



Oregon

Kate Brown, Governor

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September 1, 2021

[Text of changes](#)

Adoption of Rules to Reduce Manganese Permissible Exposure Limit; Cross-References Welding Rules with Other Standards Including Confined Spaces

This rulemaking reduces Oregon OSHA's permissible exposure limit (PEL) for manganese compounds and fume (as Mn, C.A.S. #7349-96-5) in the Air Contaminants rules for general industry (Subdivision 2/Z), construction (Subdivision 3/Z), and agriculture (Subdivision 4/Z). The revised PEL is 0.1 mg/m³, as an 8-hour time-weighted average; and retains the ceiling limit of 5 mg/m³.

This rule-making was initiated as a result of the work of two advisory committees. First, Oregon OSHA established a **Permissible Exposure Limits (PEL) Advisory Committee** -- comprised of occupational health professionals from various public and private entities throughout our state -- to identify hazardous substances (or physical hazards) with existing permissible exposure limits that were considered to be under-protective and to determine where serious exposures may be occurring in Oregon. This group selected manganese as a priority substance because of broad exposures to workers in Oregon across a wide range of industries and due to its potential for adverse health effects. In support of these concerns, the National Institute of Occupational Safety and Health (NIOSH) and the American Conference of Governmental Industrial Hygienists (ACGIH) have both recommended significantly more protective exposure levels or threshold values for manganese than the current Oregon OSHA (and federal OSHA) "Ceiling Limit" of 5 mg/ m3.

Oregon OSHA subsequently established the **Manganese PEL Advisory Committee**. Because manganese exposures in Oregon are primarily linked to welding fume, the committee was comprised of representatives from small and large business that perform welding and other hot work activities as part of their operations. In addition, consultants who work with these firms, and representatives from manufacturing, construction, labor, and associations representing potentially affected business groups were asked to participate to help determine an appropriate PEL for manganese.

During these meetings, conducted over a period of about three years, the advisory committee members made numerous recommendations including one to cross-reference the requirements of the Subdivision 2/Q Welding, Cutting and Brazing rules with other related rules such as Oregon OSHA's Confined Spaces rules (OAR 437-002-0146), our Oregon-initiated Personal Protective Equipment rules for general industry (OAR 437-002-0134), and the general industry Respiratory Protection Standard (29 CFR 1910.134). They regularly reviewed and offered suggestions that were incorporated into the proposal including ways to minimize any fiscal impact to their industries. Oregon OSHA's technical staff also took the opportunity to clarify and

simplify the Oregon-initiated rules that supplement the federal OSHA 29 CFR 1910.252 General Requirements protections in Subdivision 2/Q.

This effort also resulted in the creation of three new rules to supplement the requirements in Subdivision 2/Q.

OAR 437-002-0279, Additional Oregon Confined Space Requirements.

OAR 437-002-0281, Manganese (includes a new Table OR Q-2.)

OAR 437-002-0299, Definitions.

Oregon OSHA held two hearings on February 20, and March 4, 2020, and received no oral comments at those hearings. Oregon OSHA received three written comments in regards to the proposed rulemaking. Based on the comments received, the agency is delaying the effective date of the rule changes. The delay recognizes the dependence of the rule's provisions, designed to simplify compliance with the lower Manganese exposure limit, on the ready availability of respirators which is affected by the current COVID-19 pandemic. The rules are adopted as proposed with an effective date of September 1, 2022.

This is Oregon OSHA Administrative Order 11-2021, adopted September 1, 2021 and effective September 1, 2022.

Oregon OSHA contact: Matthew Kaiser, Salem Central Office @ 503-378-3272, or email at Matthew.C.Kaiser@oregon.gov.

Please visit our website osha.oregon.gov/rules to view our adopted rules, or select other rule activity from this page.

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Secretary of State
Certificate and Order for Filing
PERMANENT ADMINISTRATIVE RULES

I certify that the attached copies* are true, full and correct copies of the PERMANENT Rule(s) adopted on 9/1/2021 by the
Date prior to or same as filing date

Department of Consumer & Business Services/Oregon Occupational Safety & Health Division 437
Agency and Division Administrative Rules Chapter Number

Lisa Appel 350 Winter Street NE, Salem OR 97301-3882 503-947-7449
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to become effective 9/1/2022 as Oregon OSHA Administrative Order 11-2021.
Date upon filing or later

Rulemaking Notice was published in the February 2020 *Oregon Bulletin*.**
Month and Year

RULE CAPTION

Reduces manganese permissible exposure limit; clarifies, cross-references welding rules with other standards including confined spaces.

Not more than 15 words that reasonably identifies the subject matter of the agency's intended action.

RULEMAKING ACTION

ADOPT: OAR 437-002-0279, 437-002-0281, 437-002-0299

AMEND: OAR 437-002-0280, 437-002-0282, 437-002-0283, 437-002-0284, 437-002-0285, 437-002-0286, 437-002-0287, 437-002-0288, 437-002-0297, 437-002-0298, 437-002-0382, 437-003-1000, 437-004-9000

ORS 654.025(2), 654.035, 656.726(4)

Stat. Auth.

ORS 654.001 through 654.295

Stats. Implemented

RULEMAKING SUMMARY

This rulemaking reduces Oregon OSHA's permissible exposure limit (PEL) for manganese compounds and fume (as Mn, C.A.S. #7349-96-5) in the Air Contaminants rules for general industry (Subdivision 2/Z), construction (Subdivision 3/Z), and agriculture (Subdivision 4/Z). The revised PEL is 0.1 mg/m³, as an 8-hour time-weighted average; and retains the ceiling limit of 5 mg/m³.

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Oregon OSHA subsequently established the **Manganese PEL Advisory Committee**. Because manganese exposures in Oregon are primarily linked to welding fume, the committee was comprised of representatives from small and large business that perform welding and other hot work activities as part of their operations. In addition, consultants who work with these firms, and representatives from manufacturing, construction, labor, and associations representing potentially affected business groups were asked to participate to help determine an appropriate PEL for manganese.

During these meetings, conducted over a period of about three years, the advisory committee members made numerous recommendations including one to cross-reference the requirements of the Subdivision 2/Q Welding, Cutting and Brazing rules with other related rules such as Oregon OSHA's Confined Spaces rules (OAR 437-002-0146), our Oregon-initiated Personal Protective Equipment rules for general industry (OAR 437-002-0134), and the general industry Respiratory Protection Standard (29 CFR 1910.134). They regularly reviewed and offered suggestions that were incorporated into the proposal including ways to minimize any fiscal impact to their industries. Oregon OSHA's technical staff also took the opportunity to clarify and simplify the Oregon-initiated rules that supplement the federal OSHA 29 CFR 1910.252 General Requirements protections in Subdivision 2/Q.

This effort also resulted in the creation of three new rules to supplement the requirements in Subdivision 2/Q.

OAR 437-002-0279, Additional Oregon Confined Space Requirements.

OAR 437-002-0281, Manganese (includes a new Table OR Q-2.)

OAR 437-002-0299, Definitions.

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INDIVIDUAL RULE SUMMARY (By rule number)

Provide a brief summary of the rule (if new adoption), or a brief summary of changes made to the rule (if amending)

437-002-0279 - Additional Oregon Confined Space Requirements clarifies and standardizes the protections for workers welding in confined spaces. Because an exception to the requirements of OAR 437-002-0146 -- for situations when the only hazards in a confined space are "related to the welding process"-- has been a point of confusion for employers about which rules apply and what protections must be provided, this rule clarifies that any confined space must be evaluated as required in OAR 437-002-0146, then guides the employer to specific directions for protecting workers in either situation. Rule name also emphasizes that these requirements related to welding in confined spaces are in addition to those in 29 CFR 1910.252.

437-002-0280- Adoption by Reference.

- (1) Changes the reference to the OAR that applies (instead of the repealed 1910.251 Definitions) to the new rule 437-002-0299. The previously referenced rule (437-002-2253) was incorrectly cited here, as it has a limited scope.
- (2) Shows that Oregon has amended 29 CFR 1910.252 with this rule-making. (For clarity, two references to federal OSHA's PPE rules were changed to Oregon's equivalent rules, and that is noted here as an amendment to adopting the federal rule exactly as it is printed by federal OSHA.)
- (3) Corrects a typo in the reference to the OAR replacing the repealed 1910.253 Oxygen-Fuel Gas Welding and Cutting.

437-002-0281- Manganese. Offers an alternative to air monitoring for estimating manganese exposures that is based on historical data and research completed by staff from Oregon OSHA and the Department of Consumer and Business Services. The rule allows employers to use specific levels of respiratory protection -- based on the assigned protective factor (APF) of the equipment -- for specific types of welding tasks within specific periods of time and other limits. The new Table OR Q-2 correlates this approach which is offered as an option, and not as a requirement.

437-002-0282- Job Planning and Layout. Plain language and active verbs clarify responsibilities. One requirement eliminated because it was duplicated in 1910.252.

437-002-0283- Additional Protective Clothing Requirements. Plain language and active verbs clarify responsibilities. Requirements limited to protective clothing used during hot work activities; rule renamed to

reflect more limited scope and to clarify that there are other requirements related to protective clothing in 1910.252. A confusing “eye protection” provision was eliminated.

437-002-0284- Additional Specifications for Eye and Face Protection. Plain language and active verbs clarify responsibilities and coordinate them with existing PPE requirements. Rule renamed to clarify that there are other requirements related to eye and face protection during hot work in 1910.252.

437-002-0285- Additional Special Precautions. Plain language and active verbs clarify responsibilities. Rule renamed to clarify that there are other precautions related to welding near combustible materials in 1910.252.

437-002-0286- Flammable Preservative Coatings. Plain language and active verbs clarify responsibilities. Rule renamed to reflect scope limited to flammable coatings. “Highly flammable” coatings given a working definition in the rule.

437-002-0287- Toxic Preservative Coatings. Scope expanded to include “confined and other” enclosed spaces and is limited to coatings that are toxic, but not “highly flammable” (as defined in 437-002-0286.) Plain language and active verbs clarify responsibilities. An alternative to stripping coatings prior to heating is cross-referenced to the existing respiratory protection program requirements in 1910.134. Notes allow artificial cooling to limit the size of the area to be stripped; and provides an exception for “coated steels” from the requirements unless the manufacturer’s Safety Data Sheet classifies the product as a health hazard when heated.

437-002-0288- Additional General Health Protection. Rule renamed to reflect more general scope and to clarify that there are other requirements related to general health protection in 1910.252. Scope expanded to include welding, cutting “or grinding” operations performed on “or with” the materials listed; and, requirements in substance-specific rules cross-referenced to more general requirements in Table OR Q-1. Plain language and active verbs clarify responsibilities. Engineering controls – including local exhaust ventilation -- identified as primary control measures for indoor workplaces when feasible and effective.

437-002-0297- Oregon Requirements for Welding or Cutting Containers. Plain language and active verbs clarify responsibilities. Requirements that a “competent person” must ensure are taken prior to or as part of the hot work process. (Competent person defined in new 437-002-0299.) A new requirement is included to document the process used to ensure safe conditions and to retain that documentation for at least one year. Rule renamed to clarify that there are other requirements related to welding or cutting containers in 1910.252. Added a note regarding that 437-002-0097 applies instead of 1910.252 (a)(3)(i), as that section was previously not adopted by Oregon OSHA.

437-002-0298- Supplied Air Respiratory Equipment. Rule renamed using a more general category for this type of respiratory protective equipment. Hazards cross-referenced to the better-understood concept of “IDLH” atmospheres and to the requirements of 1910.134. Acknowledges the National Institute for Occupational Safety and Health (NIOSH) as the agency that currently approves all respiratory protection equipment. Added a note regarding that 437-002-0298 applies instead of 1910.252(c)(4)(iii), as that section was previously not adopted by Oregon OSHA.

437-002-0299 - General definitions. Adds a more general definition of terms used in Division 2/Q. (This new rule is referenced in 437-002-0280 as an substitute for the repealed 1910.251, replacing the previous reference to 437-002-2253, where the definitions in the rule only pertain to that specific rule.) Includes definitions of the welding, cutting, or grinding tasks referenced in Table OR Q-2. Also includes a section with notes and recommended practices about the “standard order” for atmospheric testing in confined or other enclosed spaces.

437-002-0382 - In Table Z-1 of the Oregon’s Rules for Air Contaminants for general industry, two entries were combined into one for “Manganese Compounds and fume (as Mn)” in the “Substance” column; “7439-96-5” remains in the “CAS No.” column; and the Permissible Exposure Limit is lowered to “0.1” in the “mg/ m³” as an 8-hr time-weighted average, while the 5 mg/m³ Ceiling Limit is maintained.

437-003-1000 - In Table Z-1 of the Oregon's Rules for Air Contaminants for the construction industry, two entries were combined into one for "Manganese Compounds and fume (as Mn)" in the "Substance" column; "7439-96-5" remains in the "CAS No." column; and the Permissible Exposure Limit is lowered to "0.1" in the "mg/ m³" as an 8-hr time-weighted average, while the 5 mg/m³ Ceiling Limit is maintained.

437-004-9000 - In Table Z-1 of the Oregon's Rules for Air Contaminants for the agriculture industry, two entries were combined into one for "Manganese Compounds and fume (as Mn)" in the "Substance" column; "7439-96-5" remains in the "CAS No." column; and the Permissible Exposure Limit is lowered to "0.1" in the "mg/ m³" as an 8-hr time-weighted average, while the 5 mg/m³ Ceiling Limit is maintained.

Please visit the rules and laws section of our website at osha.oregon.gov/rules and select *adopted rules* in the rule making column to view our adopted rules.



Authorized Signer

Michael D. Wood
Printed name

9/1/2021
Date

*With this original, file one photocopy of certificate, one paper copy of rules listed in Rulemaking Actions, and electronic copy of rules.

**The *Oregon Bulletin* is published on the 1st of each month and updates rules found in the OAR Compilation. For publication in Bulletin, rule and notice filings must be submitted by 5:00 pm on the 15th day of the preceding month unless this deadline falls on a weekend or legal holiday, when filings are accepted until 5:00 pm on the preceding workday.

ARC 930-2005



PERMANENT ADMINISTRATIVE ORDER

OSHA 11-2021

CHAPTER 437
DEPARTMENT OF CONSUMER AND BUSINESS SERVICES
OREGON OCCUPATIONAL SAFETY AND HEALTH DIVISION

FILED

09/01/2021 9:34 AM
ARCHIVES DIVISION
SECRETARY OF STATE
& LEGISLATIVE COUNSEL

FILING CAPTION: Reduces Manganese Permissible Exposure Limit; Cross-References Welding Rules with Other Standards Including Confined Spaces

EFFECTIVE DATE: 09/01/2022

AGENCY APPROVED DATE: 09/01/2021

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RULES:

437-002-0279, 437-002-0280, 437-002-0281, 437-002-0282, 437-002-0283, 437-002-0284, 437-002-0285, 437-002-0286, 437-002-0287, 437-002-0288, 437-002-0297, 437-002-0298, 437-002-0299, 437-002-0382, 437-003-1000, 437-004-9000

ADOPT: 437-002-0279

RULE TITLE: Additional Oregon Confined Space Requirements

NOTICE FILED DATE: 01/28/2020

RULE SUMMARY: Additional Oregon Confined Space Requirements clarifies and standardizes the protections for workers welding in confined spaces. Because an exception to the requirements of OAR 437-002-0146 -- for situations when the only hazards in a confined space are "related to the welding process"-- has been a point of confusion for employers about which rules apply and what protections must be provided, this rule clarifies that any confined space must be evaluated as required in OAR 437-002-0146, then guides the employer to specific directions for protecting workers in either situation. Rule name also emphasizes that these requirements related to welding in confined spaces are in addition to those in 29 CFR 1910.252.

RULE TEXT:

(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.

STATUTORY/OTHER AUTHORITY: ORS 654.025(2), 654.035, 656.726(4)

STATUTES/OTHER IMPLEMENTED: ORS 654.001 through 654.295

AMEND: 437-002-0280

RULE TITLE: Adoption by Reference

NOTICE FILED DATE: 01/28/2020

RULE SUMMARY: (1) Changes the reference to the OAR that applies (instead of the repealed 1910.251 Definitions) to the new rule 437-002-0299. The previously referenced rule (437-002-2253) was incorrectly cited here, as it has a limited scope.

(2) Shows that Oregon has amended 29 CFR 1910.252 with this rule-making. (For clarity, two references to federal OSHA's PPE rules were changed to Oregon's equivalent rules, and that is noted here as an amendment to adopting the federal rule exactly as it is printed by federal OSHA.)

(3) Corrects a typo in the reference to the OAR replacing the repealed 1910.253 Oxygen-Fuel Gas Welding and Cutting.

RULE TEXT:

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 437-002-0299 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 437-002-2253 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, Department of Consumer and Business Services, and the United States Government Printing Office.

STATUTORY/OTHER AUTHORITY: ORS 654.025(2), 654.035, 656.726(4)

STATUTES/OTHER IMPLEMENTED: ORS 654.001 through 654.295

ADOPT: 437-002-0281

RULE TITLE: Manganese

NOTICE FILED DATE: 01/28/2020

RULE SUMMARY: Offers an alternative to air monitoring for estimating manganese exposures that is based on historical data and research completed by staff from Oregon OSHA and the Department of Consumer and Business Services. The rule allows employers to use specific levels of respiratory protection – based on the assigned protective factor (APF) of the equipment -- for specific types of welding tasks within specific periods of time and other limits. The new Table OR Q-2 correlates this approach which is offered as an option, and not as a requirement.

RULE TEXT:

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.

[Table OR Q-2]

STATUTORY/OTHER AUTHORITY: ORS 654.025(2), 654.035, 656.726(4)

STATUTES/OTHER IMPLEMENTED: ORS 654.001 through 654.295

TABLE OR Q-2 for Manganese

Welding, cutting or grinding tasks	Minimum Assigned Protective Factor (APF) for respiratory protection when performing the task listed during a single work shift within the range of times shown	
	APF = 10	APF = 25
Carbon Arcing	5 minutes – 60 minutes (1 hr.)	> 60 minutes
Flux Core Arc Welding (FCAW) or MIG-flux core welding	15 minutes – 120 minutes (2 hrs.)	> 120 minutes
Gas Metal Arc Welding (GMAW) or MIG-solid wire welding	30 minutes – 270 minutes (4.5 hrs.)	>270 minutes
Gas Tungsten Arc Welding (GTAW) or TIG-welding	150 minutes (2.5 hrs.) or more	N/A
Grinding Tasks directly related to the Welding process	15 minutes – 180 minutes (3 hrs.)	> 180 minutes
Hand-Held Torch Cutting	15 minutes – 150 minutes (2.5 hrs.)	> 150 minutes
Hand-Held Plasma Cutting	30 minutes – 300 minutes (5 hrs.)	> 300 minutes
Shielded Metal Arc Welding (SMAW)	10 minutes – 90 minutes (1.5 hrs.)	> 90 minutes

Notes for Table OR Q-2:

- The symbol “>” means “greater than” the number of minutes that follow it.
- See descriptions of the tasks included in OAR 437-002-0299.
- Assigned Protective Factor (APF) is defined in 1910.134 Respiratory Protection.
- Estimated exposures to Manganese within these guidelines were calculated using a more protective exposure target of 0.02 mg/m³.

AMEND: 437-002-0282

RULE TITLE: Job Planning and Layout

NOTICE FILED DATE: 01/28/2020

RULE SUMMARY: Job Planning and Layout. Plain language and active verbs clarify responsibilities. One requirement eliminated because it was duplicated in 1910.252.

RULE TEXT:

- (1) Before starting operations, securely block portable equipment to prevent accidental movement.
- (2) Equip tanks, boilers, drums and similar containers with ladders for the use of welders and other workers when required for safe access and egress.
- (3) Do not allow welding equipment on elevated structures unless the structure is designed and built to support all loads imposed on the structure.
- (4) Design, lay out and operate work areas in a manner that prevents welding hose and cable from creating a tripping hazard.

STATUTORY/OTHER AUTHORITY: ORS 654.025(2), 654.035, 656.726(4)

STATUTES/OTHER IMPLEMENTED: ORS 654.001 through 654.295

AMEND: 437-002-0283

RULE TITLE: Additional Protective Clothing Requirements During Hot Work Activities

NOTICE FILED DATE: 01/28/2020

RULE SUMMARY: Plain language and active verbs clarify responsibilities. Requirements limited to protective clothing used during hot work activities; rule renamed to reflect more limited scope and to clarify that there are other requirements related to protective clothing in 1910.252. A confusing "eye protection" provision was eliminated.

RULE TEXT:

(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 easily ignited, highly flammable clothing, such as is made from synthetic materials.

STATUTORY/OTHER AUTHORITY: ORS 654.025(2), 654.035, 656.726(4)

STATUTES/OTHER IMPLEMENTED: ORS 654.001 through 654.295

AMEND: 437-002-0284

RULE TITLE: Additional Specifications for Eye and Face Protection

NOTICE FILED DATE: 01/28/2020

RULE SUMMARY: Additional Specifications for Eye and Face Protection. Plain language and active verbs clarify responsibilities and coordinate them with existing PPE requirements. Rule renamed to clarify that there are other requirements related to eye and face protection during hot work in 1910.252.

RULE TEXT:

(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.

(2) Provide additional eye protection from the hazard of flying particles when a lift-front-type welder's helmet is used.

