- **Understanding SEER Ratings for Mobile Home Cooling**
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Minimizing Heat Loss with Insulation for Mobile Home HVAC

How SEER Ratings Impact Energy Efficiency in Mobile Homes

In the quest for energy efficiency and comfort, mobile homeowners often find themselves exploring various strategies to minimize heat loss. One of the most critical components in this endeavor is insulation, particularly when it comes to optimizing the performance of HVAC systems. Insulation plays a pivotal role in enhancing HVAC efficiency by reducing the amount of energy required to maintain a comfortable indoor environment, thus minimizing heat loss and ultimately leading to significant cost savings.

Mobile homes, due to their construction and design, are often more susceptible to temperature fluctuations compared to traditional houses. Professional inspection is necessary before installing a new HVAC unit **mobile home hvac ductwork** inventory. This vulnerability accentuates the need for effective insulation. Proper insulation acts as a thermal barrier that prevents unwanted heat exchange between the interior of a home and its surrounding environment. During colder months, well-insulated walls, floors, and ceilings help retain indoor warmth generated by heating systems. Conversely, during hot weather, insulation helps keep cool air inside by blocking external heat from penetrating living spaces.

The importance of insulation extends beyond mere thermal regulation; it directly impacts the overall efficiency of HVAC systems. When heat loss is minimized through effective insulation, HVAC units do not have to work as hard or run as frequently to maintain desired temperatures. This reduced workload translates into lower energy consumption and increased longevity for HVAC components, as they experience less wear and tear over time.

Additionally, investing in quality insulation can lead to a more consistent distribution of temperature throughout the mobile home. It eliminates cold spots or drafts that can occur in poorly insulated spaces, thereby improving overall comfort for occupants. By maintaining stable indoor temperatures with minimal energy input, homeowners can enjoy an enhanced living experience without incurring excessive utility bills.

In conclusion, insulation is an indispensable element in maximizing HVAC efficiency within mobile homes by minimizing heat loss. Its ability to create a thermal envelope around living spaces ensures that heating and cooling systems operate optimally while conserving energy resources. For mobile homeowners seeking both economic advantages and environmental sustainability, prioritizing proper insulation is not just beneficial-it's essential.

When it comes to maximizing energy efficiency and comfort in mobile homes, insulation plays a pivotal role. Mobile homes, also known as manufactured homes, are particularly susceptible to heat loss due to their construction and materials. Therefore, choosing the right type of insulation is essential for minimizing heat loss and reducing energy costs associated with heating and cooling systems.

One of the most common types of insulation used in mobile homes is fiberglass batt insulation. This type of insulation is favored for its affordability and ease of installation. Fiberglass batts are typically installed between wall studs, floor joists, and ceiling rafters, providing an effective barrier against heat transfer. However, it's important to ensure that these batts are properly fitted without gaps or compression to achieve optimal performance.

Another popular choice for insulating mobile homes is spray foam insulation. Spray foam offers superior thermal resistance compared to traditional fiberglass batts because it forms an airtight seal that minimizes air infiltration. Closed-cell spray foam is particularly effective at resisting moisture and adding structural strength to walls and ceilings. Although more expensive than fiberglass, its high R-value can result in significant energy savings over time.

Reflective or radiant barrier insulation can also be used in mobile homes, especially in warmer climates where keeping heat out during the summer months is crucial. These barriers work by reflecting radiant heat away from living spaces rather than absorbing it like conventional insulation materials. When installed beneath roofing or along exterior walls facing the sun, they can significantly reduce cooling loads on HVAC systems.

For those seeking environmentally friendly options, cellulose insulation provides a sustainable solution made from recycled paper products treated with fire retardants. It boasts excellent soundproofing qualities and can be blown into walls and attics to fill small gaps and voids effectively. Cellulose has a similar R-value to fiberglass but with added environmental benefits.

Lastly, rigid foam board insulation offers high insulating value per inch of thickness and is resistant to moisture damage-a vital consideration for mobile homes which may be exposed to varying weather conditions. These boards can be applied directly under siding or as part of a roof assembly.

In conclusion, selecting the appropriate type of insulation for a mobile home requires considering factors such as climate, budget, environmental impact, and specific areas needing improvement within the home's structure. By investing in quality insulation tailored to your needs, you can greatly enhance your home's energy efficiency while maintaining comfortable indoor temperatures year-round-ultimately leading to reduced reliance on HVAC systems and lower utility bills.

