Taking an Exposure History

Timur S. Durrani, MD, MPH, MBA
Assistant Medical Director, San Francisco Division
California Poison Control System
Clinical Instructor of Medicine
University of California San Francisco
Acknowledgements

• This educational module is funded by a cooperative agreement between the American College of Medical Toxicology (ACMT) and the Agency for Toxic Substances Disease Registry (ATSDR)

• This educational model is based on the ATSDR Case Study in Environmental Medicine: Taking an Exposure History
Objectives

• Explain why clinicians should be knowledgeable about the exposure history process
• Recognize resources available that help identify toxicants
• Identify potential health effects acute or chronic of exposure to toxicants
• Identify activities that can increase the risk of exposure to toxicants
• Identify the possible sources of toxicants from indoor air pollution, in the home and environment
• Evaluate a possible temporal relationship between patient’s symptoms and patient’s home, work and surrounding environment
Outline

• Define Occupation and Environment
• Introductory Case
• Examples of occupational exposures
• Purpose of taking an exposure history
• Illustrative Occupational Exposure Cases
• Setting of the exposure history
• Components of an exposure history
• Examples of environmental exposures
• Illustrative Environmental Exposure Cases
• Additional Resources
Occupation and Environment

• Occupation
  • Occupation vs Avocation
• Environment
  • Indoor vs. Outdoor
• Built vs. Natural
Case #1

• On Tuesday afternoon, a 52 year old man presents with complaints of recurring headaches for the past three weeks. He describes them as dull in nature, located in the frontal aspect of his head.

• They range from a nagging annoyance to severe pain, lasting 30 minutes to all day. They do not resolve with aspirin. They are sometimes accompanied by nausea, but no vomiting.
52 y/o M with HA

• He notes this past weekend he suffered a mild angina attack after he awoke on Sunday morning. He took his sublingual nitroglycerin, and his symptoms resolved within several minutes.

• He has experienced no further cardiac symptoms since that episode.
Past Medical History

• Diagnosed with angina pectoris three years ago

• Medications:
  • 0.4 mg nitroglycerin sublingually PRN
  • 81 mg Aspirin daily

• Social: No tobacco, rarely drinks alcohol
Physical Exam

• T: Afebrile, BP: 120/85, HR: 80, R: 20
• He is a trim man with a slightly ruddy complexion
• Physical exam is normal
Laboratories

• CBC, Cardiac Enzymes, ESR, Chem-7, TSH and Lipid Panel are normal

• ECG is normal
Conclusion

• This first case illustrates the importance of the exposure history.

• The symptoms he is describing could be attributed to a number of factors, including exposures at his work or home.
How is taking an exposure history different than any other history?

- Extensive knowledge of toxicology is not needed to suspect environmental or occupational disease
- The same criteria are employed as those used in diagnosing other medical problems, including onset and temporal pattern of symptoms and palliative and provocative factors
Types of Exposure History

- Occupational
- Environmental
- Pediatric
### Timing of topics to introduce in the pediatric exposure history

<table>
<thead>
<tr>
<th>Topic</th>
<th>Suggested Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home environment, smoking, environmental tobacco smoke (ETS), mold, occupational exposures, breast-feeding and bottle-feeding</td>
<td>Prenatal Period</td>
</tr>
<tr>
<td>ETS, sun exposure, mold</td>
<td>When the child is 2 months old</td>
</tr>
<tr>
<td>Poison exposures, including household pesticides; lead poisoning</td>
<td>When the child is 6 months old</td>
</tr>
<tr>
<td>Arts and crafts exposures</td>
<td>Preschool Period</td>
</tr>
<tr>
<td>Occupational exposures, exposures from hobbies</td>
<td>When the patient is a teenager</td>
</tr>
<tr>
<td>Lawn and garden products, lawn services, scheduled chemical applications</td>
<td>Spring and Summer</td>
</tr>
<tr>
<td>Wood-stoves and fireplaces, gas stoves</td>
<td>Fall and Winter</td>
</tr>
</tbody>
</table>

Time at work

Time use on an average work day for employed persons ages 25 to 54 with children

NOTE: Data include employed persons on days they worked, ages 25 to 54, who lived in households with children under 18. Data include non-holiday weekdays and are annual averages for 2010.

Examples of Occupational Exposures

- Lead
- Methylene Chloride
- Beryllium
- Anesthetic Gases
Lead at work
Lead at work

• People who work in jobs where they are exposed to lead dusts or lead-containing compounds may get lead on their clothing and shoes and bring it into their cars or homes, where children and other family members may be exposed.

• Lead has been shown to cause a number health problems, including; hypertension in adults, learning problems in children, increased rate of miscarriage.

