

Oregon OSHA's Adoption of Rules to Reduce Manganese Permissible Exposure Limit; Clarifies, Cross-References Welding Rules with Other Standards Including Confined Spaces

September 2021

Text removed is in [~~brackets with line through~~].

Text added is in **bold and underline**.

DIVISION 2, GENERAL INDUSTRY

Division 2/Q, Welding, Cutting, & Brazing

437-002-0280 Adoption by Reference

In addition to, and not in lieu of, any other safety and health codes contained in OAR Chapter 437, the Department adopts by reference the following federal regulations printed as part of the Code of Federal Regulations, 29 CFR 1910, in the Federal Register:

(1) 29 CFR 1910.251 Definitions. Repealed. Oregon OSHA Admin. Order 6-2014, f. 10/28/14, ef. 5/1/15. In Oregon, OAR [~~473~~]**437**-002-~~[2253]~~**0299** applies.

(2) 29 CFR 1910.252 General Requirements, published 3/26/12, FR vol. 77, no. 58, p. 17574. **Amended with Oregon OSHA Administrative Order 11-2021.**

(3) 29 CFR 1910.253 Oxygen-Fuel Gas Welding and Cutting. Repealed. Oregon OSHA Admin. Order 6-2014, f. 10/28/14, ef. 5/1/15. In Oregon, OAR **437**[~~473~~]-002-2253 applies.

(4) 29 CFR 1910.254 Arc Welding and Cutting, published 9/13/05, FR vol. 70, no. 176, p. 53925.

(5) 29 CFR 1910.255 Resistance Welding, published 4/11/90, Federal Register, vol. 55, no. 70, pp. 13710-13711.

These rules are on file with the Oregon Occupational Safety and Health Division, Oregon Department of Consumer and Business Services, and the United States Government Printing Office.

Stat. Auth.: ORS 654.025(2), **654.035** and ORS 656.726(4).

Stats. Implemented: ORS 654.001 through 654.295.

Hist:

OR-OSHA Admin. Order 23-1990, f. 9/28/90, ef. 12/1/90.

OR-OSHA Admin. Order 4-1997, f. 4/2/97, ef. 4/2/97.

OR-OSHA Admin. Order 3-1998, f. 7/7/98, ef. 7/7/98.

OR-OSHA Admin. Order 4-2005, f. 12/14/05, ef. 12/14/05.
 OR-OSHA Admin. Order 7-2008, f. 5/30/08, ef. 5/30/08.
 OR-OSHA Admin. Order 2-2010, f. 2/25/10, ef. 2/25/10.
 OR-OSHA Admin. Order 1-2012, f. 4/10/12, ef. 4/10/12.
 OR-OSHA Admin. Order 5-2012, f. 9/25/12, ef. 9/25/12.
 OR-OSHA Admin. Order 6-2014, f. 10/28/14, ef. 5/1/15.
OR OSHA Admin. Order 11-2021, f. 9/1/21 ef. 9/1/22.

1910.252

...
 (b)

...
 (2)

...
 (ii) Specifications for protectors

(A) Helmets and hand shields shall be made of a material which is an insulator for heat and electricity. Helmets, shields and goggles shall be not readily flammable and shall be capable of withstanding sterilization.

(B) Helmets and hand shields shall be arranged to protect the face, neck and ears from direct radiant energy from the arc.

(C) Helmets shall be provided with filter plates and cover plates designed for easy removal.

(D) All parts shall be constructed of a material which will not readily corrode or discolor the skin.

(E) Goggles shall be ventilated to prevent fogging of the lenses as much as practicable.

(F) All glass for lenses shall be tempered, substantially free from striae, air bubbles, waves and other flaws. Except when a lens is ground to provide proper optical correction for defective vision, the front and rear surfaces of lenses and windows shall be smooth and parallel.

(G) Lenses shall bear some permanent distinctive marking by which the source and shade may be readily identified.

Welding operation	Shade No.
Shielded metal-arc welding – 1/16-, 3/32-, 1/8-, 5/32-inch electrodes	10
Gas-shielded arc welding (nonferrous) – 1/16-, 3/32-, 1/8-, 5/32-inch electrodes	11
Gas-shielded arc welding (ferrous) – 1/16-, 3/32-, 1/8-, 5/32-inch electrodes	12
Shielded metal-arc welding: 3/16-, 7/32-, 1/4-inch electrodes	12
Shielded metal-arc welding: 5/16-, 3/8-inch electrodes	14
Atomic hydrogen welding	10-14
Carbon arc welding	14
Soldering	2
Torch brazing	3 or 4

Light cutting, up to 1 inch	3 or 4
Medium cutting, 1 inch to 6 inches	4 or 5
Heavy cutting, 6 inches and over	5 or 6
Gas welding (light) up to 1/8 inch	4 or 5
Gas welding (medium) 1/8 inch to 1/2 inch	5 or 6
Gas welding (heavy) 1/2 inch and over	6 or 8

Note: In gas welding or oxygen cutting where the torch produces a high yellow light, it is desirable to use a filter or lens that absorbs the yellow or sodium line in the visible light of the operation.

(H) The following is a guide for the selection of the proper shade numbers. These recommendations may be varied to suit the individual's needs.

(I) Filter lenses must meet the test for transmission of radiant energy prescribed by any of the consensus standards listed in ~~[29 CFR 1910.133(b)(1)]~~ **OAR 437-002-0134(8)**.

(iii) Protection from arc welding rays. Where the work permits, the welder should be enclosed in an individual booth painted with a finish of low reflectivity, such as zinc oxide (an important factor for absorbing ultraviolet radiations) and lamp black, or shall be enclosed with noncombustible screens similarly painted. Booths and screens shall permit circulation of air at floor level. Workers or other persons adjacent to the welding areas shall be protected from the rays by noncombustible or flameproof screens or shields or shall be required to wear appropriate goggles.

(3) Protective clothing – General requirements. Employees exposed to the hazards created by welding, cutting, or brazing operations shall be protected by personal protective equipment in accordance with the requirements of ~~[1910.132 of this part]~~ **OAR 437-002-0134**. Appropriate protective clothing required for any welding operation will vary with the size, nature and location of the work to be performed.

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[55 FR 13696, Apr. 11, 1990, as amended at 61 FR 9240, Mar. 7, 1996; 63 FR 1284, Jan. 8, 1998; 74 FR46357, Sept. 9, 2009; 77 FR 17777, Mar. 26, 2012.]

Stat. Auth.: ORS 654.025(2), **654.035** and ORS 656.726(4).

Stats. Implemented: ORS 654.001 through 654.295.

Hist: OR-OSHA Admin. Order 23-1990, f. 9/28/90, ef. 12/1/90.

OR-OSHA Admin. Order 4-1997, f. 4/2/97, ef. 4/2/97.

OR-OSHA Admin. Order 3-1998, f. 7/7/98, ef. 7/7/98.

OR-OSHA Admin. Order 2-2010, f. 2/25/10, ef. 2/25/10.

OR-OSHA Admin. Order 5-2012, f. 9/25/12, ef. 9/25/12.

OR-OSHA Admin. Order 11-2021, f. 9/1/21, ef. 9/1/22.

437-002-0279 Additional Oregon Confined Space Requirements

(1) Prior to performing welding operations inside a confined space, evaluate the space in accordance with OAR 437-002-0146, Confined Spaces:

(a) When there are potential or actual hazards within the space that are not directly related to the welding process, follow the requirements of OAR 437-002-0146.

(b) When the only potential or actual hazards associated with the space are directly related to the welding process, follow the requirements of paragraphs (2) through (5), below.

(2) To ensure that the atmosphere remains safe for entry, continuously test the internal atmosphere of the confined space with a properly calibrated, direct-reading instrument.

(a) Provide all necessary equipment at no cost to employees.

(b) Ensure that all equipment is maintained and used in accordance with the instructions from the manufacturer.

(c) Train all employees who use the equipment in the proper use of that equipment.

(3) Document each entry.

(a) This documentation must include:

(A) The date of the entry.

(B) The duration of the entry.

(C) The location of the space.

(D) The hazards of the space determined to be related to the welding process.

(E) The measures taken to eliminate those hazards.

(F) The identity (such as make/model) of the direct-reading instrument(s) used to test the atmosphere.

(G) When applicable, any conditions that required the evacuation of the space.

(H) The name, job title, contact information, and signature of the person responsible for ensuring the safe entry conditions.