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Choosing the Right SEER Rating for Your Mobile Home HVAC System

In the quest to create energy-efficient living spaces, mobile homes present a unique set of challenges and opportunities. Unlike traditional homes, mobile homes often face issues with heat retention due to their typically thinner walls and less robust construction methods. One of the most effective ways to combat this issue is by installing insulation in the HVAC systems. Properly installed insulation can significantly minimize heat loss, leading to enhanced comfort and reduced energy bills.

The first step in minimizing heat loss through insulation involves selecting the appropriate type of insulation material. Common materials include fiberglass, foam board, and spray foam. Each has its own benefits: fiberglass is cost-effective and easy to install; foam boards offer high insulating value with less thickness; spray foam provides an excellent seal against air leaks but can be more costly. Choosing the right material depends on factors such as budget, climate conditions, and specific areas of installation within the HVAC system.

Once the material selection is complete, attention turns to the technique employed during installation. In mobile homes, where space constraints are common, precision in cutting and fitting insulation is crucial. For ductwork within HVAC systems, ensuring that all joints and seams are tightly sealed is paramount to prevent any air leakage that could contribute to heat loss. This often involves using mastic or foil-backed tape specifically designed for sealing ducts.

Another critical area of focus should be around vents and registers where conditioned air enters rooms from ductwork. These points are frequent culprits for heat escape if not properly insulated or sealed. Installing gaskets or using caulk around these edges can effectively reduce unwanted airflow.

Furthermore, insulating areas around HVAC units themselves-such as furnaces or air handlers-is equally important. Ensuring that these units have adequate surrounding insulation helps maintain their efficiency by reducing thermal exchange between conditioned air inside ducts and unconditioned air in surrounding spaces.

A comprehensive approach would also consider inspecting existing insulation for wear or damage over time-especially given that mobile homes may experience more movement compared to stationary structures which might compromise previously well-installed insulative barriers.

In conclusion, minimizing heat loss through effective insulation techniques requires careful planning and execution tailored specifically for mobile home HVAC systems' unique requirements. By selecting suitable materials and employing precise installation practices focused on eliminating potential leak points across all relevant components-from ductwork seals down vent perimeters-a significant improvement in thermal retention can be achieved ultimately resulting not only in better comfort levels but also financial savings via lower energy consumption costs over time while contributing positively towards environmental sustainability goals by reducing overall carbon footprint associated with heating/cooling operations within residential settings like mobile homes.

Factors Influencing SEER Rating Effectiveness in Mobile Homes

Minimizing heat loss in mobile homes is a crucial aspect of ensuring energy efficiency and comfort. Proper insulation plays an indispensable role in this process, offering numerous benefits that extend beyond mere temperature regulation. In mobile homes, where space is often limited and construction materials may differ from traditional houses, the significance of effective insulation becomes even more pronounced.

One of the primary benefits of minimizing heat loss through proper insulation is the substantial reduction in energy consumption. Mobile homes equipped with high-quality insulation require less energy to maintain a comfortable indoor temperature, whether it be heating during the colder months or cooling when temperatures rise. This increased efficiency translates directly into lower utility bills, providing homeowners with significant savings over time. By investing in adequate insulation materials and techniques, mobile home owners can enjoy these financial benefits while also contributing to environmental sustainability by reducing their carbon footprint.

Beyond cost savings, proper insulation enhances the overall comfort within mobile homes. Insulation acts as a barrier against external weather conditions, preventing drafts and maintaining a consistent indoor climate. This stability not only ensures that residents remain comfortable throughout varying seasons but also reduces the strain on HVAC systems. When heating, ventilation, and air conditioning units are not overworked to compensate for heat loss or gain, they tend to last longer and require less maintenance-a dual advantage for homeowners seeking both comfort and cost-effectiveness.

Moreover, well-insulated mobile homes offer improved air quality by minimizing the infiltration of outdoor pollutants and allergens. Proper sealing and insulating help keep out dust, pollen, and other airborne particles that can compromise indoor air quality. For individuals with allergies or respiratory issues, this benefit can significantly enhance their quality of life.