• For further information see *Case Studies in Environmental Medicine: Lead Toxicity.*
Methylene chloride at work

- 13 deaths reported in workers refinishing bathtubs using a paint stripping product containing methylene chloride.

- CDC Morbidity and Mortality Weekly Report (MMWR)
Beryllium

- Beryllium has been used by machinists and welders
- Exposure may result in a granulomatous inflammatory disorder that is clinically identical to sarcoidosis
Anesthetic gas exposure to healthcare workers

- Exposure measurements taken in operating rooms during the clinical administration of inhaled anesthetics indicate that waste gases can escape into the room air from various components of the anesthesia delivery system.

- **Halogenated agents used for anesthesia have been linked to reproductive problems in women and developmental defects in their offspring.**
<table>
<thead>
<tr>
<th>Signs &amp; Symptoms</th>
<th>Agent</th>
<th>Potential Exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chest Pain</td>
<td>carbon monoxide, methylene chloride</td>
<td>car repair, traffic exhaust, foundry, wood finishing</td>
</tr>
<tr>
<td>Dyspnea</td>
<td>formaldehyde, toluene diisocyanate, animal dander</td>
<td>textiles, plastics, polyurethane kits, lacquer, animal handler</td>
</tr>
<tr>
<td>Pulmonary Edema</td>
<td>nitrogen oxides, phosgene, cadmium</td>
<td>welding, farming, chemical pneumonitis cadmium operations, smelting</td>
</tr>
<tr>
<td>Abdominal Pain</td>
<td>lead</td>
<td>battery making, enameling, smelting, painting, welding, ceramics, plumbing</td>
</tr>
<tr>
<td>Psychosis</td>
<td>lead, mercury, carbon disulfide</td>
<td>paint removal, fungicide application, wood preserving, viscose rayon industry</td>
</tr>
<tr>
<td>Hepatitis</td>
<td>2-Nitropropane, carbon tetrachloride</td>
<td>solvent use, lacquer use, hospital workers</td>
</tr>
<tr>
<td>Headache</td>
<td>carbon monoxide, solvents</td>
<td>firefighting, automobile exhaust, wood finishing, dry cleaning</td>
</tr>
<tr>
<td>Dermatitis</td>
<td>chromium, nickel,</td>
<td>electroplating, metal cleaning, plastics, machining, leather tanning, housekeeping</td>
</tr>
</tbody>
</table>

# Possible Effects of Chronic Exposure

<table>
<thead>
<tr>
<th>Signs &amp; Symptoms</th>
<th>Agent</th>
<th>Potential Exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peripheral neuropathy</td>
<td>Lead, arsenic, n-hexane, methyl butyl ketone, acrylamide</td>
<td>Battery production, plumbing, smelting, painting, shoe making, solvent use, insecticides</td>
</tr>
<tr>
<td>Extrapyramidal syndrome</td>
<td>Carbon disulfide, manganese</td>
<td>Viscose rayon industry, steel production, battery production, foundry</td>
</tr>
<tr>
<td>Behavioral changes</td>
<td>Lead, carbon disulfide, solvents, mercury, manganese</td>
<td>Battery makers, smelting, viscose rayon industry, degreasing, mfg/repair of scientific instruments, dental amalgam workers</td>
</tr>
<tr>
<td>Chronic bronchitis emphysema</td>
<td>Cotton dust, cadmium, coal dust, organic solvents, cigarettes</td>
<td>Textile industry, battery production, soldering, mining, solvent use</td>
</tr>
<tr>
<td>Pulmonary fibrosis</td>
<td>Asbestos, silica, beryllium, coal, aluminum</td>
<td>Mining, insulation, pipefitting, sandblasting, quarrying, metal alloy work, aircraft or electrical parts</td>
</tr>
<tr>
<td>Bladder cancer</td>
<td>β-Naphthylamine, benzidine dyes</td>
<td>Dye industry, leather, rubber-working, chemists</td>
</tr>
<tr>
<td>Lung cancer</td>
<td>Asbestos, arsenic, nickel, uranium</td>
<td>Insulation, pipefitting, smelting, shipyard workers, nickel refining, uranium mining</td>
</tr>
<tr>
<td>Aplastic anemia, leukemia</td>
<td>Benzene, ionizing radiation</td>
<td>Chemists, furniture refinishing, cleaning, degreasing, radiation workers</td>
</tr>
</tbody>
</table>
Purpose of taking an exposure history

• Symptoms from environmental/toxicologic exposures can present nonspecific descriptions which can be confused with non-toxicologic common medical problems
  • numbness of feet can be confused with neuropathy in diabetes when it could be caused by neurotoxic exposures
  • inhaling irritants such as chlorine can be confused with an asthma exacerbation or ischemic chest pain
• Because of this easy confusion, practitioners need to have increased awareness and suspicion for environmental exposures
• Incorporate a standardized exposure history into the exam (or use a questionnaire)
Setting of the Exposure History