STATUTORY/OTHER AUTHORITY: ORS 654.025(2), 654.035, 656.726(4)

STATUTES/OTHER IMPLEMENTED: ORS 654.001 through 654.295

AMEND: 437-002-0285

RULE TITLE: Additional Special Precautions

NOTICE FILED DATE: 01/28/2020

RULE SUMMARY: Plain language and active verbs clarify responsibilities. Rule renamed to clarify that there are other precautions related to welding near combustible materials in 1910.252.

RULE TEXT:

Before welding or cutting on walls, floors or ceilings, inspect the hidden side to ensure that no combustible material is present.

STATUTORY/OTHER AUTHORITY: ORS 654.025(2), 654.035, 656.726(4)

STATUTES/OTHER IMPLEMENTED: ORS 654.001 through 654.295

AMEND: 437-002-0286

RULE TITLE: Flammable Preservative Coatings

NOTICE FILED DATE: 01/28/2020

RULE SUMMARY: Plain language and active verbs clarify responsibilities. Rule renamed to reflect scope limited to flammable coatings. "Highly flammable" coatings given a working definition in the rule.

RULE TEXT:

(1) A competent person must test any preservative coating whose flammability is not known before welding, cutting or other hot work is started.

(2) Highly flammable coatings (those coatings whose surface scrapings ignite when heat is applied) must be stripped from the area to be heated to prevent ignition.

STATUTORY/OTHER AUTHORITY: ORS 654.025(2), 654.035, 656.726(4)

STATUTES/OTHER IMPLEMENTED: ORS 654.001 through 654.295

AMEND: 437-002-0287

RULE TITLE: Toxic Preservative Coatings

NOTICE FILED DATE: 01/28/2020

RULE SUMMARY: Scope expanded to include "confined and other" enclosed spaces and is limited to coatings that are toxic, but not "highly flammable" (as defined in 437-002-0286.) Plain language and active verbs clarify responsibilities. An alternative to stripping coatings prior to heating is cross-referenced to the existing respiratory protection program requirements in 1910.134. Notes allow artificial cooling to limit the size of the area to be stripped; and provides an exception for "coated steels" from the requirements unless the manufacturer's Safety Data Sheet classifies the product as a health hazard when heated.

RULE TEXT:

(1) In confined and other enclosed spaces, preservative coatings that are toxic but not highly flammable must be removed:

(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.

(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.

Note: Artificial cooling of the metal surrounding the heated area may be used to limit the size of the area that must be stripped.

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

STATUTORY/OTHER AUTHORITY: ORS 654.025(2), 654.035, 656.726(4)

STATUTES/OTHER IMPLEMENTED: ORS 654.001 through 654.295

AMEND: 437-002-0288

RULE TITLE: Additional General Health Protection

NOTICE FILED DATE: 01/28/2020

RULE SUMMARY: Rule renamed to reflect more general scope and to clarify that there are other requirements related to general health protection in 1910.252. Scope expanded to include welding, cutting "or grinding" operations performed on "or with" the materials listed; and, requirements in substance-specific rules cross-referenced to more general requirements in Table OR Q-1. Plain language and active verbs clarify responsibilities. Engineering controls – including local exhaust ventilation -- identified as primary control measures for indoor workplaces when feasible and effective.

RULE TEXT:

(1) When welding, cutting, or grinding operations are performed on or with the materials listed in Table OR Q-1, follow the protective measures indicated. These measures are not required if air monitoring samples confirm that the 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.

(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]

STATUTORY/OTHER AUTHORITY: ORS 654.025(2), 654.035, 656.726(4)

STATUTES/OTHER IMPLEMENTED: ORS 654.001 through 654.295

TABLE OR Q-1 Additional General Protective Measures

Material	Condition	In addition to the protective measures required in 1910.252 (c):
Beryllium	Follow applicable requirements in Subdivision 2/Z, Beryllium	
Cadmium	Follow applicable requirements in 29 CFR 1910.1027 Cadmium	
Chromium	Follow applicable requirements in 29 CFR 1910.1026 Chromium (VI)	
Fluorine Compounds (Fluxes)	Indoors or Outdoors	Local Exhaust Ventilation or Appropriate Respirator
Lead	Follow applicable requirements in 29 CFR 1910.1025 Lead	
Manganese	Local Exhaust Ventilation or Appropriate Respirator. Also, see OAR 437-002-0281	
Mercury	Confined Space or Indoors	Local Exhaust Ventilation or Appropriate Respirator
Mercury	Outdoors	Appropriate Respirator
Zinc	Confined Space or Indoors	Local Exhaust Ventilation or Appropriate Respirator
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.

AMEND: 437-002-0297

RULE TITLE: Oregon Requirements for Welding or Cutting Containers

NOTICE FILED DATE: 01/28/2020

RULE SUMMARY: Plain language and active verbs clarify responsibilities. Requirements that a "competent person" must ensure are taken prior to or as part of the hot work process. (Competent person defined in new 437-002-0299.) A new requirement is included to document the process used to ensure safe conditions and to retain that documentation for at least one year. Rule renamed to clarify that there are other requirements related to welding or cutting containers in 1910.252. Added a note regarding that 437-002-0097 applies instead of 1910.252 (a)(3)(i), as that section was previously not adopted by Oregon OSHA.

RULE TEXT:

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 welding, or torch- or abrasive-cutting is performed on drums, barrels, or tanks that contain substances that are flammable or that could produce toxic vapors when subjected to heat:

(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.

(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.

STATUTORY/OTHER AUTHORITY: ORS 654.025(2), 654.035, 656.726(4)

STATUTES/OTHER IMPLEMENTED: ORS 654.001 through 654.295

AMEND: 437-002-0298

RULE TITLE: Supplied Air Respiratory Equipment

NOTICE FILED DATE: 01/28/2020

RULE SUMMARY: Rule renamed using a more general category for this type of respiratory protective equipment. Hazards cross-referenced to the better-understood concept of "IDLH" atmospheres and to the requirements of 1910.134. Acknowledges the National Institute for Occupational Safety and Health (NIOSH) as the agency that currently approves all respiratory protection equipment. Added a note regarding that 437-002-0298 applies instead of 1910.252(c)(4)(iii), as that section was previously not adopted by Oregon OSHA.

RULE TEXT:

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.

STATUTORY/OTHER AUTHORITY: ORS 654.025(2), 654.035, 656.726(4)

STATUTES/OTHER IMPLEMENTED: ORS 654.001 through 654.295

ADOPT: 437-002-0299

RULE TITLE: Definitions

NOTICE FILED DATE: 01/28/2020

RULE SUMMARY: Adds a more general definition of terms used in Division 2/Q. (This new rule is referenced in 437-002-0280 as an substitute for the repealed 1910.251, replacing the previous reference to 437-002-2253, where the definitions in the rule only pertain to that specific rule.) Includes definitions of the welding, cutting, or grinding tasks referenced in Table OR Q-2. Also includes a section with notes and recommended practices about the "standard order" for atmospheric testing in confined or other enclosed spaces.

RULE TEXT:

(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.

STATUTORY/OTHER AUTHORITY: ORS 654.025(2), 654.035, 656.726(4)

STATUTES/OTHER IMPLEMENTED: ORS 654.001 through 654.295

AMEND: 437-002-0382

RULE TITLE: Oregon Rules for Air Contaminants

NOTICE FILED DATE: 01/28/2020

RULE SUMMARY: In Table Z-1 of the Oregon's Rules for Air Contaminants for general industry, two entries were combined into one for "Manganese Compounds and fume (as Mn)" in the "Substance" column; "7439-96-5" remains in the "CAS No." column; and the Permissible Exposure Limit is lowered to "0.1" in the "mg/ m3" as an 8-hr time-weighted average, while the 5 mg/m3 Ceiling Limit is maintained.

RULE TEXT:

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 Z2 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: 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]

(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 Z3, 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) 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) 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) In case of a mixture of air contaminants an employer shall compute the equivalent exposure as follows:

$$Em = (C1 \div L1) + (C2 \div L2) + \dots (Cn \div Ln)$$

Where:

Em 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 Em shall not exceed unity (1).

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

[Table Z 2.1]

Substituting in the formula, we have:

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

$$Em = 0.500 + 0.225 + 0.200$$

$$Em = 0.925$$

Since Em 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 Z-1, Notes, Footnotes; Table Z-2, Note, Footnotes; Table Z-3, Note, Footnotes.]

STATUTORY/OTHER AUTHORITY: ORS 654.025(2), 654.035, 656.726(4)

STATUTES/OTHER IMPLEMENTED: ORS 654.001 through 654.295

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 pmm	25 pmm	50 pmm	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	

Table Z 2.1

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

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

Substance	CAS No. ^(c)	ppm ^(a)	mg/m ³ ^(b)	Skin
Abate	3383-96-8	—	10	
Acetaldehyde	75-07-0	100	180	
Acetic Acid	64-19-7	10	25	
Acetic anhydride	108-24-7	5	20	
Acetone	67-64-1	1,000	2,400	
Acetonitrile	75-05-8	40	70	
2-Acetylaminoflourine	53-96-3	(C)	(See 1910.1003)	
Acetylene	74-86-2	1,000	—	
Acetylene dichloride, see 1,2-Dichloroethylene				
Acetylene tetrabromide	79-27-6	1	14	
Acrolein	107-02-8	0.1	0.25	
Acrylamide	79-06-1	—	0.3	X
Acrylonitrile	107-13-1		(See 1910.1045)	
Aldrin	309-00-2	—	0.25	X
Allyl alcohol	107-18-6	2	5	X
Allyl chloride	107-05-1	1	3	

Allyn glycidyl ether (AGE)	106-92-3	5 (C) 10	22 (C) 45	
Allyl propyl disulfide	2179-59-1	2	12	
alpha Alumina	1344-28-1			
Total Dust		—	10	
Respirable Fraction		—	5	
Aluminum Metal Dust	7429-90-5			
Total Dust		—	10	
Respirable Fraction		—	5	
Alundum (A1203)		—	10	
4-Aminodiphenyl	92-67-1		(See 1910.1003)	
2-Aminoethanol, see Ethanolamine				
2-Aminopyridine	504-29-0	0.5	2	
Ammonia	7664-41-7	25	18	
Ammonium Chloride Fumes	12125-02-9	—	10	
Ammonium sulfamate	7773-06-0			
Total Dust		—	10	
Respirable Fraction		—	5	
n-Amyl acetate	628-63-7	100	525	
sec-Amyl acetate	626-38-0	125	650	
Aniline and homologs	62-53-3	5	19	X
Anisidine (o, p-isomers)	29191-52-4		0.5	X
Antimony & Compounds (as Sb)	7440-36-0	—	0.5	
ANTU (alpha Naphthylthiourea)	86-88-4	—	0.3	
Arsenic, Inorganic Compounds (as As)	7440-38-2		0.01 (See 1910.1018)	
Arsenic, Organic Compounds (as As)	7440-38-2	—	0.5	
Arsine	7784-42-1	0.05	0.2	
Asbestos		(See 1910.1001 and 1926.1101)		
Asphalt (petroleum) Fumes	8052-42-4	—	5	
Azinphos-methyl	86-50-1	—	0.2	X
Barium (soluble compounds)	7440-39-3	—	0.5	
Barium Sulfate	7727-43-7			
Total Dust		—	10	
Respirable Fraction		—	5	
Benomyl	17804-35-2			
Total Dust		—	10	
Respirable Fraction		—	5	
Benzene See Oregon Table Z-2 for the limits applicable in the operations or sectors excluded in 1910.1028 ^(d)	71-43-2		(See 1910.1028)	
Benzidine	92-87-5		(See 1910.1003)	
p-Benzoquinone, see Quinone				

Benzoyl peroxide	94-36-0	—	5	
Benzyl chloride	100-44-7	1	5	
Beryllium and Beryllium compounds (as Be); see Division 2/Z Beryllium ^(k)	7440-41-7		(See Oregon Table Z-2)	
Biphenyl, see Diphenyl				
Bismuth telluride (undoped)	1304-82-1	—	10	
Total Dust		—	5	
Respirable Fraction				
Bismuth telluride (Se-doped)		—	5	
Bisphenol A, see Diglycidyl ether				
Boron oxide	1303-86-2	—	10	
Boron tribromide	10294-33-4	1	10	
Boron trifluoride	7637-07-2	(C) 1	(C) 3	
Bromine	7726-95-6	0.1	0.7	
Bromine pentafluoride	7789-30-2	0.1	0.7	
Bromoform	75-25-2	0.5	5	X
Butadiene (1,3-Butadiene)	106-99-0	1 ppm/5 ppm STEL	(See 1910.1051; 1910.19(l))	
Butane	106-97-8	800	1,900	
Butanethiol, see Butyl mercaptan				
2-Butanone (Methyl Ethyl Ketone)	78-96-3	200	590	
2-Butoxyethanol (Butyl cellosolve)	111-76-2	50	240	X
Butyl acetate (n-Butyl acetate)	123-86-4	150	710	
sec-Butyl acetate	105-46-4	200	950	
tert-Butyl acetate	540-88-5	200	950	
n-Butyl alcohol	71-36-3	100	300	
sec-Butyl alcohol	78-92-2	150	450	
tert-Butyl alcohol	75-65-0	100	300	
Butyl lactate	138-22-7	1	5	
Butylamine	109-73-9	(C) 5	(C) 15	X
tert-Butyl chromate (as CrO ₃)	1189-85-1	(See 1910.1026) ^g		
n-Butyl glycidyl ether (BGE)	2426-08-6	50	270	
Butyl mercaptan	109-79-5	0.5	1.5	
p-tert-Butyltoluene	98-51-1	10	60	
Cadmium dust and fume (as Cd)	7440-43-9	(See 1910.1027,1926.1127 and Division 4) 0.005		
Calcium carbonate	1317-65-3	—	10	
Total Dust		—	5	
Respirable Fraction				
Calcium hydroxide	1305-62-0	—	10	
Total Dust		—	5	
Respirable Fraction				
Calcium oxide	1305-78-8	—	5	
Calcium silicate	1344-95-2	—	10	
Total Dust		—	5	
Respirable Fraction				

Calcium sulfate	7778-18-9			
Total Dust		—	10	
Respirable Fraction		—	5	
Camphor, synthetic	76-22-2	—	2	
Caprolactam (2-Oxonexa-methylenimine)	105-60-2	—	5	
Carbaryl (Sevin®)	63-25-2	—	5	
Carbon black	1333-86-4	—	3.5	
Carbon dioxide	124-38-9	5,000	9,000	
Carbon disulfide	75-15-0		(See Oregon Table Z-2)	
Carbon monoxide	630-08-0	50	55	
Carbon tetrachloride	56-23-5		(See Oregon Table Z-2)	
Cellulose	9006-34-6			
Total Dust		—	10	
Respirable Fraction		—	5	
Chlordane	57-74-9	—	0.5	X
Chlorinated camphene	8001-35-2	—	0.5	X
Chlorinated diphenyl oxide	55720-99-5	—	0.5	
Chlorine	7782-50-5	(C) 1	(C) 3	
Chlorine dioxide	10049-04-4	0.1	0.3	
Chlorine trifluoride	7790-91-2	(C) 0.1	(C) 0.4	
Chloroacetaldehyde	107-20-0	(C) 1	(C) 3	
a-Chloroacetophenone (Phenacyl chloride)	532-27-4	0.05	0.3	
Chlorobenzene	108-90-7	75	350	
o-Chlorobenzylidene malononitrile	2698-41-1	0.05	0.4	
Chlorobromomethane	74-97-5	200	1,050	
2-Chloro-1, 3-butadiene, see beta-Chloroprene				
Chlorodiphenyl (42% Chlorine)	53469-21-9	—	1	X
Chlorodiphenyl (54% Chlorine)	11097-69-1	—	0.5	X
1-Chloro, 2, 3-epoxypropane, see Epichlorhydrin				
2-Chloroethanol, see Ethylene chlorohydrin				
Chloroethylene, see Vinyl Chloride				
Chloroform (Trichloromethane)	67-66-3	(C) 25	(C) 120	
bis-Chloromethyl ether	542-88-1		(See 1910.1003)	
Chloromethyl methyl ether	107-30-2		(See 1910.1003)	
1-Chloro-1-nitropropane	600-25-9	20	100	
Chloropicrin	76-06-2	0.1	0.7	
beta-Chloroprene (2-chloro-1,3-butadiene)	126-99-8	25	90	X
2-Chloro-6-(trichloromethyl) pyridine	1929-82-4			

Total Dust		—	10	
Respirable Fraction		—	5	
Chromic acid and chromates (as CrO ₃)			(See Oregon Table Z-2)	
Chromium (II) compounds (as Cr)	7440-47-3	—	0.5	
Chromium (III) compounds (as Cr)	7440-47-3	—	0.5	
Chromium (VI) compounds			(See 1910.1026)	
Chromium metal & insol. salts (as Cr)	7440-47-3	—	1	
Clopidol	2971-90-6			
Total Dust		—	10	
Respirable Fraction		—	5	
Coal Dust			(See Oregon Table Z-3)	
Coal tar pitch volatiles (Benzene soluble fraction) anthracene, BaP, phenanthrene, acridine, chrysene, pyrene	65966-93-2	—	0.2 (See 1910.1002)	
Cobalt metal, fume & dust	7440-48-4	—	0.1	
Coke oven emissions			(See 1910.1029)	
Copper fume	7440-50-8	—	0.1	
Dusts and Mists	7440-50-8	—	1	
Corundum (A1203)	1302-74-5	—	10	
Cotton dust			(See 1910.1043)	
Cotton dust (raw)		—	1 ^(e)	
Crag® herbicide (Sesone)	136-78-7			
Total Dust		—	10	
Respirable Fraction		—	5	
Cresol (all isomers)	1319-77-3	5	22	X
Crotonaldehyde	123-73-9/ 4170-30-3	2	6	
Cumene	98-82-8	50	245	X
Cyanides (as CN)		—	5	X
Cyanogen	460-19-5	10	—	
Cyclohexane	110-82-7	300	1,050	
Cyclohexanol	108-93-0	50	200	
Cyclohexanone	108-94-1	50	200	
Cyclohexene	110-83-8	300	1,015	
Cyclopentadiene	542-92-7	75	200	
2,4-D (Dichlorophenoxyacetic acid)	94-75-7	—	10	
DDT	50-29-3	—	1	X
DDVP, see Dichlorvos				
Decaborane	17702-41-9	0.05	0.3	X
Demeton® (Systox)	8065-48-3	—	0.1	X
Diacetone alcohol (4-hydroxy-4-methyl-2-pentanone)	123-42-2	50	240	
1, 2-Diaminoethane, see Ethylenediamine				

Diazinon	333-41-5	—	0.1	X
Diazomethane	334-88-3	0.2	0.4	
Diborane	19287-45-7	0.1	0.1	
Dibrom®	300-76-5	—	3	
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	0.001	(See 1910.1044)	
1,2-Dibromoethane, see Ethylene dibromide				
2-N-Dibutylaminoethanol	102-81-8	2	14	X
Dibutyl phosphate	107-66-4	1	5	
Dibutyl phthalate	84-74-2	—	5	
Dichloroacetylene	7572-29-4	(C) 0.1	(C) 0.4	
o-Dichlorobenzene	95-50-1	(C) 50	(C) 300	
p-Dichlorobenzene	106-46-7	75	450	
3,3-Dichlorobenzidine	91-94-1		(See 1910.1003)	X
Dichlorodifluoromethane	75-71-8	1,000	4,950	
1,3-Dichloro-5, 5-dimethyl hydantoin	118-52-5	—	0.2	
Dichlorodiphenyltrichloroethane (DDT)	50-29-3	—	1	X
1, 1-Dichloroethane	75-34-3	100	400	
1, 2-Dichloroethane, see Ethylene dichloride				
1, 2-Dichlorethylene	540-59-0	200	790	
Dichloroethyl Ether	111-44-4	5	30	X
		(C) 15	(C) 90	
Dichloromethane, see Methylene chloride				
Dichloromonofluoromethane	75-43-4	1,000	4,200	
1, 1-Dichloro-1-nitroethane	594-72-9	(C) 10	(C) 60	
1, 2-Dichloropropane, see Propylene dichloride				
Dichlorotetrafluoroethane	76-14-2	1,000	7,000	
Dichlorvos (DDVP)	62-73-7	0.1	1	X
Dicyclohexylmethane 4,4'-diisocyanate (hydrogenated MDI, see Oregon Table Z-2 (Diisocyanates))	5124-30-1			
Dicyclopentadienyl iron	102-54-5		10	
Total Dust		—	5	
Respirable Fraction		—		
Dieldrin	60-57-1	—	0.25	X
Diethylamine	109-89-7	25	75	
2-Diethylaminoethanol	100-37-8	10	50	X
Diethylene triamine	111-40-0	(C) 1	(C) 4	X
Diethylether, see Ethyl ether				
Difluorodibromomethane	75-61-6	100	860	
Diglycidyl ether (DGE)	2238-07-5	(C) 0.5	(C) 2.8	
Dihydroxybenzene, see Hydroquinone				