(b) Maintain this documentation for at least one year from the date of entry.

(4) Ensure that all employees leave the space immediately if at any time during entry:

(a) Monitoring indicates that atmospheric conditions are outside of the ranges that are recognized as safe; or

(b) A hazardous condition is otherwise detected.

(5) Control respiratory hazards.

(a) Either:

(A) Provide forced air ventilation; or

(B) Provide and require the use of supplied air respiratory protection.

(b) When forced air ventilation is relied upon, it must:

(A) Be sufficient to protect employees entering the space from the respiratory hazards associated with the welding process; and,

(B) Be directed to ventilate the immediate area(s) where each employee is working within the space; and,

(C) Continue until all employees have left the space.

Note: 29 CFR 1910.1020 Access to Employee Exposure and Medical Records requires that data -- from workplace monitoring showing employee exposure to a toxic substance or harmful physical agent -- be retained for at least thirty years as an employee exposure record.

Stat. Auth.: ORS 654.025(2), 654.035 and ORS 656.726(4)

Stats. Implemented: ORS 654.001 - ORS 654.295

Hist.: OR-OSHA Admin. Order 11-2021, f. 9/1/21, ef. 9/1/22.

437-002-0281 Manganese

Note: Table OR Q-2 describes levels of respiratory protection that may be relied upon, within the duration of time indicated for the specific welding-related task, to prevent exposure to Manganese above the Permissible Exposure Limit (PEL) listed in Division 2/Z, OAR 437-002-0382, Oregon Rules for Air Contaminants.

(1) The guidelines in Table OR Q-2 may be used as an alternative to air monitoring for Manganese exposure under the following conditions:

(a) All respirator use must be in accordance with the Respiratory Protection Standard, 1910.134.

(b) The employer must provide the respiratory protection with the Assigned Protective Factor (APF) based on the type of welding-related task and the expected duration of that task. (See descriptions of tasks in 437-002-0299.)

(c) If the duration of the task reaches the upper time limit for the APF listed, then the employer must either:

(A) End the exposures for that employee for that shift, or

(B) Provide respiratory protection with the higher APF listed in the Table for any additional performance of the task during the employee's shift.

(2) If, during the course of a single work shift, an employee will perform more than one task listed in Table OR Q-2, the employer must add together the anticipated duration of all tasks and provide the respiratory protection with the most protective Assigned Protective Factor for the total duration of all tasks performed.

Note:

EXAMPLE #1: The employer anticipates 60 minutes of “Grinding tasks related to welding” and 90 minutes of Flux Core Arc Welding (FCAW) during an employee’s work shift. Although both of these tasks, performed individually for the specified time periods would fall within the APF=10 column for respiratory protection, adding 90 + 60 minutes together = 150 total minutes. In this example the most protective Assigned Protection Factor is for FCAW, when exposures above 120 minutes would fall in the APF=25 column. Therefore, to meet the conditions for the exemption from air monitoring for Manganese, the employer would need to provide the APF=25 level of respiratory protection for the duration of both of the combined tasks.

EXAMPLE #2: The employer anticipates 10 minutes of “Grinding tasks related to welding” and 30 minutes of “Hand-held torch cutting” during a work shift. Although the grinding tasks, if done alone for the specified time would be below the threshold for the APF=10 column of respiratory protection, adding 10 + 30 minutes together = 40 total minutes. The combined duration of 40 minutes places both the hand-held torch work and the grinding tasks within the APF=10 column. Therefore, to meet the conditions for the exemption from air monitoring for Manganese, the employer would need to provide the APF=10 level of respiratory protection for the duration of both of the combined tasks.

<u>TABLE OR Q-2 for Manganese</u>		
<u>Welding, cutting or grinding tasks</u>	<u>Minimum Assigned Protective Factor (APF) for respiratory protection when performing the task listed during a single work shift within the range of times shown</u>	
	<u>APF = 10</u>	<u>APF = 25</u>
<u>Carbon Arcing</u>	<u>5 minutes – 60 minutes (1 hr.)</u>	<u>> 60 minutes</u>
<u>Flux Core Arc Welding (FCAW) or MIG-flux core welding</u>	<u>15 minutes – 120 minutes (2 hrs.)</u>	<u>> 120 minutes</u>
<u>Gas Metal Arc Welding (GMAW) or MIG-solid wire welding</u>	<u>30 minutes – 270 minutes (4.5 hrs.)</u>	<u>>270 minutes</u>
<u>Gas Tungsten Arc Welding (GTAW) or TIG-welding</u>	<u>150 minutes (2.5 hrs.) or more</u>	<u>N/A</u>
<u>Grinding Tasks directly related to the Welding process</u>	<u>15 minutes – 180 minutes (3 hrs.)</u>	<u>> 180 minutes</u>
<u>Hand-Held Torch Cutting</u>	<u>15 minutes – 150 minutes (2.5 hrs.)</u>	<u>> 150 minutes</u>
<u>Hand-Held Plasma Cutting</u>	<u>30 minutes – 300 minutes (5 hrs.)</u>	<u>> 300 minutes</u>
<u>Shielded Metal Arc Welding (SMAW)</u>	<u>10 minutes – 90 minutes (1.5 hrs.)</u>	<u>> 90 minutes</u>
<u>Notes for Table OR Q-2:</u>		
<ul style="list-style-type: none"> • <u>The symbol “>” means “greater than” the number of minutes that follow it.</u> • <u>See descriptions of the tasks included in OAR 437-002-0299.</u> • <u>Assigned Protective Factor (APF) is defined in 1910.134 Respiratory Protection.</u> • <u>Estimated exposures to Manganese within these guidelines were calculated using a more protective exposure target of 0.02 mg/m3.</u> 		

Stat. Auth.: ORS 654.025(2), 654.035 and ORS 656.726(4)
Stats. Implemented: ORS 654.001 - ORS 654.295
Hist.: OR-OSHA Admin. Order 11-2021, f. 9/1/21, ef. 9/1/22.

437-002-0282 Job Planning and Layout

- (1) Before **starting** operations~~[are started]~~, **securely block** portable equipment ~~[shall be securely blocked]~~ to prevent accidental movement.
- (2) **Equip** ~~[T]~~ tanks, boilers, drums and similar containers~~[shall be equipped]~~ with ladders for the **use of** welders and other workers when ~~[ever conditions]~~ required ~~[their use]~~ for safe access and egress.
- (3) **Do not allow** ~~[No]~~ welding equipment~~[shall be allowed]~~ on elevated structures unless **the**~~[such]~~ structure is designed and built to support all loads imposed on the structure.
- (4) ~~[Work areas shall be d]~~ Design~~[ed]~~, lay~~[id-]~~ out and operate~~[d]~~ **work areas** in a manner **that**~~[e]~~ prevents welding hose and cable from creating a tripping hazard.
- ~~[(5) When welding or cutting is being performed in any confined space, the gas cylinders and/or welding machines shall be left on the outside.]~~

Stat. Auth.: ORS 654.025(2), **654.035** and ORS 656.726(~~[3]~~**4**).

Stats. implemented: ORS 654.001-654.295

Hist: OR-OSHA Admin. Order 23-1990, f. 9/28/90, ef. 12/1/90.

OR-OSHA Admin. Order 11-2021, f. 9/1/21, ef. 9/1/22.

437-002-0283 **Additional** ~~[Eye Protection and]~~ Protective Clothing **Requirements During Hot Work Activities**

- (1) **Require employees to completely cover their skin with a double layer of clothing or equivalent to prevent burns or other damage by ultraviolet light.**
- (2) **Do not allow employees to wear** ~~[E]~~ easily ignited, highly flammable clothing, such as is made from synthetic materials ~~[, shall not be worn]~~. ~~[Flash goggles with side shields (Shade No. 2, Style Nos. 2 or 3) shall be worn under the welding helmet or hand shield].~~
- ~~[(3) The skin shall be covered completely, by a double layer of clothing or equivalent, to prevent burns or other damage by ultraviolet light.]~~

Stat. Auth.: ORS 654.025(2), **654.035** and ORS 656.726(~~[3]~~**4**).

Stats. Implemented: ORS 654.001-654.295

Hist: OR-OSHA Admin. Order 23-1990, f. 9/28/90, ef. 12/1/90.

OR-OSHA Admin. Order 11-2021, f. 9/1/21, ef. 9/1/22.

