



- **Selecting Appropriate Multimeters for HVAC Checks**
Selecting Appropriate Multimeters for HVAC Checks Maintaining HVAC Gauges for Accurate Readings Choosing Coil Cleaners Suited to Household Needs Comparing Protective Gloves for Different Tasks Identifying Goggles Designed for Refrigerant Handling Using Screwdriver Sets for Precise Adjustments Organizing Toolkits for Efficient Site Visits Calibrating Equipment for Reliable Measurements Handling Harmful Chemicals with Proper Ventilation Safely Storing Extra HVAC Parts and Supplies Dressing for Extreme Temperatures during Repairs Assessing Essential Items for Emergency Calls
- **Examining Pollutants Affecting Air Circulation**
Examining Pollutants Affecting Air Circulation Improving Vent Placement for Even Distribution Managing Excess Humidity with Simple Techniques Using UV Lights to Minimize Microbial Growth Testing Indoor Air Quality with Basic Tools Filtering Particulates through Electrostatic Options Checking Fan Speed for Consistent Comfort Controlling Airflow Patterns across Different Rooms Maintaining Clear Ducts for Cleaner Breathing Spaces Exploring Optional Dehumidifiers for Damp Areas Balancing Comfort and Efficiency in Vent Adjustments Assessing Long Term Effects of Poor Air Quality
- **About Us**



Maintaining HVAC systems in mobile homes is crucial for ensuring comfort and energy efficiency. A key component of this maintenance involves the use of HVAC gauges to obtain accurate readings, which help in diagnosing and optimizing the performance of these systems. Understanding the types of HVAC gauges commonly used can empower homeowners and technicians to keep their systems running smoothly.

One of the primary types of HVAC gauges used in mobile homes is the manifold gauge set.

This tool is indispensable for measuring the pressure of refrigerants within an air conditioning system. It typically consists of two types of gauges: a low-pressure gauge (also known as a compound gauge) and a high-pressure gauge. The low-pressure gauge measures both pressures below atmospheric pressure (vacuum) and positive pressures, while the high-pressure gauge measures only positive pressures. Technicians need training specific to mobile home HVAC systems **mobile home hvac system** pump. These readings are essential for charging or evacuating refrigerant accurately, ensuring that the system operates efficiently without leaks or overcharging.

Digital gauges are another prevalent type used in modern HVAC maintenance. Unlike traditional analog manifold sets, digital gauges provide highly accurate readings with digital precision, reducing human error associated with reading dial needles. They often come with additional features such as temperature sensors and data logging capabilities, which enable technicians to record data over time for analysis. This feature is particularly useful in mobile homes where space constraints demand optimal performance from every appliance.

Additionally, vacuum gauges play a vital role during the installation or servicing phases by measuring how well an air conditioning system has been evacuated before charging new refrigerant into it. An appropriately evacuated system ensures that no moisture or non-condensable gases remain inside, which could otherwise lead to inefficiencies or damage over time.

Finally, some technicians might employ micron gauges when dealing with very precise vacuum measurements required by certain advanced systems or specific service protocols. These gauges measure vacuums at a much finer scale than standard vacuum gauges, offering detailed insight into system conditions.

In conclusion, maintaining accurate readings from HVAC gauges is fundamental to ensuring efficient operation within mobile homes' constrained environments. Whether using analog manifold sets for basic pressure measurements or leveraging advanced digital technologies for precise diagnostics, each type plays an integral role in safeguarding home comfort and

prolonging equipment lifespan through effective maintenance practices. Regular calibration and proper handling of these tools further enhance their reliability and accuracy-ultimately contributing to more comfortable living spaces in any season.

Maintaining the accuracy of HVAC gauges is critical for ensuring optimal system performance and energy efficiency. Routine inspection procedures are essential to uphold this accuracy, which in turn guarantees reliable readings and effective HVAC maintenance. These procedures not only safeguard the longevity of the equipment but also help prevent costly repairs and inefficient operation.

First and foremost, regular calibration is a cornerstone of maintaining gauge accuracy. Over time, even the most high-quality gauges can drift from their initial settings due to wear and tear or environmental factors. Calibration involves comparing the readings of a gauge against a known standard to identify any discrepancies. By scheduling periodic calibrations, technicians can ensure that these instruments provide precise measurements, which are crucial for diagnosing system issues accurately.

Visual inspections play a significant role as well. Technicians should routinely examine gauges for physical damage or signs of wear such as cracks, corrosion, or leaks in pressure connections. Such defects can lead to inaccurate readings or complete gauge failure if left unattended. Moreover, checking for secure connections between gauges and their respective ports helps avoid false readings caused by leaks or misalignments.

Cleaning is another vital aspect of routine inspection procedures. Dust, grime, and other environmental contaminants can accumulate on and around gauges over time. This buildup can obscure readings or interfere with the mechanics of analog gauges. Regularly cleaning these components with appropriate solutions ensures that they remain in good working order and provides clear visibility for accurate data interpretation.

Additionally, understanding the operational limits of each gauge is crucial during inspections. Technicians must be aware of the maximum pressure ratings and temperature ranges specific to each device to prevent overuse that could lead to permanent damage or inaccuracies in measurements.

Documentation forms an integral part of routine inspection procedures as well. Keeping detailed records of all inspections, calibrations, repairs, and replacements provides a

comprehensive history that informs future maintenance decisions. This documentation helps track performance trends over time and identifies potential recurring issues before they escalate.

In conclusion, routine inspection procedures for ensuring gauge accuracy are indispensable in maintaining HVAC systems' integrity and efficiency. Through regular calibration, visual inspections, cleaning practices, adherence to operational limits, and meticulous documentation, technicians can ensure that HVAC gauges continue to provide accurate readings necessary for optimal system performance. Investing time in these practices pays off by enhancing equipment reliability while minimizing downtime and unnecessary expenses associated with faulty diagnostics or operations based on inaccurate data.

Posted by on

Posted by on

Types of Measurements Required in Mobile Home HVAC Checks

Maintaining HVAC gauges for accurate readings is a crucial aspect of ensuring the efficiency and longevity of heating, ventilation, and air conditioning systems. At the heart of this maintenance lies the practice of cleaning and calibration techniques, which are pivotal for optimal gauge performance. These tasks, often overlooked, are essential in preventing erroneous data that could lead to improper system adjustments, energy inefficiencies, or even costly repairs.

Cleaning HVAC gauges involves more than just a superficial wipe down. Over time, dust, debris, and other environmental contaminants can accumulate on gauge surfaces and within their mechanisms. This buildup can obscure readings or interfere with the delicate components inside the gauges. Therefore, regular cleaning using appropriate materials—such as microfiber cloths that do not scratch surfaces and mild cleaning agents—is essential. For analogue gauges with moving parts, careful disassembly may be necessary to access all areas where dirt might gather. In doing so, technicians must ensure that no part is damaged or improperly reassembled.

Calibration is another critical component in maintaining gauge accuracy. Even high-quality gauges can drift over time due to mechanical wear or exposure to varying environmental conditions such as temperature fluctuations or pressure changes. Calibration involves adjusting the gauge back to its original specifications by comparing it against a standard reference known for its precision. This process ensures that any deviation from true readings is corrected.

The calibration procedure can vary depending on whether the gauge is digital or analogue. Digital gauges often come with built-in calibration functions but may require specialized software or hardware interfaces for precise adjustments. Analogue gauges might require manual tweaks using tools like screwdrivers or wrenches to fine-tune their settings.

Regular training in proper cleaning and calibration techniques should be provided to HVAC technicians as part of their ongoing professional development. Understanding how to maintain these instruments not only enhances their technical skills but also underscores their role in promoting energy efficiency and system reliability.

In conclusion, while maintaining HVAC systems encompasses many tasks, focusing on cleaning and calibrating gauges should never be underestimated. These practices not only safeguard accurate readings but also contribute significantly to the overall health of HVAC systems, ensuring they operate efficiently and effectively for years to come. By adhering to meticulous maintenance protocols for gauges, professionals uphold standards of excellence that benefit both consumers and service providers alike.



Comparing Digital vs Analog Multimeters for HVAC Use

Maintaining accurate HVAC gauges is essential for ensuring the proper functioning of heating, ventilation, and air conditioning systems in mobile homes. These compact living spaces often rely heavily on their HVAC systems to provide comfort in varying climates, making it crucial that the gauges used to monitor these systems are functioning correctly. Troubleshooting

common issues with HVAC gauges can help prevent larger problems down the line and ensure that mobile home residents enjoy a comfortable living environment.

One of the most frequent issues encountered with HVAC gauges is inaccurate readings. This can stem from several sources, including calibration errors, physical damage to the gauge, or even environmental factors like extreme temperatures or humidity levels. To maintain the accuracy of these instruments, regular calibration checks should be conducted. Calibration ensures that the gauge's measurements align with standard references and can help identify any deviations before they lead to misdiagnoses of system problems.

Another common issue is related to gauge leaks. Over time, wear and tear or improper installation can result in leaks within the gauge itself or at connection points. These leaks not only compromise the accuracy of readings but also pose safety risks due to potential refrigerant exposure. Regular inspections for signs of wear or damage can prevent leaks from developing into more severe problems. Ensuring that all connections are tight and secure during routine maintenance checks can also mitigate this risk.

Additionally, obstructions in the pressure lines connected to HVAC gauges can cause erratic readings or complete malfunctions. Dust, debris, or even moisture accumulation within these lines may obstruct normal operation. Regularly cleaning these components and ensuring they are free from blockages will help maintain consistent gauge performance.

Environmental factors unique to mobile homes can also impact HVAC gauge accuracy. Mobile homes often experience more significant temperature fluctuations than stationary houses due to less insulation and different building materials. Exposure to direct sunlight or cold drafts can alter a gauge's performance if it is not properly shielded or insulated. Installing protective covers or relocating gauges away from extreme conditions can help preserve their accuracy over time.

Ultimately, maintaining HVAC gauges in mobile homes involves a combination of regular inspection, timely repairs, and preventive measures against environmental stressors. By addressing common issues such as inaccurate readings, leaks, obstructions, and environmental impacts promptly, homeowners and technicians alike can ensure that their HVAC systems operate efficiently year-round. This attention to detail not only extends the life of the equipment but also enhances energy efficiency and maintains indoor comfort—an invaluable benefit for anyone residing in a mobile home.

Safety Considerations When Using Multimeters in Mobile Homes

Maintaining HVAC gauges for accurate readings is an essential practice for any technician aiming to ensure optimal performance and longevity of HVAC systems. These devices serve as the eyes through which professionals can assess the pressure, temperature, and overall functioning of heating, ventilation, and air conditioning units. As such, handling and storing them with care is crucial not only for preserving their accuracy but also for extending their lifespan.

Firstly, it is important to recognize the significance of cleanliness when dealing with HVAC gauges. Dust and debris can easily interfere with the sensitive components of these instruments. Therefore, technicians should routinely wipe down the gauges with a soft cloth or use compressed air to remove any particles that might have settled on them during usage. This simple act helps prevent contamination that could distort readings or damage internal mechanisms.

Equally critical is ensuring that these gauges are calibrated regularly. Over time, even minor bumps or shifts in temperature can lead to inaccuracies in measurement. A well-calibrated gauge ensures precision in readings, which directly impacts the efficiency and safety of HVAC operations. Technicians should follow manufacturers' recommendations or industry standards regarding calibration intervals to maintain reliability.

Proper storage conditions are another vital aspect of maintaining HVAC gauges. When not in use, they should be stored in a clean, dry environment where they are protected from extreme temperatures and humidity levels that could degrade their components. Ideally, they should be kept in protective cases to shield them from physical impact during transportation or storage.

Another best practice involves handling these tools with care during operation. Avoid dropping or knocking them against hard surfaces as this can lead to mechanical failure or misalignment within the gauge itself. When attaching gauges to system fittings, ensure connections are secure yet not overly tight as excessive force can damage both the fitting and the gauge.

Additionally, technicians should be vigilant about inspecting hoses and connectors attached to their gauges before each use. Cracks or leaks in these parts can result in inaccurate pressure readings or complete failure of the gauge system altogether. Regular inspection allows for timely replacement of worn-out components before they cause significant issues.

Lastly, education plays a pivotal role in effectively maintaining HVAC gauges. Technicians must stay informed about new technologies and methodologies related to gauge usage and maintenance through continuous learning opportunities such as workshops or online courses offered by professional organizations within the industry.

In conclusion, best practices for storing and handling HVAC gauges revolve around cleanliness, regular calibration, proper storage conditions, careful handling during operation, diligent inspection of associated components, and ongoing education about advancements in technology and techniques within the field. By adhering to these guidelines consistently over time-technicians will not only safeguard their equipment but also enhance their ability to deliver accurate diagnostics-which ultimately contributes towards improved service delivery across all aspects related thereto involving heating ventilation air conditioning systems alike ensuring customer satisfaction above all else while fostering trustworthiness among clientele served thereby promoting business growth organically without compromise whatsoever therein entailed necessarily so forthwith assuredly always thusly likewise indeed verily so!





Recommended Brands and Models for HVAC Multimeters

In the realm of modern living, where energy efficiency and indoor comfort are more than just luxuries, maintaining accurate HVAC gauge readings holds paramount importance. Heating, Ventilation, and Air Conditioning (HVAC) systems are integral to creating comfortable indoor environments while managing energy consumption. The precision of gauge readings directly influences these aspects, underscoring the need for regular maintenance and calibration.

Accurate gauge readings ensure that an HVAC system operates at its optimal performance level. Gauges provide critical information about pressure levels, refrigerant charge, and temperature differentials within the system. When these readings are accurate, they enable technicians to diagnose issues promptly and make informed decisions regarding repairs or adjustments. This not only prevents small problems from escalating into costly breakdowns but also ensures that the system runs efficiently, consuming less energy.

Energy efficiency is a significant concern in today's world as we face increasing environmental challenges and rising energy costs. An inefficient HVAC system can result in excessive energy consumption, leading to higher utility bills and a larger carbon footprint. Accurate gauge readings help maintain proper refrigerant levels and ensure that all components function harmoniously. This optimizes the energy used by the system to heat or cool spaces effectively without unnecessary wastage.