Diisobutyl ketone	108-83-8	25	150	
Diisopropylamine	108-18-9	5	20	X
Dimethoxymethane, see Methylal				
Dimethyl acetamide	127-19-5	10	35	X
Dimethylamine	124-40-3	10	18	
4-Dimethylaminoazobenzene	60-11-7		(See 1910.1003)	
Dimethylaminobenzene, see Xylidene				
Dimethylaniline (N,N-Dimethylaniline)	121-69-7	5	25	X
Dimethylbenzene, see Xylene				
Dimethyl-1,2-dibromo-2, 2-dichloroethyl phosphate	300-76-5		3	
Dimethylformamide	68-12-2	10	30	X
2,6-Dimethylheptanone, see Diisobutyl ketone				
1,1-Dimethylhydrazine	57-14-7	0.5	1	X
Dimethylphthalate	131-11-3		5	
Dimethyl sulfate	77-78-1	1	5	X
Dinitrobenzene (all isomers)			1	X
(ortho)	528-29-0			
(meta)	99-65-0			
(para)	100-25-4			
Dinitro-o-cresol	534-52-1	—	0.2	X
Dinitrotoluene	25321-14-6	—	1.5	X
Dioxane (Diethylene dioxide)	123-91-1	100	360	X
Diphenyl (Biphenyl)	92-52-4	0.2	1	
Diphenylamine	122-39-4	—	10	
Diphenylmethane diisocyanate (MDI), see Oregon Table Z-2 (Diisocyanates)				
Dipropylene glycol methyl ether	34590-98-8	100	600	X
Diquat	231-36-7	—	0.5	
Di-sec, octyl phthalate (Di-2-ethylhexylphthalate)	117-81-7	—	5	
Emery	12415-34-8			
Total Dust		—	10	
Respirable Fraction		—	5	
Endosulfan (Thiodan®)	115-29-7	—	0.1	X
Endrin	72-20-8	—	0.1	X
Epichlorohydrin	106-89-8	5	19	X
EPN	2104-64-5	—	0.5	X
1,2-Epoxypropane, see Propylene oxide				
2,3-Epoxy-1-propanol, see Glycidol				
Ethane	74-84-0	1,000	—	
Ethanethiol, see Ethyl mercaptan				
Ethanolamine	141-43-5	3	6	

2-Ethoxyethanol (Cellosolve)	110-80-5	100	370	X
2-Ethoxyethylacetate (Cellosolve acetate)	111-15-9	100	540	X
Ethyl acetate	141-78-6	400	1,400	
Ethyl acrylate	140-88-5	25	100	X
Ethyl alcohol (ethanol)	64-17-5	1,000	1,900	
Ethylamine	75-04-7	10	18	
Ethyl amyl ketone (5-methyl-3-heptanone)	541-85-5	25	130	
Ethyl benzene	100-41-4	100	435	
Ethyl bromide	74-96-4	200	890	
Ethyl butyl ketone (3-Heptanone)	106-35-4	50	230	
Ethyl chloride	75-00-3	1,000	2,600	
Ethyl ether	60-29-7	400	1,200	
Ethyl formate	109-94-4	100	300	
Ethyl mercaptan	75-08-1	0.5 (C) 10	1 (C) 25	
Ethyl silicate	78-10-4	100	850	
Ethylene	74-85-1	1,000	—	
Ethylene chlorohydrin	107-07-3	5	16	X
Ethylenediamine	107-15-3	10	25	
Ethylene dibromide	106-93-4		(See Oregon Table Z-2)	
Ethylene dichloride	107-06-2		(See Oregon Table Z-2)	
Ethylene glycol particulate		—	10	
Ethylene glycol, Vapor	107-21-1	100	260	
Ethylene glycol dinitrate	628-96-6	(C) 0.2	(C) 1	X
Ethylene glycol methyl acetate (Methyl cellosolve acetate) (2-Methoxy-ethyl acetate)	110-49-6	25	120	X
Ethylenimine	151-56-4		(See 1910.1003)	
Ethylene oxide	75-21-8	1	(See 1910.1047)	
Ethylidene chloride, see 1, 1-Dichloroethane				
N-Ethylmorpholine	100-74-3	20	94	X
Ferbam	14484-64-1			
Total Dust		—	10	
Respirable Fraction		—	5	
Ferrovandium dust	12604-58-9	—	1	
Fibrous glass, see Glass, Fibrous				
Fluorides (As F)		—	2.5 (See Oregon Table Z-2)	
Fluorine	7782-41-4	0.1	0.2	

Fluorotrichloromethane (Trichlorofluoromethane)	75-69-4	1,000	5,600	
Formaldehyde	50-00-0	0.75	(See 1910.1048)	
Formic acid	64-18-6	5	9	
Furfural	98-01-1	5	20	X
Furfuryl alcohol	98-00-0	5	20	
Gasoline	8006-61-9	—	(g)	
Germanium tetrahydride	7782-65-2	0.2	0.6	
Glass, Fibrous or dust		—	10	
Glycerin (mist)	56-81-5	—	10	
Total Dust		—	5	
Respirable Fraction				
Glycidol	556-52-5	50	150	
Glycol momoethyl ether, see 2-Ethoxythanol				
Grain dust (oat, wheat, barley)		—	10	
Graphite natural, respirable	7782-42-5		(See Oregon Table Z-3)	
Graphite (Synthetic)	7782-42-5	—	10	
Total Dust		—	5	
Respirable Fraction				
Guthion®, see Azinphosmethyl				
Gypsum	13397-24-5			
Total Dust		—	10	
Respirable Fraction		—	5	
Hafnium	7440-58-6	—	0.5	
Heptachlor	76-44-8	—	0.5	X
Heptane (n-heptane)	142-82-5	500	2,000	
Hexachlorocyclopentadiene	77-47-4	0.1	1	
Hexachloroethane	67-72-1	1	10	X
Hexachloronaphthalene	1335-87-1	—	0.2	X
Hexafluoroacetone	684-16-2	0.1	0.7	X
Hexamethylene diisocyanate (HDI), see Oregon Table Z-2 (Diisocyanates)	822-06-0			
1,6 Hexamethylene diisocyanate Based Adduct, see Oregon Table Z-2 (Diisocyanates)				
Hexane (n-hexane)	110-54-3	500	1,800	
2-Hexanone	591-78-6	100	410	
Hexone (Methyl isobutyl ketone)	108-10-1	100	410	
sec-Hexyl acetate	108-84-9	50	300	
Hydrazine	302-01-2	1	1.3	X
Hydrogen	1333-74-0	1,000	—	
Hydrogen bromide	10035-10-6	3	10	
Hydrogen chloride	7647-01-0	(C) 5	(C) 7	
Hydrogen cyanide	74-90-8	10	11	X

Hydrogen fluoride (as F)	7664-39-3		(See Oregon Table Z-2)	
Hydrogen peroxide	7722-84-1	1	1.4	
Hydrogen selenide (as Se)	7783-07-5	0.05	0.2	
Hydrogen sulfide	7783-06-4		(See Oregon Table Z-2)	
Hydroquinone	123-31-9	—	2	
Indene	95-13-6	10	45	
Indium and compounds (as In)	7440-74-6	—	0.1	
Iodine	7553-56-2	(C) 0.1	(C) 1	
Iron oxide fume	1309-37-1	—	10	
Iron pentacarbonyl	13463-40-6	0.1	0.23	
Iron salts, soluble, as Fe		—	1	
Isoamyl acetate	123-92-2	100	525	
Isoamyl alcohol (primary and secondary)	123-51-3	100	360	
Isobutyl acetate	110-19-0	150	700	
Isobutyl alcohol	78-83-1	100	300	
Isophorone	78-59-1	10	55	
Isophorone diisocyanate (IPDI), see Oregon Table Z-2 (Diisocyanates)	4098-71-9			
Isopropyl acetate	108-21-4	250	950	
Isopropyl alcohol	67-63-0	400	980	
Isopropylamine	75-31-0	5	12	
Isopropyl ether	108-20-3	250	1,050	
Isopropyl glycidyl ether (IGE)	4016-14-2	50	240	
Kaolin	1332-58-7			
Total Dust		—	10	
Respirable Fraction		—	5	
Ketene	463-51-4	0.5	0.9	
Lead, inorganic (as Pb)	7439-92-1	(See 1910.1025 & 1926.62) 0.05		
Lead arsenate	7784-40-9	(See 1910.1018)	0.01	
Limestone	1317-65-3			
Total Dust		—	10	
Respirable Fraction		—	5	
Lindane	58-89-9	—	0.5	X
Lithium hydride	7580-67-8	—	0.025	
L.P.G. (Liquified petroleum gas)	68476-85-7	1,000	1,800	
Magnesite	546-93-0			
Total Dust		—	10	
Respirable Fraction		—	5	
Magnesium oxide fume	1309-48-4			
Total Dust		—	10	
Respirable Fraction		—	5	
Malathion	121-75-5	—	10	X

Maleic anhydride	108-31-6	0.25	1	
Manganese Compounds and fume (as Mn)	7439-96-5	—	0.1 (C) 5	
Marble	1317-65-3			
Total Dust		—	10	
Respirable Fraction		—	5	
Mercury (aryl, inorganic, organo, and vapor) (as Hg)	7439-97-6		(See Oregon Table Z-2)	
Mesityl oxide	141-79-7	25	100	
Methane	74-82-8	1,000	—	
Methanethiol, see Methyl mercaptan				
Methoxychlor	72-43-5			
Total Dust		—	10	
Respirable Fraction		—	5	
2-Methoxyethanol (Methyl Cellosolve)	109-86-4	25	80	X
2-Methoxyethyl acetate (Methyl cellosolve acetate)	110-49-6	25	120	X
Methyl acetate	79-20-9	200	610	
Methyl acetylene (propyne)	74-99-7	1,000	1,650	
Methyl acetylene-propadiene mixture (MAPP)		1,000	1,800	
Methyl acrylate	96-33-3	10	35	X
Methylacrylonitrile	126-98-7	1	3	X
Methylal (dimethoxymethane)	109-87-5	1,000	3,100	
Methyl alcohol (methanol)	67-56-1	200	260	
Methylamine	74-89-5	10	12	
Methyl amyl alcohol, see Methyl isobutyl carbinol				
Methyl (n-amyl) ketone	110-43-0	100	465	
Methyl bromide	74-83-9	15 (C) 20	60 (C) 80	X
Methyl butyl ketone, see 2-Hexanone				
Methyl cellosolve, see 2 Methoxy ethanol				X
Methyl cellosolve acetate (Ethylene glycol monomethyl ether acetate)	110-49-6	25	120	X
Methyl Chloride	74-87-3		(See Oregon Table Z-2)	
Methyl Chloroform (1,1,1-Trichloroethane)	71-55-6	350	1,900	
Methyl Chloromethyl ether			(See 1910.1003)	
Methyl 2-cyanoacrylate	137-05-3	2	8	
Methylcyclohexane	108-87-2	500	2,000	
Methylcyclohexanol	25639-42-3	50	235	
o-Methylcyclohexanone	583-60-8	50	230	X

2-Methylcyclopentadienyl manganese tricarbonyl (as Mn)	12108-13-3	0.1	0.2	X
Methyl demeton	8022-00-2	—	0.5	X
Methyl ethyl ketone (MEK), see 2-Butanone				
Methyl formate	107-31-3	100	250	
Methyl iodide	74-88-4	5	28	X
Methyl isoamyl ketone	110-12-3	100	475	
Methyl isobutyl carbinol	108-11-2	25	100	X
Methyl isobutyl ketone, see Hexone				
Methyl isocyanate	624-83-9	0.02	0.05	X
Methyl mercaptan	74-93-1	0.5 (C) 10	1 (C) 20	
Methyl methacrylate	80-62-6	100	410	
Methyl parathion	298-00-0	—	0.2	X
Methyl propyl ketone, see 2-Pentanone				
Methyl silicate	681-84-5	(C) 5	(C) 30	
a-Methyl styrene	98-83-9	(C) 100	(C) 480	
Methylene bisphenyl isocyanate (MDI)	101-68-8	(See Oregon Table Z-2 (diisocyanates))		
Methylenedianiline (MDA)		(See 1910.1050 & 1926.60) 0.01		
Methylene Chloride	75-09-2	25	(See 1910.1052)	
Mineral Wool Fiber		—	10	
MOCA	101-14-4		(See 437-002-0346)	
Molybdenum (soluble compounds)	7439-98-7	—	5	
(insoluble compounds)		—	10	
Monomethyl aniline	100-61-8	2	9	X
Monomethyl hydrazine	60-34-4	(C) 0.2	(C) 0.35	X
Morpholine	110-91-8	20	70	X
Naphtha (coal tar)	8030-30-6	100	400	
Naphthalene	91-20-3	10	50	
Naphthalene diisocyanate (NDI), see Oregon Table Z-2 (Diisocyanates)	3173-72-6			
alpha-Naphthylamine	134-32-7		(See 1910.1003)	
beta-Naphthylamine	91-59-8		(See 1910.1003)	
Nickel carbonyl (as Ni)	13463-39-3	0.001	0.007	
Nickel, metal and insoluble compounds, as Ni	7440-02-0	—	1	
Nickel, soluble compounds, (as Ni)	7440-02-0	—	1	
Nicotine	54-11-5	0.075	0.5	X

Nitric acid	7697-37-2	2	5	
Nitric oxide	10102-43-9	25	30	
p-Nitroaniline	100-01-6	1	6	X
Nitrobenzene	98-95-3	1	5	X
4-Nitrodiphenyl	92-93-3		(See 1910.1003)	
p-Nitrochlorobenzene	100-00-5	—	1	X
Nitroethane	79-24-3	100	310	
Nitrogen dioxide	10102-44-0	(C) 5	(C) 9	
Nitrogen trifluoride	7783-54-2	10	29	
Nitroglycerin	55-63-0	(C) 0.2	(C) 2	X
Nitromethane	75-52-5	100	250	
1-Nitropropane	108-03-2	25	90	
2-Nitropropane	79-46-9	25	90	
N-Nitrosodimethylamine			(See 1910.1003)	
Nitrotoluene (all isomers)	88-72-2/ 99-08-1/ 99-99-0	5	30	X
Nitrotrichloromethane, see Chloropicrin				
Nitrous oxide	10024-97-5	50	90	
Octachloronaphthalene	2234-13-1	—	0.1	X
Octane	111-65-9	400	1,900	
Oil mist (mineral)	8012-95-1	—	5	
Oil mist, vapor		—	(g)	
Osmium tetroxide (as Os)	20816-12-0		0.002	
Oxalic acid	144-62-7	—	1	
Oxygen difluoride	7783-41-7	0.05	0.1	
Ozone	10028-15-6	0.1	0.2	
Parafin wax fume	8002-74-2	—	1	
Paraquat respirable dust	4685-14-7/ 1910-42-5/ 2074-50-2	—	0.5	X
Parathion	56-38-2	—	0.1	X
Particulates not otherwise regulated (PNOR) ^(f)				
Total Dust		—	10	
Respirable Fraction		—	5	
Pentaborane	19624-22-7	0.005	0.01	
Pentachloronaphthalene	1321-64-8	—	0.5	X

Pentachlorophenol	87-86-5	—	0.5	X
Pentaerythritol	115-77-5			
Total Dust		—	10	
Respirable Fraction		—	5	
Pentane	109-66-0	500	1,500	
2-Pentanone (Methyl propyl ketone)	107-87-9	200	700	
Perchloroethylene (tetrachloroethylene)	127-18-4		(See Oregon Table Z-2)	
Perchloromethyl mercaptan	594-42-3	0.1	0.8	
Perchloryl fluoride	7616-94-6	3	13.5	
Perlite	93763-70-3			
Total Dust		—	10	
Respirable Fraction		—	5	
Petroleum distillates (naphtha) (Rubber Solvent)		500	2,000 ⁽⁹⁾	
Phenol	108-95-2	5	19	X
Phenothiazine	92-84-2	—	5	X
p-Phenylene diamine	106-50-3	—	0.1	X
Phenyl ether (vapor)	101-84-8	1	7	
Phenyl ether – diphenyl mixture (vapor)	8004-13-5	1	7	
Phenylethylene, see Styrene				
Phenyl glycidyl ether (PGE)	122-60-1	10	60	
Phenylhydrazine	100-63-0	5	22	X
Phenylphosphine	638-21-1	(C) 0.05	(C) 0.25	
Phosdrin (Mevinphos®)	7786-34-7		0.1	X
Phosgene (carbonyl chloride)	75-44-5	0.1	0.4	
Phosphine	7803-51-2	0.3	0.4	
Phosphoric acid	7664-38-2	—	1	
Phosphorus (yellow)	7723-14-0	—	0.1	
Phosphorus pentachloride	10026-13-8	—	1	
Phosphorus pentasulfide	1314-80-3	—	1	
Phosphorus trichloride	7719-12-2	0.5	3	
Phthalic anhydride	85-44-9	2	12	
Picloram	1918-02-1			
Total Dust		—	10	
Respirable Fraction		—	5	
Picric acid	88-89-1	—	0.1	X
Pindone (2-Pivalyl-1, 3-indan-dione)	83-26-1	—	0.1	
Plaster of Paris	26499-65-0			

Total Dust		—	10	
Respirable Fraction		—	5	
Platinum (Soluble Salts) as Pt	7440-06-4	—	0.002	
Polychlorobiphenyls, see Chloro-diphenyls				
Portland Cement	65997-15-1			
Total Dust		—	10	
Respirable Fraction		—	5	
Propane	74-98-6	1,000	1,800	
Beta-Propiolactone	57-57-8		(See 1910.1003)	
Propargyl alcohol	107-19-7	1	—	X
n-Propyl acetate	109-60-4	200	840	
n-Propyl alcohol	71-23-8	200	500	
n-Propyl nitrate	627-13-4	25	110	
Propylene dichloride	78-87-5	75	350	
Propylene glycol monomethyl ether	107-98-2	100	360	
Propylene imine	75-55-8	2	5	X
Propylene oxide	75-56-9	100	240	
Propyne, see Methyl acetylene				
Pyrethrum	8003-34-7	—	5	
Pyridine	110-86-1	5	15	
Quinone	106-51-4	0.1	0.4	
RDX (Cyclonite)	121-82-4	—	1.5	X
Rhodium, Metal fume and dusts, as Rh	7440-16-6	—	0.1	
Soluble salts	7440-16-6	—	0.001	
Ronnel	299-84-3	—	10	
Rosin core solder pyrolysis products (as Formaldehyde)		—	0.1	
Rotenone	83-79-4	—	5	
Rouge				
Total Dust		—	10	
Respirable Fraction		—	5	
Selenium compounds (as Se)	7782-49-2	—	0.2	
Selenium hexafluoride (as Se)	7783-79-1	0.05	0.4	
Silica, crystalline, respirable dust⁽¹⁾				
Cristobalite	14464-46-1			
Quartz	14808-60-7	—	(See Division 2/Z-Silica)	
Tripoli (as quartz)	1317-95-9			
Tridamite	15468-32-3			

Silicon	7440-21-3			
Total Dust		—	10	
Respirable Fraction		—	5	
Silicon carbide	409-21-2			
Total Dust		—	10	
Respirable Fraction		—	5	
Silver, metal and soluble compounds (as Ag)	7440-22-4	—	0.01	
Sodium fluoroacetate	62-74-8	—	0.05	X
Sodium hydroxide	1310-73-2	—	2	
Starch	9005-25-8			
Total Dust		—	10	
Respirable Fraction		—	5	
Stibine	7803-52-3	0.1	0.5	
Stoddard solvent	8052-41-3	200	1,150	
Strychnine	57-24-9	—	0.15	
Styrene	100-42-5		(See Oregon Table Z-2)	
Subtilisins (Proteolytic enzymes) (as 100% pure crystalline enzyme)	1395-21-7	—	(C) 0.0003	
Sucrose	57-50-1			
Total Dust		—	10	
Respirable Fraction		—	5	
Sulfur dioxide	7446-09-5	5	13	
Sulfur hexafluoride	2551-62-4	1,000	6,000	
Sulfuric acid	7664-93-9	—	1	
Sulfur monochloride	10025-67-9	1	6	
Sulfur pentafluoride	5714-22-7	0.025	0.25	
Sulfur tetrafluoride	7783-60-0	0.1	0.4	
Sulfuryl fluoride	2699-79-8	5	20	
Systox, see Demeton®				
2, 4, 5-T	93-76-5	—	10	
Tantalum, metal and oxide dust	7440-25-7	—	5	
TEDP (Sulfotepp)	3689-24-5	—	0.2	X
Tellurium and compounds (as Te)	13494-80-9	—	0.1	
Tellurium hexafluoride (as Te)	7783-80-4	0.02	0.2	
Temephos	3383-96-8			
Total Dust		—	10	
Respirable Fraction		—	5	
TEPP (Tetraethyl pyrophosphate)	107-49-3	0.004	0.05	X
Terphenyls	26140-60-3	(C) 1	(C) 9	

