or revised IHSP (or IHEA if the Sampling Plan is located in the IHEA) <u>OR</u> a clean electronic copy of the IHSP to the SWIHD Administrator.
SWIHD Administrator	10.	ENTER the IHSP into SWIHD.
IH Professional	11.	SEND a copy of the IHSP, or the revised IHSP, to the CHPRC Website Administrator for posting on the Project or OS&IH Website.
Website Administrator	12.	POST the IHSP and/or revisions to the Project or OS&IH Website.

## Industrial Hygiene Exposure Assessments

Published Date: 02/26/19

Effective Date: 02/26/19

### 3.4 IH Technical Evaluation

An IH Technical Evaluation (IHTE) is a document that may be used to establish a decision basis or process not otherwise specified by regulation or industry standard (sometimes referred to as a white paper or interpretative guidance document). An IHTE is not a required document and cannot be used in lieu of an IHEA. The IHEA may reference a Technical Evaluation, such as ventilation calculations performed in support of a work activity, but the IHTE is a separate stand-alone document.

The following elements are typically documented in an IHTE:

- Summary of the technical issue
- Summary of the requirements (e.g., regulatory, procedural, contractual)
- Calculations
- Decision description
- Basis for the decision (including any assumptions)
- Bounding conditions of the decisions

Actionee	Step	Action
IH Professional	1.	OBTAIN an IHTE number from the SWIHD Administrator.
	2.	PREPARE the IHTE using <i>Industrial Hygiene Technical Evaluation</i> (Site Form A-6006-552) <u>AND ATTACH</u> calculations and supporting data. <ul style="list-style-type: none"> <li>a. IDENTIFY peer reviewer(s), the TA, and the Project OS&amp;IH Manager reviewers <u>AND FORWARD</u> for review and approval signatures.</li> </ul>
IH Peer	3.	REVIEW the IHTE, PROVIDE an approval signature after the review is complete, <u>AND RETURN</u> to the IH Professional. <ul style="list-style-type: none"> <li>a. <u>IF</u> the IHTE cannot be approved as is, <u>THEN WORK</u> with the IH Professional who prepared the IHTE to resolve the concern.</li> </ul>
IH Professional	4.	<u>WHEN</u> changes and/or a periodic review of the IHTE is required <u>THEN REVISE</u> the IHTE <u>AND OBTAIN</u> Peer Approval.
	5.	PROVIDE the signed original or revised IHTE <u>OR</u> a clean electronic copy of the IHTE to the SWIHD Administrator.
SWIHD Administrator	6.	PROCESS the IHTE for inclusion into the Integrated Document Management System (IDMS).

## Industrial Hygiene Exposure Assessments

Published Date: 02/26/19

Effective Date: 02/26/19

Actionee	Step	Action
IH Professional	7.	SEND a copy of the IHTE and/or revisions, to the CHPRC Website Administrator for posting on the Project or OS&IH Website.
Website Administrator	8.	POST the IHTE and/or revisions to the Project or OS&IH Website.

### 3.5 IH Work Permit

The IH Work Permit (IHWP) is not required but may be used to communicate sampling and control set information identified in the IHEA, to the work package. For example, the IHWP may be used:

- In an area/facility with multiple postings, where each posting identifies different requirements for PPE and/or sampling;
- For repetitive activities where a long list of chemicals may be potentially used, such as for maintenance activities/procedures (e.g., specific PPE and controls for long chemical lists are identified by chemical name so the user can easily determine PPE/controls for the chemical they are using);
- In areas where there could be multiple work groups.

If an IHWP is used, an *Industrial Hygiene Work Permit Acknowledgement/Review Record* (Site form A-6007-634) may be used to document employee review of the IHWP. The acknowledgement form is retained in project documents (e.g., work package or procedure) and managed in accordance with PRC-PRO-WKM-12115.

Actionee	Step	Action
IH Professional	1.	OBTAIN IHWP number from the SWIHD Administrator.
	2.	PREPARE the IHWP using the <i>Industrial Hygiene Work Permit</i> (Site Form A-6007-313). <ol style="list-style-type: none"> <li>IDENTIFY peer reviewer(s) <u>AND FORWARD</u> for review and approval signatures.</li> </ol>
IH Peer	3.	REVIEW the IHWP, PROVIDE an approval signature after the review is complete, <u>AND RETURN</u> to the IH Professional. <ol style="list-style-type: none"> <li><u>IF</u> the IHWP cannot be approved as is, <u>THEN WORK</u> with the IH Professional who prepared the IHWP to resolve the concern.</li> </ol>

