

Office of Research Services

Xylene Program

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Clinical Center Xylene Surveillance Program

INTRODUCTION

A xylene surveillance program has been established at the National Institutes of Health (NIH) to:

- 1) Identify and quantify exposure levels of workers in the Clinical Center potentially exposed to xylene
- 2) To provide information on the effectiveness of the controls being used to minimize exposures.

Surveys provide documentation of surveillance activities to both The Joint Commission (TJC) and the College of American Pathologists (CAP). The program is maintained by the Technical Assistance Branch (TAB) of the Division of Occupational Health and Safety (DOHS). Medical surveillance of NIH employees is provided by the Occupational Medical Service (OMS). Personnel in the Clinical Center are covered by this protocol. All other NIH laboratories where potential xylene exposure results from the handling and use of xylene are covered by the Occupational Safety and Health Administration (OSHA) Laboratory Standard, 29 CFR 1910.1450.

Xylene (o-, m-, and p-isomers), C₈H₁₀ [CAS 1330-20-7] is a colorless liquid with an aromatic hydrocarbon odor (odor threshold ranging from ~1 - 40 ppm) and is a dangerous fire hazard (class 1C flammable liquid) from heat, flame and powerful oxidizers. Xylene is insoluble in water but it is soluble in alcohol, ether and organic solvents. In histology and pathology areas xylene is used in cover slipping and mounting of slides. Synonyms include: dimethylbenzene, methyl toluene and xylol.

Xylene vapor causes irritation to the eyes, mucous membranes and skin. At high concentrations it has caused narcosis. Exposure to xylene liquid on the skin causes erythema, dryness and defatting.

DEFINITIONS

For purposes of this program, the following definitions shall apply:

Employee exposure – means the exposure to airborne xylene that would occur without protection provided by use of a respirator.

Integrated sampling – sampling during the entire time period in which a potential exposure occurs

Permissible exposure limit (PEL) – this is the maximum concentration, determined as an 8-hour time-weighted average (TWA) or 15 minute STEL (defined below), to which an employee in the workplace may be exposed.

Similar Exposure Group (SEG) – group of workers having a similar exposure profile, as per the job tasks performed

Supervisor – means the NIH/IC Director, designated representative, Research Director, Project Director, Branch Chief, Section Chief, or other immediate supervisor of an employee.

Short Term Exposure Limit (STEL) – is defined as a 15-minute exposure limit, which should not be exceeded during any 15 minute time period during a workday.

Threshold Limit Value (TLV) – is defined as an airborne concentration of a chemical substance and represents the conditions under which it is believed that nearly all workers may be repeatedly exposed, day after day, over a working lifetime, without adverse health effects. The TLV is established through the American Conference of Governmental Industrial Hygienists (ACGIH).

OCCUPATIONAL EXPOSURE CRITERIA

For evaluating employee exposures to xylene, the NIH uses exposure criteria established by both the Occupational Safety and Health Administration (OSHA) and the American Conference of Governmental Industrial Hygienists (ACGIH). OSHA has set a permissible exposure limit (PEL) of 100 ppm as an 8 hour time-weighted-average (TWA) for xylene. The Threshold Limit Value (TLV), an 8 hour TWA workday exposure level from ACGIH, is also 100 ppm.

The Short Term Exposure Level (STEL), an ACGIH exposure level that should not be exceeded during any 15 minute time period of the workday, is 150 ppm.

OSHA indicates that xylene has an odor threshold of ~ 1 ppm.

WORKPLACE EVALUATION

All work sites in the NIH Clinical Center where xylene is used should be identified and initially evaluated to determine if workers in the area may be exposed to xylene vapors. The initial evaluation should be conducted by the Clinical Center Safety Officer or designee, using the Xylene Workplace Evaluation Sheet (attached as Appendix 1). All locations should be documented in Table 1.

A copy of the initial evaluation will be given to the TAB. If, based on the initial evaluation, it is determined that workers are potentially exposed to xylene vapors exceeding the OSHA or ACGIH occupational exposure criteria, then the workplace will be monitored by TAB on an annual basis.