1, 1, 1, 2-Tetrachloro-2, 2-difluoroethane	76-11-9	500	4,170	
1, 1, 2, 2-Tetrachloro-1, 2-difluoroethane	76-12-0	500	4,170	
1, 1, 2, 2-Tetrachloroethane	79-34-5	5	35	X
Tetrachloroethylene, see Perchloroethylene				
Tetrachloronaphthalene	1335-88-2	—	2	X
Tetrachloromethane, see Carbon tetrachloride				
Tetraethyl lead (as Pb)	78-0-2	—	.075	X
Tetrahydrofuran	109-99-9	200	590	
Tetramethyl lead (as Pb)	75-74-1	—	0.075	X
Tetramethyl succinonitrile	3333-52-6	0.5	3	X
Tetranitromethane	509-14-8	1	8	
Tetryl (2, 4, 6-trinitro-phenyl-methylnitramine)	479-45-8	—	1.5	X
Thallium (soluble compounds) as TI	7440-28-0	—	0.1	X
4,4'-Thiobis (6-tert, Butyl-m-cresol)	96-69-5			
Total Dust		—	10	
Respirable Fraction		—	5	
Thiram	137-26-8		(See 437-002 0373) 0.15	
Tin (inorganic compounds, except oxides) as Sn	7440-31-5	—	2	
Tin (organic compounds)	7440-31-5	—	0.1	
Tin oxide	1332-29-2			
Total Dust		—	10	
Respirable Fraction		—	5	
Titanium dioxide	13463-67-7	—	10	
Toluene (toluol)	108-88-3		(See Oregon Table Z-2)	
Toluene diisocyanate (TDI), See Oregon Table Z-2 (Diisocyanates)	584-84-9			
o-Toluidine	95-53-4	5	22	X
Toxaphene, see Chlorinated camphene				
Tributyl phosphate	126-73-8	—	5	
1, 1, 1-Trichloroethane, see Methyl chloroform				
1, 1, 2-Trichloroethane	79-00-5	10	45	X
Trichloroethylene	79-01-6		(See Oregon Table Z-2)	

Trichloromethane, see Chloroform				
Trichloronaphthalene	1321-65-9	—	5	X
1, 2, 3-Trichloropropane	96-18-4	50	300	
1,1, 2-Trichloro 1, 2, 2-trifluoroethane	76-13-1	1,000	7,600	
Triethylamine	121-44-8	25	100	
Trifluorobromomethane	75-63-8	1,000	6,100	
Trimethyl benzene	25551-13-7	25	120	
2,4, 6-Trinitrophenol, see Picric acid				
2, 4, 6-Trinitrophenylmethyl-nitramine, see Tetryl				
Trinitrotoluene (TNT)	118-96-7		1.5	X
Triorthocresyl phosphate	78-30-8	—	0.1	
Triphenyl phosphate	115-86-6	—	3	
Tungsten & compounds, as W	7440-33-7			
Soluble		—	1	
Insoluble		—	5	
Turpentine	8006-64-2	100	560	
Uranium (as U)	7440-61-1			
Soluble compounds		—	0.05	
Insoluble compounds		—	0.2	
Vanadium respirable dust				
(as V ₂ O ₅)	1314-62-1	—	(C) 0.5	
Fume (as V₂O₅)	1314-62-1	—	(C) 0.05	
Vegetable oil mist				
Total Dust		—	10	
Respirable Fraction		—	5	
Vinyl acetate	108-05-4	10	30	
Vinyl benzene, see Styrene				
Vinyl bromide	593-60-2	250	1,100	
Vinyl chloride	75-01-4		(See 1910.1017)	
Vinyl cyanide, see Acrylonitrile				
Vinyl toluene	25013-15-4	100	480	
Warfarin	81-81-2	—	0.1	
Wood Dust (non-allergenic)		—	10	
Xylene (o-, m-, p-isomers)	1330-20-7	100	435	
Xylidine	1300-73-8	5	25	X
Yttrium	7440-65-5	—	1	
Zinc chloride fume	7646-85-7	—	1	

Zinc oxide	1314-13-2	—	10	
Total Dust		—	5	
Respirable Fraction		—	5	
Zinc oxide fume	1314-13-2	—	5	
Zinc stearate	557-05-1	—	10	
Total Dust		—	5	
Respirable Fraction		—	5	
Zirconium compounds (as Zr)	7440-67-7	—	5	

Note: Bold print identifies substances for which the Oregon Permissible Exposure Limits (PELs) are different than the federal Limits.

Note: PNOR means “particles not otherwise regulated.”

Footnotes:

(a) Parts of vapor or gas per million parts of contaminated air by volume at 25°C and 760 torr.

(b) Milligrams of substance per cubic meter of air. When entry is in this column only, the value is exact; when listed with a ppm entry, it is approximate.

(c) The CAS number is for information only. Enforcement is based on the substance name. For an entry covering more than one metal compound, measured as the metal, the CAS number for the metal is given – not CAS numbers for the individual compounds.

(d) The final benzene standard in 1910.1028 applies to all occupational exposures to benzene except in some circumstances the distribution and sale of fuels, sealed containers and pipelines, coke production, oil and gas drilling and production, natural gas processing, and the percentage exclusion for liquid mixtures; for the excepted subsegments, the benzene limits in Oregon Table Z-2 apply. See 1910.1028 for specific circumstances.

(e) This 8-hour TWA applies to respirable dust as measured by a vertical elutriator cotton dust sampler or equivalent instrument. The time weighted average applies to the cotton waste processing operations of waste recycling (sorting, blending, cleaning, and willowing) and garnetting. See also 1910.1043 for cotton dust limits applicable to other sectors.

(f) All inert or nuisance dusts, whether mineral, inorganic, or organic, not listed specifically by substance name are covered by the Particulates Not Otherwise Regulated (PNOR) limit which is the same as the inert or nuisance dust limit of Oregon Table Z-3.

(g) Usually a mixture, in general the aromatic hydrocarbon content will determine which TWA applies.

(h) If the exposure limit in 1910.1026 is stayed or is otherwise not in effect, the exposure limit is a ceiling of 0.1 mg/m³.

(i) See Table Z-2 for the exposure limit for any operations or sectors where the exposure limit in 1910.1026 is stayed or is otherwise not in effect.

(j) See Table Z-3 for the exposure limit for any operations or sectors where the exposure limit in Division 2/Z-Silica is stayed or is otherwise not in effect.

(k) See Table Z-2 for the exposure limits for any operations or sectors where the exposure limits in Division 2/Z Beryllium are stayed or otherwise not in effect.

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 (Z37.29-1970) ^(d)	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	
Chromic acid and chromates (Z37.7-1971) (as CrO ₃) ^c		0.1 mg/m ³			
Ethylene dibromide (Z37.31-1970)	20 ppm	25 ppm	50 ppm	5 min.	X
Ethylene dichloride (Z37.21-1969)	50 ppm	100 ppm	200 ppm	5 min. in any 3 hrs	
Fluoride as dust (Z37.28-1969)	2.5 mg/m ³				
Formaldehyde (see 1910.1048)					
Hydrogen fluoride (Z37.28-1969)	3 ppm				
Hydrogen sulfide (Z37.2-1966)		20 ppm	50 ppm	10 min. once, only if no other measurable exposure occurs	
Mercury (Z37.8-1971)	0.05 mg/m³	0.1 mg/m³			X
Methyl chloride (Z37.18-1969)	100 ppm	200 ppm	300 ppm	5 min. in any 3 hrs	
Organo (alkyl) mercury (Z37.30-1969)	0.001 mg/m³	0.01 mg/m³			X

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	
Styrene (Z37.15-1969)	100 ppm	200 ppm	600 ppm	5 min. in any 3 hrs	
Tetrachloroethylene (Z37.22-1967)	100 ppm	200 ppm	300 ppm	5 min. in any 3 hrs	
Toluene (Z37.12-1967)	100 ppm	300 ppm	500 ppm	10 min.	
Trichloroethylene (Z37.19-1967)	100 ppm	200 ppm	300 ppm	5 min. in any 2 hrs	

Table 1 – Oregon Table Z-2 (Continued)

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	
Diisocyanates Dicyclohexylmethane 4,4'-diisocyanate (hydrogenated MDI)	.055 mg/m .005 ppm	0.210 mg/m ³ 0.02 ppm			
Diphenylmethane diisocyanate (MDI)	.050 mg/m ³ .005 ppm	0.200 mg/m ³ 0.02 ppm			
Hexamethylene diisocyanate (HDI)	.035 mg/m ³ .005 ppm	0.140 mg/m ³ 0.02 ppm			
1,6 Hexamethylene diisocyanated Based Adduct(includes HDI-Biuret trimer, and other polymeric forms of HDI, including isocyanurates)	0.5 mg/m ³	1.0 mg/m ³			
Isophorone diisocyanate (IPDI)	.045 mg/m ³ 005 ppm	0.180 mg/m ³ 0.02 ppm			
Napthalene diisocyanate (NDI)	.040 mg/m ³ .005 ppm	0.170 mg/m ³ 0.02 ppm			
Toluene diisocyanate (TDI)	.035 mg/m ³ .005 ppm	0.140 mg/m ³ 0.02 ppm			

Note: Bold print identifies substances for which the Oregon Permissible Exposure Limits (PELs) are different than the federal limits.

Footnotes:

- (a) This standard applies to the industry segments exempt from the 1 ppm 8-hour TWA and 5 ppm STEL of the Benzene Standard, 1910.1028.
- (b) This standard applies to any operations or sectors for which the Cadmium Standard, 1910.1027, is stayed or otherwise not in effect.
- (c) This standard applies to any operations or sectors for which the exposure limit in the Chromium (VI) standard, 1910.1026, is stayed or is otherwise not in effect.
- (d) This standard applies to any operations or sectors for which the exposure limits in the beryllium standard, Division 2/Z Beryllium, are stayed or is otherwise not in effect.

Oregon Table Z-3 Mineral Dusts

Oregon Table Z-3 Mineral Dusts

Substance	mppcf ^(a)	mg/m ³
Silica: Crystalline Quartz (respirable)		0.1 mg/m ³
Quartz (total dust)		$\frac{30 \text{ mg/m}^3 \text{ (e)}}{\% \text{SiO}_2 + 2}$
Cristobalite (respirable) Tridymite: Use 1/2 the value calculated from the formulae for quartz.		0.05 mg/m ³
Amorphous, including natural diatomaceous earth	20	$\frac{80 \text{ mg/m}^3 \text{ (e)}}{\% \text{SiO}_2}$
Silicates (less than 1% crystalline silica): Mica	20	
Soapstone	20	
Talc (not containing asbestos)	20 ^(c)	
Talc (containing asbestos) Use asbestos limit.	20	
Tremolite, asbestiform (see OAR 437, Div. 2/Z, 1910.1001, Asbestos).		
Portland cement	50	
Graphite (Natural)		5 mg/m ³
Coal Dust: Respirable fraction less than 5% SiO ₂		2.4 mg/m ^{3(e)} (f)
Coal Dust: Respirable fraction greater than 5% SiO ₂		0.1 mg/m ^{3(e)}
Inert or Nuisance Dust: ^(d) Respirable fraction		5 mg/m³
Total dust		10 mg/m³

Note: Bold print identifies substances for which the Oregon Permissible Exposure Limits (PELs) are different than the federal limits.

Note: Conversion factors - mppcf x 35.3 = million particles per cubic meter = particles per c.c.

Footnotes:

^(a) Millions of particles per cubic foot of air, based on impinger samples counted by light-field techniques.

^(b) The percentage of crystalline silica in the formula is the amount determined from airborne samples, except in those instances in which other methods have been shown to be applicable.

^(c) Containing less than 1% quartz; if 1% quartz or more, use quartz limit.

^(d) All inert or nuisance dusts, whether mineral, inorganic, or organic, not listed specifically by substance name are covered by this limit, which is the same as the Particulates Not Otherwise Regulated (PNOR) limit in Oregon Table Z-1.

^(e) Silica sampling methods must conform to OSHA or NIOSH sampling methods for respirable quartz silica.

^(f) The measurements under this note refer to the use of an AEC (now NRC) instrument. If the respirable fraction of coal dust is determined with a MRE the figure corresponding to that of 2.4 mg/m³ in the table for coal dust is 4.5 mg/m³.

AMEND: 437-003-1000

RULE TITLE: Oregon Rules for Air Contaminants

NOTICE FILED DATE: 01/28/2020

RULE SUMMARY: In Table Z-1 of the Oregon's Rules for Air Contaminants for the construction industry, two entries were combined into one for "Manganese Compounds and fume (as Mn)" in the "Substance" column; "7439-96-5" remains in the "CAS No." column; and the Permissible Exposure Limit is lowered to "0.1" in the "mg/ m3" as an 8-hr time-weighted average, while the 5 mg/m3 Ceiling Limit is maintained.

RULE TEXT:

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 Z2 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: 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.

[Oregon Table Example]

(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 Z3, 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) The cumulative exposure for an 8-hour work shift shall be computed as follows:

$$E = (C_a T_a + C_b T_b + \dots C_n T_n) / 8$$

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) 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

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

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

(b) Mixtures.

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

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

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

[Oregon Table Z 2.1]

Substituting in the formula, we have:

$$E_m = (500 / 1000) + (45 / 200) + (40 / 200)$$

$$E_m = 0.500 + 0.225 + 0.200$$

$$E_m = 0.925$$

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 Z-1, Notes, Footnotes; Table Z-2, Note, Footnotes; Table Z-3, Notes, Footnotes.]

STATUTORY/OTHER AUTHORITY: ORS 654.025(2), 654.035, 656.726(4)

STATUTES/OTHER IMPLEMENTED: ORS 654.001 through 654.295

Oregon Table Example

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	

Oregon Table Z-2.1

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

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

Substance	CAS No. ^(c)	Ppm ^(a)	Mg/m ³ ^(b)	Skin
Abate	3383-96-8	—	10	
Acetaldehyde	75-07-0	100	180	
Acetic Acid	64-19-7	10	25	
Acetic anhydride	108-24-7	5	20	
Acetone	67-64-1	1,000	2,400	
Acetonitrile	75-05-8	40	70	
2-Acetylaminoflourine	53-96-3	(C)	(See 1910.1003)	
Acetylene	74-86-2	1,000	—	
Acetylene dichloride, see 1,2-Dichloroethylene				

Substance	CAS No. ^(c)	Ppm ^(a)	Mg/m ³ ^(b)	Skin
Acetylene tetrabromide	79-27-6	1	14	
Acrolein	107-02-8	0.1	0.25	
Acrylamide	79-06-1	—	0.3	x
Acrylonitrile	107-13-1		(See 1910.1045)	x
Aldrin	309-00-2	—	0.25	x
Allyl alcohol	107-18-6	2	5	x
Allyl chloride	107-05-1	1	3	
Allyl glycidyl ether (AGE)	106-92-3	5 (C) 10	22 (C) 45	
Allyl propyl disulfide	2179-59-1	2	12	
alpha Alumina	1344-28-1			
Total Dust		—	10	
Respirable Fraction		—	5	
Aluminum Metal Dust	7429-90-5			
Total Dust		—	10	
Respirable Fraction		—	5	
Alundum (A1203)		—	10	
4-Aminodiphenyl	92-67-1		(See 1910.1003)	
2-Aminoethanol, see Ethanolamine				
2-Aminopyridine	504-29-0	0.5	2	
Ammonia	7664-41-7	25	18	
Ammonium Chloride Fumes	12125-02-09	—	10	
Ammonium sulfamate	7773-06-0			
Total Dust		—	10	
Respirable Fraction		—	5	
n-Amyl acetate	628-63-7	100	525	
sec-Amyl Acetate	626-38-0	125	650	
Aniline and homologs	62-53-3	5	19	X
Anisidine (o, p-isomers)	29191-52-4	0.1	0.5	X
Antimony & Compounds (as Sb)	7440-36-0	—	0.5	
ANTU (alpha naphthyl-thiourea)	86-88-4	—	0.3	
Arsenic Inorganic Compounds (as As)	7440-38-2		(See 1910.1018) 0.01	
Arsenic Organic Compounds (as As)	7440-38-2	—	0.5	
Arsine	7784-42-1	0.05	0.2	
Asbestos		(See 1910.1001 and 1926.1101)		
Asphalt (petroleum) Fumes	8052-42-4	—	5	

Substance	CAS No. ^(c)	Ppm ^(a)	Mg/m ³ ^(b)	Skin
Azinphos-methyl	86-50-1	—	0.2	X
Barium (soluble compounds)	7440-39-3	—	0.5	
Barium Sulfate	7727-43-7			
Total Dust		—	10	
Respirable Fraction		—	5	
Benomyl	17804-35-2			
Total Dust		—	10	
Respirable Fraction		—	5	
Benzene See Oregon Table Z-2 for the limits applicable in the operations or sectors excluded in 1910.1028 ^(d)	71-43-2		(See 1910.1028)	
Benzidine	92-87-5		(See 1910.1003)	
p-Benzoquinone, see Quinone				
Benzoyl peroxide	94-36-0	—	5	
Benzyl chloride	100-44-7	1	5	
Beryllium and Beryllium compounds (as Be); see Division 2/Z Beryllium ^(k)	7440-41-7		(See Oregon Table Z-2)	
Biphenyl, see Diphenyl				
Bismuth telluride (undoped)	1304-82-1			
Total Dust		—	10	
Respirable Fraction		—	5	
Bismuth telluride (Se-doped)		—	5	
Bisphenol A, see Diglycidyl ether				
Boron oxide	1303-86-2	—	10	
Boron tribromide	10294-33-4	1	10	
Boron trifluoride	7637-07-2	(C) 1	(C) 3	
Bromine	7726-95-6	0.1	0.7	
Bromine pentafluoride	7789-30-2	0.1	0.7	
Bromoform	75-25-2	0.5	5	X
Butadiene (1,3-Butadiene)	106-99-0	1 ppm/5 ppm STEL	(See 1910.1051; 1910.19(l))	
Butane	106-97-8	800	1,900	
Butanethiol, see Butyl mercaptan				
2-Butanone (Methyl Ethyl Ketone)	78-93-3	200	590	
2-Butoxyethanol (Butyl cellosolve)	111-76-2	50	240	X
Butyl acetate (n-Butyl acetate)	123-86-4	150	710	
sec-Butyl acetate	105-46-4	200	950	
tert-Butyl acetate	540-88-5	200	950	

Substance	CAS No. ^(c)	Ppm ^(a)	Mg/m ³ ^(b)	Skin
n-Butyl alcohol	71-36-3	100	300	
sec-Butyl alcohol	78-92-2	150	450	
tert-Butyl alcohol	75-65-0	100	300	
Butyl lactate	138-22-7	1	5	
Butylamine	109-73-9	(C) 5	(C) 15	X
tert-Butyl chromate (as CrO ₃)	1189-85-1	(See 1926.126) ^(h)		
n-Butyl glycidyl ether (BGE)	2426-08-6	50	270	
Butyl mercaptan	109-79-5	0.5	1.5	
p-tert-Butyltoluene	98-51-1	10	60	
Cadmium dust and fume (as Cd)	7440-43-9	(See 1910.1027, 1926.1127 and Division 4) 0.005		
Calcium carbonate	1317-65-3			
Total Dust		—	10	
Respirable Fraction		—	5	
Calcium hydroxide	1305-62-0			
Total Dust		—	10	
Respirable Fraction		—	5	
Calcium oxide	1305-78-8	—	5	
Calcium silicate	1344-95-2			
Total Dust		—	10	
Respirable Fraction		—	5	
Calcium sulfate	7778-18-9			
Total Dust		—	10	
Respirable Fraction		—	5	
Camphor, synthetic	76-22-2	—	2	
Caprolactam (2-Oxonexa-methylenimine)	105-60-2	—	5	
Carbaryl (Sevin®)	63-25-2	—	5	
Carbon black	1333-86-4	—	3.5	
Carbon dioxide	124-38-9	5,000	9,000	
Carbon disulfide	75-15-0		(See Oregon Table Z-2)	
Carbon monoxide	630-08-0	50	55	
Carbon tetrachloride	56-23-5		(See Oregon Table Z-2)	
Cellulose	9006-34-6			
Total Dust		—	10	
Respirable Fraction		—	5	
Chlordane	57-74-9	—	0.5	X
Chlorinated camphene	8001-35-2	—	0.5	X
Chlorinated diphenyl oxide	55720-99-5	—	0.5	
Chlorine	7782-50-5	(C) 1	(C) 3	

Substance	CAS No. ^(c)	Ppm ^(a)	Mg/m ³ ^(b)	Skin
Chlorine dioxide	10049-04-4	0.1	0.3	
Chlorine trifluoride	7790-91-2	(C) 0.1	(C) 0.4	
Chloroacetaldehyde	107-20-0	(C) 1	(C) 3	
a-Chloroacetophenone (phenacyl chloride)	532-27-4	0.05	0.3	
Chlorobenzene	108-90-7	75	350	
o-Chlorobenzylidene malononitrile	2698-41-1	0.05	0.4	
Chlorobromomethane	74-97-5	200	1,050	
2-Chloro-1, 3-butadiene, see beta-Chloroprene				
Chlorodiphenyl (42% Chlorine)	53469-21-9	—	1	X
Chlorodiphenyl (54% Chlorine)	11097-69-1	—	0.5	X
1-Chloro, 2, 3-epoxypropane, see Epichlorhydrin				
2-Chloroethanol, see Ethylene Chlorohydrin				
Chloroethylene, see Vinyl Chloride				
Chloroform (trichloromethane)	67-66-3	(C) 25	(C) 120	
bis-Chloromethyl ether	542-88-1		(See 1910.1003)	
Chloromethyl methyl ether	107-30-2		(See 1910.1003)	
1-Chloro-1-nitropropane	600-25-9	20	100	
Chloropicrin	76-06-2	0.1	0.7	
Beta-Chloroprene (2-chloro-1,3-butadiene)	126-99-8	25	90	X
2-Chloro-6-(trichloromethyl) pyridine	1929-82-4			
Total Dust		—	10	
Respirable Fraction		—	5	
Chromic acid and chromates (as CrO ₃)			(See Oregon Table Z-2)	
Chromium (II) compounds (as Cr)	7440-47-3	—	0.5	
Chromium (III) compounds (as Cr)	7440-47-3	—	0.5	
Chromium (VI) compounds		(See 1926.1126) ^(d)		
Chromium metal & insol. salts	7440-47-3	—	1	
Clopidol	2971-90-6			
Total Dust		—	10	
Respirable Fraction		—	5	
Coal Dust			(See Oregon Table Z-3)	