## Industrial Hygiene Exposure Assessments

Published Date: 02/26/19

Effective Date: 02/26/19

<b>Actionee</b>	<b>Step</b>	<b>Action</b>
IH Professional	4.	<u>WHEN</u> changes and/or a periodic review of the IHWP is required <u>THEN</u> REVISE the IHWP <u>AND</u> OBTAIN Peer Approval.
	5.	PROVIDE the signed original or revised IHWP with associated legend/map <u>OR</u> a clean electronic copy of the IHWP to the SWIHD Administrator. <ul style="list-style-type: none"> <li>a. PROVIDE a copy to the Work Planner for inclusion in the work package, in accordance with PRC-PRO-WKM-079.</li> </ul>
	6.	PROVIDE a briefing on the IH Work Permit requirements to management, IH Technicians, and project workers, as needed. <ul style="list-style-type: none"> <li>a. As deemed necessary by the project, employees may sign an <i>Industrial Hygiene Work Permit Acknowledgement/Review Record</i> (Site Form A-6007-634), managed in accordance with PRC-PRO-WKM-12115.</li> </ul>
SWIHD Administrator	7.	PROCESS the IHWP for inclusion into the IDMS.
IH Professional	8.	SEND a copy of the IHWP, or the IHWP revision, to the CHPRC Website Administrator for posting on the Project or OS&IH Website.
Website Administrator	9.	POST the IHWP and/or revisions to the Project or OS&IH Website.

## Industrial Hygiene Exposure Assessments

Published Date: 02/26/19

Effective Date: 02/26/19

### 4.0 FORMS

*Industrial Hygiene Hazard Screening Form, A-6007-295 (optional form)*

*Industrial Hygiene Exposure Assessment, A-6007-296*

*IHEA Worksheet, A-6007-448*

*CHPRC Industrial Hygiene Sample Plan, A-6007-395*

*CHPRC Soil and Groundwater/CPRM Industrial Hygiene Sample Plan, A-6005-784*

*Industrial Hygiene Technical Evaluation, A-6006-552*

*Industrial Hygiene Work Permit, A-6007-313*

*Industrial Hygiene Work Permit Acknowledgement/Review Record, A-6007-634*

### 5.0 RECORD IDENTIFICATION

All records are generated, processed, and maintained in accordance with PRC-PRO-IRM-10588, *Records Management Processes*.

**Records Capture Table**

<b>Name of Document</b>	<b>Submittal Responsibility</b>	<b>Retention Responsibility</b>
<i>Industrial Hygiene Exposure Assessment, A-6007-296 (or equivalent) with optional IHEA Worksheet, A-6007-448</i>	SWIHD Administrator	IRM Service Provider
<i>CHPRC Industrial Hygiene Sample Plan, A-6007-395 or CHPRC Soil and Groundwater/CPRM Industrial Hygiene Sample Plan A-6005-784</i>	SWIHD Administrator	IRM Service Provider
<i>Industrial Hygiene Technical Evaluation, A-6006-552</i>	SWIHD Administrator	IRM Service Provider
<i>Industrial Hygiene Work Permit, A-6007-313</i>	SWIHD Administrator	IRM Service Provider

**Industrial Hygiene Exposure Assessments**

Published Date: 02/26/19

Effective Date: 02/26/19

**6.0 SOURCES****6.1 Requirements**

10 CFR 851, *Worker Safety and Health Program*

29 CFR 1910, *Occupational Safety and Health Standards*

29 CFR 1926, *Safety and Health Regulations for Construction*

ACGIH, *Threshold Limit Values for Chemical Substances, Physical Agents and Biological Exposure Indices*, 2005

DOE-0342, *Hanford Site Chronic Beryllium Disease Prevention Program (CBDPP)*

PRC-MP-SH-32219, *10 CFR 851 CHPRC Worker Safety and Health Program Description*

**6.2 References**

10 CFR 830, *Nuclear Safety Management*

DOE-0342-001, *Hanford Site Beryllium Work Permit (BWP) and Hazard Assessment Procedure or the Hanford Site CBDPP*

DOE-0352, *Hanford Site Respiratory Protection Program (HSRPP)*

DOE-0360, *Hanford Site Confined Space Procedure*

PRC-PRO-IRM-10588, *Records Management Processes*

PRC-PRO-RP-325, *Contaminated Wildlife or Vegetation*

PRC-PRO-SH-121, *Heat Stress Control*

PRC-PRO-SH-409, *Industrial Hygiene Monitoring, Reporting and Records Management*