An employee health complaint related to xylene exposure, e.g., symptoms of respiratory, ocular or dermal conditions, will initiate personal monitoring of that employee and background

monitoring of the job task. Monitoring of employees reporting signs or symptoms will be done promptly.

In lieu of monitoring, an objective assessment may be performed to determine the exposure. This assessment may include a review of data on similar exposure groups (SEGs), as per those workers that have a similar exposure profile and job classification. Specifically, similar job tasks that that have previously monitored through integrated sampling (covering the entire period of exposure) could be reviewed and used as a representative comparison. When objective data is used, the employee's name and ID number, job task, and the Industrial Hygienist's (IH) reasoning for exempting the employee from monitoring will be documented.

SAMPLING & ANALYTICAL METHODS

Sampling media capable of detecting nitric oxide will be used to take area and personal samples. Direct-reading instruments may also be used; and, these devices will be calibrated before and after use. The sampling media will be analyzed by an American Industrial Hygiene Association (AIHA) accredited laboratory.

MONITORING PROCEDURE

a. Frequency of Monitoring

Monitoring will be conducted at the Clinical Center work sites where a workplace evaluation has determined that workers may be exposed to xylene vapors. Monitoring will be carried out on a yearly basis.

If two consecutive surveys are completed without any recorded exposures that exceed the OSHA or ACGIH exposure criteria, monitoring will be discontinued at that location (CAP locations may still be monitored annually). Monitoring will be re-instituted at any work site if any symptoms of exposure to xylene are reported or equipment or personnel change.

Locations that require annual monitoring under the CAP accreditation program will be reviewed with the Clinical Center Safety Officer on an annual basis.

b. Monitoring Locations

Monitoring locations, including procedures and contact persons are listed in Table 1. It is the responsibility of the Clinical Center Safety Officer and/or Clinical Center Safety Committee to provide TAB with any additions to the list of xylene usage areas within the Clinical Center as they appear in Table 1.

The Clinical Center Safety Officer will be contacted on an annual basis to determine existing locations and/or new locations.

c. Field Sampling

Field sampling should represent worst-case situations. Area and personal sampling should be conducted using passive dosimeters. Direct-reading instruments may also be used. Placement of monitoring equipment and passive dosimeters will be at the discretion of the industrial hygienist conducting the sampling. Information related to the sampling activity and passive dosimeter placement will be documented.

Passive dosimeters will be stored in a cool place away from chemical contaminants until used.

d. Ventilation

The directional airflow of the worksite, with respect to the corridor, will be determined and recorded. Any local exhaust ventilation (LEV) devices used will be evaluated and certified by TAB, DOHS to determine that they meet the LEV criteria established by NIH.

PERSONAL PROTECTIVE EQUIPMENT

In those locations or during those procedures where it is determined by monitoring that xylene vapors exceed the exposure criteria, appropriate engineering controls will be instituted to lower xylene exposures. Until the engineering controls are instituted, workers will wear half-face respirators, fitted with organic vapor cartridges, and participate in the NIH Respiratory Protection Program administered by the TAB.

Because xylene has the potential to cause skin and eye irritation, additional personal protective equipment (PPE), such as splash-proof goggles, nitrile gloves and lab coats, or aprons should also be made available to workers who use xylene. The Supervisor is responsible for providing appropriate PPE.

TRAINING

Training and information on the hazards of xylene, use of personal protective equipment and spill and emergency response will be provided by the area supervisor to those employees working in NIH locations where exposure levels to xylene exceed the exposure criteria. This information appears in Appendix 2, Xylene Safety Data Sheet.

REPORTS

Written reports will be prepared by the TAB as soon as possible after receipt of the laboratory results and sent to the appropriate supervisor and employee(s) in each location (see Table 1). Reports will include:

- 1) Name of person conducting monitoring
- 2) Date survey was conducted
- 3) Sampling and analytical method used
- 4) Work site ventilation characteristics at the time of sampling
- 5) Monitoring results
- 6) Any personal protective equipment worn
- 7) Recommendations for corrective action, if required.

It is the responsibility of the supervisor in each location to initiate and to complete the recommendations made in the report. Implementation of recommendations shall be coordinated by the Clinical Center Safety Officer and/or Supervisor.