- Depending on the setting, the accuracy and availability of history is variable
- There are multiple sources of the patient’s history, including:
  - Family, co-workers, EMS
Obtaining occupational exposure information

- The Occupational Safety and Health Administration (OSHA) has developed a right-to-know regulation covering three basic areas.
  - the generation and distribution of information about chemical hazards
  - requirements for the labeling of chemicals used in the workplace
  - programs for training employees in the safe use of these chemicals
- The Materials Safety Data Sheet (MSDS) is a component of the right-to-know law.
- Manufacturers and importers are required to provide an MSDS for each hazardous chemical in a shipment. Users of the chemicals must keep copies of MSDSs and make them available to workers, clinicians, and others.
Material Safety Data Sheet (MSDS)

- An MSDS should be requested anytime there is a concern for a chemical exposure

- Note these are written by the product manufacturer and:
  - May not be complete due to “trade secrets” – although the manufacturer is required to disclose such information to assist patient care
  - May not contain thorough health information
  - Inert ingredients (including solvents), process intermediates or byproducts may not be specifically listed
  - When in doubt, always call the Poison Control Center, who have access to the most current poison information resources
# MATERIAL SAFETY DATA SHEET

## 1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

<table>
<thead>
<tr>
<th>Product Name:</th>
<th>BR® 6747-1 Water Based Primer, 20-40% Solids</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synonyms:</td>
<td>None</td>
</tr>
<tr>
<td>Chemical Family:</td>
<td>Epoxy</td>
</tr>
<tr>
<td>Molecular Formula:</td>
<td>Mixture</td>
</tr>
<tr>
<td>Molecular Weight:</td>
<td>Mixture</td>
</tr>
</tbody>
</table>

CYTEC INDUSTRIES INC., FIVE GARRET MOUNTAIN PLAZA, WEST PATERNON, NEW JERSEY 07424, USA
For Product Information call 1-800/652-6013. Outside the USA and Canada call 1-973/357-3193.
EMERGENCY PHONE: For emergency involving spill, leak, fire, exposure or accident call CHEMTREC: 1-800/424-9300. Outside the USA and Canada call 1-703/527-3887.

© indicates trademark registered in the U.S. Outside the U.S., mark may be registered, pending or a trademark. Mark is or may be used under license.

## 2. COMPOSITION/INFORMATION ON INGREDIENTS

<table>
<thead>
<tr>
<th>Component / CAS No.</th>
<th>% (w/w)</th>
<th>OSHA (PEL)</th>
<th>ACGIH (TLV)</th>
<th>Carcinogen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strontium chromate</td>
<td>2-4</td>
<td>1 mg/m³ (TWA)</td>
<td>0.0005 mg/m³ as Cr (TWA)</td>
<td>IARC NTP ACGIH A2</td>
</tr>
<tr>
<td>Aromatic amine</td>
<td>3-6</td>
<td>Not established</td>
<td>Not established</td>
<td></td>
</tr>
<tr>
<td>Aromatic substituted urea</td>
<td>2-5</td>
<td>Not established</td>
<td>Not established</td>
<td></td>
</tr>
<tr>
<td>Modified phenolic epoxy resin</td>
<td>2-4</td>
<td>Not established</td>
<td>Not established</td>
<td></td>
</tr>
</tbody>
</table>
Referral Resources

- The **Association of Occupational and Environmental Clinics (AOEC)** is a network of clinics that provide professional training, community education, exposure and risk assessment, clinical evaluations, and consultative services.

- **Pediatric Environmental Health Specialty Units (PEHSUs)** have been developed to provide education and consultation for health professionals, and others about the topic of children's environmental health.

- **Education and Resource Centers (ERCs)** have been established by the **National Institute for Occupational Safety and Health (NIOSH)** to educate professionals in occupational medicine topics. ERCs offer training courses in occupational and environmental medicine topics; continuing medical education credit is available.
Poison Control

- **Regional poison control** centers can act as valuable resources in providing information about the toxicity and health effects of hazardous exposures involved in poisonings.

- The main emergency number in the United States is 1-800-222-1222, although some states have other contact numbers as well as a number for the hearing impaired.
Consultation

- **Industrial hygienists**, are often employed by state health departments or industry, are a source of information to the clinician investigating a possible toxic exposure.

- Industrial hygiene is the discipline devoted to the recognition, evaluation, and control of workplace-related factors or stresses that may cause illness, impaired health or well-being, or significant discomfort and inefficiency among workers or community members.