Moreover, precise gauge readings contribute significantly to indoor comfort—a key element of quality living environments. Whether it's sweltering summer heat or biting winter cold, a well-calibrated HVAC system provides consistent temperature control throughout a building. It maintains humidity levels within desirable ranges and ensures adequate ventilation—all crucial factors for occupant comfort and health.

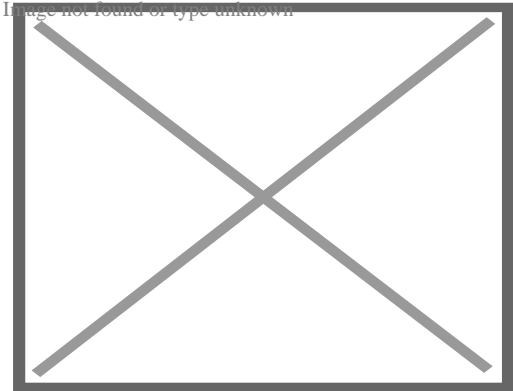
Regular maintenance of HVAC gauges involves inspecting them for signs of wear or damage and recalibrating them periodically. Over time, gauges can drift from their original settings due to mechanical stressors or external factors like vibrations. By routinely checking these instruments against known standards, technicians can correct any discrepancies before they adversely affect the entire system's operation.

Furthermore, advancements in digital technology have introduced sophisticated sensors that offer real-time monitoring capabilities for HVAC systems. These innovations not only enhance accuracy but also facilitate predictive maintenance practices—anticipating potential failures before they occur based on data analytics rather than reactive measures after issues arise.

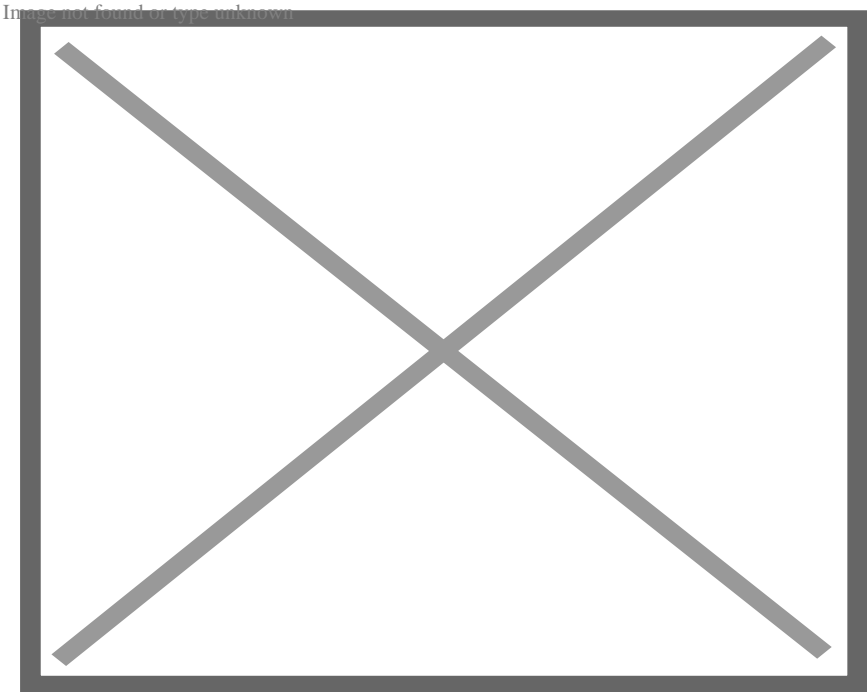
In conclusion, maintaining accurate HVAC gauge readings is indispensable for achieving both energy efficiency and indoor comfort—a dual objective vital in contemporary residential and commercial settings alike. Through diligent upkeep practices including regular inspection and calibration alongside embracing technological advancements when appropriate—we can ensure our heating/cooling systems deliver optimum performance with minimal environmental impact while maximizing user satisfaction across diverse climates worldwide!

About Air pollution

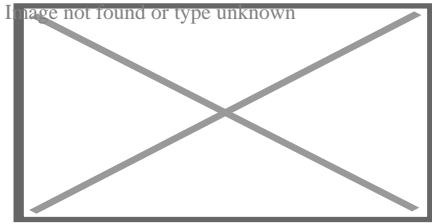
"Bad air quality" and "Air quality" redirect here. For the obsolete medical theory, see Miasma theory. For the measurement of air pollution, see Air quality index. For the qualities of air, see Atmosphere of Earth.



Air pollution from a coking oven



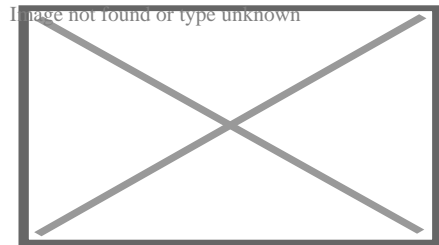
2016 Environmental Performance Index – darker colors indicate lower concentrations of fine particulate matter and nitrogen dioxide, as well as better indoor air quality.



Deaths from air pollution per 100,000 inhabitants (IHME, 2019)

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Part of a series on



Air pollution from a factory



- 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

-
-  Environment portal
 -  Ecology portal
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Part of a series on

Weather

Temperate and polar seasons

- Winter
- Spring
- Summer
- Autumn

Tropical seasons

- Dry season
 - Harmattan
- Wet season

Storms

- Cloud
 - Cumulonimbus cloud
 - Arcus cloud
- Downburst
 - Microburst
 - Heat burst
 - Derecho
- Lightning
 - Volcanic lightning
- Thunderstorm
 - Air-mass thunderstorm
 - Thundersnow
 - Dry thunderstorm
- Mesocyclone
 - Supercell
- Tornado
 - Anticyclonic tornado
 - Landspout
 - Waterspout
- Dust devil
- Fire whirl
- Anticyclone
- Cyclone
- Polar low
- Extratropical cyclone
 - European windstorm
 - Nor'easter
- Subtropical cyclone
- Tropical cyclone
 - Atlantic hurricane
 - Typhoon
- Storm surge
- Dust storm
 - Simoom
 - Haboob
- Monsoon
 - Amihan
- Gale
- Sirocco
- Firestorm
- Winter storm
 - Ice storm
 - Blizzard
 - Ground blizzard
 - Snow squall

Precipitation

- Drizzle
 - Freezing
- Graupel
- Hail
 - Megacryometeor
- Ice pellets
- Diamond dust
- Rain
 - Freezing
- Cloudburst
- Snow
 - Rain and snow mixed
 - Snow grains
 - Snow roller
 - Slush

Topics

- Air pollution
- Atmosphere
 - Chemistry
 - Convection
 - Physics
 - River
- Climate
- Cloud
 - Physics
- Fog
 - Mist
 - Season
- Cold wave
- Heat wave
- Jet stream
- Meteorology
- Severe weather
 - List
 - Extreme
 - Severe weather terminology
 - Canada
 - Japan
 - United States
- Weather forecasting
- Weather modification

Glossaries

- Meteorology
- Climate change
- Tornado terms
- Tropical cyclone terms

Weather portal

Air pollution is the contamination of air due to the presence of substances called pollutants in the atmosphere that are harmful to the health of humans and other living beings, or cause damage to the climate or to materials.^[1] It is also the contamination of the indoor or outdoor environment either by chemical, physical, or biological agents that alters the natural features of the atmosphere.^[1] There are many different types of air pollutants, such as gases (including ammonia, carbon monoxide, sulfur dioxide, nitrous oxides, methane and chlorofluorocarbons), particulates (both organic and inorganic) and biological molecules. Air pollution can cause diseases, allergies, and even death to humans; it can also cause harm to other living organisms such as animals and crops, and may damage the natural environment (for example, climate change, ozone depletion or habitat degradation) or built environment (for example, acid rain).^[2] Air pollution can be caused by both human activities^[3] and natural phenomena.^[4]

Air quality is closely related to the Earth's climate and ecosystems globally. Many of the contributors of air pollution are also sources of greenhouse emission i.e., burning of fossil fuel.^[1]

Air pollution is a significant risk factor for a number of pollution-related diseases, including respiratory infections, heart disease, chronic obstructive pulmonary disease (COPD), stroke, and lung cancer.^[5] Growing evidence suggests that air pollution exposure may be associated with reduced IQ scores, impaired cognition,^[6] increased risk for psychiatric disorders such as depression^[7] and detrimental perinatal health.^[8] The human health effects of poor air quality are far reaching, but principally affect the body's respiratory system and the cardiovascular system.^[9]^[10] Individual reactions to air pollutants depend on the type of pollutant a person is exposed to,^[11]^[12] the degree of exposure, and the individual's health status and genetics.^[13]

Air pollution is the largest environmental risk factor for disease and premature death^[5] ^[14] and the fourth largest risk factor overall for human health.^[15] Air pollution causes the premature deaths of around 7 million people worldwide each year,^[5] or a global mean loss of life expectancy (LLE) of 2.9 years,^[16] and there has been no significant change in the number of deaths caused by all forms of pollution since at least 2015.^[14] ^[17]^[18] Outdoor air pollution attributable to fossil fuel use alone causes ~3.61 million

deaths annually,^[19] making it one of the top contributors to human death.^[5] Anthropogenic ozone causes around 470,000 premature deaths a year and fine particulate (PM_{2.5}) pollution around another 2.1 million.^[20] The scope of the air pollution crisis is large: In 2018, WHO estimated that "9 out of 10 people breathe air containing high levels of pollutants."^[21] Although the health consequences are extensive, the way the problem is handled is considered largely haphazard^[22]^[21]^[23] or neglected.^[14]

The World Bank has estimated that welfare losses (premature deaths) and productivity losses (lost labour) caused by air pollution cost the world economy \$5 trillion per year.^[24]^[25]^[26] The costs of air pollution are generally an externality to the contemporary economic system and most human activity, although they are sometimes recovered through monitoring, legislation, and regulation.^[27]^[28]

Many different technologies and strategies are available for reducing air pollution.^[29] Although a majority of countries have air pollution laws, according to UNEP, 43 percent of countries lack a legal definition of air pollution, 31 percent lack outdoor air quality standards, 49 percent restrict their definition to outdoor pollution only, and just 31 percent have laws for tackling pollution originating from outside their borders.^[30] National air quality laws have often been highly effective, notably the 1956 Clean Air Act in Britain and the US Clean Air Act, introduced in 1963.^[31]^[32] Some of these efforts have been successful at the international level, such as the Montreal Protocol,^[33] which reduced the release of harmful ozone depleting chemicals, and the 1985 Helsinki Protocol,^[34] which reduced sulfur emissions,^[35] while others, such as international action on climate change,^[36]^[37]^[38] have been less successful.

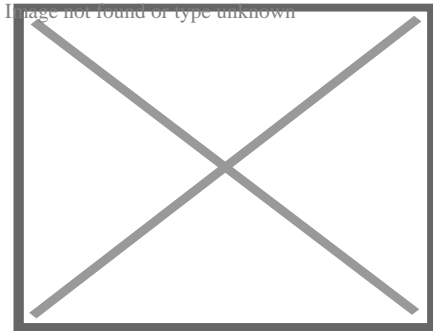
Sources of air pollution

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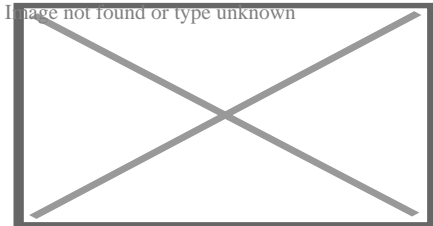
There are many different sources of air pollution. Some air pollutants (such as nitrogen oxides) originate mainly from human activities,^[39] while some (notably radon gas) come mostly from natural sources.^[40] However, many air pollutants (including dust and sulfur dioxide) come from a mixture of natural and human sources.^[41]

Anthropogenic (human-made) sources

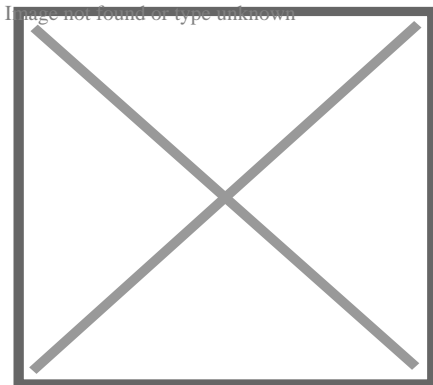
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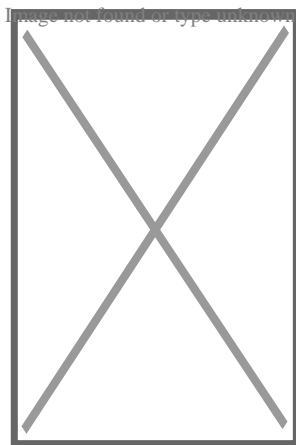
Demolition of the cooling towers of a power station, Athlone, Cape Town, South Africa, 2010



Controlled burning of a field outside of Statesboro, Georgia, US, in preparation for spring planting



Smoking of fish over an open fire in Ghana, 2018



Burning of joss paper in a Chinese temple in Hong Kong

- Stationary sources include:
 - fossil-fuel power plants and biomass power plants both have smoke stacks (see for example environmental impact of the coal industry)^[42]
 - Oil and gas sites that have methane leaks^{[43][44][45][46]}
 - burning of traditional biomass such as wood, crop waste and dung. (In developing and poor countries,^[47] traditional biomass burning is the major source of air pollutants.^{[48][49]} It is also the main source of particulate pollution in many developed areas including the UK & New South Wales.^[50]^[51] Its pollutants include PAHs.^[52])
 - manufacturing facilities (factories)^[53]
 - a 2014 study found that in China equipment-, machinery-, and devices-manufacturing and construction sectors contributed more than 50% of air pollutant emissions.^[54]^[better source needed] This high emission is due to high emission intensity and high emission factors in its industrial structure.^[55]
 - construction^{[56][57]}
 - renovation^[58]
 - waste incineration (incinerators as well as open and uncontrolled fires of mismanaged waste, making up about a fourth of municipal solid terrestrial waste)^{[59][60]}
 - furnaces and other types of fuel-burning heating devices^[61]
- Mobile sources include motor vehicles, trains (particularly diesel locomotives and DMUs), marine vessels and aircraft^[62] as well as rockets and re-entry of components and debris.^[63] The air pollution externality of cars enters the air from the exhaust gas and car tires (including microplastics^[64]). Road vehicles make a significant amount of all air pollution (typically, for example, around a third to a half of all nitrogen dioxide emissions)^{[65][66][67]} and are a major driver of climate change.^{[68][69]}
- Agriculture and forest management strategies using controlled burns. Practices like slash-and-burn in forests like the Amazon cause large air pollution with the deforestation.^[70] Controlled or prescribed burning is a practice used in forest management, agriculture, prairie restoration, and greenhouse gas reduction.^[71] Foresters can use controlled fire as a tool because fire is a natural feature of both forest and grassland ecology.^{[72][73]} Controlled burning encourages the sprouting of some desirable forest trees, resulting in a forest renewal.^[74]

