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Formaldehyde Training

MEDICAL COLLEGE OF WISCONSIN

ENVIRONMENTAL HEALTH & SAFETY

2020

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Instructions

1. Please review the content of this presentation carefully.
2. Upon finishing this presentation, you will select a link to a quiz/attestation.
3. Upon successful completion, your eBridge Researcher Profile will be updated with the completion course and date.

Agenda

- Overview of OSHA's Formaldehyde Standard
- Potential Health Effects
- Controlling Exposure to Formaldehyde
- Signs and Symptoms of Exposure
- PPE
- Emergency, Spill and Disposal Procedures
- Medical Surveillance
- Recordkeeping
- Material Safety Data Sheet (MSDS)

OSHA's Formaldehyde Standard

29 CFR 1910.1048

- Exposure Limits:
  - **Permissible Exposure Limit (PEL) is 0.75 ppm**, measured as an 8-hour Time-Weighted Average (TWA)
  - **Short Term Exposure Limit (STEL) is 2 ppm**; limit for any 15-minute period during the work period
  - **Action Level (AL) is 0.5 ppm**; measured as an 8-hour TWA

OSHA's Formaldehyde Standard

29 CFR 1910.1048

- Air monitoring requirements:
  - Monitor initially to determine exposures for employees who:
    - May be exposed at or above the Action Level (AL) or Short-Term Exposure Level (STEL)
      - AL = Time-weighted Average exposure of 0.5 ppm over 8 hours
      - STEL = 2 ppm over any 15-minute period during the workday
  - Monitor whenever someone reports signs or symptoms of exposure
  - Monitor periodically, if initial levels detected were at or above the AL, or lab conditions change

OSHA's Formaldehyde Standard
29 CFR 1910.1048

- Training is required:
  - Whenever there is a potential exposure over 0.1 ppm as a Time-Weighted Average (TWA) over an 8-hour day
    - Required for pathology and anatomy employees
    - Recommended for any employee working periodically with formaldehyde
- Training is required:
  - Initially, and annually thereafter

Properties of Formaldehyde

- Formaldehyde can be present in various forms:
  - Gas (exists naturally as a gas)
  - Solid (paraformaldehyde; solid polymer)
  - Aqueous solutions:
    - Formalin (formaldehyde in solution with methanol or water)
    - Paraformaldehyde solution
  - Within solid materials that can release formaldehyde gas
    - Insulation, carpeting, plywood, glues
    - Also as a byproduct of some combustion processes (e.g. car exhaust, cigarette smoke)

Properties of Formaldehyde

- If you are unsure whether your process results in a formaldehyde exposure, consult the Material Safety Data Sheet (MSDS), or call EHS at 955-8007
- Synonyms or chemicals that can release formaldehyde vapors:
  - Formalin
  - Formic aldehyde
  - Paraform
  - Formol
  - Methanal
  - Methyl aldehyde
  - Methylene Glycol

Properties of Formaldehyde

- Formaldehyde vapors can be released at room temperature from aqueous solutions or solids
  - Open containers of formalin or paraformaldehyde solid can easily vaporize high levels of formaldehyde
  - Materials containing formaldehyde can “off gas” in buildings where new carpeting, plywood or insulation has recently been installed

Routes of Exposure

- Inhalation (most common)
- Skin
- Eyes

Potential Health Effects

- The following levels of airborne concentrations have been associated with these acute symptoms:
  - 0.4 – 2.0 ppm - eye, nose and throat irritation
  - 3-5 ppm – eye tearing; intolerable to some people
  - 5-10 ppm – coughing, chest tightness, possibly eye damage
  - 10-20 ppm – difficulty breathing, burning of nose and throat; heavy tearing of eyes
  - 25-30 ppm – Severe injury to respiratory tract
  - 100 ppm – Immediately dangerous to life and health

Inhalation Exposure Effects

- Acute Exposure
  - Eye, nose and throat irritation
- Repeated or Chronic Exposure
  - Headaches, rhinitis, nausea, drowsiness, respiratory impairment, kidney injury, pulmonary sensitization, and tissue damage
  - Neuropsychological effects – sleeping disorders, irritability, altered sense of balance, memory deficits, loss of concentration, and mood alterations

Inhalation Exposure Effects

- Carcinogenic Effects:
  - Classified by the International Agency for Research on Cancer (IARC) as a Class 1 human carcinogen for nasopharyngeal cancer
  - Long-term exposure is reported to be associated with an increased risk of rare nasopharyngeal and oropharyngeal cancers in humans
  - Role in lung cancer has not been substantiated