PRC-PRO-SH-40463, *Ergonomics*

PRC-STD-SH-40518, *Personal Protection*

PRC-PRO-SH-52755, *Employee Job Task Analysis*

PRC-PRO-WKM-079, *Job Hazard Analysis*

PRC-PRO-WKM-12115, *Work Management*

**6.3 Other Basis Documents**

PRC-PRO-SH-40469, *Occupational Carcinogen Control*

PRC-PRO-SH-40498, *Occupational Lead (Toxic Metals) Exposure Control*

PRC-PRO-SH-40516, *Chemical Management Program*

## Industrial Hygiene Exposure Assessments

Published Date: 02/26/19

Effective Date: 02/26/19

### 6.4 Developmental References

*American Conference of Governmental Industrial Hygienists Threshold Limit Values for Chemical Substances and Physical Agents & Biological Exposure Indices*, 2016, ACGIH Worldwide Signature Publications, Cincinnati, OH

*Industrial Ventilation, A Manual of Recommended Practice*, 26<sup>th</sup> edition, 2007, ACGIH Worldwide Signature Publications, Cincinnati, OH

*Manual of Analytical Methods*, 2015, Centers for Disease Control and Prevention-National Institute of Occupational Safety and Health, 5<sup>th</sup> edition

*OSHA Technical Manual, Section II, Personal Sampling for Air Contaminants*, 2014, U.S. Department of Labor, Occupational Safety & Health Administration, Washington DC

Armstrong, TW and BD Silverstein, editors, 2000, *User's Guide to "A Strategy for Assessing and Managing Occupational Exposures"*. (Second Edition). American Industrial Hygiene Association (AIHA) Press, Fairfax, VA.

Di Nardi, SR., editor, 2003. *The Occupational Environmental: Its Evaluation, Control, and Management*. 2nd Edition. AIHA Press, Fairfax, VA

Mulhausen, JR and J Damiano. 1998. *A Strategy for Assessing and Managing Occupational Exposures*, 2nd Edition. American Industrial Hygiene Association Press, Fairfax, VA

Jahn, S.D., WH Bullock and JS Ignacio, editors, 2015. *A Strategy for Assessing and Managing Occupational Exposures*, 4th Edition. American Industrial Hygiene Association Press, Fairfax, VA

## Industrial Hygiene Exposure Assessments

Published Date: 02/26/19

Effective Date: 02/26/19

## Appendix A - Glossary

<i>Term</i>	<i>Definition</i>
<b>Administrative Control Level (ACL)</b>	The hazard level below which additional assessment may not be necessary. In general, CHPRC uses 10% of the OEL as the ACL.
<b>Action Level (AL)</b>	A percentage, usually 50%, of the PEL assigned to agents with vertical OSHA standards; or more generally, 50% of an OEL. The AL exposure triggers compliance actions to conduct exposure monitoring, limit employee exposure, and initiates medical surveillance and training requirements.
<b>Exposure</b>	Subjection of an individual to a biological, chemical, ergonomic or physical hazard; the amount of an agent that has reached the individual (external dose) or has been absorbed into the individual (internal dose).
<b>Exposure Assessment</b>	The process of estimating or measuring the magnitude, frequency and duration of exposure to a hazardous agent. Ideally, it describes the sources, pathways, routes, and the uncertainties in measurement and assessment.
<b>Occupational Exposure Limit (OEL)</b>	A health-based upper limit on the acceptable concentration of a hazardous agent. At CHPRC, OELs are the lower value of either the OSHA PEL or the ACGIH TLV®.
<b>OEL-TWA, OEL-STEL, OEL-EL OEL-C</b>	OELs are typically expressed as: <ul style="list-style-type: none"> <li>• OEL-TWA as an 8-hour <i>Time-Weighted Average</i> exposure limit (could also be expressed as a 10- or 12-hour TWAs);</li> <li>• OEL-STEL as a 15-minute <i>Short-Term Exposure Limit</i></li> <li>• OEL-EL as a 30-minute <i>Excursion Limit</i> for asbestos;</li> <li>• OEL-C as an instantaneous <i>Ceiling</i> exposure limit.</li> </ul>
<b>Permissible Exposure Limit (PEL)</b>	A legal limit for exposure of an employee to a chemical/physical agent, established by OSHA. A PEL is generally given as an 8-hour TWA (and/or 15-minute STEL for chemicals) that cannot be exceeded unless mitigations, such as respiratory or hearing protection, are used to reduce the exposure to a level below the PEL and/or STEL.
<b>Professional Judgment</b>	The process of forming an opinion or evaluation by the application and appropriate use of specialized knowledge gained from extensive academic preparation through formal education, observation, experimentation, inference and analogy, which is also characterized by conformance with technical and ethical standards within a discipline.
<b>Recommended Exposure Limit (REL)</b>	NIOSH establishes Recommended Exposure Limits (REL) in criteria documents and recommends to OSHA the adoption of RELs as PELs, to reduce or eliminate adverse health effects.

