Retrofit HVAC

- **Reviewing Key Safety Measures for Mobile Home HVAC Work**
  Reviewing Key Safety Measures for Mobile Home HVAC Work Understanding PPE Guidelines for Mobile Home Furnace Repair Following OSHA Standards During Mobile Home AC Installations Noting Electrical Hazard Precautions in Mobile Home HVAC Projects Planning Lockout Procedures for Mobile Home Heating Maintenance Checking for Proper Ventilation in Mobile Home HVAC Crawl Spaces Confirming Compliance with HUD Requirements for Mobile Home Ducts Conducting On Site Safety Assessments Before Mobile Home AC Repairs Checking Gas Line Integrity in Mobile Home Heating Systems Identifying Combustion Clearance Issues in Mobile Home Furnaces Monitoring Air Quality Factors During Mobile Home HVAC Upkeep Coordinating Exit Strategies for Emergencies in Mobile Home HVAC Work
- **Identifying Warning Signs of Outdated Components**
  Identifying Warning Signs of Outdated Components Converting Older Units to High Efficiency Models Examining Duct Layout for Better Distribution Adjusting Equipment Size to Fit Modern Needs Evaluating Newer Options to Replace Electric Heaters Implementing Airflow Balancing Techniques Overcoming Physical Constraints in Legacy Structures Transitioning to Improved Refrigerants for Compliance Strengthening Insulation to Enhance Performance Matching Compatibility of Controls and Existing Wiring Coordinating Expert Consultations for Complex Projects Planning Timelines for Effective System Upgrades
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Furnace Repair

Importance of Safety in Mobile Home HVAC Work

In the realm of mobile home furnace repair, the importance of Personal Protective Equipment (PPE) cannot be overstated. This specialized field involves a unique set of challenges and hazards that make the use of PPE not just advisable, but essential for ensuring the safety and well-being of technicians. Understanding and adhering to PPE guidelines is crucial in mitigating risks and fostering a culture of safety.

Proper vent placement ensures even distribution of heated or cooled air **mobile home hvac repair** heat exchanger.

Mobile homes present distinct characteristics that differentiate them from traditional houses, notably in terms of their heating systems. Furnaces in mobile homes are typically more compact and can be located in confined spaces, which pose additional risks during repair work. Technicians are often required to navigate tight areas, sometimes with limited ventilation, making them more susceptible to inhaling harmful substances or sustaining physical injuries.

The primary function of PPE in this context is to provide a barrier between the technician and potential hazards. For instance, respiratory protection becomes vital when dealing with dust, mold, or airborne particles that might be released during the disassembly or cleaning of furnace components. A high-quality respirator ensures that technicians do not inhale these dangerous particles, which could lead to respiratory issues over time.

Moreover, protective gloves are indispensable when handling sharp edges or hot surfaces within furnaces. These gloves safeguard against cuts and burns-common injuries associated with metal components and heated elements. Similarly, eye protection is crucial as it prevents debris or harmful substances from causing eye injuries during tasks like soldering or using power tools.

Another significant aspect is the importance of wearing appropriate clothing while on-site. Flame-resistant clothing can protect technicians from potential ignition hazards inherent in working with gas lines and electrical connections. Such attire reduces the risk of serious injury should an unexpected fire occur.

Understanding PPE guidelines goes beyond mere compliance; it embodies a commitment to personal safety and professional responsibility. Proper training on how to select, use, and maintain PPE ensures that each piece functions effectively when needed most. Employers must prioritize regular training sessions that emphasize not only how to wear PPE correctly but also why each item is necessary.

The conscientious application of PPE transcends individual safety; it reflects an organization's overall approach to workplace health standards. By consistently implementing rigorous PPE protocols during mobile home furnace repairs, companies demonstrate their dedication to safeguarding employees against occupational hazards while enhancing operational efficiency.

In conclusion, the role of PPE in mobile home furnace repair extends far beyond fulfilling regulatory requirements-it is a fundamental component that protects technicians from potentially life-threatening dangers encountered on the job. Embracing comprehensive PPE guidelines fosters an environment where safety takes precedence over expedience-a principle every responsible technician should uphold unwaveringly throughout their career.

When it comes to mobile home furnace repair, understanding and adhering to Personal Protective Equipment (PPE) guidelines is crucial for ensuring safety. The unique construction of mobile homes, with their compact spaces and specialized components, presents several hazards that technicians must navigate cautiously. By being aware of these common hazards and following PPE protocols, repair professionals can protect themselves from potential injuries and ensure a safe working environment.

One of the primary hazards in mobile home furnace repair is exposure to harmful substances. Furnaces may accumulate dust, mold, or even asbestos over time. Inhaling such particles can lead to respiratory issues or other health complications. To mitigate this risk, technicians should wear respirators or masks that filter out these hazardous elements. Proper ventilation in the work area is also essential to minimize the concentration of airborne contaminants.

Another significant hazard is the risk of electrical shock. Mobile home furnaces are often connected to complex electrical systems that can pose serious dangers if not handled correctly. Before beginning any repair work, it's vital to disconnect power supplies and use insulated tools designed for electrical work. Wearing rubber-soled shoes and gloves provides an additional layer of protection against electric shocks.

Thermal burns are another concern during furnace repairs. Parts of the furnace can become extremely hot during operation or shortly after being turned off. To avoid burns, technicians should wait until components have cooled down before handling them directly. Heat-resistant gloves serve as a critical piece of PPE in this scenario, allowing workers to manage hot parts safely without risking injury.

In confined spaces typical in mobile homes, ergonomic injuries are a real threat due to awkward positions or repetitive movements required during repairs. Technicians should be mindful of their body mechanics and take regular breaks to stretch and adjust positioning as needed. Additionally, wearing knee pads and supportive footwear helps reduce strain on joints when working in tight areas.

Finally, eye protection cannot be overlooked when repairing mobile home furnaces. Particles from rust or debris can easily dislodge during maintenance activities and pose risks to one's vision if proper precautions aren't taken. Safety goggles shield eyes from flying particles while also protecting against accidental splashes from chemicals used in cleaning processes.

In conclusion, understanding PPE guidelines is indispensable for anyone involved in mobile home furnace repair due to the array of potential hazards present in such settings. By equipping themselves with the appropriate protective gear-such as respirators, insulated gloves, heat-resistant apparel, ergonomic supports, and safety goggles-technicians not only safeguard their health but also enhance their ability to perform repairs efficiently and effectively without incident. Adhering strictly to these guidelines fosters a culture of safety that benefits both workers and homeowners alike by ensuring reliable service without compromising well-being.

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Essential Safety Gear and Equipment for Technicians

When it comes to mobile home furnace repair, ensuring safety is of paramount importance. The unique challenges posed by the compact and often intricate layouts of mobile homes necessitate strict adherence to personal protective equipment (PPE) guidelines. Understanding and utilizing essential PPE can greatly reduce the risk of accidents and enhance the overall safety of any repair operation.

First and foremost, eye protection is crucial. Furnaces can release debris or sparks during maintenance, posing a significant risk to one's vision. Wearing safety goggles or face shields helps prevent eye injuries, ensuring that technicians can work without fear of sudden hazards. In environments where visibility might be compromised by steam or smoke, clear vision becomes even more critical.

Similarly, respiratory protection cannot be overlooked. Mobile home furnaces might emit noxious gases like carbon monoxide if not functioning properly. It is essential for technicians to use appropriate masks or respirators when working in confined spaces where ventilation may be limited. This not only protects against toxic inhalation but also ensures compliance with health regulations.

Furthermore, hand protection via gloves is another fundamental aspect of PPE in furnace repair. Given the high temperatures involved and the potential for sharp edges within furnace components, wearing heat-resistant gloves can prevent burns and cuts. Moreover, insulated gloves are vital when dealing with electrical components to avoid shocks.

Additionally, hearing protection should not be underestimated in noisy environments where machinery operates at high decibel levels. Earplugs or earmuffs safeguard against long-term hearing damage while allowing technicians to focus on their tasks without distraction.

Lastly, appropriate footwear is indispensable for maintaining stability and protecting against heavy objects that might fall during repairs. Steel-toed boots provide both comfort and security on potentially slippery surfaces around furnaces.

In conclusion, understanding PPE guidelines for mobile home furnace repair involves recognizing the specific risks associated with these environments and equipping oneself accordingly. By integrating proper eye protection, respiratory gear, gloves, hearing protection, and sturdy footwear into every job routine, technicians ensure not only their own safety but also that of those who rely on their expertise to maintain a safe living environment within their mobile homes. Safety must always remain at the forefront of every repair operation as it serves as the foundation for effective and responsible workmanship in this field.

Proper Procedures for Handling Refrigerants and Chemicals

Understanding the guidelines for proper use and maintenance of personal protective equipment (PPE) is crucial, especially in specialized areas like mobile home furnace repair. This task not only involves technical skills but also demands a strong commitment to safety. PPE serves as the first line of defense against potential hazards, ensuring the well-being of technicians as they navigate challenging environments.

First and foremost, it's essential to recognize what constitutes appropriate PPE for mobile home furnace repair. Typically, this includes items such as safety goggles, gloves, respirators, and flame-resistant clothing. Each piece plays a vital role in safeguarding against specific risks like flying debris, sharp edges, harmful fumes, and high temperatures. Proper selection of PPE tailored to the unique conditions present during furnace repair is indispensable.

Once equipped with the right gear, understanding its correct usage becomes paramount. For example, safety goggles should fit snugly without impairing vision while ensuring complete coverage of the eyes from any angle. Gloves must be durable yet flexible enough to allow dexterous handling of tools and parts. Respirators require proper fitting to effectively filter out hazardous particles or gases that may be released during repairs.

Maintenance of PPE is another critical aspect that cannot be overlooked. Regular inspections before each use are necessary to ensure that all equipment remains in optimal condition. This involves checking for signs of wear and tear or any damage that might compromise their effectiveness. Cleaning protocols must be diligently followed according to manufacturer instructions to prevent contamination buildup that could degrade performance or introduce health risks.

In addition to maintaining individual pieces of equipment, storing them correctly is equally important. Designated storage areas should be clean and free from environmental factors such as moisture or extreme temperatures which could deteriorate materials over time.