- Other medical specialists, such as clinicians specializing in occupational/environmental and general preventive medicine, can be helpful in assessing whether a significant exposure has occurred. Occupational health nurses, who often work at patients’ work sites, also have expertise and experience that may be valuable to the clinician.
Components of an exposure history

- Occupational exposure survey
- Exposures
- Health and safety practices at worksite
- Work history
- Environmental history
Occupational Exposure survey: Exposures

- Current and past exposure to metals, dust, fibers, fumes, chemicals, biologic hazards, radiation, noise, and/or vibration
- Typical workday (job tasks, location, materials, and agents used)
- Changes in routines or processes
- Other employees or household members similarly affected
<table>
<thead>
<tr>
<th>1. Are you currently exposed to any of the following?</th>
</tr>
</thead>
<tbody>
<tr>
<td>metals</td>
</tr>
<tr>
<td>dust or fibers</td>
</tr>
<tr>
<td>chemicals</td>
</tr>
<tr>
<td>fumes</td>
</tr>
<tr>
<td>radiation</td>
</tr>
<tr>
<td>loud noise, vibration, extreme heat or cold</td>
</tr>
<tr>
<td>biologic agents</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Have you been exposed to any of the above in the past?</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>3. Do any household members have contact with metals, dust, fibers, chemicals, fumes, radiation, or biologic agents?</th>
</tr>
</thead>
</table>

If you answered yes to any of the items above, describe your exposure in detail—how you were exposed; to what you were exposed, to what extent (how much) you were exposed if you know. If you need more space, please use a separate sheet of paper.
Exposure survey: Health and safety practices

- Employment exams
- Personal protective equipment (e.g., respirators, gloves, and coveralls)
- Ventilation
- Medical and industrial hygiene surveillance
- Personal habits (Smoke and/or eat in work area? Wash hands with solvents?)
- Lockout devices, alarms, training, and drills
<table>
<thead>
<tr>
<th>Question</th>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Do you know the names of the metals, dusts, fibers, chemicals, fumes, or radiation that you are/were exposed to? [If yes, list them below.]</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>5. Do you get the material on your skin or clothing?</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>6. Are your work clothes laundered at home?</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>7. Do you shower at work?</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>8. Can you smell the chemical or material you are working with?</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>9. Do you use protective equipment such as gloves, masks, respirator, hearing protectors? [If yes, list the protective equipment used.]</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>10. Have you been advised to use protective equipment?</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>11. Have you been instructed in the use of protective equipment?</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>12. Do you wash your hands with solvents?</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>13. Do you smoke at the workplace? at home?</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>14. Are you exposed to secondhand tobacco smoke at the workplace?</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>at home?</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>15. Do you eat at the workplace?</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>16. Do you know of any coworkers experiencing similar or unusual symptoms?</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>17. Are family members experiencing similar or un-usual symptoms?</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>18. Has there been a change in the health or behavior of family pets?</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>19. Do your symptoms seem to be aggravated by a specific activity?</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>20. Do your symptoms get either worse or better at work?</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>at home?</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>on weekends?</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>on vacation?</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>21. Has anything about your job changed in recent months (such as duties, procedures, overtime)?</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>22. Do you use any traditional or alternative medicines?</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>23. Have you or your child ever eaten on-food items, such as paint, plaster, dirt, clay?</td>
<td>no</td>
<td>yes</td>
</tr>
</tbody>
</table>

If you answered yes to any of the questions, please explain.
Work history

- Description of previous jobs including short-term, seasonal, and part-time employment and military service
- Description of present jobs
Sample work history form

The following questions refer to your current or most recent job:

Job title: ___________________________ Describe this job: ___________________________

Type of industry: ___________________________

Name of employer: ___________________________

Date job began: ___________________________

Are you still working in this job? Yes No

If no, when did this job end? ___________________________

Fill in the table below listing all jobs you have worked including short-term, seasonal, part-time employment, and military service. Begin with your most recent job. Use additional paper if necessary.

<table>
<thead>
<tr>
<th>Dates of Employment</th>
<th>Job Title and Description of Work</th>
<th>Exposures*</th>
<th>Protective Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Sample work history form

| Have you ever worked at a job or hobby in which you came in contact with any of the following by breathing, touching, or ingesting (swallowing)? If yes, please check the circle beside the name. |
|---|---|---|---|---|---|
| O Acids | O Chloroprene | O Methylene chloride | O Styrene |
| O Alcohols (industrial) | O Chromates | O Nickel | O Talc |
| O Alkalies | O Coal dust | O PBBs | O Toluene |
| O Ammonia | O Dichlorobenzene | O PCBs | O TDI or MDI |
| O Arsenic | O Ethylene dibromide | O Perchloroethylene | O Trichloroethylene |
| O Asbestos | O Ethylene dichloride | O Pesticides | O Trinitrotoluene |
| O Benzene | O Fiberglass | O Phenol | O Vinyl chloride |
| O Beryllium | O Halothane | O Phosgene | O Welding fumes |
| O Cadmium | O Isocyanates | O Radiation | O X-rays |
| O Carbon tetrachloride | O Ketones | O Rock dust | O Other (specify) |
| O Chlorinated naphthalenes | O Lead | O Silica powder | |
| O Chloroform | O Mercury | O Solvents | |