437-002-0284 **Additional** Specifications for **Eye and Face** Protection~~[ers]~~

- (1) **Provide and require the use of appropriate eye and face protection during all welding, cutting, and grinding tasks, in accordance with the requirements of the personal protective equipment rules at OAR 437-002-0134.** ~~[Where the "lift front" welder's helmet is used, there shall be a stationary safety glass on the inside of the frame next to the eyes to protect welder against flying particles when the front is lifted. Where lens containers will not permit use of such safety glass, safety goggles shall be worn.]~~

- (2) **Provide additional eye protection from the hazard of flying particles when a lift-front-type welder's helmet is used.** [~~Where the "lift front" helmet with three glasses is not used, or the flat type helmet is used, the welders shall wear other spectacle-type safety goggles in addition to the filter lens and cover glass.~~]

Stat. Auth.: ORS 654.025(2), **654.035** and ORS 656.726(~~3~~**4**).

Stats. Implemented: ORS 654.001-654.295

Hist:OR-OSHA Admin. Order 23-1990, f. 9/28/90, ef. 12/1/90.

OR-OSHA Admin. Order 11-2021, f. 9/1/21, ef. 9/1/22.

437-002-0285 **Additional** Special Precautions

Before welding or cutting on walls, floors or ceilings, **inspect the hidden side to ensure**[~~an inspection shall be made to see~~] that no combustible material is present [~~on the hidden side~~].

Stat. Auth.: ORS 654.025(2), **654.035** and ORS 656.726(~~3~~**4**).

Stats. Implemented: ORS 654.001-654.295

Hist:OR-OSHA Admin. Order 23-1990, f. 9/28/90, ef. 12/1/90

OR-OSHA Admin. Order 11-2021, f. 9/1/21, ef. 9/1/22.

437-002-0286 **Flammable** Preservative Coatings

- (1) **A competent person must test** [~~Before welding, cutting or heating is commenced on any surface covered by]~~**any** preservative coating whose flammability is not known **before welding, cutting or other hot work is started**[~~, a test shall be made by a competent person to determine its flammability~~].

- (2) [~~Precautions shall be taken to prevent ignition of h~~]**Highly flammable** [~~hardened preservative~~] coatings **(those coatings whose surface scrapings ignite when heat is applied) must**[~~When coatings are determined to be highly flammable, they shall~~] be stripped from the area to be heated to prevent ignition.

Stat. Auth.: ORS 654.025(2), **654.035** and ORS 656.726(~~3~~**4**).

Stats. Implemented: ORS 654.001 - ORS 654.295

Hist:OR-OSHA Admin. Order 23-1990, f. 9/28/90, ef. 12/1/90.

OR-OSHA Admin. Order 11-2021, f. 9/1/21, ef. 9/1/22.

437-002-0287 Toxic Preservative Coatings

- (1) In **confined and other** enclosed spaces, [~~all surfaces covered with toxic~~] preservative[s] **coatings that are** [~~shall be stripped of all~~] toxic **but not highly flammable must be removed**: [~~coatings~~]

(a) [~~for a~~]**A** distance of at least 4 inches from the area of heat application; **or**

(b) A greater distance, if that is necessary to prevent the production of toxic fumes and gases. [~~, or the employees shall be protected by a respirator against hazards from breathing toxic vapors in accordance with occupational health regulations.~~]

- (2) **As an alternative to stripping the coating, the employer can choose to protect all affected employees by requiring the use of appropriate respiratory protection in accordance with the Respiratory Protection Standard, 1910.134.** [~~The preservative coatings shall be removed a sufficient distance from the area to be heated to ensure that the temperature of the unstripped metal will not be appreciably raised.~~]

Note: Artificial cooling of the metal surrounding the heated area may be used to limit the size of the area **that must be stripped.** [~~required to be cleaned~~]

Note: “Coated Steels” are excluded from these requirements unless the manufacturer’s safety data sheet designates the product as a health hazard when heated.

Stat. Auth.: ORS 654.025(2), **654.035** and ORS 656.726(~~3~~4).

Stats. Implemented: ORS 654.001 - ORS 654.295.

Hist: OR-OSHA Admin. Order 23-1990, f. 9/28/90, ef. 12/1/90.

OR-OSHA Admin. Order 11-2021, f. 9/1/21, ef. 9/1/22.

437-002-0288 **Additional General** Health Protection [~~and Ventilation—General~~]

- (1) When welding, [~~or~~] cutting, **or grinding** operations are [~~being~~] performed on **or with** the [~~following~~] materials **listed in** [~~{~~] Table OR Q -1[~~}]~~, **follow** the protective measures indicated. **These measures** are **not** required [~~unless~~] **if air monitoring**[~~atmospheric~~] samples [~~taken in the welder’s breathing zone indicate~~] **confirm** that the [~~concentration does not exceed the limits~~] **permissible exposure limits** specified in Division 2/Z, OAR 437-002-0382, Oregon Rules for Air Contaminants **are not exceeded.**
- (2) **Use effective engineering controls, including local exhaust ventilation, as the primary control measure for indoor workplaces, when feasible.** [~~Nearby workers shall be afforded equivalent, effective, protection from these dangerous fumes.~~]
- (a) Use respiratory protection as a control measure when engineering controls are not feasible, or are not effective, or they are insufficient to protect employees to permissible exposure levels.**
- (b) Follow all applicable requirements when working with materials covered by substance-specific rules.**
- (3) Provide nearby workers with potential exposure to the air contaminants associated with the materials in Table OR Q-1 with equivalent, effective protection.**

TABLE OR Q-1 **Additional General Protective Measures**

Material	Condition	<u>In addition to the [P]protective [M]measures required in 1910.252 (c):</u>
Manganese	Confined Space	Airline Respirator or Local Exhaust Ventilation
Manganese	Indoors	Fume Respirator or Local Exhaust Ventilation
Zinc	Confined Space	Airline Respirator or Local Exhaust Ventilation
Zinc	Indoors or Outdoors	Fume Respirator or Local Exhaust Ventilation
Lead	Confined Space	Airline Respirator or Local Exhaust Ventilation
Lead	Indoors or Outdoors	Fume Respirator or Local Exhaust Ventilation
Lead in Immediate Vicinity	Other workers	Local Exhaust or Airline Respirator
Cadmium (in or coating base metals)	Confined Space or Indoors	Airline Respirator or Local Exhaust Ventilation
Cadmium (in or coating base metals)	Outdoors	Fume Respirator
Cadmium (in filler metals)	Confined Space	Local Exhaust and Airline Respirator
Mercury	Confined Space or Indoors	Airline Respirator or Local Exhaust Ventilation
Mercury	Outdoors	Approved Respirator
Beryllium	Confined Space	Airline Respirator or Local Exhaust Ventilation
Manganese	Confined Space	Airline Respirator or Local Exhaust Ventilation
Beryllium	Indoors or Outdoors	Airline Respirator and Local Exhaust Ventilation
Beryllium	Other Workers	Local Exhaust or Airline Respirator in Immediate Vicinity
Fluorine Compounds (Fluxes)	Indoors or Outdoors	Fume Respirator or Comp. Local Exhaust Ventilation]
<u>Beryllium</u>	<u>Follow applicable requirements in Subdivision 2/Z, Beryllium</u>	
<u>Cadmium</u>	<u>Follow applicable requirements in 29 CFR 1910.1027 Cadmium</u>	
<u>Chromium</u>	<u>Follow applicable requirements in 29 CFR 1910.1026 Chromium (VI)</u>	
<u>Fluorine Compounds (Fluxes)</u>	<u>Indoors or Outdoors</u>	<u>Local Exhaust Ventilation or Appropriate Respirator</u>
<u>Lead</u>	<u>Follow applicable requirements in 29 CFR 1910.1025 Lead</u>	
<u>Manganese</u>	<u>Local Exhaust Ventilation or Appropriate Respirator. Also, see OAR 437-002-0281</u>	
<u>Mercury</u>	<u>Confined Space or Indoors</u>	<u>Local Exhaust Ventilation or Appropriate Respirator</u>
<u>Mercury</u>	<u>Outdoors</u>	<u>Appropriate Respirator</u>
<u>Zinc</u>	<u>Confined Space or Indoors</u>	<u>Local Exhaust Ventilation or Appropriate Respirator</u>

Zinc

Outdoors

Appropriate Respirator

Note: The requirements of the Respiratory Protection Standard (1910.134) apply to all respirator use referenced in OAR 437-002-0288, and Table OR Q-1.

