AIHA | GUIDELINE FOUNDATION

Principles of Good Practice:

Section 1: Introduction

For the Industrial Hygienist/Occupational Hygienist (IH/OH)

aiha.org

Version 6 | February 1, 2026

Document Version and Revision Dates

Version	Date	Revisions
1.0	2/15/2023	AIHA Guidelines Foundation Standards of Care: For the Occupational Environmental Health and Safety (OEHS) Profession Document with Occupational Exposure Assessment Domain publication date of 11/29/2022
2.0	3/29/2023	Standards of Care document with enhanced legal disclaimers
3.0	8/25/2023	Title of document changes to Principles of Good Practice: For the Occupational Environmental Health and Safety (OEHS) Profession. Changes Standards of Care to Principles of Good Practice and replaces "SOC" with "good" practices.
4.0	3/27/2024	Title of document changes to Principles of Good Practice: For the Industrial Hygiene/Occupational Hygiene (IH/OH) Profession. Adds Document Version and Revision information, revised purpose and approach section; adds definitions to key terms, changes "Best Practice" to "Enhanced Practice," enhanced approach section, acknowledges the role of professional judgment.
5.0	10/1/2024	Edition changes the format of the Principles of Good Practice (PGP) document to be split into individual sections for each domain of practice. Sections include version 2 of the Exposure Assessment PGP and version 1 of both the Noise and Hearing Loss Prevention PGP and the Respiratory Protection PGP.
6.0	2/1/2026	This edition adds two new domains of practice. Section 5: *Legionella* and Waterborne Pathogens and Section 6: Heat Stress.

Principles of Good Practice

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DISCLAIMER

Purpose

The Principles of Good Practice (PGP) initiative was established by the AIHA Guideline Foundation (AIHA GF) to document occupational and environmental health and safety (OEHS) professional practices that have been determined to reliably and effectively protect workers and communities from unacceptable risks. The chosen guidelines are practical, proven, and available to all practitioners around the world.

The PGP provide all IH/OH professionals with a common vision of practices determined by subject matter experts to ensure strong foundational risk management programs that deliver a level of protection beyond regulatory compliance. The intent is to elevate the performance of all IH/OH programs by recommending a set of program and performance targets that can be used in continuous improvement activities by IH/OH practitioners and the profession as a whole.

Approach

AIHA GF established the Principles of Good Practice Advisory Group (PGP AG). The PGP AG was tasked to document and maintain concise, easily applied summaries of fundamental recommended global PGP for the professional practice of IH/OH that incorporate good and enhanced risk management practices whenever feasible.

Principles of Good Practice establish recommended levels of risk management practice and performance based on established professional norms, guidelines, standards, regulations, and practices. The PGP are organized by IH/OH areas of practice, or domains. For each area of practice, the PGP AG worked closely with relevant subject matter experts from AIHA volunteer groups and other partners to document risk-critical PGP good and enhanced practices. Practices that are "risk- critical" are those that are most needed to effectively and efficiently manage hazards/risks within the scope and objectives established by the volunteer group.

The PGP process is an enhancement to worker protection beyond the minimum regulatory and statutory requirements addressing worker health. The PGP outlines a set of practices with supporting documentation that a practitioner can reference to better protect worker health. The PGP will also help drive familiarity with various tools and guidance documents available for use.

The PGP project will have value that will vary depending upon a practitioner's needs, career stage and level of expertise. For students, it is a set of practices for which they will need to develop skills to implement. For early career professionals PGP may look more like a "quick start guide" to putting practices in place. For mid-career, it may serve as a continuous practice improvement guide, and for more experienced professionals it may serve as a refresher, benchmark or mentoring guide. The PGP also serve as a communication tool to help convey to an organization's senior management what experts have defined as important practices to safeguard the health of workers and their communities.

Uses and Limitations

These PGP were chosen because AIHA GF held them to be reasonable recommendations for all IH/OH practitioners around the world. They are intended to be used as targets that continuous improvement strategies seek to meet or exceed over time. The speed of implementation will vary depending on many factors, including the size of the gaps between the PGP and current practices and the resources available to fill these gaps.

These PGP are meant to be used not only by practitioners who work within single organizations but also by consultants who guide their clients toward implementing effective worker health protection practices.

The PGP documents include enhanced practice criteria to guide and inspire continuous improvement efforts that advance risk-critical program performance with more robust and comprehensive practices than the foundational PGP criteria.

These PGP are time sensitive. They are based on reasonable, fundamental practices documented at the time of publication and do not necessarily reflect past or future reasonable and fundamental practices.

These PGP are neither comprehensive nor complete. They are applicable as foundational program and practice needs; however, no rigorous review was conducted of every guidance, standard, and regulation. There may be other means by which equivalent worker and community risk protection can be delivered.

These PGP do not represent a consensus reached by AIHA Guideline Foundation or the IH/OH profession. They were chosen based on the professional judgment, advice, and opinion of experts within AIHA Guideline Foundation, with input from other selected subject matter experts.

These PGP are not intended as legal expectations, "requirements of practice," or "standards" along the lines of ANSI or ISO standards. It is hoped that they will influence standard setting organizations, but the ultimate intention is that the PGP will drive continuous improvement in IH/OH practices and program performance to better protect workers and communities.

These PGP are not equivalent to "minimum acceptable practice," which is primarily driven by regulatory requirements. Such requirements must always be followed. Nor are the PGP necessarily state of the art, which may be more theoretical or experimental.

The PGP allows for professional judgment and flexibility. There may be other means by which equivalent worker and community risk protection can be delivered. Under certain circumstances, alternate approaches may be more efficient and effective than those in the PGP. When making adjustments in those circumstances, each IH/OH practitioner is responsible for acting with integrity, in conformance with professional ethics, and within the limitations of their capabilities to ensure that the level of risk protection is equivalent or better than that provided by the PGP.

Suggested Implementation Strategy

These PGP provide practice and program performance targets meant to be used as parts of continuous improvement strategies that may span years. The following are suggested steps for their use.

1. Gap Analysis

Once you are satisfied that you are in compliance with regulatory and statutory requirements, compare the PGP to your current practices and programs to determine where there are opportunities to improve them. Be mindful of opportunities to move beyond good practice targets to enhanced practice targets.

2. Prioritization

Prioritize your opportunities for improvement. Consider prioritization criteria such as the risk posed by the gap, size of the gap, and effort required to close the gap.

3. Planning

Develop a plan to close the higher priority gaps. Multi-year plans may be useful because some gaps may require more than one year to close. Include SMART (specific, measurable, attainable, relevant, and time-based) objectives in your plan so that implementation progress can be efficiently tracked.

4. Implementation

Implement your plan and track your progress against the SMART objectives.

5. Verification

Verify plan implementation, progress, and effectiveness. Identify areas where implementation was incomplete or not fully effective and instances where plan objectives were not met completely for inclusion in the next round of continuous improvement.

6. Repeat

Return to Step 1 to repeat the process.

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Principles of Good Practice

Section 2: Exposure Assessment Strategies

For the Industrial Hygienist/Occupational Hygienist (IH/OH)

aiha.org

Version 5 | October 1, 2024

Principles of Good Practice Documents

The PGP are organized by OEHS areas of practice in a concise, easy-to-use table format. They are published as they are developed for each area of practice and are designed to be kept "evergreen" via regular updates. Refer to **Section 1** for PGP use and limitations.

Currently, PGP have been documented for the following areas of practice:

OEHS Area of Practice/ PGP Authors and Contributors	Date	
	Completion Date	Publication Date
Exposure Assessment Strategies Committee (EASC) PGP Version 1 **PGP Advisory Group Members:** Joe Damiano, John Mulhausen **PGP Subteam:** Andy Becker, Roy Byer, Jon Campbell, Samantha Connell, Matt Ferreri, Brian Harms, Maria Matias, Greg Richey, and Jennifer Sheffer	11/29/22	11/29/22
Exposure Assessment Strategies Committee (EASC) PGP Version 2 (V2) **PGP Advisory Group Members:** Joe Damiano, John Mulhausen **PGP Subteam:** Andy Becker, Roy Byer, Jon Campbell, Samantha Connell, Matt Ferreri, Brian Harms, Maria Matias, Greg Richey, and Jennifer Sheffer	5/2/24	10/21/24

Significant improvements to PGP Version 2 (V2) include changes to:

Occupational Exposure Limits

V2 clarifies the role of "Internal OELs," the derivation of "Working OELs," and the process for moving up the hierarchy of OELs. Internal OELs may be established by an organization when 1) authoritative OELs are unavailable, or 2) robust health effects studies support internal OELs set at levels above or below authoritative OELs. Working OELs are utilized where authoritative or internal OELs are unavailable. Working OELs can be determined using an exposure banding system (e.g. NIOSH OEB), IRIS or REACH data, or based on analogy with another agent for which there is an authoritative, internal or regulatory OEL. As an Enhanced Practice, the PGP recommends a prioritized process to supplant working OELs associated with SEG exposure categories 2 and higher with robust internal OELs.

Health Hazard Control

V2 clarifies the process for moving up the hierarchy of controls: A systematic prioritization and continuous improvement process is in place across SEGs to improve control reliability and effectiveness by moving up the hierarchy of controls. The rationale for continuing to rely on administrative, work practice, and or PPE controls, rather than instituting superior mitigation strategies is documented.

The statement addressing "engineering control" feasibility was omitted because feasibility assessments may also apply to other control strategies (e.g., substitution). Feasibility assessments are performed selectively, and are not always needed to move up the hierarchy of control.

Standard controls were added as an Enhanced Practice

Standard controls identify the measures proven to effectively mitigate exposures to acceptable levels in an operation or category of operations. The selection of standard controls may be based on the recommendations from an authoritative organization (e.g., ACGIH Industrial Ventilation Manual), or the successful implementation of a specific control strategy in a very similar operation.

Standard controls and control banding systems are employed to enhance the efficiency or effectiveness of the exposure assessment and management process. Validation studies demonstrate exposures are effectively controlled to acceptable levels.

Other improvements

The V2 update acknowledges partnerships with allied health professionals (e.g., occupational medicine specialists, toxicologists, biosafety specialists, health physicists, ergonomists). The PGP V2 update references the national professional accreditation schemes listed by the IOHA. The identification and control of plausible failure conditions that may result in unacceptably high exposures was added as an enhanced practice. References were updated including the AIHA Ergonomics Toolkit, ASHRAE 241 Control of Infectious Aerosols, and IEEE C95.7 for Electromagnetic Safety Programs.

AIHA PRINCIPLES OF GOOD PRACTICE for OCCUPATIONAL EXPOSURE ASSESSMENT

V2: 05/02/2024

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Scope and Objectives	The AIHA Principles of Good Practice (PGP) for Occupational Exposure Assessment is directed at preventing work-related illness and disease. This is achieved through comprehensively assessing and managing all chemical, physical, and biological exposures for all workers across all workdays. Note: The PGP does not address workplace psychosocial risks, risks to the community, risks to the environment, product safety, and the management of safety hazards for the prevention of accidents and injuries.	X		Chapter 2: Establishing the Exposure Assessment Strategy. A Strategy for Assessing and Managing Occupational Exposures. 4th Edition. AIHA 2015.
Program Management	The organization maintains a written Occupational Exposure Assessment and Management program. The written program addresses all PGP elements either directly or by citing other administrative programs and procedures. Also, while the scope is all chemical, physical and biological agents, organizations may choose to partition the program into two or more environmental agent-specific programs. For example, an organization may establish an administratively separate ergonomics program where the PGP exposure assessment and management principles are used to prevent musculoskeletal disorders, strains and sprains.	X		Chapter 2: Establishing the Exposure Assessment Strategy. A Strategy for Assessing and Managing Occupational Exposures. 4th Edition. AIHA 2015. Occupational Exposure Assessment and Management - A Model Written Program. AIHA 2024.
	Occupational exposure assessments are performed by or under the supervision of a qualified and experienced industrial hygienist who has been trained and has demonstrated competence in exposure assessment methodology (e.g., AIHA's comprehensive exposure assessment strategy). The training includes decision statistics; exposure categories; formation of SEGs; selection and use of OELs; qualitative exposure assessment techniques and tools; selection, use and limitations of exposure models; sampling strategies; the application of traditional and Bayesian statistics; measures of certainty; dermal assessments; prioritization schemes; and control strategies. Note: Some program elements may require support from allied health professionals (e.g. occupational medicine specialists, toxicologists, biosafety specialists, health physicists, ergonomists).	X		Chapter 2: Establishing the Exposure Assessment Strategy. A Strategy for Assessing and Managing Occupational Exposures. 4th Edition. AIHA 2015. Competency Framework - Understanding How ARECC Works Within Occupational Exposure Assessment. AIHA 2022.

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Program Management (continued)	Occupational exposure assessments are performed by or under the supervision of an Industrial Hygienist certified by a recognized credentialing organization (e.g. Certified Industrial Hygienist, Registered Occupational Hygienist, Diploma of Professional Competence in Occupational Hygiene, Certified Occupational Hygienist).		X	Recognized National Accreditation Schemes. International Occupational Hygiene Association.
	Occupational exposure assessments are performed by or under the supervision of an industrial hygienist who maintains AIHA Exposure Decision Analysis registration.		X	AIHA Exposure Decision Analysis Registry Program.
	The industrial hygienist is proficient in the selection, use and limitations of standard monitoring methods and instrumentation, including calibration practices and the utilization of accredited laboratories.	X		Air Sampling Technologies - Principles and Applications. American Conference of Governmental Industrial Hygienists (ACGIH) 2022. Important Instrumentation and Methods for the Detection of Chemicals in the Field, 2nd Edition AIHA 2019.
	Exposure judgments performed prior to and following the statistical analysis of monitoring data are compared as a feedback tool for strengthening the accuracy of professional judgment.		X	AIHA Webinar "Making Accurate Exposure Risk Decisions." 2022.
	The effective implementation of the organization's Occupational Exposure Assessment and Management program is reviewed periodically through a formal assessment (e.g., self-assessment, peer review, external audit). Gaps revealed by the formal assessment are resolved.		X	ANSI Z10.0 - 2019 Occupational Health and Safety Management Systems. American National Standards Institute (ANSI). ISO 45001: Occupational Health and Safety Management System. International Standards Organization (ISO). 2018

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Basic Characterization	Critical information for characterizing exposures is gathered on the workplace (e.g., operations, processes, equipment, controls, etc.), work force (jobs, division of labor, tasks, etc.), and environmental agents (materials, agents, quantities, chemical and physical properties, potential health effects and OELs, etc.).	X		Chapter 3: Basic Characterization and Information Gathering. A Strategy for Assessing and Managing Occupational Exposures. 4th Edition. AIHA 2015.
Occupational Exposure Limits	Authoritative or internal OELs are used as criteria for exposure judgments to differentiate acceptable from unacceptable exposures. Authoritative and internal OELs are based on robust toxicologic and or epidemiologic studies and integrate appropriate safety factors. Regulatory OELs are used if lower than authoritative or internal OELs. Internal OELs for specific environmental agents may be established and documented by an organization when 1) authoritative OELs are unavailable, or 2) robust health effects studies support internal OELs set at levels above or below authoritative OELs. Note: Authoritative OELs are established by the American Conference of Governmental Industrial Hygienists (ACGIH) (i.e., TLVs - Threshold Limit Values), the National Institute for Occupational Safety and Health (NIOSH) (i.e. RELs - Recommended Exposure Limits), the Occupational Alliance for Risk Science (OARS) (i.e., WEELs - Workplace Environmental Exposure Levels), the German Research Foundation (DFG) (i.e. MAKs-Maximum Workplace Concentrations) and other standard setting organizations.	X		Chapter 3: Basic Characterization and Information Gathering. A Strategy for Assessing and Managing Occupational Exposures. 4th Edition. AIHA 2015. AIHA Occupational Exposure Limits Position Statement April 14, 2021. TLVs and BEIs Based on the Documentation of the Threshold Limit Values for Chemical Substances and Physical Agents & Biological Exposure Indices. American Conference of Governmental Industrial Hygienists (ACGIH). Latest edition. NIOSH Pocket Guide to Chemical Hazards. National Institute for Occupational Safety and Health (NIOSH). WEELs. Occupational Alliance for Risk Science (OARS). German Research Foundation – Permanent Senate Commission for the Investigation of Health Hazards of Chemical Compounds in the Work Area (MAK Commission).

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Occupational Exposure Limits (continued)	Internal OEL documentation is published in the peer-reviewed literature and / or shared with authoritative organizations.		X	The NIOSH Occupational Exposure Banding Process for Chemical Risk Management. NIOSH 2019-132.
	Working OELs are utilized where authoritative or internal OELs are unavailable. Working OELs can be determined using an exposure banding system (e.g. NIOSH OEB) where working OELs are expressed as a range of exposure levels (i.e., OEL bands). Working OELs can also be based on EPA IRIS data, REACH DNELs (Derived No Effect Levels) or DMELs (Derived Minimal Effect Levels); or based on analogy with another environmental agent for which there is an authoritative, internal or regulatory OEL.	X		The NIOSH Occupational Exposure Banding Process for Chemical Risk Management. NIOSH 2019-132. Integrated Risk Information System (IRIS). US Environmental Protection Agency (EPA). Regulation (EC) No 1907/2006 of the European Parliament and of the Council 18 December 2006 concerning the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH).
	A prioritized process is in place to supplant working OELs associated with SEG exposure categories 2 and higher with robust internal OELs. Note: Working OELs are based on limited health effects information, and generally feature more uncertainty than internal OELs. The need for a more robust OEL increases as exposure levels approach a working OEL.		X	Chapter 7: Further Information Gathering, and Chapter 9: Reassessment. A Strategy for Assessing and Managing Occupational Exposures. 4th Edition. AIHA 2015.
	The ACGIH Threshold Limit Value (TLV) additive mixture formula is applied when workers are simultaneously exposed to two or more chemical agents with the same target effect.	X		TLVs and BEIs Based on the Documentation of the Threshold Limit Values for Chemical Substances and Physical Agents & Biological Exposure Indices. ACGIH. Latest edition.

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Occupational Exposure Limits (continued)	In operations involving non-traditional work schedules, OELs are adjusted based on the methodologies cited by the ACGIH TLV Committee (i.e., Brief and Scala, pharmacokinetic, Haber) or other schemes published in the peer-reviewed literature (e.g. IRSST).	X		TLVs and BEIs Based on the Documentation of the Threshold Limit Values for Chemical Substances and Physical Agents & Biological Exposure Indices. ACGIH. Latest edition. Toxico-kinetic Extended Shift OEL Adjustment. AIHA Risk Assessment Tools. 2022. Guide for the Adjustment of Permissible Exposure Values for Unusual Work Schedules. Institut de recherche Robert-Sauve en sante et en securite du travail (IRSST). 2015.
Similar Exposure Groups	The workforce is stratified into similar exposure groups. This stratification covers all operations and tasks including those performed infrequently. SEGs can be defined by processes, jobs, tasks, or other logical groupings. Individual workers may be assigned to more than one SEG. Each SEG is linked to one or more environmental agents, and SEGs may be further categorized according to OEL integration period (e.g., 8 hr. TWA, 15-minute STEL, instantaneous Ceiling Limit) and route of exposure (e.g., inhalation, skin contact, ingestion). The organization's system for establishing SEGs is documented.	X		Chapter 4: Establishing Similar Exposure Groups. A Strategy for Assessing and Managing Occupational Exposures. 4th Edition. AIHA 2015.
	Exposure category 2, 3 and 4 SEGs with large geometric standard deviations (e.g., > 3) are re-viewed, and if appropriate, subdivided into two or more SEGs in order to ensure accurate exposure characterization and reduce the likelihood of worker misclassification.	X		Chapter 4: Establishing Similar Exposure Groups. A Strategy for Assessing and Managing Occupational Exposures. 4th Edition. AIHA 2015.