Ultimately, adherence to these guidelines not only protects technicians but also enhances their efficiency by allowing them to focus on the task at hand without distraction from discomfort or fear of injury. Employers bear a responsibility too; providing adequate training on PPE usage and fostering a culture where safety is prioritized can make a significant difference in reducing accidents.

In conclusion, understanding and implementing guidelines for proper use and maintenance of PPE is an integral part of mobile home furnace repair operations. By equipping themselves appropriately and caring for their gear meticulously, technicians can ensure both their safety and success as they tackle one complex project after another in this demanding field.

Electrical Safety Protocols for Mobile Home HVAC Work

In the dynamic field of HVAC technology, technicians are often required to operate in varied and sometimes challenging environments. One such environment is mobile home furnace repair, which presents unique challenges due to the confined spaces and specific structural considerations. Understanding Personal Protective Equipment (PPE) guidelines in these scenarios is crucial not only for the safety of the technician but also for ensuring efficient and effective repairs.

Personal Protective Equipment serves as a critical line of defense against potential hazards that technicians may face during furnace repairs in mobile homes. These hazards can range from electrical shocks and exposure to harmful substances, to physical injuries from sharp tools or equipment. Hence, proper PPE usage is essential.

The first step in understanding PPE guidelines is recognizing the fundamental pieces of equipment every technician should have as part of their toolkit. This includes safety goggles for eye protection against dust particles and chemical splashes; gloves that are resistant to chemicals, heat, and cuts; durable work boots with steel toes for foot protection; and appropriate clothing that covers exposed skin while allowing freedom of movement.

Furthermore, when working within the tight confines of a mobile home, it's imperative to consider respiratory protection. The presence of dust, mold, or other airborne particles necessitates the use of respirators or masks. Technicians must ensure their masks fit properly to provide adequate protection against inhaling hazardous materials.

Training on proper PPE usage is equally important as having the right equipment. HVAC technicians must undergo regular training sessions where they learn not only about different types of PPE but also about their correct usage and maintenance. This includes understanding how to inspect gear before use, how to don and doff equipment correctly, and how to recognize when gear needs replacement due to wear or damage.

Adhering strictly to PPE guidelines enhances not just personal safety but also project efficiency. When technicians are confident in their safety gear's effectiveness, they can focus more intently on diagnosing issues accurately and executing repairs efficiently without undue concern over potential accidents or health risks.

Moreover, complying with established PPE protocols demonstrates professionalism and responsibility-qualities highly valued by employers and clients alike. By showing a commitment to safety standards through diligent use of protective equipment, HVAC technicians build trust with those they serve while safeguarding their own health.

In conclusion, understanding and implementing PPE guidelines is indispensable for HVAC technicians involved in mobile home furnace repair. Through comprehensive training programs focusing on both knowledge acquisition and practical application, technicians can enhance their safety practices significantly. As this knowledge becomes ingrained into daily operations, it promotes a culture of safety that benefits everyone involved-from individual workers upholding high standards of care for themselves-to clients who receive quality service delivered by well-protected professionals.

Best Practices for Ensuring Structural Integrity During Installation and Maintenance

Understanding the legal and regulatory standards for personal protective equipment (PPE) in HVAC repairs, particularly in the context of mobile home furnace repair, is crucial for ensuring both safety and compliance with industry regulations. The HVAC industry, characterized by its complex systems and potentially hazardous conditions, demands a comprehensive approach to safety that includes the proper use of PPE.

The Occupational Safety and Health Administration (OSHA) provides clear guidelines regarding PPE requirements for various industries, including HVAC. These guidelines are designed to protect workers from potential hazards such as exposure to harmful chemicals, extreme temperatures, electrical risks, and physical injuries. For technicians working on mobile home furnaces-a task that may involve cramped spaces and unique structural challenges-adhering to these standards is particularly important.

First and foremost, understanding the specific risks associated with mobile home furnace repair is key. Such environments often present challenges like limited space and outdated or non-standardized equipment. Therefore, selecting appropriate PPE becomes crucial. This typically includes safety goggles to protect eyes from debris or chemical splashes, gloves resistant to heat or chemicals depending on the nature of the repair work, and respiratory protection if there is a risk of inhaling dust or fumes.

Moreover, hearing protection might be necessary when working around loud machinery or tools. Ensuring proper footwear is also essential; slip-resistant shoes can prevent falls on wet or uneven surfaces often found in mobile home settings.

Legal compliance goes beyond just wearing PPE; it requires regular training and education about how to properly use and maintain this equipment. Employers must ensure their technicians not only have access to appropriate PPE but are also well-versed in its correct application. Regular inspections of PPE for wear-and-tear are mandatory under OSHA regulations to ensure ongoing effectiveness in protecting workers.

In addition to federal OSHA standards, technicians must also consider state-specific regulations which can vary significantly across different regions. Staying informed about these laws helps avoid potential legal issues while promoting a safe working environment.

Ultimately, understanding PPE guidelines within the context of mobile home furnace repair means committing to continuous learning and adaptation as new technologies emerge and standards evolve. It's about fostering a culture of safety where technicians feel empowered and protected while performing their duties effectively.

By prioritizing compliance with legal standards for PPE use in HVAC repairs, companies not only safeguard their workforce but also enhance their reputation as responsible employers who value worker health and safety above all else. In doing so, they contribute positively towards creating safer residential environments through meticulous attention to detail during every repair job undertaken within the unique challenges posed by mobile homes.

About Mixed-mode ventilation

Mixed-mode ventilation is a hybrid approach to space conditioning that uses a combination of natural ventilation from operable windows (either manually or automatically controlled), and mechanical systems that include air distribution equipment and refrigeration equipment for cooling. A well-designed mixed-mode building begins with intelligent facade design to minimize cooling loads. It then integrates the use of air conditioning when and where it is necessary, with the use of natural ventilation whenever it is feasible or desirable, to maximize comfort while avoiding the significant energy use and operating costs of year-round air conditioning.[1][2]

References

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1. **^** About Mixed Mode, Center for the Built Environment (CBE), University of California, Berkeley, 2005.
2. **^** *Bienvenido-Huertas, David; de la Hoz-Torres, María Luisa; Aguilar, Antonio J.; Tejedor, Blanca; Sánchez-García, Daniel (2023-11-01). "Holistic overview of natural ventilation and mixed mode in built environment of warm climate zones and hot seasons". Building and Environment.* ***245****: 110942. doi:10.1016/j.buildenv.2023.110942. hdl:10481/88452. ISSN 0360-1323.*

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Heating, ventilation, and air conditioning

Fundamental concepts	◦ Air changes per hour ◦ Bake-out ◦ Building envelope ◦ Convection ◦ Dilution ◦ Domestic energy consumption ◦ Enthalpy ◦ Fluid dynamics ◦ Gas compressor ◦ Heat pump and refrigeration cycle ◦ Heat transfer ◦ Humidity ◦ Infiltration ◦ Latent heat ◦ Noise control ◦ Outgassing ◦ Particulates ◦ Psychrometrics ◦ Sensible heat ◦ Stack effect ◦ Thermal comfort ◦ Thermal destratification ◦ Thermal mass ◦ Thermodynamics ◦ Vapour pressure of water

Technology	◦ Absorption-compression heat pump ◦ Absorption refrigerator ◦ Air barrier ◦ Air conditioning ◦ Antifreeze ◦ Automobile air conditioning ◦ Autonomous building ◦ Building insulation materials ◦ Central heating ◦ Central solar heating ◦ Chilled beam ◦ Chilled water ◦ Constant air volume (CAV) ◦ Coolant ◦ Cross ventilation ◦ Dedicated outdoor air system (DOAS) ◦ Deep water source cooling ◦ Demand controlled ventilation (DCV) ◦ Displacement ventilation ◦ District cooling ◦ District heating ◦ Electric heating ◦ Energy recovery ventilation (ERV) ◦ Firestop ◦ Forced-air ◦ Forced-air gas ◦ Free cooling ◦ Heat recovery ventilation (HRV) ◦ Hybrid heat ◦ Hydronics ◦ Ice storage air conditioning ◦ Kitchen ventilation ◦ Mixed-mode ventilation ◦ Microgeneration ◦ Passive cooling ◦ Passive daytime radiative cooling ◦ Passive house ◦ Passive ventilation ◦ Radiant heating and cooling ◦ Radiant cooling ◦ Radiant heating ◦ Radon mitigation ◦ Refrigeration ◦ Renewable heat ◦ Room air distribution ◦ Solar air heat ◦ Solar combisystem ◦ Solar cooling ◦ Solar heating

- Air conditioner inverter
    - Air door
    - Air filter
    - Air handler
    - Air ionizer
    - Air-mixing plenum
    - Air purifier
    - Air source heat pump
    - Attic fan
    - Automatic balancing valve
    - Back boiler
    - Barrier pipe
    - Blast damper
    - Boiler
    - Centrifugal fan
    - Ceramic heater
    - Chiller
    - Condensate pump
    - Condenser
    - Condensing boiler
    - Convection heater
    - Compressor
    - Cooling tower
    - Damper
    - Dehumidifier
    - Duct
    - Economizer
    - Electrostatic precipitator
    - Evaporative cooler
    - Evaporator
    - Exhaust hood
    - Expansion tank
    - Fan
    - Fan coil unit
    - Fan filter unit
    - Fan heater
    - Fire damper
    - Fireplace
    - Fireplace insert
    - Freeze stat
    - Flue
    - Freon
    - Fume hood
    - Furnace
    - Gas compressor
    - Gas heater
    - Gasoline heater
    - Grease duct

Components

    - Grille

Measurement and control

- Air flow meter
- Aquastat
- BACnet
- Blower door
- Building automation
- Carbon dioxide sensor
- Clean air delivery rate (CADR)
- Control valve
- Gas detector
- Home energy monitor
- Humidistat
- HVAC control system
- Infrared thermometer
- Intelligent buildings
- LonWorks
- Minimum efficiency reporting value (MERV)
- Normal temperature and pressure (NTP)
- OpenTherm
- Programmable communicating thermostat
- Programmable thermostat
- Psychrometrics
- Room temperature
- Smart thermostat
- Standard temperature and pressure (STP)
- Thermographic camera
- Thermostat
- Thermostatic radiator valve