Skin Contact Effects

- Acute Exposure:
  - May cause irritation, white discoloration, hardness, and numbing
  - Some develop sensitization dermatitis, characterized by the sudden eruption of blisters on eyelids, neck, face, hands, or arms

Skin Contact Effects

- Repeated or Chronic Exposure:
  - Burns
  - Numbness and/or itching rash
  - Fingernail damage
  - Hardening or tanning (discoloration) of skin
  - Sensitization
    - May result in dermatitis or respiratory sensitization; once sensitized, symptoms can be seen with very low doses
    - Dermatitis may be a sudden reaction, or could react slowly over several years with eruptions on extremities or other body parts
      - Skin may appear burned, develop welts, or become dry or cracked; depending upon severity of the allergic reaction

Eye Contact Effects

- Acute Exposure:
  - Irritation and tearing as airborne concentration of formaldehyde vapors increase
  - Airborne concentrations from 4 to 20 ppm can cause extreme tearing and damage to the eye
  - Direct contact with concentrated solutions can cause severe corneal injury and loss of vision
  - Direct contact with dilute concentrations can cause discomfort and irritation that may diminish over time (and if treated promptly)

Controlling Exposures

- Engineering Controls:
  - Reduce or eliminate the hazard at the source
  - Preferred method of control
  - Example:
    - Always work with concentrated solutions (>10% formalin or >4% paraformaldehyde) in a chemical fume hood
    - Work with powder, granules, or flakes of paraformaldehyde only in a fume hood
  - Do not use a biosafety cabinet to weigh paraformaldehyde powder (off-gassed formaldehyde will not be captured by the cabinet's particulate filter)

Only very small quantities of dilute solutions (≤10% formalin or ≤4% paraformaldehyde) may be used on the benchtop (preferably use a fume hood) – keep containers tightly covered when not in use

Controlling Exposures

- Ensure you are using a fume hood which is locally exhausted, and NOT a biosafety cabinet!
  - Some biosafety cabinets are locally exhausted, but many exhaust back into the lab after removing particulates.
  - Hoods that recirculate the air back into the lab and use a filter to adsorb formaldehyde may only be used with review and permission of EHS.
- Equipment containing formalin should also be exhausted

Controlling Exposures

- Work Practice Methods (Administrative controls)
  - Keep solutions that may off-gas formaldehyde tightly closed when not in use
  - Clean up small spills promptly
- In the Morgue:
  - Minimize the time spent between the body being embalmed, and the exhaust air (i.e. stay “upwind” as much as possible)
- In the Anatomy Lab:
  - Try and minimize the time spent with your face close to the body (increasing the distance from the source will reduce your exposure)
  - Keep cadavers covered whenever possible to minimize exposure to the air
  - Follow procedures specified for the ventilated tables at the Wausau Regional campus.

Controlling Exposures

- Personal Protective Equipment (PPE)
  - Creates a barrier between you and the splash or other contact with formaldehyde
  - Last line of defense (doesn't reduce ambient exposure in the room)

Personal Protective Equipment

- Eye and face protection
  - Wear vented goggles if there is minimal potential for splashing
  - Wear a face shield in addition to goggles if a splash hazard is probable (for example if pouring from one container into another)
  - All anatomy students require safety glasses (must have side shields) or goggles

Personal Protective Equipment

- Gloves
  - Double-glove with **neoprene or nitrile** during embalming or if there is incidental contact expected with liquids containing formaldehyde
  - Latex is permeable to many chemicals (including formaldehyde), and is **not** recommended
  - Change gloves at least every two hours, or more frequently if you are encountering more than incidental contact with the chemical

Personal Protective Equipment

- Aprons and sleeves over a labcoat
  - May offer additional protection if splashes are likely, or if arm contact is likely
  - Neoprene and nitrile offer excellent resistance to formaldehyde and many other chemicals
  - Do not reuse disposable sleeves or disposable aprons
- Labcoats
  - If contaminated with formaldehyde, they must be decontaminated prior to reuse. Do not take them home to clean.
  - Any personnel who launders/cleans contaminated clothing and/or equipment shall be notified of formaldehyde's potentially harmful effects. Contaminated labcoats sent out for cleaning should be labeled:
    - "Danger – Formaldehyde-contaminated clothing; avoid inhalation and skin contact."

