



Formaldehyde Testing For IAQ Applications

What is formaldehyde?

Formaldehyde (HCHO) is a colorless, reactive and pungent smelling gas. Formaldehyde is one of many compounds known as volatile organic compounds (VOCs). While it is possible to quantify the total volatile organic compounds (TVOCs) present, formaldehyde is usually of heightened interest by itself due to its significant health concerns, even at extremely low concentrations. Formaldehyde is used widely by industry in various building materials and household products.



Sources of formaldehyde

Formaldehyde may off-gas from pressed wood products such as hardwood plywood wall paneling, particle board, fiberboard, laminate flooring and furniture. HCHO may be present in the home due to household cleaners, paints, coatings, lacquers, personal care products (especially certain hair products), pet products and tobacco smoke. Other sources of formaldehyde can be from urea-formaldehyde foam insulation (UFFI), combustion processes, pesticides, textiles, fertilizers, specialty paper, glues and adhesives. Formaldehyde is also heavily used in the embalming process as a preservative in hospitals and lab animal facilities. Formaldehyde can also be generated through a reaction with ambient air in areas where ozone is present. Due to the various sources of formaldehyde, it may be present both indoors and outdoors.



Health Effects from formaldehyde

Formaldehyde is a highly toxic compound with known, detrimental health effects. Formaldehyde can cause watery eyes along with burning sensations in the throat and eyes, nausea, and difficulty breathing when healthy adults are exposed to high levels (>0.1 ppm). Elderly, very young and asthmatic populations may be at increased risk at lower exposures. As of June 2011, the US National Institute of Health's National Toxicology Program considers formaldehyde a known human carcinogen¹, while the USEPA describes it as a probable human carcinogen². The World Health Organization's International Agency on Cancer (IRAC) has designated formaldehyde as the cause of several types of nose and throat cancer³.



GrayWolf Formaldehyde Smart Sensor

¹ NIEHS (NIH)

<http://www.niehs.nih.gov/health/materials/formaldehyde.pdf>

² USEPA <http://www.epa.gov/iaq/formaldehyde.html>

³ IRAC (WHO)

<http://monographs.iarc.fr/ENG/Monographs/vol88/mono88-6.pdf>



Regulations for formaldehyde

There are many regulations and guidelines for formaldehyde in the US, Europe, and worldwide. US OSHA has determined a time-weighted average (TWA) of 0.75 ppm with a short-term elevated level (STEL) of 2 ppm for worker exposures⁴. The National Institute for Occupational Safety and Health (NIOSH) has defined a TWA of 0.016 ppm⁵. The World Health Organization (WHO) has an IAQ guideline of 0.1 mg/m³ (0.08 ppm) over a 30-minute period⁶. Many other countries have similar, or sometimes lower exposure regulations. For example, China⁷, Japan⁸, Portugal⁹ and UAE¹⁰ cite a 0.08ppm maximum for their IAQ standards. France has 0.04ppm¹¹ and Hong Kong's "excellent class" IAQ requirement is at 0.025ppm¹². The US Green Building Council's LEED v4.1 Building Design & Construction EQ credit requires a formaldehyde concentration limit of 20µg/m³ or 16ppb¹³.

Influences on Formaldehyde Emission Rates

Emission rates of materials that contain formaldehyde decrease with time. However, as temperature and/or

relative humidity increase, so will the emission rate. When temperature and/or relative humidity decrease, the formaldehyde emission levels will typically decrease.

Ways to reduce exposure to formaldehyde

The ideal solution to reducing existing formaldehyde levels is to remove any formaldehyde emitting products from the area. This will greatly reduce the levels of formaldehyde and prevent other materials from absorbing formaldehyde and then re-emitting it. Increasing ventilation rates with fresh air will typically also reduce formaldehyde levels. Surfaces that are treated with formaldehyde (and have not already been coated or laminated) can be sealed by a material that does not contain formaldehyde. When choosing furnishing and building materials, make sure to check whether they contain formaldehyde. Choosing composites with Ultra Low Emission Formaldehyde (ULEF) will help reduce the levels.