There are also sources from processes other than combustion:

- Fumes from paint, hair spray, varnish, aerosol sprays and other solvents. These can be substantial; emissions from these sources was estimated to account for almost half of pollution from volatile organic compounds in the Los Angeles basin in the 2010s.^[75]

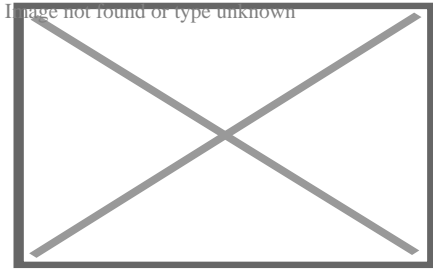
- Waste deposition in landfills produces methane^[76] and open burning of waste releases harmful substances.^[77]
- Nuclear weapons, toxic gases, germ warfare, and rocketry are examples of military resources.^[78]
- Agricultural emissions and emissions from meat production or livestock contribute substantially to air pollution^{[79][80]}
 - Fertilized farmland may be a major source of nitrogen oxides.^[81]

Mean acidifying emissions (air pollution) of different foods per 100g of protein^[82]

Food Types	Acidifying Emissions (g SO₂eq per 100g protein)
Beef	343.6
Cheese	165.5
Pork	142.7
Lamb and mutton	139.0
Farmed crustaceans	133.1
Poultry	102.4
Farmed fish	65.9
Eggs	53.7
Groundnuts	22.6
Peas	8.5
Tofu	6.7

Natural sources

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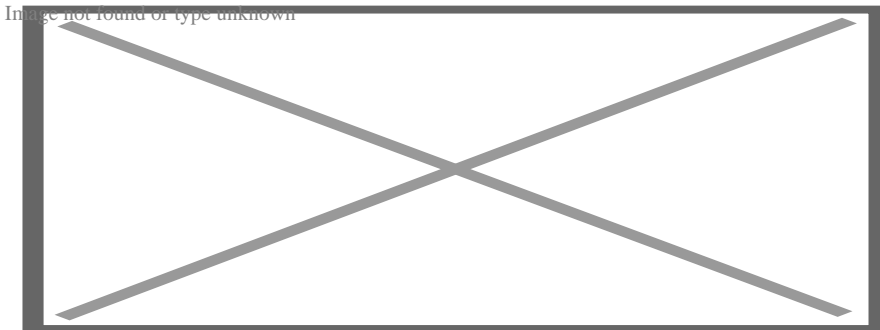
Dust storm approaching Stratford, Texas, in 1935

- Dust from natural sources, usually large areas of land with little or no vegetation.
- Methane, emitted by the digestion of food by animals, for example cattle.
- Radon gas from radioactive decay within the Earth's crust. Radon is a colorless, odorless, naturally occurring, radioactive noble gas that is formed from the decay of radium. It is considered to be a health hazard. Radon gas from natural sources can accumulate in buildings, especially in confined areas such as the basement and it is the second most frequent cause of lung cancer, after cigarette smoking.
- Smoke and carbon monoxide from wildfires. During periods of active wildfires, smoke from uncontrolled biomass combustion can make up almost 75% of all air pollution by concentration.^[83]
- Vegetation, in some regions, emits environmentally significant amounts of volatile organic compounds (VOCs) on warmer days. These VOCs react with primary anthropogenic pollutants – specifically, NO_x , SO_2 , and anthropogenic organic carbon compounds – to produce a seasonal haze of secondary pollutants.^[84] Black gum, poplar, oak and willow are some examples of vegetation that can produce abundant VOCs. The VOC production from these species result in ozone levels up to eight times higher than the low-impact tree species.^[85]
- Volcanic activity, which produces sulfur, chlorine, and ash particulates.^[86]

Emission factors

[edit]

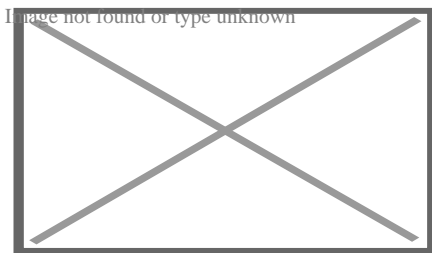
Main article: AP 42 Compilation of Air Pollutant Emission Factors



Beijing air in 2005 after rain (left) and a smoggy day (right)

Air pollutant emission factors are reported representative values that aim to link the quantity of a pollutant released into the ambient air to an activity connected with that pollutant's release.^{[2][87][88][89]} The weight of the pollutant divided by a unit weight, volume, distance, or time of the activity generating the pollutant is how these factors are commonly stated (e.g., kilograms of particulate emitted per tonne of coal burned). These criteria make estimating emissions from diverse sources of pollution easier. Most of the time, these components are just averages of all available data of acceptable quality, and they are thought to be typical of long-term averages.

The Stockholm Convention on Persistent Organic Pollutants identified pesticides and other persistent organic pollutants of concern. These include dioxins and furans which are unintentionally created by combustion of organics, like open burning of plastics, and are endocrine disruptors and mutagens.



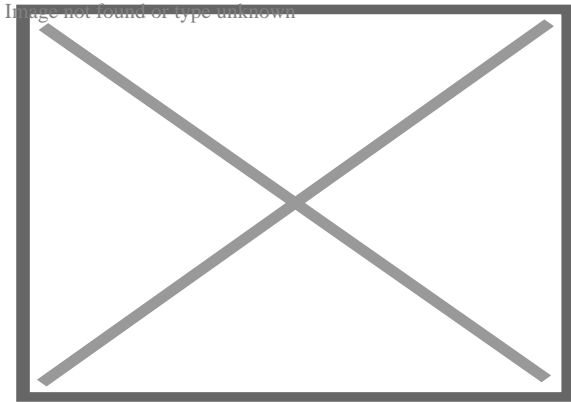
E-waste processing in Agbogbloshie, Ghana, using open-burning of electronics to access valuable metals like copper. Open burning of plastics is common in many parts of the world without the capacity for processing. Especially without proper protections, heavy metals and other contaminants can seep into the soil, and create water pollution and air pollution.

The United States Environmental Protection Agency has published a compilation of air pollutant emission factors for a wide range of industrial sources.^[90] The United Kingdom, Australia, Canada, and many other countries have published similar compilations, as well as the European Environment Agency.^{[91][92][93][94]}

Pollutants

[edit]

Main articles: Pollutant and Greenhouse gas emissions



Schematic drawing, causes and effects of air pollution: (1) greenhouse effect, (2) particulate contamination, (3) increased UV radiation, (4) acid rain, (5) increased ground-level ozone concentration, (6) increased levels of nitrogen oxides

An air pollutant is a material in the air that can have many effects on humans and the ecosystem.^[95] The substance can be solid particles, liquid droplets, or gases, and often takes the form of an aerosol (solid particles or liquid droplets dispersed and carried by a gas).^[96] A pollutant can be of natural origin or man-made. Pollutants are classified as primary or secondary. Primary pollutants are usually produced by processes such as ash from a volcanic eruption.

Other examples include carbon monoxide gas from motor vehicle exhausts or sulfur dioxide released from factories. Secondary pollutants are not emitted directly. Rather, they form in the air when primary pollutants react or interact. Ground level ozone is a prominent example of a secondary pollutant. Some pollutants may be both primary and secondary: they are both emitted directly and formed from other primary pollutants.

Primary pollutants

[edit]



This section is in list format but may read better as prose. You can help by converting this section, if appropriate. Editing help is available. *(April 2023)*

Pollutants emitted into the atmosphere by human activity include:

- Ammonia: Emitted mainly by agricultural waste. Ammonia is a compound with the formula NH_3 . It is normally encountered as a gas with a characteristic pungent odor. Ammonia contributes significantly to the nutritional needs of terrestrial organisms by serving as a precursor to foodstuffs and fertilizers. Ammonia, either directly or indirectly, is also a building block for the synthesis of many pharmaceuticals. Although in wide use, ammonia is both caustic and hazardous. [

^{97]} In the atmosphere, ammonia reacts with oxides of nitrogen and sulfur to form secondary particles.^[98]

- Carbon dioxide (CO₂): Carbon dioxide is a natural component of the atmosphere, essential for plant life and given off by the human respiratory system.^[99] It is potentially lethal at very high concentrations (typically 100 times "normal" atmospheric levels).^{[100][101]} Although the World Health Organization recognizes CO₂ as a climate pollutant, it does not include the gas in its *Air Quality Guidelines* or set recommended targets for it.^[102] Because of its role as a greenhouse gas, CO₂ has been described as "the worst climate pollutant".^[103] Statements such as this refer to its long-term atmospheric effects rather than shorter-term effects on such things as human health, food crops, and buildings. This question of terminology has practical consequences, for example, in determining whether the U.S. Clean Air Act (which is designed to improve air quality) is deemed to regulate CO₂ emissions.^[104] That issue was resolved in the United States by the Inflation Reduction Act of 2022, which specifically amended the Clean Air Act "to define the carbon dioxide produced by the burning of fossil fuels as an 'air pollutant.'"^[105] CO₂ currently forms about 410 parts per million (ppm) of Earth's atmosphere, compared to about 280 ppm in pre-industrial times,^[106] and billions of metric tons of CO₂ are emitted annually by burning of fossil fuels.^[107] CO₂ increase in Earth's atmosphere has been accelerating.^[108] CO₂ is an asphyxiant gas and not classified as toxic or harmful in general.^[109] Workplace exposure limits exist in places like UK (5,000 ppm for long-term exposure and 15,000 ppm for short-term exposure).^[101] Natural disasters like the limnic eruption at Lake Nyos can result in a sudden release of huge amount of CO₂ as well.^[110]
- Carbon monoxide (CO): CO is a colorless, odorless, toxic gas.^[111] It is a product of combustion of fuel such as natural gas, coal or wood. Vehicular exhaust contributes to the majority of carbon monoxide let into the atmosphere. It creates a smog type formation in the air that has been linked to many lung diseases and disruptions to the natural environment and animals.
- Chlorofluorocarbons (CFCs): Emitted from goods that are now prohibited from use; harmful to the ozone layer. These are gases emitted by air conditioners, freezers, aerosol sprays, and other similar devices. CFCs reach the stratosphere after being released into the atmosphere.^[112] They interact with other gases here, causing harm to the ozone layer. UV rays are able to reach the Earth's surface as a result of this. This can result in skin cancer, eye problems, and even plant damage.^[113]
- Nitrogen oxides (NO_x): Nitrogen oxides, particularly nitrogen dioxide, are expelled from high temperature combustion, and are also produced during thunderstorms by electric discharge. They can be seen as a brown haze dome above or a plume downwind of cities. Nitrogen dioxide is a chemical compound with the formula NO₂. It is one of several nitrogen oxides. One of the most prominent air pollutants, this reddish-brown toxic gas has a characteristic sharp, biting odor.

- Odors: Such as from garbage, sewage, and industrial processes.
- Particulate matter/particles (PM), also known as particulates, atmospheric particulate matter (APM), or fine particles, are microscopic solid or liquid particles suspended in a gas.^[114] Aerosol is a mixture of particles and gas. Volcanoes, dust storms, forest and grassland fires, living plants, and sea spray are all sources of particles. Aerosols are produced by human activities such as the combustion of fossil fuels in automobiles, power plants, and numerous industrial processes.^[115] Averaged worldwide, anthropogenic aerosols – those made by human activities – currently account for approximately 10% of the atmosphere. Increased levels of fine particles in the air are linked to health hazards such as heart disease,^[116] altered lung function and lung cancer. Particulates are related to respiratory infections and can be particularly harmful to those with conditions like asthma.^[117]
- Persistent organic pollutants, which can attach to particulates. Persistent organic pollutants are organic compounds that are resistant to environmental degradation due to chemical, biological, or photolytic processes (POPs). As a result, they've been discovered to survive in the environment, be capable of long-range transmission, bioaccumulate in human and animal tissue, biomagnify in food chains, and pose a major threat to human health and the ecosystem.^[118]
- Persistent free radicals connected to airborne fine particles are linked to cardiopulmonary disease.^{[119][120]}
- Polycyclic Aromatic Hydrocarbons (PAHs): a group of aromatic compounds formed from the incomplete combustion of organic compounds including coal and oil and tobacco.^[121]
- Radioactive pollutants: Produced by nuclear explosions, nuclear events, war explosives, and natural processes such as the radioactive decay of radon.
- Sulfur oxides (SO_x): particularly sulfur dioxide, a chemical compound with the formula SO₂. SO₂ is produced by volcanoes and in various industrial processes. Coal and petroleum often contain sulfur compounds, and their combustion generates sulfur dioxide. Further oxidation of SO₂, usually in the presence of a catalyst such as NO₂, forms H₂SO₄, and thus acid rain is formed. This is one of the causes for concern over the environmental impact of the use of these fuels as power sources.
- Toxic metals, such as lead and mercury, especially their compounds.
- Volatile organic compounds (VOC): VOCs are both indoor and outdoor air pollutants.^[122] They are categorized as either methane (CH₄) or non-methane (NMVOCs). Methane is an extremely efficient greenhouse gas which contributes to enhanced global warming. Other hydrocarbon VOCs are also significant greenhouse gases because of their role in creating ozone and prolonging the life of methane in the atmosphere. This effect varies depending on local air quality. The aromatic NMVOCs benzene, toluene and xylene are suspected carcinogens and may lead to leukemia with prolonged exposure. 1,3-butadiene is another dangerous compound often associated with industrial use.