Another important aspect is noise reduction. High-quality insulation can dampen external noises such as traffic or neighborhood activities-a particularly desirable feature for those living in densely populated areas or near high-traffic zones.

Finally, proper insulation increases the resale value of a mobile home. Prospective buyers are often attracted to properties that promise lower operating costs and enhanced living conditions-qualities ensured by robust insulation solutions.

In conclusion, minimizing heat loss through effective insulation offers myriad benefits for mobile home owners-from reduced energy expenses and heightened comfort levels to improved air quality and noise reduction. As awareness grows regarding these advantages, embracing proper insulation becomes not just an option but an essential consideration for anyone looking to optimize their home's efficiency and value over time.

Comparing SEER Ratings Across Different Mobile Home Cooling Systems

Minimizing heat loss in mobile homes is a pivotal concern for homeowners looking to enhance energy efficiency and maintain comfortable living conditions. Mobile homes, often characterized by their lightweight construction and limited space, present unique challenges when it comes to insulation. However, understanding these common challenges and implementing effective solutions can significantly improve the thermal performance of a mobile home's HVAC system.

One of the primary challenges in insulating mobile homes is their construction material. Many older mobile homes were built with materials that are not inherently good insulators. Thin walls, single-pane windows, and insufficient roofing materials contribute to significant heat loss. Additionally, gaps and seams in the construction can lead to drafts that further exacerbate the problem.

A major solution to this challenge is upgrading insulation throughout the mobile home. This process often begins with assessing existing insulation levels in walls, ceilings, and floors. High-quality spray foam or rigid foam board insulation can be installed to fill cavities and create a solid barrier against heat transfer. These types of insulation are particularly effective because they provide an excellent R-value per inch and help seal gaps through expansion properties.

Furthermore, addressing windows is critical in minimizing heat loss. Replacing single-pane windows with double or triple-pane alternatives can drastically reduce thermal conductivity. For those on a tighter budget, installing storm windows or applying window film can also offer substantial improvements in reducing heat exchange without requiring full replacements.

The roof of a mobile home is another area where considerable heat loss occurs. Adding a layer of reflective roofing material or installing an insulated roof-over system can help reflect solar radiation away during summer months while retaining warmth during winter. Such modifications not only aid in minimizing heat loss but also prolong the lifespan of the roof by protecting it from harsh weather conditions.

Skirting around the base of a mobile home also plays an essential role in maintaining internal temperatures by preventing cold air from circulating underneath the structure. Insulated skirting panels should be used to limit exposure to external temperatures while providing ventilation to avoid moisture build-up which could potentially damage structural components.

Finally, regular maintenance of HVAC systems ensures they operate efficiently within well-insulated environments. Sealing ductwork reduces leaks that allow treated air to escape before reaching its intended destination inside living spaces.

In conclusion, while insulating mobile homes presents several unique challenges due to their design and materials used during construction, there are numerous practical solutions available today that effectively minimize heat loss when correctly implemented alongside efficient HVAC systems management practices.. By investing time into assessing current insulation levels coupled with strategic upgrades such as improved window installations , enhanced roofing solutions ,and better skirting options ,homeowners stand not only benefit from reduced energy bills but also enjoy heightened comfort year-round regardless climate conditions outside .

Tips for Maintaining Optimal Performance of High-SEER Rated Systems

When it comes to maintaining comfortable temperatures in mobile homes, efficient HVAC systems are crucial. However, one of the significant challenges faced by these structures is heat loss, which can lead to increased energy consumption and higher utility bills. Improved insulation within HVAC systems emerges as a cost-effective solution to minimize this heat loss, providing both economic and environmental benefits.

Mobile homes, due to their construction methods and materials, often have less effective thermal barriers compared to traditional houses. This makes them particularly susceptible to heat transfer issues. In winter months, heat escapes more quickly; conversely, in summer months, unwanted heat infiltrates easily. This means that the HVAC system must work harder and longer to maintain desired indoor temperatures, leading to increased wear and tear on the system and elevated energy costs for the homeowner.