Personal Protective Equipment

- Respirators
  - These are only used in limited circumstances, including:
    - Emergency spill clean-up (only by trained EHS team)
    - Where engineering and work practice controls are not feasible or sufficient
    - While engineering controls or work practices are being implemented or installed.
  - Employees must be trained, have a medical evaluation, and be properly fit tested prior to wearing respiratory protection for formaldehyde
  - Cartridges for formaldehyde must be replaced after three hours of use, or at the end of the workshift, whichever is sooner
  - Filtering facepiece respirators will NOT protect you from formaldehyde vapors

In event of contact:

- Skin Contact:
  - Immediately wash affected area with soap and water; remove contaminated clothing
  - Follow up with Internal Occupational Health or emergency physician if necessary
- Eye Contact:
  - Immediately flush eyes for 10-15 minutes in nearest eyewash; lifting upper and lower eyelids; and seek medical attention
  - If pain, irritation, tearing, or sensitivity to light are persistent symptoms, notify Occupational Health Services

Fill out on-line accident/injury form

Emergency Equipment

- **Emergency Shower** – Must be present if skin could be splashed with a solution with 1% or greater concentration of formaldehyde
- **Emergency Eyewashes** - Must be present if eyes could be splashed with a solution with 0.1% or greater concentration of formaldehyde

Emergency Equipment

- Use safety showers and eyewashes as immediate first aid for chemical splashes!
- Know the location of the nearest eyewash and shower!
- Facilities checks and flushes the eyewashes and showers periodically
- It is your responsibility to keep your eyewash clean and accessible!

Spill Procedures

- For small spills (less than 100 ml) aqueous solution in areas with good ventilation:
  - Remove ignition sources (remember, 37% formalin is flammable due to the methanol)
  - Put on proper PPE (gloves, goggles, apron)
  - Contain spill with paper towels or other absorbent
  - If available, use neutralizing substance, such as ALDE-X powder, or absorbent pads impregnated with formaldehyde-neutralization chemical
  - Place used absorbents into a plastic bag, close, date, and label appropriately (e.g. “Waste 10% formalin and absorbent from spill”); contact EHS for disposal assistance, or for assistance with the spill if you don’t feel comfortable cleaning it up yourself

Spill Procedures

- For larger spills (300 ml or more), or smaller amounts if there is poor ventilation
  - Evacuate the area, and close the lab door
  - Contact Public Safety (X8299) for assistance

Disposal Procedures

- Refer to the SOP for formaldehyde
- Collect all formaldehyde solutions in a waste container labeled “Waste XX% Formalin/paraformaldehyde solution for disposal”
- Date container when full
- Label any unused or waste paraformaldehyde solid as “Waste paraformaldehyde,” and date
- Contact EHS for disposal as waste

Sink Disposal May Be Used in Certain Situations…

- Only if formalin or paraformaldehyde solution concentration is 10% or less
- Only sink dispose 4L or less per day, per investigator lab
- Only if you have a sink that is located INSIDE a working fume hood
  - Start water running
  - Pour solution directly into the drain with water continuously flowing
  - Continue to run water for a few minutes once you have finished pouring the waste
- NEVER use a sink in the open lab!

Medical Surveillance

- Employer is required to offer medical surveillance for:
  - Those exposed to airborne concentrations over the OSHA Action Limit (0.5 ppm over an 8-hour day);
  - Those exposed to airborne concentrations over the OSHA Short Term Exposure Limit (STEL) of 2 ppm during any 15-minute time period;
  - Employees who develop signs and symptoms of overexposure to formaldehyde; and
  - Those employees exposed to formaldehyde in emergencies.

Medical Surveillance

- Occupational Health provides a Medical Disease Questionnaire to employees:
  - When the Action Limit (0.5 ppm) is exceeded,
  - When the STEL (2 ppm) is exceeded,
  - When someone is required to wear a respirator, and
  - When they report symptoms or signs of overexposure to formaldehyde.