Substance	CAS No. ^(c)	Ppm ^(a)	Mg/m ³ ^(b)	Skin
Coal tar pitch volatiles (Benzene soluble fraction) anthracene, BaP, phenanthracene, acridine, chrysene, pyrene	65966-93-2	—	0.2 (See 1910.1002)	
Cobalt metal, fume & dust	7440-48-4	—	0.1	
Coke oven emissions			(See 1910.1029)	
Copper fume	7440-50-8	—	0.1	
Dusts and Mists	7440-50-8	—	1	
Corundum (A1203)	1302-74-5	—	10	
Cotton dust			(See 1910.1043)	
Cotton dust (raw)		—	1 ^(e)	
Crag[®] herbicide (Sesone)	136-78-7			
Total Dust		—	10	
Respirable Fraction		—	5	
Cresol (all isomers)	1319-77-3	5	22	X
Crotonaldehyde	123-73-9/ 4170-30-3	2	6	
Cumene	98-82-8	50	245	X
Cyanide (as CN)		—	5	X
Cyanogen	460-19-5	10	—	
Cyclohexane	110-82-7	300	1,050	
Cyclohexanol	108-93-0	50	200	
Cyclohexanone	108-94-1	50	200	
Cyclohexene	110-83-8	300	1,015	
Cyclopentadiene	542-92-7	75	200	
2,4-D (Dichlorophenoxyacetic acid)	94-75-7	—	10	
DDT	50-29-3	—	1	X
DDVP, see Dichlorvos				
Decaborane	17702-41-9	0.05	0.3	X
Demeton [®] (Systox)	8065-48-3	—	0.1	X
Diacetone alcohol (4-hydroxy-4- methyl-2-pentanone)	123-42-2	50	240	
1, 2-Diaminoethane, see Ethylenediamine				
Diazinon	333-41-5	—	0.1	X
Diazomethane	334-88-3	0.2	0.4	
Diborane	19287-45-7	0.1	0.1	
Dibrom[®]	300-76-5	—	3	
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	0.001	(See 1910.1044)	

Substance	CAS No. ^(c)	Ppm ^(a)	Mg/m ³ ^(b)	Skin
1,2-Dibromoethane, see Ethylene dibromide				
2-N-Dibutylaminoethanol	102-81-8	2	14	X
Dibutyl phosphate	107-66-4	1	5	
Dibutyl phthalate	84-74-2	—	5	
Dichloroacetylene	7572-29-4	(C) 0.1	(C) 0.4	
o-Dichlorobenzene	95-50-1	(C) 50	(C) 300	
p-Dichlorobenzene	106-46-7	75	450	
3,3-Dichlorobenzidine	91-94-1		(See 1910.1003)	X
Dichlorodifluoromethane	75-71-8	1,000	4,950	
1,3-Dichloro-5, 5-dimethyl hydantoin	118-52-5	—	0.2	
Dichlorodiphenyltrichloroethane (DDT)	50-29-3	—	1	X
1, 1-Dichloroethane	75-34-3	100	400	
1, 2-Dichloroethane, see Ethylene dichloride				
1, 2-Dichlorethylene	540-59-0	200	790	
Dichloroethyl Ether	111-44-4	5 (C) 15	30 (C) 90	X X
Dichloromethane, see Methylenechloride				
Dichloromonofluoromethane	75-43-4	1,000	4,200	
1, 1-Dichloro-1-nitroethane	594-72-9	(C) 10	(C) 60	
1, 2-Dichloropropane, see Propylene dichloride				
Dichlorotetrafluoroethane	76-14-2	1,000	7,000	
Dichlorvos (DDVP)	62-73-7	0.1	1	X
Dicyclohexylmethane 4,4'-diisocyanate (hydrogenated MDI, see Oregon Table Z-2 (Diisocyanates))	5124-30-1			
Dicyclopentadienyl iron Total Dust	102-54-5	—	10	
Respirable Fraction		—	5	
Dieldrin	60-57-1	—	0.25	X
Diethylamine	109-89-7	25	75	
2-Diethylaminoethanol	100-37-8	10	50	X
Diethylene triamine	111-40-0	(C) 1	(C) 4	X
Diethylether, see Ethyl ether				
Difluorodibromomethane	75-61-6	100	860	

Substance	CAS No. ^(c)	Ppm ^(a)	Mg/m ³ ^(b)	Skin
Diglycidyl ether (DGE)	2238-07-5	(C) 0.5	(C) 2.8	
Dihydroxybenzene, see Hydroquinone				
Diisobutyl ketone	108-83-8	25	150	
Diisopropylamine	108-18-9	5	20	X
Dimethoxymethane, see Methylal				
Dimethyl acetamide	127-19-5	10	35	X
Dimethylamine	124-40-3	10	18	
4-Dimethylaminoazobenzene	60-11-7		(See 1910.1003)	
Dimethylaminobenzene, see Xylidene				
Dimethylaniline (N,N-Dimethylaniline)	121-69-7	5	25	X
Dimethylbenzene, see Xylene				
Dimethyl-1,2-dibromo-2,2-dichloroethyl phosphate	300-76-5	—	3	
Dimethylformamide	68-12-2	10	30	X
2,6-Dimethylheptanone, see Diisobutyl ketone				
1,1-Dimethylhydrazine	57-14-7	0.5	1	X
Dimethylphthalate	131-11-3	—	5	
Dimethyl sulfate	77-78-1	1	5	X
Dinitrobenzene (all isomers)	528-29-0/ 99-65-0/ 100-25-4			
Dinitro-o-cresol	534-52-1	—	0.2	X
Dinitrotoluene	25321-14-6	—	1.5	X
Dioxane (Diethylene dioxide)	123-91-1	100	360	X
Diphenyl (Biphenyl)	92-52-4	0.2	1	
Diphenylamine	122-39-4	—	10	
Diphenylmethane diisocyanate (MDI), see Oregon Table Z-2 (Diisocyanates)				
Dipropylene glycol methyl ether	34590-94-8	100	600	X
Diquat	231-36-7	—	0.5	
Di-sec, octyl phthalate (Di-2-ethyl-hexyl-phthalate)	117-81-7	—	5	
Emery	12415-34-8			
Total Dust		—	10	
Respirable Fraction		—	5	
Endosulfan (Thiodan[®])	115-29-7	—	0.1	X

Substance	CAS No. ^(c)	Ppm ^(a)	Mg/m ³ ^(b)	Skin
Endrin	72-20-8	—	0.1	X
Epichlorohydrin	106-89-8	5	19	X
EPN	2104-64-5	—	0.5	X
1,2-Epoxypropane, see Propylene oxide				
2,3-Epoxy-1-propanol, see Glycidol				
Ethane	74-84-0	1,000	—	
Ethanethiol, see Ethyl mercaptan				
Ethanolamine	141-43-5	3	6	
2-Ethoxyethanol (Cellosolve)	110-80-5	100	370	
2-Ethoxyethyl acetate (Cellosolve acetate)	111-15-9	100	540	X
Ethyl acetate	141-78-6	400	1,400	
Ethyl acrylate	140-88-5	25	100	X
Ethyl alcohol (ethanol)	64-17-5	1,000	1,900	
Ethylamine	75-04-7	10	18	
Ethyl amyl ketone (5-methyl-3-heptanone)	541-85-5	25	130	
Ethyl benzene	100-41-4	100	435	
Ethyl bromide	74-96-4	200	890	
Ethyl butyl ketone (3-Heptanone)	106-35-4	50	230	
Ethyl chloride	75-00-3	1,000	2,600	
Ethyl ether	60-29-7	400	1,200	
Ethyl formate	109-94-4	100	300	
Ethyl mercaptan	75-08-1	0.5 (C) 10	1 (C) 25	
Ethyl silicate	78-10-4	100	850	
Ethylene	74-85-1	1,000	—	
Ethylene chlorohydrin	107-07-3	5	16	X
Ethylenediamine	107-15-3	10	25	
Ethylene dibromide	106-93-4		(See Oregon Table Z-2)	
Ethylene dichloride	107-06-2		(See Oregon Table Z-2)	
Ethylene glycol particulate		—	10	
Ethylene glycol, Vapor	107-21-1	100	260	
Ethylene glycol dinitrate	628-96-6	(C) 0.2	(C) 1	X
Ethylene glycol methyl acetate (Methyl cellosolve acetate) (2-Methoxy-ethyl acetate)	110-49-6	25	120	

Substance	CAS No. ^(c)	Ppm ^(a)	Mg/m ³ ^(b)	Skin
Ethylenimine	151-56-4		(See 1910.1003)	
Ethylene oxide	75-21-8		(See 1910.1047)	
Ethylidene chloride, see 1,1-Dichloroethane				
N-Ethylmorpholine	100-74-3	20	94	X
Ferbam	14484-64-1			
Total Dust		—	10	
Respirable Fraction		—	5	
Ferrovandium dust	12604-58-9	—	1	
Fibrous glass, see Glass, Fibrous				
Fluorides (As F)		—	2.5 (See Oregon Table Z-2)	
Fluorine	7782-41-4	0.1	0.2	
Fluorotrichloromethane (Trichlorofluoromethane)	75-69-4	1,000	5,600	
Formaldehyde	50-00-0	0.75	(See 1910.1048)	
Formic acid	64-18-6	5	9	
Furfural	98-01-1	5	20	X
Furfuryl alcohol	98-00-0	5	20	
Gasoline	8006-61-9	—	^(g)	
Germanium tetrahydride	7782-65-2	0.2	0.6	
Glass, Fibrous or dust		—	10	
Glycerin (mist)	56-81-5			
Total Dust		—	10	
Respirable Fraction		—	5	
Glycidol	556-52-5	50	150	
Glycol monoethyl ether, see 2-Ethoxyethanol				
Grain dust (oat, wheat, barley)		—	10	
Graphite natural, respirable	7782-42-5		(See Oregon Table Z-3)	
Graphite (Synthetic)	7782-42-5			
Total Dust		—	10	
Respirable Fraction		—	5	
Guthion [®] , see Azinphosmethyl				
Gypsum	13397-24-5			
Total Dust		—	10	
Respirable Fraction		—	5	
Hafnium	7440-58-6	—	0.5	
Heptachlor	76-44-8	—	0.5	X
Heptane (n-heptane)	142-82-5	500	2,000	

Substance	CAS No. ^(c)	Ppm ^(a)	Mg/m ³ ^(b)	Skin
Hexachlorocyclopentadiene	77-47-4	0.1	1	
Hexachloroethane	67-72-1	1	10	X
Hexachloronaphthalene	1335-87-1	—	0.2	X
Hexafluoracetone	684-16-2	0.1	0.7	X
Hexamethylene diisocyanate (HDI), see Oregon Table Z-2 (Diisocyanates)	822-06-01			
1,6 Hexamethylene diisocyanate Based Adduct, see Oregon Table Z-2 (Diisocyanates)				
Hexane (n-hexane)	110-54-3	500	1,800	
2-Hexanone	591-78-6	100	410	
Hexone (Methyl isobutyl ketone)	108-10-1	100	410	
sec-Hexyl acetate	108-84-9	50	300	
Hydrazine	302-01-2	1	1.3	X
Hydrogen	1333-74-0	1,000	—	
Hydrogen bromide	10035-10-6	3	10	
Hydrogen chloride	7647-01-0	(C) 5	(C) 7	
Hydrogen cyanide	74-90-8	10	11	X
Hydrogen fluoride (as F)	7664-39-3		(See Oregon Table Z-2)	
Hydrogen peroxide	7722-84-1	1	1.4	
Hydrogen selenide (as Se)	7783-07-5	0.05	0.2	
Hydrogen sulfide	7783-06-4		(See Oregon Table Z-2)	
Hydroquinone	123-31-9	—	2	
Indene	95-13-6	10	45	
Indium and compounds (as In)	7440-74-6	—	0.1	
Iodine	7553-56-2	(C) 0.1	(C) 1	
Iron oxide fume	1309-37-1	—	10	
Iron pentacarbonyl	13463-40-6	0.1	.23	
Iron salts, soluble, as Fe		—	1	
Isoamyl acetate	123-92-2	100	525	
Isoamyl alcohol (primary and secondary)	123-51-3	100	360	
Isobutyl acetate	110-19-0	150	700	
Isobutyl alcohol	78-83-1	100	300	
Isophorone	78-59-1	10	55	

Substance	CAS No. ^(c)	Ppm ^(a)	Mg/m ³ ^(b)	Skin
Isophorone diisocyanate (IPDI), see Oregon Table Z-2 (Diisocyanates)	4098-71-9			
Isopropyl acetate	108-21-4	250	950	
Isopropyl alcohol	67-63-0	400	980	
Isopropylamine	75-31-0	5	12	
Isopropyl ether	108-20-3	250	1,050	
Isopropyl glycidyl ether (IGE)	4016-14-2	50	240	
Kaolin	1332-58-7			
Total Dust		—	10	
Respirable Fraction		—	5	
Ketene	463-51-4	0.5	0.9	
Lead, inorganic (as Pb)	7439-92-1	(See 1910.1025 & 1926.62)	(See 1910.1025 & 1926.62)	
Lead arsenate	7784-40-9	(See 1910.1018)	0.01	
Limestone	1317-65-3			
Total Dust		—	10	
Respirable Fraction		—	5	
Lindane	58-89-9	—	0.5	X
Lithium hydride	7580-67-8	—	0.025	
L.P.G. (Liquified petroleum gas)	68476-85-7	1,000	1,800	
Magnesite	546-93-0			
Total Dust		—	10	
Respirable Fraction		—	5	
Magnesium oxide fume	1309-48-4			
Total Dust		—	10	
Respirable Fraction		—	5	
Malathion	121-75-5	—	10	X
Maleic anhydride	108-31-6	0.25	1	
Manganese Compounds and fume (as Mn)	7439-96-5	—	0.1 (C) 5	
Marble	1317-65-3			
Total Dust		—	10	
Respirable Fraction		—	5	
Mercury (aryl, inorganic, organo, and vapor) (as Hg)	7439-97-6		(See Oregon Table Z-2)	
Mesityl oxide	141-79-7	25	100	
Methane	74-82-8	1,000	—	
Methanethiol, see Methyl mercaptan				
Methoxychlor	72-43-5			
Total Dust		—	10	
Respirable Fraction		—	5	

Substance	CAS No. ^(c)	Ppm ^(a)	Mg/m ³ ^(b)	Skin
2-Methoxyethanol (Methyl Cellosolve)	109-86-4	25	80	X
2-Methoxyethyl acetate (Methyl cellosolve acetate)	110-49-6	25	120	X
Methyl acetate	79-20-9	200	610	
Methyl acetylene (propyne)	74-99-7	1,000	1,650	
Methyl acetylene-propadiene mixture (MAPP)		1,000	1,800	
Methyl acrylate	96-33-3	10	35	X
Methylacrylonitrile	126-98-7	1	3	X
Methylal (dimethoxy-methane)	109-87-5	1,000	3,100	
Methyl alcohol (methanol)	67-56-1	200	260	
Methylamine	74-89-5	10	12	
Methyl amyl alcohol, see Methyl isobutyl carbinol				
Methyl (n-amyl) ketone	110-43-0	100	465	
Methyl bromide	74-83-9	15 (C) 20	60 (C) 80	X
Methyl butyl ketone, see 2-Hexanone				
Methyl cellosolve, see 2 Methoxy ethanol				X
Methyl cellosolve acetate (Ethylene glycol monomethyl ether acetate)	110-49-6	25	120	X
Methyl Chloride	74-87-3		(See Oregon Table Z-2)	
Methyl Chloroform (1,1,1-Trichloroethane)	71-55-6	350	1,900	
Methyl Chloromethyl ether			(See 1910.1003)	
Methyl 2-cyanoacrylate	137-05-3	2	8	
Methylcyclohexane	108-87-2	500	2,000	
Methylcyclohexanol	25639-42-3	50	235	
o-Methylcyclohexanone	583-60-8	50	230	X
2-Methylcyclopentadienyl manganese tricarbonyl (as Mn)	12108-13-3	0.1	0.2	X
Methyl demeton	8022-00-2	—	0.5	X
Methyl ethyl ketone (MEK), see 2-Butanone				
Methyl formate	107-31-3	100	250	
Methyl iodide	74-88-4	5	28	X
Methyl isoamyl ketone	110-12-3	100	475	
Methyl isobutyl carbinol	108-11-2	25	100	X

Substance	CAS No. ^(c)	Ppm ^(a)	Mg/m ³ ^(b)	Skin
Methyl isobutyl ketone, see Hexone				
Methyl isocyanate	624-83-9	0.02	0.05	X
Methyl mercaptan	74-93-1	0.5 (C) 10	1 (C) 20	
Methyl methacrylate	80-62-6	100	410	
Methyl parathion	298-00-0	—	0.2	X
Methyl propyl ketone, see 2-Pentanone				
Methyl silicate	681-84-5	(C) 5	(C) 30	
a-Methyl styrene	98-83-9	(C) 100	(C) 480	
Methylene bisphenyl isocyanate (MDI)	101-68-8	(See Oregon Table Z-2 (diisocyanates))		
Methylenedianiline (MDA)		(See 1910.1050 & 1926.60)	0.01	
Methylene Chloride	75-09-2	25	(See 1910.1052)	
Mineral Wool Fiber		—	10	
MOCA	101-14-4		(See 437-002-0346)	
Molybdenum (soluble compounds)	7439-98-7	—	5	
(insoluble compounds)		—	10	
Monomethyl aniline	100-61-8	2	9	X
Monomethyl hydrazine	60-34-4	(C) 0.2	(C) 0.35	X
Morpholine	110-91-8	20	70	X
Naphtha (coal tar)	8030-30-6	100	400	
Naphthalene	91-20-3	10	50	
Naphthalene diisocyanate (NDI), see Oregon Table Z-2 (Diisocyanates)	3173-72-6			
Alpha naphthylamine	134-32-7		(See 1910.1003)	
B-Naphthylamine	91-59-8		(See 1910.1003)	
Nickel carbonyl (as Ni)	13463-39-3	0.001	0.007	
Nickel, metal and insoluble compounds, as Ni	7440-02-0	—	1	
Nickel, soluble compounds, (as Ni)	7440-02-0	—	1	
Nicotine	54-11-5	0.075	0.5	X
Nitric acid	7697-37-2	2	5	
Nitric oxide	10102-43-9	25	30	
p-Nitroaniline	100-01-6	1	6	
Nitrobenzene	98-95-3	1	5	X
4-Nitrodiphenyl	92-93-3		(See 1910.1003)	

Substance	CAS No. ^(c)	Ppm ^(a)	Mg/m ³ ^(b)	Skin
p-Nitrochlorobenzene	100-00-5	—	1	X
Nitroethane	79-24-3	100	310	
Nitrogen dioxide	10102-44-0	(C) 5	(C) 9	
Nitrogen trifluoride	7783-54-2	10	29	
Nitroglycerin	55-63-0	(C) 0.2	(C) 2	X
Nitromethane	75-52-5	100	250	
1-Nitropropane	108-03-2	25	90	
2-Nitropropane	79-46-9	25	90	
N-Nitrosodimethylamine			(See 1910.1003)	
Nitrotoluene (all isomers)	88-72-2/ 99-08-1/ 99-99-0	5	30	X
Nitrotrichloromethane, see Chloropicrin				
Nitrous oxide	10024-97-2	50	90	
Octachloronaphthalene	2234-13-1	—	0.1	X
Octane	111-65-9	400	1,900	
Oil mist (mineral)	8012-95-1	—	5	
Oil mist, vapor		—	^(g)	
Osmium tetroxide (as Os)	20816-12-0		0.002	
Oxalic acid	144-62-7	—	1	
Oxygen difluoride	7783-41-7	0.05	0.1	
Ozone	10028-15-6	0.1	0.2	
Parafin wax fume	8002-74-2	—	1	
Paraquat respirable dust	4685-14-7/ 1910-42-5/ 2074-50-2	—	0.5	X
Parathion	56-38-2	—	0.1	X
Particulates not otherwise regulated (PNOR)^(f)				
Total Dust		—	10	
Respirable Fraction		—	5	
Pentaborane	19624-22-7	0.005	0.01	
Pentachloronaphthalene	1321-64-8	—	0.5	X
Pentachlorophenol	87-86-5	—	0.5	X
Pentaerythritol	115-77-5			
Total Dust		—	10	
Respirable Fraction		—	5	
Pentane	109-66-0	500	1,500	
2-Pentanone (Methyl propyl ketone)	107-87-9	200	700	