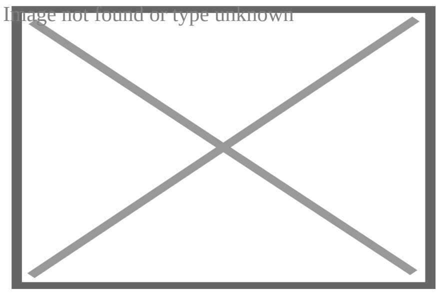
By upgrading insulation in mobile home HVAC systems, these inefficiencies can be significantly reduced. Improved insulation acts as a barrier that minimizes conductive heat flow through walls and ceilings. This not only helps retain warmth during colder months but also keeps interiors cooler during hot weather by reducing the amount of external heat entering the home.

The cost-effectiveness of such upgrades becomes evident when considering both short-term savings on energy bills and long-term benefits like extended lifespan of HVAC equipment due to reduced operational strain. Initial investments in better insulation may seem daunting; however, they typically pay off over time through decreased energy usage. Moreover, many regions offer incentives or rebates for homeowners who choose energy-efficient upgrades-further enhancing the financial viability of improved insulation.

Beyond individual savings, there is a broader environmental impact worth considering. Energy efficiency reduces reliance on fossil fuels used in power generation, thus lowering greenhouse gas emissions. For communities looking towards sustainable living practices, improving insulation aligns with broader goals of reducing carbon footprints while promoting responsible resource use.

In conclusion, enhancing insulation within mobile home HVAC systems represents a smart investment for those seeking cost-effective ways to combat heat loss. It provides immediate economic advantages through lower energy bills and offers long-term benefits by protecting HVAC components from premature failure. Additionally, this approach supports environmental stewardship by contributing to reduced energy consumption overall-a win-win situation for both homeowners and the planet alike.

About Indoor air quality



An air filter being cleaned

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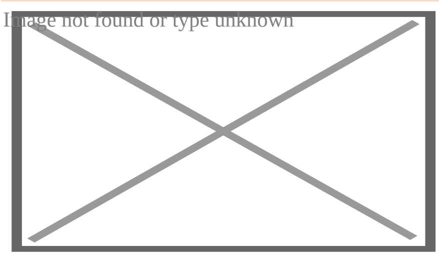


Air pollution from a factory

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
- Pollutants
    - 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]

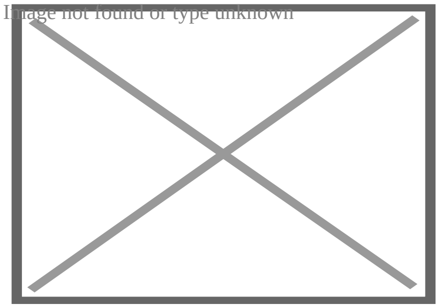
For health reasons it is crucial to breathe clean air, free from chemicals and toxicants as much as possible. It is estimated that humans spend approximately 90% of their lifetime indoors[8] and that indoor air pollution in some places can be much worse than that of the ambient air.[9][10]

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]

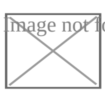
While mold growth is associated with high moisture levels,[72] it is likely to grow when a combination of favorable conditions arises. As well as high moisture levels, these conditions include suitable temperatures, pH and nutrient sources.[73] Mold grows primarily on surfaces, and it reproduces by releasing 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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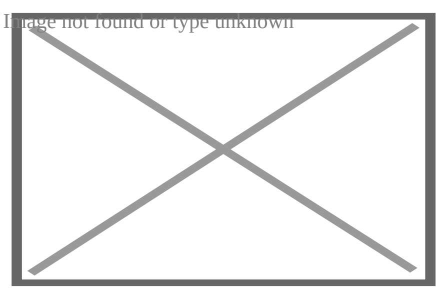
Legionnaires' disease is caused by a waterborne bacterium *Legionella* that grows best in slow-moving or still, warm water. The primary route of exposure is through the creation of an aerosol effect, most commonly from evaporative cooling towers or showerheads. A common source of *Legionella* in commercial 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]



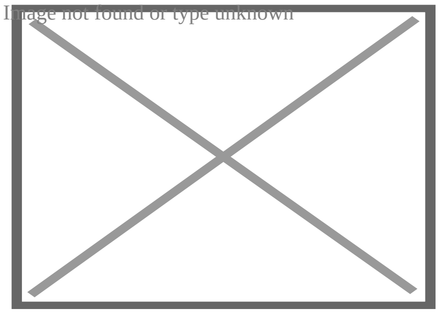
Airborne bacteria

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

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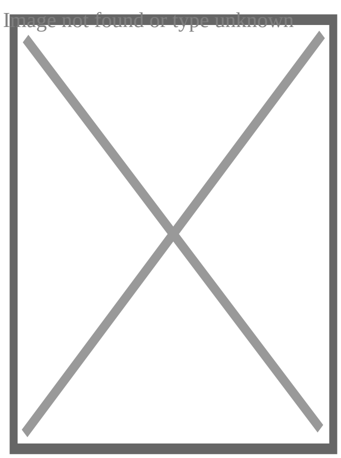

Spider plants *(Chlorophytum comosum)* absorb some airborne contaminants.