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Exposure Judgments	The exposure profile for each SEG is judged acceptable or unacceptable. Some SEGs initially judged uncertain, are reclassified as acceptable or unacceptable following the collection of additional monitoring data (e.g., air samples, biological samples, electromagnetic measurements, etc.) and/or health effects data. In performing the exposure assessments, the industrial hygienist assumes the absence of personal protective equipment (PPE) used to control exposures (such as respirators, hearing protectors, and chemically protective gloves).	X		Chapter 5: Defining and Judging Exposure Profiles. A Strategy for Assessing and Managing Occupational Exposures. 4th Edition. AIHA 2015.
	Decision statistic for air contaminants and noise: Exposures are judged acceptable if the estimated 95th percentile for the exposure profile is less than the OEL with at least 70% confidence. Note: Decision statistics define what constitutes an acceptable exposure. The availability of personal monitoring methods for air contaminants and noise enables the practical collection of samples over multiple workdays for statistical analysis to estimate an SEG exposure distribution's 95th percentile and its certainty. Maintaining the 95th percentile below the OEL with at least 70% confidence (i.e., UTL95/70 < OEL, or BDA chart category 4 probability < 30%) ensures that the maximum number of day-to-day exposures that may exceed the OEL is restricted to less than 5% with at least 70% confidence. Any monitoring result over an OEL provides an opportunity to evaluate its cause and prevent the exposure from recurring.	X		Chapter 8: Quantitative Exposure Data: Interpretation, Decision Making, and Statistical Tools: A Strategy for Assessing and Managing Occupational Exposures. 4th Edition. AIHA 2015. EN 689. (2018) Workplace exposure—measurement of exposure by inhalation to chemical agents—strategy for testing compliance with occupational exposure limit values. Bruxelles, Belgium: European Committee for Standardization EN 689:2018.
	For category 2 and category 3 SEGs, monitoring is performed as part of a continuous improvement process that strives to increase statistical confidence from 70% to 95% that the 95th percentile is less than the OEL. Monitoring of category 3 SEGs with low certainty is the first priority, followed by category 3 with moderate certainty, category 2 with low certainty, and category 2 with moderate certainty.		X	AIHA Webinar "Making Accurate Exposure Risk Decisions." 2022.

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Exposure Judgments (continued)	An AIHA exposure category is selected for each air contaminant and noise SEG: Category 0: 95th percentile < 1% OEL; Category 1: 95th percentile 1-10% OEL; Category 2: 95th percentile 10-50% OEL; Category 3: 95th percentile 50-100% OEL; Category 4: 95th percentile > 100% OEL. Additionally, the certainty associated with each exposure assessment is rated (high, medium, or low). For initial assessments, qualitative criteria are used to rate the certainty. When monitoring data are available, quantitative criteria based on traditional, or Bayesian statistics are used to rate the certainty. Note - Criteria for SEG Certainty Ratings: Qualitative: High: The environmental agent's exposure profile is well understood. The industrial hygienist has high confidence in the acceptability judgment. Medium: There is enough information to make a judgment, but further information gathering is warranted to verify the exposure assessment. Low: The acceptability judgment was made in the absence of significant information on the exposure profile. Quantitative -Traditional Statistics High: The 95th percentile and the upper tolerance limit (UTL) are in the same exposure category. Medium: The 95th percentile is one category below the UTL Low: The 95th percentile is two or more categories below the UTL Quantitative - Bayesian Statistics (BDA Charts) High: The likelihood that the selected exposure category is correct is >75% Medium: The likelihood that the selected exposure category is correct is 50% - 75% Low: The likelihood that the selected exposure category is correct is <50%	X		Chapter 5: Defining and Judging Exposure Profiles. A Strategy for Assessing and Managing Occupational Exposures. 4th Edition. AIHA 2015. AIHA Webinar "Making Accurate Exposure Risk Decisions." 2022.

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Exposure Judgments (continued)	Initial exposure assessments compare an estimate of the SEG exposure profile 95th percentile to the OEL. Initial exposure assessments utilize observation of the SEG activities, and all available data collected during the basic characterization. Judgments are based on past or surrogate monitoring data, mathematical models, and other tools (e.g., algorithms, checklists based on material chemical and physical properties and workplace conditions such as Structured Deterministic Model 2.0). The rationale for each exposure assessment is documented.	X		Chapter 5: Defining and Judging Exposure Profiles, Chapter 6: Approaches to Improving Professional Judgment Accuracy, and Chapter 26: Rules and Guidelines to Facilitate Professional Judgments. A Strategy for Assessing and Managing Occupational Exposures. 4th Edition. AIHA 2015. Mathematical Models for Estimating Occupational Exposure to Chemicals, 2nd Edition. AIHA 2009. IHMOD 2.0. AIHA Risk Assessment Tools. 2022. Structured Deterministic Model (SDM) 2.0. University of Minnesota Exposure Science and Sustainability Institute. 2022 ODHMOD Inert Gas Asphyxiation Risk Model. AIHA Risk Assessment Tools. 2021.

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Exposure Judgments (continued)	Exposure data are analyzed using traditional and/or Bayesian statistics. The inferential findings are used to select the exposure category and the certainty rating for each SEG. Note: For very small sample sizes traditional IH statistics cannot be calculated or are very uncertain. In these instances, Bayesian methods can assist in selecting the most appropriate exposure category.	X		Chapter 8: Quantitative Exposure Data: Interpretation, Decision Making, and Statistical Tools: A Strategy for Assessing and Managing Occupational Exposures. 4th Edition. AIHA 2015. IHSTAT. AIHA Risk Assessment Tools. IHDA-AIHA. AIHA Risk Assessment Tools. Expostats. AIHA Risk Assessment Tools. IHSTAT-Bayes. AIHA Risk Assessment Tools.

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Exposure Judgments (continued)	Qualitative dermal exposure assessments are completed for each SEG associated with exposure to chemicals harmful to the skin or absorbed through the skin. These chemicals can be identified through GHS ratings, ACGIH TLV Skin and DSEN designations, and NIOSH Skin notations; they generally include corrosives, irritants, skin sensitizers, skin carcinogens and defatting agents.	X		TLVs and BEIs Based on the Documentation of the Threshold Limit Values for Chemical Substances and Physical Agents & Biological Exposure Indices. ACGIH Latest edition. Chapter 13: Dermal Exposure Assessments. A Strategy for Assessing and Managing Occupational Exposures. 4th Edition. AIHA 2015. Dermal Risk Assessment Model DRAM 1.0. AIHA Risk Assessment Tools. 2022. Current Intelligence Bulletin 61: A Strategy for Assigning New NIOSH Skin Notations. NIOSH 2009-147.
	Qualitative dermal exposure assessments are completed for each SEG associated with chemical skin contact.		X	
	Exposure assessments identify plausible failure conditions that may result in unacceptably high exposures.		X	
	Presently the monitoring methods for many physical and biological agents (e.g., thermal stress, vibration, repetitive motion, microwave radiation) do not adequately support the collection and statistical analysis of robust multiple-day exposure samples. Nevertheless, exposures to these various physical and biological agents must be identified, assessed, and judged acceptable or unacceptable. The basis for each exposure assessment must be documented including the exposure scenario (relative to the temporal range of exposure conditions), the assessment methods used (measurement, surrogate data, modeling techniques, instrumentation, etc.), and an estimate of the certainty associated with the exposure judgment (high, medium, or low).	X		Ergonomic Assessment Toolkit. AIHA 2023. Bioaerosols: Assessment and Control, 2nd Edition. ACGIH 2024.

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Monitoring Practices	The collection of exposure monitoring data across SEGs within an organization is prioritized. A prioritization scheme may be established and applied to guide the collection of monitoring data. Prioritization is often based on the exposure category, certainty rating, and other criteria (e.g., health effects rating, number of workers in each SEG, frequency of the exposure).	X		Chapter 7: Further Information Gathering. A Strategy for Assessing and Managing Occupational Exposures. 4th Edition. AIHA 2015.
	Three or more baseline personal samples are collected for each SEG initially rated exposure category 2 or 3. The monitoring results are analyzed using traditional and/or Bayesian statistics and are used to update the SEG exposure category and the associated certainty rating. Three or more additional samples are then collected for each SEG rated exposure category 2 or 3 with low or medium certainty. Implementing controls or improving existing controls is an alternative to collecting additional samples.	X		EN 689. (2018) Workplace exposure—measurement of exposure by inhalation to chemical agents—strategy for testing compliance with occupational exposure limit values. Bruxelles, Belgium: European Committee for Standardization EN 689:2018. AIHA Webinar "Making Accurate Exposure Risk Decisions." 2022.
	Six to ten baseline personal samples are collected for each SEG initially rated exposure category 2 or 3. The data are analyzed using traditional and/or Bayesian statistics and are used to update the SEG exposure category and the associated certainty rating.		X	Chapter 7: Further Information Gathering, and Chapter 8: Quantitative Exposure Data : Interpretation, Decision Making, and Statistical Tools. A Strategy for Assessing and Managing Occupational Exposures. 4th Edition. AIHA 2015.

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Monitoring Practices (continued)	Personal monitoring data are collected for SEGs judged unacceptable when: a) the data may support updating the assessment to acceptable, b) the data are needed to support the selection of controls, including PPE in view of respirator protection factors or hearing protection noise reduction ratings, or c) the data are needed to establish a baseline for assessing the effectiveness of newly planned engineering or work practice controls.	X		Chapter 8: Quantitative Exposure Data: Interpretation, Decision Making, and Statistical Tools, and Chapter 23: Health Hazard Control. A Strategy for Assessing and Managing Occupational Exposures. 4th Edition. AIHA 2015.
	A small percentage of exposure category 0 and 1 SEGs are periodically monitored to validate initial exposure assessments.		X	Chapter 9: Reassessment. A Strategy for Assessing and Managing Occupational Exposures. 4th Edition. AIHA 2015.
	When characterizing a SEG exposure profile, samples are collected in a manner that is unbiased, representative of the entire SEG population of exposures, and as close to random as is practical.	X		Chapter 7: Further Information Gathering. A Strategy for Assessing and Managing Occupational Exposures. 4th Edition. AIHA 2015.
	Air samples are collected in accordance with standard methods, good quality assurance / quality control processes, and analyzed by an AIHA-accredited laboratory or equivalent.	X		OSHA Sampling and Analytical Methods, OSHA.gov. NIOSH Manual of Analytical Methods. AIHA Laboratory Accreditation Program.
	Where practical, all periods of exposure during the work shift are monitored in order to accurately determine the time-weighted average. Measured exposure values are averaged over the integration period of the OEL. However, the airborne concentration during the unsampled period is only counted as zero if it is known that exposures were not present during this period.	X		Chapter 7: Further Information Gathering. A Strategy for Assessing and Managing Occupational Exposures. 4th Edition. AIHA 2015.

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Monitoring Practices (continued)	Biological monitoring is considered as a supplement to air monitoring where a) validated protocols and Biological Exposure Indices (BEIs) have been established, and b) the assessment findings may provide additional insight into worker exposures and associated health risks.		X	TLVs and BEIs Based on the Documentation of the Threshold Limit Values for Chemical Substances and Physical Agents & Biological Exposure Indices. ACGIH Latest edition. Biological Monitoring: A Practical Field Manual. 2nd Edition. AIHA.
	Biological monitoring and surface sampling are considered where skin absorption or inadvertent ingestion are significant routes of exposure.	X		TLVs and BEIs Based on the Documentation of the Threshold Limit Values for Chemical Substances and Physical Agents & Biological Exposure Indices. ACGIH Latest edition. Biological Monitoring: A Practical Field Manual. 2nd Edition. AIHA.
	Quantitative dermal assessments (modeling, skin pads, etc.) are performed where an improved characterization of exposure (beyond a qualitative assessment) is needed to more accurately quantify the health risk or support the selection of control strategies.		X	Appendix II: Dermal Exposure Monitoring and Estimation of Dermal Exposures. A Strategy for Assessing and Managing Occupational Exposures. 4th Edition. AIHA 2015. IH Skin Perm 2.4. AIHA Risk Assessment Tools. 2021.
	Real-time monitors with alarms are used to provide an early warning of exposure levels trending toward exceedance of an OEL.		X	Chapter 7: Further Information Gathering. A Strategy for Assessing and Managing Occupational Exposures. 4th Edition. AIHA 2015. Establishing a Process for Setting Real-Time Detection System Alarms. AIHA White Paper 2023.

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Monitoring Practices (continued)	Personal data logging instrumentation is used to illustrate how sources and tasks contribute to exposure assessments.		X	Chapter 7: Further Information Gathering. A Strategy for Assessing and Managing Occupational Exposures. 4th Edition. AIHA 2015.
Non-recurring Operations	Non-recurring operations are anticipated, prospectively assessed, and controlled to prevent unacceptably high exposures to environmental agents. Non-recurring operations include the one-time manufacture of unique products, some maintenance work, construction projects, environmental remediation, research experiments, and emergency response. Exposures are assessed through modeling or surrogate data from similar operations performed elsewhere. Personal protective equipment is conservatively prescribed to compensate for the high uncertainty in the exposure assessment. Direct reading instruments may be used in real time to determine exposure control strategies.	X		Technical Framework - Role of the OEHS Professional in Emergency Planning. AIHA 2021.
Health Hazard Controls	Newly identified unacceptable SEGs are quickly controlled, often through administrative controls, work practice controls, and/or personal protective equipment. Then permanent controls are sought featuring one (or more) of the superior mitigation strategies. Note: The hierarchy of controls is elimination or substitution, followed by engineering controls, administrative controls / work practice controls, and finally personal protective equipment. The hierarchy is based on the reliability and effectiveness of the control strategies. Effective and reliable protection is often achieved through multiple layers of protection. While preferred, the superior mitigation strategies (elimination, substitution, engineering controls) may take time to plan, resource and implement.	X		Chapter 23: Health Hazard Control. A Strategy for Assessing and Managing Occupational Exposures. 4th Edition. AIHA 2015. A Framework to Guide Selection of Chemical Alternatives. National Research Council, The National Academies Press, 2014. Industrial Ventilation – A Manual of Recommended Practice for Design. ACGIH Latest edition. ASHRAE Standard 241 – Control of Infectious Aerosols. American Society of Heating, Refrigerating and Air-Conditioning Engineers. 2023.

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Health Hazard Controls (continued)	A systematic prioritization and continuous improvement process is in place across SEGs to improve control reliability and effectiveness by moving up the hierarchy of controls. Prioritization is often based upon the exposure category, certainty rating, and other criteria (e.g., health effects rating, number of workers in each SEG, frequency of the exposure). The rationale for continuing to rely on administrative, work practice, and or PPE controls, rather than instituting superior mitigation strategies is documented.	X		Chapter 23: Health Hazard Control. A Strategy for Assessing and Managing Occupational Exposures. 4th Edition. AIHA 2015.
	Operating and preventative maintenance procedures/schedules are established for engineering controls. If appropriate, the procedures address the limitations of the engineering controls. Workers are trained in the operating and maintenance procedures. Where available, engineering controls feature monitors if performance can decline or fail (e.g., static pressure gauges).	X		Chapter 23: Health Hazard Control. A Strategy for Assessing and Managing Occupational Exposures. 4th Edition. AIHA 2015. Industrial Ventilation: A Manual of Recommended Practice for Operation and Maintenance, 2nd Edition. ACGIH. 2020.
	Procedures are established for administrative and work practice controls. Workers are trained in the administrative and work practice controls. Observational inspections are performed to verify adherence to the administrative and work practice controls.	X		Chapter 23: Health Hazard Control. A Strategy for Assessing and Managing Occupational Exposures. 4th Edition. AIHA 2015.
	The effectiveness of newly instituted engineering, administrative and work practice controls is validated through exposure reassessments.	X		Chapter 23: Health Hazard Control. A Strategy for Assessing and Managing Occupational Exposures. 4th Edition. AIHA 2015.
	Procedures are established addressing the limitations, selection and use of PPE. Workers are trained in the PPE procedures. Observational inspections are conducted to verify if PPE are properly selected, properly maintained, used where and when required, and properly worn.	X		Technical Framework – A Resource for Respiratory Protection Programs. AIHA 2022.

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Health Hazard Controls (continued)	Where plausible failure conditions may result in unacceptably high exposures, the operation is modified to eliminate each failure condition, or is designed to fail to a safe condition. If a fail-safe design is not feasible, the reliability and or redundancy of controls is increased to minimize the likelihood and impact of each failure condition.		X	
	Prevention through Design: Newly planned operations, facilities and equipment are designed and selected in an effort to ensure prospective exposures are maintained well below OELs.		X	ANSI/ASSP Z590.3-2021. Prevention through Design - Guidelines for Addressing Occupational Hazards and Risks in Design and Redesign Processes.
Standard Controls	Standard controls and control banding systems are employed to enhance the efficiency or effectiveness of the exposure assessment and management process. Standard controls identify the measures proven to effectively control exposures to acceptable levels in an operation or category of operations. The selection of standard controls may be based on the recommendations from an authoritative organization, or the successful implementation of a specific control strategy in a very similar operation. Note: Control banding is a management system linking exposure classifications to standardized controls. The exposure classifications may be expressed as a range of airborne concentrations, or they may be aligned to levels of increasing risk that require increasing layers of protection (e.g., laser classes with controls based on power and wavelength, or standard mitigations for classes of research facilities).		X	AIHA Guideline 9-2007 Guidance for Conducting Control Banding Analyses. Industrial Ventilation – A Manual of Recommended Practice for Design. ACGIH. Latest edition. IEEE Standard C95.7 for Electromagnetic Safety Programs, 0 Hz to 300 Hz. Institute of Electrical and Electronic Engineers. 2022.
	Standard controls and control banding systems are validated using the AIHA exposure assessment strategy. The validation studies demonstrate exposures are effectively controlled to acceptable levels.		X	
Medical Surveillance	Medical surveillance is provided to workers in exposure categories 3 and 4 where protocols are available. The protocols are established by occupational medicine resources and address physical examinations, bioassays, and other evaluations for detecting early indicators or evidence of adverse health effects. The protocols may address high-risk workers. The surveillance findings may direct work restrictions or medical treatments.	X		OSHA 3162-01R 2014, Medical Screening and Surveillance Requirements in OSHA Standards: A Guide.