## Industrial Hygiene Exposure Assessments

Published Date: 02/26/19

Effective Date: 02/26/19

## Appendix A - (Cont.)

<i>Term</i>	<i>Definition</i>
<b>Step Back Level, or Turnback Value</b>	A Step Back Level or Turnback Value may be established for airborne contaminants that are detected with a Direct Reading Instrument. The Step Back Level, if applicable, is usually identified on the IH Sampling Plan, and is the point where workers are to back out of the work area.
<b>SDS</b>	Safety Data Sheet (and/or the predecessor <i>Material Safety Data Sheet</i> ) contain standardized information from the manufacturer listing the chemical components, their amounts, health hazards, required PPE, spill protection requirements, and contact information.
<b>Similar Exposure Group (SEG)</b>	<p>A group of workers having the same general exposure profile for the agent(s) being evaluated because of the similarity and frequency of the tasks they perform; the materials and processes with which they work; and the similarity of the way they perform the tasks.</p> <p>A SEG can be task-based, process-based or craft-based. A task-based SEG may include an unrelated group of workers who perform a similar defined task; a craft-based SEG may include a craft group performing a variety of tasks throughout the work day or week.</p>
<b>Threshold Limit Value (TLV®)</b>	<p>Threshold limit values (TLV®) refer to concentrations of chemical substances or physical agents and represent conditions under which it is believed that <i>nearly all</i> healthy adult workers may be repeatedly exposed, day after day, over a working lifetime (e.g., 40 years), without adverse health effects. TLVs are developed to protect workers who are normal, healthy adults.</p> <p>TLVs® for chemical agents are expressed as: TLV®-TWA, TLV®-STEL, or TLV®-C. For ergonomic and physical agents, TLVs® are generally identified for a range or set of conditions.</p>
<b>Time-Weighted Average (TWA)</b>	The average measured exposure during a given work day or shift, generally expressed as an 8-hour TWA (within a 40-hour work week). The TWA may be adjusted to account for shorter or longer time periods within a 40-hour week.
<b>Technical Evaluation (TE)</b>	An evaluation or calculation used to establish a decision basis not otherwise specified by regulation or industry standard. An IH Technical Evaluation is documented by the process established in this procedure using Site Form A-6006-552, <i>Industrial Hygiene Technical Evaluation</i> .

## Industrial Hygiene Exposure Assessments

Published Date: 02/26/19

Effective Date: 02/26/19

### Appendix B - Statistical Evaluation of Exposure Data

After a “sufficient” number of *representative* samples have been collected for compliance assessment, or for agents with an AL or OEL Exceedance, statistical evaluation may be performed to determine the:

- Type of distribution (normal versus lognormal),
- Measure of central tendency (geometric or arithmetic mean),
- Upper Confidence Limit (UCL) as a value, and as a percent (%) of the OEL,
- Homogeneity of the exposures.

**NOTES:**

1. *Following the AIHA Exposure Assessment Strategy, a “sufficient” number of samples for a SEG having little variability is six (6). If results are more variable, up to twelve (12) samples may be collected.*
2. *If the SEG cannot be defined with twelve (12) samples, consider re-defining the SEG.*
3. *When calculating any statistical metric it is critical to include all data, including those values reported as less than Limit of Detection (LOD) or Reporting Limit (RL), which are reported in summary statistics as the numeric value of the LOD/RL.*
4. *Metrics such as the 95<sup>th</sup> percentile or the exceedance fraction or Upper Tolerance Limit (UTL) may also be useful in describing the potential to exceed the exposure limit for the exposure profile.*
5. *When evaluating noise exposure data, use the Dose % to calculate summary statistics, rather than the dBA results.*

An exposure profile is a “snapshot” of the exposures experienced by members of a SEG. The use of statistical tools to characterize the exposure profile provides the IH with a technically sound basis for determining the acceptability of a SEG or exposure profile. While SEG exposures show some variability, a SEG should reflect a fairly stationary exposure condition.

Critical SEGs are those having exposure profiles near, but below, the OEL. When critical SEGs are present, the IH should carefully review the number of samples required to demonstrate with 95% confidence that the true 95<sup>th</sup> percentile exposure result is less than the OEL.

Analysis of variance (ANOVA) is another statistical technique that may be used to determine if a SEG has been appropriately defined. For additional information, review the chapters on Sampling Strategy Design and Quantitative Exposure Data, and, Appendix V in the 4<sup>th</sup> edition of AIHA’s *A Strategy for Assessing and Managing Occupational Exposures*.

E-Tools such as IHSTAT, a Microsoft® Excel e-tool from the AIHA, approved for use at CHPRC, may be used to assist in the determination of the most appropriate data distribution (normal or log-normal) and in the calculation of summary statistics (e.g., mean, standard deviation, UCL, UTL).

