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Methods for Sampling and Analyzing Gases from Welding and Allied Processes



American Welding Society



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Methods for Sampling and Analyzing Gases from Welding and Allied Processes

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Prepared by
AWS Project Committee on Fumes and Gases

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AWS Safety and Health Committee

Approved by
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Abstract

This standard contains recommended sampling methods and analytical techniques for ozone, carbon monoxide, nitric oxide, nitrogen dioxide, and gaseous fluoride in welding environments. It complements AWS F1.1, *Methods for Sampling Airborne Particulates Generated by Welding and Allied Processes*.



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Methods for Sampling and Analyzing Gases from Welding and Allied Processes

1. Scope and Purpose

1.1 Scope. This publication includes the recommended procedures for sampling and methods of analysis for gases that may be formed during the use of various welding and allied processes. These gases include the following:

- (1) Ozone (O₃)
- (2) Carbon Monoxide (CO)
- (3) Nitric Oxide (NO) + Nitrogen Dioxide (NO₂) = Oxides of Nitrogen (NO_x)
- (4) Gaseous Fluorides

Summaries of the acceptable methods are presented in the body of this document. Detailed descriptions of NIOSH¹ and OSHA² methods and references are presented in the Annexes. This standard makes use of the International System of Units (SI).

1.2 Purpose. This publication is intended for use by personnel who are responsible for sample collection, sample analysis, and evaluation of the environment of personnel involved with welding and allied processes.

This guide provides the most widely recognized, safe methods for the sampling and analysis to be used in the evaluation of airborne concentrations of gases commonly formed during welding.

2. Referenced Standards

The following standards are referenced in the mandatory section of this document and may be obtained from the following sources:

American Welding Society (AWS), 550 N.W. LeJeune Road, Miami, FL 33126 (www.aws.org).

Global Engineering Documents, 15 Inverness Way East, Englewood, CO 80112 (www.global.ihs.com).

1. National Institute for Occupational Safety and Health (NIOSH), 4676 Columbia Parkway, Cincinnati, OH 45226.

2. Occupational Safety and Health Administration (OSHA), P.O. Box 65200, Salt Lake City, UT 84165.

(1) AWS F1.1, *Method for Sampling Airborne Particulates Generated by Welding and Allied Processes*.

(2) AWS F1.2, *Laboratory Method for Measuring Fume Generation Rates and Total Fume Emission of Welding and Allied Processes*.

(3) AWS F1.3, *A Sampling Strategy Guide for Evaluating Contaminants in the Welding Environment*.

(4) ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes*.

3. Background

Welding and allied processes generate a complex mixture of gases and fumes. The quantity of fume and gases generated varies widely from process to process. The toxic effects of welding a given material depend upon the fume content and gases generated.

One part of the overall effort to protect the health of the worker in the welding environment is to sample and analyze for contaminants and to determine their concentrations in the welder's breathing zone. This guide presents sampling and analysis methods for gases formed during welding. Analytical methods have been selected based on the experience of a number of welding and health professionals and will be revised as required upon technical advancements in the field.

4. Summary of Analytical Techniques

4.1 General. The following are three major analytical methods for gases formed during welding:

- (1) Instruments
- (2) Colorimetric or length of stain (commonly referred to as *detector tubes* or *passive samplers*)
- (3) Chemical

Each of these methods has advantages and disadvantages which shall be considered by the user. Since welding by-products are a complex mixture of gases and