Professions, trades, and services

- Architectural acoustics
- Architectural engineering
- Architectural technologist
- Building services engineering
- Building information modeling (BIM)
- Deep energy retrofit
- Duct cleaning
- Duct leakage testing
- Environmental engineering
- Hydronic balancing
- Kitchen exhaust cleaning
- Mechanical engineering
- Mechanical, electrical, and plumbing
- Mold growth, assessment, and remediation
- Refrigerant reclamation
- Testing, adjusting, balancing

Industry organizations	○ AHRI ○ AMCA ○ ASHRAE ○ ASTM International ○ BRE ○ BSRIA ○ CIBSE ○ Institute of Refrigeration ○ IIR ○ LEED ○ SMACNA ○ UMC
Health and safety	○ Indoor air quality (IAQ) ○ Passive smoking ○ Sick building syndrome (SBS) ○ Volatile organic compound (VOC)
See also	○ ASHRAE Handbook ○ Building science ○ Fireproofing ○ Glossary of HVAC terms ○ Warm Spaces ○ World Refrigeration Day ○ Template:Home automation ○ Template:Solar energy

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About Indoor air quality

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An air filter being cleaned

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Part of a series on

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Air pollution from a factory

Air

- Acid rain
- Air quality index
- Atmospheric dispersion modeling
- Chlorofluorocarbon
- Combustion
- Exhaust gas
- Haze
- Global dimming
- Global distillation
- Indoor air quality
- Non-exhaust emissions
- Ozone depletion
- Particulates
- Persistent organic pollutant
- Smog
- Soot
- Volatile organic compound

Biological

- Biological hazard
- Genetic
- Illegal logging
- Introduced species
    - Invasive species

Digital

- Information

Electromagnetic

- Light
    - Ecological
    - Overillumination
- Radio spectrum

Natural

- Ozone
- Radium and radon in the environment
- Volcanic ash
- Wildfire

Noise

- Transportation
- Health effects from noise
- Marine mammals and sonar
- Noise barrier
- Noise control
- Soundproofing

Radiation

- Actinides
- Bioremediation
- Depleted uranium
- Nuclear fission
- Nuclear fallout
- Plutonium
- Poisoning
- Radioactivity
- Uranium
- Radioactive waste

Soil

- Agricultural
- Land degradation
- Bioremediation
- Defecation
- Electrical resistance heating
- Illegal mining
- Soil guideline values
- Phytoremediation

Solid waste

- Advertising mail
- Biodegradable waste
- Brown waste
- Electronic waste
- Foam food container
- Food waste
- Green waste
- Hazardous waste
- Industrial waste
- Litter
- Mining
- Municipal solid waste
- Nanomaterials
- Plastic
- Packaging waste
- Post-consumer waste
- Waste management

Space

- Space debris

Thermal

- Urban heat island

Visual

- Air travel
- Advertising clutter
- Overhead power lines
- Traffic signs
- Urban blight
- Vandalism

War

- Chemical warfare
- Herbicidal warfare
    - Agent Orange
- Nuclear holocaust
    - Nuclear fallout
    - Nuclear famine
    - Nuclear winter
- Scorched earth
- Unexploded ordnance
- War and environmental law

Water

- Agricultural wastewater
- Biosolids
- Diseases
- Eutrophication
- Firewater
- Freshwater
- Groundwater
- Hypoxia
- Industrial wastewater
- Marine
- Monitoring
- Nonpoint source
- Nutrient
- Ocean acidification
- Oil spill
- Pharmaceuticals
- Freshwater salinization
- Septic tanks
- Sewage
- Shipping
- Sludge
- Stagnation
- Sulfur water
- Surface runoff
- Turbidity
- Urban runoff
- Water quality
- Wastewater

Topics

- History
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  - Heavy metals
  - Paint

Misc

- Area source
- Brain health and pollution
- Debris
- Dust
- Garbology
- Legacy
- Midden
- Point source
- Waste
  - Toxic

Lists

- Diseases
- Law by country
- Most polluted cities
- Least polluted cities by PM2.5
- Treaties
- Most polluted rivers

Categories

- By country

- Image not found or type unknown icon Environment portal
- Image not found or type unknown icon Ecology portal

Indoor air quality (**IAQ**) is the air quality within buildings and structures. Poor indoor air quality due to **indoor air pollution** is known to affect the health, comfort, and well-being of building occupants. It has also been linked to sick building syndrome, respiratory issues, reduced productivity, and impaired learning in schools. Common pollutants of indoor air include: secondhand tobacco smoke, air pollutants from indoor combustion, radon, molds and other allergens, carbon monoxide, volatile organic compounds, legionella and other bacteria, asbestos fibers, carbon dioxide,[1] ozone and particulates.

Source control, filtration, and the use of ventilation to dilute contaminants are the primary methods for improving indoor air quality. Although ventilation is an integral component of maintaining good indoor air quality, it may not be satisfactory alone.[2] In scenarios where outdoor pollution would deteriorate indoor air quality, other treatment devices such as filtration may also be necessary.[3]

IAQ is evaluated through collection of air samples, monitoring human exposure to pollutants, analysis of building surfaces, and computer modeling of air flow inside buildings. IAQ is part of indoor environmental quality (IEQ), along with other factors that exert an influence on physical and psychological aspects of life indoors (e.g., lighting, visual quality, acoustics, and thermal comfort).[4]

Indoor air pollution is a major health hazard in developing countries and is commonly referred to as "household air pollution" in that context.[5] It is mostly relating to cooking and heating methods by burning biomass fuel, in the form of wood, charcoal, dung, and crop residue, in indoor environments that lack proper ventilation. Millions of people, primarily women and children, face serious health risks. In total, about three billion people in developing countries are affected by this problem. The World Health Organization (WHO) estimates that cooking-related indoor air pollution causes 3.8 million annual deaths.[6] The Global Burden of Disease study estimated the number of deaths in 2017 at 1.6 million.[7]

Definition

[edit]

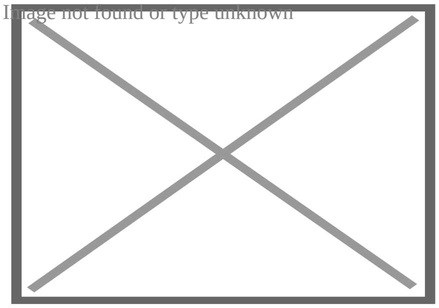
For health reasons it is crucial to breathe clean air, free from chemicals and toxicants as much as possible. It is estimated that humans spend approximately 90% of their lifetime indoors[8] and that indoor air pollution in some places can be much worse than that of the ambient air.[9][10]

Various factors contribute to high concentrations of pollutants indoors, ranging from influx of pollutants from external sources, off-gassing by furniture, furnishings including carpets, indoor activities (cooking, cleaning, painting, smoking, etc. in homes to using office equipment in offices), thermal comfort parameters such as temperature, humidity, airflow and physio-chemical properties of the indoor air.[*citation needed*] Air pollutants can enter a building in many ways, including through open doors or windows. Poorly maintained air conditioners/ventilation systems can harbor mold, bacteria, and other contaminants, which are then circulated throughout indoor spaces, contributing to respiratory problems and allergies.

There have been many debates among indoor air quality specialists about the proper definition of indoor air quality and specifically what constitutes "acceptable" indoor air quality.

Health effects

[edit]



Share of deaths from indoor air pollution. Darker colors mean higher numbers.

IAQ is significant for human health as humans spend a large proportion of their time in indoor environments. Americans and Europeans on average spend approximately 90% of their time indoors.[11][12]

The World Health Organization (WHO) estimates that 3.2 million people die prematurely every year from illnesses attributed to indoor air pollution caused by indoor cooking, with over 237 thousand of these being children under 5. These include around an eighth of all global ischaemic heart disease, stroke, and lung cancer deaths. Overall the WHO estimated that poor indoor air quality resulted in the loss of 86 million healthy life years in 2019.[13]

Studies in the UK and Europe show exposure to indoor air pollutants, chemicals and biological contamination can irritate the upper airway system, trigger or exacerbate asthma and other respiratory or cardiovascular conditions, and may even have carcinogenic effects.[14][15][16][17][18][19]

Poor indoor air quality can cause sick building syndrome. Symptoms include burning of the eyes, scratchy throat, blocked nose, and headaches.[20]

Common pollutants

[edit]

Generated by indoor combustion

[edit]
Main article: Household air pollution
Further information: Energy poverty and cooking

a 3-stone stove

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A traditional wood-fired 3-stone stove in Guatemala, which causes indoor air pollution

Indoor combustion, such as for cooking or heating, is a major cause of indoor air pollution and causes significant health harms and premature deaths. Hydrocarbon fires cause air pollution. Pollution is caused by both biomass and fossil fuels of various types, but some forms of fuels are more harmful than others.