In the event that personal monitoring of NIH employees for xylene measures concentrations exceeding the exposure criteria, employees will be notified in writing, of the results of the monitoring within fifteen (15) days of the results being received from the analytical laboratory. The written notification will also describe procedures or changes being instituted to correct the overexposure.

TAB will maintain records of monitoring activity.

MEDICAL SURVEILLANCE

NIH workers who are exposed to xylene vapors in concentrations exceeding the exposure criteria will be referred to OMS for evaluation. In these instances, copies of the workplace evaluation and monitoring results will be sent to the Medical Director, OMS.

RECORDKEEPING

TAB will maintain and update records of all monitoring data obtained to measure employee exposures. The record includes:

- a.) Date measurements were obtained.
- b.) Operation or procedure being monitored.
- c.) Method of sampling and analysis used.
- d.) Number, duration, time, and results of samples taken.
- e.) Types of protective equipment used.
- f.) Employee names, IC, area supervisor, job classification, and exposure estimate of the employee whose exposures are represented by the actual monitoring results.

REFERENCES

1. Charney, William, and Joseph Schirmer (eds.), Essentials of Modern Hospital Safety: Vol. 1, Lewis Publishers, Ann Arbor, Michigan, 1994.
2. NIOSH Pocket Guide to Chemical Hazards, U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, June 1997.
3. Documentation of the Threshold Limit Values and Biological Exposure Indices, 6th edition, American Conference of Governmental Industrial Hygienists, Cincinnati, Ohio.
4. Material Safety Data Sheet (MSDS) for xylene, MSDS # OHS 25150, Effective Date 3/16/99, MDL Information Systems, Inc., Nashville, Tennessee.
5. Sax, Irving, and Richard Lewis, Rapid Guide to Hazardous Chemicals in the Workplace, Van Nostrand Reinhold Company, New York, New York, 1986.

TABLE 1

NIH XYLENE LOCATIONS, SUPERVISORS AND REPORT RECIPIENTS				
Location	Supervisor	IC	Ext.	Report Recipients (Safety Specialist)
ACRF NCI/Lab of Pathology 10/2N109-2N110 Removed from program in 2005 See below for 2010	Dr. Lynn Sorbara	NCI	435-2627	Tina Pham (435-2632) Patricia Fetsch (594-9532) (Michele Evans)
ACRF NCI/Lab of Pathology 10/2N100, 10/2A21 Removed from program in 2004 See below for 2010	Ms. Patty Fetsch	NCI	496-6355	Patricia Fetsch (594-9532) (Michele Evans)
ACRF NCI/Lab of Pathology 10/2A09, 10/2A10 Removed from program in 2005 See below for 2010	Mones Abu-Asab PhD	NCI	6-2164	Patricia Fetsch (594-9532) (Michele Evans)
ACRF NCI/Lab of Pathology 10/6N109 Removed from program in 2004	Mr. Greg Jasper	NCI	435-2640	Patricia Fetsch (594-9532) (Michele Evans)
ACRF NCI/Lab of Pathology 10/2A22, 10/2A24, 10/2A26, 10/2A28, & 10/2C533	Ms. Magaly Rojasy	NCI	496-3126	Melba Ashby (496-3126) Patricia Fetsch (594-9532) (12/13 – 2A22 – 2A28, follow-up 12/14, survey 3/15, survey 6/15) (11/14 – 2C533; 11/15 survey) CAP locations (Michele Evans)
ACRF NCI/Lab of Pathology 10/2B58	Ms. Cindy Harris	NCI	402-0434	Patricia Fetsch (594-9532) (4/11 CAP & MEMO), 11/13 – follow-up, 12/14 – follow-up CAP location (Michele Evans)
ACRF NCI/Lab of Pathology 10/2A07 and 10/B1 Morgue (xylene is not currently used in this lab)	Mr. Willie Young	NCI	496-5658	Patricia Fetsch (594-9532) CAP location (Michele Evans)
ACRF/Clinical Pathology/ Microbiology Area 10/2C300	Ms. Chung-Hee Row Cheryl Clarke Jeb Monasterial	CC	496-3386	Chung-Hee Row (496-3386) Cheryl Clarke (496-4473) Jeb Monasterial (496-4473) (1/14 - 2C360A/2C360C—CAP & MEMO), 12/14 – follow-up (Michele Evans)