Secondary pollutants

[edit]

Secondary pollutants include:

- Ground level ozone (O_3): Ozone is created when NO_x and VOCs mix. It is a significant part of the troposphere.^[123] It's also an important part of the ozone layer, which can be found in different sections of the stratosphere. Photochemical and chemical reactions involving it fuel many of the chemical activities that occur in the atmosphere during the day and night. It is a pollutant and a component of smog that is produced in large quantities as a result of human activities (mostly the combustion of fossil fuels).^[124] O_3 is largely produced by chemical reactions involving NO_x gases (nitrogen oxides, especially from combustion) and volatile organic compounds in the presence of sunlight. Due to the influence of temperature and sunlight on this reaction, high ozone levels are most common on hot summer afternoons.^[125]
- Peroxyacetyl nitrate ($C_2H_3NO_5$): similarly formed from NO_x and VOCs.
- Photochemical smog: particles are formed from gaseous primary contaminants and chemicals.^[126] Smog is a type of pollution that occurs in the atmosphere. Smog is caused by a huge volume of coal being burned in a certain region, resulting in a mixture of smoke and sulfur dioxide.^[127] Modern smog is usually caused by automotive and industrial emissions, which are acted on in the atmosphere by UV light from the sun to produce secondary pollutants, which then combine with the primary emissions to generate photochemical smog.

Other pollutants

[edit]

There are many other chemicals classed as hazardous air pollutants. Some of these are regulated in the USA under the Clean Air Act and in Europe under numerous directives (including the Air "Framework" Directive, 96/62/EC, on ambient air quality assessment and management, Directive 98/24/EC, on risks related to chemical agents at work, and Directive 2004/107/EC covering heavy metals and polycyclic aromatic hydrocarbons in ambient air).^[128]^[129]

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Hazardous air pollutants (4 C, 68 P)

Before flue-gas desulfurization was installed, the emissions from this power plant in New

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Before flue-gas desulfurization was installed, the emissions from this power plant in New Mexico contained excessive amounts of sulfur dioxide.

Thermal oxidisers are air pollution abatement options for hazardous air pollutants (HAPs)

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Thermal oxidisers are air pollution abatement options for hazardous air pollutants (HAPs), volatile organic compounds (VOCs), and odorous emissions.

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This video provides an overview of a NASA study on the human fingerprint on global air quality.

Exposure

[edit]

The risk of air pollution is determined by the pollutant's hazard and the amount of exposure to that pollutant. Air pollution exposure can be measured for a person, a group, such as a neighborhood or a country's children, or an entire population. For example, one would want to determine a geographic area's exposure to a dangerous air pollutant, taking into account the various microenvironments and age groups. This can be calculated^[130] as an inhalation exposure. This would account for daily exposure in various settings, e.g. different indoor micro-environments and outdoor locations. The exposure needs to include different ages and other demographic groups, especially infants, children, pregnant women, and other sensitive subpopulations.^[130]

For each specific time that the subgroup is in the setting and engaged in particular activities, the exposure to an air pollutant must integrate the concentrations of the air pollutant with regard to the time spent in each setting and the respective inhalation rates for each subgroup, playing, cooking, reading, working, spending time in traffic, etc. A little child's inhaling rate, for example, will be lower than that of an adult. A young person engaging in strenuous exercise will have a faster rate of breathing than a child engaged in sedentary activity. The daily exposure must therefore include the amount of time spent in each micro-environmental setting as well as the kind of activities performed there. The air pollutant concentration in each microactivity/microenvironmental setting is summed to indicate the exposure.^[130]

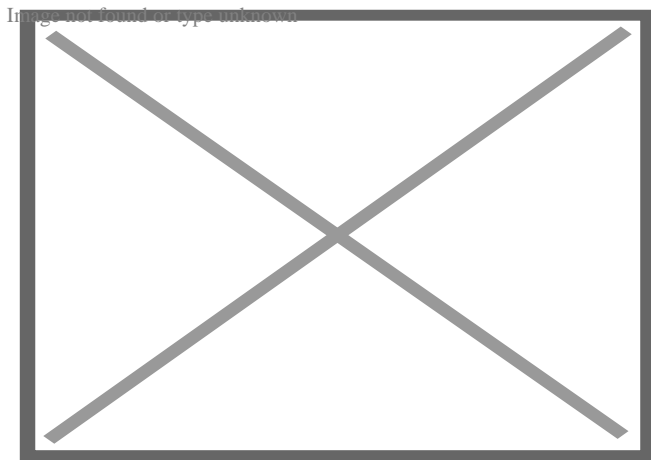
For some pollutants such as black carbon, traffic related exposures may dominate total exposure despite short exposure times since high concentrations coincide with proximity to major roads or participation in (motorized) traffic.^[131] A large portion of total daily exposure occurs as short peaks of high concentrations, but it remains unclear how to define peaks and determine their frequency and health impact.^[132]

In 2021, the WHO halved its recommended guideline limit for tiny particles from burning fossil fuels. The new limit for nitrogen dioxide (NO₂) is 75% lower.^[133] Growing evidence that air pollution—even when experienced at very low levels—hurts human health, led the WHO to revise its guideline (from 10 µg/m³ to 5 µg/m³) for what it considers a safe level of exposure of particulate pollution, bringing most of the world—97.3 percent of the global population—into the unsafe zone.^[134]

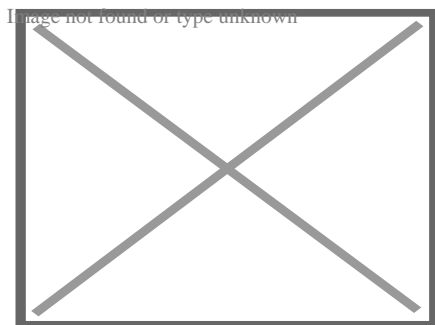
Indoor air quality

[edit]

Main articles: Indoor air quality and Indoor air pollution in developing countries



The share of total deaths from indoor air pollution, 2017



Air quality monitoring, New Delhi, India

A lack of ventilation indoors concentrates air pollution where people often spend the majority of their time. Indoor air pollution can pose a significant health risk. According to EPA reports, the concentrations of many air pollutants can be two to five times higher in indoor air than in outdoor air. Indoor air pollutants can be up to 100 times higher in some cases than they are outside. People can spend up to 90% of their time indoors, according to the American Lung Association; the US Consumer Product Safety Commission (CPSC) 2012; and the US Environmental Protection Agency 2012a.^[135]

Indoor contaminants that can cause pollution include asbestos, biologic agents, building materials, radon, tobacco smoke, and wood stoves, gas ranges, or other heating systems.^[135]

Radon (Rn) gas, a carcinogen, is exuded from the Earth in certain locations and trapped inside houses. Building materials including carpeting and plywood emit formaldehyde (H-CHO) gas. Paint and solvents give off volatile organic compounds (VOCs) as they dry. Lead paint can degenerate into dust and be inhaled.^{[136][137]}

Intentional air pollution is introduced with the use of air fresheners, incense, and other scented items. Controlled wood fires in cook stoves and fireplaces can add significant amounts of harmful smoke particulates into the air, inside and out.^{[136][137]} Indoor pollution fatalities may be caused by using pesticides and other chemical sprays indoors without proper ventilation. Also the kitchen in a modern produce harmful particles and gases, with equipment like toasters being one of the worst sources.^[138]

Carbon monoxide poisoning and fatalities are often caused by faulty vents and chimneys, or by the burning of charcoal indoors or in a confined space, such as a tent.^[139] Chronic carbon monoxide poisoning can result even from poorly-adjusted pilot lights. Traps are built into all domestic plumbing to keep sewer gas and hydrogen sulfide, out of interiors. Clothing emits tetrachloroethylene, or other dry cleaning fluids, for days after dry cleaning.

Though its use has now been banned in many countries, the extensive use of asbestos in industrial and domestic environments in the past has left a potentially very dangerous material in many localities. Asbestosis is a chronic inflammatory medical condition affecting the tissue of the lungs. It occurs after long-term, heavy exposure to asbestos from asbestos-containing materials in structures. Those with asbestosis have severe dyspnea (shortness of breath) and are at an increased risk regarding several different types of lung cancer. As clear explanations are not always stressed in non-technical literature, care should be taken to distinguish between several forms of relevant diseases. According to the World Health Organization,^[140] these may be defined as asbestosis, lung cancer, and peritoneal mesothelioma (generally a very rare form of cancer, when more widespread it is almost always associated with prolonged exposure to asbestos).

Biological sources of air pollution are also found indoors, as gases and airborne particulates. Pets produce dander, people produce dust from minute skin flakes and decomposed hair, dust mites in bedding, carpeting and furniture produce enzymes and micrometre-sized fecal droppings, inhabitants emit methane, mold forms on walls and generates mycotoxins and spores, air conditioning systems can incubate Legionnaires' disease and mold, and houseplants, soil and surrounding gardens can produce pollen, dust, and mold. Indoors, the lack of air circulation allows these airborne pollutants to accumulate more than they would otherwise occur in nature.

Health effects

[edit]

Air pollution has both acute and chronic effects on human health, affecting a number of different systems and organs but principally affect the body's respiratory system and the cardiovascular system. Afflictions include minor to chronic upper respiratory

irritation such as difficulty in breathing, wheezing, coughing, asthma^[141] and heart disease, lung cancer, stroke, acute respiratory infections in children and chronic bronchitis in adults, aggravating pre-existing heart and lung disease, or asthmatic attacks.

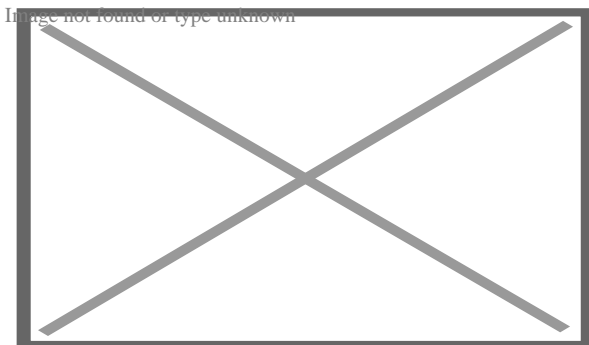
Short and long term exposures have been linked with premature mortality and reduced life expectancy^[142] and can result in increased medication use, increased doctor or emergency department visits, more hospital admissions and premature death.^[130]^{[better sou} Diseases that develop from persistent exposure to air pollution are environmental health diseases, which develop when a health environment is not maintained.^[143]

Even at levels lower than those considered safe by United States regulators, exposure to three components of air pollution, fine particulate matter, nitrogen dioxide and ozone, correlates with cardiac and respiratory illness.^[144] Individual reactions to air pollutants depend on the type of pollutant a person is exposed to, the degree of exposure, and the individual's health status and genetics.^[130] The most common sources of air pollution include particulates and ozone (often from burning fossil fuels),^[145] nitrogen dioxide, and sulfur dioxide. Children aged less than five years who live in developing countries are the most vulnerable population to death attributable to indoor and outdoor air pollution.^[146]

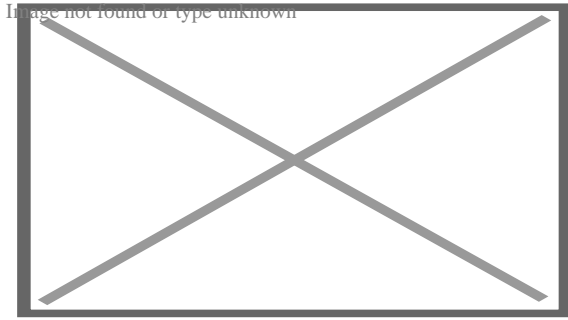
Under the Clean Air Act, U.S. EPA sets limits on certain air pollutants, including setting limits on how much can be in the air anywhere in the United States.^[147] Mixed exposure to both carbon black and ozone could result in significantly greater health affects.^[148]

Mortality

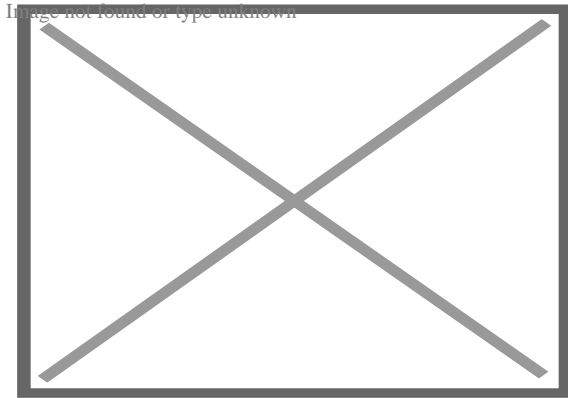
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Estimates of the death toll from air pollution vary across publications.



Deaths caused by accidents and air pollution from fossil fuel use in power plants exceed those caused by production of renewable energy.^[149]



Estimated annual number of deaths attributed to air pollution in 2019. This includes three categories of air pollution: indoor household, outdoor particulate matter and ozone.

