



MNOSHA Instruction **STD 1-4.1A**

April 1, 2024

## **SUBJECT: Citation Guidelines for Air Contaminant Overexposures**

### **Purpose:**

This instruction provides guidelines to promote uniform enforcement of Subpart Z, and to provide guidance on the use of the mixture formula, 1910.1000(d).

### **Scope:**

This instruction applies MNOSHA wide

### **References:**

1. MNOSHA Instruction Field Compliance Manual.
2. CPL 2-2.120B Respiratory Protection Enforcement Procedures
3. Technical Manual (Section II, Ch. 1, SAEs for chemical mixtures)  
Federal OSHA Instruction CPL 02-02-080, Inspection Procedures for the Respirable Crystalline Silica Standards, 29 CFR 1910.1053 and 29 CFR 1926.1153, June 25, 2020.
4. 1988 OSHA PEL Project Documentation, <https://www.cdc.gov/niosh/pel88/pelstart.html>
5. PEL Project Documentation, Federal Register  
<https://www.osha.gov/sites/default/largefiles/FED19890119.pdf>

### **Cancelation:**

This instruction supersedes MNOSHA Instruction STD 1-4.1, Citation Guidelines for Air Contaminant Overexposures, dated January 27, 2015.

## Background:

One OSHA standard, 1910.1000, contains permissible exposure limits (PELs) for several hundred contaminants. The remainder of Subpart Z contains substance-specific standards. PELs include 8-hour averages, ceiling, peak and short term exposure limits (STEL). Employees may be exposed to any combination of chemicals and for any exposure durations. Paragraph 1910.1000(d) allows for the calculation of a combined 8-hour TWA dose when multiple components in a mixture affect/target the same body organ or physiological system. Similar language is not found in the construction standard, 1926.55.

When an employee has been exposed to more than one such contaminant and one or more concentration is already above its PEL, questions arise as to whether to include the results of a combined dose calculation. Reduction of one contaminant concentration does not guarantee a similar reduction in all other concentrations, nor does it guarantee that after all concentrations are individually reduced below their respective PEL, that the mixture dose will also be below 1.0.

In addition, employees may be exposed to contaminants which have multiple PELs, such as 8-hour and short term, and exposures may exceed each PEL. These are found in 1910.1000, or in substance specific standards.

The following mention of overexposures also assumes concentrations exceed any relevant sampling and analytical errors (SAEs).

## Action:

### A. One Substance

#### 1. Substance Specific Standards:

Consult each standard for appropriate paragraphs to cite. Many requirements are triggered by exposure level or number of days exposed.

#### 2. Single Limit Overexposures to Substances in 1910.1000:

- a. One instance: In the case of an overexposure to an 8-hour TWA, Ceiling, Peak or STEL limit for one substance, 1910.1000(a)(3) shall be cited, in addition, a separate citation under 1910.1000 (e) for lack of engineering or administrative controls shall be cited as well. In the case of an overexposure to welding fume, 1910.252(c)(1)(iii) will be cited in place of 1910.1000(e). 1910.134(a)(2) will also be cited separately if respirators were not provided, or if respirators were provided but there were one or more deficiencies in the respiratory protection program (e.g. lack of fit testing, damaged respirator). The abatement guidelines for any 1910.134(a)(2) citation should include the full respiratory protection guidelines, if necessary.

- b. Multiple instances: all instances of a violation of a PEL (ceiling, peak, STEL or 8-hour TWA) shall be included in one citation item and cited separately (i.e., once) for each PEL that was violated. For example, in the case of an employee overexposed to styrene over the 8-hour TWA PEL and the STEL, the employer would receive two citations under 1910.1000(a)(3) and two under 1910.1000(e).

Each occurrence of a limit being exceeded is listed as a separate instance in the AVD. For example, two employees with styrene exposures exceeding the STEL a total of five times is one violation of 1910.1000(a)(3) with five instances. Engineering controls under 1910.1000(e) (or 1910.252(c)(1)(iii) in the case of an overexposure to welding fume), shall be cited in addition for each 1910.1000(a)(3) violation.

1910.134(a)(2) will be cited separately one time (for all instances) if respirators were not provided, or if respirators were provided but there were one or more deficiencies in the respiratory protection program (e.g. lack of fit testing, damaged respirator). In the 1910.134(a)(2) AVD, list the respirator deficiencies as they pertain to each substance.

### 3. Multiple Limits:

Overexposures to 8-hour and Ceiling, Peak or STEL limits for the same contaminant may not be combined and shall be cited and penalized separately. Each item shall be cited in addition to engineering controls, and respiratory protection should be cited as outlined in A.2. 1910.134(a)(2) is cited one time, regardless of the number of overexposure violations; the AVD may need to specify the deficiencies by the type of overexposure or hazardous substance.