Indoor fire can produce black carbon particles, nitrogen oxides, sulfur oxides, and mercury compounds, among other emissions.[21] Around 3 billion people cook over open fires or on rudimentary cook stoves. Cooking fuels are coal, wood, animal dung, and crop residues.[22] IAQ is a particular concern in low and middle-income countries where such practices are common.[23]

Cooking using natural gas (also called fossil gas, methane gas or simply gas) is associated with poorer indoor air quality. Combustion of gas produces nitrogen dioxide and carbon monixide, and can lead to increased concentrations of nitrogen dioxide throughout the home environment which is linked to respiratory issues and diseases.[24][25]

Carbon monoxide

[edit]
Main article: Carbon monoxide poisoning

One of the most acutely toxic indoor air contaminants is carbon monoxide (CO), a colourless and odourless gas that is a by-product of incomplete combustion. Carbon monoxide may be emitted from tobacco smoke and generated from malfunctioning fuel burning stoves (wood, kerosene, natural gas, propane) and fuel burning heating systems (wood, oil, natural gas) and from blocked flues connected to these appliances.[26] In developed countries the main sources of indoor CO emission come from cooking and heating devices that burn fossil fuels and are faulty, incorrectly installed or poorly maintained.[27] Appliance malfunction may be due to faulty installation or lack of maintenance and proper use.[26] In low- and middle-income countries the most common sources of CO in homes are burning biomass fuels and cigarette smoke.[27]

Health effects of CO poisoning may be acute or chronic and can occur unintentionally or intentionally (self-harm). By depriving the brain of oxygen, acute exposure to carbon monoxide may have effects on the neurological system (headache, nausea, dizziness, alteration in consciousness and subjective weakness), the cardiovascular and respiratory systems (myocardial infarction, shortness of breath, or rapid breathing, respiratory failure). Acute exposure can also lead to long-term neurological effects such as cognitive and behavioural changes. Severe CO poisoning may lead to unconsciousness, coma and death. Chronic exposure to low concentrations of carbon monoxide may lead to lethargy, headaches, nausea, flu-like symptoms and neuropsychological and cardiovascular issues.[28][26]

The WHO recommended levels of indoor CO exposure in 24 hours is 4 mg/m^3.[29] Acute exposure should not exceed 10 mg/m^3 in 8 hours, 35 mg/m^3 in one hour and 100 mg/m^3 in 15 minutes.[27]

Secondhand tobacco smoke

[edit]
Main article: Passive smoking

Secondhand smoke is tobacco smoke which affects people other than the 'active' smoker. It is made up of the exhaled smoke (15%) and mostly of smoke coming from the burning end of the cigarette, known as sidestream smoke (85%).[30]

Secondhand smoke contains more than 7000 chemicals, of which hundreds are harmful to health.[30] Secondhand tobacco smoke includes both a gaseous and a particulate materials which, with particular hazards arising from levels of carbon monoxide and very small particulates (fine particulate matter, especially PM2.5 and PM10) which get into the bronchioles and alveoles in the lung.[31] Inhaling secondhand smoke on multiple occasions can cause asthma, pneumonia, lung cancer, and sudden infant death syndrome, among other conditions.[32]

Thirdhand smoke (THS) refers to chemicals that settle on objects and bodies indoors after smoking. Exposure to thirdhand smoke can happen even after the actual cigarette smoke is not present anymore and affect those entering the indoor environment much later. Toxic substances of THS can react with other chemicals in the air and produce new toxic chemicals that are otherwise not present in cigarettes.[33]

The only certain method to improve indoor air quality as regards secondhand smoke is to eliminate smoking indoors.[34] Indoor e-cigarette use also increases home particulate matter concentrations.[35]

Particulates

[edit]

Atmospheric particulate matter, also known as particulates, can be found indoors and can affect the health of occupants. Indoor particulate matter can come from different indoor sources or be created as secondary aerosols through indoor gas-to-particle reactions. They can also be outdoor particles that enter indoors. These indoor particles vary widely in size, ranging from nanomet (nanoparticles/ultrafine particles emitted from combustion sources) to micromet (resuspensed dust).[36] Particulate matter can also be produced through cooking activities. Frying produces higher concentrations than boiling or grilling and cooking meat produces higher concentrations than cooking vegetables.[37] Preparing a Thanksgiving dinner can produce very high concentrations of particulate matter, exceeding 300 ?g/m^3.[38]

Particulates can penetrate deep into the lungs and brain from blood streams, causing health problems such as heart disease, lung disease, cancer and preterm birth.[39]

Generated from building materials, furnishing and consumer products

[edit]

See also: Building materials and Red List building materials

Volatile organic compounds

[edit]

Volatile organic compounds (VOCs) include a variety of chemicals, some of which may have short- and long-term adverse health effects. There are numerous sources of VOCs indoors, which means that their concentrations are consistently higher indoors (up to ten times higher) than outdoors.[40] Some VOCs are emitted directly indoors, and some are formed through the subsequent chemical reactions that can occur in the gas-phase, or on surfaces.[41][42] VOCs presenting health hazards include benzene, formaldehyde, tetrachloroethylene and trichloroethylene.[43]

VOCs are emitted by thousands of indoor products. Examples include: paints, varnishes, waxes and lacquers, paint strippers, cleaning and personal care products, pesticides, building materials and furnishings, office equipment such as copiers and printers, correction fluids and carbonless copy paper, graphics and craft materials including glues and adhesives, permanent markers, and photographic solutions.[44] Chlorinated drinking water releases chloroform when hot water is used in the home. Benzene is emitted from fuel stored in attached garages.

Human activities such as cooking and cleaning can also emit VOCs.[45][46] Cooking can release long-chain aldehydes and alkanes when oil is heated and terpenes can be released when spices are prepared and/or cooked.[45] Leaks of natural gas from cooking appliances have been linked to elevated levels of VOCs including benzene in homes in the USA.[47] Cleaning products contain a range of VOCs, including monoterpenes, sesquiterpenes, alcohols and esters. Once released into the air, VOCs can undergo reactions with ozone and hydroxyl radicals to produce other VOCs, such as formaldehyde.[46]

Health effects include eye, nose, and throat irritation; headaches, loss of coordination, nausea; and damage to the liver, kidney, and central nervous system.[48]

Testing emissions from building materials used indoors has become increasingly common for floor coverings, paints, and many other important indoor building materials and finishes.[49] Indoor materials such as gypsum boards or carpet act as VOC 'sinks', by trapping VOC vapors for extended periods of time, and releasing them by outgassing. The VOCs can also undergo transformation at the surface through interaction with ozone.[42] In both cases, these delayed emissions can result in chronic and low-level exposures to VOCs.[50]

Several initiatives aim to reduce indoor air contamination by limiting VOC emissions from products. There are regulations in France and in Germany, and numerous voluntary ecolabels and rating systems containing low VOC emissions criteria such as EMICODE,[51] M1,[52] Blue Angel[53] and Indoor Air Comfort[54] in Europe, as well as California Standard CDPH Section 01350[55] and several others in the US. Due to these initiatives an increasing number of low-emitting products became available to purchase.

At least 18 microbial VOCs (MVOCs) have been characterised[56][57] including 1-octen-3-ol (mushroom alcohol), 3-Methylfuran, 2-pentanol, 2-hexanone, 2-heptanone, 3-octanone, 3-octanol, 2-octen-1-ol, 1-octene, 2-pentanone, 2-nonanone, borneol, geosmin, 1-butanol, 3-methyl-1-butanol, 3-methyl-2-butanol, and thujopsene. The last four are products of *Stachybotrys chartarum*, which has been linked with sick building syndrome.[56]

Asbestos fibers

[edit]

Many common building materials used before 1975 contain asbestos, such as some floor tiles, ceiling tiles, shingles, fireproofing, heating systems, pipe wrap, taping muds, mastics, and other insulation materials. Normally, significant releases of asbestos fiber do not occur unless the building materials are disturbed, such as by cutting, sanding, drilling, or building remodelling. Removal of asbestos-containing materials is not always optimal because the fibers can be spread into the air during the removal process. A management program for intact asbestos-containing materials is often recommended instead.

When asbestos-containing material is damaged or disintegrates, microscopic fibers are dispersed into the air. Inhalation of asbestos fibers over long exposure times is associated with increased incidence of lung cancer, mesothelioma, and asbestosis. The risk of lung cancer from inhaling asbestos fibers is significantly greater for smokers. The symptoms of disease do not usually appear until about 20 to 30 years after the first exposure to asbestos.

Although all asbestos is hazardous, products that are friable, e.g. sprayed coatings and insulation, pose a significantly higher hazard as they are more likely to release fibers to the air.[58]

Microplastics

[edit]
Main article: Microplastics
See also: Renovation and Particulates

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Microplastic is a type of airborne particulates and is found to prevail in air.[59][60][61][62] A 2017 study found indoor airborne microfiber concentrations between 1.0 and 60.0 microfibers per cubic meter (33% of which were found to be microplastics).[63] Airborne microplastic dust can be produced during renovation, building, bridge and road reconstruction projects[64] and the use of power tools.[65]

Ozone

[edit]
See also: Ground-level ozone

Indoors ozone (O_3) is produced by certain high-voltage electric devices (such as air ionizers), and as a by-product of other types of pollution. It appears in lower concentrations indoors than outdoors, usually at 0.2-0.7 of the outdoor concentration.[66] Typically, most ozone is lost to surface reactions indoors, rather than to reactions in air, due to the large surface to volume ratios found indoors.[67]

Outdoor air used for ventilation may have sufficient ozone to react with common indoor pollutants as well as skin oils and other common indoor air chemicals or surfaces. Particular concern is warranted when using "green" cleaning products based on citrus or terpene extracts, because these chemicals react very quickly with ozone to form toxic and irritating chemicals[46] as well as fine and ultrafine particles.[68] Ventilation with outdoor air containing elevated ozone concentrations may complicate remediation attempts.[69]

The WHO standard for ozone concentration is 60 ?g/m^3 for long-term exposure and 100 ?g/m^3 as the maximum average over an 8-hour period.[29] The EPA standard for ozone concentration is 0.07 ppm average over an 8-hour period.[70]

Biological agents

[edit]

Mold and other allergens

[edit]
Main articles: Indoor mold and Mold health issues

Occupants in buildings can be exposed to fungal spores, cell fragments, or mycotoxins which can arise from a host of means, but there are two common classes: (a) excess moisture induced growth of mold colonies and (b) natural substances released into the air such as animal dander and plant pollen.[71]

While mold growth is associated with high moisture levels,[72] it is likely to grow when a combination of favorable conditions arises. As well as high moisture levels, these conditions include suitable temperatures, pH and nutrient sources.[73] Mold grows primarily on surfaces, and it reproduces by releasing spores, which can travel and settle in different locations. When these spores experience appropriate conditions, they can germinate and lead to mycelium growth.[74] Different mold species favor different environmental conditions to germinate and grow, some being more hydrophilic (growing at higher levels of relative humidity) and other more xerophilic (growing at levels of relative humidity as low as 75–80%).[74][75]

Mold growth can be inhibited by keeping surfaces at conditions that are further from condensation, with relative humidity levels below 75%. This usually translates to a relative humidity of indoor air below 60%, in agreement with the guidelines for thermal comfort that recommend a relative humidity between 40 and 60 %. Moisture buildup in buildings may arise from water penetrating areas of the building envelope or fabric, from plumbing leaks, rainwater or groundwater penetration, or from condensation due to improper ventilation, insufficient heating or poor thermal quality of the building envelope.[76] Even something as simple as drying clothes indoors on radiators can increase the risk of mold growth, if the humidity produced is not able to escape the building via ventilation.[77]

Mold predominantly affects the airways and lungs. Known effects of mold on health include asthma development and exacerbation,[78] with children and elderly at greater risk of more severe health impacts.[79] Infants in homes with mold have a much greater risk of developing asthma and allergic rhinitis.[80][71] More than half of adult workers in moldy or humid buildings suffer from nasal or sinus symptoms due to mold exposure.[71] Some varieties of mold contain toxic compounds (mycotoxins). However, exposure to hazardous levels of mycotoxin via inhalation is not possible in most cases, as toxins are produced by the fungal body and are not at significant levels in the released spores.