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

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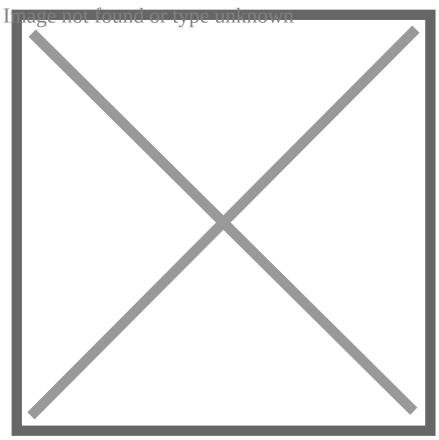

EPA graphic about asthma triggers

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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Further reading

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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

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Pollution

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

Electromapagnetic

- 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

<table>
<tr><td>Solid waste</td><td>

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

</td></tr>
<tr><td>Space</td><td>
Satellite
</td></tr>
<tr><td>Visual</td><td>

Air travel
Clutter (advertising)
Traffic signs
Overhead power lines
Vandalism

</td></tr>
</table>

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

<table>
<tr><td>Occupational hygiene</td><td colspan="2">

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
</td></tr>
<tr><td>Professions</td><td colspan="2">

Environmental health
Industrial engineering
Occupational health nursing
Occupational health psychology
Occupational medicine
Occupational therapist
Safety engineering
</td></tr>
<tr><td rowspan="2">Agencies and organizations</td><td>International</td><td>

European Agency for Safety and Health at Work
International Labour Organization
World Health Organization
</td></tr>
<tr><td>National</td><td>

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)
</td></tr>
<tr><td>Standards</td><td colspan="2">

Bangladesh Accord
OHSAS 18001
ISO 45001
Occupational Safety and Health Convention, 1981
Worker Protection Standard (US)
Working Environment Convention, 1977
</td></tr>
</table>

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

- Image not found or type unknown **Category**
  - Occupational diseases
  - Journals
  - Organizations
- Image not found or type unknown **Commons**

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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

- 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

	○ 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
Measurement and control	
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 Energy consumption

For electric consumption, see Electric energy consumption.

Energy consumption is the amount of energy used.[1]

Biology

[edit]

In the body, energy consumption is part of energy homeostasis. It derived from food energy. Energy consumption in the body is a product of the basal metabolic rate and the physical activity level. The physical activity level are defined for a non-pregnant, non-lactating adult as that person's total energy expenditure (TEE) in a 24-hour period, divided by his or her basal metabolic rate (BMR):[2]

\displaystyle \textPAL=\frac \textTEE/24h\textBMR

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Demographics

[edit]

Topics related to energy consumption in a demographic sense are:

- World energy supply and consumption
- Domestic energy consumption
- Electric energy consumption

Effects of energy consumption

[edit]

- Environmental impact of the energy industry
    - Climate change
- White's law

Reduction of energy consumption

[edit]

- Energy conservation, the practice of decreasing the quantity of energy used
- Efficient energy use

See also

[edit]

- Energy efficiency
- Energy efficiency in transport
- Electricity generation
- Energy mix
- Energy policy
- Energy transformation

References

[edit]

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2. **^** *"Human energy requirements: Principles and Definitions". Report of a Joint FAO/WHO/UNU Expert Consultation. Food and Agriculture Organization of the United Nations. 2004. Retrieved 2009-10-15.*

External links

[edit]

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Wikibooks has a book on the topic of: ***How to reduce energy usage***

- Image not found or type unknown Media related to Energy consumption at Wikimedia Commons
- World energy consumption per capita per country