Estimates of deaths toll due to air pollution vary.^[150] In 2014 the World Health Organization estimated that every year air pollution causes the premature death of 7 million people worldwide,^[5] 1 in 8 deaths worldwide.^[151] A study published in 2019 indicated that in 2015 the number may be closer to 8.8 million, with 5.5 million of these premature deaths due to air pollution from anthropogenic sources.^{[152][153]} A 2022 review concluded that in 2019 air pollution was responsible for approximately 9 million premature deaths. It concluded that since 2015 little real progress against pollution has been made.^{[14][154]} Causes of deaths include strokes, heart disease, COPD, lung cancer, and lung infections.^[5] Children are particularly at risk.^[155]

In 2021, the WHO reported that outdoor air pollution was estimated to cause 4.2 million premature deaths worldwide in 2019.^[156]

The global mean loss of life expectancy (LLE; similar to YPLL) from air pollution in 2015 was 2.9 years, substantially more than, for example, 0.3 years from all forms of direct violence.^[16] Communities with persons that live beyond 85 years have low

ambient air pollution, suggesting a link between air pollution levels and longevity. [157]

Primary mechanisms

[edit]

The WHO estimates that in 2016, ~58% of outdoor air pollution-related premature deaths were due to ischaemic heart disease and stroke. [156] The mechanisms linking air pollution to increased cardiovascular mortality are uncertain, but probably include pulmonary and systemic inflammation. [158]

By region

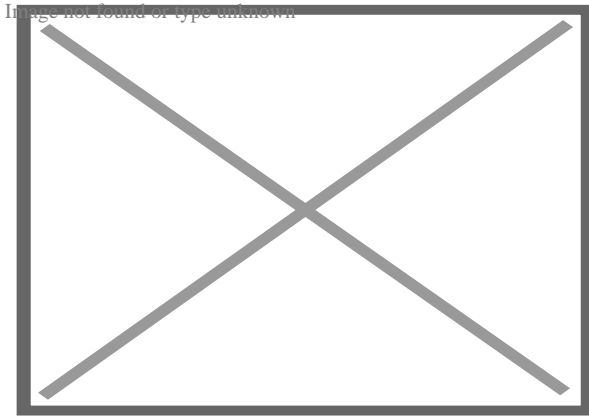
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India and China have the highest death rate due to air pollution. [159][160] India also has more deaths from asthma than any other nation according to the World Health Organization. In 2019, 1.6 million deaths in India were caused by air pollution. [161] In 2013, air pollution was estimated to kill 500,000 people in China each year. [162] In 2012, 2.48% of China's total air pollution emissions were caused by exports due to US demand, causing an additional 27,963 deaths across 30 provinces. [163]

Annual premature European deaths caused by air pollution are estimated at 430,000 [164] to 800,000. [153] An important cause of these deaths is nitrogen dioxide and other nitrogen oxides (NO_x) emitted by road vehicles. [164] Across the European Union, air pollution is estimated to reduce life expectancy by almost nine months. [165] In a 2015 consultation document the UK government disclosed that nitrogen dioxide is responsible for 23,500 premature UK deaths per annum. [166] There is a positive correlation between pneumonia-related deaths and air pollution from motor vehicle emissions in England. [167]

Eliminating energy-related fossil fuel emissions in the United States would prevent 46,900–59,400 premature deaths each year and provide \$537–\$678 billion in benefits from avoided PM_{2.5}-related illness and death. [168]

A study published in 2023 in *Science* focused on sulfur dioxide emissions by coal power plants (coal PM_{2.5}) and concluded that "exposure to coal PM_{2.5} was associated with 2.1 times greater mortality risk than exposure to PM_{2.5} from all sources." [169] From 1999 to 2020, a total of 460,000 deaths in the US were attributed to coal PM_{2.5}. [169]

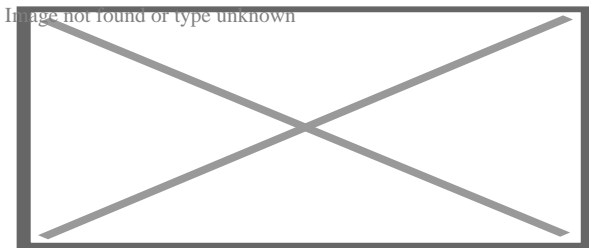


Air pollution deaths by nation due to fossil fuels

Major causes

[edit]

Further information: § Sources



A comparison of footprint-based and transboundary pollution-based relationships among G20 nations for the number of PM_{2.5}-related premature deaths^[170]

The largest cause of air pollution is fossil fuel combustion^[171] – mostly the production and use of cars, electricity production, and heating.^[172] There are estimated 4.5 million annual premature deaths worldwide due to pollutants released by high-emission power stations and vehicle exhausts.^[173]

Diesel exhaust (DE) is a major contributor to combustion-derived particulate matter air pollution. In several human experimental studies, using a well-validated exposure chamber setup, DE has been linked to acute vascular dysfunction and increased thrombus formation.^[174]^[175]

A study concluded that PM_{2.5} air pollution induced by the contemporary free trade and consumption by the 19 G20 nations causes two million premature deaths annually, suggesting that the average lifetime consumption of about ~28 people in these countries causes at least one premature death (average age ~67) while developing countries "cannot be expected" to implement or be able to implement

countermeasures without external support or internationally coordinated efforts. ^[176]
170]

Guidelines

[edit]

Main article: Air quality guideline

The US EPA has estimated that limiting ground-level ozone concentration to 65 parts per billion (ppb), would avert 1,700 to 5,100 premature deaths nationwide in 2020 compared with the 75 ppb standard. The agency projected the more protective standard would also prevent an additional 26,000 cases of aggravated asthma, and more than a million cases of missed work or school. ^[177]^[178] Following this assessment, the EPA acted to protect public health by lowering the National Ambient Air Quality Standards (NAAQS) for ground-level ozone to 70 ppb. ^[179]

A 2008 economic study of the health impacts and associated costs of air pollution in the Los Angeles Basin and San Joaquin Valley of Southern California shows that more than 3,800 people die prematurely (approximately 14 years earlier than normal) each year because air pollution levels violate federal standards. The number of annual premature deaths is considerably higher than the fatalities related to auto collisions in the same area, which average fewer than 2,000 per year. ^[180]^[181]^[182] A 2021 study found that outdoor air pollution is associated with substantially increased mortality "even at low pollution levels below the current European and North American standards and WHO guideline values" shortly before the WHO adjusted its guidelines. ^[183]^[184]

Cardiovascular disease

[edit]

According to the Global Burden of Disease Study, air pollution is responsible for 19% of all cardiovascular deaths. ^[185]^[186] There is strong evidence linking both short- and long-term exposure to air pollution with cardiovascular disease mortality and morbidity, stroke, blood pressure, and ischemic heart diseases (IHD). ^[186]

Air pollution is a leading risk factor for stroke, particularly in developing countries where pollutant levels are highest. ^[187] A systematic analysis of 17 different risk factors in 188 countries found air pollution is associated with nearly one in three strokes (29%) worldwide (33.7% of strokes in developing countries versus 10.2% in developed countries). ^[187]^[188] In women, air pollution is not associated with hemorrhagic but with ischemic stroke. ^[189] Air pollution was found to be associated

with increased incidence and mortality from coronary stroke.^[190] Associations are believed to be causal and effects may be mediated by vasoconstriction, low-grade inflammation and atherosclerosis.^[191] Other mechanisms such as autonomic nervous system imbalance have also been suggested.^{[192][193]}

Lung disease

[edit]

Research has demonstrated increased risk of developing asthma^[194] and chronic obstructive pulmonary disease (COPD)^[195] from increased exposure to traffic-related air pollution. Air pollution has been associated with increased hospitalization and mortality from asthma and COPD.^{[196][197]}

COPD comprises a spectrum of clinical disorders that include emphysema, bronchiectasis, and chronic bronchitis.^[198] COPD risk factors are both genetic and environmental. Elevated particle pollution contributes to the exacerbation of this disease and likely its pathogenesis.^[199]

The risk of lung disease from air pollution is greatest for infants and young children, whose normal breathing is faster than that of older children and adults; the elderly; those who work outside or spend a lot of time outside; and those who have heart or lung disease comorbidities.^[200]

A study conducted in 1960–1961 in the wake of the Great Smog of 1952 compared 293 London residents with 477 residents of Gloucester, Peterborough, and Norwich, three towns with low reported death rates from chronic bronchitis. All subjects were male postal truck drivers aged 40 to 59. Compared to the subjects from the outlying towns, the London subjects exhibited more severe respiratory symptoms (including cough, phlegm, and dyspnea), reduced lung function (FEV₁ and peak flow rate), and increased sputum production and purulence. The differences were more pronounced for subjects aged 50 to 59. The study controlled for age and smoking habits, so concluded that air pollution was the most likely cause of the observed differences.^[201] More studies have shown that air pollution exposure from traffic reduces lung function development in children^[202] and lung function may be compromised by air pollution even at low concentrations.^[203]

It is believed that, much like cystic fibrosis, serious health hazards become more apparent when living in a more urban environment. Studies have shown that in urban areas people experience mucus hypersecretion, lower levels of lung function, and more self-diagnosis of chronic bronchitis and emphysema.^[204]

Cancer

[edit]

Dark factory clouds obscure the Clark Avenue Bridge in Cleveland, Ohio, July 1973.

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Dark factory-emitted clouds obscuring the Clark Avenue Bridge in Cleveland, Ohio in July 1973

Around 300,000 lung cancer deaths were attributed globally in 2019 to exposure to fine particulate matter, PM_{2.5}, suspended in the air.^[205] PM_{2.5} exposure, such as from car exhausts, activates dormant mutations in lung cells, causing them to become cancerous.^[206]^[205] Unprotected exposure to PM_{2.5} air pollution can be equivalent to smoking multiple cigarettes per day,^[207]^[*dead link*] potentially increasing the risk of cancer, which is mainly the result of environmental factors.^[208]

Long-term exposure to PM_{2.5} (fine particulates) increases the overall risk of non-accidental mortality by 6% per 10 µg/m³ increase. Exposure to PM_{2.5} is also associated with an increased risk of mortality from lung cancer (range: 15–21% per 10 µg/m³ increase) and total cardiovascular mortality (range: 12–14% per 10 µg/m³ increase).^[209]

The review further noted that living close to busy traffic appears to be associated with elevated risks of these three outcomes – increase in lung cancer deaths, cardiovascular deaths, and overall non-accidental deaths. The reviewers also found suggestive evidence that exposure to PM_{2.5} is positively associated with mortality from coronary heart diseases and exposure to SO₂ increases mortality from lung cancer, but the data was insufficient to provide solid conclusions.^[209] Another investigation showed that higher activity level increases deposition fraction of aerosol particles in human lung and recommended avoiding heavy activities like running in outdoor space at polluted areas.^[210]

In 2011, a large Danish epidemiological study found an increased risk of lung cancer for people who lived in areas with high nitrogen oxide concentrations.^[211] Another Danish study, likewise noted evidence of possible associations between air pollution and other forms of cancer, including cervical cancer and brain cancer.^[212]

Kidney disease

[edit]

A study of 163,197 Taiwanese residents over the period of 2001–2016 estimated that every 5 $\mu\text{g}/\text{m}^3$ decrease (from an approximate peak of 30 $\mu\text{g}/\text{m}^3$) in the ambient concentration of $\text{PM}_{2.5}$ was associated with a 25% reduced risk of chronic kidney disease development.^[213] According to a cohort study involving 10,997 atherosclerosis patients, higher $\text{PM}_{2.5}$ exposure is associated with increased albuminuria.^[214]

Fertility

[edit]

Nitrogen dioxide (NO_2)

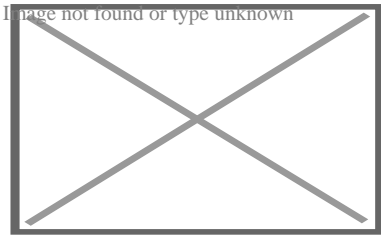
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An increase in NO_2 is significantly associated with a lower live birth rate in women undergoing IVF treatment.^[215] In the general population, there is a significant increase in miscarriage rate in women exposed to NO_2 compared to those not exposed.^[215]

Carbon monoxide (CO)

[edit]

CO exposure is significantly associated with stillbirth in the second and third trimester. [^{215]}



Standard line-angle structure of benzo-a-pyrene (BaP)

Polycyclic aromatic hydrocarbons

[edit]

Polycyclic aromatic hydrocarbons (PAHs) have been associated with reduced fertility. Benzo(a)pyrene (BaP) is a well-known PAH and carcinogen which is often found in exhaust fumes and cigarette smoke.^[216] PAHs have been reported to administer their toxic effects through oxidative stress by increasing the production of Reactive Oxygen Species (ROS) which can result in inflammation and cell death. More long-term exposure to PAHs can result in DNA damage and reduced repair.^[217]

Exposure to BaP has been reported to reduce sperm motility and increasing the exposure worsens this effect. Research has demonstrated that more BaPs were found in men with reported fertility issues compared to men without.^[218]

Studies have shown that BaPs can affect folliculogenesis and ovarian development by reducing the number of ovarian germ cells via triggering cell death pathways and inducing inflammation which can lead to ovarian damage.^[219]

Particulate matter

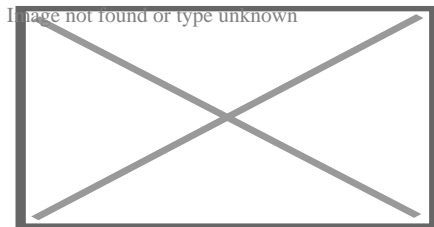
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Particulate matter (PM) refers to the collection of solids and liquids suspended in the air. These can be harmful to humans, and more research has shown that these effects may be more extensive than first thought; particularly on male fertility. PM can be different sizes, such as PM_{2.5} which are tiny particles of 2.5 microns in width or smaller, compared with PM₁₀ which are classified as 10 microns in diameter or less.

A study in California found that increased exposure to PM_{2.5} led to decreased sperm motility and increased abnormal morphology. Similarly, in Poland exposure to PM_{2.5} and PM₁₀ led to an increase in the percentage of cells with immature chromatin (DNA that has not fully developed or has developed abnormally).^[220]

In Turkey, a study examined the fertility of men who work as toll collectors and are therefore exposed to high levels of traffic pollutants daily. Traffic pollution often has high levels of PM_{10} alongside carbon monoxide and nitrogen oxides.^[220] There were significant differences in sperm count and motility in this study group compared to a control group with limited air pollution exposure.

In women, while overall effects on fertility do not appear significant there is an association between increased exposure to PM_{10} and early miscarriage. Exposure to smaller particulate matter, $PM_{2.5}$, appears to have an effect on conception rates in women undergoing IVF but does not affect live birth rates.^[215]



Ozone structure showing three oxygen atoms

Ground-level ozone pollution

[edit]

Ground-level ozone (O_3), when in high concentrations, is regarded as an air pollutant and is often found in smog in industrial areas.