Stat. Auth.: ORS 654.025(2), **654.035** and ORS 656.726(4).

Stats. Implemented: ORS 654.001-654.295

Hist: OR-OSHA Admin. Order 23-1990, f. 9/28/90, ef. 12/1/90.

OR-OSHA Admin. Order 6-1994, f. 9/30/94, ef. 9/30/94.

OR-OSHA Admin. Order 5-2012, F. 9/25/12 ef. 9/25/12

OR-OSHA Admin. Order 11-2021, f. 9/1/21, ef. 9/1/22.

437-002-0297 **Oregon Requirements for** Welding or Cutting Containers

Note: 1910.252(a)(3)(i) was not adopted by the Department. In Oregon, 437-002-0297 applies instead.

(1) **A competent person must ensure that the following actions are taken before any hot work (such as [No-]welding, or torch- or abrasive-cutting [,-or other hot work shall be]is performed on drums, barrels, or tanks that contain substances that are [or other containers until they have been cleaned so thoroughly as to make absolutely certain that there are no] flammable or that could produce toxic vapors [materials present or any substances such as greases, tars, acids, surface coatings or other materials which]when subjected to heat;[- might produce flammable or toxic vapors. Any pipe lines or connections to the drum or vessel shall be disconnected or blanked.]**

(a) Clean and ventilate the containers to eliminate these substances, including solvents, greases, tars, acids, and surface coatings that could be affected;

(b) Disconnect or blank any pipe lines or connections to the container unless it is necessary for the release of pressure during the application of heat;

(2) **Use appropriate atmospheric testing equipment during the hot work operation to confirm that the air in the work area at the container remains within safe parameters.** [~~In order to meet the "absolutely certain" test required in subsection (1) of this rule, appropriate testing equipment shall be used prior to and frequently during the welding, torch or abrasive cutting or other hot work operation to insure that the container is free and remains free of flammable or toxic vapors.]~~

(3) **Document the actions taken to ensure safe conditions were maintained.**

(4) **Retain this documentation for at least one year following completion of the work.**

Stat. Auth.: ORS 654.025(2), **654.035** and ORS 656.726(~~3~~4).

Stats. Implemented: ORS 654.001-654.295

Hist: OR-OSHA Admin. Order 23-1990, f. 9/28/90, ef. 12/1/90.

OR-OSHA Admin. Order 11-2021, f. 9/1/21, ef. 9/1/22.

Note: 1910.252(c)(4)(iii) was not adopted by the Department. In Oregon, OAR 437-002-0298 applies instead.

Use self-contained breathing apparatus or other supplied air respiratory equipment in areas that are immediately dangerous to life and health (IDLH) due to known respiratory hazards; or when respiratory hazards are unknown. All respiratory equipment used must be approved by the National Institute for Occupational Safety and Health (NIOSH) and used in accordance with the Respiratory Protection Standard, 1910.134. [~~In areas immediately hazardous to life, self-contained breathing equipment shall be used. The breathing equipment shall be approved by the Mine Safety and Health Administration and the National Institute for Occupational Safety and Health.~~]

Stat. Auth.: ORS 654.025(2), **654.035** and ORS 656.726(~~3~~**4**)

Stats. Implemented: ORS 654.001 - ORS 654.295

Hist.: OR-OSHA Admin. Order 23-1990, f. 9/28/90, ef. 12/1/90.

OR-OSHA Admin. Order 11-2021, f. 9/1/21, ef. 9/1/22.

437-002-0299 Definitions

(1) Terms used in Division 2/Q

(a) Approved: listed or approved by a nationally recognized testing laboratory (NRTL). Note: 1910.7 has NRTL requirements.

(b) Coated steels: include metal coated to provide a protective covering such as to prevent rusting or to shield the metal from chemicals. Protective coatings can contain chromium, lead, tin, zinc or other potentially hazardous materials. During hot work, the coatings can give off fumes, smoke, or dust. Welders must know what a coating can give off when heated or burned. This information is available on the manufacturers' Safety Data Sheets. Permissible Exposure Limits for these materials must not be exceeded.

(c) Competent person: a person capable of identifying existing and predictable hazards in the work environment which are unsanitary, hazardous, or dangerous to employees; and who has authorization to take prompt, corrective measures to eliminate these hazards.

(d) Confined space: As defined in OAR 437-002-0146, a space that meets all of the following:

(A) Large enough and so configured that an employee can fully enter the space and perform work.

(B) Has limited or restricted means for entry or exit.

(C) Is not designed for continuous human occupancy.

(e) Feasible: In this context, something that is possible or capable of being done and that effectively accomplishes the goal of protecting employees.

(f) Hot work activities: include welding, torch-cutting, brazing and any similar activity that produces heat or a source of ignition.

(g) Toxic substance or harmful physical agent: As defined in 1910.1020, any chemical substance, biological agent (bacteria, virus, fungus, etc.), or physical stress (noise, heat, cold, vibration, repetitive motion, ionizing and non-ionizing radiation, hypo- or hyperbaric pressure, etc.) which:

(A) Is listed in the latest printed edition of the National Institute for Occupational Safety and Health (NIOSH) Registry of Toxic Effects of Chemical Substances (RTECS); or

(B) Has yielded positive evidence of an acute or chronic health hazard in testing conducted by, or known to, the employer; or

(C) Is the subject of a safety data sheet kept by or known to the employer indicating that the material may pose a hazard to human health.

(2) Welding, cutting or grinding tasks referenced in Table OR Q-2:

(a) Carbon Arcing – or carbon gouging -- is an arc cutting process in which metals to be cut are melted by the heat of the carbon arc and the molten metal is removed by a blast of air.

(b) Flux-Cored Arc Welding (FCAW) -- or FCA or MIG flux core welding -- is an automatic or semi-automatic arc welding process requiring a continuously fed consumable tubular electrode containing a flux. (Shielding gas is often not needed; but a constant welding current or power supply is required.)

(c) Gas Metal Arc Welding (GMAW) – or MIG Solid Wire uses a spooled, solid steel wire fed through a welding lead to the welding gun.

(d) Gas Tungsten Arc Welding (GTAW) -- or Tungsten Inert Gas -- TIG Welding (also called “Heliarc” welding) uses a non-consumable tungsten electrode to produce the weld and an inert gas to shield the weld from the atmosphere.

(e) Grinding tasks directly related to the welding process include the preparation of metal surfaces such as the removal of coatings, rust, or oxidation; and beveling or otherwise reducing the thickness at the edge of the metal to be joined by welding.

(f) Hand-held means any welding or cutting process where the torch or electrode holder is manipulated by hand.

(g) Torch cutting includes heating the metal with a torch flame until it is red, then using a blast trigger to deliver a higher concentration of oxygen that forces the molten metal away, creating a cut.

(h) Plasma Cutting uses a high-intensity plasma arc to melt a very narrow area that pushes through the work piece and removes the molten metal.

(i) Shielded Metal Arc Welding (SMAW) – also called “stick” welding -- uses a stick-type electrode core covered by chemical or metallic materials that provide shielding from surrounding air to complete an electrical circuit. Typically, a holder keeps the electrode at a chosen angle.

(3) Notes about the recommended “Standard order for atmospheric testing” in a confined or other enclosed space:

(a) Before workers are allowed to enter confined and enclosed spaces, and at sufficient intervals to ensure safe conditions, a person competent in the use of atmospheric testing equipment may be required to test the atmosphere.

(b) The following is considered the standard order of testing and provides guidelines for ranges of concentration that are recognized as safe:

(A) Oxygen. To support life, Oxygen content levels must be maintained at or above 19.5% and below 22.0% by volume. (Above 22.0% by volume is an “oxygen-enriched atmosphere with additional safety hazards for fire and explosion.) If an oxygen-deficient or oxygen-enriched atmosphere is found, ventilation must be provided at volumes and flow rates sufficient to restore oxygen content to the safe range.

(B) Flammable gases/ vapors. The concentration of flammable gasses or vapors must be maintained below 10% of the Lower Explosive Limit (LEL).

(C) Toxic vapors. The types of toxic gases, vapors, or fumes present will depend on the types of materials being worked on and worked with. These air contaminants must be maintained below the OSHA permissible exposure limits (PELs). If there is no established OSHA PEL, the levels must be maintained below the NIOSH immediately dangerous to life and health (IDLH) level. Local exhaust ventilation can remove these contaminants at their source while general exhaust ventilation -- provided at sufficient volumes and flow rates -- can restore concentrations to safe levels.