1. Have you ever been off work for more than 1 day because of an illness related to work? no yes
2. Have you ever been advised to change jobs or work assignments because of any health problems or injuries? no yes
3. Has your work routine changed recently? no yes
4. Is there poor ventilation in your workplace? no yes
Environmental history

- Present and previous home locations
- Jobs of household members
- Home insulating and heating and cooling system
- Home cleaning agents
- Pesticide exposure
Environmental history

- Water supply
- Recent renovation/remodeling
- Air pollution, indoor and outdoor
- Hobbies (e.g., painting, photography, sculpting, welding, woodworking, piloting, restoring automobiles, shooting firearms, creating stained glass, creating ceramics, and gardening)
- Hazardous wastes/spill exposure
- Home ventilation/moisture control/flooding
Sample environmental history form

1. Do you live next to or near an industrial plant, commercial business, dump site, or nonresidential property? no yes
2. Which of the following do you have in your home? Please circle those that apply.
   - Air conditioner
   - Air purifier
   - Central heating (gas or oil?)
   - Gas stove
   - Electric stove
   - Fireplace
   - Wood
   - Humidifier
   no yes
3. Have you recently acquired new furniture or carpet, refinished furniture, or remodeled your home? no yes
4. Have you weatherized your home recently? no yes
5. Are pesticides or herbicides (bug or weed killers; flea and tick sprays, collars, powders, or shampoos) used in your home or garden, or on pets? no yes
6. Do you (or any household member) have a hobby or craft? no yes
7. Do you work on your car? no yes
8. Have you ever changed your residence because of a health problem? no yes
9. Does your drinking water come from a private well, city water supply, or grocery store? no yes
10. Approximately what year was your home built? ________________
Case #2: The commercial cleaner

- A 52-year-old male complains of headache
- This patient owns a commercial cleaning service and uses cleaning products at various industrial and commercial sites.
Review

HPI

Location: Frontal headache, now with chest pain

Timing: Headache has been cyclical for the last 3 weeks, most recent Tuesday Afternoon. Sunday when he awoke with chest pain, but hasn’t had it return.

Duration: from half an hour to all day

Severity: from 3 to a 9 on a 0 – 10 pain scale

Modifying Factors: Headache not improved with ASA, CP improved with nitroglycerin

Associated Signs and Symptoms: Nausea, no vomiting

PMHx: 3 years ago: Angina

Meds: 0.4mg Nitro SL PRN, 81mg ASA qDay

Social: No tab, occasional EtOH

PE: T: Afebrile, BP: 120/85, HR: 80, R: 20

He is a trim man with a slightly ruddy complexion, otherwise his physical exam is normal

Labs: CBC, Cardiac Enzymes, ESR, Chem-7, TSH and Lipid Panel are normal, ECG is normal
According to his wife:

• He has been in excellent health until one week ago, when he began staying up later and later at night.

• She was initially not too concerned, until he began awakening her to talk about the “revolutionary” new ideas he had about creating an international commercial cleaning service.

• She notes he was “full of energy” and talked rapidly about many ideas that he had. She became quite concerned when at 3:00 a.m. (London time) her husband called the manager of a local rayon mill, who was in Europe, to discuss his ideas.

• He then began telephoning European banks in an attempt to find partners for his business venture. When his wife confronted him about the inappropriateness of his phone calls, he became enraged and accused her of purposefully attempting to sabotage his venture.
Analysis

- The results of the patient’s physical examination are normal, and the mental status exam shows symptoms and behavior that are typical of a manic episode.
- The patient is grandiose, irritable, has a marked decreased need for sleep, and is possibly having auditory hallucinations.
- The clinician calls the Poison Control Center to obtain information on carbon disulfide.
A call to Poison Control

POISON Help®
1-800-222-1222
Analysis

• Consultation with the Poison Control Center confirms that this patient’s symptoms could indeed be caused by exposure to carbon disulfide.

• His physician orders a CBC; ECG; urinalysis; liver, kidney and thyroid function tests; blood serology; and an electrolyte panel.

• His physician received the faxed information from the Poison Control Center and an MSDS on carbon disulfide from the textile plant safety manager.