There is limited research about the effect that ozone pollution has on fertility.^[215] At present, there is no evidence to suggest that ozone exposure poses a deleterious effect on spontaneous fertility in either females or males. However, there have been studies which suggest that high levels of ozone pollution, often a problem in the summer months, exert an effect on in vitro fertilisation (IVF) outcomes. Within an IVF population, NO_x and ozone pollutants were linked with reduced rates of live birth.^[215]

While most research on this topic is focused on the direct human exposure of air pollution, other studies have analysed the impact of air pollution on gametes and embryos within IVF laboratories. Multiple studies have reported a marked improvement in embryo quality, implantation and pregnancy rates after IVF laboratories have implemented air filters in a concerted effort to reduce levels of air pollution.^[221] Therefore, ozone pollution is considered to have a negative impact on the success of assisted reproductive technologies (ART) when occurring at high levels.

Ozone is thought to act in a biphasic manner where a positive effect on live birth is observed when ozone exposure is limited to before IVF embryo implantation.

Conversely, a negative effect is demonstrated upon exposure to ozone after embryo implantation. However, after adjusting for NO₂, the association between O₃ and IVF live birth rate was no longer significant.^{[222][223]}

In terms of male fertility, ozone is reported to cause a significant decrease in the concentration and count of sperm in semen after exposure.^[224] Similarly, sperm vitality, the proportion of live spermatozoa in a sample, was demonstrated to be diminished as a result of exposure to air pollution.^[223] However, findings on the effect of ozone exposure on male fertility are somewhat discordant, highlighting the need for further research.^[223]

Children

[edit]

Children and infants are among the most vulnerable to air pollution. Polluted air leads to the poisoning of millions of children under the age of 15, resulting in the death of some 600,000 children annually (543,000 under 5 years of age and 52,000 aged 5-15 years).^[225] Children in low or middle income countries are exposed to higher levels of fine particulate matter than those in high income countries.^[225]

Health effects of air pollution on children include asthma, pneumonia and lower respiratory tract infections and low birth weight.^[226] A study in Europe found that exposure to ultrafine particles can increase blood pressure in children.^[227]

Prenatal exposure

[edit]

Prenatal exposure to polluted air has been linked to a variety of neurodevelopmental disorders in children. For example, exposure to polycyclic aromatic hydrocarbons (PAH) was associated with reduced IQ scores and symptoms of anxiety and depression.^[228] They can also lead to detrimental perinatal health outcomes that are often fatal in developing countries.^[8] A 2014 study found that PAHs might play a role in the development of childhood attention deficit hyperactivity disorder (ADHD).^[229]

Researchers have found a correlation between air pollution and risk of autism spectrum disorder (ASD) diagnosis, although definitive causality has not yet been established. In Los Angeles, children living in areas with high levels of traffic-related air pollution were more likely to be diagnosed with autism between three–five years of age.^[230] A cohort study in Southern California linked in-utero exposure to near-roadway air pollution to an increased risk of ASD diagnosis^[231] and a study in

Sweden concluded that exposure to PM_{2.5} during pregnancy was associated with ASD.^[232] A Danish study linked exposure to air pollution during infancy, but not during pregnancy, to an increased risk of ASD diagnosis.^[233]

The connection between air pollution and neurodevelopmental disorders in children is thought to be related to epigenetic dysregulation of the primordial germ cells, embryo, and fetus during a critical period. Some PAHs are considered endocrine disruptors and are lipid soluble. When they build up in adipose tissue they can be transferred across the placenta can exert a genotoxic effect, causing DNA damage and mutations.^[234] Air pollution has been associated with the prevalence of preterm births.^[235]

Infants

[edit]

Ambient levels of air pollution have been associated with preterm birth and low birth weight. A 2014 WHO worldwide survey on maternal and perinatal health found a statistically significant association between low birth weights (LBW) and increased levels of exposure to PM_{2.5}. Women in regions with greater than average PM_{2.5} levels had statistically significant higher odds of pregnancy resulting in a low-birth weight infant even when adjusted for country-related variables.^[236] The effect is thought to be from stimulating inflammation and increasing oxidative stress.

A study found that in 2010 exposure to PM_{2.5} was strongly associated with 18% of preterm births globally, which was approximately 2.7 million premature births. The countries with the highest air pollution associated preterm births were in South and East Asia, the Middle East, North Africa, and West sub-Saharan Africa.^[237] In 2019, ambient particulate matter pollution in Africa resulted in at least 383,000 early deaths, according to new estimates of the cost of air pollution in the continent. This increased from 3.6% in 1990 to around 7.4% of all premature deaths in the area.^{[238][239][240]}

The source of PM_{2.5} differs greatly by region. In South and East Asia, pregnant women are frequently exposed to indoor air pollution because of wood and other biomass fuels being used for cooking, which are responsible for more than 80% of regional pollution. In the Middle East, North Africa and West sub-Saharan Africa, fine PM comes from natural sources, such as dust storms.^[237] The United States had an estimated 50,000 preterm births associated with exposure to PM_{2.5} in 2010.^[237]

A study between 1988 and 1991 found a correlation between sulfur dioxide (SO₂) and total suspended particulates (TSP) and preterm births and low birth weights in Beijing. A group of 74,671 pregnant women, in four separate regions of Beijing, were monitored from early pregnancy to delivery along with daily air pollution levels of SO₂

and TSP (along with other particulates). The estimated reduction in birth weight was 7.3 g for every 100 $\mu\text{g}/\text{m}^3$ increase in SO_2 and 6.9 g for each 100 $\mu\text{g}/\text{m}^3$ increase in TSP. These associations were statistically significant in both summer and winter, although summer was greater. The proportion of low birth weight attributable to air pollution, was 13%. This is the largest attributable risk ever reported for the known risk factors of low birth weight.^[241] Coal stoves, which are in 97% of homes, are a major source of air pollution in this area.

Brauer et al. studied the relationship between air pollution and proximity to a highway with pregnancy outcomes in a Vancouver cohort of pregnant women using addresses to estimate exposure during pregnancy. Exposure to NO, NO_2 , CO, PM_{10} and $\text{PM}_{2.5}$ were associated with infants born small for gestational age (SGA). Women living less than 50 meters away from an expressway or highway were 26% more likely to give birth to a SGA infant.^[242]

Central nervous system

[edit]

See also: Brain health and pollution and neuroplastic effects of pollution

Data is accumulating that air pollution exposure also affects the central nervous system.^[243]

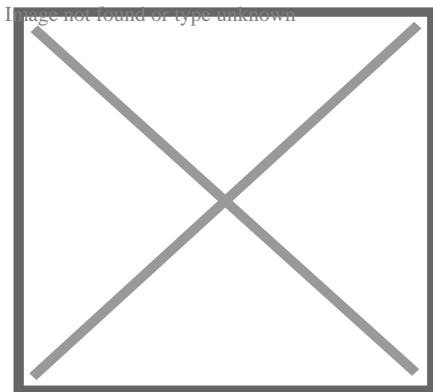
Air pollution increases the risk of dementia in people over 50 years old.^[244] Indoor air pollution exposure during childhood may negatively affect cognitive function and neurodevelopment.^{[245][246]} Prenatal exposure may also affect neurodevelopment.^{[247][248]} Studies show that air pollution is associated with a variety of developmental disabilities, oxidative stress, and neuro-inflammation and that it may contribute to Alzheimer's disease and Parkinson's disease.^[246]

Researchers found that early exposure to air pollution causes the same changes in the brain as autism and schizophrenia in mice. It also showed that air pollution also affected short-term memory, learning ability, and impulsivity. In this study, air pollution had a larger negative impact on male mice than on females.^{[249][250]} Lead researcher on the study, Deborah Cory-Slechta, said that:^[251]

When we looked closely at the ventricles, we could see that the white matter that normally surrounds them hadn't fully developed. It appears that inflammation had damaged those brain cells and prevented that region of the brain from developing, and the ventricles simply expanded to fill the space. Our findings add to the growing body of evidence that air pollution may play a role in autism, as well as in other neurodevelopmental disorders.

Exposure to fine particulate matter can increase levels of cytokines - neurotransmitters produced in response to infection and inflammation that are also associated with depression and suicide. Pollution has been associated with inflammation of the brain, which may disrupt mood regulation. Heightened PM_{2.5} levels are linked to more self-reported depressive symptoms, and increases in daily suicide rates. [252][253]

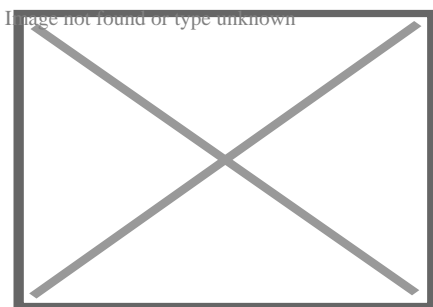
In 2015, experimental studies reported the detection of significant episodic (situational) cognitive impairment from impurities in indoor air breathed by test subjects who were not informed about changes in the air quality. Significant deficits were observed in the performance scores achieved in increasing concentrations of either volatile organic compounds (VOCs) or carbon dioxide, while keeping other factors constant. The highest impurity levels reached are not uncommon in some classroom or office environments. [254][255] Higher PM_{2.5} and CO₂ concentrations were shown to be associated with slower response times and reduced accuracy in tests. [256]



PM2.5 Levels Across the World's 5 Most Populated Nations in 2019

"Clean" areas

[edit]



Share of the population exposed to air pollution levels above WHO guidelines, 2017

Even in areas with relatively low levels of air pollution, public health effects can be significant and costly, since a large number of people breathe in such pollutants. A

study found that even in areas of the U.S. where ozone and PM_{2.5} meet federal standards, Medicare recipients who are exposed to more air pollution have higher mortality rates.^[257]

Rural populations in India, like those in urban areas, are also exposed to high levels of air pollution.^[258] In 2020, scientists found that the boundary layer air over the Southern Ocean around Antarctica is 'unpolluted' by humans.^[259]

Agricultural effects

[edit]

Various studies have estimated the impacts of air pollution on agriculture, especially ozone. A 2020 study showed that ozone pollution in California may reduce yields of certain perennial crops such as table grapes by as much as 22% per year, translating into economic damages of more than \$1 billion per year.^[260] After air pollutants enter the agricultural environment, they not only directly affect agricultural production and quality, but also enter agricultural waters and soil.^[261] The COVID-19 induced lockdown served as a natural experiment to expose the close links between air quality and surface greenness. In India, the lockdown induced improvement in air quality, enhanced surface greenness and photosynthetic activity, with the positive response of vegetation to reduce air pollution was dominant in croplands.^[262] On the other hand, agriculture in its traditional form is one of the primary contributors to the emission of trace gases like atmospheric ammonia.^[263]

Economic effects

[edit]

Air pollution costs the world economy \$5 trillion per year as a result of productivity losses and degraded quality of life.^{[24][25][26]} These productivity losses are caused by deaths due to diseases caused by air pollution. One out of ten deaths in 2013 was caused by diseases associated with air pollution and the problem is getting worse.

A small improvement in air quality (1% reduction of ambient PM_{2.5} and ozone concentrations) would produce \$29 million in annual savings in the lower Fraser Valley region in 2010.^[264] This finding is based on health valuation of lethal (death) and sub-lethal (illness) affects.

The problem is even more acute in the developing world. "Children under age 5 in lower-income countries are more than 60 times as likely to die from exposure to air pollution as children in high-income countries."^{[24][25]} The report states that additional economic losses caused by air pollution, including health costs^[265] and the adverse

effect on agricultural and other productivity were not calculated in the report, and thus the actual costs to the world economy are far higher than \$5 trillion.

A study published in 2022 found "a strong and significant connection between air pollution and construction site accidents" and that "a 10-ppb increase in NO₂ levels increases the likelihood of an accident by as much as 25%".^[266]

Other effects

[edit]

Artificial air pollution may be detectable on Earth from distant vantage points such as other planetary systems via atmospheric SETI – including NO₂ pollution levels and with telescopic technology close to today. It may also be possible to detect extraterrestrial civilizations this way.^[267]^[268]^[269]

Historical disasters

[edit]

The world's worst short-term civilian pollution crisis was the 1984 Bhopal Disaster in India.^[270] Leaked industrial vapours from the Union Carbide factory, belonging to Union Carbide, Inc., U.S.A. (later bought by Dow Chemical Company), killed at least 3787 people and injured from 150,000 to 600,000. The United Kingdom suffered its worst air pollution event when the 4 December Great Smog of 1952 formed over London. In six days more than 4,000 died and more recent estimates put the figure at nearer 12,000.^[271]

An accidental leak of anthrax spores from a biological warfare laboratory in the former USSR in 1979 near Yekaterinburg (formerly Sverdlovsk) is believed to have caused at least 64 deaths.^[272] The worst single incident of air pollution to occur in the US occurred in Donora, Pennsylvania, in late October 1948, when 20 people died and over 7,000 were injured.^[273]

Reduction and regulation

[edit]

Global depletion of the surrounding air pollution will require valiant leadership, a surplus of combined resources from the international community, and extensive societal changes.^[274] Pollution prevention seeks to prevent pollution such as air pollution and could include adjustments to industrial and business activities such as designing sustainable manufacturing processes (and the products' designs)^[275] and

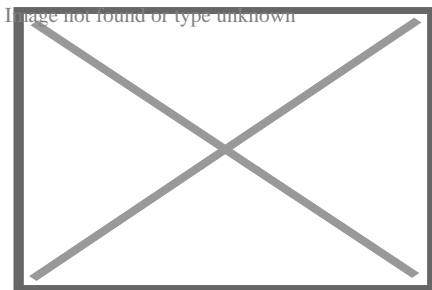
related legal regulations as well as efforts towards renewable energy transitions. [276][277]

Efforts to reduce particulate matter in the air may result in better health. [278]

The 9-Euro-Ticket scheme in Germany which allowed people to buy a monthly pass allowing use on all local and regional transport (trains, trams and busses) for 9 euro (€) for one month of unlimited travel saved 1.8 million tons of CO₂ emissions during its three-month implementation from June to August 2022. [279]