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Energy

- History
- Index
- Outline

Fundamental concepts

- Conservation of energy
- Energetics
- Energy
  - Units
- Energy condition
- Energy level
- Energy system
- Energy transformation
- Energy transition
- Mass
  - Negative mass
  - Mass–energy equivalence
- Power
- Thermodynamics
  - Enthalpy
  - Entropic force
  - Entropy
  - Exergy
  - Free entropy
  - Heat capacity
  - Heat transfer
  - Irreversible process
  - Isolated system
  - Laws of thermodynamics
  - Negentropy
  - Quantum thermodynamics
  - Thermal equilibrium
  - Thermal reservoir
  - Thermodynamic equilibrium
  - Thermodynamic free energy
  - Thermodynamic potential
  - Thermodynamic state
  - Thermodynamic system
  - Thermodynamic temperature
  - Volume (thermodynamics)
  - Work

Types	◦ Binding
	    ◦ Nuclear
	◦ Chemical
	◦ Dark
	◦ Elastic
	◦ Electric potential energy
	◦ Electrical
	◦ Gravitational
	    ◦ Binding
	◦ Interatomic potential
	◦ Internal
	◦ Ionization
	◦ Kinetic
	◦ Magnetic
	◦ Mechanical
	◦ Negative
	◦ Phantom
	◦ Potential
	◦ Quantum chromodynamics binding energy
	◦ Quantum fluctuation
	◦ Quantum potential
	◦ Quintessence
	◦ Radiant
	◦ Rest
	◦ Sound
	◦ Surface
	◦ Thermal
	◦ Vacuum
	◦ Zero-point

Energy carriers

- Battery
- Capacitor
- Electricity
- Enthalpy
- Fuel
  - Fossil
  - Oil
- Heat
  - Latent heat
- Hydrogen
  - Hydrogen fuel
- Mechanical wave
- Radiation
- Sound wave
- Work

Primary energy

- Bioenergy
- Fossil fuel
  - Coal
  - Natural gas
  - Petroleum
- Geothermal
- Gravitational
- Hydropower
- Marine
- Nuclear fuel
  - Natural uranium
- Radiant
- Solar
- Wind

Energy system components	◦ Biomass
	◦ Electric power
	◦ Electricity delivery
	◦ Energy engineering
	◦ Fossil fuel power station
	    ◦ Cogeneration
	    ◦ Integrated gasification combined cycle
	◦ Geothermal power
	◦ Hydropower
	    ◦ Hydroelectricity
	    ◦ Tidal power
	    ◦ Wave farm
	◦ Nuclear power
	    ◦ Nuclear power plant
	    ◦ Radioisotope thermoelectric generator
	◦ Oil refinery
	◦ Solar power
	    ◦ Concentrated solar power
	    ◦ Photovoltaic system
	◦ Solar thermal energy
	    ◦ Solar furnace
	    ◦ Solar power tower
	◦ Wind power
	    ◦ Airborne wind energy
	    ◦ Wind farm

- Efficient energy use
  - Agriculture
  - Computing
  - Transport
- Energy conservation
- Energy consumption
- Energy policy
  - Energy development
- Energy security
- Energy storage
- Renewable energy
- Sustainable energy
- World energy supply and consumption
- Africa
- Asia
- Australia
- Canada
- Europe
- Mexico
- South America
- United States

Use and supply

- Carbon footprint
- Energy democracy
- Energy recovery
- Energy recycling
- Jevons paradox
- Waste-to-energy
  - Waste-to-energy plant

Misc.

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About Durham Supply Inc

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Things To Do in Oklahoma County

Photo

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USS Oklahoma Anchor Memorial

5 (15)

Photo

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Route 66 Park

4.6 (756)

Photo

Martin Park Nature Center

4.7 (2457)

Photo

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Centennial Land Run Monument

4.8 (811)

Photo

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Oklahoma City Zoo

4.5 (14305)

Photo

Oklahoma City's Adventure District

4.2 (37)

Driving Directions in Oklahoma County

Driving Directions From Texas Roadhouse to Durham Supply Inc

Driving Directions From Bob Moore Ford to Durham Supply Inc

Driving Directions From Oklahoma City to Durham Supply Inc

Driving Directions From Central Oklahoma City to Durham Supply Inc

Driving Directions From Residence Inn Oklahoma City South to Durham Supply Inc

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Driving Directions From National Cowboy & Western Heritage Museum to Durham Supply Inc