Substance	CAS No. ^(c)	Ppm ^(a)	Mg/m ³ ^(b)	Skin
Perchloroethylene (tetrachloroethylene)	127-18-4		(See Oregon Table Z-2)	
Perchloromethyl mercaptan	594-42-3	0.1	0.8	
Perchloryl fluoride	7616-94-6	3	13.5	
Perlite	93763-70-3			
Total Dust		—	10	
Respirable Fraction		—	5	
Petroleum distillates (naphtha) (Rubber Solvent)		500	2,000 ^(g)	
Phenol	108-95-2	5	19	X
Phenothiazine	92-84-2	—	5	X
p-Phenylene diamine	106-50-3	—	0.1	X
Phenyl ether (vapor)	101-84-8	1	7	
Phenyl ether - biphenyl mixture (vapor)	8004-13-5	1	7	
Phenylethylene, see Styrene				
Phenyl glycidyl ether (PGE)	122-60-1	10	60	
Phenylhydrazine	100-63-0	5	22	X
Phenylphosphine	638-21-1	(C) 0.05	(C) 0.25	
Phosdrin (Mevinphos [®])	7786-34-7		0.1	X
Phosgene (carbonyl chloride)	75-44-5	0.1	0.4	
Phosphine	7803-51-2	0.3	0.4	
Phosphoric acid	7664-38-2	—	1	
Phosphorus (yellow)	7723-14-0	—	0.1	
Phosphorus pentachloride	10026-13-8	—	1	
Phosphorus pentasulfide	1314-80-3	—	1	
Phosphorus trichloride	7719-12-2	0.5	3	
Phthalic anhydride	85-44-9	2	12	
Picloram	1918-02-1			
Total Dust		—	10	
Respirable Fraction		—	5	
Picric acid	88-89-1	—	0.1	X
Pindone (2-Pivalyl-1, 3-indandione)	83-26-1	—	0.1	
Plaster of Paris	26499-65-0			
Total Dust		—	10	
Respirable Fraction		—	5	
Platinum (Soluble Salts) as Pt	7440-06-4	—	0.002	
Polychlorobiphenyls, see Chlorodiphenyls				

Substance	CAS No. ^(c)	Ppm ^(a)	Mg/m ³ ^(b)	Skin
Portland Cement	65997-15-1			
Total Dust		—	10	
Respirable Fraction		—	5	
Propane	74-98-6	1,000	1,800	
Beta-Propiolactone	57-57-8		(See 1910.1003)	
Propargyl alcohol	107-19-7	1	—	X
n-Propyl acetate	109-60-4	200	840	
n-Propyl alcohol	71-23-8	200	500	
n-Propyl nitrate	627-13-4	25	110	
Propylene dichloride	78-87-5	75	350	
Propylene glycol monomethyl ether	107-98-2	100	360	
Propylene imine	75-55-8	2	5	X
Propylene oxide	75-56-9	100	240	
Propyne, see Methyl acetylene				
Pyrethrum	8003-34-7	—	5	
Pyridine	110-86-1	5	15	
Quinone	106-51-4	0.1	0.4	
RDX (Cyclonite)	121-82-4	—	1.5	X
Rhodium, Metal fume and dusts, as Rh Soluble salts	7440-16-6 7440-16-6	— —	0.1 0.001	
Ronnel	299-84-3	—	10	
Rosin core solder pyrolysis Products (as Formaldehyde)		—	0.1	
Rotenone	83-79-4	—	5	
Rouge				
Total Dust		—	10	
Respirable Fraction		—	5	
Selenium compounds (as Se)	7782-49-2	—	0.2	
Selenium hexafluoride (as Se)	7783-79-1	0.05	0.4	
Silica, crystalline, respirable dust^(d)			(See Division 2/Z Silica)	
Cristobalite	14464-46-1			
Quartz	14808-60-7	—		
Tripoli (as quartz)	1317-95-9			
Tridamite	15468-32-3			
Silicon	7440-21-3			
Total Dust		—	10	
Respirable Fraction		—	5	
Silicon carbide	409-21-2			
Total Dust		—	10	
Respirable Fraction		—	5	

Substance	CAS No. ^(c)	Ppm ^(a)	Mg/m ³ ^(b)	Skin
Silver, metal and soluble compounds (as Ag)	7440-22-4	—	0.01	
Sodium fluoroacetate	62-74-8	—	0.05	X
Sodium hydroxide	1310-73-2	—	2	
Starch	9005-25-8			
Total Dust		—	10	
Respirable Fraction		—	5	
Stibine	7803-52-3	0.1	0.5	
Stoddard solvent	8052-41-3	200	1,150	
Strychnine	57-24-9	—	0.15	
Styrene	100-42-5		(See Oregon Table Z-2)	
Subtilisins (Proteolytic enzymes) (as 100% pure crystalline enzyme)	1395-21-7	—	(C) 0.0003	
Sucrose	57-50-1			
Total Dust		—	10	
Respirable Fraction		—	5	
Sulfur dioxide	7446-09-5	5	13	
Sulfur hexafluoride	2551-62-4	1,000	6,000	
Sulfuric acid	7664-93-9	—	1	
Sulfur monochloride	10025-67-9	1	6	
Sulfur pentafluoride	5714-22-7	0.025	0.25	
Sulfur tetrafluoride	7783-60-0	0.1	0.4	
Sulfuryl fluoride	2699-79-8	5	20	
Systox, see Demeton®				
2, 4, 5-T	93-76-5	—	10	
Tantalum, metal and oxide dust	7440-25-7	—	5	
TEDP (Sulfotepp)	3689-24-5	—	0.2	X
Tellurium and compounds (as Te)	13494-80-9	—	0.1	
Tellurium hexafluoride (as Te)	7783-80-4	0.02	0.2	
Temephos	3383-96-8			
Total Dust		—	10	
Respirable Fraction		—	5	
TEPP (Tetraethyl pyrophosphate)	107-49-3	0.004	0.05	X
Terphenyls	26140-60-3	(C) 1	(C) 9	
1, 1, 1, 2-Tetrachloro-2,2-difluoroethane	76-11-9	500	4,170	
1, 1, 2, 2-Tetrachloro-1,2-difluoroethane	76-12-0	500	4,170	
1, 1, 2, 2-Tetrachloroethane	79-34-5	5	35	X

Substance	CAS No. ^(c)	Ppm ^(a)	Mg/m ³ ^(b)	Skin
Tetrachloroethylene, see Perchloroethylene				
Tetrachloronaphthalene	1335-88-2	—	2	X
Tetrachloromethane, see Carbon tetrachloride				
Tetraethyl lead (as Pb)	78-00-2	—	0.075	X
Tetrahydrofuran	109-99-9	200	590	
Tetramethyl lead (as Pb)	75-74-1	—	0.075	X
Tetramethyl succinonitrile	3333-52-6	0.5	3	X
Tetranitromethane	509-14-8	1	8	
Tetryl (2, 4, 6-trinitro-phenyl-methyl-nitramine)	479-45-8	—	1.5	X
Thallium (soluble compounds) as Tl	7440-28-0	—	0.1	X
4,4'-Thiobis (6-tert, Butyl-m-cresol)	96-69-5			
Total Dust		—	10	
Respirable Fraction		—	5	
Thiram	137-26-8		(See 437-002-0373) 0.15	
Tin (inorganic compounds, except oxides) as Sn	7440-31-5	—	2	
Tin (organic compounds)	7440-31-5	—	0.1	
Tin oxide	1332-29-2			
Total Dust		—	10	
Respirable Fraction		—	5	
Titanium dioxide	13463-67-7	—	10	
Toluene (toluol)	108-88-3		(See Oregon Table Z-2)	
Toluene diisocyanate (TDI), See Oregon Table Z-2 (Diisocyanates)	584-84-9			
o-Toluidine	95-53-4	5	22	X
Toxaphene, see Chlorinated camphene				
Tributyl phosphate	126-73-8	—	5	
1, 1, 1-Trichloroethane, see Methyl chloroform				
1, 1, 2-Trichloroethane	79-00-5	10	45	X
Trichloroethylene	79-01-6		(See Oregon Table Z-2)	
Trichloromethane, see Chloroform				
Trichloronaphthalene	1321-65-9	—	5	
1, 2, 3-Trichloropropane	96-18-4	50	300	

Substance	CAS No. ^(c)	Ppm ^(a)	Mg/m ³ ^(b)	Skin
1, 1, 2-Trichloro 1, 2, 2-trifluoroethane	76-13-1	1,000	7,600	
Triethylamine	121-44-8	25	100	
Trifluorobromomethane	75-63-8	1,000	6,100	
Trimethyl benzene	25551-13-7	25	120	
2, 4, 6-Trinitrophenol, see Picric acid				
2, 4, 6-Trinitrophenylmethyl-nitramine, see Tetryl				
Trinitrotoluene (TNT)	118-96-7		1.5	X
Triorthocresyl phosphate	78-30-8	—	0.1	
Triphenyl phosphate	115-86-6	—	3	
Tungsten & compounds, as W	7440-33-7			
Soluble		—	1	
Insoluble		—	5	
Turpentine	8006-64-2	100	560	
Uranium (as U)	7440-61-1			
Soluble compounds		—	0.05	
Insoluble compounds		—	0.2	
Vanadium respirable dust				
(as V ₂ O ₅)	1314-62-1	—	(C) 0.5	
Fume (as V₂O₅)	1314-62-1	—	(C) 0.05	
Vegetable oil mist				
Total Dust		—	10	
Respirable Fraction		—	5	
Vinyl acetate	108-05-4	10	30	
Vinyl benzene, see Styrene				
Vinyl bromide	593-60-2	250	1,100	
Vinyl chloride	75-01-4		(See 1910.1017)	
Vinyl cyanide, see Acrylonitrile				
Vinyl toluene	25013-15-4	100	480	
Warfarin	81-81-2	—	0.1	
Wood Dust (non-allergenic)		—	10	
Xylene (o-, m-, p-isomers)	1330-20-7	100	435	
Xylidine	1300-73-8	5	25	X
Yttrim	7440-65-5	—	1	
Zinc chloride fume	7646-85-7	—	1	
Zinc oxide	1314-13-2			
Total Dust		—	10	
Respirable Fraction		—	5	
Zinc oxide fume	1314-13-2	—	5	

Substance	CAS No. ^(c)	Ppm ^(a)	Mg/m ³ ^(b)	Skin
Zinc stearate	557-05-1	—	10	
Total Dust		—	5	
Respirable Fraction		—	5	
Zirconium compounds (as Zr)	7440-67-7	—	5	

Note: Bold print identifies substances for which the Oregon Permissible Exposure Limits (PELs) are different than the federal Limits.

Note: PNOR means "particles not otherwise regulated."

FOOTNOTES:

- (a) Parts of vapor or gas per million parts of contaminated air by volume at 25°C and 760 torr.
- (b) Milligrams of substance per cubic meter of air. When entry is in this column only, the value is exact; when listed with a ppm entry, it is approximate.
- (c) The CAS number is for information only. Enforcement is based on the substance name. For an entry covering more than one metal compound, measured as the metal, the CAS number for the metal is given – not CAS numbers for the individual compounds.
- (d) The final benzene standard in 1910.1028 applies to all occupational exposures to benzene except in some circumstances the distribution and sale of fuels, sealed containers and pipelines, coke production, oil and gas drilling and production, natural gas processing, and the percentage exclusion for liquid mixtures; for the excepted subsegments, the benzene limits in Oregon Table Z-2 apply. See 1910.1028 for specific circumstances.
- (e) This 8-hour TWA applies to respirable dust as measured by a vertical elutriator cotton dust sampler or equivalent instrument. The time weighted average applies to the cotton waste processing operations of waste recycling (sorting, blending, cleaning, and willowing) and garnetting. See also 1910.1043 for cotton dust limits applicable to other sectors.
- (f) All inert or nuisance dusts, whether mineral, inorganic, or organic, not listed specifically by substance name are covered by the Particulates Not Otherwise Regulated (PNOR) limit which is the same as the inert or nuisance dust limit of Oregon Table Z-3.

- (g) Usually a mixture, in general the aromatic hydrocarbon content will determine which TWA applies.
- (h) If the exposure limit in 1926.1126 is stayed or is otherwise not in effect, the exposure limit is a ceiling of 0.1 mg/m³.
- (i) If the exposure limit in 1926.1126 is stayed or is otherwise not in effect, the exposure limit is 0.1 mg/m³ (as CrO₃) as an 8-hour TWA.
- (j) See Table Z-3 for the exposure limit for any operations or sectors where the exposure limit in Division 2/Z-Silica is stayed or is otherwise not in effect.
- (k) This standard applies to any operations or sectors for which the beryllium standard, Division 2/Z Beryllium, is stayed or otherwise is not in effect.

Table Z-2 Air Contaminants

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	
Chromic acid and chromates (Z37.7-1971) (as CrO ₃) ^(c)		0.1 mg/m ³			
Ethylene dibromide (Z37.31-1970)	20 ppm	30 ppm	50 ppm	5 min.	X
Ethylene dichloride (Z37.21-1969)	50 ppm	100 ppm	200 ppm	5 min. in any 3 hrs	
Fluoride as dust (Z37.28-1969)	2.5 mg/m ³				
Formaldehyde (see 1910.1048)					
Hydrogen fluoride (Z37.28-1969)	3 ppm				
Hydrogen sulfide (Z37.2-1966)		20 ppm	50 ppm	10 min. once, only if no other measureable exposure occurs	

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	
Mercury (Z37.8-1971)	0.05 mg/m³	0.1 mg/m³			X
Methyl chloride (Z37.18-1969)	100 ppm	200 ppm	300 ppm	5 min. in any 3 hrs	
Organo (alkyl) mercury (Z37.30-1969)	0.001 mg/m³	0.01 mg/m³			X
Styrene (Z37.15-1969)	100 ppm	200 ppm	600 ppm	5 min. in any 3 hrs	
Tetrachloroethylene (Z37.22-1967)	100 ppm	200 ppm	300 ppm	5 min. in any 3 hrs	
Toluene (Z37.12-1967)	100 ppm	300 ppm	500 ppm	10 min.	
Trichloroethylene (Z37.19-1967)	100 ppm	200 ppm	300 ppm	5 min. in any 2 hrs	
Diisocyanates					
Dicyclohexylmethane 4,4'-diisocyanate (hydrogenated MDI)	.055 mg/m .005 ppm	.210 mg/m ³ .02 ppm			
Diphenylmethane diisocyanate (MDI)	.050 mg/m ³ .005 ppm	.200 mg/m ³ .02 ppm			
Hexamethylene diisocyanate (HDI)	.035 mg/m ³ .005 ppm	.140 mg/m ³ .02 ppm			
1,6 Hexamethylene diisocyanated Based Adduct (includes HDI-Biuret trimer, and other polymeric forms of HDI, including isocyanurates)	0.5 mg/m ³	1.0 mg/m ³			
Isophorone diisocyanate (IPDI)	.045 mg/m ³ .005 ppm	.180 mg/m ³ .02 ppm			
Napthalene diisocyanate (NDI)	.040 mg/m ³ .005 ppm	.170 mg/m ³ .02 ppm			
Toluene diisocyanate (TDI)	.035 mg/m ³ .005 ppm	.140 mg/m ³ .02 ppm			

Note: Bold print identifies substances for which the Oregon Permissible Exposure Limits (PELs) are different than the federal limits.

FOOTNOTES:

- (a) This standard applies to the industry segments exempt from the 1 ppm 8-hour TWA and 5 ppm STEL of the Benzene Standard, 1910.1028.
- (b) This standard applies to any operations on sectors for which the Cadmium Standard, 1910.1027, is stayed or otherwise not in effect.

- (c) This standard applies to any operations or sectors for which the exposure limit in the Chromium (VI) standard, 1926.1126, is stayed or is otherwise not in effect.

Table Z-3 Mineral Dust

Substance	mppcf ^(a)	mg/m ³
Silica: Crystalline Quartz (respirable)		0.1 mg/m ³
Quartz (total dust)		$\frac{30 \text{ mg/m}^3}{\% \text{SiO}_2 + 2}$
Cristobalite (respirable) Tridymite: Use 1/2 the value calculated from the formulae for quartz.		0.05 mg/m ³
Amorphous, including natural diatomaceous earth	20	$\frac{80 \text{ mg/m}^3}{\% \text{SiO}_2}$
Silicates (less than 1% crystalline silica):		
Mica	20	
Soapstone	20	
Talc (not containing asbestos)	20 ^(c)	
Talc (containing asbestos) Use asbestos limit; see 1926.1101.	20	
Tremolite, asbestiform (see OAR 437, Div. 2/Z, 1910.1001 and 1926.1101, Asbestos).		
Portland cement	50	
Graphite (Natural)		5 mg/m ³
Coal Dust: Respirable fraction less than 5% SiO ₂		2.4 mg/m ^{3(e)(f)}
Coal Dust: Respirable fraction greater than 5% SiO ₂		0.1 mg/m ^{3(e)}
Inert or Nuisance Dust: ^(d) Respirable fraction Total dust		5 mg/m ³ 10 mg/m ³

Note: Bold print identifies substances for which the Oregon Permissible Exposure Limits (PELs) are different than the federal limits.

Note: Conversion factors - mppcf x 35.3 = million particles per cubic meter = particles per c.c.

FOOTNOTES:

- (a) Millions of particles per cubic foot of air, based on impinger samples counted by light-field techniques.
- (b) The percentage of crystalline silica in the formula is the amount determined from airborne samples, except in those instances in which other methods have been shown to be applicable.
- (c) Containing less than 1% quartz; if 1% quartz or more, use quartz limit.
- (d) All inert or nuisance dusts, whether mineral, inorganic, or organic, not listed specifically by substance name are covered by this limit, which is the same as the Particulates Not Otherwise Regulated (PNOR) limit in Oregon Table Z-1.
- (e) Silica sampling methods must conform to OSHA or NIOSH sampling methods for respirable quartz silica.

- (f) The measurements under this note refer to the use of an AEC (now NRC) instrument. If the respirable fraction of coal dust is determined with a MRE the figure corresponding to that of 2.4 mg/m³ in the table for coal dust is 4.5 mg/m³.

AMEND: 437-004-9000

RULE TITLE: Oregon Rules for Air Contaminants

NOTICE FILED DATE: 01/28/2020

RULE SUMMARY: In Table Z-1 of the Oregon's Rules for Air Contaminants for the agriculture industry, two entries were combined into one for "Manganese Compounds and fume (as Mn)" in the "Substance" column; "7439-96-5" remains in the "CAS No." column; and the Permissible Exposure Limit is lowered to "0.1" in the "mg/ m³" as an 8-hr time-weighted average, while the 5 mg/m³ Ceiling Limit is maintained.

RULE TEXT:

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 substances 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: 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]

(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:

$$E = (C_a T_a + C_b T_b + \dots C_n T_n) \div 8$$

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) 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:

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

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

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

[Example]

Substituting in the formula, we have:

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

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

$$E_m = 0.500 + 0.225 + 0.200$$

$E_m = 0.925$

Since E_m (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.

[Table Z-1, Notes, Footnotes; Table Z-2, Note, Footnotes; Table Z-3, Note, Footnotes.]