Pollution control

[edit]



Burning of items polluting Jamestown environment in Accra, Ghana

Various pollution control technologies and strategies are available to reduce air pollution. [280][281] At its most basic level, land-use planning is likely to involve zoning and transport infrastructure planning. In most developed countries, land-use planning is an important part of social policy, ensuring that land is used efficiently for the benefit of the wider economy and population, as well as to protect the environment. [282] Stringent environmental regulations, effective control technologies and shift towards the renewable source of energy also helping countries like China and India to reduce their sulfur dioxide pollution. [283]

Titanium dioxide has been researched for its ability to reduce air pollution. Ultraviolet light will release free electrons from material, thereby creating free radicals, which break up VOCs and

NO_x gases. One form is superhydrophilic. [284]

Pollution-eating nanoparticles placed near a busy road were shown to absorb toxic emission from around 20 cars each day. [285]

Energy transition

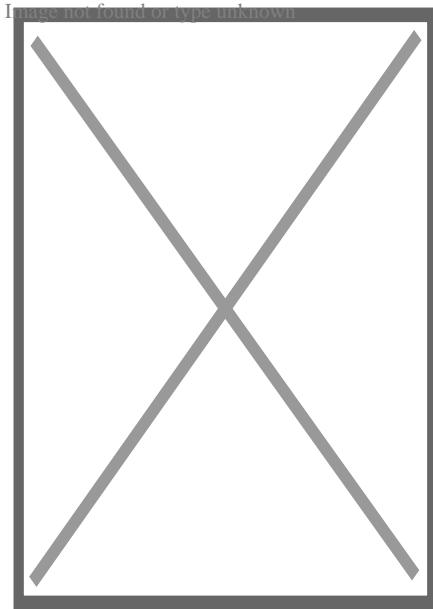
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Since a large share of air pollution is caused by combustion of fossil fuels such as coal and oil, the reduction of these fuels can reduce air pollution drastically. Most effective is the switch to clean power sources such as wind power, solar power, hydro power which do not cause air pollution.^[286] Efforts to reduce pollution from mobile sources includes expanding regulation to new sources (such as cruise and transport ships, farm equipment, and small gas-powered equipment such as string trimmers, chainsaws, and snowmobiles), increased fuel efficiency (such as through the use of hybrid vehicles), conversion to cleaner fuels, and conversion to electric vehicles. For example, buses in New Delhi, India, have run on compressed natural gas since 2000, to help eliminate the city's "pea-soup" smog.^[226]^[287]

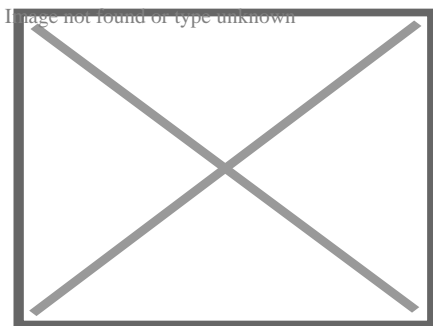
A very effective means to reduce air pollution is the transition to renewable energy. According to a study published in Energy and Environmental Science in 2015 the switch to 100% renewable energy in the United States would eliminate about 62,000 premature mortalities per year and about 42,000 in 2050, if no biomass were used. This would save about \$600 billion in health costs a year due to reduced air pollution in 2050, or about 3.6% of the 2014 U.S. gross domestic product.^[286] Air quality improvement is a near-term benefit among the many societal benefits from climate change mitigation.

Alternatives to pollution

[edit]



Support for a ban on high-emission vehicles in city centres in Europe, China and the US from respondents to the European Investment Bank Climate Survey



Support, use and infrastructure-expansion of forms of public transport that do not cause air pollution may be a critical key alternative to pollution.

There are now practical alternatives to the principal causes of air pollution:

- Strategic substitution of air pollution sources in transport with lower-emission or, during the lifecycle, emission-free forms of public transport^{[288][289]} and bicycle use and infrastructure (as well as with remote work, reductions of work, relocations, and localizations)
 - Phase-out of fossil fuel vehicles is a critical component of a shift to sustainable transport; however, similar infrastructure and design decisions like electric vehicles may be associated with similar pollution for production as well as mining and resource exploitation for large numbers of needed batteries as well as the energy for their recharging^{[290][291]}
- Areas downwind (over 20 miles) of major airports have more than double *total particulate emissions in air* than other areas, even when factoring in areas with frequent ship calls, and heavy freeway and city traffic like Los Angeles.^[292]

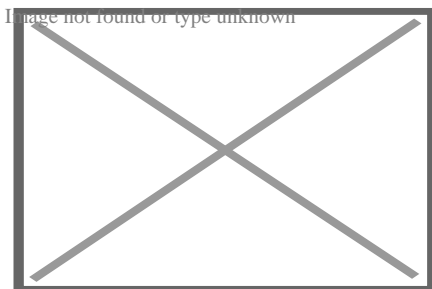
Aviation biofuel mixed in with jetfuel at a 50/50 ratio can reduce jet derived cruise altitude particulate emissions by 50–70%, according to a NASA led 2017 study (however, this should imply ground level benefits to urban air pollution as well). [293]

- Ship propulsion and idling can be switched to much cleaner fuels like natural gas. (Ideally a renewable source but not practical yet)
- Combustion of fossil fuels for space heating can be replaced by using ground source heat pumps and seasonal thermal energy storage. [294]
- Electricity generated from the combustion of fossil fuels can be replaced by nuclear and renewable energy. Heating and home stoves, which contribute significantly to regional air pollution, can be replaced with a much cleaner fossil fuel, such as natural gas, or, preferably, renewables, in poor countries. [295][296]
- Motor vehicles driven by fossil fuels, a key factor in urban air pollution, can be replaced by electric vehicles. Though lithium supply and cost is a limitation, there are alternatives. Herding more people into clean public transit such as electric trains can also help. Nevertheless, even in emission-free electric vehicles, rubber tires produce significant amounts of air pollution themselves, ranking as 13th worst pollutant in Los Angeles. [297]
- Reducing travel in vehicles can curb pollution. After Stockholm reduced vehicle traffic in the central city with a congestion tax, nitrogen dioxide and PM₁₀ pollution declined, as did acute pediatric asthma attacks. [298]
- Biodigesters can be utilized in poor nations where slash and burn is prevalent, turning a useless commodity into a source of income. The plants can be gathered and sold to a central authority that will break them down in a large modern biodigester, producing much needed energy to use. [299]
- Induced humidity and ventilation both can greatly dampen air pollution in enclosed spaces, which was found to be relatively high inside subway lines due to braking and friction and relatively less ironically inside transit buses than lower sitting passenger automobiles or subways. [300]

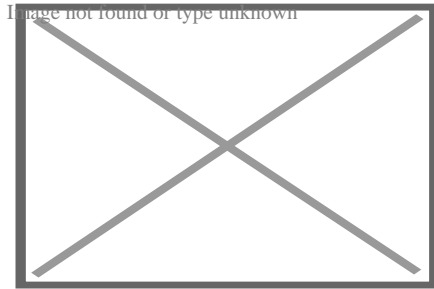
Further information: § Sources

Control devices

[edit]



Tarps and netting are often used to reduce the amount of dust released from construction sites.



Air pollution from a car

The following items are commonly used as pollution control devices in industry and transportation. They can either destroy contaminants or remove them from an exhaust stream before it is emitted into the atmosphere.

- **Particulate control**

- Mechanical collectors (dust cyclones, multicyclones)
- Electrostatic precipitators: An electrostatic precipitator (ESP), or electrostatic air cleaner, is a particulate collection device that removes particles from a flowing gas (such as air), using the force of an induced electrostatic charge. Electrostatic precipitators are highly efficient filtration devices that minimally impede the flow of gases through the device, and can easily remove fine particulates such as dust and smoke from the air stream.
- Baghouses: Designed to handle heavy dust loads, a dust collector consists of a blower, dust filter, a filter-cleaning system, and a dust receptacle or dust removal system (distinguished from air cleaners which utilize disposable filters to remove the dust).
- Particulate scrubbers: A wet scrubber is a form of pollution control technology. The term describes a variety of devices that use pollutants from a furnace flue gas or from other gas streams. In a wet scrubber, the polluted gas stream is brought into contact with the scrubbing liquid, by spraying it with the liquid, by forcing it through a pool of liquid, or by some other contact method, so as to remove the pollutants.

- **Scrubbers**

- Baffle spray scrubber
- Cyclonic spray scrubber
- Ejector venturi scrubber
- Mechanically aided scrubber
- Spray tower
- Wet scrubber

- **NO_x control**

- LO-NO_x burners
- Selective catalytic reduction (SCR)

- Selective non-catalytic reduction (SNCR)
- NOx scrubbers
- Exhaust gas recirculation
- Catalytic converter (also for VOC control)
- **VOC abatement**
 - Adsorption systems, using activated carbon, such as Fluidized Bed Concentrator
 - Flares
 - Thermal oxidizers
 - Catalytic converters
 - Biofilters
 - Absorption (scrubbing)
 - Cryogenic condensers
 - Vapor recovery systems
- **Acid gas/SO₂ control**
 - Wet scrubbers
 - Dry scrubbers
 - Flue-gas desulfurization
- **Mercury control**
 - Sorbent injection technology
 - Electro-catalytic oxidation (ECO)
 - K-Fuel
- **Dioxin and furan control**
- **Miscellaneous associated equipment**
 - Source capturing systems
 - Continuous emissions monitoring systems (CEMS)

Monitoring

[edit]

See also: Smart city

Further information: Air pollution measurement and Environmental monitoring

Spatiotemporal monitoring of air quality may be necessary for improving air quality, and thereby the health and safety of the public, and assessing impacts of interventions.^[301] Such monitoring is done to different extents with different regulatory requirements with discrepant regional coverage by a variety of organizations and governance entities such as using a variety of technologies for use of the data and sensing such mobile IoT sensors,^{[302][303]} satellites,^{[304][305][306]} and monitoring stations.^{[307][308]} Some websites attempt to map air pollution levels using available data.^{[309][310][311]}

Air quality modeling

[edit]

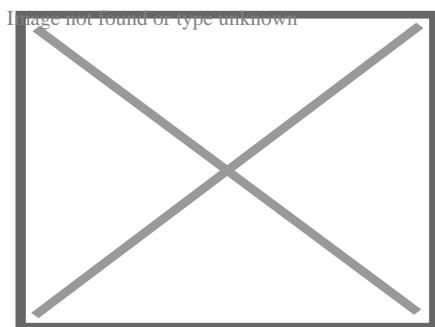
Main article: Air quality modeling

Numerical models either on a global scale using tools such as GCMs (general circulation models coupled with a pollution module) or CTMs (Chemical transport model) can be used to simulate the levels of different pollutants in the atmosphere. These tools can have several types (Atmospheric model) and different uses. These models can be used in forecast mode which can help policy makers to decide on appropriate actions when an air pollution episode is detected. They can also be used for climate modeling including evolution of air quality in the future, for example the IPCC (Intergovernmental Panel on Climate Change) provides climate simulations including air quality assessments in their reports (latest report accessible through their site).

Regulations

[edit]

Main article: Air quality law



Smog in Cairo

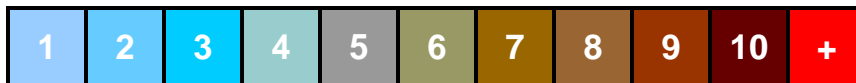
In general, there are two types of air quality standards. The first class of standards (such as the U.S. National Ambient Air Quality Standards and E.U. Air Quality Directive^[312]) set maximum atmospheric concentrations for specific pollutants. Environmental agencies enact regulations which are intended to result in attainment of these target levels. The second class (such as the North American air quality index) take the form of a scale with various thresholds, which is used to communicate to the public the relative risk of outdoor activity. The scale may or may not distinguish between different pollutants.

Canada

[edit]

In Canada, air pollution and associated health risks are measured with the Air Quality Health Index (AQHI).^[313] It is a health protection tool used to make decisions to reduce short-term exposure to air pollution by adjusting activity levels during increased levels of air pollution.

The AQHI is a federal program jointly coordinated by Health Canada and Environment Canada. However, the AQHI program would not be possible without the commitment and support of the provinces, municipalities and NGOs. From air quality monitoring to health risk communication and community engagement, local partners are responsible for the vast majority of work related to AQHI implementation. The AQHI provides a number from 1 to 10+ to indicate the level of health risk associated with local air quality. Occasionally, when the amount of air pollution is abnormally high, the number may exceed 10. The AQHI provides a local air quality current value as well as a local air quality maximums forecast for today, tonight and tomorrow and provides associated health advice.



Risk: Low (1–3) Moderate (4–6) High (7–10) Very high (above 10)

As it is now known that even low levels of air pollution can trigger discomfort for the sensitive population, the index has been developed as a continuum: The higher the number, the greater the health risk and need to take precautions. The index describes the level of health risk associated with this number as 'low', 'moderate', 'high' or 'very high', and suggests steps that can be taken to reduce exposure.^[314]

Health risk	Air Quality Health Index	Health messages ^[315]	
		At risk population	General population
Low	1–3	Enjoy your usual outdoor activities.	Ideal air quality for outdoor activities
Moderate	4–6	Consider reducing or rescheduling strenuous activities outdoors if you are experiencing symptoms.	No need to modify your usual outdoor activities unless you experience symptoms such as coughing and throat irritation.

High	7–10	Reduce or reschedule strenuous activities outdoors. Children and the elderly should also take it easy.	Consider reducing or rescheduling strenuous activities outdoors if you experience symptoms such as coughing and throat irritation.
Very high	Above 10	Avoid strenuous activities outdoors. Children and the elderly should also avoid outdoor physical exertion and should stay indoors.	Reduce or reschedule strenuous activities outdoors, especially if you experience symptoms such as coughing and throat irritation.

The measurement is based on the observed relationship of nitrogen dioxide (NO₂), ground-level ozone (O₃) and particulates (PM_{2.5}) with mortality, from an analysis of several Canadian cities. Significantly, all three of these pollutants can pose health risks, even at low levels of exposure, especially among those with pre-existing health problems.