• The clinician reviews the Health Hazard Data section of the MSDS, and notes all pertinent information in the patient’s medical record, along with the prior information faxed from the Poison Control Center.
Conclusion

• The acute exposure the patient incurred at the time of the accident has continued to occur for a limited number of hours each week, while he drives with the contaminated rags and bottle in his truck.

• Results of the laboratory tests on this patient are all within normal limits. Other employees at risk of exposure from this spill are also examined; none incurred acute exposure or suffered ill effects. Once the patient’s exposure ceases, he improves and experiences no further symptoms.
Scope of the problem

- According to the World Health Organization, nearly a quarter of worldwide disease can be attributed to preventable environmental exposures.
- The percentage increases for children under 5 years of age, which is estimated to be about 1/3 of their disease burden.
- Exposure to toxic agents ranked fifth in underlying causes of U.S. deaths in the year 2000.
Environmental Exposure History

- Indoor Home Environment
- Surrounding Neighborhood
- Exposures brought into the home
Indoor Environment

- Age and condition of dwelling
- Fuel sources, ventilation, plumbing
- Pets (in good health?)
- Second-hand cigarette smoke
- Anything change recently?
Outdoors - Neighborhood

• Nearby industry or agriculture
• Air quality – pollution sources
• Traffic proximity and density
• Anything change recently?
“Imported” Exposures

• Home hobbies/avocations
• Home use of industrial products
• Relevant cultural practices
• Anything change recently?
Infection vs. Intoxication

- The American Public Health Associations lists nearly 500 infectious diseases in their publication Control of Communicable Diseases.

- The EPA lists over 82,000 chemicals in its inventory for the toxic substances control act.
Need for further environmental assessment

• Multiple studies have shown low rates of environmental exposure assessment by clinicians, while many want more training in the subject

• This points to a need for increased awareness among clinicians regarding understanding environmental exposures
Examples of outdoor environmental exposures

- Water supply contamination (TCE) exposure
- Soil contamination
Water supply

- Both public water supplies and private wells can be a source of toxic exposure, especially for industrial solvents, heavy metals, pesticides, and fertilizers.

- An EPA groundwater survey detected trichloroethylene in approximately 10% of the wells tested. It is estimated to be in 34% of the nation’s drinking water supplies.

- Up to 25% of the water supplies have detectable levels of tetrachloroethylene.

- Methylene chloride may remain in groundwater for years.
Water supply

• Some solvents can volatilize from showers and during laundering of clothes, thereby creating a risk of toxicity via inhalation.

• Nitrates, a common contaminant of rural shallow wells, pose a risk of methemoglobinemia, especially to infants.

• For further information see:

  *Case Studies in Environmental Medicine: Nitrates/Nitrites Toxicity*

  *Case Studies in Environmental Medicine: Tetrachloroethylene Toxicity*
Soil Contamination

• Ingestion of contaminated soil poses a risk of toxicity, especially to children under the age of six, because of natural mouthing or pica behaviors

• Lead is a common soil contaminant

• Dioxin also adsorbs to soils

• Certain pesticides such as chlordane can remain in the soil for years

For further information see:

Case Studies in Environmental Medicine: Chromium Toxicity
Possible Sources of Indoor Air Pollution

- Environmental tobacco smoke (ETS)
- Wood Stoves/Gas Ranges/Other Heating Devices
- Building Materials
- Asbestos
- Radon
- Biologic Agents
- Lead
Environmental tobacco smoke (ETS)

- ETS is a mixture of irritating gases and carcinogenic tar particles and is one of the most widespread and harmful air pollutants.
- Forty-three of the more than 4,700 chemical compounds contained in cigarette smoke are known carcinogens.
Wood Stoves/Gas Ranges/Other Heating Devices

- Major combustion pollutants that may be present at harmful levels in the home or workplace stem chiefly from malfunctioning heating devices, or inappropriate, inefficient use of such devices.

- Possible sources include: gas ranges that are malfunctioning or used as heat sources; improperly vented fireplaces, furnaces, wood or coal stoves, gas water heaters and gas clothes dryers; and unvented or otherwise improperly used kerosene or gas space heaters.

- Gas ranges, which may produce nitrogen oxide, a respiratory irritant.
Wood Stoves/Gas Ranges/Other Heating Devices

- When not properly maintained and vented, wood stoves emit noxious gases including carbon monoxide, oxides of nitrogen, particulates, and hydrocarbons.