4. Exposures to contaminants with no PEL, but another occupational exposure limit (OEL) such as a REL or TLV exists:

Exposure at a concentration above a recommended limit does not prove that a hazard exists. CSHOs must document that the exposure measured is hazardous, not merely that it exceeds a recommended limit, and also include the basis for using another OEL.

Even if a general duty citation is not proposed, the CHSO should consider a citation for 1910.134(a)(2), which requires respiratory protection when necessary to protect an individual, and is not necessarily tied to an exposure limit.

## **B. Two or More Substances**

1. Dissimilar Health Effects:

Each limit listed in subpart Z is to be considered a separate standard for purposes of determining appropriate citations. Overexposures to the 8-hour TWA of two or more air contaminants with dissimilar health effects shall be cited separately (do not use the mixture formula). Each item shall be cited in addition to engineering controls, and cite respiratory protection as outlined in A.2 (with one 1910.134(a)(2) citation for all instances).

2. Similar Health Effects (Use of the Mixture Formula):

a. General Guidelines

- i. The mixture formula may only be used for 8-hour TWA exposures, not Ceiling, Peak or STEL.
- ii. The mixture formula may only be used when contaminants affect/target the same body organ or physiological system.
- iii. The mixture formula may be used with contaminants which have their own specific standard.

b. Exposures to mixtures with similar health effects when no single concentration is above the PEL:

If no single contaminant is above its 8-hour TWA PEL, but the combined dose calculation determines that a violation exists, cite 1910.1000(d) in addition to 1910.1000(e), engineering controls, and cite respiratory protection as outlined in A.2. Document which health effects were considered the basis for using the mixture formula. The primary resources should be the preambles to the substance specific standards and/or the preamble to the 1989 1910.1000 Final Rule – Section 6 - VI. Health Effects Discussion and Determination of Final PEL:

<https://www.osha.gov/sites/default/files/FED19890119.pdf> (use Ctrl-F to search for the contaminant) or at the CDC site PEL Project Documentation here:

<https://www.cdc.gov/niosh/pel88/pelstart.html>.

Include the contaminants in the AVD of the 1910.1000 citation. Respiratory protection should be cited as outlined in A.2.

c. Exposures to mixtures with similar health effects when only one concentration is above the PEL:

Follow the procedure outlined in d below.

d. Exposures to the 8-hour TWA of two or more air contaminants when both (or more) exceed its PEL:

Cite each contaminant for exceeding the PEL, in addition to citing 1910.1000(e), engineering controls, or the appropriate paragraphs from the substance specific standard. Also cite respiratory protection as outlined in A.2 as necessary. Also cite separately 1910.1000(d), but do

not propose a penalty for 1910.1000(d). Document which health effects were considered the basis for using the mixture formula.

### 3. Specific examples

#### Exposures to welding fumes

When an overexposure to welding fumes is measured, paragraphs 1910.1000(a), 1910.1000(e) and 1910.252(c)(1)(iii) apply. However, because 1910.1000(e) allows for the use of administrative controls to reduce employee exposure, it is less protective than the language in 1910.252, which requires mechanical ventilation. The welding standard is also the more vertical standard. Therefore, cite 1910.1000(a)(3) and 1910.252(c)(1)(iii) when an overexposure to welding fumes is measured, and remove any mention of administrative controls in the Abatement Guidelines. Also cite respiratory protection as outlined in A.2 as necessary.

## C. Sampling and Analytical Error (SAE)

The sampling result is seldom 100% accurate in reflecting the true exposure. The SAE is a combination of errors inherent in sampling, analysis and pump flow. Among the factors affecting the accuracy are: flow rate and sample volume, collection efficiency, sample stability, efficiency of recovery from sampling media, interferences introduced by sampling substrate, and effect of other co-contaminants present during sampling, storage and analysis. (ref: federal OSHA)

The formula for the SAE is:

$$SAE = \sqrt{[(SAMPLE PUMP ERROR)^2 + (ANALYTICAL ERROR)^2]} \times 1.645$$

Where Analytical Error is expressed as the Relative Standard Deviation (RSD), which is the same as the Coefficient of Variation (CV) of the analytical process.  $RSD = CV = \text{STD Dev}/\text{Mean}$

Sample Pump Error should be expressed as an RSD also. A value of 5% (0.05) is considered standard.

Using 1.645 in the formula leaves a 5% one-sided uncertainty tail.

Typical SAE values range from 8-25%, but can be higher.

In all cases where a citation for exceeding a PEL is being considered, the exposures must also exceed the SAE for the sampling and analytical method. For a single sample, if the [Dose minus SAE] is greater than 1.0, then there is a 95% chance that the measured exposure is really over the PEL, and a citation may be

proposed. When multiple samples are collected, the SAE calculation is more involved. Consult the federal OSHA technical manual, Section IV D and Appendix F.

The SAE is unique to a given analytical method and laboratory. One cannot rely on previously published data. Therefore, if you need to obtain an SAE, contact the lab that conducted the analysis and request the SAE.

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