



Formaldehyde – Deployment Occupational and Environmental Health Concerns

FACT SHEET 55-012-1011

PURPOSE: To provide information regarding potential exposures to formaldehyde that personnel may experience during deployments.

BACKGROUND: Formaldehyde gas has been identified as a cause of certain complaints of odors and eye, nose, and throat irritation among deployed personnel in certain structures at operating bases in Iraq and Afghanistan. The formaldehyde is being emitted primarily from plywood building materials in newly constructed buildings, Container Express (CONEX) units, shelving, and furniture. Other source materials include certain insulation, glues, and paints.

Formaldehyde: What is it and where does it come from?

At room temperature, formaldehyde is a colorless, distinct, pungent-smelling gas. In liquid form it is commonly used as a preservative in medical laboratories and mortuaries. It is used widely by industry to manufacture building materials and numerous household products. It is also found in plastics, carpets, disinfectants, tobacco products, and many every day personal use products and as a by-product of combustion.

Formaldehyde is in so many products and building materials used in homes and commercial facilities, most persons are frequently exposed to low levels of formaldehyde that come out of these materials into the indoor air (called off-gassing). To minimize the amount that would be associated with odors and adverse health effects, the U.S. Environmental Protection Agency regulates the use of formaldehyde. Though there is U.S. military guidance to minimize use of unregulated/inappropriate building materials at bases in Iraq and Afghanistan, there are still occasional problems. This is because much of the construction materials are procured from local vendors and foreign countries where the use of formaldehyde is not regulated to minimize exposure as it is in the United States. The amount of formaldehyde released into the indoor spaces of CONEXs, tents, and other wood structures, depends on the quantity, type, and age of pressed wood used inside as building components and used to make furniture and shelving for inside the space, and other factors such as air temperature, humidity and ventilations. The rate at which formaldehyde is released is accelerated by heat and humidity.

What do we know about exposures during deployments?

Past and ongoing industrial hygiene assessments in Iraq and Afghanistan indicate a range of formaldehyde levels in different structures. Structures including wood-built structures as well as structures built using CONEXs (see picture). Structures are used for storage, bathroom facilities, office work areas, as well as living quarters. The levels vary due to source of formaldehyde, type of structure, ventilation, and temperature. In theatre, the most significant sources of formaldehyde are pressed wood products made using adhesives that contain urea-formaldehyde (UF) resins. These pressed wood products include: particleboard (used as sub-flooring and shelving and in cabinetry and furniture); hardwood plywood paneling (used in cabinets and furniture); and medium density fiberboard (used for drawer fronts, cabinets, and furniture tops). Medium density is generally recognized as being the highest formaldehyde-emitting pressed wood product. Other pressed wood products that are produced for exterior construction use (such as softwood plywood and flake or oriented strand board) contain a dark or red/black-colored phenol-formaldehyde (PF) resin which generally emits less formaldehyde than those containing UF.



The formaldehyde sampling to date has indicated a range of exposure levels that can be associated with no effects, to moderate irritation. The unique odor associated with formaldehyde and its association with indoor air makes this an often recognized hazard. Though many persons may notice the strong smell with or without other symptoms, odor adaptation can occur so some individuals may experience symptoms without noticing an odor.

Typical symptoms described by deployed personnel include odors or minor nasal or eye irritation, slight cough, nausea, or headache. Mild to moderate irritation levels have not been associated with long term irreversible adverse health effects (NRC, 2007). Though rare, more severe effects such as difficulty breathing have been reported by some deployed personnel.

Ongoing industrial hygiene investigations are attempting to identify whether unique sources in structures or inadequate ventilation is associated with recent complaints. Higher levels have been identified in some newly constructed structures or in CONEXs, especially when there is no means for ventilation (airing out) of the interior space. Formaldehyde levels generally decay and exposures will lessen with time, especially with ventilation. However, hotter temperatures (summer months) may increase amount released into the air. Recent data also suggest that plywood material used as shelving and furniture and even locally purchased furniture itself may present either an additional source or a 'new' source in older, previously aired out structures.

While formaldehyde is a unique indoor exposure, other exposures that occur during deployment may also present similar symptoms such as mild to moderate eye, nose, throat irritation or coughing. The most recognized is dust or 'particulate matter' (PM) in the outside air. These exposures can be difficult to control or prevent. One control measure includes going inside and closing windows vents, etc. This could decrease the rate at which a structure is aired out if formaldehyde is a concern. It is important to follow control measures (see below) to minimize formaldehyde exposures.

Should an exposed person seek medical evaluation?