STATUTORY/OTHER AUTHORITY: ORS 654.025(2), 654.035, 656.726(4)

STATUTES/OTHER IMPLEMENTED: ORS 654.001 through 654.295

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	

Example

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

Table Z-1

Substance	CAS No. (c)	ppm (a)	mg/m ³ (b)	Skin
Abate	3383-96-8		10	
Acetaldehyde	75-07-0	100	180	
Acetic Acid	64-19-7	10	25	
Acetic anhydride	108-24-7	5	20	
Acetone	67-64-1	1,000	2,400	
Acetonitrile	75-05-8	40	70	
2-Acetylaminoflourine	53-96-3		(See 437-004-9090)	
Acetylene	74-86-2	1,000		
Acetylene dichloride, see 1,2-Dichloroethylene				
Acetylene tetrabromide	79-27-6	1	14	
Acrolein	107-02-8	0.1	0.25	
Acrylamide	79-06-1	—	0.3	X
Acrylonitrile	107-13-1		(See 437-004-9710)	
Aldrin	309-00-2	—	0.25	X
Allyl alcohol	107-18-6	2	5	X
Allyl chloride	107-05-1	1	3	
Allyn glycidyl ether (AGE)	106-92-3	5 (C) 10	22 (C) 45	
Allyl propyl disulfide	2179-59-1	2	12	
alpha Alumina	1344-28-1			
Total Dust		—	10	
Respirable Fraction		—	5	
Aluminum Metal Dust	7429-90-5			
Total Dust		—	10	
Respirable Fraction		—	5	
Alundum (A1203)		—	10	
4-Aminodiphenyl	92-67-1		(See 437-004-9090)	

Substance	CAS No. ^(c)	ppm ^(a)	mg/m ³ ^(b)	Skin
2-Aminoethanol, see Ethanolamine				
2-Aminopyridine	504-29-0	0.5	2	
Ammonia	7664-41-7	25	18	
Ammonium Chloride Fumes	12125-02-9	—	10	
Ammonium sulfamate	7773-06-0	—	10	
Total Dust		—	5	
Respirable Fraction		—		
n-Amyl acetate	628-63-7	100	525	
sec-Amyl acetate	626-38-0	125	650	
Aniline and homologs	62-53-3	5	19	X
Anisidine (o, p-isomers)	29191-52-4		0.5	X
Antimony & Compounds (as Sb)	7440-36-0	—	0.5	
ANTU (alpha Naphthylthiourea)	86-88-4	—	0.3	
Arsenic, Inorganic Compounds (as As) (See 1910.1018)	7440-38-2		0.01	
Arsenic, Organic Compounds (as As)	7440-38-2	—	0.5	
Arsine	7784-42-1	0.05	0.2	
Asbestos		(See 437-004-9050)		
Asphalt (petroleum) Fumes	8052-42-4	—	5	
Azinphos-methyl	86-50-1	—	0.2	X
Barium (soluble compounds)	7440-39-3	—	0.5	
Barium Sulfate	7727-43-7	—	10	
Total Dust		—	5	
Respirable Fraction		—		
Benomyl	17804-35-2	—	10	
Total Dust		—	5	
Respirable Fraction		—		
Benzene See Table Z-2 for the limits applicable in the operations or sectors excluded in OAR 437-004- 9640 ^(d)	71-43-2		(See 437-004-9640)	
Benzidine	92-87-5		(See 437-004-9090)	
p-Benzoquinone, see Quinone				
Benzoyl peroxide	94-36-0	—	5	
Benzyl chloride	100-44-7	1	5	
Beryllium and Beryllium compounds	7440-41-7		(See Table Z-2)	
Biphenyl, see Diphenyl				
Bismuth telluride (undoped)	1304-82-1	—	10	
Total Dust		—	5	
Respirable Fraction		—		
Bismuth telluride (Se-doped)		—	5	
Bisphenol A, see Diglycidyl ether				
Boron oxide	1303-86-2	—	10	
Boron tribromide	10294-33-4	1	10	
Boron trifluoride	7637-07-2	(C) 1	(C) 3	

Substance	CAS No. ^(c)	ppm ^(a)	mg/m ³ ^(b)	Skin
Bromine	7726-95-6	0.1	0.7	
Bromine pentafluoride	7789-30-2	0.1	0.7	
Bromoform	75-25-2	0.5	5	X
Butadiene (1,3-Butadiene) (See 1910.1051; and 1910.19(l))	106-99-0	1 ppm/5 ppm STEL		
Butane	106-97-8	800	1,900	
Butanethiol, see Butyl mercaptan				
2-Butanone (Methyl Ethyl Ketone)	78-96-3	200	590	
2-Butoxyethanol (Butyl cellosolve)	111-76-2	50	240	X
Butyl acetate (n-Butyl acetate)	123-86-4	150	710	
sec-Butyl acetate	105-46-4	200	950	
tert-Butyl acetate	540-88-5	200	950	
n-Butyl alcohol	71-36-3	100	300	
sec-Butyl alcohol	78-92-2	150	450	
tert-Butyl alcohol	75-65-0	100	300	
Butyl lactate	138-22-7	1	5	
Butylamine	109-73-9	(C) 5	(C) 15	X
tert-Butyl chromate (as CrO ₃)	1189-85-1		(See 437-004-9626)	
n-Butyl glycidyl ether (BGE)	2426-08-6	50	270	
Butyl mercaptan	109-79-5	0.5	1.5	
p-tert-Butyltoluene	98-51-1	10	60	
Cadmium dust and fume (as Cd)	7440-43-9	(See 437-004-9620)	0.005	
Calcium carbonate	1317-65-3			
Total Dust		—	10	
Respirable Fraction		—	5	
Calcium hydroxide	1305-62-0			
Total Dust		—	10	
Respirable Fraction		—	5	
Calcium oxide	1305-78-8	—	5	
Calcium silicate	1344-95-2			
Total Dust		—	10	
Respirable Fraction		—	5	
Calcium sulfate	7778-18-9			
Total Dust		—	10	
Respirable Fraction		—	5	
Camphor, synthetic	76-22-2	—	2	
Caprolactam (2-Oxonoxa-methylenimine)	105-60-2	—	5	
Carbaryl (Sevin®)	63-25-2	—	5	
Carbon black	1333-86-4	—	3.5	
Carbon dioxide	124-38-9	5,000	9,000	
Carbon disulfide	75-15-0		(See Table Z-2)	
Carbon monoxide	630-08-0	50	55	
Carbon tetrachloride	56-23-5		(See Table Z-2)	

Substance	CAS No. ^(c)	ppm ^(a)	mg/m ³ ^(b)	Skin
Cellulose	9006-34-6			
Total Dust		—	10	
Respirable Fraction		—	5	
Chlordane	57-74-9	—	0.5	X
Chlorinated camphene	8001-35-2	—	0.5	X
Chlorinated diphenyl oxide	55720-99-5	—	0.5	
Chlorine	7782-50-5	(C) 1	(C) 3	
Chlorine dioxide	10049-04-4	0.1	0.3	
Chlorine trifluoride	7790-91-2	(C) 0.1	(C) 0.4	
Chloroacetaldehyde	107-20-0	(C) 1	(C) 3	
a-Chloroacetophenone (Phenacyl chloride)	532-27-4	0.05	0.3	
Chlorobenzene	108-90-7	75	350	
o-Chlorobenzylidene malononitrile	2698-41-1	0.05	0.4	
Chlorobromomethane	74-97-5	200	1,050	
2-Chloro-1, 3-butadiene, see beta-Chloroprene				
Chlorodiphenyl (42% Chlorine)	53469-21-9	—	1	X
Chlorodiphenyl (54% Chlorine)	11097-69-1	—	0.5	X
1-Chloro, 2, 3-epoxypropane, see Epichlorhydrin				
2-Chloroethanol, see Ethylene chlorohydrin				
Chloroethylene, see Vinyl Chloride				
Chloroform (Trichloromethane)	67-66-3	(C) 25	(C) 120	
bis-Chloromethyl ether	542-88-1		(See 437-004-9090)	
Chloromethyl methyl ether	107-30-2		(See 437-004-9090)	
1-Chloro-1-nitropropane	600-25-9	20	100	
Chloropicrin	76-06-2	0.1	0.7	
beta-Chloroprene (2-chloro-1,3-butadiene)	126-99-8	25	90	X
2-Chloro-6-(trichloromethyl) pyridine	1929-82-4			
Total Dust		—	10	
Respirable Fraction		—	5	
Chromic acid and chromates (as CrO ₃)	1333-82-0		(See Table Z-2)	
Chromium (II) compounds (as Cr)	7440-47-3	—	0.5	
Chromium (III) compounds (as Cr)	7440-47-3	—	0.5	
Chromium (VI) compounds			(See 437-004-9626)	
Chromium metal & insol. salts (as Cr)	7440-47-3	—	1	
Clopidol	2971-90-6			
Total Dust		—	10	
Respirable Fraction		—	5	
Coal Dust			(See Table Z-3)	

Substance	CAS No. ^(c)	ppm ^(a)	mg/m ³ ^(b)	Skin
Coal tar pitch volatiles (See 1910.1002) (Benzene soluble fraction) anthracene, BaP, phenanthrene, acridine, chrysene, pyrene	65966-93-2	—	0.2	
Cobalt metal, fume & dust	7440-48-4	—	0.1	
Coke oven emissions (See 1910.1029)				
Copper fume	7440-50-8	—	0.1	
Dusts and Mists	7440-50-8	—	1	
Corundum (A1203)	1302-74-5	—	10	
Cotton dust (See 1910.1043)				
Cotton dust (raw)		—	1 ^(e)	
Crag® herbicide (Sesone)	136-78-7			
Total Dust		—	10	
Respirable Fraction		—	5	
Cresol (all isomers)	1319-77-3	5	22	X
Crotonaldehyde	123-73-9/ 4170-30-3	2	6	
Cumene	98-82-8	50	245	X
Cyanides (as CN)		—	5	X
Cyanogen	460-19-5	10	—	
Cyclohexane	110-82-7	300	1,050	
Cyclohexanol	108-93-0	50	200	
Cyclohexanone	108-94-1	50	200	
Cyclohexene	110-83-8	300	1,015	
Cyclopentadiene	542-92-7	75	200	
2,4-D (Dichlorophenoxyacetic acid)	94-75-7	—	10	
DDT	50-29-3	—	1	X
DDVP, see Dichlorvos				
Decaborane	17702-41-9	0.05	0.3	X
Demeton® (Systox)	8065-48-3	—	0.1	X
Diacetone alcohol (4-hydroxy-4-methyl-2-pentanone)	123-42-2	50	240	
1, 2-Diaminoethane, see Ethylenediamine				
Diazinon	333-41-5	—	0.1	X
Diazomethane	334-88-3	0.2	0.4	
Diborane	19287-45-7	0.1	0.1	
Dibrom®	300-76-5	—	3	
1,2-Dibromo-3-chloropropane (DBCP) (See 1910.1044)	96-12-8	0.001		
1,2-Dibromoethane, see Ethylene dibromide				
2-N-Dibutylaminoethanol	102-81-8	2	14	X
Dibutyl phosphate	107-66-4	1	5	
Dibutyl phthalate	84-74-2	—	5	

Substance	CAS No. ^(c)	ppm ^(a)	mg/m ³ ^(b)	Skin
Dichloroacetylene	7572-29-4	(C) 0.1	(C) 0.4	
o-Dichlorobenzene	95-50-1	(C) 50	(C) 300	
p-Dichlorobenzene	106-46-7	75	450	
3,3-Dichlorobenzidine	91-94-1		(See 437-004-9090)	X
Dichlorodifluoromethane	75-71-8	1,000	4,950	
1,3-Dichloro-5, 5-dimethyl hydantoin	118-52-5	—	0.2	
Dichlorodiphenyltrichloroethane (DDT)	50-29-3	—	1	X
1, 1-Dichloroethane	75-34-3	100	400	
1, 2-Dichloroethane, see Ethylene dichloride				
1, 2-Dichlorethylene	540-59-0	200	790	
Dichloroethyl Ether	111-44-4	5 (C) 15	30 (C) 90	X
Dichloromethane, see Methylene chloride				
Dichloromonofluoromethane	75-43-4	1,000	4,200	
1, 1-Dichloro-1-nitroethane	594-72-9	(C) 10	(C) 60	
1, 2-Dichloropropane, see Propylene dichloride				
Dichlorotetrafluoroethane	76-14-2	1,000	7,000	
Dichlorvos (DDVP)	62-73-7	0.1	1	X
Dicyclohexylmethane 4,4'-diisocyanate (hydrogenated MDI)	5124-30-1		See Table Z-2	
Dicyclopentadienyl iron Total Dust Respirable Fraction	102-54-5	— —	10 5	
Dieldrin	60-57-1	—	0.25	X
Diethylamine	109-89-7	25	75	
2-Diethylaminoethanol	100-37-8	10	50	X
Diethylene triamine	111-40-0	(C) 1	(C) 4	X
Diethylether, see Ethyl ether				
Difluorodibromomethane	75-61-6	100	860	
Diglycidyl ether (DGE)	2238-07-5	(C) 0.5	(C) 2.8	
Dihydroxybenzene, see Hydroquinone				
Diisobutyl ketone	108-83-8	25	150	
Diisopropylamine	108-18-9	5	20	X
Dimethoxymethane, see Methylal				
Dimethyl acetamide	127-19-5	10	35	X
Dimethylamine	124-40-3	10	18	
4-Dimethylaminoazobenzene	60-11-7		(See 437-004-9090)	
Dimethylaminobenzene, see Xylidene				
Dimethylaniline (N,N-Dimethylaniline)	121-69-7	5	25	X
Dimethylbenzene, see Xylene				

Substance	CAS No. ^(c)	ppm ^(a)	mg/m ³ ^(b)	Skin
Dimethyl-1,2-dibromo-2, 2-dichloroethyl phosphate	300-76-5	—	3	
Dimethylformamide	68-12-2	10	30	X
2,6-Dimethylheptanone, see Diisobutyl ketone				
1,1-Dimethylhydrazine	57-14-7	0.5	1	X
Dimethylphthalate	131-11-3	—	5	
Dimethyl sulfate	77-78-1	1	5	X
Dinitrobenzene (all isomers) (ortho) (meta) (para)	528-29-0 99-65-0 100-25-4		1	X
Dinitro-o-cresol	534-52-1	—	0.2	X
Dinitrotoluene	25321-14-6	—	1.5	X
Dioxane (Diethylene dioxide)	123-91-1	100	360	X
Diphenyl (Biphenyl)	92-52-4	0.2	1	
Diphenylamine	122-39-4	—	10	
Diphenylmethane diisocyanate (MDI),			(See Table Z-2)	
Dipropylene glycol methyl ether	34590-94-8	100	600	X
Diquat	231-36-7	—	0.5	
Di-sec, octyl phthalate (Di-2-ethyl-hexylphthalate)	117-81-7	—	5	
Emery	12415-34-8	—	10	
Total Dust		—	5	
Respirable Fraction		—		
Endosulfan (Thiodan®)	115-29-7	—	0.1	X
Endrin	72-20-8	—	0.1	X
Epichlorohydrin	106-89-8	5	19	X
EPN	2104-64-5	—	0.5	X
1,2-Epoxypropane, see Propylene oxide				
2,3-Epoxy-1-propanol, see Glycidol				
Ethane	74-84-0	1,000	—	
Ethanethiol, see Ethyl mercaptan				
Ethanolamine	141-43-5	3	6	
2-Ethoxyethanol (Cellosolve)	110-80-5	100	370	X
2-Ethoxyethylacetate (Cellosolve acetate)	111-15-9	100	540	X
Ethyl acetate	141-78-6	400	1,400	
Ethyl acrylate	140-88-5	25	100	X
Ethyl alcohol (ethanol)	64-17-5	1,000	1,900	
Ethylamine	75-04-7	10	18	
Ethyl amyl ketone (5-methyl-3-heptanone)	541-85-5	25	130	
Ethyl benzene	100-41-4	100	435	
Ethyl bromide	74-96-4	200	890	

Substance	CAS No. ^(c)	ppm ^(a)	mg/m ³ ^(b)	Skin
Ethyl butyl ketone (3-Heptanone)	106-35-4	50	230	
Ethyl chloride	75-00-3	1,000	2,600	
Ethyl ether	60-29-7	400	1,200	
Ethyl formate	109-94-4	100	300	
Ethyl mercaptan	75-08-1	0.5 (C) 10	1 (C) 25	
Ethyl silicate	78-10-4	100	850	
Ethylene	74-85-1	1,000	—	
Ethylene chlorohydrin	107-07-3	5	16	X
Ethylenediamine	107-15-3	10	25	
Ethylene dibromide	106-93-4		(See Table Z-2)	
Ethylene dichloride	107-06-2		(See Table Z-2)	
Ethylene glycol particulate		—	10	
Ethylene glycol, Vapor	107-21-1	100	260	
Ethylene glycol dinitrate	628-96-6	(C) 0.2	(C) 1	X
Ethylene glycol methyl acetate (Methyl cellosolve acetate) (2-Methoxy-ethyl acetate)	110-49-6	25	120	X
Ethylenimine	151-56-4		(See 437-004-9090)	
Ethylene oxide	75-21-8	1	(See 437-004-9740)	
Ethylidene chloride, see 1, 1-Dichloroethane				
N-Ethylmorpholine	100-74-3	20	94	X
Ferbam Total Dust Respirable Fraction	14484-64-1	— —	10 5	
Ferrovandium dust	12604-58-9	—	1	
Fibrous glass, see Glass, Fibrous				
Fluorides (As F)		—	(See Table Z-2)	
Fluorine	7782-41-4	0.1	0.2	
Fluorotrichloromethane (Trichlorofluoromethane)	75-69-4	1,000	5,600	
Formaldehyde	50-00-0		(See 437-004-9760)	
Formic acid	64-18-6	5	9	
Furfural	98-01-1	5	20	X
Furfuryl alcohol	98-00-0	5	20	
Gasoline	8006-61-9		(g)	
Germanium tetrahydride	7782-65-2	0.2	0.6	
Glass, Fibrous or dust			10	
Glycerin (mist) Total Dust Respirable Fraction	56-81-5		10 5	
Glycidol	556-52-5	50	150	
Glycol momoethyl ether, see 2-Ethoxyethanol				

Substance	CAS No. ^(c)	ppm ^(a)	mg/m ³ ^(b)	Skin
Grain dust (oat, wheat, barley)			10	
Graphite natural, respirable	7782-42-5		(See Table Z-3)	
Graphite (Synthetic) Total Dust Respirable Fraction	7782-42-5		10 5	
Guthion®, see Azinphosmethyl				
Gypsum Total Dust Respirable Fraction	13397-24-5	— —	10 5	
Hafnium	7440-58-6	—	0.5	
Heptachlor	76-44-8	—	0.5	X
Heptane (n-heptane)	142-82-5	500	2,000	
Hexachlorocyclopentadiene	77-47-4	0.1	1	
Hexachloroethane	67-72-1	1	10	X
Hexachloronaphthalene	1335-87-1	—	0.2	X
Hexafluoroacetone	684-16-2	0.1	0.7	X
Hexamethylene diisocyanate (HDI)	822-06-0		(See Table Z-2)	
1,6 Hexamethylene diisocyanate Based Adduct			(See Table Z-2)	
Hexane (n-hexane)	110-54-3	500	1,800	
2-Hexanone	591-78-6	100	410	
Hexone (Methyl isobutyl ketone)	108-10-1	100	410	
sec-Hexyl acetate	108-84-9	50	300	
Hydrazine	302-01-2	1	1.3	X
Hydrogen	1333-74-0	1,000	—	
Hydrogen bromide	10035-10-6	3	10	
Hydrogen chloride	7647-01-0	(C) 5	(C) 7	
Hydrogen cyanide	74-90-8	10	11	X
Hydrogen fluoride (as F)	7664-39-3		(See Table Z-2)	
Hydrogen peroxide	7722-84-1	1	1.4	
Hydrogen selenide (as Se)	7783-07-5	0.05	0.2	
Hydrogen sulfide	7783-06-4		(See Table Z-2)	
Hydroquinone	123-31-9	—	2	
Indene	95-13-6	10	45	
Indium and compounds (as In)	7440-74-6	—	0.1	
Iodine	7553-56-2	(C) 0.1	(C) 1	
Iron oxide fume	1309-37-1	—	10	
Iron pentacarbonyl	13463-40-6	0.1	0.23	
Iron salts, soluble, as Fe		—	1	
Isoamyl acetate	123-92-2	100	525	
Isoamyl alcohol (primary and secondary)	123-51-3	100	360	
Isobutyl acetate	110-19-0	150	700	

Substance	CAS No. ^(c)	ppm ^(a)	mg/m ³ ^(b)	Skin
Isobutyl alcohol	78-83-1	100	300	
Isophorone	78-59-1	10	55	
Isophorone diisocyanate (IPDI)	4098-71-9		(See Table Z-2)	
Isopropyl acetate	108-21-4	250	950	
Isopropyl alcohol	67-63-0	400	980	
Isopropylamine	75-31-0	5	12	
Isopropyl ether	108-20-3	250	1,050	
Isopropyl glycidyl ether (IGE)	4016-14-2	50	240	
Kaolin	1332-58-7			
Total Dust		—	10	
Respirable Fraction		—	5	
Ketene	463-51-4	0.5	0.9	
Lead, inorganic (as Pb)	7439-92-1	(See 437-004-9600)	0.05	
Lead arsenate (See 1910.1018)	7784-40-9		0.01	
Limestone	1317-65-3			
Total Dust		—	10	
Respirable Fraction		—	5	
Lindane	58-89-9	—	0.5	X
Lithium hydride	7580-67-8	—	0.025	
L.P.G. (Liquified petroleum gas)	68476-85-7	1,000	1,800	
Magnesite	546-93-0			
Total Dust		—	10	
Respirable Fraction		—	5	
Magnesium oxide fume	1309-48-4			
Total Dust		—	10	
Respirable Fraction		—	5	
Malathion	121-75-5	—	10	X
Maleic anhydride	108-31-6	0.25	1	
Manganese Compounds and Fume (as Mn)	7439-96-5	—	0.1 (C) 5	
Marble	1317-65-3			
Total Dust		—	10	
Respirable Fraction		—	5	
Mercury (aryl, inorganic, organo, and vapor) (as Hg)	7439-97-6 (metal)		(See Table Z-2)	
Mesityl oxide	141-79-7	25	100	
Methane	74-82-8	1,000	—	
Methanethiol, see Methyl mercaptan				
Methoxychlor	72-43-5			
Total Dust		—	10	
Respirable Fraction		—	5	
2-Methoxyethanol (Methyl Cellosolve)	109-86-4	25	80	X
2-Methoxyethyl acetate (Methyl cellosolve acetate)	110-49-6	25	120	X
Methyl acetate	79-20-9	200	610	
Methyl acetylene (propyne)	74-99-7	1,000	1,650	
Methyl acetylene-propadiene mixture (MAPP)		1,000	1,800	

Substance	CAS No. ^(c)	ppm ^(a)	mg/m ³ ^(b)	Skin
Methyl acrylate	96-33-3	10	35	X
Methylacrylonitrile	126-98-7	1	3	X
Methylal (dimethoxymethane)	109-87-5	1,000	3,100	
Methyl alcohol (methanol)	67-56-1	200	260	
Methylamine	74-89-5	10	12	
Methyl amyl alcohol, see Methyl isobutyl carbinol				
Methyl (n-amyl) ketone	110-43-0	100	465	
Methyl bromide	74-83-9	15 (C) 20	60 (C) 80	X
Methyl butyl ketone, see 2-Hexanone				
Methylcyclohexane	108-87-2	500	2,000	
Methylcyclohexanol	25639-42-3	50	235	
o-Methylcyclohexanone	583-60-8	50	230	X
2-Methylcyclopentadienyl manganese tricarbonyl (as Mn)	12108-13-3	0.1	0.2	X
Methyl demeton	8022-00-2	—	0.5	X
Methyl ethyl ketone (MEK), see 2-Butanone				
Methyl formate	107-31-3	100	250	
Methyl iodide	74-88-4	5	28	X
Methyl isoamyl ketone	110-12-3	100	475	
Methyl isobutyl carbinol	108-11-2	25	100	X
Methyl isobutyl ketone, see Hexone				
Methyl isocyanate	624-83-9	0.02	0.05	X
Methyl mercaptan	74-93-1	0.5 (C) 10	1 (C) 20	
Methyl methacrylate	80-62-6	100	410	
Methyl parathion	298-00-0	—	0.2	X
Methyl propyl ketone, see 2-Pentanone				
Methyl silicate	681-84-5	(C) 5	(C) 30	
a-Methyl styrene	98-83-9	(C) 100	(C) 480	
Methylene bisphenyl isocyanate (MDI)	101-68-8	(See Table Z-2 -- diisocyanates)		
Methylenedianiline (MDA)		(See 437-004-9780)	0.01	
Methylene Chloride	75-09-2	25		
Mineral Wool Fiber		—	10	
MOCA [4,4'-Methylene bis (2-chloroaniline)] (See 437-002-0346)	101-14-4			
Molybdenum (soluble compounds)	7439-98-7	—	5	
(insoluble compounds)		—	10	
Monomethyl aniline	100-61-8	2	9	X
Monomethyl hydrazine	60-34-4	(C) 0.2	(C) 0.35	X
Morpholine	110-91-8	20	70	X