Stat. Auth.: ORS 654.025(2), 654.035 and ORS 656.726(4)

Stats. Implemented: ORS 654.001 - ORS 654.295

Hist.: OR-OSHA Admin. Order 11-2021, f. 9/1/21, ef. 9/1/22.

Division 2/Z, Toxic and Hazardous Substances

437-002-0382

An employee’s exposure to any substance listed in Oregon Tables Z-1, Z-2, or Z-3 of this section shall be limited in accordance with the requirements of the following paragraphs of this section.

(1) Oregon Table Z-1.

(a) Substances with limits preceded by “C” – Ceiling Values. An employee’s exposure to any substance in Oregon Table Z-1, the exposure limit of which is preceded by a “C”, shall at no time exceed the exposure limit given for that substance. If instantaneous monitoring is not feasible, then the ceiling shall be assessed as a 15-minute time weighted average exposure which shall not be exceeded at any time during the working day.

(b) Other substances – 8-hour Time Weighted Averages. An employee’s exposure to any substance in Oregon Table Z-1, the exposure limit of which is not preceded by a “C”, shall not exceed the 8-hour Time Weighted Average given for that substance in any 8-hour work shift of a 40-hour work week.

(c) Other Substances – Excursion Limits. Excursions in worker exposure levels may exceed 3 times the PEL-TWA for no more than a total of 30 minutes during a workday, and under no circumstances should they exceed 5 times the PEL-TWA, provided that the PEL-TWA is not exceeded.

(d) Skin Designation. To prevent or reduce skin absorption, an employee’s skin exposure to substances listed in Oregon Table Z-1 with an “X” in the Skin Designation column following the substance name shall be prevented or reduced to the extent necessary in the circumstances through the use of gloves, coveralls, goggles, or other appropriate personal protective equipment, engineering controls or work practices.

(2) Oregon Table Z-2. An employee’s exposure to any substance listed in Oregon Table Z-2 shall not exceed the exposure limits specified as follows:

(a) 8-hour time weighted averages. An employee’s exposure to any substance listed in Oregon Table Z-2, in any 8-hour work shift of a 40-hour work week, shall not exceed the 8-hour time weighted average limit given for that substance in Oregon Table Z-2.

(b) Acceptable ceiling concentrations. An employee’s exposure to a substance listed in Oregon Table Z-2 shall not exceed the acceptable ceiling concentration for the given substance in the table at any time during an 8-hour shift except: ~~{(i)}~~ Acceptable maximum peak above the acceptable ceiling concentration for an 8-hour shift. An employee’s exposure to a substance listed in Oregon Table Z-2 shall not exceed the acceptable maximum peak above the acceptable ceiling concentration, and shall not exceed the maximum duration for the given substance during an 8-hour shift.

(c) Example. During an 8-hour work shift, an employee exposed to benzene may be exposed to an 8-hour time weighted average (TWA) of 10 ppm. Concentrations of benzene during the 8-hour work shift may not exceed 25 ppm, unless that exposure is no more than 50 ppm and does not exceed 10 minutes during an 8-hour work shift. Such exposures must be compensated by exposures to concentrations below 10 ppm so that the 8-hour time-weighted average is less than 10 ppm.

Example					
Substance	8-Hour Time-Weighted Average	Acceptable Ceiling Concentration	Acceptable Max. Peak Above the acceptable Ceiling Concentration for an 8-hour Shift		Skin
			Concentration	Maximum Duration	
Benzene ^(a) (Z87.4-1969)	10 ppm	25 ppm	50 ppm	10 min.	
Beryllium, and beryllium compounds (Z37.29-1970)	2 µg/m ³	5 µg/m ³	25 µg/m ³	30 min.	
Cadmium fume ^(b) (Z37.5-1970)	0.1 mg/m ³	0.3 mg/m ³			
Cadmium dust ^(b) (Z37.5-1970)	0.2 mg/m ³	0.6 mg/m ³			
Carbon disulfide (Z37.3-1968)	20 ppm	30 ppm	100 ppm	30 min.	X
Carbon tetrachloride (Z37.17-1967)	10 ppm	25 ppm	200 ppm	5 min. in any 4 hrs	

(d) Skin Designation. To prevent or reduce skin absorption, an employee's skin exposure to substances listed in Oregon Table Z-2 with an "X" in the Skin Designation column following the substance name shall be prevented or reduced to the extent necessary in the circumstances through the use of gloves, coveralls, goggles, or other appropriate personal protective equipment, engineering controls or work practices.

(3) Oregon Table Z-3. An employee's exposure to any substance listed in Oregon Table Z-3, in any 8-hour work shift of a 40-hour work week, shall not exceed the 8-hour time weighted average limit given for that substance in the table.

(4) Computation formulae. The computation formula which shall apply to employee exposure to more than one substance for which 8-hour time weighted averages are included in OAR 437, Division 2/Z, Toxic and Hazardous Substances, in order to determine whether an employee is exposed over the regulatory limit is as follows:

(a) Cumulative exposures.

(A) [(i)] The cumulative exposure for an 8-hour work shift shall be computed as follows:

$$E = (CaTa + CbTb + \dots CnTn) \div 8$$

Where:

E is the equivalent exposure for the working shift.

C is the concentration during any period of time T where the concentration remain constant.

T is the duration in hours of the exposure at the concentration C.

The value of E shall not exceed the 8-hour time weighted average specified in subpart Z of 29 CFR part 1910 for the substance involved.

(B) [(ii)] To illustrate the formula prescribed in paragraph (4)(a)(i) of this section, assume that Substance A has an 8-hour time weighted average limit of 100 ppm (Oregon Table Z-1).

Assume that an employee is subject to the following exposure:

Two hours exposure at 150 ppm

Two hours exposure at 75 ppm

Four hours exposure at 50 ppm

Substituting this information in the formula, we have

$$[(2 \times 150) + (2 \times 75) + (4 \times 50)] \div 8 = 81.25 \text{ ppm}$$

Since 81.25 ppm is less than 100 ppm, the 8-hour time weighted average limit, the exposure is acceptable.

(b) Mixtures.

(A) ~~[(i)]~~ In case of a mixture of air contaminants an employer shall compute the equivalent exposure as follows:

$$E_m = (C_1 \div L_1) + (C_2 \div L_2) + \dots (C_n \div L_n)$$

Where:

E_m is the equivalent exposure for the mixture.

C is the concentration of a particular contaminant.

L is the exposure limit for that substance specified in Subpart Z of 29 CFR Part 1910.

The value of E_m shall not exceed unity (1).

(B) ~~[(ii)]~~ To illustrate the formula prescribed in paragraph (4)(b)(i) of this section, consider the following exposures:

Substance	Actual concentration of 8-hour exposure	8-hour time weighted average exposure limit
B	500 ppm	1,000 ppm
C	45 ppm	200 ppm
D	40 ppm	200 ppm

Substituting in the formula, we have:

$$E_m = (500 \div 1000) + (45 \div 200) + (40 \div 200)$$

$$E_m = 0.500 + 0.225 + 0.200$$

$$E_m = 0.925$$

Since E_m is less than unity (1), the exposure combination is within acceptable limits.

(5) To achieve compliance with paragraphs (1) through (4) of this section, administrative or engineering controls must first be determined and implemented whenever feasible. When such controls are not feasible to achieve full compliance, protective equipment or any other protective measures shall be used to keep the exposure of employees to air contaminants within the limits prescribed in this section. Any equipment and/or technical measures used for this purpose must be approved for each particular use by a competent industrial hygienist or other technically qualified person. Whenever respirators are used, their use shall comply with 1910.134.

Oregon Table Z-1 Table Z-1 Adopted Values (In Alphabetical Order)

Note: Only changes made to the table are shown.

Substance	CAS No. ^(c)	ppm ^(a)	mg/m ³ ^(b)	Skin
Manganese Compounds <u>and fume</u> (as Mn)	7439-96-5	—	<u>0.1</u> (C) 5	
[Manganese fume (as Mn)]	[7439-96-5]	[—]	[(C) 5]	

Statutory/Other Authority: ORS 654.025(2), **654.035** and 656.726(4)

Statutes/Other Implemented: ORS 654.001 - 654.295

History: APD Admin. Order 13-1988, f. 8/2/88, ef. 8/2/88 (Benzene).