Legionella

[edit]

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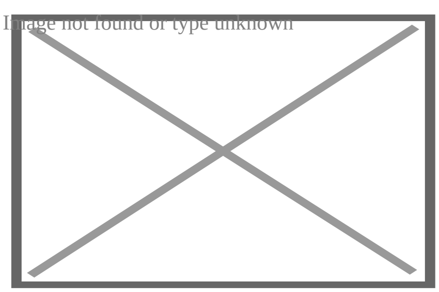
Legionnaires' disease is caused by a waterborne bacterium *Legionella* that grows best in slow-moving or still, warm water. The primary route of exposure is through the creation of an aerosol effect, most commonly from evaporative cooling towers or showerheads. A common source of *Legionella* in commercial buildings is from poorly placed or maintained evaporative cooling towers, which often release water in an aerosol which may enter nearby ventilation intakes. Outbreaks in medical facilities and nursing homes, where patients are immuno-suppressed and immuno-weak, are the most commonly reported cases of Legionellosis. More than one case has involved outdoor fountains at public attractions. The presence of *Legionella* in commercial building water supplies is highly under-reported, as healthy people require heavy exposure to acquire infection.

Legionella testing typically involves collecting water samples and surface swabs from evaporative cooling basins, shower heads, faucets/taps, and other locations where warm water collects. The samples are then cultured and colony forming units (cfu) of Legionella are quantified as cfu/liter.

Legionella is a parasite of protozoans such as amoeba, and thus requires conditions suitable for both organisms. The bacterium forms a biofilm which is resistant to chemical and antimicrobial treatments, including chlorine. Remediation for *Legionella* outbreaks in commercial buildings vary, but often include very hot water flushes (160 °F (71 °C)), sterilisation of standing water in evaporative cooling basins, replacement of shower heads, and, in some cases, flushes of heavy metal salts. Preventive measures include adjusting normal hot water levels to allow for 120 °F (49 °C) at the tap, evaluating facility design layout, removing faucet aerators, and periodic testing in suspect areas.

Other bacteria

[edit]



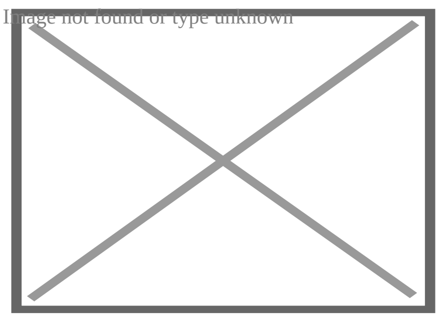
Airborne bacteria

There are many bacteria of health significance found in indoor air and on indoor surfaces. The role of microbes in the indoor environment is increasingly studied using modern gene-based analysis of environmental samples. Currently, efforts are under way to link microbial ecologists and indoor air scientists to forge new methods for analysis and to better interpret the results.[81]

A large fraction of the bacteria found in indoor air and dust are shed from humans. Among the most important bacteria known to occur in indoor air are Mycobacterium tuberculosis, Staphylococcus aureus, Streptococcus pneumoniae.[*citation needed*]

Virus

[edit]



Ninth floor layout of the Metropole Hotel in Hong Kong, showing where an outbreak of the severe acute respiratory syndrome (SARS) occurred

Viruses can also be a concern for indoor air quality. During the 2002–2004 SARS outbreak, virus-laden aerosols were found to have seeped into bathrooms from the bathroom floor drains, exacerbated by the draw of bathroom exhaust fans, resulting in the rapid spread of SARS in Amoy Gardens in Hong Kong.[82][83] Elsewhere in Hong Kong, SARS CoV RNA was found on the carpet and in the air intake vents of the Metropole Hotel, which showed that secondary environmental contamination could generate infectious aerosols and resulted in superspreading events.[84]

Carbon dioxide

[edit]

Humans are the main indoor source of carbon dioxide (CO_2) in most buildings. Indoor CO_2 levels are an indicator of the adequacy of outdoor air ventilation relative to indoor occupant density and metabolic activity.

Indoor CO_2 levels above 500 ppm can lead to higher blood pressure and heart rate, and increased peripheral blood circulation.[85] With CO_2 concentrations above 1000 ppm cognitive performance might be affected, especially when doing complex tasks, making decision making and problem solving slower but not less accurate.[86][87] However, evidence on the health effects of CO_2 at lower concentrations is conflicting and it is difficult to link CO_2 to health impacts at exposures below 5000 ppm – reported health outcomes may be due to the presence of human bioeffluents, and other indoor air pollutants related to inadequate ventilation.[88]

Indoor carbon dioxide concentrations can be used to evaluate the quality of a room or a building's ventilation.[89] To eliminate most complaints caused by CO_2, the total indoor CO_2 level should be reduced to a difference of no greater than 700 ppm above outdoor levels.[90] The National Institute for Occupational Safety and Health (NIOSH) considers that indoor air concentrations of carbon dioxide that exceed 1000 ppm are a marker suggesting inadequate ventilation.[91] The UK standards for schools say that carbon dioxide levels of 800 ppm or lower indicate that the room is well-ventilated.[92] Regulations and standards from around the world show that CO_2 levels below 1000 ppm represent good IAQ, between 1000 and 1500 ppm represent moderate IAQ and greater than 1500 ppm represent poor IAQ.[88]

Carbon dioxide concentrations in closed or confined rooms can increase to 1,000 ppm within 45 minutes of enclosure. For example, in a 3.5-by-4-metre (11 ft × 13 ft) sized office, atmospheric carbon dioxide increased from 500 ppm to over 1,000 ppm within 45 minutes of ventilation cessation and closure of windows and doors.[93]

Radon

[edit]
Main article: Radon

Radon is an invisible, radioactive atomic gas that results from the radioactive decay of radium, which may be found in rock formations beneath buildings or in certain building materials themselves.

Radon is probably the most pervasive serious hazard for indoor air in the United States and Europe. It is a major cause of lung cancer, responsible for 3–14% of cases in countries, leading to tens of thousands of deaths.[94]

Radon gas enters buildings as a soil gas. As it is a heavy gas it will tend to accumulate at the lowest level. Radon may also be introduced into a building through drinking water particularly from bathroom showers. Building materials can be a rare source of radon, but little testing is carried out for stone, rock or tile products brought into building sites; radon accumulation is greatest for well insulated homes.[95] There are simple do-it-yourself kits for radon gas testing, but a licensed professional can also check homes.

The half-life for radon is 3.8 days, indicating that once the source is removed, the hazard will be greatly reduced within a few weeks. Radon mitigation methods include sealing concrete slab floors, basement foundations, water drainage systems, or by increasing ventilation.[96] They are usually cost effective and can greatly reduce or even eliminate the contamination and the associated health risks.[*citation needed*]

Radon is measured in picocuries per liter of air (pCi/L) or becquerel per cubic meter (Bq m^{-3}). Both are measurements of radioactivity. The World Health Organization (WHO) sets the ideal indoor radon levels at 100 Bq/m-^{3}.[97] In the United States, it is recommend to fix homes with radon levels at or above 4 pCi/L. At the same time it is also recommends that people think about fixing their homes for radon levels between 2 pCi/L and 4 pCi/L.[98] In the United Kingdom the ideal is presence of radon indoors is 100 Bq/m-^{3}. Action needs to be taken in homes with 200 Bq/m$^{?3}$ or more.[99]

Interactive maps of radon affected areas are available for various regions and countries of the world.[100][101][102]

IAQ and climate change

[edit]
See also: Effects of climate change on human health

Indoor air quality is linked inextricably to outdoor air quality. The Intergovernmental Panel on Climate Change (IPCC) has varying scenarios that predict how the climate will change in the future.[103] Climate change can affect indoor air quality by increasing the level of outdoor air pollutants such as ozone and particulate matter, for example through emissions from wildfires caused by extreme heat and drought.[104][105] Numerous predictions for how indoor air pollutants will change have been made,[106][107][108][109] and models have attempted to predict how the forecasted IPCC scenarios will vary indoor air quality and indoor comfort parameters such as humidity and temperature.[110]

The net-zero challenge requires significant changes in the performance of both new and retrofitted buildings. However, increased energy efficient housing will trap pollutants inside, whether produced indoors or outdoors, and lead to an increase in human exposure.[111][112]

Indoor air quality standards and monitoring

[edit]

Quality guidelines and standards

[edit]

For occupational exposure, there are standards, which cover a wide range of chemicals, and applied to healthy adults who are exposed over time at workplaces (usually industrial environments).These are published by organisations such as Occupational

Safety and Health Administration (OSHA), the National Institute for Occupational Safety and Health (NIOSH), the UK Health and Safety Executive (HSE).