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Communications and Training	Exposure assessment findings and recommendations are reported to all affected workers, management staff and medical resources in an effective and timely fashion.	X		Chapter 10: Recordkeeping and Reporting for Current and Future Needs. A Strategy for Assessing and Managing Occupational Exposures. 4th Edition. AIHA 2015.
	Charts, graphs, or other effective illustrations are used to communicate exposure assessment findings.		X	Chapter 10: Recordkeeping and Reporting for Current and Future Needs. A Strategy for Assessing and Managing Occupational Exposures. 4th Edition. AIHA 2015.
	Environmental agent-specific education and training is provided to workers in SEG exposure categories 2 and higher. The training addresses potential health effects, OELs, SEG-specific exposure levels, engineering controls, administrative controls, work practice controls, and medical surveillance.	X		Chapter 10: Recordkeeping and Reporting for Current and Future Needs. A Strategy for Assessing and Managing Occupational Exposures. 4th Edition. AIHA 2015.
Reassessments	Management of change (MOC): Administrative procedures are established to provide notification of newly planned changes in the workplace, workforce, or environmental agents. A robust MOC process features the review of planned changes in staffing or work duties, review of new materials or a new use of an existing material, and formal reviews of new or modified operations, facilities, and equipment. Once informed, the industrial hygienist is responsible for prospectively assessing the changes and recommending strategies for ensuring the effective control of exposures. The exposures associated with newly implemented changes to the workplace, workforce or environmental agents are assessed to confirm worker health protection.	X		Chapter 9: Reassessment. A Strategy for Assessing and Managing Occupational Exposures. 4th Edition. AIHA 2015.
	Periodic audits are performed to evaluate the effectiveness of the management-of-change process.		X	ANSI Z10.0 - 2019 Occupational Health and Safety Management Systems.

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Reassessments (continued)	Periodic monitoring is performed to detect changes in exposure levels that may not surface via the management-of-change process or that could occur between comprehensive exposure reassessments. In a stationary SEG, samples collected through periodic monitoring expand the database and enable improved statistical inferences.		X	Chapter 9: Reassessment. A Strategy for Assessing and Managing Occupational Exposures. 4th Edition. AIHA 2015.
	Exposures are reassessed whenever new and significant information becomes available on the health effects of an environmental agent, or a change occurs in an OEL.	X		Chapter 9: Reassessment. A Strategy for Assessing and Managing Occupational Exposures. 4th Edition. AIHA 2015.
	Comprehensive exposure reassessments are performed at a frequency commensurate with the effectiveness of the MOC process, and no less than once every five years.	X		Chapter 9: Reassessment. A Strategy for Assessing and Managing Occupational Exposures. 4th Edition. AIHA 2015.
Performance Measures	Performance measures are identified, tracked, and communicated to stakeholders. Examples: 1) the number of SEGs rated exposure category 4 as a measure of progress toward reducing unacceptable exposures, 2) the percent of workers found to comply with PPE requirements and 3) percent completion of stated monitoring plan.		X	Industrial Hygiene Performance Metrics, 2nd Edition. AIHA 2023. Best Practice Guide for Leading Health Metrics in Occupational Health and Safety Programs. AIHA and the Center for Safety and Health Sustainability. 2020.

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Recordkeeping	Exposure assessment records are maintained indefinitely. The records include the Occupational Exposure Assessment and Management program, safety data sheets, monitoring plans, laboratory reports, exposure data, interpretive reports, surveys, prospective assessments of newly planned operations, administrative and work practice control procedures, engineering control verification data, PPE programs, and training records.	X		Chapter 10: Recordkeeping and Reporting for Current and Future Needs. A Strategy for Assessing and Managing Occupational Exposures. 4th Edition. AIHA 2015.
	Standard exposure data are captured and maintained. The minimum data elements are identified by the AIHA; the data categories are Environmental Agents, Similar Exposure Groups, Exposure Assessments, and Monitoring Data.	X		Chapter 10: Recordkeeping and Reporting for Current and Future Needs. A Strategy for Assessing and Managing Occupational Exposures. 4th Edition. AIHA 2015. (1996) Special Report: Data Elements for Occupational Exposure Databases: Guidelines and Recommendations for Airborne Hazards and Noise, Applied Occupational and Environmental Hygiene, 11:11, 1294-1311.
	All exposure data are maintained in a master electronic file or database.		X	Appendix VII Data Management and Information Systems to Support Exposure Assessments. A Strategy for Assessing and Managing Occupational Exposures. 4th Edition. AIHA 2015.
	Individual worker assignments in SEGs are tracked by the organization for the purpose of establishing and maintaining exposure histories.		X	Chapter 10: Recordkeeping and Reporting for Current and Future Needs. A Strategy for Assessing and Managing Occupational Exposures. 4th Edition. AIHA 2015.

AIHA | GUIDELINE FOUNDATION

Principles of Good Practice

Section 3:

Noise and Hearing Loss Prevention

For the Industrial Hygienist/Occupational Hygienist (IH/OH)

aiha.org

Version 1 | October 1, 2024

Principles of Good Practice Documents

The PGP are organized by OEHS areas of practice in a concise, easy-to-use table format. They are published as they are developed for each area of practice and are designed to be kept "evergreen" via regular updates. Refer to Section 1 for PGP use and limitations.

Currently, PGP have been documented for the following areas of practice:

OEHS Area of Practice/ PRP Authors and Contributors	Date	
	Initial Publication	Most Recent Update
Noise Committee **PGP Version 1** **PGP Advisory Group Members:** John Mulhausen **PGP Subteam:** Coty Maypole, Tiffany Lyons, Katherine Crawford, Sharon Sever	10/1/24	11/14/24

AIHA PRINCIPLES OF GOOD PRACTICE for NOISE AND HEARING LOSS PREVENTION

v1.0 - 10/1/2024

Objective

The AIHA Principles of Good Practice for Hearing Loss Prevention aims to document a concise, easy-to-use summary of minimum recommended elements for a workplace Hearing Loss Prevention Plan that incorporates best risk management practices, whenever feasible. Note: Readers should also refer to the AIHA Principles of Good Practice for Occupational Exposure Assessment, where many elements apply to workplace noise exposures.

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Occupational Exposure Limit (OEL)	Criterion Level: 85 dBA; Exchange rate: 3 dB; Threshold 80 dBA	X		US Department of Health and Human Services. "Criteria for a recommended standard: Occupational noise exposure: Revised criteria (DHHS [NIOSH] Publication No. 98-126). Cincinnati, OH: Centers for Disease Control and Prevention." National Institute for Occupational Safety and Health (1998). American Conference of Governmental Industrial Hygienists. "TLVs and BEIs : Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices," 1996.
	Criterion Level: 85 dBA; Exchange rate: 3 dB; Threshold 75 dBA		X	Neitzel, Richard L., and Brian J. Fligor. "Risk of noise-induced hearing loss due to recreational sound: Review and recommendations." The Journal of the Acoustical Society of America 146, no. 5 (2019): 3911-3921.

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Occupational Exposure Limit (OEL)	Adjust the criterion level for extended shifts: Adjusted level= 85 - (10* log (T/8)) where T= length of shift in hours (e.g., 10 hr = 84 dBA, 12 hr = 83 dBA)	X		Meinke, Deanna K., Elliott H. Berger, Dennis P. Driscoll, Richard L. Neitzel, and Kathryn Bright, eds. Noise Manual. Revised 6th Edition. Falls Church, VA: American Industrial Hygiene Association (AIHA), 2022.
	Peak limit for impulse and impact noise: 140 dB SPL	X		Occupational Safety and Health Administration (OSHA). "1910.95, Occupational Noise Exposure," 2008. https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.95. Office of the Under Secretary of Defense for Personnel and Readiness. "DOD INSTRUCTION 6055.12, HEARING CONSERVATION PROGRAM (HCP)," 2019. https://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodi/605512p.pdf%3Fver=2019-08-14-073309-537.
Exposure Assessment	Basic Characterization is completed first -- information for characterizing exposures is gathered on the workplace, work force, and environmental agents. Basic Sound Survey and Interviews should be conducted to group workers based on exposures so that full-shift sampling can be completed.	X		Jahn, Steven D., William H. Bullock, and Joselito S. Ignacio, eds. A Strategy for Assessing and Managing Occupational Exposures. 4th Edition. Falls Church, VA: American Industrial Hygiene Association (AIHA), 2015.
	Similar Exposure Groups (SEGs) are defined as logical grouping of workers with similar processes, jobs, tasks, or other groupings. SEGs should be prioritized by potential exposures (i.e., <85 dBA, 85-90 dBA, 90-95 dBA, 95-100 dBA, >100 dBA)	X		Meinke, Deanna K., Elliott H. Berger, Dennis P. Driscoll, Richard L. Neitzel, and Kathryn Bright, eds. Noise Manual. Revised 6th Edition. Falls Church, VA: American Industrial Hygiene Association (AIHA), 2022.

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Exposure Assessment	Conduct area / positional SLM noise surveys to estimate the exposures for each SEG. Collect noise dosimeter samples as prescribed by the Occupational Exposure Assessment PGP for Exposure Categories 2 and 3. The dosimetric data are statistically analyzed in view of a 95th%ile decision statistic, and each SEG is classified into the appropriate Exposure Category 0 - 4: Category 0: 95th percentile < 1% OEL; Category 1: 95th percentile 1-10% OEL; Category 2: 95th percentile > 10-50% OEL; Category 3: 95th percentile > 50-100% OEL; Category 4: 95th percentile > 100% OEL.	X		Jahn, Steven D., William H. Bullock, and Joselito S. Ignacio, eds. A Strategy for Assessing and Managing Occupational Exposures. 4th Edition. Falls Church, VA: American Industrial Hygiene Association (AIHA), 2015.
	Noise dosimeter samples are collected for Category 4 SEGs if the data: a) may support reducing the assessment to Category 3 or below, b) if the data are needed to support the selection of hearing protection in view of noise reduction ratings, or c) the data are needed to establish a baseline for assessing the effectiveness of newly planned engineering or work practice controls.	X		Meinke, Deanna K., Elliott H. Berger, Dennis P. Driscoll, Richard L. Neitzel, and Kathryn Bright, eds. Noise Manual. Revised 6th Edition. Falls Church, VA: American Industrial Hygiene Association (AIHA), 2022.
	Exposure assessment findings are summarized in written interpretive reports. The reports are communicated to all affected workers, management staff and medical resources in a timely and effective fashion.	X		
	Noise exposures are reassessed in accordance with the AIHA Standard of Care for Occupational Exposure Assessment	X		"AIHA Principles of Good Practice for Occupational Exposure Assessment." American Industrial Hygiene Association (AIHA), 2022. https://aiha-assets.sfo2.digitaloceanspaces.com/AIHA/resources/Get-Involved/AIHA-Guideline-Foundation-Standards-of-Care.pdf.

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Noise Measurement	Sound Level Meters (Type 1 or Type 2) are used for area noise measurements.	X		Meinke, Deanna K., Elliott H. Berger, Dennis P. Driscoll, Richard L. Neitzel, and Kathryn Bright, eds. Noise Manual. Revised 6th Edition. Falls Church, VA: American Industrial Hygiene Association (AIHA), 2022. US Department of Health and Human Services. "Criteria for a recommended standard: Occupational noise exposure: Revised criteria (DHHS [NIOSH] Publication No. 98-126). Cincinnati, OH: Centers for Disease Control and Prevention." National Institute for Occupational Safety and Health (1998).
	Noise dosimeters (Class 2) are used for personal exposure assessments.	X		
	Any instrument used to measure noise is pre- and post-calibrated.	X		
	Instruments use A-weighting with Slow Response.	X		
Ototoxicants	Perform exposure assessment and control strategies for ototoxicant agents.	X		Occupational Safety and Health Administration. "Preventing hearing loss caused by chemical (ototoxicity) and noise exposure." Safety and Health Information Bulletin 2124 (2018).
	Reference ACGIH TLVs for ototoxicant notations and review Safety Data Sheets (SDS) in the workplace for potential ototoxic hazards and health effects (found in Section 11).	X		Meinke, Deanna K., Elliott H. Berger, Dennis P. Driscoll, Richard L. Neitzel, and Kathryn Bright, eds. Noise Manual. Revised 6th Edition. Falls Church, VA: American Industrial Hygiene Association (AIHA), 2022.
	Include workers exposed greater than 50% of the OEL or when there is significant dermal exposure to ototoxicants in hearing loss prevention programs. Annual audiograms are recommended for workers exposed to > 50% of the most stringent occupational exposure limit for ototoxic airborne exposures.	X		
	Provide ototoxicant-specific education and training to workers in SEGs rated category 2 and higher. Training should address potential health effects, OELs, SEG-specific exposure levels/ categories, engineering controls, administrative controls, work practice controls, and medical surveillance (i.e., audiometric testing).	X		

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Education and Training	Workers in SEGs whose noise exposures are 50% or more of the OEL (Exposure Categories 3 and 4) are provided annual training on the following: 1) The hazards of noise including the risk for hearing loss and its effect on communication, 2) Job / task-specific noise exposures vs. occupational exposure limit, 3) Hearing protection rules, 4) How to select hearing protectors, 5) Proper insertion and care of hearing protectors, 6) An explanation of audiometric testing as means for identifying the early signs of hearing loss so that action can be taken to prevent further loss, and 7) the risks associated with off-the-job noise exposures.	X		"AIHA Principles of Good Practice for Occupational Exposure Assessment." American Industrial Hygiene Association (AIHA), 2022. https://aiha-assets.sfo2.digitaloceanspaces.com/AIHA/resources/Get-Involved/AIHA-Guideline-Foundation-Standards-of-Care.pdf.
	Workers in SEGs whose noise exposures are 10 - 50% of the OEL (Exposure Category 2) are provided annual awareness training addressing the hazards of noise including the risk for hearing loss and its effect on communication.		X	
	Retrain and refit employees with hearing protection if they have experienced a standard threshold shift.	X		Meinke, Deanna K., Elliott H. Berger, Dennis P. Driscoll, Richard L. Neitzel, and Kathryn Bright, eds. Noise Manual. Revised 6th Edition. Falls Church, VA: American Industrial Hygiene Association (AIHA), 2022.
	Train newly hired employees prior to their first exposure to noise.	X		
	Develop, routinely review and update your HLPP training materials.	X		
Hearing Protection	Hearing protection rules are established to ensure exposures above the OEL are effectively controlled. Initially the rules will be based on area / positional noise measurements, and later refined in view of the statistical analysis of noise dosimeter data. The hearing protection rules may target specific tasks, work positions, equipment, or require all workers to don hearing protection when entering designated work areas.	X		Occupational Safety and Health Administration (OSHA). "1910.95, Occupational Noise Exposure," 2008. https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.95.
	Workers are offered a selection of at least two types of earplugs and two models of earmuffs with suitable attenuation.	X		

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Hearing Protection	For those employees who have not had a baseline audiogram or have experienced a standard threshold shift, hearing protection is required when exposed to 50% or more of the OEL (Exposure categories 3 and 4).	X		Occupational Safety and Health Administration (OSHA). "1910.95, Occupational Noise Exposure," 2008. https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.95.
	Hearing protection must attenuate employee noise exposure below the OEL.	X		
	Hearing protection should attenuate employee noise exposures below 50% of the OEL.		X	
	Conduct a qualitative fit evaluation of hearing protection. **Foam Ear Plugs:** Observe if employees are correctly inserting and wearing hearing protection. Roll-up earplugs should be rolled-down into a tight cylinder and held in place until expanded. The earplug should completely seal the ear canal. Visually check that the inserted earplug does not extend beyond the tragus. Have the employee place cupped hands over their ears with earplugs inserted in the presence of background noise; the wearer should not notice a substantial difference in the background noise level when their hands are removed. **Pre-Molded Ear Plugs:** Have the employee tug back and forth on the inserted earplug. If properly inserted, the employee should feel a slight pressure change in the ear canal. **Ear Muffs:** Observe (1) if the ear muff cup is centered around the ear and presses against the skull; (2) that no obstructions interfere with the cup seal (e.g., hair, glasses, pinna/lobule); and (3) that the headband is directly over the top of the head.	X		

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Hearing Protection	Individualized attenuation of a selected hearing protector is verified through hearing protector fit testing using a field attenuation estimation system that is compliant with ASA/ANSI S12.71-2018(R2022)		X	Wells, Laurie & Schulz, Theresa & Saleem, Mohammed & Dantscher, Sandra & Borst, Bev & Giguère, Christian & Fackler, Cameron & Murphy, William. (2023). Standards and Regulations for Hearing Protector Fit Testing - Outcomes of the International Hearing Protector Fit-Testing Symposium. 10.1121/2.0001843.
	Estimate the noise reaching the ear using one of the following methods: (1) For C-weighted noise measurements: The noise-reduction rating (NRR) is subtracted from the C-weighted TWA to obtain the estimated A-weighted TWA under the ear protector; (2) For A-weighted noise measurements: subtract 7 from the NRR, then the "adjusted" NRR is subtracted from the A-weighted TWA (1). (3) Derate the NRR by multiplying the NRR by 0.50, then subtract the NRR from the noise measurement as described above for A-weighting or C-weighting (2).	X		OSHA. "US Department of Labor Occupational Safety and Health Administration directive number: CPL 02-02-035, 29 CFR 1910.95(b)(1), Guidelines for Noise Enforcement; Appendix A; effective date: 12/19/1983." OSHA. "1910.95, Occupational Noise Exposure," 2008. https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.95.
	A combination of earplugs and earmuffs is required where a single set of hearing protectors does not provide adequate attenuation. Note 1: Double hearing protection (i.e., earmuff and earplugs) is recommended when the employee 8-hr TWA exposures exceed 100 dBA. Note 2: NRR's are not additive; double protection will add only 5 to 10 dB of attenuation. To be conservative, add 5 dB to the higher of the two NRRs. Exposure-time limits are established where the noise exposures cannot be reduced below the OEL through the use of engineering controls or both ear plugs and muffs.	X		US Department of Health and Human Services. "Criteria for a recommended standard: Occupational noise exposure: Revised criteria (DHHS [NIOSH] Publication No. 98-126). Cincinnati, OH: Centers for Disease Control and Prevention." National Institute for Occupational Safety and Health (1998).
	Careful attention is given to the selection of hearing protection for workers with hearing impairments and for workers with critical communication and/or auditory tasks. Identify audibility needs and select hearing protector attenuation to neither underprotect nor overprotect. Overprotection may create a safety risk or lead to noncompliance with hearing protector use.	X		