**Industrial Hygiene Exposure Assessments**

Published Date: 02/26/19

Effective Date: 02/26/19

**Appendix B – (Cont.)**

To conduct statistical review and validation of a SEG perform the following:

**1. Calculate the mean, standard deviation, UCL, and UTL**

- Calculate the UCL for the dataset as a percent of the OEL (% OEL-UCL) and determine if all data points fall below the upper confidence limit.
- Calculate the 95% UTL and determine if it is below the OEL. If the UTL exceeds the OEL, then determine the exceedance fraction for the dataset.
- IF a data point falls beyond the 95% OEL-UCL, and/or if the geometric standard deviation is greater than 3,  
THEN re-evaluate the SEG and consider subdivision into 2 or more SEGs.

**2. Evaluate the homogeneity of the exposures**

- Arithmetic mean exposures are the average of a data set (e.g., of individual surveys), calculated by adding all sample results, and dividing by the number of samples in the data set.
- To be considered a SEG, the arithmetic mean of exposures from different surveys should not differ by more than a factor of 2, for 95% of the workers evaluated.

**3. Verify the SEG**

- If all data points are all below the 95% OEL-UCL, AND, the data set meets a criterion for homogeneity, then the SEG may be considered as validated. Ideally, the 95% UTL will also be below the OEL.

## Industrial Hygiene Exposure Assessments

Published Date: 02/26/19

Effective Date: 02/26/19

### Appendix C - Recommended Controls for Carcinogens and Teratogens

Carcinogens and teratogens generally require special consideration when assessing exposure hazards, because:

- Compliance sampling is required;
- Some agents pose reproductive hazards;
- Some agents lack a recognized “safe” exposure level.

At CHPRC, the following chemical groups are defined as “carcinogens” and require an IHEA if present above threshold quantities:

#### International Agency for Research on Cancer (IARC):

- Group 1 (Carcinogenic to Humans)
- Group 2A (Probably Carcinogenic to Humans)
- Group 2B (Possibly Carcinogenic to Humans)

#### American Conference of Governmental Industrial Hygienists (ACGIH®):

- A1 (Confirmed Human Carcinogen)
- A2 (Suspected Human Carcinogen)

#### National Toxicology Program (NTP):

- Group 1 (Known to be Human Carcinogens)
- Group 2 (Reasonably Anticipated to be Human Carcinogens)

#### OSHA-Specific Carcinogens that have a Vertical OSHA Standard (see Table C-1):

- OSHA-Regulated Carcinogen listed under 29 CFR 1910.1003 or 29 CFR 1926.1103 (see Table 2 “OSHA-Regulated Carcinogens”)

General requirements for managing carcinogens include considerations such as threshold quantities, state of matter, monitoring, reporting of monitoring results, exposure limits, medical surveillance, warning signs/labels, hygiene facilities/practices, use of PPE and training.

**THRESHOLD QUANTITY EXEMPTIONS:** Regulatory threshold quantities are the stipulated minimal prerequisite concentrations that must be present in a chemical product or waste mixture. Threshold quantities vary for OSHA-regulated carcinogens.

The following chemicals are exempt by OSHA for those mixtures of a solid or liquid with carcinogenic constituents less than or equal to **1.0 percent (%)**:

α-Naphthalene	3,3'-Dichlorobenzidine (and its salts)
Ethyleneimine	β -Propiolactone
2-Acetylaminofluorene	4-Dimethylaminoazobenzene
N-Nitrosodimethylamine	Asbestos

For chemical carcinogens not otherwise specified, the threshold quantity is **0.1%** or less by weight or volume. A limited number of chemical carcinogens regulated by OSHA standards have NO exempted threshold quantity.

## Industrial Hygiene Exposure Assessments

Published Date: 02/26/19

Effective Date: 02/26/19

## Appendix C – (Cont.)

Table C-1. OSHA-Specific Carcinogens with Vertical Standards

Compound	CAS Number(s)	OSHA Reference
1, 2-Dibromo-3-chloropropane	96-12-8	29 CFR 1910.1044
1, 3-Butadiene	106-99-0	29 CFR 1910.1051
4,4'-Methylenedianiline	101-77-9	29 CFR 1910.1050
Acrylonitrile	107-13-1	29 CFR 1910.1045
Asbestos	Varies by mineral	29 CFR 1910.1001
Benzene	71-43-2	29 CFR 1910.1028
Cadmium	Varies by compound	29 CFR 1910.1027
Chromium (VI) (Hexavalent)	Varies by compound	29 CFR 1910.1026
Ethylene oxide	75-21-8	29 CFR 1910.1047
Formaldehyde	50-00-1	29 CFR 1910.1048
Inorganic arsenic	Varies by compound	29 CFR 1910.1018
Methylene chloride	75-09-2	29 CFR 1910.1052
Vinyl chloride	75-01-4	29 CFR 1910.1017