It is difficult to say at what point personnel should seek medical evaluation since different individuals can have different reactions. Some individuals are more sensitive to formaldehyde so they may experience effects before others or have more serious effects. As previously described, odor and mild to moderate eye, nose and throat irritation are temporary and have not been associated with irreversible effects. Confirmatory field sample results indicate levels in this range are not unusual in certain structures in Iraq and Afghanistan. Other effects in this range can include coughing, headaches, nausea or skin irritation. Typically, mild to moderate effects would not put an individual at risk for long-term health effects and would not be an indication for medical surveillance.

If irritation is severe, individuals may develop difficulty breathing or wheezing. These symptoms require immediate medical attention. Medical evaluation might be needed if exposure is prolonged, repeated, and if symptoms continue after exposure has stopped. Extreme exposures could result in pulmonary injury that could continue to worsen for 12 hours or more after exposure.

If you are concerned that you are experiencing severe effects, seek medical evaluation immediately. You will be evaluated based on your unique symptoms, exposure situation, and physical condition. The healthcare provider may or may not perform any tests. Specific tests are not performed to determine if formaldehyde exposure occurred, but rather to assess your physical status.

What long-term health effects are associated with repeated formaldehyde exposures?

At present, confirmatory results of field samples from structures in Iraq and Afghanistan do not indicate exposures that would cause permanent and irreversible effects. However, potentially irreversible effects such as respiratory tract damage could occur at exposure levels that result in severe and immediate health effects. If individuals experience severe immediate symptoms or they are exposed repeatedly for long durations, possible damage to the respiratory tract may occur. Formaldehyde has also been associated with certain cancers in persons whose occupations (e.g., industrial workers, health laboratory technicians, and mortuary employees) involved repeated high level exposures. Some people develop an allergic reaction to formaldehyde on repeated exposure and this can show itself as skin rashes/eczema; swelling of the face; red, itchy eyes; runny nose; and possibly chest tightness/asthma.

What can you do to minimize exposures?

While formaldehyde is an acknowledged hazard in deployment settings, measures are available to minimize or mitigate exposures that are particularly troublesome. Exposure concerns should be evaluated in terms of sources, personnel involved and symptoms, activities, and mitigation options. Some measures you can take:

- Do not use local plywood or leftover construction for interior use (e.g., shelving and furniture)*
- Do not purchase furniture or construction materials (wood, paints, etc) from unapproved local vendors*
- Avoid repeated and long term exposure in areas that cause notable irritation or more severe effects.
- Report such exposures through your field preventive medicine/medical channels. Or if you have specific questions you may also contact USAPHC directly (see Points of Contact below).
- You may be advised of certain controls such ventilation (leaving doors open), avoiding or limiting time in certain structures, or possible use of protective masks if you perform certain routine duties.

* If you have previously purchased furniture or used plywood or unapproved wood that is inside your current personal work unit or living quarters, take measures to remove such items unless they can be properly assessed.

Specific engineering measures to mitigate formaldehyde exposures include purchasing wood and products from U.S. approved sources (often difficult in deployed areas) and using exterior-grade pressed wood products (lower emitting) instead of interior grade. If locally procured wood, control measures include following proper procedures to 'bake off' in sun, use of materials to coat and 'seal' wood products, and use of proper ventilation procedures (note; air vent holes in doors (see picture may not be adequate, air flow and movement may also be needed). For additional details to minimizing and controlling the release of formaldehyde in structures, contact the PHC's Industrial Hygiene Field Services Program below.



Key references:

- National Research Council, 2007: http://www.nap.edu/openbook.php?record_id=11170&page=128.
- USEPA: <http://www.epa.gov/iaq/formalde.html>
- USACHPPM Industrial Hygiene Survey No. 55-ML-9203-05, Formaldehyde Sampling, Camp Liberty, Baghdad, Iraq, 4-12 April 2005.
- Department of Health and Human Services(DHHS)/National Institute of Health (NIH): http://www.cancer.gov/cancertopics/factsheet/Risk/Fs3_8.pdf

If you have questions, concerns, or any additional information please contact:

Industrial Hygiene Assessments and Formaldehyde Sampling:

Industrial Hygiene Field Services Program: DSN 584-3118; COMM (410) 436-3118

Medical Concerns

Environmental Medicine Program, DSN 584-2714; COMM (410) 436-2714; USAPHC-EnvironmentalMedicineProgram@AMEDD.army.mil

Deployment Occupational and Environmental Health Surveillance:

Deployment Environmental Surveillance Program; DSN 312-584-6096; COMM (410) 436-6096

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