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Hearing Protection	Earmuffs are provided for workers who choose not to insert hearing protector into ear canal and those who have a medical conditions such as infection.	X		US Department of Health and Human Services. "Criteria for a recommended standard: Occupational noise exposure: Revised criteria (DHHS [NIOSH] Publication No. 98-126). Cincinnati, OH: Centers for Disease Control and Prevention." National Institute for Occupational Safety and Health (1998).
Audiometric Testing	Audiometric testing is performed by a physician, audiologist, or occupational hearing conservationist certified by the Council for Accreditation in Occupational Hearing Conservation (CAOHC).	X		Occupational Safety and Health Administration (OSHA). "1910.95, Occupational Noise Exposure," 2008. https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.95. US Department of Health and Human Services. "Criteria for a recommended standard: Occupational noise exposure: Revised criteria (DHHS [NIOSH] Publication No. 98-126). Cincinnati, OH: Centers for Disease Control and Prevention." National Institute for Occupational Safety and Health (1998). Meinke, Deanna K., Elliott H. Berger, Dennis P. Driscoll, Richard L. Neitzel, and Kathryn Bright, eds. Noise Manual. Revised 6th Edition. Falls Church, VA: American Industrial Hygiene Association (AIHA), 2022. (See Ch. 13)
	Baseline audiograms are collected within 30 days of employment for all workers who may be exposed to noise exceeding 50% of the OEL (Exposure categories 3 and 4).	X		
	Workers are not exposed to sound levels of 85 dBA or higher for 12 hours prior to baseline audiogram.	X		
	All employees identified in Categories 3 and 4 during exposure assessments will be included in the HLPP. Audiometric testing is performed annually for employees in exposure categories 3 and 4.	X		

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Audiometric Testing	A Standard Threshold Shift (STS) is a change in hearing threshold levels in one or both ears of an average of 10 decibels or more relative to the baseline at 2000, 3000 and 4000 Hz. (OSHA allows for application of age correction values first.) Annual audiograms that meet the STS criteria will be retested within 30 days of the annual audiogram and after a 14 hour quiet period. The worker will be judged to have incurred a Persistent Threshold Shift if the repeat audiogram meets the criteria for a STS. The Persistent Threshold Shift becomes the new baseline as determined by the professional supervisor (audiologist or physician). Baseline references are separate for each ear. Although age-corrections are allowed by some regulatory standards, use of age corrections is not recommended.	X		Occupational Safety and Health Administration (OSHA). "1910.95, Occupational Noise Exposure," 2008. https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.95. US Department of Health and Human Services. "Criteria for a recommended standard: Occupational noise exposure: Revised criteria (DHHS [NIOSH] Publication No. 98-126). Cincinnati, OH: Centers for Disease Control and Prevention." National Institute for Occupational Safety and Health (1998). Meinke, Deanna K., Elliott H. Berger, Dennis P. Driscoll, Richard L. Neitzel, and Kathryn Bright, eds. Noise Manual. Revised 6th Edition. Falls Church, VA: American Industrial Hygiene Association (AIHA), 2022. (See Ch. 13)
	An investigation is performed in an effort to identify the cause of each Persistent Threshold Shift and prevent its recurrence. The investigation addresses: 1) the adequacy of hearing protection rules and the worker's understanding of the rules, 2) hearing protection selection in view of the noise exposures, 3) hearing protection fit testing to verify the adequacy of attenuation, 4) the worker's capability to safely perform the job in view of the hearing loss, and 5) off-the-job noise exposures.	X		
	If an employee's audiogram indicates a work-related Standard Threshold Shift (STS) of 10 dB in one or both ears, and the employee's total hearing level is 25 decibels (dB) or more above audiometric zero (averaged at 2000, 3000, and 4000 Hz) in the same ear(s) as the STS, employer must record the case on the OSHA 300 Log.	X		
	Conduct semi-annual (2x per year) testing for workers exposed to more than 100 dBA TWA.		X	
	If hearing has been determined as an essential function of a specific job or task, consider job re-assignments or special accommodations for workers exhibiting work or non work-related hearing loss.	X		

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Audiometric Testing	Workers are provided with an assessment of their audiometric test results in a confidential and timely fashion. This may include if present the identification of a Persistent Threshold Shift or newly identified Hearing Impairment. Medical referrals are made where audiograms suggest a non-noise related condition.	X		Occupational Safety and Health Administration (OSHA). "1910.95, Occupational Noise Exposure," 2008. https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.95. US Department of Health and Human Services. "Criteria for a recommended standard: Occupational noise exposure: Revised criteria (DHHS [NIOSH] Publication No. 98-126). Cincinnati, OH: Centers for Disease Control and Prevention." National Institute for Occupational Safety and Health (1998). Meinke, Deanna K., Elliott H. Berger, Dennis P. Driscoll, Richard L. Neitzel, and Kathryn Bright, eds. Noise Manual. Revised 6th Edition. Falls Church, VA: American Industrial Hygiene Association (AIHA), 2022. (See Ch. 13)

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Noise Control Engineering	Engineering controls should be used as primary means to eliminate personal exposure. Noise control action plans are established to address the implementation of engineering controls. The action plans identify tasks, accountable individuals, resources and schedule.	X		Meinke, Deanna K., Elliott H. Berger, Dennis P. Driscoll, Richard L. Neitzel, and Kathryn Bright, eds. Noise Manual. Revised 6th Edition. Falls Church, VA: American Industrial Hygiene Association (AIHA), 2022. Office of the Under Secretary of Defense for Personnel and Readiness. "DOD INSTRUCTION 6055.12, HEARING CONSERVATION PROGRAM (HCP)," 2019. https://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodi/605512p.pdf%3Fver=2019-08-14-073309-537. NIOSH. "Buy Quiet," 2023. https://www.cdc.gov/niosh/topics/buyquiet/default.html. Jahn, Steven D., William H. Bullock, and Joselito S. Ignacio, eds. A Strategy for Assessing and Managing Occupational Exposures. 4th Edition. Falls Church, VA: American Industrial Hygiene Association (AIHA), 2015. (See Ch. 23)
	Prevention through Design: Newly planned operations, facilities and equipment are designed and selected in an effort to control noise exposures below the OEL.	X		
	Manufactured equipment is designed and verified to limit noise levels at or below 80 dBA at three feet. If this is not feasible, written information describing the noise levels is supplied to the customers, and warnings are affixed to the equipment.		X	
Performance Measures/ Evaluation	Periodic random inspections of hearing protection usage are conducted to address if the protection is used 1) where required, 2) when required, and 3) is worn properly. The target is 95% or more of observed workers were found to be properly wearing hearing protection.	X		
	The OEHS Manager tracks and reports the annual percentage of individuals exhibiting newly identified persistent threshold shifts.	X		
	The OEHS Manager tracks and reports the annual number of workers exhibiting newly identified noise-induced Hearing Impairments. The target is zero work-related noise-induced hearing loss.		X	

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Performance Measures/ Evaluation	The effective implementation of the Hearing Loss Prevention Program is reviewed annually through a self-assessment and any gaps revealed by the self-assessment are resolved.	X		
Recordkeeping	Retain noise exposure assessment (personal and area monitoring) indefinitely.	X		"AIHA Principles of Good Practice for Occupational Exposure Assessment." American Industrial Hygiene Association (AIHA), 2022. https://aiha-assets.sfo2.digitaloceanspaces.com/AIHA/resources/Get-Involved/AIHA-Guideline-Foundation-Standards-of-Care.pdf.
	Retain audiometric testing records for duration of employment, plus 30 years.	X		US Department of Health and Human Services. "Criteria for a recommended standard: Occupational noise exposure: Revised criteria (DHHS [NIOSH] Publication No. 98-126). Cincinnati, OH: Centers for Disease Control and Prevention." National Institute for Occupational Safety and Health (1998). Meinke, Deanna K., Elliott H. Berger, Dennis P. Driscoll, Richard L. Neitzel, and Kathryn Bright, eds. Noise Manual. Revised 6th Edition. Falls Church, VA: American Industrial Hygiene Association (AIHA), 2022. (see Ch. 19, Table 19-2)

AIHA | GUIDELINE FOUNDATION

Principles of Good Practice

Section 4:

Respiratory Protection Programs

For the Industrial Hygienist/Occupational Hygienist (IH/OH)

aiha.org

Version 1 | October 1, 2024

Principles of Good Practice Documents

The PGP are organized by OEHS areas of practice in a concise, easy-to-use table format. They are published as they are developed for each area of practice and are designed to be kept "evergreen" via regular updates. Refer to Section 1 for PGP use and limitations.

Currently, PGP have been documented for the following areas of practice:

OEHS Area of Practice/ PRP Authors and Contributors	Date	
	Initial Publication	Most Recent Update
Respiratory Protection Committee **PGP Version 1** **PGP AG Members:** Stephanie Carter, James Speckhart, Kelly Tuttle, John Mulhausen **RPC PGP Subteam:** David Abrams, Steven Briggs, Margaret Sietsema, Jessica Tredinnick	10/1/24	11/14/24

AIHA PRINCIPLES OF GOOD PRACTICE for RESPIRATORY PROTECTION PROGRAMS

v1.0 - 07/05/2024

Objective

The AIHA Principles of Good Practice for Respiratory Protection aims to document a concise, easy-to-use summary of minimum recommended elements for a workplace Respiratory Protection Program that incorporates best risk management practices, whenever feasible. Note: Readers should also refer to the AIHA Principles of Good Practice for Occupational Exposure Assessment, where many elements apply to workplace respiratory exposures.

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Scope and Objectives)	The PGP for Respiratory Protection Programs seeks to ensure that respirator use in the workplace provides adequate protection from airborne hazards, is safe for users, and is part of a continuously improving risk management program focused on moving up the hierarchy of controls.	X		Technical Framework: A Resource for Respiratory Protection Programs. AIHA, 2022 ASTM F3387 – 19 Standard Practice for Respiratory Protection (2019) Small Entity Compliance Guide for the Respiratory Protection Standard (OSHA 3384 -09 2011) https://www.osha.gov/sites/default/files/publications/3384small-entity-for-respiratory-protection-standard-rev.pdf OSHA 1910.134
	The PGP for Respiratory Protection Programs scope does not include the use of face coverings or "masks" as devices for infectious agent source control. NOTE: industrial hygienists and respirator program administrators who are asked to provide guidance and leadership in the selection and use of face coverings in the workplace will find ASTM F3502-24 to be a useful reference.	X		ASTM F3502-24 - Standard Specifications for Barrier Face Coverings (2024)

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Written Program	The organization maintains a written Respiratory Protection program that covers required and/or voluntary respirator use, as well as routine and emergency practices. The program identifies scope and objectives, roles and responsibilities, and describes processes for managing the program, including the aspects covered in this PGP. NOTE: An example written program can be found in Attachment A of the Small Entity Compliance Guide for the Respiratory Protection Standard (OSHA 3384 -09 2011)	X		Technical Framework: A Resource for Respiratory Protection Programs. AIHA, 2022 ASTM F3387-19 Standard Practice for Respiratory Protection (2019) ASTM F3537 Standard Guide for Respirator Fit Testing Methods (2021) Small Entity Compliance Guide for the Respiratory Protection Standard (OSHA 3384 -09 2011) https://www.osha.gov/sites/default/files/publications/3384small-entity-for-respiratory-protection-standard-rev.pdf
	The written program is readily available to any employee included in the program.	X		ASTM F3387-19 Standard Practice for Respiratory Protection (2019) Hospital Respiratory Protection Program Toolkit: Resources for Respirator Program Administrators, NIOSH, APRIL 2022
Program Administrator	Basic Characterization is completed first -- information for characterizing exposures is gathered on the workplace, work force, and environmental agents. Basic Sound Survey and Interviews should be conducted to group workers based on exposures so that full-shift sampling can be completed.	X		Technical Framework: A Resource for Respiratory Protection Programs. AIHA, 2022 Hospital Respiratory Protection Program Toolkit: Resources for Respirator Program Administrators, NIOSH, APRIL 2022
Hazard Evaluation	Exposures to hazards are anticipated, assessed, and documented in accordance with the AIHA Guideline Foundation Occupational Exposure Assessment PGP.	X		AIHA Guideline Foundation Principles of Good Practice for Occupational Exposure Assessment v2.0 - 05/02/24
	Evaluation of the potential for IDLH (Immediately Dangerous to Life or Health) atmospheres includes the identification of failure conditions that may result in IDLH atmospheres as well as a specific assessment of the need for adequate equipment fail-safe and redundancy.	X		ASTM F3387-19 Standard Practice for Respiratory Protection (2019)

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Respirator Selection	Respirators are selected appropriate to the agents' properties, hazards, potential exposures, and specific conditions of use as assessed and documented in the hazard evaluation. They provide an assigned protection factor appropriate to the agents' known or anticipated potential exposure levels. NOTE: A checklist for respirator selection can be found in Attachment 2 of the Small Entity Compliance Guide for the Respiratory Protection Standard (OSHA 3384 -09 2011) NOTE: Consistent with the Occupational Exposure Assessment PGP, assigned protection factors should be defined to lower worker exposures such that their 95th percentile exposures are less than the OEL with at least 70 percent confidence.	X		NIOSH Pocket Guide to Chemical Hazards. Last Reviewed: February 18, 2020. https://www.cdc.gov/niosh/npg/ NIOSH Respirator Selection Logic 2004 ASTM F3387-19 Standard Practice for Respiratory Protection (2019) Assigned Protection Factors for the Revised Respiratory Protection Standard - OSHA 3352-02 2009. https://www.osha.gov/sites/default/files/publications/3352-APF-respirators.pdf Small Entity Compliance Guide for the Respiratory Protection Standard (OSHA 3384 -09 2011) https://www.osha.gov/sites/default/files/publications/3384small-entity-for-respiratory-protection-standard-rev.pdf AIHA Guideline Foundation Principles of Good Practice for Occupational Exposure Assessment v2.0 - 05/02/24
	There is an inventory of respirator use for the organization that describes the operations and agents for which respirators are used, the specific types of respirators selected for each operation / agent, the rational for the respirator selection, and change out schedules for air purifying respirators.	X		Hospital Respiratory Protection Program Toolkit: Resources for Respirator Program Administrators, NIOSH, APRIL 2022 ASTM F3387 – 19 Standard Practice for Respiratory Protection (2019)
	Respirators selected do not impede workers with corrected vision or are equipped with adapters to allow for the use of corrected vision equipment.	X		Small Entity Compliance Guide for the Respiratory Protection Standard (OSHA 3384 -09 2011) https://www.osha.gov/sites/default/files/publications/3384small-entity-for-respiratory-protection-standard-rev.pdf

Respirator Selection	Respirators selected are approved by NIOSH or other appropriate respirator approval or certification authority.	X		NIOSH Certified Equipment List https://www.cdc.gov/niosh/npptl/topics/respirators/cel/default.html OSHA 1910.134 Small Entity Compliance Guide for the Respiratory Protection Standard (OSHA 3384 -09 2011) https://www.osha.gov/sites/default/files/publications/3384small-entity-for-respiratory-protection-standard-rev.pdf NIOSH Guide to the Selection and Use of Particulate Respirators Certified Under 42 CFR 84. DHHS (NIOSH) PUBLICATION NUMBER 96-101. JANUARY 1996. https://www.cdc.gov/niosh/docs/96-101/default.html#print NIOSH [2023]. How to Tell if Your N95® Respirator is NIOSH Approved. Video. By Kiederer M, McCleery T, Lybrand E, Coop B, Magnafichi D, Cichowicz, J, Casey M, Cauley J. Pittsburgh, PA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2023-120: https://www.cdc.gov/niosh/docs/video/2023-120/?s_cid=3ni7d2_RPW_N95_approval_2022
	For potential IDLH or oxygen deficient exposure conditions caused by the presence of toxic materials or a reduced percentage of oxygen, only full-face-piece, pressure-demand self-contained breathing apparatus or supplied-air respirators with auxiliary self-contained air supply are selected. These devices must be approved for entry into and escape from the hazardous environment.	X		NIOSH Respirator Selection Logic 2004

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Medical Evaluation	Evaluations designed to medically certify employees for each specific respirator use are performed by a licensed healthcare professional of all employees required to use respirators prior to use and fit testing. Medical evaluations consider pulmonary and cardiac capability as well as psychological and physical fitness appropriate to the specific respirator and use conditions. Medical certification is also required for employees who voluntarily use respirators other than filtering facepieces. NOTE: A checklist for medical evaluation can be found in Attachment 2 of the Small Entity Compliance Guide for the Respiratory Protection Standard (OSHA 3384 -09 2011)	X		ASTM F3620 – 22 Standard Practice for Respiratory Protection—Respirator Use—Physical Qualifications for Personnel (2022). Small Entity Compliance Guide for the Respiratory Protection Standard (OSHA 3384 -09 2011) https://www.osha.gov/sites/default/files/publications/3384small-entity-for-respiratory-protection-standard-rev.pdf OSHA 1910.134
	Medical certification is required for all employees who voluntarily use respirators -including filtering facepieces.		X	

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Medical Evaluation	Follow-up medical evaluations are performed periodically with a frequency that is age specific, for example, every five years up to age 35, then every two years until age 45, and annually thereafter.	X		Hospital Respiratory Protection Program Toolkit: Resources for Respirator Program Administrators, NIOSH, APRIL 2022 10.1.1 in ASTM F3620-22 Standard Practice for Respiratory Protection - Respirator Use - Physical Qualifications for Personnel (2022) Minnesota Department of Health "Medical Screening: Respiratory Protection" https://www.health.state.mn.us/facilities/patientsafety/infectioncontrol/rpp/comp/evaluation.html#:~:text=Some%20recommendations%3A,years%20of%20age%2C%20every%20year Chapter 9 – US Navy Industrial Hygiene Field Operations Manual = Technical Manual NMCPHC-TM6290.91-2 13 SEP 21 https://www.med.navy.mil/Navy-and-Marine-Corps-Force-Health-Protection-Command/Environmental-Health/Industrial-Hygiene/Program-Support/Industrial-Hygiene-Field-Operations-Manual-IHFOM/ ASTM F3387 – 19 Standard Practice for Respiratory Protection (2019)

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Fit Testing	Qualitative fit testing is performed and documented prior to use and annually for each specific model and size of tight-fitting respirator that each employee uses to ensure that the respirator will provide adequate protection. If an individual fails a fit test for a specific respirator, then they cannot use that respirator and alternate solutions must be found (e.g. another size of the same respirator, a similar respirator from another manufacturer, a respirator that provides protection without the need for a tight face-fit) Qualitative fit testing may only be used to fit test negative pressure air-purifying respirators that must achieve a fit factor of 100 or less (APF of 10 or less) or will be used in situations when the air concentration is less than 10 times the exposure limit. NOTE: A checklist for respirator fit testing can be found in Attachment 2 of the Small Entity Compliance Guide for the Respiratory Protection Standard (OSHA 3384 -09 2011)	X		ASTM F3537 – 21 Standard Guide for Respirator Fit Testing Methods (2021) Small Entity Compliance Guide for the Respiratory Protection Standard (OSHA 3384 -09 2011) https://www.osha.gov/sites/default/files/publications/3384small-entity-for-respiratory-protection-standard-rev.pdf Technical Framework: A Resource for Respiratory Protection Programs. AIHA, 2022 OSHA Standard 1910.134(f)(6)
	Respirator wearers who are being fist-tested for the first time with a specific model and/or brand of respirator will don the respirator for about five minutes prior to the fit testing in order to make adjustments to achieve a comfortable fit. Another respirator will be made available for the wearer to try in cases where they found the first respirator to be uncomfortable.	X		7.6.3 in ASTM F3537 – 21 Standard Guide for Respirator Fit Testing Methods (2021)