Table C-2. OSHA-Regulated Carcinogens

Compound	CAS Number	OSHA Reference
4-Nitrobiphenyl	92-93-3	29 CFR 1910.1003
$\alpha$ -Naphthalene	134-32-7	29 CFR 1910.1004
Methyl chloromethyl ether	107-30-2	29 CFR 1910.1006
3,3'-Dichlorobenzidine, salts	91-94-1	29 CFR 1910.1007
Bis-Chloromethyl ether	542-88-1	29 CFR 1910.1008
$\beta$ -Naphthalene	91-59-8	29 CFR 1910.1009
Benzidine	92-87-5	29 CFR 1910.1010
4-Aminodiphenyl	92-67-1	29 CFR 1910.1011
Ethyleneimine	151-56-4	29 CFR 1910.1012
$\beta$ -Propiolactone	57-57-8	29 CFR 1910.1013
2-Acetylaminofluorene	53-96-3	29 CFR 1910.1014
4-Dimethyleaminobenzene	60-11-7	29 CFR 1910.1015
N-Nitrosodimethylamine	62-75-9	29 CFR 1910.1016

## Industrial Hygiene Exposure Assessments

Published Date: 02/26/19

Effective Date: 02/26/19

### Appendix C – (Cont.)

#### IHEA Considerations for Carcinogens and Teratogens

1. Where feasible, IDENTIFY substitute products/materials to minimize exposure to carcinogens and/or teratogens in accordance with PRC-PRO-SH-40516, Chemical Management Program.
2. DEVELOP exposure controls for CHPRC-defined “carcinogens” above threshold quantities that have the potential to:
  - Become airborne,
  - Cause skin/eye irritation,
  - Enter the body through the skin/eye.
3. CONDUCT baseline exposure assessment for all activities where the potential for carcinogen or teratogen exposure has been evaluated as greater than 10% of the OEL.
  - MANAGE all work activities involving carcinogens above threshold quantities as if they exceed the OSHA PEL until exposure assessment activities have been completed, i.e., until statistical analysis has validated the IHEA.
4. RECOMMEND the establishment of regulated areas where carcinogens identified in Tables C-1 and C-2 are processed, used, repackaged, released, or handled, where exposure is reasonably anticipated to exceed the OSHA PEL or STEL.
  - IDENTIFY prohibitions in the regulated area, such as prohibitions on storage and consumption of food, beverage, medicines, tobacco products, chewing gum, and the application of cosmetics or handling of contact lenses.
5. RECOMMEND use of personal protective equipment (PPE) where carcinogens and/or teratogens are processed, used, repackaged, released or handled.
  - IDENTIFY PPE and/or respiratory protection in accordance with PRC-STD-SH-40518, *Personal Protection*, and DOE-0352, *Hanford Site Respiratory Protection Program (HSRPP)*, to include chemical protective clothing and respiratory protection.
6. IDENTIFY specialized training and medical surveillance on employee EJTA’s for those who may be exposed to a carcinogen at or above a regulatory action level.

## Industrial Hygiene Exposure Assessments

Published Date: 02/26/19

Effective Date: 02/26/19

### Appendix D - Recommended Controls for Biological Agents

Anticipated exposure to Hazardous Biological Agents (HBA) in CHPRC operations is minimal. Human infection could result from inhalation of aerosolized dusts from infected animal excreta (urine, feces, saliva), fungal spores, or aerosolized mists from water systems containing legionella bacteria.

The key to prevention of illness from biological agents is to:

- Minimize contact with animal carcasses and wastes, molds, or water system components such as cooling towers; and/or limit time in locations where exposure could occur.

Hazards from biological agents in CHPRC Operations may include but are not limited to:

- Hantavirus Pulmonary or Cardiopulmonary Syndrome, from inhalation of aerosolized rodent (e.g., deer mice) urine, saliva and/or feces;
- Illness from inhalation of aerosolized fungal/histoplasma spores, or bacteria/protista (leptospira, coccidia, salmonella) potentially present in rodent, bird or bat urine or feces;
- Illness from or allergic response to inhalation of aerosolized mold and/or spores in facilities from water intrusion;
- Illness from inhalation of aerosolized legionella bacteria in water system cooling towers, evaporative coolers in facilities, and portable evaporative cooling equipment;
- Illness from contact with blood or materials contaminated with a vector's blood (e.g., bloodborne pathogens) (refer to PRC-PRO-SH-40143, *Bloodborne Pathogens*).