- Studies have shown that children living in homes heated with wood stoves have a significant increase in respiratory symptoms compared with children living in homes without wood stoves.
Building Materials

- Building materials, home improvement products, and textiles used in the home can pose health risks

- Formaldehyde volatilizes from particle board, insulation materials, carpet adhesives, and other household products. This is a particular problem in the confined spaces of mobile homes

- Formaldehyde exposure can cause rhinitis, nausea, dry skin or dermatitis, and upper respiratory and eye irritation. It has also been reported to precipitate bronchospasm in persons who have asthma
Asbestos

- Asbestos was widely used from 1950 to the early 1970s in areas requiring soundproofing, thermal proofing, or durability (e.g., floor and ceiling coverings, heating and water pipe insulation)

- Intact, undisturbed asbestos-containing materials generally do not pose a health risk, however if they become damaged, are disturbed in some manner, or deteriorate over time, asbestos fibers can be released into building air

- Exposure to these fibers has been associated with lung cancer, asbestosis, and mesothelioma
Asbestos

- The occurrence of disease is influenced by the type of asbestos mineral inhaled, the concentration and dimension of the fibers, and the duration of the exposure.

- Smoking cigarettes in addition to asbestos exposure increases the risk of cancer by an order of magnitude above smoking alone or asbestos exposure alone.

- For further information see:

  - *Case Studies in Environmental Medicine: Asbestos Toxicity*
Radon

- Radon, a colorless, odorless gas, is a decay product of uranium and is found in significant concentrations in some areas.

- Radon itself does no harm, but its progeny attach to airborne particulates such as cigarette smoke and can be inhaled.

- During subsequent decay, the progeny emit high-energy alpha particles that may injure adjacent bronchial cells, thereby causing lung cancer.

For Further information see:

- Case Studies in Environmental Medicine:
- Radon Toxicity.
Biologic Agents

- Biological agents in indoor air are known to cause three types of human disease: infections, hypersensitivity diseases, and toxicosis,
- Exposure to conditions conducive to biological contamination (e.g., dampness, water damage) has been related to nonspecific upper and lower respiratory symptoms.
- Evidence is available that shows that some episodes of the group of nonspecific symptoms known as "sick building syndrome" may be related to microbial contamination in buildings.
Biologic Agents

- A number of factors allow biological agents to grow and be released into the air.

- High humidity encourages house dust mite populations to increase and allows fungal growth on damp surfaces.

- Mite and fungus contamination can be caused by flooding, continually damp carpet (which may occur when carpet is installed on poorly ventilated concrete floors), inadequate exhaust of bathrooms, or kitchen-generated moisture.

- Appliances such as humidifiers, dehumidifiers, air conditioners, and drip pans under cooling coils (as in refrigerators), support the growth of bacteria and fungi.
Lead at home

• Millions of homes, particularly those built before 1950, still contain high amounts of lead in paint that is peeling and accessible for ingestion by children

• Lead exposure can occur through drinking water, especially in homes that have lead-soldered pipes

• Significant exposures have occurred in children, particularly ages one to six years, who played in lead-contaminated soil

• Acidic foods, such as juices, stored in imported pottery may leach lead from ceramic glazes

• Some ceramic glazes used by hobbyists and those in imported pottery also may contain lead
Potentially toxic compounds commonly found at home

<table>
<thead>
<tr>
<th>What</th>
<th>Where Found</th>
</tr>
</thead>
<tbody>
<tr>
<td>methylene chloride</td>
<td>adhesive removers, paint strippers, paint thinners</td>
</tr>
<tr>
<td>paradichlorobenzene</td>
<td>air fresheners, moth crystals, toilet bowl deodorizers</td>
</tr>
<tr>
<td>tetrachloroethylene</td>
<td>dry cleaning fluids</td>
</tr>
</tbody>
</table>
Case #3: The accountant

- A 52-year-old male who presents with headache and chest pain.
- This patient is an accountant who has had the same job and the same residence for many years.
Review

**HPI**

Location: Frontal headache, now with chest pain

Timing: Headache has been cyclical for the last 3 weeks, most recent Tuesday Afternoon. Sunday when he awoke with chest pain, but hasn’t had it return.

Duration: from half an hour to all day

Severity: from 3 to a 9 on a 0 – 10 pain scale

Modifying Factors: Headache not improved with ASA, CP improved with nitroglycerin

Associated Signs and Symptoms: Nausea, no vomiting

**PMHx:** 3 years ago: Angina

**Meds:** 0.4mg Nitro SL PRN, 81mg ASA qDay

**Social:** No tab, occasional EtOH

**PE:** T: Afebrile, BP: 120/85, HR: 80, R: 20

He is a trim man with a slightly ruddy complexion, otherwise his physical exam is normal

**Labs:** CBC, Cardiac Enzymes, ESR, Chem-7, TSH and Lipid Panel are normal, ECG is normal
The patient notes:

• He has been in the same office for the past 12 years

• No other workers are experiencing similar or unusual symptoms, and he denies recent changes in his job routine

• His wife is having similar symptoms, his symptoms are worse on the weekends and better when he gets to work
The interview: exposures
Analysis

• The preceding dialogue reveals that the patient’s symptoms may be associated with the home environment, and his cardiac symptoms, headache, and nausea may be related.