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Fit Testing	When performing qualitative fit testing, irritant smoke is not used as the challenge agent and sensitivity testing to the challenge agent is performed prior to fit testing.	X		U.S. National Institute of Occupational Safety and Health (NIOSH) Health Hazard Evaluation report, HETA 93-0040-2315, Anchorage Fire Department. May 1993. https://www.cdc.gov/niosh/hhe/reports/pdfs/1993-0040-2315.pdf NIOSH Respirator Use Policy Statement, August 4 1999 In: NIOSH policy statements. Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health. (included as appendix here, pg. 27): https://www.cdc.gov/niosh/docs/2005-100/pdfs/2005-100.pdf) NIOSH Respirator Selection Logic 2004 - Appendix
	Fit tested of workers is completed while they wear any applicable safety equipment that may be worn during actual respirator use which could interfere with respirator fit.	X		OSHA 1910.134 Appendix A
	Fit testing is performed by a trained and qualified individual who's competency has been verified by the Respirator Program Administrator. NOTE: A form for evaluating the knowledge of fit test operators can be found in Annex A2 of ASTM F3537 – 21	X		ASTM F3537 – 21 Standard Guide for Respirator Fit Testing Methods (2021)
	Fit testing is performed by an individual, who has either a.) achieved a fit tester qualification (e.g. Fit2Fit in the UK, RESP-FIT in Australia, or similar) or b.) has completed a comprehensive in-person educational program on qualitative fit testing.		X	

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Fit Testing	Instead of qualitative fit testing, quantitative fit testing is performed and documented prior to use and annually for each specific type of tight-fitting respirator that each employee uses to ensure that the respirator will provide adequate protection. When quantitative fit testing is used to fit negative pressure respirators, a minimum fit factor of 100 is achieved for tight-fitting half-face piece respirators and 500 for full-face piece respirators. If an individual fails a fit test for a specific respirator, then they cannot use that respirator and alternate solutions must be found (e.g. another size of the same respirator, a similar respirator from another manufacturer, a respirator that provides protection without the need for a tight face-fit)		X	ASTM F3537 – 21 Standard Guide for Respirator Fit Testing Methods (2021) OSHA 29 CFR 1910.134
	When negative pressure respirators are intended to protect employees from contaminant concentrations greater than 10 times the OEL, then quantitative fit testing is performed and documented prior to use and annually for each specific model and size of respirator that each employee uses to ensure that the respirator will provide adequate protection. A minimum fit factor of 100 is achieved for tight-fitting half facepieces and 500 for full facepieces. If an individual fails a fit test for a specific respirator, then they cannot use that respirator and alternate solutions must be found (e.g. another size of the same respirator, a similar respirator from another manufacturer, a respirator that provides protection without the need for a tight face-fit)	X		Small Entity Compliance Guide for the Respiratory Protection Standard (OSHA 3384 -09 2011) https://www.osha.gov/sites/default/files/publications/3384small-entity-for-respiratory-protection-standard-rev.pdf ASTM F3537 – 21 Standard Guide for Respirator Fit Testing Methods (2021)
	Fit testing of tight-fitting atmosphere-supplying respirators and tight-fitting powered air-purifying respirators shall be accomplished by performing quantitative or qualitative fit testing in the negative pressure mode, regardless of the mode of operation (negative or positive pressure) that is used for respiratory protection.	X		OSHA Standard 1910.134(f)(8)

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Fit Testing	Fit testing is not performed on any employee having facial hair or other impediment that may interfere with proper sealing of a tight-fitting respirator or proper functioning of its valves. NOTE: Example Facial Hair Policy Statement: "Facial hair or any other condition or article of clothing is not permitted in the sealing area of a tight-fitting respirator or allowed to interfere with respirator valve function. Respirator fit testing shall not be conducted on people for whom this is the case."	X		ASTM F3537 – 21 Standard Guide for Respirator Fit Testing Methods. (2021). Technical Framework: A Resource for Respiratory Protection Programs. AIHA, 2022
	Fit testing is performed and documented after any physical changes that may affect fit (e.g. significant change in weight, change to the face in the sealing area, dental changes, discomfort) to ensure that the respirator will provide adequate protection. If an individual fails a fit test for a specific respirator, then they cannot use that respirator and alternate solutions must be found (e.g. another size of the same respirator, a similar respirator from another manufacturer, a respirator that provides protection without the need for a tight face-fit)	X		ASTM F3537 – 21 Standard Guide for Respirator Fit Testing Methods. (2021). Hospital Respiratory Protection Program Toolkit: Resources for Respirator Program Administrators, NIOSH, APRIL 2022
Training	Respirator training is provided and documented for each employee that uses a respirator prior to use and annually thereafter and includes the following elements: physiological limitations created by the use of respirators; the functions, capabilities, and limitations of assigned respirators; understanding of the specific respirator hazards for which the respirators are providing protection; applicable cartridge/filter change-out schedules; procedures for inspection, maintenance, cleaning, and storage of respirators; proper use of tight-fitting respirators - including factors that can interfere with proper fit; proper respirator donning, doffing, user-seal checks, and what to do when a user-seal check fails. NOTE: A checklist for respirator training can be found in Attachment 2 of the Small Entity Compliance Guide for the Respiratory Protection Standard (OSHA 3384 -09 2011)	X		ASTM F3387 Standard Practice for Respiratory Protection (Aug 2019) Small Entity Compliance Guide for the Respiratory Protection Standard (OSHA 3384 -09 2011) https://www.osha.gov/sites/default/files/publications/3384small-entity-for-respiratory-protection-standard-rev.pdf Technical Framework: A Resource for Respiratory Protection Programs. AIHA, 2022 OSHA 1910.134

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Training	Respirator training is conducted more frequently than annually (e.g. quarterly) when SCBAs are used for emergency response and/ or when inadequacies in the employee's knowledge or use of the respirator indicate that the employee has not retained the requisite understanding or skill.		X	NFPA 1404, Standard for Fire Service Respiratory Protection Training. 2018.
	Respirator training is provided on the set-up, proper use, functionality, and operation of supplied air systems, including the systems that provide breathing air to the wearer such as bottle stations or compressors, any associated alarms, and actions to take should the alarms be activated.	X		ASTM F3387 – 19 Standard Practice for Respiratory Protection (2019) Small Entity Compliance Guide for the Respiratory Protection Standard (OSHA 3384 -09 2011) https://www.osha.gov/sites/default/files/publications/3384small-entity-for-respiratory-protection-standard-rev.pdf
	Respirator program training is provided to those who supervise employees who wear respirators. The supervisor training includes: knowledge of respirators; the organization's respiratory protection program and respiratory protection practices; selection and use of respirators used to protect workers under their supervision; the nature and extent of the respiratory hazards to which their workers may be exposed; and the supervisor's role in ensuring that employees are adequately protected by the respirator program.		X	ASTM F3387 – 19 Standard Practice for Respiratory Protection (2019)

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Proper Respirator Use	Worksite specific procedures for proper use of respirators are documented and correctly followed, including proper respirator donning and doffing; user-seal check procedures; change-out schedules; signs to be aware of that indicate respirators may be failing to protect; proper respirator storage and maintenance; proper disposal of used cartridges, filters, and canisters; personal medical conditions that can interfere with respirator use; and conditions that require emergency exit from a work area. NOTE: A checklist for proper use of respirators can be found in Attachment 2 of the Small Entity Compliance Guide for the Respiratory Protection Standard (OSHA 3384 -09 2011) NOTE: Procedures for conducting a user seal check, to be performed by respirator users each time they put on a respirator, can be found in Appendix B-1: User Seal Check Procedures (Mandatory) of OSHA 1910.134.	X		ASTM F3387 – 19 Standard Practice for Respiratory Protection (2019) Small Entity Compliance Guide for the Respiratory Protection Standard (OSHA 3384 -09 2011) https://www.osha.gov/sites/default/files/publications/3384small-entity-for-respiratory-protection-standard-rev.pdf Technical Framework: A Resource for Respiratory Protection Programs. AIHA, 2022 OSHA 1910.134 Appendix B-1
	Procedures are documented and correctly followed for proper set-up, use, functionality, and operation of supplied air systems, including the systems that provide breathing air to the wearer such as bottle stations or compressors.	X		ASTM F3387 – 19 Standard Practice for Respiratory Protection (2019) OSHA 1910.134(i)(8)
Storage, Maintenance, Disposal	Procedures and schedules for the storage, inspection, maintenance, cleaning and disinfection of respirators are documented and correctly followed. NOTE: A checklist for respirator maintenance and care can be found in Attachment 2 of the Small Entity Compliance Guide for the Respiratory Protection Standard (OSHA 3384 -09 2011)	X		ASTM F3387 – 19 Standard Practice for Respiratory Protection (2019) Small Entity Compliance Guide for the Respiratory Protection Standard (OSHA 3384 -09 2011) https://www.osha.gov/sites/default/files/publications/3384small-entity-for-respiratory-protection-standard-rev.pdf Technical Framework: A Resource for Respiratory Protection Programs. AIHA, 2022
	Facilities, equipment, and supplies for appropriate storage, maintenance, cleaning and disinfection of respirators are provided in a section of the workplace that is free of hazards.	X		

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Program Evaluation	Regular evaluations (at least annually) are performed and documented by a knowledgeable person not directly associated with the program for each aspect of the respirator program.	X		Technical Framework: A Resource for Respiratory Protection Programs. AIHA, 2022 ASTM F3387 – 19 Standard Practice for Respiratory Protection (2019) Small Entity Compliance Guide for the Respiratory Protection Standard (OSHA 3384 -09 2011) https://www.osha.gov/sites/default/files/publications/3384small-entity-for-respiratory-protection-standard-rev.pdf
	Regular respirator program evaluations include input from a variety of stakeholders, including respirator users.	X		
	Regular assessments are conducted and documented to verify that employees are using respirators for operations / agents as specified in the respirator program and that they are using the respirators correctly.	X		ASTM F3387 – 19 Standard Practice for Respiratory Protection (2019)
	Frequent random assessments are conducted and documented to verify that employees are using respirators for operations / agents as specified in the respirator program and that they are using the respirators correctly.		X	ASTM F3387 – 19 Standard Practice for Respiratory Protection (2019)
	Program improvement plans are developed and implemented based on the outcomes of the evaluations and assessments.	X		NIOSH Technical Guide: NIOSH Guide to Industrial Respiratory Protection, 1987
Recordkeeping	Records are maintained for each aspect of the respirator program, including the current written program and the most recent fit test record.	X		OSHA Standard1910.134(m). https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.134 Technical Framework: A Resource for Respiratory Protection Programs. AIHA, 2022

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Recordkeeping	Employee medical evaluation records are kept for at least the duration of employment plus thirty (30) years.	X		OSHA Standard1910.134(m). https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.134 Technical Framework: A Resource for Respiratory Protection Programs. AIHA, 2022
Supplied Air Respirators	Breathing air supplied by compressors that are oil-lubricated or powered by internal combustion engines are equipped with continuous CO monitoring and alarm, high temperature alarm, and flow rate confirmation. Alarms are detectable by the wearers. NOTE: A checklist for breathing air quality and use can be found in Attachment 2 of the Small Entity Compliance Guide for the Respiratory Protection Standard (OSHA 3384 -09 2011)	X		ASTM F3387 – 19 Standard Practice for Respiratory Protection (2019) Small Entity Compliance Guide for the Respiratory Protection Standard (OSHA 3384 -09 2011) https://www.osha.gov/sites/default/files/publications/3384small-entity-for-respiratory-protection-standard-rev.pdf 29 CFR 1910.134(i)(4)
	Breathing air supplied by compressors having air intakes that can draw air from areas that may be significantly contaminated by exhaust from internal combustion engine vehicles (high traffic areas, vehicle bays, loading docks etc.) are equipped with continuous CO monitoring and alarms that are detectable by the wearers.		X	
	Compressor breathing air is monitored quarterly to ensure Grade D quality and appropriate moisture content (dew point at 1 atm is 10 degrees F below the ambient air)	X		CSA Z180.1-2019 - Compressed Breathing Air And Systems (6 month testing) CGA G-7.1-2018 - Commodity Specification For Air - Seventh Edition
	Cylinders of breathing air must have a certificate of analysis from the manufacturer indicating the air meets Grade D. Moisture content cannot exceed a dew point of -50 degrees F at 1 atm	X		29 CFR 1910.134(i)(4) CGA G-7.1-2018 - Commodity Specification For Air - Seventh Edition Chapter 296-842 Washington State Administrative Code (WAC) - Safety Standards for Respirators

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Supplied Air Respirators	Cylinders of Reconstituted or Synthetic Air (produced by blending liquid or gaseous nitrogen and oxygen in the proper proportions) are tested for appropriate oxygen content when received on site before being put into service.	X		ASTM F3387 – 19 Standard Practice for Respiratory Protection (2019) Chapter 296-842 Washington State Administrative Code (WAC) - Safety Standards for Respirators
	All cylinders of breathing air are tested for appropriate oxygen content when received on site before being put into service.		X	
	Airline supplied air respirators used in IDLH environments must be pressure demand or other positive pressure supplied air respirator with auxiliary SCBA.	X		ASTM F3387 – 19 Standard Practice for Respiratory Protection (2019) NIOSH Respirator Selection Logic 2004
	Air supplying respirator systems such as bottle or compressor systems are certified by a recognized certification agency (NIOSH, MSHA, etc.) and are used without modification or adaptations. This includes all harnesses, hoses, fittings, high and low pressure regulators, and warning devices.	X		42 CFR 84 Subpart J
	No asphyxiating substance shall be introduced into breathing air lines. Air supply fittings are not compatible with, and cannot be activated by, any other compressed gas system fittings in use by the organization. Practices are in place to ensure vendor and contractor airline systems are not compatible with, and cannot be activated by, host compressed gas system fittings.	X		OSHA 1910.134
Voluntary Use of Respirators	Voluntary use of respirators is assessed to ensure that the respirators are appropriate for the hazard and that their use does not in itself create a hazard	X		OSHA Standard 1910.134 Small Entity Compliance Guide for the Respiratory Protection Standard (OSHA 3384 -09 2011) https://www.osha.gov/sites/default/files/publications/3384small-entity-for-respiratory-protection-standard-rev.pdf

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Voluntary Use of Respirators	Employees may provide their own respirators for voluntary use provided that: 1) exposures are within acceptable limits, 2) the respirators are intended for protection from the hazards for which they are used, 3) the respirators are used appropriately, 4) use of the respirators does not increase safety and health risks, and 5) they are provided with the basic information on proper respirator use. NOTE: Basic information to be provided is summarized in OSHA Standard 1910.134 Appendix D and includes 1) adhering to instructions provided by the respirator manufacturer; 2) choosing respirators certified for use against the contaminant of concern; 3) not using a respirator for protection from contaminants for which it is not designed to protect against; and 4) preventing the mistaken use someone else's respirator.	X		OSHA Standard 1910.134 Appendix D Small Entity Compliance Guide for the Respiratory Protection Standard (OSHA 3384 -09 2011) https://www.osha.gov/sites/default/files/publications/3384small-entity-for-respiratory-protection-standard-rev.pdf
	Employers provide respirators for voluntary use, along with all relevant information on their safe and effective use. NOTE: People using respirators as provided by the employer for voluntary use must be enrolled in the full respirator protection program, including medical evaluation and fit testing.		X	"AIHA Principles of Good Practice for Occupational Exposure Assessment." American Industrial Hygiene Association (AIHA), 2022. https://aiha-assets.sfo2.digitaloceanspaces.com/AIHA/resources/Get-Involved/AIHA-Guideline-Foundation-Standards-of-Care.pdf.
	Medical certification is required for employees who voluntarily use respirators other than filtering facepieces.	X		OSHA Standard 1910.134 Small Entity Compliance Guide for the Respiratory Protection Standard (OSHA 3384 -09 2011) https://www.osha.gov/sites/default/files/publications/3384small-entity-for-respiratory-protection-standard-rev.pdf
	Medical certification is required for all employees who voluntarily use respirators -including filtering facepieces.		X	

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	References
	Processes are in place to ensure proper cleaning, storage, maintenance, and disposal of voluntary use respirators.	X		OSHA Standard 1910.134 Small Entity Compliance Guide for the Respiratory Protection Standard (OSHA 3384 -09 2011) https://www.osha.gov/sites/default/files/publications/3384small-entity-for-respiratory-protection-standard-rev.pdf

AIHA | GUIDELINE FOUNDATION

Principles of Good Practice

Section 5:

Legionella and Waterborne Pathogens

For the Industrial Hygienist/Occupational Hygienist (IH/OH)

aiha.org

Version 1 | November 3, 2025

Principles of Good Practice Documents

The PGP are organized by OEHS areas of practice in a concise, easy-to-use table format. They are published as they are developed for each area of practice and are designed to be kept "evergreen" via regular updates. Refer to Section 1 for PGP use and limitations.

Currently, PGP have been documented for the following areas of practice:

OEHS Area of Practice/ PGP Authors and Contributors	Date	
	Initial Publication	Most Recent Update
Indoor Environmental Quality Committee ***Legionella* and Waterborne Pathogens PGP Version 1** **PGP AG Members:** Larry Sloan, Michele Twilley **IEQC PGP Subteam:** David Krause, Alex LeBeau, Robert McNeely, Deborah Jaeger, Jack Springston, David Miller, Donald Weekes, Eric Brown, Cheri Marcham, David Brinkerhoff and Kadeem Hill.	11/3/2025	11/3/2025

Preamble

This guidance identifies the foundational knowledge and background information needed to reliably assess the risk of *Legionella* and other Waterborne Pathogen contamination in building water systems.

Before working on facility water issues, offering consultation, or providing technical services related to the assessment of water sources for *Legionella* and other waterborne pathogens, or in support of a disease outbreak investigation, practitioners, referred throughout this guidance as Competent Technicians and Competent Professionals, should possess basic knowledge of the biology, ecology, and pathogenic risks of common waterborne pathogens. Individuals should seek out and attend reliable education and training courses, read relevant reference texts and guidelines, and work under the guidance and supervision of competent professionals before practicing independently in this area. This information and education will allow the practitioner to gain the experience necessary to safely and reliably investigate possible sources of amplification and exposure or assess the risk of amplification and disease transmission. When assessments are performed or guidance ins provided without sufficient knowledge, sources of amplification can be missed, exposures to pathogens can continue, and additional cases of disease can occur. (1-4)

Practitioners need to possess knowledge of the biology, ecology, and pathogenic risks of *Legionella*, *Pseudomonas*, and nontuberculous mycobacteria (NTM). (5-11)

Practitioners need to have knowledge about diseases caused by *Legionella* (i.e., Legionnaires' disease and Pontiac Fever, referred to collectively as Legionellosis), how it is transmitted, disease signs and symptoms, and the known risk factors for contracting Legionellosis. (12-15)

Competent Technicians and Competent Professionals should also possess knowledge of respiratory diseases resulting from exposure to aerosols containing *Pseudomonas* and NTM. (5,6,11,12)

Practitioners must understand and can describe the chain of events and conditions that are known to cause Legionnaires' disease. (13, 14)

Practitioners should also know the history of Legionnaires' disease, and particularly about the seminal outbreak in 1976.