Driving Directions From Model T Graveyard to Durham Supply Inc

Driving Directions From Sanctuary Asia to Durham Supply Inc

Driving Directions From Lighthouse to Durham Supply Inc

Driving Directions From Oklahoma City National Memorial & Museum to Durham Supply Inc

Driving Directions From Bricktown Water Taxi to Durham Supply Inc

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97.4774449!2d35.3963954!3e2

Reviews for Durham Supply Inc

Durham Supply Inc

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Jennifer Williamson

(5)

First we would like to thank you for installing our air conditioning unit! I'd like to really brag about our technician, Mack, that came to our home to install our unit in our new home. Mack was here for most of the day and throughly explained everything we had a question about. By the late afternoon, we had cold air pumping through our vents and we couldn't have been more thankful. I can tell you, I would be very lucky to have a technician like Mack if this were my company. He was very very professional, kind, and courteous. Please give Mack a pat on the back and stay rest assured that Mack is doing a great job and upholding your company name! Mack, if you see this, great job!! Thanks for everything you did!! We now have a new HVAC company in the event we need one. We will also spread the word to others!!

Durham Supply Inc

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Crystal Dawn

(1)

I would give 0 stars. This isnTHE WORST company for heating and air. I purchased a home less than one year ago and my ac has gone out twice and these people refuse to repair it although I AM UNDER WARRANTY!!!! They say it's an environmental issue and they can't fix it or even try to or replace my warrantied air conditioning system.

Durham Supply Inc

Image not found or type unknown

K Moore

(1)

No service after the sale. I purchased a sliding patio door and was given the wrong size sliding screen door. After speaking with the salesman and manager several times the issue is still not resolved and, I was charged full price for an incomplete door. They blamed the supplier for all the issues…and have offered me nothing to resolve this.

Durham Supply Inc

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Noel Vandy

(5)

Thanks to the hard work of Randy our AC finally got the service it needed. These 100 degree days definitely feel long when your house isn't getting cool anymore. We were so glad when Randy came to work on the unit, he had all the tools and products he needed with him and it was all good and running well when he left. With a long drive to get here and only few opportunities to do so, we are glad he got it done in 1 visit. Now let us hope it will keep running well for a good while.

Durham Supply Inc

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Salest

(5)

Had to make a quick run for 2 sets of ?? door locks for front and back door.. In/ out in a quick minute! They helped me right away. ?? Made sure the 2 sets had the same ? keys. The ? bathroom was clean and had everything I needed. ? ?. Made a quick inquiry about a random item... they quickly looked it up and gave me pricing. Great ? job ?

Minimizing Heat Loss with Insulation for Mobile Home HVAC**View GBP**

Check our other pages :

- **Choosing Thermostat Controls for Better Mobile Home Efficiency**
- **Minimizing Heat Loss with Insulation for Mobile Home HVAC**
- **Exploring Common Certifications Required for Mobile Home HVAC Service**

Frequently Asked Questions

What types of insulation materials are most effective for reducing heat loss in mobile home HVAC systems?

The most effective insulation materials for minimizing heat loss in mobile homes include fiberglass batts, spray foam, and rigid foam panels. Fiberglass batts are cost-effective and easy to install, while spray foam offers excellent air sealing properties but can be more expensive. Rigid foam panels provide high R-values with a thinner profile, making them suitable for tight spaces.

How can I identify areas in my mobile home where additional insulation is needed to improve HVAC efficiency?

To identify areas needing extra insulation, perform an energy audit or use a thermal imaging camera to detect cold spots. Common areas requiring attention include windows and doors, attics or roof cavities, underneath the floor (especially if the mobile home is elevated), and any uninsulated walls.

What steps should I take to ensure proper installation of insulation to minimize heat loss effectively?

Proper installation involves sealing all gaps and cracks with caulk or weatherstripping before adding insulation. Ensure that the chosen material fits snugly without compressing it too much as this reduces its effectiveness. Pay close attention to areas around ducts, pipes, and electrical outlets to prevent air leakage. Additionally, consider professional help for installing complex materials like spray foam.

Royal Supply Inc

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State : OK

Zip : 73149

Address : Unknown Address

Google Business Profile

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

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