Medical Surveillance Follow-up

- A medical exam might be required, based on information provided in the medical questionnaire
- A medical exam is required for employees who need to wear respirators to reduce exposures to formaldehyde

Medical Removal

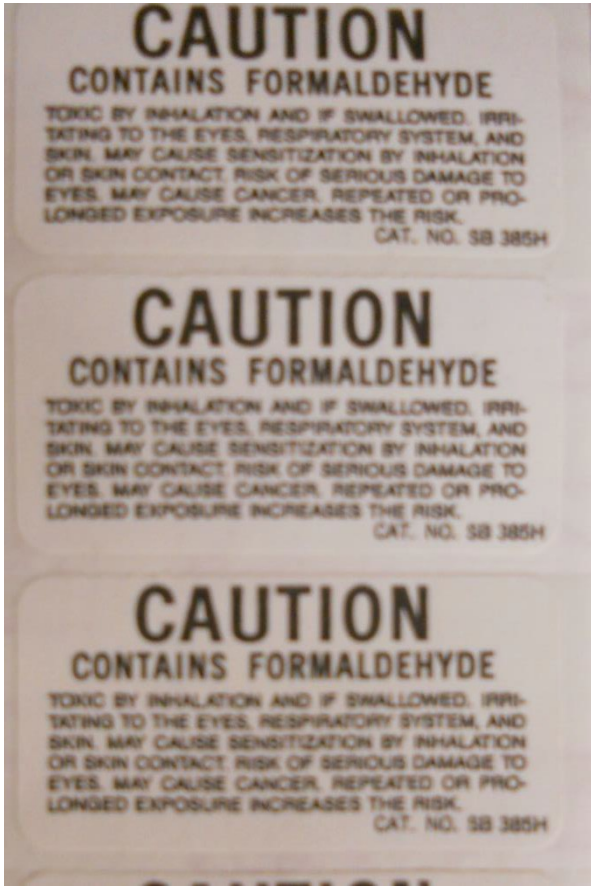
- Can be granted due to significant eye or upper respiratory tract irritation, respiratory or dermal sensitization attributed to formaldehyde exposure

Labeling

- Never deface the manufacturer's labels on original containers of formalin, formaldehyde or paraformaldehyde

  - Secondary containers used to hold formalin or paraformaldehyde solution (any container that is not the original container) must be labeled with the contents, and a hazard label

  - Labels can be requested from EHS department



Air Monitoring Results

- Histology Labs
  - Ranged from less than 0.01 ppm to 0.05 ppm for a full-shift sample
  - 15-minute Short Term Exposure sample during tasks involving formalin ranged from 0.01 to 0.3 ppm (the highest exposure of 0.3 was due to a malfunctioning grossing station at CMH)
- Morgue
  - 0.02 to 0.4 ppm for a full shift personal sample during embalming process
  - 0.06 – 0.6 ppm for 15-minute exposures while filling embalming solution containers

Air Monitoring Results Anatomy/Form and Function Labs

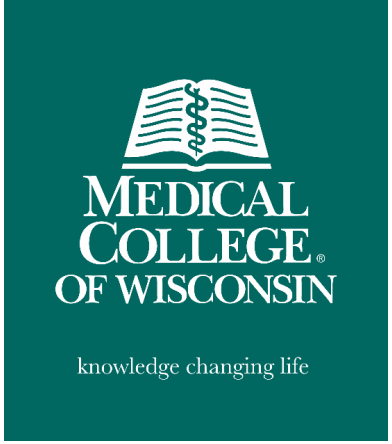
- Milwaukee lab
  - 0.1 ppm for a full shift during set up of practical exam (2011/2012)
  - 0.5 – 0.7 ppm on instructor in the Form and Function lab, opening the thoracic cavity – 2012/2014/2016
    - calculated to a 0.2 ppm, 8-hour time-weighted average (TWA) exposure if no other exposure occurs outside of the 2-hour lab
- Wausau Regional Campus lab
  - 0.3 ppm on instructor during lab opening thoracic cavity (2016)
    - Calculated to a 0.1 ppm, 8-hr TWA exposure
    - Note: not all work practices were adhered to; expect lower exposures are possible
- Green Bay Regional Campus lab
  - 0.3 ppm on instructor during lab during pelvis and lower limb dissection (2015)
    - Calculated to a 0.1 ppm, 8-hr TWA exposure

Miscellaneous Air Monitoring Results

- Benchtop work with small containers of formalin
  - Less than 0.02 to 0.03 ppm (2011)
- Fixing cells with 4.5% formalin (open bench)
  - Less than 0.02 ppm (2016)
- Sectioning tissues using small containers of f0.25% formalin (benchtop)
  - 0.02 ppm (2011)
- Preparing paraformaldehyde solution (weighed powder on open bench, diluted solution in fume hood)
  - 0.01 ppm (2011)

Material Safety Data Sheets (MSDS)

- Maintain a copy of the MSDS in your lab



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Select the link below to access the quiz.

Start Quiz