Competent Professionals should understand how Legionnaires' disease is clinically diagnosed, how different clinical diagnostic methods relate to interpretation of environmental sampling methods, and how Legionnaires' disease cases are classified and investigated by public health authorities. (15-17)

The PGPs described throughout this document are intended to apply to the assessments of any waterborne pathogen, with a focus on *Legionella* species, *Pseudomonas* species, and NTMs. Because there is more historical knowledge about *Legionella* in building water systems and sources than for other waterborne pathogens, *Legionella* is used as an exemplar or proxy for the assessment of all waterborne pathogens.

Where specific pathogens exhibit differences in ecology, risks, or assessment practices, the practitioner must act accordingly. As more information becomes available and is published on the assessment, prevalence, and prevention of contaminated water sources and systems by *Pseudomonas* species, NTMs, and other waterborne pathogens, this guide will be updated accordingly to cite and reference credible sources. It is incumbent upon the practitioner, whether at the Technician level or Professional level, to stay informed and up-to-date on research, publications, and practices affecting the assessment, prevention, and control of waterborne pathogens.

The guidance presented here is relevant to the following.

- Performing inventories and assessments of water sources and building water systems to identify risk factors for the colonization and amplification of waterborne pathogens and for possible aerosolization of infectious agents and hazardous substances.
- Assessing microbiological sources within cooling towers, decorative water features, green walls, and other recognized sources that may be external to the premise plumbing or the specific building but are served by the building's water system.
- When remediation of pathogen sources is necessary; assessing residual levels of biological contamination (i.e. waterborne pathogens) after remediation efforts are performed in premise plumbing systems, cooling towers, recreational spas, and other sources of pathogen amplification to validate their effectiveness and determine if further actions are needed.

This PGP includes a "Performed by:" column in indicate whether a risk critical task must be performed by a competent professional (CP), is typically performed by a competent technician (CT), or is typically performed by both (CT/CP). It should be noted that risk critical tasks designated as typically performed by a competent technician may be performed by a competent professional should a competent technician not be available, but that competent technicians should not perform risk critical tasks that must be performed by a competent professional.

AIHA PRINCIPLES OF GOOD PRACTICE for LEGIONELLA AND WATERBORNE PATHOGENS

v1.0 - 11/03/2025

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	Performed by:	References
Chapter 1	**Scope and Objective**				
Scope and Objectives)	The AIHA Principles of Good Practice (PGP) for Assessing *Legionella* and Other Waterborne Pathogens is directed at preventing illness and disease in workers and members of the community from aerosol exposures to waterborne pathogens in water sources and systems controlled or managed in the workplace. This is achieved through the efforts of Competent Professionals (CPs) and Competent Technicians (CTs), collectively referred to as "Practitioners." Collectively, their responsibility is to recognize, assess, and manage all building water systems for risk factors, and to monitor (i.e., sampling) them for signs of colonization and amplification by pathogenic organisms, including but not limited to *Legionella* species, *Pseudomonas* species, and nontuberculous mycobacteria (NTM).	X		**CT/CP**	Section 1.0: AIHA *Legionella* Guidelines 2nd Edition CDC 2021: Developing a WMP for *Legionella*
	Note: The PGP does not address unknown atypical sources of amplification or exposure, person-to-person transmission of waterborne pathogens (which is not currently recognized to occur), transmission via improperly sterilized medical instruments or devices, or pathogen transmission via pathways beyond inhalation or aspiration.				

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	Performed by:	References
Chapter 2	**Assessing Building Water Sources & Systems to Identify Risk Factors**				
Assessing Building Water Sources & Systems to Identify Risk Factors	*Legionella* Source Risk Assessments (LSRAs) and Waterborne Pathogen Source Risk Assessments (WPSRAs) are performed by Competent Technicians (CTs) under the supervision of, a Competent Professional (CP), or directly by a CP who has been trained, and has demonstrated competence, in assessment methodologies, technically sound measurement and sampling techniques, and interpretation of sample results.	X		**CT/CP**	Chapter 7: AIHA *Legionella* Guidelines 2nd Edition AIHA Technical Framework (pp 11-26): section on *Legionella* knowledge levels
	Prepare an assessment strategy and sampling plan for *Legionella* or other waterborne pathogens of concern. Establish the scope of the assessment, which water systems and sources must be assessed, and how to identify risk factors for pathogen growth and transmission via aerosols for both routine and investigative risk assessments.	X		**CP**	Section 7.0: AIHA *Legionella* Guidelines 2nd Edition
	Perform the sampling and risk assessment tasks that have been prescribed or recommended by a CP in the assessment strategy and sampling plan. Provide reliable data, measurements, and observations.	X		**CT**	Section 7.2: AIHA *Legionella* Guidelines 2nd Edition
	Review facility plans, drawings, and other information necessary to perform a building water system assessment safely and efficiently.	X		**CT**	Section 7.2: AIHA *Legionella* Guidelines 2nd Edition AIHA Technical Framework: *Legionella*
	Identify and document potential sources of water that can harbor pathogen growth (amplification) and may be capable of producing aerosols.	X		**CT**	Section 7.2: AIHA *Legionella* Guidelines 2nd Edition AIHA Technical Framework: *Legionella*

Assessing Building Water Sources & Systems to Identify Risk Factors	Identify the potable water service of a building and trace how water flows from the municipal water supply entry point to distal termination sites within the facility. Prepare a building water system process flow diagram that accurately and simply depicts the building's water distribution system and how water flows through the building.	X		**CT**	Section 7.2: AIHA *Legionella* Guidelines 2nd Edition AIHA Technical Framework: *Legionella* 6.2.3 and Appendix A (A.3) ASHRAE 188-2021
	Identify and document non-potable water service, systems, and sources that can harbor pathogen growth (amplification) and may be capable of producing aerosols (i.e., fire suppression systems, hot water service, bathing facility water and treatment systems, and HVAC systems).	X		**CT**	Section 7.2: AIHA *Legionella* Guidelines 2nd Edition AIHA Technical Framework: *Legionella*
	Identify and document how plumbing lines serving non-potable systems are prevented from back flowing into potable service lines.	X		**CT**	Section 7.2: AIHA *Legionella* Guidelines 2nd Edition AIHA Technical Framework: *Legionella*
	Document observations of building water systems and water quality that can indicate an increased risk of waterborne pathogen growth.	X		**CT**	Section 7.2: AIHA *Legionella* Guidelines 2nd Edition
	Survey a building's water systems to identify potential *Legionella* (or other waterborne pathogens) amplification and transmission sources.	X		**CT**	Section 7.2: AIHA *Legionella* Guidelines 2nd Edition AIHA Technical Framework: *Legionella*
	Provide recommendations for repairing deficiencies and mitigating immediate risks of *Legionella* transmission.	X		**CP**	Section 7.1: AIHA *Legionella* Guidelines 2nd Edition Pg. 11: AIHA Technical Framework: *Legionella*
	Recommend further investigation of water systems to assess malfunctions or deficiencies that will be conveyed to the Water Management Team or Public Health Authorities.	X		**CP**	
	Compile, interpret and report the findings and observations of a building water systems assessment to stakeholders. Provide substantive and direct recommendations for testing, sampling, modification, or closure of a water source based upon the assessment results, observations, reliable information, or evidence of contamination by *Legionella* or other waterborne pathogens.	X		**CP**	

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	Performed by:	References
Chapter 3	**Waterborne Pathogen Risk Assessments**				
Waterborne Pathogen Risk Assessments	Design and direct *Legionella* or other waterborne pathogen source risk assessments that describes the water parameter measurements, the means to collect measurements, and describes the number, location, types, and analysis methods used for samples. Review the measurement data, observations, field notes, and sample results to interpret them and form conclusions and recommendations. Prepare and author written reports that provide recommendations, including the selection of any supplemental disinfection systems necessary to control (i.e., remediate or prevent) *Legionella* or other waterborne pathogen amplification.	X		**CP**	Section 7.0: AIHA *Legionella* Guidelines 2nd Edition AIHA Technical Framework: *Legionella* Chapter 12: ACGIH Bioaerosols 2nd edition
	Implement risk assessments for *Legionella* or other waterborne pathogen sources. Help to refine the scope of work, collect measurements, take field notes and document observations to characterize building water sources and systems. Perform routine monitoring of building water systems to ensure they do not become a source of waterborne pathogen amplification or disease transmission.	X		**CT**	Section 7.0: AIHA *Legionella* Guidelines 2nd Edition AIHA Technical Framework: *Legionella*
	Interpret the findings and observations resulting from a water system and source inventory. Evaluate this information to prepare an assessment strategy and sampling plan.	X		**CP**	Chapter 3: AIHA *Legionella* Guidelines 2nd Edition
	Identify water sources that have and have NOT generally been associated with Legionnaires' disease. Water sources that are frequently but incorrectly assumed to be sources of amplification (e.g., Air Handling Units (AHUs), swimming pools [cold], metal working fluids, etc. should be identified and reported along with their operational status.		X	**CT**	
	Collect environmental samples for *Legionella* and other WBPs from sources commonly recognized as sites of amplification and exposure.	X		**CT**	
	Identify uncommon sources of *Legionella* or other WBP amplification and aerosol exposure. These are sources that have been well documented to cause Legionnaires' disease or to harbor and transmit other waterborne pathogens.			**CP**	

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	Performed by:	References
Chapter 4	**Routine Risk Assessments**				
Routine Risk Assessments	Perform routine risk assessments of water sources and systems for *Legionella* and other WBPs when there are no known or suspected cases of disease associated with the facility.	X		**CT**	Chapter 3.0: AIHA *Legionella* Guidelines 2nd Edition
	Establish a Water Management Plan (WMP) or program following the completion of a routine risk assessment.	X		**CP**	Chapter 3.0: AIHA *Legionella* Guidelines 2nd Edition CDC 2021: Developing a WMP for *Legionella* CSTE 2019 WMP template
	Determine if existing water sources and systems are impacted by *Legionella* or other WBPs, what risk factors are contributing to conditions, and if existing operations or control measures are preventing the amplification of WBPs.	X		**CP**	Chapter 3.0: AIHA *Legionella* Guidelines 2nd Edition
	Select appropriate and reliable measurement methods and devices to characterize water quality parameters and interpret the results to determine if the risk of *Legionella* or other WBPs amplification is high or low.	X		**CP**	Chapter 3.0: AIHA *Legionella* Guidelines 2nd Edition
	Perform quantitative testing and collect water quality measurements, using appropriate and reliable measurement methods and devices to determine if the risk of *Legionella* amplification (or other WBPs) is high or low.	X		**CT**	Section 3.1.3 #3: AIHA *Legionella* Guidelines 2nd Edition AIHA Field Guide for the Determination of Biological Contaminants in Environmental Samples,2nd Edition section 6.2 *Legionella*

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	Performed by:	References
Routine Risk Assessments	Select or approve appropriate and reliable sample collection and laboratory analysis methods to estimate the concentrations of *Legionella* or other WBPs in water sources and systems. Interpret the results of laboratory sample analysis, water parameter measurements, and all available information to determine if pathogen amplification is present, or if the risk of amplification is elevated.	X		**CP**	Section 3.5.1: AIHA *Legionella* Guidelines 2nd Edition AIHA Field Guide for the Determination of Biological Contaminants in Environmental Samples,2nd Edition section 6.2 *Legionella*
	Perform environmental sampling of water sources and systems, using appropriate and reliable sample collection and analysis methods, to determine if pathogen amplification is taking place, or if the risk of amplification is elevated.	X		**CT**	Section 3.5: AIHA *Legionella* Guidelines 2nd Edition AIHA Field Guide for the Determination of Biological Contaminants in Environmental Samples,2nd Edition section 6.2 *Legionella*

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	Performed by:	References
Chapter 5	**Investigative Risk Assessments**				
Investigative Risk Assessments	Oversee or perform investigative *Legionella* risk assessments of water sources and systems when there are known or suspected cases of Legionellosis associated with the facility.	X		**CP**	Chapter 3: AIHA *Legionella* Guidelines 2nd Edition
	Inventory potential sources of pathogen amplification and exposure based upon epidemiological and/or empirical evidence provided by public health authorities, historical environmental water sampling data, or affected individuals.	X		**CT/CP**	Chapters 3 and 6: AIHA *Legionella* Guidelines 2nd Edition
	Select appropriate and reliable measurement methods and devices to characterize water quality parameters and to interpret the results to determine if the risk of *Legionella* amplification is high or low.	X		**CP**	Section 3.1.3: AIHA *Legionella* Guidelines 2nd Edition
	Collect quantitative water quality measurements using appropriate and reliable measurement methods and devices to determine if the risk of *Legionella* amplification is high or low.	X		**CT**	Chapter 3: AIHA *Legionella* Guidelines 2nd Edition
	Select appropriate and reliable sample collection and laboratory analysis methods to estimate the concentrations of *Legionella* in water sources and systems. Interpret the results of these measurements and samples to determine if *Legionella* amplification is present, is possibly present, or there is potential for amplification.	X		**CP**	Section 3.5.5 & Table 3.1: AIHA *Legionella* Guidelines 2nd Edition
	Perform environmental sampling of water sources and systems, using appropriate and reliable sample collection and analysis methods that are used to estimate concentrations of *Legionella* or other WBPs.	X		**CT**	Section 3.5.2: AIHA *Legionella* Guidelines 2nd Edition

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	Performed by:	References
Chapter 6	**Measurement, Sampling Methods, & Equipment**				
Measurement, Sampling Methods, & Equipment	Use appropriate and reliable equipment and/or sampling procedures to measure water quality parameters (i.e. temperature, free chlorine, pH, turbidity, etc.) to support interpretation of pathogen culture sample results. Maintain, calibrate, and operate testing equipment in accordance with manufacturer's instructions or other industry guidance. Confirm that the selected equipment will scientifically support the goal of the WMP or risk assessment.	X		**CT**	Section 7.0: AIHA *Legionella* Guidelines 2nd Edition OSHA Website on Legionellosis (2-9-2025) Domain X: AIHA Technical Framework: *Legionella*

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	Performed by:	References
Chapter 7	Identifying and Assessing Pathogen Control Measures				
Identifying and Assessing Pathogen Control Measures	Use appropriate and reliable measurement and sampling methods to assess if *Legionella* or other WBPs are effectively being controlled (i.e., not amplifying or growing) in building water systems and other water sources.	X		**CT**	Sections 1.3.1, 3.5.6, and 3.5.4.1: AIHA *Legionella* Guidelines 2nd Edition AIHA Field Guide for the Determination of Biological Contaminants in Environmental Samples, 2nd Edition section 6.2 *Legionella*
	Prescribe or approve appropriate methodologies for evaluating *Legionella* and other WBPs control measures. Establish the frequency of verification and validation assessments and specify the number and types of samples needed to reliably assess each water system or source using a reliable methodology.	X		**CP**	Section 3.5.6 & Table 3.3: AIHA *Legionella* Guidelines 2nd Edition Domain I Program Professional: AIHA Technical Framework: *Legionella* Chapter 11: ACGIH Bioaerosols 2nd edition AIHA Field Guide for the Determination of Biological Contaminants in Environmental Samples, 2nd Edition section 6.2 *Legionella*
	Determine if alternative sample analysis methods are appropriate to assess the effectiveness of control measures. Consider proficiency programs and quality assurance practices of the laboratories used to perform analyses for *Legionella* bacteria and other waterborne pathogens (e.g., *Pseudomonas* and nontuberculous mycobacteria).		X	**CP**	Chapter 3: AIHA *Legionella* Guidelines 2nd Edition

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	Performed by:	References
Chapter 8	**Sample Analysis and Interpretation of Results**				
Sample Analysis and Interpretation of Results	Rely upon scientifically defensible culture-based methods for laboratory analysis of samples for waterborne pathogens that detect *Legionella* pneumophila and estimate concentrations of pathogens in environmental samples. Avoid selecting test methods that tend to produce false-positive results, and minimize reliance upon analysis methods that report non-viable and non-culturable pathogens as these findings can confuse investigators and the public.	X		**CP**	Section 3.5.3 & 3.3.1.3 #3: AIHA *Legionella* Guidelines 2nd Edition ISO 11731, 2017 Domain II: Responder & Program Professionals): AIHA Technical Framework: *Legionella* AIHA Field Guide for the Determination of Biological Contaminants in Environmental Samples,2nd Edition section 6.2 *Legionella*
	Review laboratory culture sample results and interpret their meaning as it relates to the amplification or growth of *Legionella* and other WBPs. Consider sample results to determine the effectiveness of facility control measures. Based upon culture sample results, recommend corrective actions needed to mitigate risk and remediate sources of amplification.	X		**CP**	Section 3.5.5 Table 3.1: AIHA *Legionella* Guidelines 2nd Edition
	Determine if *Legionella* growth is occurring in a water system or source. Water clarity, surrogate measures of water chemistry (i.e. disinfectant levels and pH), temperature, heterotrophic bacteria concentrations (HPC) and total bacteria concentrations have not been demonstrated to be predictive indicators or surrogates of either the presence of absence of *Legionella* growth. However, these metrics and complimentary methods may be useful to understanding why *Legionella* growth may be occurring and what corrective actions may be needed.	X		**CP**	Sections 1.3.1, 3.3, and 3.1.3 #3 Table 3.1: AIHA *Legionella* Guidelines 2nd Edition
	Assist building operators and remediation contractors to implement elements of the WMP, remediation plans, or other corrective actions. Carry out procedures to verify and validate their effectiveness.	X		**CT/CP**	Table 3.2: AIHA *Legionella* Guidelines 2nd Edition

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	Performed by:	References
Chapter 9	**Practitioner Safety Procedures and Interim Protective Measures**				
Practitioner Safety Procedures and Interim Protective Measures	Anticipate and recognize hazards present that can cause injury or death to investigators, building occupants, and contractors including, but not limited to, chemical, biological, electrical, fire, the potential for slips/trips/falls, confined spaces, combustion gasses, mechanical hazards (i.e., machine guarding), and other relevant occupational hazards.	X		**CT**	Sections 4.5.1, 4.5.6, and 5.3.1 #1: AIHA *Legionella* Guidelines 2nd Edition Domain I; PHS Resources – Safety Training: AIHA Technical Framework: *Legionella*
	Take measures to protect investigators, building occupants, and members of the public from exposure to known or suspected sources of aerosolized *Legionella* or other WBPs. These procedures are commonly implemented when pathogen amplification is associated with an outbreak.	X		**CT**	Section 3.5: AIHA *Legionella* Guidelines 2nd Edition
	Implement interim or short-term measures to protect workers, patients, residents, visitors, building occupants, and the public from suspected or confirmed sources of *Legionella* or other waterborne pathogens.	X		**CT**	Sections 3.1.3 #2, 3.5.2, 3.5.5 and 4.4, and Table 3.2: AIHA *Legionella* Guidelines 2nd Edition Chapter 11: ACGIH Bioaerosols 2nd edition Domain 1 Responder Professional: AIHA Technical Framework: *Legionella*
	Select appropriate filtration, chemical disinfection, or thermal pasteurization to mitigate exposures to sources of pathogen amplification and aerosols for either short-term or long-term control measures.	X		**CP**	Chapter 4 and Appendix II Supplemental Treatment Technologies: AIHA *Legionella* Guidelines 2nd Edition Chapter 11 Section 11.8.1.2: ACGIH Bioaerosols 2nd edition EPA 2016: Technologies for *Legionella* Control