Substance	CAS No. ^(c)	ppm ^(a)	mg/m ³ ^(b)	Skin
Naphtha (coal tar)	8030-30-6	100	400	
Naphthalene	91-20-3	10	50	
Naphthalene diisocyanate (NDI)	3173-72-6		(See Table Z-2)	
alpha-Naphthylamine	134-32-7		(See 437-004-9090)	
beta-Naphthylamine	91-59-8		(See 437-004-9090)	
Nickel carbonyl (as Ni)	13463-39-3	0.001	0.007	
Nickel, metal and insoluble compounds, as Ni	7440-02-0	—	1	
Nickel, soluble compounds, (as Ni)	7440-02-0	—	1	
Nicotine	54-11-5	0.075	0.5	X
Nitric acid	7697-37-2	2	5	
Nitric oxide	10102-43-9	25	30	
p-Nitroaniline	100-01-6	1	6	X
Nitrobenzene	98-95-3	1	5	X
4-Nitrodiphenyl	92-93-3		(See 437-004-9090)	
p-Nitrochlorobenzene	100-00-5	—	1	X
Nitroethane	79-24-3	100	310	
Nitrogen dioxide	10102-44-0	(C) 5	(C) 9	
Nitrogen trifluoride	7783-54-2	10	29	
Nitroglycerin	55-63-0	(C) 0.2	(C) 2	X
Nitromethane	75-52-5	100	250	
1-Nitropropane	108-03-2	25	90	
2-Nitropropane	79-46-9	25	90	
N-Nitrosodimethylamine			(See 437-004-9090)	
Nitrotoluene (all isomers)	88-72-2/ 99-08-1/ 99-99-0	5	30	X
Nitrotrichloromethane, see Chloropicrin				
Nitrous oxide	10024-97-5	50	90	
Octachloronaphthalene	2234-13-1	—	0.1	X
Octane	111-65-9	400	1,900	
Oil mist (mineral)	8012-95-1	—	5	
Oil mist, vapor		—	(g)	
Osmium tetroxide (as Os)	20816-12-0		0.002	
Oxalic acid	144-62-7	—	1	
Oxygen difluoride	7783-41-7	0.05	0.1	
Ozone	10028-15-6	0.1	0.2	
Parafin wax fume	8002-74-2	—	1	
Paraquat respirable dust	4685-14-7/ 1910-42-5/ 2074-50-2	—	0.5	X
Parathion	56-38-2	—	0.1	X

Substance	CAS No. (c)	ppm (a)	mg/m ³ (b)	Skin
Particulates not otherwise regulated (PNOR) (d)				
Total Dust		—	10	
Respirable Fraction		—	5	
Pentaborane	19624-22-7	0.005	0.01	
Pentachloronaphthalene	1321-64-8	—	0.5	X
Pentachlorophenol	87-86-5	—	0.5	X
Pentaerythritol	115-77-5			
Total Dust		—	10	
Respirable Fraction		—	5	
Particulates not otherwise regulated (PNOR) (d)				
Total Dust		—	10	
Respirable Fraction		—	5	
2-Pentanone (Methyl propyl ketone)	107-87-9	200	700	
Perchloroethylene (tetrachloroethylene)	127-18-4		(See Table Z-2)	
Perchloromethyl mercaptan	594-42-3	0.1	0.8	
Perchloryl fluoride	7616-94-6	3	13.5	
Perlite	93763-70-3			
Total Dust		—	10	
Respirable Fraction		—	5	
Petroleum distillates (naphtha) (Rubber Solvent)		500	2,000 (g)	
Phenol	108-95-2	5	19	X
Phenothiazine	92-84-2	—	5	X
p-Phenylene diamine	106-50-3	—	0.1	X
Phenyl ether (vapor)	101-84-8	1	7	
Phenyl ether – diphenyl mixture (vapor)	8004-13-5	1	7	
Phenylethylene, see Styrene				
Phenyl glycidyl ether (PGE)	122-60-1	10	60	
Phenylhydrazine	100-63-0	5	22	X
Phenylphosphine	638-21-1	(C) 0.05	(C) 0.25	
Phosdrin (Mevinphos®)	7786-34-7		0.1	X
Phosgene (carbonyl chloride)	75-44-5	0.1	0.4	
Phosphine	7803-51-2	0.3	0.4	
Phosphoric acid	7664-38-2	—	1	
Phosphorus (yellow)	7723-14-0	—	0.1	
Phosphorus pentachloride	10026-13-8	—	1	
Phosphorus pentasulfide	1314-80-3	—	1	
Phosphorus trichloride	7719-12-2	0.5	3	
Phthalic anhydride	85-44-9	2	12	
Picloram	1918-02-1			
Total Dust		—	10	
Respirable Fraction		—	5	
Picric acid	88-89-1	—	0.1	X
Pindone (2-Pivalyl-1, 3-indan-dione)	83-26-1	—	0.1	

Substance	CAS No. ^(c)	ppm ^(a)	mg/m ³ ^(b)	Skin
Plaster of Paris	26499-65-0			
Total Dust		—	10	
Respirable Fraction		—	5	
Platinum (Soluble Salts) as Pt	7440-06-4	—	0.002	
Polychlorobiphenyls, see Chloro-diphenyls				
Portland Cement	65997-15-1			
Total Dust		—	10	
Respirable Fraction		—	5	
Propane	74-98-6	1,000	1,800	
Beta-Propiolactone	57-57-8		(See 437-004-9090)	
Propargyl alcohol	107-19-7	1	—	X
n-Propyl acetate	109-60-4	200	840	
n-Propyl alcohol	71-23-8	200	500	
n-Propyl nitrate	627-13-4	25	110	
Propylene dichloride	78-87-5	75	350	
Propylene glycol monomethyl ether	107-98-2	100	360	
Propylene imine	75-55-8	2	5	X
Propylene oxide	75-56-9	100	240	
Propyne, see Methyl acetylene				
Pyrethrum	8003-34-7	—	5	
Pyridine	110-86-1	5	15	
Quinone	106-51-4	0.1	0.4	
RDX (Cyclonite)	121-82-4	—	1.5	X
Rhodium, Metal fume and dusts, as Rh	7440-16-6	—	0.1	
Soluble salts	7440-16-6	—	0.001	
Ronnel	299-84-3	—	10	
Rosin core solder pyrolysis products (as Formaldehyde)		—	0.1	
Rotenone	83-79-4	—	5	
Rouge				
Total Dust		—	10	
Respirable Fraction		—	5	
Selenium compounds (as Se)	7782-49-2	—	0.2	
Selenium hexafluoride (as Se)	7783-79-1	0.05	0.4	
Silica			(See Table Z-3)	
Silicon	7440-21-3			
Total Dust		—	10	
Respirable Fraction		—	5	
Silicon carbide	409-21-2			
Total Dust		—	10	
Respirable Fraction		—	5	
Silver, metal and soluble compounds (as Ag)	7440-22-4	—	0.01	
Sodium fluoroacetate	62-74-8	—	0.05	X
Sodium hydroxide	1310-73-2	—	2	

Substance	CAS No. ^(c)	ppm ^(a)	mg/m ³ ^(b)	Skin
Starch	9005-25-8			
Total Dust		—	10	
Respirable Fraction		—	5	
Stibine	7803-52-3	0.1	0.5	
Stoddard solvent	8052-41-3	200	1,150	
Strychnine	57-24-9	—	0.15	
Styrene	100-42-5		(See Table Z-2)	
Subtilisins (Proteolytic enzymes) (as 100% pure crystalline enzyme)	1395-21-7	—	(C) 0.0003	
Sucrose	57-50-1			
Total Dust		—	10	
Respirable Fraction		—	5	
Sulfur dioxide	7446-09-5	5	13	
Sulfur hexafluoride	2551-62-4	1,000	6,000	
Sulfuric acid	7664-93-9	—	1	
Sulfur monochloride	10025-67-9	1	6	
Sulfur pentafluoride	5714-22-7	0.025	0.25	
Sulfur tetrafluoride	7783-60-0	0.1	0.4	
Sulfuryl fluoride	2699-79-8	5	20	
Systox, see Demeton®				
2, 4, 5-T	93-76-5	—	10	
Tantalum, metal and oxide dust	7440-25-7	—	5	
TEDP (Sulfotepp)	3689-24-5	—	0.2	X
Tellurium and compounds (as Te)	13494-80-9	—	0.1	
Tellurium hexafluoride (as Te)	7783-80-4	0.02	0.2	
Temephos	3383-96-8			
Total Dust		—	10	
Respirable Fraction		—	5	
TEPP (Tetraethyl pyrophosphate)	107-49-3	0.004	0.05	X
Terphenyls	26140-60-3	(C) 1	(C) 9	
1, 1, 1, 2-Tetrachloro-2, 2-difluoroethane	76-11-9	500	4,170	
1, 1, 2, 2-Tetrachloro-1, 2-difluoroethane	76-12-0	500	4,170	
1, 1, 2, 2-Tetrachloroethane	79-34-5	5	35	X
Tetrachloroethylene, see Perchloroethylene				
Tetrachloronaphthalene	1335-88-2	—	2	X
Tetrachloromethane, see Carbon tetrachloride				
Tetraethyl lead (as Pb)	78-0-2	—	.075	X
Tetrahydrofuran	109-99-9	200	590	
Tetramethyl lead (as Pb)	75-74-1	—	0.075	X
Tetramethyl succinonitrile	3333-52-6	0.5	3	X
Tetranitromethane	509-14-8	1	8	

Substance	CAS No. ^(c)	ppm ^(a)	mg/m ³ ^(b)	Skin
Tetryl (2, 4, 6-trinitro-phenyl-methylnitramine)	479-45-8	—	1.5	X
Thallium (soluble compounds) as TI	7440-28-0	—	0.1	X
4,4'-Thiobis (6-tert, Butyl-m-cresol) Total Dust Respirable Fraction	96-69-5	— —	10 5	
Thiram	137-26-8		(See 437-004-9720)	
Tin (inorganic compounds, except oxides) as Sn	7440-31-5	—	2	
Tin (organic compounds)	7440-31-5	—	0.1	
Tin oxide Total Dust Respirable Fraction	1332-29-2	— —	10 5	
Titanium dioxide	13463-67-7	—	10	
Toluene (toluol)	108-88-3		(See Table Z-2)	
Toluene diisocyanate (TDI),	584-84-9		(See Table Z-2)	
o-Toluidine	95-53-4	5	22	X
Toxaphene, see Chlorinated camphene				
Tributyl phosphate	126-73-8	—	5	
1, 1, 1-Trichloroethane, see Methyl chloroform				
1, 1, 2-Trichloroethane	79-00-5	10	45	X
Trichloroethylene	79-01-6		(See Table Z-2)	
Trichloromethane, see Chloroform				
Trichloronaphthalene	1321-65-9	—	5	X
1, 2, 3-Trichloropropane	96-18-4	50	300	
1, 1, 2-Trichloro 1, 2, 2-trifluoro-ethane	76-13-1	1,000	7,600	
Triethylamine	121-44-8	25	100	
Trifluorobromomethane	75-63-8	1,000	6,100	
Trimethyl benzene	25551-13-7	25	120	
2, 4, 6-Trinitrophenol, see Picric acid				
2, 4, 6-Trinitrophenylmethyl-nitramine, see Tetryl				
Trinitrotoluene (TNT)	118-96-7		1.5	X
Triorthocresyl phosphate	78-30-8	—	0.1	
Triphenyl phosphate	115-86-6	—	3	
Tungsten & compounds, as W Soluble Insoluble	7440-33-7	— —	1 5	
Turpentine	8006-64-2	100	560	
Uranium (as U) Soluble compounds Insoluble compounds	7440-61-1	— —	0.05 0.2	
Vanadium respirable dust (as V₂O₅) Fume (as V₂O₅)	1314-62-1 1314-62-1	— —	(C) 0.5 (C) 0.05	

Substance	CAS No. ^(c)	ppm ^(a)	mg/m ³ ^(b)	Skin
Vegetable oil mist				
Total Dust		—	10	
Respirable Fraction		—	5	
Vinyl acetate	108-05-4	10	30	
Vinyl benzene, see Styrene				
Vinyl bromide	593-60-2	250	1,100	
Vinyl chloride (See 1910.1017)	75-01-4			
Vinyl cyanide, see Acrylonitrile				
Vinyl toluene	25013-15-4	100	480	
Warfarin	81-81-2	—	0.1	
Wood Dust (non-allergenic)		—	10	
Xylene (o-, m-, p-isomers)	1330-20-7	100	435	
Xylidine	1300-73-8	5	25	X
Yttrium	7440-65-5	—	1	
Zinc chloride fume	7646-85-7	—	1	
Zinc oxide	1314-13-2			
Total Dust		—	10	
Respirable Fraction		—	5	
Zinc oxide fume	1314-13-2	—	5	
Zinc stearate	557-05-1			
Total Dust		—	10	
Respirable Fraction		—	5	
Zirconium compounds (as Zr)	7440-67-7	—	5	

NOTE: Bold print identifies substances for which the Permissible Exposure Limits (PELs) are different than the federal Limits.

NOTE: PNOR means "particles not otherwise regulated."

Table Z-1 FOOTNOTES:

- ^(a) Parts of vapor or gas per million parts of contaminated air by volume at 25 degrees C and 760 torr.
- ^(b) Milligrams of substance per cubic meter of air. When entry is in this column only, the value is exact; when listed with a ppm entry, it is approximate.
- ^(c) The CAS number is for information only. Enforcement is based on the substance name. For an entry covering more than one metal compound, measured as the metal, the CAS number for the metal is given - not CAS numbers for the individual compounds.
- ^(d) The benzene standard in 4/Z, OAR 437-004-9640 applies to all occupational exposures to benzene except in some circumstances the distribution and sale of fuels, sealed containers and pipelines, coke production, oil and gas drilling and production, natural gas processing, and the percentage exclusion for liquid mixtures; for the excepted subsegments, the benzene limits in Table Z-2 apply. See 4/Z, OAR 437-004-9640 for specific circumstances.
- ^(e) All inert or nuisance dusts, whether mineral, inorganic, or organic, not listed specifically by substance name are covered by the Particulates Not Otherwise Regulated (PNOR) limit that is the same as the inert or nuisance dust limit of Table Z-3.
- ^(f) Usually a mixture, in general the aromatic hydrocarbon content will determine which TWA applies.

(g) If the exposure limit in 1910.1026 is stayed or is otherwise not in effect, the exposure limit is a ceiling of 0.1 mg/m³.

(h) See Table Z-2 for the exposure limit for any operations or sectors where the exposure limit in 1910.1026 is stayed or is otherwise not in effect.

Oregon Table Z-2 – Adopted Permissible Exposure Limits (PEL)					
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	
Chromic acid and chromates (Z37.7-1971) (as CrO ₃) ^c		0.1 mg/m ³			
Ethylene dibromide (Z37.31-1970)	20 ppm	25 ppm	50 ppm	5 min.	X
Ethylene dichloride (Z37.21-1969)	50 ppm	100 ppm	200 ppm	5 min. in any 3 hrs	
Fluoride as dust (Z37.28-1969)	2.5 mg/m ³				
Formaldehyde (see 1910.1048)					
Hydrogen fluoride (Z37.28-1969)	3 ppm				
Hydrogen sulfide (Z37.2-1966)		20 ppm	50 ppm	10 min. once, only if no other measurable exposure occurs	
Mercury (Z37.8-1971)	0.05 mg/m³	0.1 mg/m³			X
Methyl chloride (Z37.18-1969)	100 ppm	200 ppm	300 ppm	5 min. in any 3 hrs	
Organo (alkyl) mercury (Z37.30-1969)	0.001 mg/m³	0.01 mg/m³			X
Styrene (Z37.15-1969)	100 ppm	200 ppm	600 ppm	5 min. in any 3 hrs.	
Tetrachloroethylene (Z37.22-1967)	100 ppm	200 ppm	300 ppm	5 min. in any 3 hrs.	
Toluene (Z37.12-1967)	100 ppm	300 ppm	500 ppm	10 min.	
Trichloroethylene (Z37.19-1967)	100 ppm	200 ppm	300 ppm	5 min. in any 2 hrs.	

Oregon Table Z-2 (Continued)					
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	
Diisocyanates					
Dicyclohexylmethane 4,4'-diisocyanate (hydrogenated MDI)	.055 mg/m .005 ppm	0.210 mg/m ³ 0.02 ppm			
Diphenylmethane diisocyanate (MDI)	.050 mg/m ³ .005 ppm	0.200 mg/m ³ 0.02 ppm			
Hexamethylene diisocyanate (HDI)	.035 mg/m ³ .005 ppm	0.140 mg/m ³ 0.02 ppm			
1,6 Hexamethylene diisocyanated Based Adduct (includes HDI-Biuret trimer, and other polymeric forms of HDI, including isocyanurates)	0.5 mg/m ³	1.0 mg/m ³			
Isophorone diisocyanate (IPDI)	.045 mg/m ³ .005 ppm	0.180 mg/m ³ 0.02 ppm			
Napthalene diisocyanate (NDI)	.040 mg/m ³ .005 ppm	0.170 mg/m ³ 0.02 ppm			
Toluene diisocyanate (TDI)	.035 mg/m ³ .005 ppm	0.140 mg/m ³ 0.02 ppm			

NOTE: Bold print identifies substances for which the Oregon Permissible Exposure Limits (PELs) are different than the federal limits.

Table Z-2 FOOTNOTES:

- (a) This standard applies to the industry segments exempt from the 1 ppm 8-hour TWA and 5 ppm STEL of the Benzene Standard, 4/Z, OAR 437-004-9640.
- (b) This standard applies to any operations on sectors for which the Cadmium Standard, 4/Z, OAR 437-004-9620, is stayed or otherwise not in effect.
- (c) This standard applies to any operations or sectors for which the exposure limit in the Chromium (VI) standard, 1910.1026, is stayed or is otherwise not in effect.

Oregon TABLE Z-3 – Permissible Exposure Limits (PEL-TWA) for MINERAL DUSTS		
Substance	mppcf (a)	mg/m ³
Silica:		
Crystalline	0.1 (e)
Quartz (respirable)	
Quartz (total dust)	$\frac{30\text{mg} / \text{m}^3}{\% \text{SiO}_2 + 2}$
Cristobalite (Respirable)	0.05
Tridymite: Use 1/2 the value calculated from the formulae for quartz.

Amorphous, including natural diatomaceous earth	20	$\frac{80mg}{m^3}$ % SiO ₂
Silicates (less than 1 percent crystalline silica):		
Mica	20	
Soapstone	20	
Talc (not containing asbestos)	20 ^(c)	
Talc (containing asbestos) Use asbestos limit.	
Tremolite, asbestiform (see OAR 437-004-9050, Asbestos)	
Portland cement	50	
Graphite (Natural)		5
Coal Dust:		
Respirable fraction less than 5% SiO ₂		2.4 ^{(e)(f)}
Coal Dust:		
Respirable fraction greater than 5% SiO ₂		0.1 ^(e)
Inert or Nuisance Dust (PNOR):^(d)		
Respirable fraction		5
Total dust		10

NOTE: Bold print identifies substances for which the Oregon Permissible Exposure Limits (PEL-TWAs) are different than the federal limits.

Conversion factors: mppcf x 35.3 = million particles per cubic meter = particles per c.c.

Table Z-3 FOOTNOTES:

^(d) Millions of particles per cubic foot of air, based on impinger samples counted by light-field techniques.

^(e) The percentage of crystalline silica in the formula is the amount determined from airborne samples, except in those instances in which other methods are applicable.

^(f) Containing less than 1 percent quartz; if 1 percent quartz or more, use quartz limit.

^(g) All inert or nuisance dusts, whether mineral, inorganic, or organic, not listed specifically by substance name are covered by this limit, which is the same as the Particulates Not Otherwise Regulated (PNOR) limit in Table Z-1.

^(h) Calculate both concentration and percent quartz for the application of this limit from the fraction passing a size-selector with the following characteristics.

⁽ⁱ⁾ The measurements under this note refer to the use of an AEC (now NRC) instrument. If the respirable fraction of coal dust is determined with a MRE the figure corresponding to that of 2.4 mg/m³ in the table for coal dust is 4.5 mg/m³.