APD Admin. Order 14-1988, f. 9/12/88, ef. 9/12/88 (Formaldehyde).

APD Admin. Order 18-1988, f. 11/17/88, ef. 11/17/88 (Ethylene Oxide).

APD Admin. Order 4-1989, f. 3/31/89, ef. 5/1/89 (Asbestos-Temp).

APD Admin. Order 6-1989, f. 4/20/89, ef. 5/1/89 (Non-Asbestiforms-Temp).

APD Admin. Order 9-1989, f. 7/7/89, ef. 7/7/89 (Asbestos & Non-Asbestiforms-Perm).

APD Admin. Order 11-1989, f. 7/14/89, ef. 8/14/89 (Lead).

APD Admin. Order 13-1989, f. 7/17/89, ef. 7/17/89 (Air Contaminants).

OR-OSHA Admin. Order 1-1990, f. 1/11/90, ef. 1/11/90 (Formaldehyde-Temp).

OR-OSHA Admin. Order 3-1990, f. 1/19/90, ef. 1/19/90 (Asbestos & Non-Asbestiforms-Temp).

OR-OSHA Admin. Order 6-1990, f. 3/2/90, ef. 3/2/90 (Formaldehyde-Perm).

OR-OSHA Admin. Order 7-1990, f. 3/2/90, ef. 3/2/90 (Asbestos & Non-Asbestiforms-Perm).

OR-OSHA Admin. Order 9-1990, f. 5/8/90, ef. 8/8/90 (Labs).

OR-OSHA Admin. Order 11-1990, f. 6/7/90, ef. 7/1/90 (Air Contaminants).

OR-OSHA Admin. Order 13-1990, f. 6/28/90, ef. 8/1/90 (Asbestos-Temp).

OR-OSHA Admin. Order 14-1990, f. 6/28/90, ef. 8/1/90 (Lead).

OR-OSHA Admin. Order 19-1990, f. 8/31/90, ef. 8/31/90 (Asbestos-Perm).

OR-OSHA Admin. Order 20-1990, f. 9/18/90, ef. 9/18/90 (Lead).

OR-OSHA Admin. Order 21-1990, f. 9/18/90, ef. 9/18/90 (Air Contaminants).

OR-OSHA Admin. Order 7-1991, f. 4/25/91, ef. 4/25/91 (Air Contaminants, Asbestos, Formaldehyde).

OR-OSHA Admin. Order 13-1991, f. 10/10/91, ef. 10/10/91 (Lead, Formaldehyde).

OR-OSHA Admin. Order 15-1991, f. 12/13/91, ef. 12/13/91 (Asbestos).

OR-OSHA Admin. Order 1-1992, f. 1/22/92, ef. 1/22/92 (Formaldehyde).

OR-OSHA Admin. Order 4-1992, f. 4/16/92, ef. 4/16/92 (Formaldehyde).

OR-OSHA Admin. Order 5-1992, f. 4/24/92, ef. 7/1/92 (Bloodborne Pathogens).

OR-OSHA Admin. Order 6-1992, f. 5/18/92, ef. 5/18/92 (Asbestos).

OR-OSHA Admin. Order 10-1992, f. 9/24/92, ef. 9/24/92 (Lead-temp).

OR-OSHA Admin. Order 11-1992, f. 10/9/92, ef. 10/9/92 (Asbestos).

OR-OSHA Admin. Order 12-1992, f. 10/13/92, ef. 10/13/92 (Formaldehyde).

OR-OSHA Admin. Order 15-1992, f. 12/30/92, ef. 12/30/92 (Air Contaminants, BBP, Labs).

OR-OSHA Admin. Order 1-1993, f. 1/22/93, ef. 1/22/93 (Cadmium, MDA).

OR-OSHA Admin. Order 6-1993, f. 5/17/93, ef. 5/17/93 (Air Contaminants-Temp).

OR-OSHA Admin. Order 12-1993, f. 8/20/93, ef. 11/1/93 (remainder of 2/Z).

OR-OSHA Admin. Order 17-1993, f. 11/15/93, ef. 11/15/93 (Air Contaminants-Perm).

OR-OSHA Admin. Order 4-1995, f. 3/29/95, ef. 3/29/95 (Asbestos).

OR-OSHA Admin. Order 8-1995, f. 8/25/95, ef. 8/25/95 (Asbestos).
OR-OSHA Admin. Order 4-1996, f. 9/13/96, ef. 9/13/96 (Lead).
OR-OSHA Admin. Order 6-1996, f. 11/29/96, ef. 11/29/96 (Asbestos).
OR-OSHA Admin. Order 4-1997, f. 4/2/97, ef. 4/2/97.
OR-OSHA Admin. Order 6-1997, f. 5/2/97, ef. 5/2/97.
OR-OSHA Admin. Order 8-1997, f. 11/14/97, ef. 11/14/97 (Methylene Chloride).
OR-OSHA Admin. Order 1-1998, f. 2/13/98, ef. 2/13/98 (Methylene Chloride).
OR-OSHA Admin. Order 3-1998, f. 7/7/98, ef. 7/7/98.
OR-OSHA Admin. Order 1-1999, f. 3/22/99, ef. 3/22/99.
OR-OSHA Admin. Order 4-1999, f. 4/30/99, ef. 4/30/99.
OR-OSHA Admin. Order 6-2001, f. 5/15/01, ef. 5/15/01 (Cotton Dust).
OR-OSHA Admin. Order 10-2001, f. 9/14/01, ef. 10/18/01 (Bloodborne Pathogens).
OR-OSHA Admin. Order 12-2001, f. 10/26/01, ef. 10/26/01 (Methylene Chloride).
OR-OSHA Admin. Order 1-2005, f. 4/12/05, ef. 4/12/05.
OR-OSHA Admin. Order 4-2006, f. 4/24/06, ef. 4/24/06.
OR-OSHA Admin. Order 6-2006, f. 8/30/06, ef. 8/30/06.
OR-OSHA Admin. Order 10-2006, f. 11/30/06, ef. 11/30/06.
OR-OSHA Admin. Order 5-2009, f. 5/29/09, ef. 5/29/09.
OR-OSHA Admin. Order 3-2010, f. 6/10/10, ef. 6/15/10.
OR-OSHA Admin. Order 4-2011, f. 12/8/11, ef. 12/8/11.
OR-OSHA Admin. Order 5-2011, f. 12/8/11, ef. 7/1/12.
OR-OSHA Admin. Order 1-2012, f. 4/10/12, ef. 4/10/12.
OR-OSHA Admin. Order 5-2012, f. 9/25/12, ef. 9/25/12.
OR-OSHA Admin. Order 3-2013, f. 7/18/13, ef. 7/18/13.
OR-OSHA Admin. Order 4-2013, f. 7/19/13, ef. 7/19/13.
OR-OSHA Admin. Order 3-2019, f. 10/29/19, ef. 10/29/19.
OR-OSHA Admin. Order 11-2021, f. 9/1/21, ef. 9/1/22.

DIVISION 3, CONSTRUCTION

Division 3/Z, Toxic and Hazardous Substances

437-003-1000

An employee's exposure to any substance listed in Oregon Tables Z-1, Z-2, or Z-3 of this section shall be limited in accordance with the requirements of the following paragraphs of this section.

(1) Oregon Table Z-1.

(a) Substances with limits preceded by "C" – Ceiling Values. An employee's exposure to any substance in Oregon Table Z-1, the exposure limit of which is preceded by a "C", shall at no time exceed the exposure limit given for that substance. If instantaneous monitoring is not feasible, then the ceiling shall be assessed as a 15-minute time weighted average exposure which shall not be exceeded at any time during the working day.

(b) Other substances – 8-hour Time Weighted Averages. An employee's exposure to any substance in Oregon Table Z-1, the exposure limit of which is not preceded by a "C", shall not

exceed the 8-hour Time Weighted Average given for that substance in any 8-hour work shift of a 40-hour work week.

(c) Other Substances – Excursion Limits. Excursions in worker exposure levels may exceed 3 times the PEL-TWA for no more than a total of 30 minutes during a workday, and under no circumstances should they exceed 5 times the PEL-TWA, provided that the PEL-TWA is not exceeded.

(d) Skin Designation. To prevent or reduce skin absorption, an employee's skin exposure to substances listed in Oregon Table Z-1 with an "X" in the Skin Designation column following the substance name shall be prevented or reduced to the extent necessary in the circumstances through the use of gloves, coveralls, goggles, or other appropriate personal protective equipment, engineering controls or work practices.