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	Performed by:	References
Chapter 10	**Remediating Contaminated Water Sources**				
Remediating Contaminated Water Sources	Avoid conflicts of interest by not 1) allowing remediation contractors to collect or analyze post-remediation samples intended to validate the effectiveness of remediation procedures, and 2) not allowing water treatment providers to collect or analyze samples for *Legionella* or other WBPs, either as routine testing or when identifying sources suspected of being the cause of a disease cluster or outbreak. Fundamentally, practitioners recognize that "self-validating" water treatment or remediation activities creates a conflict of interest.	X		**CT/CP**	Section 4.5.1: AIHA *Legionella* Guidelines 2nd Edition
	Recommend the implementation of effective remediation methods for *Legionella* and other waterborne pathogens when amplification sources are identified. Recommend measures to minimize exposure of occupants to hazardous substances and unnecessary risks. (Note: Mechanical cleaning and removal of sediment, scale, biofilm, algae, and other substances can influence the effectiveness of remediation and control methods when needed.)	X		**CP**	Chapter 4: AIHA *Legionella* Guidelines 2nd Edition Chapter 11: ACGIH Bioaerosols 2nd edition EPA 2016: Technologies for *Legionella* Control
	Evaluate and prescribe appropriate chemical disinfection for primary remediation of *Legionella* and other WBPs in potable and non-potable premise plumbing systems and hot water systems when appropriate. Consider the effectiveness of supplemental treatment systems and identify systems that are appropriate for a specific facility.	X		**CP**	Chapter 4: AIHA *Legionella* Guidelines 2nd Edition Chapters 11 and 12: ACGIH Bioaerosols 2nd edition EPA 2016: Technologies for *Legionella* Control

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	Performed by:	References
Remediating Contaminated Water Sources	Prepare written remediation plans for building water systems that may include premise plumbing, hot tub spas, decorative water features, and cooling towers using established protocols and procedures.	X		**CP**	Sections 4.5.1 and 7.0: AIHA *Legionella* Guidelines 2nd Edition Domain III Responder Professional; Domain III Program Professional: AIHA Technical Framework: *Legionella* Chapter 11 Section 11.8.6: ACGIH Bioaerosols 2nd edition
	Develop specific protocols and procedures unique to an individual facility, its water systems, or its occupants.	X		**CP**	Section 3.5: AIHA *Legionella* Guidelines 2nd Edition
	Direct the work of CTs during an outbreak response.	X		**CP**	Section 3.5: AIHA *Legionella* Guidelines 2nd Edition

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	Performed by:	References
Chapter 11	**Verify and Validate Remediation & Control Measures**				
Verify and Validate Remediation & Control Measures	Implement and oversee protocols to remediate water sources and systems. Collect samples to validate the effectiveness of remediation efforts in accordance with established procedures or specific recommendations. Implement and oversee remediation activities for building water systems that include premise plumbing, hot tub spas, decorative water features, and cooling towers using established protocols and procedures. Implement specific protocols and procedures that have been recommended by a CP.	X		**CT**	Sections 4.5.1 and 7.0: AIHA *Legionella* Guidelines 2nd Edition Domain III Responder Professional; Domain III Program Professional: AIHA Technical Framework: *Legionella* Chapter 11, Section 11.8.6: ACGIH Bioaerosols 2nd edition
	Verify remediation activities and procedures, perform oversight of cleaning per the remediation plan, and document the concentration of chemical treatment and duration of contact. For premise plumbing systems and drinking water sources, also document the effective flushing and removal of disinfecting chemicals prior to returning the systems to use by building occupants.	X		**CT**	Sections 3.3.1, 4.5 & 4.6; Table 3.2: AIHA *Legionella* Guidelines 2nd Edition

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	Performed by:	References
Verify and Validate Remediation & Control Measures	Implement procedures to validate the effectiveness of remediation efforts for premise plumbing systems (cold and hot water), cooling towers and evaporative condensers, hot tubs and spas, as well as decorative fountains and water features.	X		**CT**	Sections 4.5 & 4.6: AIHA *Legionella* Guidelines 2nd Edition Domain IV Program Professional: AIHA Technical Framework: *Legionella* Chapter 11, Section 11.8.6: ACGIH Bioaerosols 2nd edition Section 6.2.8: ASHRAE 188-2021 Section 8.3: ASHRAE Guideline 12-2020 CDC Toolkit 2021 Developing a *Legionella* Water Management Program: Section 6 – Make Sure the Program is Running as Designed & is Effective

OEHS Process / Program	Risk-Critical Practices	Good Practice	Enhanced Practice	Performed by:	References
Chapter 12	**Documenting, Reports & Recordkeeping**				
Documenting, Reports & Recordkeeping	Retain records for equipment used to measure water quality parameters, including maintenance and calibration records. Retain sample chain of custody (COC) and laboratory sample submission forms, shipping or courier documentation, field logs and notes, and remediation documentation forms. Retain records for at least 3 years or in accordance with local, State or Federal regulations.	X		**CT**	Section 3.5: AIHA *Legionella* Guidelines 2nd Edition Domain IV: Program Professional; Domain V Responder Professional: AIHA Technical Framework: *Legionella* Chapter 11 Section 11.8: ACGIH Bioaerosols 2nd edition
	Review all materials, documentation, and results to verify they are complete and reliable.	X		**CP**	Section 7.1: AIHA *Legionella* Guidelines 2nd Edition Domain IV Program Professional: AIHA Technical Framework: *Legionella*
	Prepare written reports on the effectiveness of recommendations to control (i.e., remediate or prevent) *Legionella* or other waterborne pathogen amplification based upon all available data, measurements, samples results, and observations.	X		**CP**	Section 5.3: AIHA *Legionella* Guidelines 2nd Edition Domain X: AIHA Technical Framework: *Legionella*

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Table 1: ASHRAE Guideline 12-2020

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AIHA | GUIDELINE FOUNDATION

Principles of Good Practice

Section 6: Heat Stress

For the Industrial Hygienist/Occupational Hygienist (IH/OH)

aiha.org

Version 1 | December 17, 2025

Principles of Good Practice Documents

The PGP are organized by OEHS areas of practice in a concise, easy-to-use table format. They are published as they are developed for each area of practice and are designed to be kept "evergreen" via regular updates. Refer to Section 1 for PGP use and limitations.

Currently, PGP have been documented for the following areas of practice:

OEHS Area of Practice/ PGP Authors and Contributors	Date	
	Initial Publication	Most Recent Update
AIHA Thermal Stress Working Group **Heat Stress PGP Version 1** **PGP AG Members:** John Mulhausen, Alan Leibowitz, Joe Damiano, Michele Twilley **Heat Stress PGP Subteam:** Edward Primeau, Don Elswick, Maggie Morrissey, Celia Kaufman, Rotem Koler, Gabrielle Brewer, Denis Logie, Kyle Lowman, Kristin Yeoman	12/17/2025	12/17/2025

AIHA PRINCIPLES OF GOOD PRACTICE for HEAT STRESS

v1.0 - 12/17/2025

PGP Elements	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Scope and Objectives)	The AIHA Principles of Good Practice for Heat Stress Management is directed at preventing work-related illness and injury from exposure to excessive heat in occupational environments. This is achieved through comprehensively assessing and managing workers exposures to environments with high temperature extremes. The PGP illustrates professional practices in heat stress program management that have been determined to reliably and effectively protect workers from unacceptable risks of heat related illness and injury resulting from exposure to hot environments. The PGP establishes program and performance targets that can be used in continuous improvement activities by IH/OH practitioners and the profession as a whole.			

PGP Elements	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Occupational Exposure Limit (OEL)	Practitioners should be aware of new and modified laws and regulations associated with Heat Stress Management. Practitioners should understand the use and limitations of heat stress laws and regulations for the jurisdiction where work is taking place. States with existing heat stress standards are based on either the temperature or heat index: **California** uses a temperature of 80°F for outdoor work (95°F as high heat) and 82°F for indoor work (87°F requires engineering controls). **Colorado** uses 80°F for agricultural sector with 95°F as high heat increased risk condition. **Minnesota** uses an indoor temperature tied to work intensity (86°F - light work, 80°F - moderate, 77°F - heavy). **Washington** uses a trigger of 80°F for outdoor work and additional controls at 90° and 100°F. **Maryland** and **Oregon** uses a heat index of 80°F for basic protection, indoors and outdoors.	X		What Works Institute. 2025. Summary of Occupational Heat Stress Standards in U.S.
	Use the following criteria for establishing action levels and exposure limits: Heat index of 80°F or a wet bulb globe temperature equal to the NIOSH Recommended Action Limit. Heat index of 90°F or a wet bulb globe temperature equal to the NIOSH Recommended Exposure Limit	X		NIOSH criteria for a recommended standard: occupational exposure to heat and hot environments. By Jacklitsch B, Williams WJ, Musolin K, Coca A, Kim J-H, Turner N. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication 2016-106.
	Adjust action levels and exposure limits in accordance with ACGIH Table 3. Screening Criteria using WBGTeff for Acclimatized and Unacclimatized Workers		X	American Conference of Govenmental Industrial Hygienist. "TLVs and BEIs: Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices," 2024

PGP Elements	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Exposure Assessment	**Qualitative Assessment**			
	Establish and follow procedures to conduct routine qualitative exposure assessment for thermal stress management using the ambient temperature and heat index.	X		Proposed Standard, 29 Code of Federal Regulations 1910.148: "Heat Injury and Illness Prevention."
	Quantitative Assessment			
	Utilize the AIHA Heat Stress App to calculate current and forecasted WBGT index (and heat index) and Heat Stress Risk Level. User inputs include but are not limited to: location (may add multiple locations); workload intensity; clothing; cloud cover.	X		https://www.aiha.org/public-resources/healthierworkplaces/healthier-community-resources/thermal-heat-stress-resources-oehs-professionals
	Perform quantitative assessment against the OEL based on temperature and metabolic rates for workers in a SEG. (The discussion of OELs is in the previous section)		X	(1) American Conference of Govenmental Industrial Hygienist. "TLVs and BEIs: Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices," 2024. (2) NIOSH criteria for a recommended standard: occupational exposure to heat and hot environments. By Jacklitsch B, Williams WJ, Musolin K, Coca A, Kim J-H, Turner N. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication 2016-106. (3) What Works Institute. 2025. Summary of Occupational Heat Stress Standards in U.S.
	Utilize the wet bulb globe temperature (WBGT) meter, which measures the dry-bulb, wet-bulb, globe temperatures, relative humidity and integrates these values into the WBGT Index and compare results to the selected OEL.		X	(1) American Conference of Govenmental Industrial Hygienist. "TLVs and BEIs: Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices," 2024. 2) ACGIH. 2025. A Guide for the Control of Heat Stress and Strain. (3) OSHA Technical manual, Section III, Chapter IV, Heat Hazard Assessment.

PGP Elements	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Medical Surveillance	Post-incident Investigation: Medical assessment conducted as part of post-incident investigations of occupational heat-related illnesses should include an evaluation of personal risk factors to inform decisions about return-to-work for affected workers and to advise employers about mitigation strategies. Clinicians should ensure that workers are asymptomatic and have normal biomarker (e.g. blood tests for kidney and liver function) before authorizing an affected employee's return to work. Serum biomarkers such as creatinine, BUN, CK, aspartate aminotransferase, alanine aminotransferase, and lactate dehydrogenase may be elevated acutely in episodes of heat stroke.	X		Tustin A, Sayeed Y, Berenji M, Fagan K, McCarthy RB, Green-McKenzie J, McNicholas J, Onigbogi CB, Perkison WB, Butler JW; ACOEM Work Group on Occupational Heat-Related Illness. Prevention of Occupational Heat-Related Illnesses. J Occup Environ Med. 2021 Oct 1;63(10):e737-e744. doi: 10.1097/JOM.0000000000002351. PMID: 34597285.
	Preplacement and Periodic Medical Examination: Workers who will be exposed to heat stress should receive pre-placement and periodic medical examinations. These examinations should include past medical history and occupational history, assessment of personal risk factors, physical examinations, and measurement of serum creatinine and glomerular filtration rate. Clinicians should recommend temporary or permanent work restrictions when indicated. Personal risk factors include: acute infection or Illness such as Hypertension, Obesity, Respiratory Disease, Hyperthyroidism, Skin Disease, Kidney Disease, Diabetes mellitus, Neurological disease, Hypohydrosis, Parkinson disease. The following medications may increase risk of heat-related illnesses: Amphetamines, ACE inhibitors ARB, Anticholinergics, Anticonvulsants, Antihistamines, Antipsychotics, Benzodiazepines, Beta-blockers, Diuretics, and Tricyclic antidepressants.		X	
	Medical surveillance should consider genetic factors to consider worker susceptibility to thermal stress (impaired heat tolerance and susceptibility to heat illness): 51 nonpolymorphic, potentially pathogenic variants in 20 genes, including RYR1, CACNA1S, CACNA2D1, and PYGM.		X	AIHA. (2023). Technical Framework: *Susceptible Worker Protection.*

PGP Elements	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Education/ Training	Training shall include information about acclimatizing, proper hydrating/fluid intake, recognizing and reporting heat-related illness symptoms, giving appropriate first aid, proper care and use of heat-protective clothing, added heat load caused by exertion/ clothing/personal protective equipment, other factors that affect heat tolerance (e.g., medications, alcohol, obesity, relevant health conditions such as sickle cell trait status, etc.), and how to ensure weather data (i.e., WBGT) is part of the process for making work/rest cycle decisions.	X		NIOSH Criteria for a Recommended Standard: Occupational Exposure to Heat and Hot Environments.
	Supervisor training shall include how to recognize heat-related illness signs and symptoms. Implementing appropriate acclimatization. What procedures to follow when a worker has symptoms of heat-related illness, including emergency response procedures. Monitoring weather reports. Responding to hot weather advisories. Monitoring and encouraging adequate fluid intake and rest breaks.	X		NIOSH Criteria for a Recommended Standard: Occupational Exposure to Heat and Hot Environments.
	Employee Training shall include how to recognize the signs and symptoms of heat-related illnesses and administration of first aid. Causes of heat-related illnesses and steps to reduce the risk. These include drinking enough water and monitoring the color and amount of urine output. Proper care and use of heat-protective clothing and equipment and the added heat load caused by exertion, clothing, and personal protective equipment. Effects of other factors (drugs, alcohol, obesity, etc.) on tolerance to occupational heat stress. The importance of acclimatization. The importance of immediately reporting any symptoms or signs of heat-related illness in themselves or in coworkers to the supervisor. Procedures for responding to symptoms of possible heat-related illness and for contacting emergency medical services.	X		NIOSH Criteria for a Recommended Standard: Occupational Exposure to Heat and Hot Environments.
	Conduct refresher training at least annually.	X		NIOSH Criteria for a Recommended Standard: Occupational Exposure to Heat and Hot Environments.

PGP Elements	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Education/ Training	Conduct supplemental training whenever a workplace heat-involved OSHA recordable incident occurs (Lesson-to-be-learned), when there are program changes that need to be addressed, and when other heat related issues, topics, and specialized equipment need to be communicated to employees.		X	https://www.safetytalkideas.com/safetytalks/learning-from-past-incidents/
	Emergency Response Team training shall include instruction on how to prevent heat-related illnesses, recognize symptoms, and respond to emergencies in hot environments. Key components include understanding factors like humidity, workload, and PPE, implementing self-monitoring and hydration, acclimating to heat gradually, and knowing first-aid measures and when to contact emergency services. Training is crucial for safety in hazardous waste, emergency response, and firefighting operations.		X	https://www.fws.gov/carp/training/category/safety-and-emergency-response
Physiological Monitoring	Physiological monitoring for evaluating heat strain experienced by individual workers can provide timely, continuous data to inform health and safety decisions based upon workers' physiological responses. This information is used by employees, or others monitoring the work, to enable them to rapidly make necessary adjustments to the heat stress conditions, thereby reducing the level of heat strain. The user has the ability to review and respond to their own data and can serve as an educational tool and facilitate behavioral changes such as a reduction in work exertion, increased consumption of fluids, increased rest, and/or adjustment of clothing.		X	(1) AIHA. 2024. White Paper: *Wearable Physiological Monitoring to Assess Heat Strain in Response to Heat Exposure*. (2) Sean R. Notley, Robert D. Meade, David P. Looney, Christopher L. Chapman, Adam W. Potter, Alison Fogarty, Tabassum Howlader, Luana C. Main, Karl E. Friedl, and Glen P. Kenny. 2025. Physiological monitoring for occupational heat stress management: recent advancements and remaining challenges. *Applied Physiology, Nutrition, and Metabolism*. 50: 1-14. https://doi.org/10.1139/apnm-2024-0395
	Employers should not rely on wearables that monitor the body's biological response (e.g., body temperature, heart rate, etc.) to heat related stressors. Wearables have several limitations that may underestimate heat stress hazards. The current wearables available on the market are regarded as physiological monitoring devices which do not have the reliability and accuracy of medical monitoring devices. Furthermore, the Food and Drug Administration (FDA) has chosen not to regulate wearables used by individuals for fitness or general wellness purposes.		X	(1) FDA's General Wellness: Policy for Low Risk Devices Guidance for Industry and Food and Drug Administration Staff, Document issued on September 27, 2019. Doc. Link: https://www.fda.gov/media/90652/download (2) Morrissey, M. C., Casa, D. J., Brewer,G. J., Adams, W. M., Hosokawa, Y.,Benjamin, C. L., et al. (2021). Heat safety in the workplace: Modified Delphi consensus to establish strategies and resources to protect the US workers. *GeoHealth*, 5, e2021GH000443.