There is no consensus globally about indoor air quality standards, or health-based guidelines. However, there are regulations from some individual countries and from health organisations. For example, the World Health Organization (WHO) has published health-based global air quality guidelines for the general population that are applicable both to outdoor and indoor air,[29] as well as the WHO IAQ guidelines for selected compounds,[113] whereas the UK Health Security Agency published IAQ guidelines for selected VOCs.[114] The Scientific and Technical Committee (STC34) of the International Society of Indoor Air Quality and Climate (ISIAQ) created an open database that collects indoor environmental quality guidelines worldwide.[115] The database is focused on indoor air quality (IAQ), but is currently extended to include standards, regulations, and guidelines related to ventilation, comfort, acoustics, and lighting.[116][117]

Real-time monitoring

[edit]

Since indoor air pollutants can adversely affect human health, it is important to have real-time indoor air quality assessment/monitoring system that can help not only in the improvement of indoor air quality but also help in detection of leaks, spills in a work environment and boost energy efficiency of buildings by providing real-time feedback to the heating, ventilation, and air conditioning (HVAC) system(s).[118] Additionally, there have been enough studies that highlight the correlation between poor indoor air quality and loss of performance and productivity of workers in an office setting.[119]

Combining the Internet of Things (IoT) technology with real-time IAQ monitoring systems has tremendously gained momentum and popularity as interventions can be done based on the real-time sensor data and thus help in the IAQ improvement.[120]

Improvement measures

[edit]

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See also: Air purifier, Air conditioner, Air filter, Cleanroom, Particulates § Controlling technologies and measures, Pollution control, and Ventilation (architecture)
Further information: Fan (machine), Dehumidifier, and Heater

Indoor air quality can be addressed, achieved or maintained during the design of new buildings or as mitigating measures in existing buildings. A hierarchy of measures has been proposed by the Institute of Air Quality Management. It emphasises removing pollutant sources, reducing emissions from any remaining sources, disrupting pathways between sources and the people exposed, protecting people from exposure to pollutants, and removing people from areas with poor air quality.[121]

A report assisted by the Institute for Occupational Safety and Health of the German Social Accident Insurance can support in the systematic investigation of individual health problems arising at indoor workplaces, and in the identification of practical solutions.[122]

Source control

[edit]

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HVAC design

[edit]

Main articles: HVAC, Air handler, and Ventilation (architecture)

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Environmentally sustainable design concepts include aspects of commercial and residential heating, ventilation and air-conditioning (HVAC) technologies. Among several considerations, one of the topics attended to is the issue of indoor air quality throughout the design and construction stages of a building's life.[*citation needed*]

One technique to reduce energy consumption while maintaining adequate air quality, is demand-controlled ventilation. Instead of setting throughput at a fixed air replacement rate, carbon dioxide sensors are used to control the rate dynamically, based on the emissions of actual building occupants.[*citation needed*]

One way of quantitatively ensuring the health of indoor air is by the frequency of effective turnover of interior air by replacement with outside air. In the UK, for example, classrooms are required to have 2.5 outdoor air changes per hour. In halls, gym, dining, and physiotherapy spaces, the ventilation should be sufficient to limit carbon dioxide to 1,500 ppm. In the US, ventilation in classrooms is based on the amount of outdoor air per occupant plus the amount of outdoor air per unit of floor area, not air changes per hour. Since carbon dioxide indoors comes from occupants and outdoor air, the adequacy of ventilation per occupant is indicated by the concentration indoors minus the concentration outdoors. The value of 615 ppm above the outdoor concentration indicates approximately 15 cubic feet per minute of outdoor air per adult occupant doing sedentary office work where outdoor air contains over 400 ppm[123] (global average as of 2023). In classrooms, the requirements in the ASHRAE standard 62.1, Ventilation for Acceptable Indoor Air Quality, would typically result in about 3 air changes per hour, depending on the occupant density. As the occupants are not the only source of pollutants, outdoor air ventilation may need to be higher when unusual or strong sources of pollution exist indoors.

When outdoor air is polluted, bringing in more outdoor air can actually worsen the overall quality of the indoor air and exacerbate some occupant symptoms related to outdoor air pollution. Generally, outdoor country air is better than indoor city air.[*citation needed*]

The use of air filters can trap some of the air pollutants. Portable room air cleaners with HEPA filters can be used if ventilation is poor or outside air has high level of PM 2.5.[122] Air filters are used to reduce the amount of dust that reaches the wet coils.[*citation needed*] Dust can serve as food to grow molds on the wet coils and ducts and can reduce the efficiency of the coils.[*citation needed*]

The use of trickle vents on windows is also valuable to maintain constant ventilation. They can help prevent mold and allergen build up in the home or workplace. They can also reduce the spread of some respiratory infections.[124]

Moisture management and humidity control requires operating HVAC systems as designed. Moisture management and humidity control may conflict with efforts to conserve energy. For example, moisture management and humidity control requires systems to be set to supply make-up air at lower temperatures (design levels), instead of the higher temperatures sometimes used to conserve energy in cooling-dominated climate conditions. However, for most of the US and many parts of Europe and Japan, during the majority of hours of the year, outdoor air temperatures are cool enough that the air does not need further cooling to provide thermal comfort indoors.[*citation needed*] However, high humidity outdoors creates the need for careful attention to humidity levels indoors. High humidity give rise to mold growth and moisture indoors is associated with a higher prevalence of occupant respiratory problems.[*citation needed*]

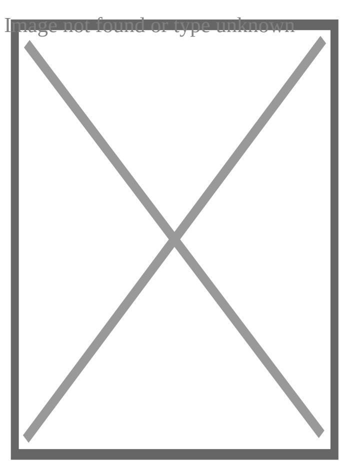
The "dew point temperature" is an absolute measure of the moisture in air. Some facilities are being designed with dew points in the lower 50s °F, and some in the upper and lower 40s °F.[*citation needed*] Some facilities are being designed using desiccant wheels with gas-fired heaters to dry out the wheel enough to get the required dew points.[citation needed] On those systems, after the moisture is removed from the make-up air, a cooling coil is used to lower the temperature to the desired level.[citation needed]

Commercial buildings, and sometimes residential, are often kept under slightly positive air pressure relative to the outdoors to reduce infiltration. Limiting infiltration helps with moisture management and humidity control.

Dilution of indoor pollutants with outdoor air is effective to the extent that outdoor air is free of harmful pollutants. Ozone in outdoor air occurs indoors at reduced concentrations because ozone is highly reactive with many chemicals found indoors. The products of the reactions between ozone and many common indoor pollutants include organic compounds that may be more odorous, irritating, or toxic than those from which they are formed. These products of ozone chemistry include formaldehyde, higher molecular weight aldehydes, acidic aerosols, and fine and ultrafine particles, among others. The higher the outdoor ventilation rate, the higher the indoor ozone concentration and the more likely the reactions will occur, but even at low levels, the reactions will take place. This suggests that ozone should be removed from ventilation air, especially in areas where outdoor ozone levels are frequently high.

Effect of indoor plants

[edit]



Spider plants *(Chlorophytum comosum)* absorb some airborne contaminants.

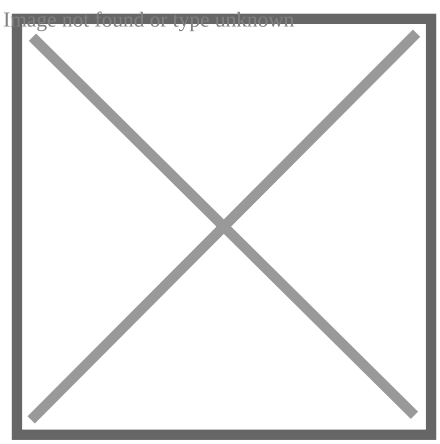
Houseplants together with the medium in which they are grown can reduce components of indoor air pollution, particularly volatile organic compounds (VOC) such as benzene, toluene, and xylene. Plants remove CO_2 and release oxygen and water, although the quantitative impact for house plants is small. The interest in using potted plants for removing VOCs was sparked by a 1989 NASA study conducted in sealed chambers designed to replicate the environment on space stations. However, these results suffered from poor replication[125] and are not applicable to typical buildings, where outdoor-to-indoor air exchange already removes VOCs at a rate that could only be matched by the placement of 10–1000 plants/m^2 of a building's floor space.[126]

Plants also appear to reduce airborne microbes and molds, and to increase humidity.[127] However, the increased humidity can itself lead to increased levels of mold and even VOCs.[128]

Since extremely high humidity is associated with increased mold growth, allergic responses, and respiratory responses, the presence of additional moisture from houseplants may not be desirable in all indoor settings if watering is done inappropriately.[129]

Institutional programs

[edit]



EPA graphic about asthma triggers

The topic of IAQ has become popular due to the greater awareness of health problems caused by mold and triggers to asthma and allergies.

In the US, the Environmental Protection Agency (EPA) has developed an "IAQ Tools for Schools" program to help improve the indoor environmental conditions in educational institutions. The National Institute for Occupational Safety and Health conducts Health Hazard Evaluations (HHEs) in workplaces at the request of employees, authorized representative of employees, or employers, to determine whether any substance normally found in the place of employment has potentially toxic effects, including indoor air quality.[130]

A variety of scientists work in the field of indoor air quality, including chemists, physicists, mechanical engineers, biologists, bacteriologists, epidemiologists, and computer scientists. Some of these professionals are certified by organizations such as the American Industrial Hygiene Association, the American Indoor Air Quality Council and the Indoor Environmental Air Quality Council.