Formaldehyde in the News

60 Minutes story about high formaldehyde levels found in Chinese-made flooring supplied by Lumber Liquidators: <http://www.cbsnews.com/news/lumber-liquidators-linked-to-health-and-safety-violations/>

Huffington Post on FEMA trailers containing high levels of formaldehyde after Hurricane Katrina: http://www.huffingtonpost.com/2012/05/29/fema-trailers-lawsuit-settlement_n_1551467.html

NBC story that electronic cigarettes lead to high emissions of formaldehyde: <http://www.nbcnews.com/health/cancer/you-vape-high-levels-formaldehyde-hidden-e-cigs-n290826>

ABC News story discussing formaldehyde in hair straightening products: <http://abcnews.go.com/US/brazilian-blowout-identify->

⁴ Part 1910 Occupational Safety and Health Standards https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=10075&p_table=STANDARDS

⁵ The National Institute for Occupational Safety and Health (NIOSH) NIOSH Pocket Guide to Chemical Hazards last reviewed April 2011

⁶ The World Health Organization's (WHO) Guidelines for Indoor Air Quality, Selected Pollutants (2010)

⁷ Chinese Indoor Air Quality Standard, GB/T 18883-2002

⁸ Japan Society for Occupational Health (JSOH) Recommendation of Occupational Exposure Limits. (2010)

⁹ Regulations on HVAC Systems in Buildings (RSECE, DL 79/2006),

¹⁰ Green Building Regulations and Specifications, 2013

¹¹ Dept. of Ecology, Sustainable Development, Transportation and Housing Decree No. 2012-14 of 5 January 2012

¹² The Government of the Hong Kong Special Administrative Region. Indoor Air Quality Management Group, Guidance Notes for the Management of Indoor Air Quality in Offices and Public Places, 2003

¹³ US Green Building Council (USGBC) LEEDv4.1 BD&C EQ Credit - Indoor Air Quality Assessment, Option 2, Air Testing, July 2024





[formaldehyde-hair-smoothing-products/story?id=15821056](#)

Measuring formaldehyde

Quantifying formaldehyde at low levels is of utmost importance for IAQ applications as not all occupants are healthy adult workers (even though such workers' productivity may be negatively impacted even by mild HCHO caused irritation). Some occupants, such as asthmatics or the elderly, are at higher risk of potentially dangerous lung irritation, and HCHO is becoming more broadly recognized as a known carcinogen. GrayWolf's SEN-SMT-HCHO-L Formaldehyde Smart Sensor is ideal for the low (0 to 1000ppb) IAQ range, with an excellent L.O.D. (<10ppb). Unlike most electrochemical HCHO sensors, this sensor exhibits negligible CO cross-sensitivity <10ppm CO and virtually no cross sensitivity below 5ppm CO. The SEN-SMT-HCHO-L Smart Sensor is designed to be utilized in a DirectSense II Probe which can be connected to either a laptop computer, a purpose built AdvancedSense XM meter or an Android Smart Phone where it is able to display and log readings, over time, as ppb or $\mu\text{g}/\text{m}^3$. It also measures $^{\circ}\text{C}/^{\circ}\text{F}$ and %RH. The SEN-SMT-HCHO-L sensor will provide constant instantaneous readings eliminating the need to send out samples for analysis, greatly reducing cost and time. The sensor must be factory calibrated yearly.

DirectSense II Kits equipped with the SEN-SMT-HCHO-L sensor, along with all GrayWolf units for a wide variety of parameters, are available for rental as well as purchase. Logged data may be downloaded to GrayWolf's WolfSense PC data transfer and reporting software. The DirectSense II Probes may also be interfaced to other GrayWolf equipment for simultaneous display, logging and remote on-line access of multiple parameters.

Alternatively, the FP-31G formaldehyde meter, for portable 15 or 30-minute test results, has a range from 10ppb (parts per *billion*) to 1000ppb, with actual limits of detection down to <5ppb (below the display value). Display your readings in ppm HCHO. These very low levels of detection are essential for Indoor Air Quality (IAQ) measurement of Formaldehyde and are typically not achieved by alternative continuous measurement technology.



Direct Formaldehyde Reading on AdvancedSense XM with HCHO Sensor in DirectSense II probe



FP-31G Formaldehyde Meter

U.S.A. (WORLDWIDE HEADQUARTERS)

GrayWolf Sensing Solutions, LLC
6 Research Drive, Shelton, CT 06484 USA

IRELAND

GrayWolf Sensing Solutions, LTD
Annacotty Industrial Park, Unit 1C
Annacotty, County Limerick, IRELAND

For More Information Call:

Tel: 1-203-402-0477 or 800-218-7997

E-Mail: SalesTeam@GrayWolfSensing.com

Web: www.GrayWolfSensing.com