DVR/DVSB 28A/107 & 110 (listed for reference only— multiple surveys completed)	Dr. Michael Eckhaus	DVR	496-4465	Michael Eckhaus (496-4465) 110 (2/09, 12/10-MEMO, follow- up 12/13) (John Barnhart)
Gaithersburg (ATC Building) NCI (listed for reference only—new survey in 2008)	Dr. Stephen Hewitt Mr. Kris Ylaya	NCI	402-9061	Stephen Hewitt (402-9061) Kris Ylaya (402-9061) (4/11 MEMO); 1/14 follow-up (follow-up mid-year 2014—will be moving to Building 10)
10/10N108 (listed for reference only)	Dr. Chi Chao Chan	NEI	496-0417	Chi Chao Chan (496-0417) (4/09, 4/10-MEMO, 8/12 – follow- up, 9/14 – follow-up)
14E/104A & 10/6D13-5N315: moved to Building 10 in 2010 (listed for reference only)	Dr. Zu Xi Yu	NHLBI	496-5035	Zu Xi Yu (496-5035) (10/10 MEMO); 8/12 – follow-up; 12/14 follow-up)
Twinbrook III 2W-03 (listed for reference only—new survey in 2010 [MEMO])	Kevin Bock Dr. Orandle	NIAID		Kevin Bock Dr. Orandle (6/10-MEMO; 8/12 – follow-up)
10/2N110 (and 2N113)	Ms. Judith Horn	NCI		Ms. Judith Horn (6/10-MEMO & CAP), 11/13 – follow-up
10/2A10	Ms. Judith Horn	NCI		Ms. Judith Horn (6/10-MEMO & CAP), 11/13 – no longer used
10/2A21	Ms. Judith Horn	NCI		Ms. Judith Horn (6/10-MEMO & CAP), 11/13 – follow-up, 12/14 follow-up
10/2N100	Ms. Judith Horn	NCI		Ms. Judith Horn (7/10-MEMO & CAP), 11/13 – follow-up, 12/14 follow-up
10/2N115	Ms. Judith Horn	NCI		Ms. Judith Horn (1/11-MEMO & CAP), 11/13 – follow-up
IRF/1B143 (listed for reference only)	CDR Jason Barr	DOHS		CDR Jason Barr (4/11-MEMO), 1/14 – follow-up— no longer in use
10/2S261	Mr. Michael Newford	NCI		Michael Newford (7/15-new survey)
10/2S253	Mr. Michael Newford	NCI		Michael Newford (8/15-new survey)
10/2S259	Mr. Michael Newford	NCI		Michael Newford (12/15-new survey)

Appendix 1

Xylene Workplace Evaluation Sheet

Building: _____ Room: _____ IC: _____

Supervisor: _____ Telephone #: _____

Number of employees who work in area: _____

Describe any reports of eye, skin, or respiratory tract irritation: _____

Procedure(s) where xylene is used: _____

Engineering controls used in area: _____

Personal protective equipment used: _____

Safety Data Sheet

XYLENE

SYNONYMS

Dimethylbenzene, Methyl Toluene, Xylol, and Mixed Xylenes

CAS NO: 1330-20-7

DESCRIPTION

Xylenes exist as three isomers (ortho-, meta-, para-xylene) commonly mixed in varying proportions. Commercial grade xylene, in which m-xylene is usually the major constituent, is widely used as a degreasing agent, thinner and solvent. It is volatile and flammable at room temperature.

PHYSICAL DATA

Appearance:	Commercial grade xylene is a clear, colorless liquid.
Odor:	Sweet, aromatic odor (threshold about 1 ppm).
Boiling point:	269 degrees F (760 mm Hg)
Freezing point:	-13 degrees F
Vapor pressure:	6-16 mm Hg (at 20 ^o C)
Flash point:	81 - 90 degrees F (27 ^o - 32 ^o C)
Flammable range:	1.0% to 7.0% (concentration in air)
Solubility:	Insoluble in water; Miscible in organic solvents

STABILITY

Xylene is a liquid, which evaporates quickly into the air from soil and surface water. In the air, it is broken down by sunlight into other less harmful chemicals.