In the UK, under the Department for Environment Food and Rural Affairs, the Air Quality Expert Group considers current knowledge on indoor air quality and provides advice to government and devolved administration ministers.[131]

At the international level, the International Society of Indoor Air Quality and Climate (ISIAQ), formed in 1991, organizes two major conferences, the Indoor Air and the Healthy Buildings series.[132]

See also

[edit]

- Environmental management
- Healthy building
- Indoor bioaerosol
- Microbiomes of the built environment
- Olfactory fatigue

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[edit]

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External links

[edit]

- US Environmental Protection Agency info on IAQ
- Best Practices for Indoor Air Quality when Remodeling Your Home, US EPA
- Addressing Indoor Environmental Concerns During Remodeling, US EPA
- Renovation and Repair, Part of Indoor Air Quality Design Tools for Schools, US EPA
- The 9 Foundations of a Healthy Building, Harvard T.H. Chan School of Public Health

History

Air

- Acid rain
- Air quality index
- Atmospheric dispersion modeling
- Chlorofluorocarbon
- Combustion
  - Biofuel
  - Biomass
  - Joss paper
  - Open burning of waste
- Construction
  - Renovation
- Demolition
- Exhaust gas
  - Diesel exhaust
- Haze
  - Smoke
- Indoor air quality
- Internal combustion engine
- Global dimming
- Global distillation
- Mining
- Ozone depletion
- Particulates
  - Asbestos
  - Metal working
  - Oil refining
  - Wood dust
  - Welding
- Persistent organic pollutant
- Smelting
- Smog
- Soot
  - Black carbon
- Volatile organic compound
- Waste

Biological

- Biological hazard
- Genetic pollution
- Introduced species
  - Invasive species

Digital

- Information pollution

Electromagnetic

- Light
  - Ecological light pollution
  - Overillumination
- Radio spectrum pollution

Natural

- Ozone
- Radium and radon in the environment
- Volcanic ash
- Wildfire

Noise

- Transportation
    - Land
    - Water
    - Air
    - Rail
    - Sustainable transport
- Urban
- Sonar
    - Marine mammals and sonar
- Industrial
- Military
- Abstract
- Noise control

Radiation

- Actinides
- Bioremediation
- Nuclear fission
- Nuclear fallout
- Plutonium
- Poisoning
- Radioactivity
- Uranium
- Electromagnetic radiation and health
- Radioactive waste

Soil

- Agricultural pollution
    - Herbicides
    - Manure waste
    - Pesticides
- Land degradation
- Bioremediation
- Open defecation
- Electrical resistance heating
- Soil guideline values
- Phytoremediation

Solid waste	○ Advertising mail
	○ Biodegradable waste
	○ Brown waste
	○ Electronic waste
	    ○ Battery recycling
	○ Foam food container
	○ Food waste
	○ Green waste
	○ Hazardous waste
	    ○ Biomedical waste
	    ○ Chemical waste
	    ○ Construction waste
	    ○ Lead poisoning
	    ○ Mercury poisoning
	    ○ Toxic waste
	○ Industrial waste
	    ○ Lead smelting
	○ Litter
	○ Mining
	    ○ Coal mining
	    ○ Gold mining
	    ○ Surface mining
	    ○ Deep sea mining
	    ○ Mining waste
	    ○ Uranium mining
	○ Municipal solid waste
	    ○ Garbage
	○ Nanomaterials
	○ Plastic pollution
	    ○ Microplastics
	○ Packaging waste
	○ Post-consumer waste
	○ Waste management
	    ○ Landfill
	    ○ Thermal treatment

Space	○ Satellite
Visual	○ Air travel ○ Clutter (advertising) ○ Traffic signs ○ Overhead power lines ○ Vandalism

War	○ Chemical warfare ○ Herbicidal warfare (Agent Orange) ○ Nuclear holocaust (Nuclear fallout - nuclear famine - nuclear winter) ○ Scorched earth ○ Unexploded ordnance ○ War and environmental law

Water	○ Agricultural wastewater
	○ Biological pollution
	○ Diseases
	○ Eutrophication
	○ Firewater
	○ Freshwater
	○ Groundwater
	○ Hypoxia
	○ Industrial wastewater
	○ Marine
	    ○ debris
	○ Monitoring
	○ Nonpoint source pollution
	○ Nutrient pollution
	○ Ocean acidification
	○ Oil exploitation
	○ Oil exploration
	○ Oil spill
	○ Pharmaceuticals
	○ Sewage
	    ○ Septic tanks
	    ○ Pit latrine
	○ Shipping
	○ Stagnation
	○ Sulfur water
	○ Surface runoff
	○ Thermal
	○ Turbidity
	○ Urban runoff
	○ Water quality

Topics	○ Pollutants
	    ○ Heavy metals
	    ○ Paint
	○ Brain health and pollution

Misc	○ Area source ○ Debris ○ Dust ○ Garbology ○ Legacy pollution ○ Midden ○ Point source ○ Waste
Responses	○ Cleaner production ○ Industrial ecology ○ Pollution haven hypothesis ○ Pollutant release and transfer register ○ Polluter pays principle ○ Pollution control ○ Waste minimisation ○ Zero waste
Lists	○ Diseases ○ Law by country ○ Most polluted cities ○ Least polluted cities by $PM_{2.5}$ ○ Most polluted countries ○ Most polluted rivers ○ Treaties

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Natural resources

Air	Pollution / quality	○ Ambient standards (US) ○ Index ○ Indoor ○ Law ○ Clean Air Act (US) ○ Ozone depletion
	Emissions	○ Airshed ○ Trading ○ Deforestation (REDD)

Energy

- Bio
- Law
- Resources
- Fossil fuels (gas, peak coal, peak gas, peak oil)
- Geothermal
- Hydro
- Nuclear
- Solar
  - sunlight
  - shade
- Wind

Land

- Agricultural
  - arable
    - peak farmland
- Degradation
- Field
- Landscape
  - cityscape
  - seascape
  - soundscape
  - viewshed
- Law
  - property
- Management
  - habitat conservation
- Minerals
  - gemstone
  - industrial
  - ore
    - metal
  - mining
    - law
    - sand
  - peak
    - copper
    - phosphorus
  - rights
- Soil
  - conservation
  - fertility
  - health
  - resilience
- Use
  - planning
  - reserve

Life

- Biodiversity
- Bioprospecting
  - biopiracy
- Biosphere
- Bushfood
- Bushmeat
- Fisheries
  - climate change
  - law
  - management
- Forests
  - genetic resources
  - law
  - management
  - non-timber products
- Game
  - law
- Marine conservation
- Meadow
- Pasture
- Plants
  - FAO Plant Treaty
  - food
  - genetic resources
  - gene banks
  - herbal medicines
  - UPOV Convention
  - wood
- Rangeland
- Seed bank
- Wildlife
  - conservation
  - management

Water

Types / location

- Aquifer
  - storage and recovery
- Drinking
- Fresh
- Groundwater
  - pollution
  - recharge
  - remediation
- Hydrosphere
- Ice
  - bergs
  - glacial
  - polar
- Irrigation
  - *huerta*
- Marine
- Rain
  - harvesting
- Stormwater
- Surface water
- Sewage
  - reclaimed water
- Watershed

Aspects

- Desalination
- Floods
- Law
- Leaching
- Sanitation
  - improved
- Scarcity
- Security
- Supply
- Efficiency
- Conflict
- Conservation
- Peak water
- Pollution
- Privatization
- Quality
- Right
- Resources
  - improved
  - policy

- Commons
  - enclosure
  - global
  - land
  - tragedy of
- Economics
  - ecological
  - land
- Ecosystem services
- Exploitation
  - overexploitation
  - Earth Overshoot Day
- Management
  - adaptive
- Natural capital
  - accounting
  - good
- Natural heritage
- Nature reserve
  - remnant natural area
- Systems ecology
- Urban ecology
- Wilderness

Related

Resource

- Common-pool
- Conflict (perpetuation)
- Curse
- Depletion
- Extraction
- Nationalism
- Renewable / Non-renewable

Politics

- Oil war
- Petrostate
- Resource war

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Occupational safety and health

Occupational diseases and injuries	◦ Acrodynia ◦ Asbestosis ◦ Asthma ◦ Barotrauma ◦ Berylliosis ◦ Brucellosis ◦ Burnout ◦ Byssinosis ("brown lung") ◦ Cardiovascular ◦ Chalicosis ◦ Chronic solvent-induced encephalopathy ◦ Chronic stress ◦ Chimney sweeps' carcinoma ◦ Coalworker's pneumoconiosis ("black lung") ◦ Concussions in sport ◦ Decompression sickness ◦ De Quervain syndrome ◦ Erethism ◦ Exposure to human nail dust ◦ Farmer's lung ◦ Fiddler's neck ◦ Flock worker's lung ◦ Glassblower's cataract ◦ Golfer's elbow ◦ Hearing loss ◦ Hospital-acquired infection ◦ Indium lung ◦ Laboratory animal allergy ◦ Lead poisoning ◦ Low back pain ◦ Mesothelioma ◦ Metal fume fever ◦ Mule spinners' cancer ◦ Noise-induced hearing loss ◦ Phossy jaw ◦ Pneumoconiosis ◦ Radium jaw ◦ Repetitive strain injury ◦ Silicosis ◦ Silo-filler's disease ◦ Sports injury ◦ Surfer's ear ◦ Tennis elbow ◦ Tinnitus ◦ Writer's cramp

Occupational hygiene		◦ Occupational hazard
		    ◦ Biological hazard
		    ◦ Chemical hazard
		    ◦ Physical hazard
		    ◦ Psychosocial hazard
		◦ Occupational stress
		◦ Hierarchy of hazard controls
		◦ Prevention through design
		◦ Exposure assessment
		◦ Occupational exposure limit
		◦ Occupational epidemiology
		◦ Workplace health surveillance

Professions		◦ Environmental health ◦ Industrial engineering ◦ Occupational health nursing ◦ Occupational health psychology ◦ Occupational medicine ◦ Occupational therapist ◦ Safety engineering
Agencies and organizations	**International**	◦ European Agency for Safety and Health at Work ◦ International Labour Organization ◦ World Health Organization
	National	◦ Canadian Centre for Occupational Health and Safety (Canada) ◦ Istituto nazionale per l'assicurazione contro gli infortuni sul lavoro (Italy) ◦ National Institute for Safety and Health at Work (Spain) ◦ Health and Safety Executive (UK) ◦ Occupational Safety and Health Administration ◦ National Institute for Occupational Safety and Health (US)
Standards		◦ Bangladesh Accord ◦ OHSAS 18001 ◦ ISO 45001 ◦ Occupational Safety and Health Convention, 1981 ◦ Worker Protection Standard (US) ◦ Working Environment Convention, 1977