• His symptoms seem to be exacerbated at home and lessen at work. Further questioning is needed to pursue this lead.
Interview continued
Analysis and Actions

• There is a temporal relationship between the headaches and being in the home.

• There may be a correlation between symptoms and use of the fireplace or furnace. The furnace is old; it may be malfunctioning or producing excessive carbon monoxide. The patient’s symptoms, including his angina attack, would be consistent with carbon monoxide poisoning.

• It would be appropriate to contact the local gas company to request that it check the furnace and stove for malfunctions and leaks.

• The patient should be advised to ventilate the house until the furnace is checked or to stay out of the house until the gas company deems it safe.

• Carboxyhemoglobin (COHb) levels are important in diagnosis of carbon monoxide exposure. In nonsmoking patients, a COHb level greater than 5% confirms exposure.
Results

• A COHb level performed on this patient is 6%, which is high for a nonsmoker.

• The gas company discovers a cracked heating element in the 12-year-old furnace, which resulted in the circulation of carbon monoxide throughout the house. The use of the fireplace most likely increased the back drafting of fumes.

• The furnace is replaced, the exposure ceases, and the patient’s symptoms abate. He experiences no further cardiac symptoms.
Conclusion

• Had the clinician failed to pursue an exposure history, the patient’s current illness might have been misdiagnosed, treatment might have been inappropriate, or measures might not have been implemented to prevent further carbon monoxide exposure.

• This could have lead to a risk of continued progression of the angina as well as the possibility of harmful health effects for patients and other residents of the household for carbon monoxide poisoning.
Case #4: The retiree

• A 52-year-old male with headache and chest pain.
• This patient is a retired advertising copywriter who lives in the vicinity of an abandoned industrial complex.
Review

HPI

Location: Frontal headache, now with chest pain

Timing: Headache has been cyclical for the last 3 weeks, most recent Tuesday Afternoon. Sunday when he awoke with chest pain, but hasn’t had it return.

Duration: from half an hour to all day

Severity: from 3 to a 9 on a 0 – 10 pain scale

Modifying Factors: Headache not improved with ASA, CP improved with nitroglycerin

Associated Signs and Symptoms: Nausea, no vomiting

PMHx: 3 years ago: Angina

Meds: 0.4mg Nitro SL PRN, 81mg ASA qDay

Social: No tab, occasional EtOH

PE: T: Afebrile, BP: 120/85, HR: 80, R: 20

He is a trim man with a slightly ruddy complexion, otherwise his physical exam is normal

Labs: CBC, Cardiac Enzymes, ESR, Chem-7, TSH and Lipid Panel are normal, ECG is normal
The patient notes:

- He has been retired for two years; he took early retirement from a stressful job in advertising shortly after being diagnosed with angina.

- He denies exposure to metals, chemicals, fibers, dust, radiation, and physical and biologic agents; he is not aware of a connection between his symptoms and activity or time; and to his knowledge other persons are not experiencing similar symptoms.

- He lives two miles from an abandoned industrial site, and prevailing winds blow toward his house.
Interview
Analysis

• The clinician contacts the state health department. The health department confirms that the site contains buried drums of methylene chloride and that it is under investigation.

• An industrial hygienist employed by the health department informs the clinician that the methylene chloride can indeed exacerbate signs and symptoms of angina.

• The laboratory reports that the patient’s COHb is 6%, indicating probable exposure to methylene chloride in this nonsmoker.
Conclusion

• A conference call is made, and the emergency response coordinator, a toxicologist, an industrial hygienist, and a physician discuss the patient’s signs and symptoms. The clinician is given the name of the local contact person for the Association of Occupational and Environmental Clinics, who recommends a specialist to provide follow-up care for this patient.

• The health department’s tests of ambient air reveal no immediate crisis in the vicinity, although the levels are above background levels; test results of water samples from private wells in the area are pending. ATSDR informs the EPA regional office of the situation. EPA provides immediate assistance to the affected area, cleanup is initiated, and threats to the surrounding population are mitigated.
Summary

• It doesn’t take a toxicologist to obtain an exposure history

• Keep in mind that patients have a broad range of potential exposures at their work and environment

• There are many resources available to assist in diagnosing and treating patients with occupational and environmental exposures
Additional Resources

- [ATSDR: Taking an Exposure History](#)
- [Taking a Targeted Occupational Respiratory History](#)
- [Taking a Targeted Environmental Respiratory History](#)
- [Pediatric Environmental Health Toolkit Training](#)