



Connecting Health & Housing: Indoor Air Quality (IAQ)

Presented by:

The California-Nevada
Public Health Training Center

Funded by Grant #UB6HP20202 from the Health Resources and
Services Administration, U.S. Department of Health and Human Services

Learning Objectives

After this tutorial you will be able to...

1. Identify the magnitude of the public health problems associated with indoor air quality
2. Understand the connection between indoor air quality and the home environment
3. Provide healthy homes recommendations to clients for improving indoor air quality

Identify the Problem

- Indoor air quality (IAQ)
 - People spend as much as 90% of their time indoors
 - Children, the elderly, and persons that are ill may spend even more time inside
 - The air we breathe can put us at risk for a variety of health problems
 - Ranging from minor irritations to chronic conditions
 - Some air pollutants can even be fatal
 - Poor IAQ can result from pollutants that are both chemical or biological in nature

Identify the Problem

- A number of exposures have been linked to poor IAQ and poor health outcomes, including:
 - Environmental tobacco smoke
 - Carbon monoxide (CO)
 - Radon gas
 - Allergens
 - Volatile organic compounds (VOCs)

Identify the Exposure Sources

- Environmental tobacco smoke (ETS) is also known as secondhand smoke or passive smoke
 - ETS is a mixture of gases and fine particles
 - From the end of a burning cigar, cigarette, or pipe
 - From the exhalation of a person smoking
 - ETS contains more than 7,000 chemicals
 - Many of these chemicals are toxic and make people ill
 - At least 70 are known human carcinogens
 - Most ETS exposures occur at home or at work

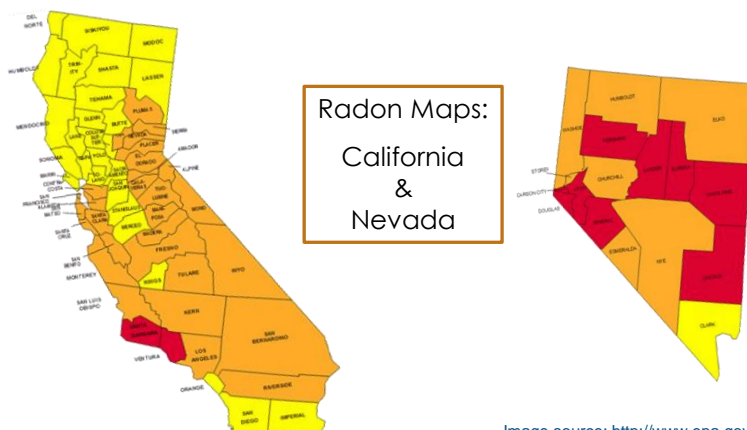
Identify the Exposure Sources

- Carbon monoxide (CO)
 - CO is an odorless, colorless, and toxic gas
 - CO is produced when fuels (e.g. coal, natural gas, propane, wood, oil) are burned
 - E.g., by vehicles, gas-burning stoves, lanterns, space heaters
 - CO replaces oxygen in the blood, leading to poisoning
 - CO exposure can cause headaches, dizziness, weakness, nausea, vomiting, chest pain, and confusion
 - At high enough levels, CO poisoning is fatal
 - CO can kill you before you are aware that it is in your home – it is often called the silent killer!

Identify the Exposure Sources

- Radon gas
 - Radon is an odorless, colorless, and radioactive gas
 - Radon naturally occurs in the soil as a normal product of uranium decay
 - Some soils have higher levels of radon than others
 - The U.S. Environmental Protection Agency recommends mitigation of homes with radon levels that exceed 4 picocuries per liter of air (pCi/L)

Identify the Exposure Sources



Red Zones: Counties have a predicted average indoor radon screening level greater than 4 pCi/L

Orange Zone: Counties have a predicted average indoor radon screening level between 2 and 4 pCi/L

Yellow Zone: Counties have a predicted average indoor radon screening level less than 2 pCi/L

Identify the Exposure Sources

- Allergens
 - The 2000 Institute of Medicine Report identifies a number of indoor allergens that contribute poor IAQ:
 - Mold and mold spores
 - Cockroach allergen
 - House dust mite allergen
 - Warm-blooded pet allergens
 - Nitrogen dioxide (NO₂; an odorless gas)

Identify the Exposure Sources

- Volatile organic compounds (VOCs)
 - VOCs encompass a large variety of chemicals emitted in gases from liquids or solids
 - VOCs are commonly found in:
 - Paints, lacquers, & paint thinner
 - Cleaning supplies
 - Pesticides
 - Building materials & furnishings
 - Glues & other office supplies
 - Air fresheners

Magnitude of the Problem

- Environmental tobacco smoke (ETS)
 - An estimated 88 million Americans were exposed to ETS from 2007 – 2008
 - ETS exposure is estimated to cause 7,500 – 15,000 hospitalizations annually for U.S. children <18 mo
 - ETS also a recognized asthma trigger and has linked to Sudden Infant Death Syndrome
 - Nonsmokers exposed to ETS increase heart disease and lung cancer risk by 25 – 30%
 - ETS estimated to cause 46,000 heart disease deaths and 3,400 lung cancer deaths in U.S. annually