(2) Oregon Table Z-2. An employee's exposure to any substance listed in Oregon Table Z-2 shall not exceed the exposure limits specified as follows:

(a) 8-hour time weighted averages. An employee's exposure to any substance listed in Oregon Table Z-2, in any 8-hour work shift of a 40-hour work week, shall not exceed the 8-hour time weighted average limit given for that substance in Oregon Table Z-2.

(b) Acceptable ceiling concentrations. An employee's exposure to a substance listed in Oregon Table Z-2 shall not exceed the acceptable ceiling concentration for the given substance in the table at any time during an 8-hour shift except: ~~(i)~~ Acceptable maximum peak above the acceptable ceiling concentration for an 8-hour shift. An employee's exposure to a substance listed in Oregon Table Z-2 shall not exceed the acceptable maximum peak above the acceptable ceiling concentration, and shall not exceed the maximum duration for the given substance during an 8-hour shift.

(c) Example. During an 8-hour work shift, an employee exposed to benzene may be exposed to an 8-hour time weighted average (TWA) of 10 ppm. Concentrations of benzene during the 8-hour work shift may not exceed 25 ppm, unless that exposure is no more than 50 ppm and does not exceed 10 minutes during an 8-hour work shift. Such exposures must be compensated by exposures to concentrations below 10 ppm so that the 8-hour time-weighted average is less than 10 ppm.

Substance	8-Hour Time-Weighted Average	Acceptable Ceiling Concentration	Acceptable Max. Peak Above the Acceptable Ceiling Concentration for an 8-hour Shift		
			Concentration	Maximum Duration	Skin
Benzene (a) (Z87.4-1969)	10 ppm	25 ppm	50 ppm	10 min.	
Beryllium and beryllium compounds (Z37.17-1970)	2 µg/m ³	5 µg/m ³	25 µg/m ³	30 min.	
Carbon disulfide (Z37.3-1968)	20 ppm	30 ppm	100 ppm	30 min.	X
Carbon tetrachloride (Z37.19-1967)	10 ppm	25 ppm	200 ppm	5 min. in any 4 hours	

(d) Skin Designation. To prevent or reduce skin absorption, an employee's skin exposure to substances listed in Oregon Table Z-2 with an "X" in the Skin Designation column following the substance name shall be prevented or reduced to the extent necessary in the circumstances through the use of gloves, coveralls, goggles, or other appropriate personal protective equipment, engineering controls or work practices.

(3) Oregon Table Z-3. An employee's exposure to any substance listed in Oregon Table Z-3, in any 8-hour work shift of a 40-hour work week, shall not exceed the 8-hour time weighted average limit given for that substance in the table.

(4) Computation formulae. The computation formula which shall apply to employee exposure to more than one substance for which 8-hour time weighted averages are included in OAR 437, Division 2/Z, Toxic and Hazardous Substances, in order to determine whether an employee is exposed over the regulatory limit is as follows:

(a) Cumulative Exposures.

(A) [(i)] The cumulative exposure for an 8-hour work shift shall be computed as follows:

$$E = (CaTa + Cb Tb + \dots CnTn) \div 8$$

Where:

E is the equivalent exposure for the working shift.

C is the concentration during any period of time T where the concentration remain constant.

T is the duration in hours of the exposure at the concentration C.

The value of E shall not exceed the 8-hour time weighted average specified in subpart Z of 29 CFR part 1910 for the substance involved.

(B) [(ii)] To illustrate the formula prescribed in paragraph (4)(a)(i) of this section, assume that Substance A has an 8-hour time weighted average limit of 100 ppm (Oregon Table Z-1). Assume that an employee is subject to the following exposure:

Two hours exposure at 150 ppm

Two hours exposure at 75 ppm

Four hours exposure at 50 ppm

Substituting this information in the formula, we have

$$[(2 \times 150) + (2 \times 75) + (4 \times 50)] \div 8 = 81.25 \text{ ppm}$$

Since 81.25 ppm is less than 100 ppm, the 8-hour time weighted average limit, the exposure is acceptable.

(b) Mixtures.

(A) [(i)] In case of a mixture of air contaminants an employer shall compute the equivalent exposure as follows:

$$E_m = (C_1 \div L_1) + (C_2 \div L_2) + \dots + (C_n \div L_n)$$

Where:

E_m is the equivalent exposure for the mixture.

C is the concentration of a particular contaminant.

L is the exposure limit for that substance specified in Subpart Z of 29 CFR Part 1910.

The value of E_m shall not exceed unity (1).

(B) [(ii)] To illustrate the formula prescribed in paragraph (4)(b)(i) of this section, consider the following exposures:

<i>Substance</i>	<i>Actual concentration of 8-hour exposure</i>	<i>8-hour time weighted average exposure limits</i>
<i>B</i>	<i>500 ppm</i>	<i>1,000 ppm</i>
<i>C</i>	<i>45 ppm</i>	<i>200 ppm</i>
<i>D</i>	<i>40 ppm</i>	<i>200 ppm</i>

Substituting in the formula, we have:

$$E_m = (500 \div 1000) + (45 \div 200) + (40 \div 200)$$

$$E_m = 0.500 + 0.225 + 0.200$$

$$E_m = 0.925$$

Since E_m is less than unity (1), the exposure combination is within acceptable limits.

(5) To achieve compliance with paragraphs (1) through (4) of this section, administrative or engineering controls must first be determined and implemented whenever feasible. When such

controls are not feasible to achieve full compliance, protective equipment or any other protective measures shall be used to keep the exposure of employees to air contaminants within the limits prescribed in this section. Any equipment and/or technical measures used for this purpose must be approved for each particular use by a competent industrial hygienist or other technically qualified person. Whenever respirators are used, their use shall comply with 1910.134.

Table Oregon Table Z-1 – Adopted Values (In Alphabetical Order)

Note: Only changes made to the table are shown.

Substance	CAS No. (c)	Ppm (a)	Mg/m ³ (b)	Skin
Manganese Compounds <u>and fume</u> (as Mn)	7439-96-5	—	<u>0.1</u> (C) 5	
[Manganese fume (as Mn)]	[7439-96-5]	[—]	[(C) 5]	

Stat. Auth.: ORS 654.025(2), **654.035** and 656.726(4).

Stats. Implemented: ORS 654.001 through 654.295.

Hist: WCB Admin. Order, Safety 3-1975, f. 10/6/75, ef. 11/1/75.

WCB Admin. Order, Safety 6-1978, f. 7/5/78, ef. 7/15/78.

WCD Admin. Order, Safety 12-1979, f. 12/21/79, ef. 3/1/80.

WCB Admin. Order, Safety 2-1980, f. 4/17/80, ef. 8/1/80.

WCB Admin. Order, Safety 1-1982, f. 3/4/82, ef. 5/5/82.

WCB Admin. Order, Safety 6-1983, f. 5/25/83, ef. 5/25/83.

WCB Admin. Order, Safety 21-1984, f. 12/20/84, ef. 1/1/85.

WCD Admin. Order, Safety 4-1986, f. 5/5/86, ef. 5/5/86.

WCB Admin. Order, Safety 5-1986, f. 5/20/86, ef. 6/13/86.

APD Admin. Order 13-1989, f. 7/17/89, ef. 7/17/89.

OR-OSHA Admin. Order 6-1997, f. 5/2/97, ef. 5/2/97.

OR-OSHA Admin. Order 4-2001, f. 02/05/01, ef. 02/05/01.

OR-OSHA Admin. Order 6-2006, f. 8/30/06, ef. 8/30/06.

OR-OSHA Admin. Order 6-2008, f. 5/13/08, ef. 7/1/08.

OR-OSHA Admin. Order 5-2016, f. 9/23/16, ef. 7/1/18.

OR-OSHA Admin. Order 3-2017, f. 07/07/17, ef. 03/12/18.

OR-OSHA Admin. Order 3-2019, f. 10/29/19, ef. 10/29/19.

OR-OSHA Admin. Order 11-2021, f. 9/1/21, ef 9/1/22.

DIVISION 4, AGRICULTURE

Division 4/Z, Chemical/Toxins

437-004-9000

An employee's exposure to any substance in Oregon Tables Z-1, Z-2, or Z-3 of this section must be limited in accordance with the requirements of the following paragraphs of this section.

(1) Oregon Table Z-1.