PGP Elements	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Controls	**Engineering Controls**			
	Portable shades and Reflective shields. At places where the work is performed under the sun with no shade availability, it is recommended to install temporary portable shading solutions. One indicator that blockage is sufficient is when objects do not cast a shadow in the area of blocked sunlight. The shade should be provided, at, or as closest to the work area. Adequate shade should also be available at the resting area.	X		NIOSH Criteria for a Recommended Standard: Occupational Exposure to Heat and Hot Environments.
	Irradiant Heat blocking barriers. Can be implemented where an irradiant-heat generating device is located near the work area.	X		NIOSH Criteria for a Recommended Standard: Occupational Exposure to Heat and Hot Environments.
	Misting machines. Can be implemented in low relative humidity (RH) environments to cool-down the work area or the resting area.	X		https://www.osha.gov/heat-exposure/controls
	Cooling fans or portable air-conditioning units. The use of a cooling fan or portable air-conditioning unit might significantly reduce the Heat Load that the worker experiences. Caution: while utilizing fans is a simpler solution, under some weather conditions especially when the ambient air is very hot (above 39°C (102°F)) and dry, increased air velocity on the worker might cause dehydration and increased Heat Load that jeopardizes the body ability to cool itself down.	X		https://www.osha.gov/heat-exposure/controls
	Administrative Controls			
	Heat Injury and Illness Prevention Program/Plan. Employers shall draft a written heat stress management program. The program includes a comprehensive list of the types of work activities covered; all policies and procedures related to heat stress; an identification of the occupational exposure limit and assessment method (i.e., heat index or wet bulb globe temperature). The plan establishes management direction as policy to implement the program, milestones to demonstrate initial launch and continuing success in implementation, and evaluation of the metrics on some frequency.	X		https://www.osha.gov/heat-exposure/planning

PGP Elements	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Controls	**Ensure that workers maintain constant communication and work in the buddy system**. Trained employees shall work in such a way that communication is continual and emergency response procedures are initiated in the event that a worker shows early symptoms of heat stress.	X		https://www.cdc.gov/disasters/extremeheat/pdf/Heat_Related_Illness.pdf
	Daily Heat Readiness Checklist. Employers should complete a Daily Heat Readiness Checklist that will enable work supervisors to perform a quick check of the workforce heat stress preparedness prior starting the work (toolbox or otherwise). The checklist could be integrated into a Pre-Task Planning or Risk Assessment being used at the site.	X		OSHA Safe and Sound - heat Illness Prevention https://www.osha.gov/sites/default/files/Activity_FF_EmployerHeatChecklist.pdf
	Warning signage. Employers should post signs in Excessively High Heat Areas for indoor areas of above 49°C (120°F).		X	NIOSH Criteria for a Recommended Standard: Occupational Exposure to Heat and Hot Environments.
	Worker hydration. Employers should ensure worker's receive adequate hydration. When the air humidity is high the sweat evaporation rate declines. Working with certain PPE items reduces even further the sweat ability to evaporate which jeopardize the sweat cooling effect while the body continues to lose precious quantities of water. Therefore, it is imperative to constantly consume large water quantities throughout the working day (8 ounces (230 ml) 3-4 times per hour – i.e. a cup of cool water every 15-20 minutes) and avoid alcoholic/caffeinated/sugary drinks. Usually, regular tap water and the typical food diet will have sufficient minerals to support the normal function of the body. In cases of prolonged work (above two hours) of heavy physical exertion in hot and/or humid conditions, it is recommended to add supplemental minerals to the water consumption regime (i.e. electrolytes drinks). Substantial loss of electrolytes can cause muscle cramps and additional dangerous health effects.	X		(1) Keeping Workers Well-Hydrated. https://www.osha.gov/sites/default/files/publications/OSHA4372.pdf (2) Morrissey, M. C., Casa, D. J., Brewer,G. J., Adams, W. M., Hosokawa, Y.,Benjamin, C. L., et al. (2021). Heat safety in the workplace: Modified Delphi consensus to establish strategies and resources to protect the US workers. *GeoHealth*, 5, e2021GH000443.

PGP Elements	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Controls	**Work hour considerations**. Scheduling the work to cooler times during the day (early mornings or late afternoons) can eliminate the Heat Stress conditions and the need for implementing engineering controls to reduce the air temperature and Relative Humidity.	X		NIOSH Criteria for a Recommended Standard: Occupational Exposure to Heat and Hot Environments.
	Acclimatization. The employer shall establish an acclimatization schedule based on a progressively longer and/or higher heat conditions so employees may gain heat tolerance. An effective acclimatization program will reduce the impact heat stress will have on the core body temperature of the worker. NIOSH recommends gradually acclimating the worker to his or her new environment by increasing the time of exposure each day over a 7 to 14 day period. The time to acclimatize varies by worker based on individual risk factors.	X		(1) NIOSH criteria for a recommended standard: occupational exposure to heat and hot environments. By Jacklitsch B, Williams WJ, Musolin K, Coca A, Kim J-H, Turner N. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication 2016-106. (2) Morrissey, M. C., Casa, D. J., Brewer,G. J., Adams, W. M., Hosokawa, Y.,Benjamin, C. L., et al. (2021). Heat safety in the workplace: Modified Delphi consensus to establish strategies and resources to protect the US workers. *GeoHealth*, 5, e2021GH000443.
	Personal Protective Equipment (PPE)			
	Cooling vests. In cases where implementation of Engineering and Administrative controls does not reduce the Heat Stress significantly enough, or when heat retaining personal protective equipment (PPE) cannot be removed, an implementation of Cooling PPE might be needed. This includes cooling vests of different kinds. Some have ice blocks pockets, some have built-in fans, others have cool water circling system, etc. Such devices should be thoroughly vetted in application with the wearers to confirm alternate hazards are not introduced (weight for ergo risk, water in electrical conditions risk, etc.).	X		(1) NIOSH criteria for a recommended standard: occupational exposure to heat and hot environments. By Jacklitsch B, Williams WJ, Musolin K, Coca A, Kim J-H, Turner N. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication 2016-106. (2) Morrissey, M. C., Casa, D. J., Brewer,G. J., Adams, W. M., Hosokawa, Y.,Benjamin, C. L., et al. (2021). Heat safety in the workplace: Modified Delphi consensus to establish strategies and resources to protect the US workers. *GeoHealth*, 5, e2021GH000443.

PGP Elements	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Controls	**Respiratory Protection Loose-fitting Hoods PAPR (Powered air-purifying respirator)**. In cases where Respiratory Protection Equipment (RPE) is required while working under excessive heat, it is advisable to implement a positive air system Respiratory Protection Loose-fitting Hoods PAPR to reduce the heat load that the worker will experience. It provides a constant air supply to the worker's face which allows improved evaporation of sweat and therefore reduces the body's heat. The system can be used with Breathing Air (BA) supply, or as Air Purifying Respiratory (APR) with filtering cartridges.	X		NIOSH Science Blog: Heat Stress Imposed by PPE Worn in Hot and Humid Environments. Posted on 6 August 6, 2020 by W. Jon Williams, PhD and Jaclyn Krah Cichowicz, MA.
	Additional safeguards. In cases where head protection PPE is not needed, a sun hat should be used to block solar radiation. Additionally wearing long sleeved cloths aiming for maximum skin coverage and using sunscreen for exposed skin area will protect the skin from irradiant heat and cancer risk due to the sun's Ultra-Violet (UV) radiation exposure.	X		NIOSH Fast Facts: Protecting Yourself from Sun Exposure, DHHS (NIOSH) Publication Number 2010-116.
Performance Measures/ Evaluation	Employers should track health and safety outcomes including heat related illness, first aid cases and near-misses to ensure program effectiveness. **Number of heat-related incidents**: Track the number of heatstroke, heat exhaustion, and other related illnesses. A reduction over time indicates program effectiveness. **First-aid cases**: Monitor the number of employees needing first aid for heat-related symptoms like dizziness or cramps. Absenteeism: Track work absences due to heat-related illness. A high rate suggests a need for program adjustments. **Near-misses**: Record and investigate situations that could have resulted in a heat-related incident. Addressing these can prevent future occurrences.	X		(1) Recommended Practices for Safety and Health Programs, OSHA 3885 October 2016. (2) NIOSH Criteria for a Recommended Standard: Occupational Exposure to Heat and Hot Environments.

PGP Elements	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Performance Measures/ Evaluation	Employers should track physiological monitoring data in real time and intervene as needed to protect worker health. **Wearable technology**: Devices like heart rate and core body temperature monitors can provide real-time data on a worker's strain in hot conditions. This allows for early intervention. **Heart rate recovery**: Use standardized tests, such as monitoring pulse rates before and after rest breaks, to assess a worker's physiological response to heat. Unfavorable recovery patterns indicate excessive stress. **Hydration status**: Measure hydration levels through techniques like pre- and post-shift body weight checks or urine color analysis.		X	(1) Physiological Monitoring as a Determinant of Heat Stress, Physiologic monitoring can help protect all workers from heat-related illness. By Bernard Fontaine, Sep 01, 2022, *Occupational Health & Safety*. https://ohsonline.com/articles/2022/09/01/physiological-monitoring.aspx (2) American Conference of Govenmental Industrial Hygienist. "TLVs and BEIs: Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices," 2024.
	Employers should conduct environmental monitoring in real time as eeded to protect worker health. **Wet Bulb Globe Temperature (WBGT)**: Considered the gold standard for assessing heat stress risk, WBGT meters measure air temperature, humidity, air movement, and radiant heat. The data shall be evaluated to determine safe work/rest cycles and inform risk assessments. **Heat index**: Use a heat index calculation (temperature and humidity) as a screening tool to identify general risk levels. Note that this measure does not account for radiant heat or wind, so it is less precise for professional applications than WBGT. **Stationary sensors**: Use fixed sensors in large industrial settings to provide continuous environmental data for multiple work zones.	X		NIOSH Criteria for a Recommended Standard: Occupational Exposure to Heat and Hot Environments.

PGP Elements	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Performance Measures/ Evaluation	Track Implementation metrics to ensure program effectiveness. **Training completion rates**: Track the percentage of employees and supervisors who complete heat stress training. High rates indicate a successful training component. **Control measure implementation**: Track the timely implementation of controls, such as providing cool-down areas, scheduling rest breaks, and adjusting work schedules. Policy compliance: Conduct regular audits to ensure workers and supervisors are following the established heat stress prevention policies.	X		https://www.osha.gov/safety-management/program-evaluation
	Collect employee feedback to ensure program effectiveness. **Surveys and interviews**: Use employee feedback to gauge satisfaction with prevention measures and identify areas for improvement. This can highlight issues that might be missed by objective data alone. **Suggestion boxes**: Provide a channel for employees to anonymously offer ideas or report concerns related to heat stress. **Lessons learned**: After a heat season or incident, conduct reviews with employees to gather insights on what worked well and what did not. This helps refine the program for the future.		X	https://www.osha.gov/safeandsound

PGP Elements	Risk-Critical Practices	Good Practice	Enhanced Practice	References
Recordkeeping	If the employer conducts on-site measurements at indoor work areas, they must have written or electronic records of those indoor work area measurements and retain those records for 6 months.		X	NIOSH criteria for a recommended standard: occupational exposure to heat and hot environments. By Jacklitsch B, Williams WJ, Musolin K, Coca A, Kim J-H, Turner N. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication 2016-106.
	The recordkeeping regulation requires employers to record certain work-related injuries and illnesses.	X		29 CFR 1904, Recording and Reporting Occupational Injuries and Illnesses.

Glossary

Acclimatization means the body's adaptation to work in the heat as a person is exposed to heat gradually over time, which reduces the strain caused by heat stress and enables a person to work with less chance of heat illness or injury.

Administrative Controls mean the strategies or procedures that minimize the risk of heat exposure to workers. This type of control focuses on altering or managing tasks through a modification of employee work practices rather than changing environmental conditions to reduce heat or relying on personal protective equipment for cooling.

Ambient temperature means the temperature of the air surrounding a body. It is also called "air temperature" or "dry bulb temperature."

Clothing Ensemble means the garments being worn by a worker as part of their job. Variations of clothing ensembles such as the worker wearing breathable fabrics versus vapor impermeable fabrics can have a significant impact on the level of heat strain imposed on the worker.

Cooling personal protective equipment (PPE) means equipment worn to protect the user against heat injury or illness.

Engineering Controls mean the modifications or interventions in the work environment designed to reduce or eliminate workers' exposure to heat stress at the heat source. These controls would include work environment/equipment modification to reduce employee heat exposure rather than relying on workers to reduce their exposure through modified work practices.

General Heat Stress Controls mean controls which are implemented when the Recommended Action Level (RAL) is exceeded. Examples would include employee heat stress training, acclimatization, medical screening, hydration, and heat stress monitoring.

Heat Cramps mean a heat-related illness characterized by spastic contractions of the voluntary muscles (mainly arms, hands, legs, and feet), usually associated with restricted salt intake and profuse sweating without significant body dehydration.

Heat Exhaustion means a heat-related illness characterized by elevation of core body temperature above 38°C (100.4°F) and abnormal performance of one or more organ systems, without injury to the central nervous system. Heat exhaustion may signal impending heat stroke.

Heat index means the National Weather Service heat index, which combines ambient temperature and humidity. High heat trigger means a heat index of 90°F or a wet bulb globe temperature equal to the National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limit.

Heat Rash means the development of red papules (bumps) which form due to skin being persistently moist from unevaporated sweat underneath restrictive clothing. As sweating increases, these papules give rise to a prickling sensation. Heat rash papules may become infected if they are not treated.

Heat Strain means the physiological response to the heat load (external or internal) experienced by a person, in which the body attempts to increase heat loss to the environment in order to maintain a stable body temperature.

Heat Stress means the net heat load to which a worker is exposed from the combined contributions of metabolic heat, environmental factors, and clothing worn which results in an increase in heat storage in the body.

Heat Stroke means an acute medical emergency caused by exposure to heat from an excessive rise in body temperature [above 41.1°C (106°F] and failure of the temperature-regulating mechanism. Injury occurs to the central nervous system characterized by a sudden and sustained loss of consciousness preceded by vertigo, nausea, headache, cerebral dysfunction, bizarre behavior, and excessive body temperature.

Heat Syncope means the collapse and/or loss of consciousness during heat exposure without an increase in body temperature or cessation of sweating, similar to vasovagal fainting except that it is heat induced.

Heat Tolerance means the physiological ability to endure heat and regulate body temperature at an average or better rate than others, often affected by the individual's level of acclimatization and physical conditioning.

Hydration means the replenishment of fluids in the body. Proper hydration and replenishment of electrolytes are important for workers who may have experienced loss of both due to sweating while working in a hot environment.

Hyperthermia means a condition where the core temperature of an individual is higher than 37.2°C (99°F). Hyperthermia can be classified as mild (37.2–38.5°C; 99–101.3°F), moderate (i.e., heat exhaustion [38.5–39.5°C; 101.3–103.1°F]), profound (>39.5°C; 103.1°F), or profound clinical hyperthermia (i.e., heat stroke [>40.5°C; 104.9°F]), and death can occur without treatment (>45°C; 113°F).

Indoor/indoors means an area under a ceiling or overhead covering that restricts airflow and has along its entire perimeter walls, doors, windows, dividers, or other physical barriers that restrict airflow, whether open or closed.

Initial heat trigger means a heat index of 80°F or a wet bulb globe temperature equal to the NIOSH Recommended Alert Limit.

Job-Specific Heat Stress Controls mean controls which are implemented when the Recommended Exposure Limit (REL) is exceeded. This type of control can be a combination of engineering, administrative, and engineering controls. Examples could include adjustments to the clothing ensemble to better facilitate

evaporative cooling, increasing the percentage of rest/cooling breaks per hour, adjusting the level of task physical exertion by process automation, rotating workers to reduce heat exposure time in hot environments, dehumidification of the work area, introducing spot cooling or increased air flow to the work area, installing heat shielding to reflect/block radiant heat, and reducing the area air temperature.

Metabolic Heat refers to the heat generated in the body due to energy expenditure associated with work activities. This internal heat must be dissipated by the body to maintain a stable core body temperature.

Outdoor/outdoors means an area that is not indoors.

Physiological Monitoring refers to a measurement of a vital sign in a worker (such as heart rate or core body temperature) as a surrogate to assess the level of heat strain being experienced by a worker under heat stress conditions.

Radiant heat means heat transferred by electromagnetic waves between surfaces. Sources of radiant heat include the sun, hot objects, hot liquids, hot surfaces, and fire.

Recommended Alert Limit (RAL) means the NIOSH-recommended heat stress alert limits for unacclimatized workers.

Recommended Exposure Limit (REL) means the NIOSH-recommended heat stress exposure limits for acclimatized workers.

Relative Humidity (RH) means the ratio of the water vapor present in the ambient air to the water vapor present in saturated air at the same temperature and pressure.

Rhabdomyolysis means a medical condition associated with heat stress and prolonged physical exertion, resulting in the rapid breakdown of muscle and the rupture and necrosis of the affected muscles.

Shade means the blockage of direct sunlight, such that objects do not cast a shadow in the area of blocked sunlight.

Signs and symptoms of a heat emergency means the physiological manifestations of a heat-related illness that requires emergency response and includes loss of consciousness (i.e., fainting, collapse) with excessive body temperature, which may or may not be accompanied by vertigo, nausea, headache, cerebral dysfunction, or bizarre behavior. This could also include staggering, vomiting, acting irrationally or disoriented, having convulsions, and (even after resting) having an elevated heart rate.

Signs and symptoms of heat-related illness means the physiological manifestations of a heat-related illness and includes headache, nausea, weakness, dizziness, elevated body temperature, muscle cramps, and muscle pain or spasms.

Temperature, Adjusted Dry Bulb (t_{adb}) means the dry bulb temperature is the temperature of the air measured by a thermometer that is shielded from direct radiation and convection.

Temperature, Ambient (t_a) means the temperature of the air surrounding a body. Also called air temperature or dry bulb temperature.

Temperature, Core Body (t_{cr}) means temperature of the tissues and organs of the body. Also called Core Temperature.

Temperature, Globe (t_g) means the temperature inside a blackened, hollow, thin copper globe measured by a thermometer whose sensing element is in the center of the sphere.

Temperature, Natural Wet Bulb (t_{nwb}) means the wet bulb temperature under conditions of the prevailing air movement.

Vapor-impermeable clothing means full-body clothing that significantly inhibits or completely prevents sweat produced by the body from evaporating into the outside air. Examples include encapsulating suits, various forms of chemical resistant suits, and other forms of nonbreathable PPE.

Vehicle means a car, truck, van, or other motorized means of transporting people or goods.

Wet bulb globe temperature (WBGT) means a heat metric that takes into account ambient temperature, humidity, radiant heat from sunlight or artificial heat sources, and air movement.

Wet bulb globe temperature – Effective ($WBGT_{Eff}$) means an adjustment of the calculated WBGT value with the WBGT - Effective also considering the impact of the clothing ensemble, in addition to environmental factors, being worn by the worker while performing a task.

Work means the physical efforts performed using energy from the metabolic rate of the body.

Work area means an area where one or more employees are working within a work site.

Work/Rest Cycle refers to the calculated duration of work which can be performed over a given time period (such as each hour) coupled with the duration of a cooling period that also occurs within that same time period based both on the WBGT and the metabolic rate associated with the environmental conditions and physical demands of the task being evaluated.

Work site means a physical location (e.g., fixed, mobile) where the employer's work or operations are performed.

Acronyms

C - Celsius

F - Fahrenheit

HI - Heat Index

NIOSH - National Institute for Occupational Safety and Health

OSHA - Occupational Safety and Health Administration

PPE - Personal Protective Equipment

RAL - Recommended Alert Limit

REL - Recommended Exposure Limit

RH - Relative Humidity

t_a - Temperature, Ambient

t_{adb} - Temperature, Adjusted Dry Bulb

t_{cr} - Temperature, Core Body

t_g - Temperature, Globe

t_{nwb} - Temperature, Natural Wet Bulb

WBGT - Wet Bulb Globe Temperature

$WBGT_{Eff}$ - Wet Bulb Globe Temperature (Effective)