### IHEA Considerations for HBA

**Use the guidance below and in Tables D-1 through D-3 to identify controls needed to safely handle HBA and/or minimize the potential for exposure.**

1. TREAT all introduced biological material (e.g., rodent/bird/bat waste, mold, etc.) as potential HBA.

NOTE: Animal carcasses and infestation areas less than 1 square meter are considered minor and may be removed under this procedure. Upon discovery of a major rodent or bird infestation, report it to the Mission Support Contractor's Site Services. They should also be notified of large animal carcasses, such as coyote or deer.
----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

2. If potential HBA exposure hazards are present, limit exposure time and access to areas of concerns and plan work to mitigate hazards using Tables D-1 through D-3.
3. CONDUCT radiological surveys on dry wildlife and excreta, prior to disturbing.
4. USE "Universal Precautions," to include PPE, to handle, clean, and/or dispose of HBA.
5. USE disinfectant solutions and identified wait times to deactivate HBA.
6. IDENTIFY the CHPRC Biological Hazards computer-based training for workers, Course #600260, prior to clean-up/disturbance, and annually thereafter.
7. REVIEW Safety Data Sheets for products used, work methods, and PPE requirements with workers, prior to clean-up/disturbance.

## Industrial Hygiene Exposure Assessments

Published Date: 02/26/19

Effective Date: 02/26/19

## Appendix D – (Cont.)

Table D-1. General Guidelines to Remediate Hazardous Biological Agents

1. If the affected area is an enclosed space, <b>ventilate for 30 minutes</b> before entry.
2. If the affected area is in a posted radiological controlled area, or if survey is deemed necessary by RadCon, complete radiological surveys of the HBA before disturbing any material, in accordance with PRC-PRO-RP-325, <i>Contaminated Wildlife or Vegetation</i> .
3. After wetting of HBA with disinfectants, <b>allow a wait time</b> for deactivation or <b>soaking</b> in accordance with the manufacturer or product recommendations.
4. CONSIDER that the thicker the HBA accumulation, the more soaking time is required. If additional wetting is required, then <b>additional wait time</b> is required.
5. Remove and containerize visible HBA, debris and cleaning rags/towels, using <b>wet methods</b> .
<b>NOTE: Do NOT dry sweep</b> or dust. HEPA-vacuuming is generally <b>not recommended</b> for HBA cleanup, but may be appropriate for some areas, in accordance with direction from OS&IH/Rad Con.
6. After deactivation of fungi, <b>remove</b> mold on drywall, wood, or carpet, using tools to cut out the affected material with visible mold or water damage.
7. <b>Wrap waste</b> and dispose of waste in accordance with Environmental Compliance direction.
8. <b>Disinfect substrate surfaces</b> after HBAs have been removed.
9. <b>Spray work gloves</b> with disinfectant before doffing them, and dispose of as HBA waste.
10. If a respirator is used, wet-wipe the respirator to remove visible debris with respirator towelettes (e.g., MSA respirator towelettes) before returning it to the respirator station and dispose of used towelettes and respirator cartridges with HBA waste.
11. Following HBA cleanup, <b>thoroughly wash hands</b> with disinfectant soap before eating, drinking, or smoking.

Table D-2. Personal Protective Equipment Selection Guidelines for Cleanup of Hazardous Biological Agents

Conditions of Use	Recommended Respiratory and PPE
<b>Cleanup Indoors - Occupied Facilities:</b> Minor rodent contamination; facility under active ventilation; JHA identifies hazards; Radiological Work Permit not required.	Nitrile, latex or surgeon's gloves
<b>Entry/Remediation of Areas not under Active Ventilation or not Occupied on a daily basis:</b> <u>Minor to moderate</u> HBA contamination; facility or area can be ventilated and/or exposed to sunlight, as feasible.	Nitrile, latex or surgeon's gloves; Disposable coveralls
<b>Entry/Remediation of Areas not under Active Ventilation or not Occupied on a daily basis:</b> <u>Moderate to heavy</u> HBA contamination; facility or area with limited ventilation and (or) other hazards.	Nitrile, latex or surgeon's gloves (2 pairs); Disposable coveralls; Air Purifying Respirator (or Powered Air Purifying Respirator) equipped with P-100 filters