(a) Substances with limits preceded by "C" – ceiling values. An employee's exposure to any substance in Oregon Table Z-1, the exposure limit of which is not preceded by a "C", must at no time exceed the ceiling exposure limit given for that substance. If instantaneous monitoring is not feasible, then assess the ceiling as a 15-minute time-weighted average. This exposure level must never be exceeded at any time during the workday.

(b) Other substances — 8-hour time-weighted averages (PEL-TWA). An employee's exposure to any substance in Oregon Table Z-1, the exposure limit of which is not preceded by a "C", must not exceed the 8-hour Time-Weighted Average for that substance in any 8-hour shift of a 40-hour work week.

(c) Other substances — Excursion Limits. Excursions in exposure levels may be more than three times the PEL-TWA number for no more than a total of 30 minutes during a workday, and must never be more than five times the PEL-TWA, provided that the overall 8-hour PEL-TWA is not exceeded.

(d) Skin designation. To prevent or reduce skin absorption, you must prevent or reduce an employee's skin exposure to substances listed in Oregon Table Z-1 with an "X" in the Skin designation column following the substance name. Prevent or reduce exposure to the extent necessary in the circumstances through the use of gloves, coveralls, goggles, or other appropriate personal protective equipment, engineering controls or work practices.

(e) Oregon Table Z-1 in Division 4/Z, OAR 437-004-9000, has a complete list of regulated substances. If your operation exposes an employee to a substance listed in Oregon Table Z-1, and that substance includes a reference to another rule, that rule may apply to your circumstances.

(2) Oregon Table Z-2. An employee's exposure to any substance listed in Oregon Table Z-2 must not exceed the following exposure limits:

(a) 8-hour time-weighted averages. An employee's exposure to any substance in Oregon Table Z-2, in any 8 hour work shift of a 40-hour work week, must not exceed the 8-hour time-weighted average limit for that substance in Oregon Table Z-2.

(b) Acceptable ceiling concentrations. An employee's exposure to a substance in Oregon Table Z-2 must not exceed the acceptable ceiling concentration for that substance during an 8-hour shift except: ~~{(i)}~~ Acceptable maximum peak above the acceptable ceiling concentration for an 8-hour shift. An employee's exposure to a substance in Oregon Table Z-2 must never exceed the acceptable maximum peak above the acceptable ceiling concentration and must not exceed the maximum duration of exposure at that level for the substance during an 8-hour shift.

(c) Example. During an 8-hour work shift, an employee's exposure to benzene is limited to an 8-hour time-weighted average (TWA) of 10 ppm. The acceptable ceiling concentration of benzene during the 8-hour work shift is a maximum of 25 ppm, unless that exposure is no more than 50 ppm and for not longer than 10 minutes during an 8-hour work shift. Such exposures must be compensated by lower exposure levels (concentrations below the TWA number – 10 ppm) during that shift so that the overall 8 hour time-weighted average is a maximum of 10 ppm.

Example from Oregon Table Z-2					
Substance	8-Hour Time-Weighted Average	Acceptable Ceiling Concentration	Acceptable Max. Peak Above the Acceptable Ceiling Concentration for an 8-hour Shift		Skin
			Concentration	Maximum Duration	
Benzene (a) (Z87.4-1969)	10 ppm	25 ppm	50 ppm	10 min.	
Beryllium and beryllium Compounds (Z37.17-1970)	2 µg/m ³	5 µg/m ³	25 µg/m ³	30 min.	
Carbon tetrachloride (Z37.19-1967)	10 ppm	25 ppm	200 ppm	5 min. In any 4 hours	

(d) Skin designation. To prevent or reduce skin absorption, you must prevent or reduce an employee's skin exposure to substances listed in Oregon Table Z-2 with an "X" in the Skin designation column following the substance name. Prevent or reduce exposure to the extent necessary in the circumstances through the use of gloves, coveralls, goggles, or other appropriate personal protective equipment, engineering controls, or work practices.

(3) Oregon Table Z-3. An employee's exposure to any substance in Oregon Table Z-3, in any 8-hour work shift of a 40-hour work week, must not exceed the 8-hour time-weighted average limit given for that substance.

(4) Computation formulae. The computation formulae that apply to exposures to one or more substances, with 8-hour time-weighted averages included in OAR 437, Division 4/Z, Chemicals/Toxins, in order to determine whether an employee is exposed is over the regulatory limit are as follow:

(a) For a single air contaminant:

(A) [(+)] Compute the cumulative exposure for an 8-hour work shift as follows:

$$E = (CaTa + CbTb + \dots CnTn) \div 8$$

Where:

E is the equivalent exposure to that substance for the shift.

C is the concentration during any period T where the concentration remains constant.

T is the duration in hours of the exposure at the concentration C.

The value of E must not exceed the 8-hour time-weighted average specified for that substance in Subdivision 4/Z.

(B) [(iii)] To illustrate the formula in (4)(a)(i) above, assume that Substance A (from Oregon Table Z-1) has an 8 hour time-weighted average limit of 100 ppm. Assume that an employee is subject to the following exposure:

Two hours exposure at 150 ppm

Two hours exposure at 75 ppm

Four hours exposure at 50 ppm

Substituting this information in the formula, we have:

$$[(C_a \times T_a) + (C_b \times T_b) + \dots (C_n \times T_n)] \div 8 = E = \text{TWA}$$

$$[(2 \times 150) + (2 \times 75) + (4 \times 50)] \div 8 = 81.25 \text{ ppm}$$

Since 81.25 ppm is less than 100 ppm, the 8-hour time-weighted average limit, the exposure is acceptable.

(b) For a mixture of air contaminants:

(A) [(i)] In case of a mixture of air contaminants, compute the equivalent exposure as follows:

$$E_m = (C_1 \div L_1) + (C_2 \div L_2) + \dots (C_n \div L_n)$$

Where:

E_m is the equivalent exposure for the mixture.

C_n is the concentration of a particular contaminant.

L_n is the exposure limit for that substance in Subdivision 4/Z.

The value of E_m must not exceed “unity” (1).

(B) [(iii)] To illustrate the formula in (4)(b)(i) above, consider the following exposures:

Substance	Actual concentration of 8-hour exposure (C_n)	8-hour time-weighted average exposure limit (L_n)
1	500 ppm	1,000 ppm
2	45 ppm	200 ppm
3	40 ppm	200 ppm

Substituting in the formula, we have:

$$E_m = (C_1 \div L_1) + (C_2 \div L_2) + \dots (C_n \div L_n)$$

$$E_m = (500 \div 1000) + (45 \div 200) + (40 \div 200)$$

$$E_m = 0.500 + 0.225 + 0.200$$

Em = 0.925

Since Em (0.925) is less than unity (1), the exposure combination is within acceptable limits.

(5) Engineering or administrative controls. To achieve compliance with the exposure limits in paragraphs (1) through (4) of this section, first determine and implement, when feasible, engineering or administrative controls. When such controls are not feasible, mandate the use of protective equipment or any other protective measures to keep exposure within the limits in this section. Any equipment or technical measures used for this purpose must be approved for each particular use by a competent Industrial Hygienist or other technically qualified person. Whenever using respirators, comply with Division 4/I, OAR 437-004-1040, Respiratory Protection. Tables Z-1, Z-2, Z-3, and notes.

Oregon Table Z-1- Adopted Values (In Alphabetical Order)

Note: Only changes made to the table are shown.

Substance	CAS No. ^(c)	ppm ^(a)	mg/m ³ ^(b)	Skin
Manganese Compounds <u>and Fume</u> (as Mn)	7439-96-5	—	<u>0.1</u> (C) 5	
[Manganese fume (as Mn)]	[7439-96-5]	[]	[(C) 5]	

Stat. Auth.: ORS 654.025(2), **654.035** and 656.726(4).

Stats. Implemented: ORS 654.001 through 654.295.

Hist: OR-OSHA Admin. Order 4-1998, f. 8/28/98, ef. 10/1/98.
OR-OSHA Admin. Order 4-2001, f. 2/5/01, ef. 2/5/01.
OR-OSHA Admin. Order 9-2001, f. 9/14/01, ef. 9/14/01.
OR-OSHA Admin. Order 6-2006, f. 8/30/06, ef. 8/30/06.
OR-OSHA Admin. Order 4-2012, f. 9/19/12, ef. 1/1/13.
OR-OSHA Admin Order 11-2021, f. 9/1/21, ef. 9/1/22