PERSONAL PROTECTIVE EQUIPMENT

Safety glasses, goggles, or faceshields should be worn during operations in which xylene might contact the eyes (e.g., through splashes of solution). Gloves and laboratory coats should be worn to protect skin from xylene exposure. Eyewash fountains and emergency showers should be available within the immediate work area whenever the potential exists for eye or skin contact with xylene. Contact lenses should not be worn if the potential exists for xylene exposure.

STORAGE

Liquid xylene is flammable. Keep container tightly closed. Store in a cool, dry, well-ventilated, flammable liquids storage area. Keep it out of confined space to prevent possible explosion.

FIRE HAZARDS

Xylene is flammable and produces poisonous gases in fire. Containers may explode. Vapors may travel to a source of ignition and flash back.

In case of fire call the NIH Fire Department at 911.

IN CASE OF SPILL

For small spills, remove all ignition sources and ventilate area. Use absorbent paper, sand or other noncombustible absorbent material to pick up all liquid spill material. Seal the absorbent material and other contaminated materials in a vapor-tight plastic bag for disposal as chemical waste. Wash all contaminated surfaces with soap and water.

In case of large spills, notify others to leave the area, turn off ignition sources, close the door and call 911. Do not reenter the contaminated area until the NIH Safety Specialist or Fire Department Personnel verified that the area has been properly cleaned.

HEALTH EFFECTS

Xylene is an eye and respiratory tract irritant. It can be absorbed through the skin. Xylene is also a central nervous system depressant. Exposure to high amounts can cause confusion, stupefaction, irregular heartbeats, metabolic disturbances, renal problems, coma and death. There is no antidote for xylene poisoning.

Acute Exposure

Inhalation: Xylene vapor may irritate the mucous membranes of the eyes, nose and throat at about 200 ppm. Breathing small amounts of vapors may cause headache, giddiness, dizziness, drowsiness, tiredness and nausea. In larger amounts, it may cause sleepiness, stumbling, tremors, fainting and even death.

Dermal: Liquid xylene can cause significant skin irritation, redness and blisters, particularly after prolonged or repeated contact.

Ocular: Eye splashes may cause burning pain, corneal injury, and sloughing of corneal epithelium. High concentrations of xylene vapor can cause eye irritation, but ophthalmic injury is rare.

Oral: If swallowed, xylene causes burning sensation in the mouth and irritation of the stomach lining, causing nausea, vomiting and salivation. Substernal pain, cough and hoarseness and hematemesis may also occur.

Potential Sequelae:

Recovering victims may experience ataxia, depressed levels of consciousness, dilated and poorly responsive pupils, and decreased or absent deep tendon reflexes. Anxiety, fatigue and insomnia may last several days. Long-term sequelae due to acute exposure have not been reported.

Chronic Exposure

Repeated exposures due to solvent abuse can result in progressive and permanent neurologic effects such as poor memory, difficulty in concentration and other brain effects. Prolonged contact can cause drying and cracking of the skin. It can also affect the heart and liver and cause anemia.

Other Health Effects

Xylene is not reported to be carcinogenic by IARC or NTP. Although effects on the fetus have been reported, in the absence of maternal toxicity, reproductive and developmental effects from acute xylene exposure are unlikely to occur.

FIRST AID PROCEDURES

In all instances where first aid is required, the employee must also report to the Occupational Medical Service (OMS), for medical evaluation (496-3457). The NIH Fire Department (911) may be called to provide additional aid and patient transport when necessary.

Eye Contact: Immediately flush with large amounts of water for at least 15 minutes.

Skin Contact: Quickly remove contaminated clothing and wash skin with large amounts of soap and water.

Inhalation: Immediately leave the contaminated area; take deep breaths of fresh air.

Ingestion: Do not induce vomiting. Seek medical attention immediately