## Industrial Hygiene Exposure Assessments

Published Date: 02/26/19

Effective Date: 02/26/19

**Table D-3. Disinfectant Selection  
Disinfectant Classes Listed in Order of Organism Susceptibility**

Type of Biohazard	Disinfectant Class	Disinfectant Base	Approved Product	Product Use	Approximate Contact Times	Can the Disinfected Waste be Disposed of as Non-Regulated Waste? (Yes/No)
<b>1. Fungi</b> ( <i>Candida</i> , <i>Cryptococcus</i> , <i>Aspergillus</i> , <i>Dermatophytes</i> )  <b>2. Bird/Bat Droppings</b> (may contain fungal spores: <i>Histoplasma</i> ; bacteria: <i>Salmonella</i> , <i>Leptospira</i> ; viruses; and protists: <i>Coccidia</i> )	Intermediate Level Disinfectant (Bio-Safety Level-1)	3 % Hydrogen Peroxide	<b>Oxivir TB</b>	Ready to Use	<b>10 minutes</b>  <b>NOTE:</b> Consult the product label for approximate contact times.	<b>Yes. Small amounts of disinfected wastes may be placed into regular trash;</b> otherwise, request container(s) for disposal.  <b>NOTE:</b> 1.) <b>Animal carcasses, free liquids and large amounts</b> of biological waste are <b>prohibited</b> in the regular trash.  2.) <b>A waste determination path is necessary before disposing unused disinfectant, Ready to Use products, and (or) prepared disinfectant solutions.</b>
		Chlorine	<b>Bleach</b>	Mix 1 part bleach with 9 parts water, solution made daily (10% solution)		
<b>3. Blood and Bloodborne Pathogens</b> (hepatitis B and C viruses, HIV)  <b>4. Vegetative Bacteria</b> ( <i>Staphylococcus</i> , <i>Salmonella</i> , <i>Pseudomonas</i> , <i>Leptospira</i> , coliforms)  <b>5. Enveloped Viruses</b> (Hantavirus, herpes, measles, mumps, rubella, influenza, respiratory syncytial, HIV)	Low Level Disinfectant (Bio-Safety Level-1)	Phenolic	<b>Lysol</b>	Ready to Use		
		Quaternary Ammonium (may cause skin/respiratory irritation)	<b>Lemon HG</b>	Mix 2 oz/1 gal water, solution made daily		
			<b>Nisus DSV</b>			

## Industrial Hygiene Exposure Assessments

Published Date: 02/26/19

Effective Date: 02/26/19

### Appendix E - Recommended Evaluation of Ventilation Controls

Ventilation systems used to control employee exposure require maintenance and evaluation. It is recommended that ventilation systems meet requirements identified by a design authority, such as ACGIH®'s *Industrial Ventilation: A Manual of Recommended Practice*. Ventilation systems that are not adequately maintained, and/or have less than adequate flow rates, can lead to employee exposure and/or building occupant illness.

A review of ventilation types and common ventilation measures are presented in publications such as ACGIH's *Industrial Ventilation: A Manual of Recommended Practice*, and/or D. Jeff Burton's *Industrial Ventilation Workbook; Indoor Air Quality (IAQ) Workbook*, or *Laboratory Ventilation Workbook*. A summary of ventilation types is presented below.

#### Natural Ventilation:

- **Dilution**, and/or removal by passive exhaust.

#### Mechanical Ventilation:

- **Circulation System**, such as through use of a portable fan or blower.
- **Positive Pressure System**, such as when fresh or make-up air is brought into a space.
- **Negative Pressure (Vacuum) System**, such as when air is exhausted from a space.
- **Balanced System**, such as a **Heating, Ventilation and Air Conditioning (HVAC) System**.
- **Common Air Plenum**, a duct or air space that facilitates HVAC system recirculation.
- **Local Exhaust or Capture System**, such as a hood, HEPA-filtered vacuum cleaner; or negative pressure containment.

#### Evaluating Ventilation Systems

Ventilation system evaluation is required when chemicals or particulates are introduced into a space. Agents used are evaluated under the IHEA process and measurements of the ventilation system and/or space are taken to determine its performance. In general, the higher the toxicity or agent concentration, the greater the *Volume Flow Rate* of air required to exhaust or remove the agent.

**NOTE:** *The IH Technical Evaluation process, used to document calculations, requires that calculations and measurements are reviewed and verified by another qualified individual. Reference the IH Technical Evaluation number in the IHEA.*

Calculations to identify the rate a contaminant will be cleared from a space, or brought below an applicable action level, can be made with a few measured parameters. Measurements and calculations are compared with design requirements to determine if the ventilation system meets control requirements.

---

**Industrial Hygiene Exposure Assessments****Published Date: 02/26/19****Effective Date: 02/26/19**

---

**Appendix E – (Cont.)****Common Ventilation Measures**

- *Air Velocity*,  $V$ , through a space.
- *Volume Flow Rate* of air,  $Q$ , typically measured or calculated according to the formula:  $Q=AV$ , where  $A$  is the *Cross-Sectional Area* of the duct/space and  $V$  is the *Velocity* of air moving through it.
- Agent chemical and physical properties, including the *Vapor Pressure*, *Density*, *Specific Gravity*, etc., to understand agent mixing and dispersal in the air space.
- Physical characteristics of the air (*Temperature*, *Pressure*, *Humidity*, etc.) in the space.
- The building HVAC system to determine the percentage of outdoor air introduced, the amount recirculated, and the amount exhausted (may vary seasonally).