Magnitude of the Problem

- Carbon monoxide
 - Each year more than 20,000 Americans visit the emergency department and 4,000 are admitted to the hospital for CO poisoning
 - More than 2/3 of CO poisonings occur in the home
 - The number of CO poisonings increases during the winter months and during power outages
 - More than 400 Americans die as a result of CO poisoning each year
 - Each year 150 of these deaths are the result of faulty, improperly-used or incorrectly-vented appliances

Magnitude of the Problem

- Radon gas
 - 1 in 15 U.S. homes exceed level set by U.S. Environmental Protection Agency for radon exposure (4 pCi/L)
 - Second leading cause of lung cancer deaths in U.S.
 - estimated to cause 20,000 deaths annually
 - number one cause of lung cancer in nonsmokers

Magnitude of the Problem

- Allergens
 - The predominant health outcome associated with allergen exposure is asthma
 - Allergens contribute to prevalence of asthma
 - Dampness in a home that contributes to mold spores in the air is estimated to result in more than 20% of current asthma cases

Magnitude of the Problem

- Volatile organic compounds (VOCs)
 - Evidence suggests that some VOC levels average 2 – 5 times higher indoors than outdoors
 - VOCs have been shown to cause a number of adverse health outcomes, including:
 - Irritation of the eyes, nose, and throat
 - Headaches and nausea
 - Damage to the liver, kidneys, and nervous system
 - Some cancers

Connection to the Home

Where do IAQ pollutants come from?

Exposure	Source	Location in the Home
Environmental tobacco smoke	Home occupant or visitor behaviors	Anywhere smoking is permitted
Carbon monoxide	Gas-burning appliances and motor vehicles	<ul style="list-style-type: none">• Near gas-burning appliances• In garages
Radon gas	Naturally occurring in the soil, rocks, and sometimes groundwater	More frequently in basements, leaking through cracks in the foundation

Connection to the Home

Exposure	Source	Location in the Home
Allergens	<ul style="list-style-type: none"> • Mold and mold spores • Cockroach allergen • House dust mite allergen • Warm-blooded pet allergens • Nitrogen dioxide 	<ul style="list-style-type: none"> • Rooms with excess moisture or anywhere with plumbing leaks • Anywhere food, water, and shelter is available • In mattresses, bedding, upholstery, and stuffed toys • Anywhere pets are allowed indoors • Gas stoves or water heaters, fireplaces, space heaters
Volatile Organic Compounds (VOCs)	<ul style="list-style-type: none"> • Paints, lacquers, & paint thinner • Cleaning supplies <ul style="list-style-type: none"> • Pesticides • Building materials & furnishings • Air fresheners 	<ul style="list-style-type: none"> • Bathrooms, kitchens, and laundry rooms • Garages and outdoor spaces • Anywhere chemicals are stored

Healthy Homes Recommendations

- Two primary ways to improve indoor air quality in a home
 1. Control emissions from indoor sources
 - Eliminate sources or take measures to reduce emissions
 2. Improve ventilation in your home
 - Increase the amount of fresh air brought in:
 - Open doors and windows
 - Use exhaust fans
 - Use central heating ventilation air conditioning (HVAC) systems
 - Regularly change HVAC filters

Healthy Homes Recommendations

Exposure Source	What can be done to reduce exposure?
Environmental tobacco smoke	<ul style="list-style-type: none"> • If possible, refrain from smoking • Otherwise, establish a smoke-free policy inside and directly outside the entrances of your home • Avoid smoking in your car • Considering removing clothing that is exposed to smoke prior to entering the home
Carbon monoxide (CO)	<ul style="list-style-type: none"> • Maintain proper function of gas-burning appliances; have them serviced by professionals if malfunctioning • Ensure gas-burning appliances are vented properly to the outdoors • Refrain from using gas generators, grills, space heaters or other fuel-burning appliances indoors • Refrain from using portable flameless chemical (catalytic) heaters indoors • Install battery backed-up carbon monoxide detectors in the home, particularly outside sleeping areas <ul style="list-style-type: none"> • Check the batteries in your carbon monoxide detector regularly • Never run a car or truck in the garage with the door shut • Relocate to a place with fresh air immediately and call 911 if the CO detector sounds

Healthy Homes Recommendations

Exposure Source	What can be done to reduce exposure?
Radon gas	<ul style="list-style-type: none"> • Perform a radon test in your home with a do-it-yourself kit • Consider passive or active mitigation if levels exceed 4 pCi/L
Allergens	<ul style="list-style-type: none"> • Control water intrusion and sources of excess moisture • Keep indoor humidity down <50% • Regularly clean hard surfaces and vacuum, with a HEPA vacuum when possible • Frequently launder linens, upholstery, and stuffed toys • Change HVAC air filters every 1 – 3 months
Volatile Organic Compounds (VOCs)	<ul style="list-style-type: none"> • Use less volatile paints and coatings • Use low-emitting building materials (e.g., wood with low levels of formaldehyde) • Use sealed poison baits and other Integrated Pest Management techniques rather than volatile pesticides • Only use chemicals in well-ventilated areas • Meet or exceed any label precautions

Conclusion

- As a public health professional:
 - You may visit a client's home and have the opportunity to identify sources that affect IAQ
 - You are also in a great position to provide critical education regarding the best ways to avoid exposures to airborne pollutants