Safety	○ Checklist
	○ Code of practice
	○ Contingency plan
	○ Diving safety
	○ Emergency procedure
	○ Emergency evacuation
	○ Hazard
	○ Hierarchy of hazard controls
	    ○ Hazard elimination
	    ○ Administrative controls
	    ○ Engineering controls
	    ○ Hazard substitution
	    ○ Personal protective equipment
	○ Job safety analysis
	○ Lockout-tagout
	○ Permit To Work
	○ Operations manual
	○ Redundancy (engineering)
	○ Risk assessment
	○ Safety culture
	○ Standard operating procedure

Legislation	○ Immediately dangerous to life or health ○ Diving regulations ○ Occupational Safety and Health Act (United States) ○ Potty parity (United States) ○ Right to sit (United States) ○ Workers' right to access the toilet

See also

- Aerosol
- Break
- Break room
- Drug policy
- Effects of overtime
- Environment, health and safety
- Environmental toxicology
- Ergonomics
- Fire Fighter Fatality Investigation and Prevention Program
- Hawks Nest Tunnel disaster
- Health physics
- Hostile work environment
- Indoor air quality
- International Chemical Safety Card
- Job strain
- National Day of Mourning (Canada)
- NIOSH air filtration rating
- Overwork
- Process safety
- Public health
- Quality of working life
- Risk management
- Safety data sheet
- Source control
- Toxic tort
- Toxic workplace
- Workers' compensation
- Workplace hazard controls for COVID-19
- Workplace health promotion

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  - Occupational diseases
  - Journals
  - Organizations
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Heating, ventilation, and air conditioning

Fundamental concepts	○ Air changes per hour ○ Bake-out ○ Building envelope ○ Convection ○ Dilution ○ Domestic energy consumption ○ Enthalpy ○ Fluid dynamics ○ Gas compressor ○ Heat pump and refrigeration cycle ○ Heat transfer ○ Humidity ○ Infiltration ○ Latent heat ○ Noise control ○ Outgassing ○ Particulates ○ Psychrometrics ○ Sensible heat ○ Stack effect ○ Thermal comfort ○ Thermal destratification ○ Thermal mass ○ Thermodynamics ○ Vapour pressure of water

Technology

- Absorption-compression heat pump
- Absorption refrigerator
- Air barrier
- Air conditioning
- Antifreeze
- Automobile air conditioning
- Autonomous building
- Building insulation materials
- Central heating
- Central solar heating
- Chilled beam
- Chilled water
- Constant air volume (CAV)
- Coolant
- Cross ventilation
- Dedicated outdoor air system (DOAS)
- Deep water source cooling
- Demand controlled ventilation (DCV)
- Displacement ventilation
- District cooling
- District heating
- Electric heating
- Energy recovery ventilation (ERV)
- Firestop
- Forced-air
- Forced-air gas
- Free cooling
- Heat recovery ventilation (HRV)
- Hybrid heat
- Hydronics
- Ice storage air conditioning
- Kitchen ventilation
- Mixed-mode ventilation
- Microgeneration
- Passive cooling
- Passive daytime radiative cooling
- Passive house
- Passive ventilation
- Radiant heating and cooling
- Radiant cooling
- Radiant heating
- Radon mitigation
- Refrigeration
- Renewable heat
- Room air distribution
- Solar air heat
- Solar combisystem
- Solar cooling
- Solar heating

- Air conditioner inverter
- Air door
- Air filter
- Air handler
- Air ionizer
- Air-mixing plenum
- Air purifier
- Air source heat pump
- Attic fan
- Automatic balancing valve
- Back boiler
- Barrier pipe
- Blast damper
- Boiler
- Centrifugal fan
- Ceramic heater
- Chiller
- Condensate pump
- Condenser
- Condensing boiler
- Convection heater
- Compressor
- Cooling tower
- Damper
- Dehumidifier
- Duct
- Economizer
- Electrostatic precipitator
- Evaporative cooler
- Evaporator
- Exhaust hood
- Expansion tank
- Fan
- Fan coil unit
- Fan filter unit
- Fan heater
- Fire damper
- Fireplace
- Fireplace insert
- Freeze stat
- Flue
- Freon
- Fume hood
- Furnace
- Gas compressor
- Gas heater
- Gasoline heater
- Grease duct

Components

- Grille

Measurement and control	○ Air flow meter ○ Aquastat ○ BACnet ○ Blower door ○ Building automation ○ Carbon dioxide sensor ○ Clean air delivery rate (CADR) ○ Control valve ○ Gas detector ○ Home energy monitor ○ Humidistat ○ HVAC control system ○ Infrared thermometer ○ Intelligent buildings ○ LonWorks ○ Minimum efficiency reporting value (MERV) ○ Normal temperature and pressure (NTP) ○ OpenTherm ○ Programmable communicating thermostat ○ Programmable thermostat ○ Psychrometrics ○ Room temperature ○ Smart thermostat ○ Standard temperature and pressure (STP) ○ Thermographic camera ○ Thermostat ○ Thermostatic radiator valve
Professions, trades, and services	○ Architectural acoustics ○ Architectural engineering ○ Architectural technologist ○ Building services engineering ○ Building information modeling (BIM) ○ Deep energy retrofit ○ Duct cleaning ○ Duct leakage testing ○ Environmental engineering ○ Hydronic balancing ○ Kitchen exhaust cleaning ○ Mechanical engineering ○ Mechanical, electrical, and plumbing ○ Mold growth, assessment, and remediation ○ Refrigerant reclamation ○ Testing, adjusting, balancing

Industry organizations	○ AHRI ○ AMCA ○ ASHRAE ○ ASTM International ○ BRE ○ BSRIA ○ CIBSE ○ Institute of Refrigeration ○ IIR ○ LEED ○ SMACNA ○ UMC
Health and safety	○ Indoor air quality (IAQ) ○ Passive smoking ○ Sick building syndrome (SBS) ○ Volatile organic compound (VOC)
See also	○ ASHRAE Handbook ○ Building science ○ Fireproofing ○ Glossary of HVAC terms ○ Warm Spaces ○ World Refrigeration Day ○ Template:Home automation ○ Template:Solar energy

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International	○ FAST
National	○ United States ○ Latvia ○ Israel

About Durham Supply Inc

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Things To Do in Tulsa County

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Oxley Nature Center

4.8 (563)

Photo

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Tours of Tulsa

4.9 (291)

Photo

Philbrook Museum of Art

4.8 (3790)

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Tulsa Botanic Garden

4.7 (1397)

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Tulsa Zoo

4.5 (10482)

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Bob Dylan Center

4.9 (245)

Driving Directions in Tulsa County

Driving Directions From Camp Bow Wow to Durham Supply Inc

Driving Directions From Nights Stay Hotel to Durham Supply Inc

Driving Directions From ALDI to Durham Supply Inc

Driving Directions From Oakwood Homes to Durham Supply Inc

Driving Directions From Reception Jehovah's Witnesses to Durham Supply Inc

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Driving Directions From Gathering Place to Durham Supply Inc

Driving Directions From Bob Dylan Center to Durham Supply Inc

Driving Directions From The Cave House to Durham Supply Inc

Driving Directions From The Tulsa Arts District to Durham Supply Inc

Driving Directions From OkieTundra to Durham Supply Inc

Driving Directions From Oxley Nature Center to Durham Supply Inc

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Reviews for Durham Supply Inc

Durham Supply Inc

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Dennis Champion

(5)

Durham supply and Royal supply seems to find the most helpful and friendly people to work in their stores, we are based out of Kansas City out here for a few remodels and these guys treated us like we've gone there for years.

Durham Supply Inc

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Ty Spears

(5)

Bought a door/storm door combo. Turns out it was the wrong size. They swapped it out, quick and easy no problems. Very helpful in explaining the size differences from standard door sizes.

Durham Supply Inc

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Ethel Schiller

(5)

This place is really neat, if they don't have it they can order it from another of their stores and have it there overnight in most cases. Even hard to find items for a trailer! I definitely recommend this place to everyone! O and the prices is awesome too!

Durham Supply Inc

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B Mann

(5)

I was in need of some items for a double wide that I am remodeling and this place is the only place in town that had what I needed (I didn't even try the other rude place)while I was there I learned the other place that was in Tulsa that also sold mobile home supplies went out of business (no wonder the last time I was in there they were VERY RUDE and high priced) I like the way Dunham does business they answered all my questions and got me the supplies I needed, very friendly, I will be back to purchase the rest of my items when the time comes.

Durham Supply Inc

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Gerald Clifford Brewster

(5)

We will see, the storm door I bought says on the tag it's 36x80, but it's 34x80. If they return it.......they had no problems returning it. And it was no fault of there's, you measure a mobile home door different than a standard door!

Understanding PPE Guidelines for Mobile Home Furnace Repair**View GBP**

Check our other pages :

- **Noting Electrical Hazard Precautions in Mobile Home HVAC Projects**
- **Overcoming Physical Constraints in Legacy Structures**
- **Implementing Airflow Balancing Techniques**
- **Examining Duct Layout for Better Distribution**

Frequently Asked Questions

What are the essential PPE items required for mobile home furnace repair?

Essential PPE for mobile home furnace repair includes safety glasses, gloves, a dust mask or respirator, hearing protection, and steel-toed boots to protect against various hazards like dust, sharp edges, and heavy objects.

Why is it important to wear PPE when repairing a mobile home furnace?

Wearing PPE is crucial for protecting oneself from potential injuries such as cuts, burns, respiratory issues from inhaling dust or chemicals, and other physical hazards encountered during furnace repairs.

What specific risks does PPE address in mobile home HVAC system repairs?

PPE addresses risks such as exposure to airborne particles (dust and insulation fibers), electrical hazards, sharp components within the HVAC system, and potential chemical exposure from refrigerants or cleaners.

How can improper use of PPE affect safety during a furnace repair job?

Improper use of PPE can lead to increased risk of injury by not adequately protecting against hazardous materials or physical dangers present during the repair process. For example, using ill-fitting gloves could result in reduced dexterity and grip.

Are there any regulations governing the use of PPE for HVAC technicians working on mobile homes?

Yes, OSHA provides guidelines that mandate the use of appropriate personal protective equipment based on the specific tasks being performed. Compliance with these regulations ensures both safety and legal adherence during repairs.

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Google Business Profile

Company Website : **https://royal-durhamsupply.com/locations/oklahoma-city-oklahoma/**

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