When developing the AQHI, Health Canada's original analysis of health effects included five major air pollutants: particulates, ozone, and nitrogen dioxide (NO₂), as well as sulfur dioxide (SO₂), and carbon monoxide (CO). The latter two pollutants provided little information in predicting health effects and were removed from the AQHI formulation.

The AQHI does not measure the effects of odour, pollen, dust, heat or humidity.

Germany

[edit]

TA Luft is the German air quality regulation.^[316]

Governing urban air pollution

[edit]

Further information: Phase-out of fossil fuel vehicles § Cities and territories

In Europe, Council Directive 96/62/EC on ambient air quality assessment and management provides a common strategy against which member states can "set objectives for ambient air quality in order to avoid, prevent or reduce harmful effects on human health and the environment ... and improve air quality where it is unsatisfactory".^[317]

In July 2008, in the case *Dieter Janecek v. Freistaat Bayern*, the European Court of Justice ruled that under this directive^[317] citizens have the right to require national authorities to implement a short term action plan that aims to maintain or achieve compliance to air quality limit values.^{[318][319]}

This important case law appears to confirm the role of the EC as centralised regulator to European nation-states as regards air pollution control. It places a supranational legal obligation on the UK to protect its citizens from dangerous levels of air pollution, furthermore superseding national interests with those of the citizen.

In 2010, the European Commission (EC) threatened the UK with legal action against the successive breaching of PM₁₀ limit values.^[320] The UK government has identified that if fines are imposed, they could cost the nation upwards of £300 million per year.^[321]

In March 2011, the Greater London Built-up Area remained the only UK region in breach of the EC's limit values, and was given three months to implement an emergency action plan aimed at meeting the EU Air Quality Directive.^[322] The City of London has dangerous levels of PM₁₀ concentrations, estimated to cause 3000 deaths per year within the city.^[323] As well as the threat of EU fines, in 2010 it was threatened with legal action for scrapping the western congestion charge zone, which is claimed to have led to an increase in air pollution levels.^[324]

In response to these charges, mayor of London Boris Johnson has criticised the current need for European cities to communicate with Europe through their nation state's central government, arguing that in future "A great city like London" should be permitted to bypass its government and deal directly with the European Commission regarding its air quality action plan.^[322]

This can be interpreted as recognition that cities can transcend the traditional national government organisational hierarchy and develop solutions to air pollution using global governance networks, for example through transnational relations. Transnational relations include but are not exclusive to national governments and intergovernmental organisations,^[325] allowing sub-national actors including cities and regions to partake in air pollution control as independent actors.

Global city partnerships can be built into networks, for example the C40 Cities Climate Leadership Group, of which London is a member. The C40 is a public 'non-state' network of the world's leading cities that aims to curb their greenhouse emissions.^[326] The C40 has been identified as 'governance from the middle' and is an alternative to intergovernmental policy.^[327] It has the potential to improve urban air quality as participating cities "exchange information, learn from best practices and consequently mitigate carbon dioxide emissions independently from national government decisions".

[³²⁶] A criticism of the C40 network is that its exclusive nature limits influence to participating cities and risks drawing resources away from less powerful city and regional actors.

Indigenous people

[edit]

Because Indigenous people[³²⁸] frequently experience a disproportionate share of the effects of environmental degradation and climate change, even while they have made very little contribution to the processes causing these changes, environmental justice is especially important to them. Indigenous peoples have been marginalized and their lands and resources have been exploited as a result of historical and continuing colonization, institutional injustices, and inequality.

Indigenous groups frequently lack the political and financial clout to influence policy decisions that impact their lands and means of subsistence or to lessen the effects of climate change. This makes the already-existing inequalities in these communities' social, economic, and health conditions worse. Furthermore, traditional ecological knowledge and Indigenous knowledge systems provide insightful information about sustainable resource management and climate change adaptation techniques. To promote persistence and environmental justice, Indigenous viewpoints must be acknowledged and integrated into efforts to mitigate the effects of climate change and adapt to them.

Combating climate change necessitates an all-encompassing strategy that recognizes the interdependence of social, economic, and environmental elements. This entails defending treaty rights, advancing Indigenous sovereignty and self-determination, and aiding Indigenous-led projects for sustainable development and environmental preservation.

Hotspots

[edit]

Main article: Toxic hotspot

See also: Cancer alley and Superfund

Air pollution hotspots are areas where air pollution emissions expose individuals to increased negative health effects.[³²⁹] They are particularly common in highly populated, urban areas, where there may be a combination of stationary sources (e.g. industrial facilities) and mobile sources (e.g. cars and trucks) of pollution. Emissions from these sources can cause respiratory disease, childhood asthma,[¹⁴¹] cancer,

and other health problems. Fine particulate matter such as diesel soot, which contributes to more than 3.2 million premature deaths around the world each year, is a significant problem. It is very small and can lodge itself within the lungs and enter the bloodstream. Diesel soot is concentrated in densely populated areas, and one in six people in the U.S. live near a diesel pollution hot spot.^[330]

While air pollution hotspots affect a variety of populations, some groups are more likely to be located in hotspots. Previous studies have shown disparities in exposure to pollution by race and/or income.

Hazardous land uses (toxic storage and disposal facilities, manufacturing facilities, major roadways) tend to be located where property values and income levels are low. Low socioeconomic status can be a proxy for other kinds of social vulnerability, including race, a lack of ability to influence regulation and a lack of ability to move to neighborhoods with less environmental pollution. These communities bear a disproportionate burden of environmental pollution and are more likely to face health risks such as cancer or asthma.^[332]

Studies show that patterns in race and income disparities not only indicate a higher exposure to pollution but also higher risk of adverse health outcomes.^[333]

Communities characterized by low socioeconomic status and racial minorities can be more vulnerable to cumulative adverse health impacts resulting from elevated exposure to pollutants than more privileged communities.^[333] Blacks and Latinos generally face more pollution than Whites and Asians, and low-income communities bear a higher burden of risk than affluent ones.^[332] Racial discrepancies are particularly distinct in suburban areas of the Southern United States and metropolitan areas of the Midwestern and Western United States.^[334] Residents in public housing, who are generally low-income and cannot move to healthier neighborhoods, are highly affected by nearby refineries and chemical plants.^[335]

Cities

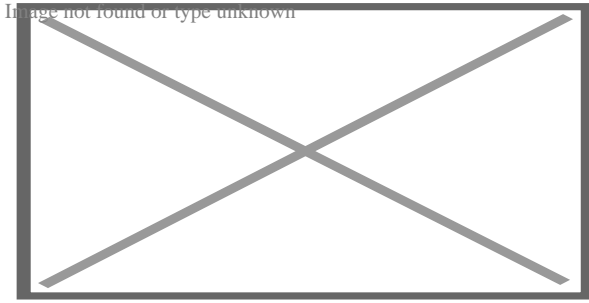
[edit]

See also: List of most polluted cities in the world by particulate matter concentration

Further information: List of least polluted cities by particulate matter concentration

External videos

[Air Visual Earth](#)
realtime map of global wind and air pollution^[331]



Nitrogen dioxide concentrations as measured from satellite 2002–2004

Air pollution is usually concentrated in densely populated metropolitan areas, especially in developing countries where cities are experiencing rapid growth and environmental regulations are relatively lax or nonexistent. Urbanization leads to a rapid rise in premature mortality due to anthropogenic air pollution in fast-growing tropical cities.^[336] However, even populated areas in developed countries attain unhealthy levels of pollution, with Los Angeles and Rome being two examples.^[337] Between 2002 and 2011 the incidence of lung cancer in Beijing near doubled. While smoking remains the leading cause of lung cancer in China, the number of smokers is falling while lung cancer rates are rising .^[338]

^[339]

World's Most Polluted Cities 2020 2020 Average 2019 Average

Hotan, China	110.2	110.1
Ghaziabad, India	106.6	110.2
Bulandshahr, India	98.4	89.4
Bisrakh Jalalpur, India	96.0	-
Bhiwadi, India	95.5	83.4

Tehran was declared the most polluted city in the world on May 24, 2022.^[340]

Projections






[edit]

In a 2019 projection, by 2030 half of the world's pollution emissions could be generated by Africa.^[341] Potential contributors to such an outcome include increased burning activities (such as the burning of open waste), traffic, agri-food and chemical industries, sand dust from the Sahara, and overall population growth.

In a 2012 study, by 2050 outdoor air pollution (particulate matter and ground-level ozone) is projected to become the top cause of environmentally related deaths worldwide.^[342]

See also

[edit]

-   Global warming portal
-   Plants portal
-   Trees portal

Source

- Beehive burner
- Bottom ash
- Concrete#Concrete – health and safety
- Diwali-related air pollution
- Flue-gas emissions from fossil-fuel combustion
- Health impacts of sawdust
- Joss paper
- Metal working
- Mining
- Non-exhaust emissions
- Power tool
- Rubber pollution
- Slag
- Smelting
- Tire fire
- Welding
- Wood ash

Measurement

- Air pollutant concentrations
- Air pollution measurement
- Organic molecular tracers
- Intake fraction
- Particulate matter sampler

Others

- Air stagnation
- ASEAN Agreement on Transboundary Haze Pollution
- Asian brown cloud
- Atmospheric chemistry
- BenMAP
- Best Available Control Technology

- Critical load
- Emission standard
- Emissions & Generation Resource Integrated Database
- Environmental agreement
- Environmental racism
- Exposome
- Global Atmosphere Watch
- Global dimming
- Great Smog of London
- Haze
- Health Effects Institute (HEI)
- Indicator value
- International Agency for Research on Cancer
- International Day of Clean Air for Blue Skies
- Kyoto Protocol
- Light water reactor sustainability
- List of smogs by death toll
- Lowest Achievable Emissions Rate
- NASA Clean Air Study
- NIEHS
- Phytoremediation
- Polluter pays principle
- Regulation of greenhouse gases under the Clean Air Act
- Silicosis#Prevention

References

[edit]

1. ^ **a b c** "Air pollution". *www.who.int*. Retrieved 14 January 2023.
2. ^ **a b** Manisalidis I, Stavropoulou E, Stavropoulos A, Bezirtzoglou E (2020). "Environmental and Health Impacts of Air Pollution: A Review". *Frontiers in Public Health*. **8**: 14. doi:10.3389/fpubh.2020.00014. ISSN 2296-2565. PMC 7044178. PMID 32154200.
3. ^ Howell R, Pickerill J (2016). "The Environment and Environmentalism". In Daniels P, Bradshaw M, Shaw D, Sidaway J, Hall T (eds.). *An Introduction To Human Geography (5th ed.)*. Pearson. p. 134. ISBN 978-1-292-12939-6.
4. ^ Dimitriou A, Christidou V (26 September 2011), Khallaf M (ed.), "Causes and Consequences of Air Pollution and Environmental Injustice as Critical Issues for Science and Environmental Education", *The Impact of Air Pollution on Health, Economy, Environment and Agricultural Sources*, InTech, doi:10.5772/17654, ISBN 978-953-307-528-0, retrieved 31 May 2022
5. ^ **a b c d e f** "7 million premature deaths annually linked to air pollution". WHO. 25 March 2014. Retrieved 25 March 2014.

6. ^ Allen JL, Klocke C, Morris-Schaffer K, Conrad K, Sobolewski M, Cory-Slechta DA (June 2017). "Cognitive Effects of Air Pollution Exposures and Potential Mechanistic Underpinnings". *Current Environmental Health Reports*. **4** (2): 180–191. Bibcode:2017CEHR....4..180A. doi:10.1007/s40572-017-0134-3. ISSN 2196-5412. PMC 5499513. PMID 28435996.
7. ^ Newbury JB, Stewart R, Fisher HL, Beevers S, Dajnak D, Broadbent M, et al. (2021). "Association between air pollution exposure and mental health service use among individuals with first presentations of psychotic and mood disorders: retrospective cohort study". *The British Journal of Psychiatry*. **219** (6) (published 19 August 2021): 678–685. doi:10.1192/bjp.2021.119. ISSN 0007-1250. PMC 8636613. PMID 35048872.
8. ^ a b Ghosh R, Causey K, Burkart K, Wozniak S, Cohen A, Brauer M (28 September 2021). "Ambient and household PM2.5 pollution and adverse perinatal outcomes: A meta-regression and analysis of attributable global burden for 204 countries and territories". *PLOS Medicine*. **18** (9): e1003718. doi:10.1371/journal.pmed.1003718. ISSN 1549-1676. PMC 8478226. PMID 34582444.
9. ^ Dominski FH, Lorenzetti Branco JH, Buonanno G, Stabile L, Gameiro da Silva M, Andrade A (October 2021). "Effects of air pollution on health: A mapping review of systematic reviews and meta-analyses". *Environmental Research*. **201**: 111487. Bibcode:2021ER....20111487D. doi:10.1016/j.envres.2021.111487. ISSN 0013-9351. PMID 34116013.
10. ^ Lee KK, Bing R, Kiang J, Bashir S, Spath N, Stelzle D, et al. (November 2020). "Adverse health effects associated with household air pollution: a systematic review, meta-analysis, and burden estimation study". *The Lancet Global Health*. **8** (11): e1427–e1434. doi:10.1016/S2214-109X(20)30343-0. ISSN 2214-109X. PMC 7564377. PMID 33069303.
11. ^ Stanek LW, Brown JS, Stanek J, Gift J, Costa DL (2011). "Air Pollution Toxicology—A Brief Review of the Role of the Science in Shaping the Current Understanding of Air Pollution Health Risks". *Toxicological Sciences*. **120**: S8–S27. doi:10.1093/toxsci/kfq367. PMID 21147959. Retrieved 7 November 2022.
12. ^ Majumder N, Kodali V, Velayutham M, Goldsmith T, Amedro J, Khramtsov VV, et al. (2022). "Aerosol physicochemical determinants of carbon black and ozone inhalation co-exposure induced pulmonary toxicity". *Toxicological Sciences*. **191** (1): 61–78. doi:10.1093/toxsci/kfac113. PMC 9887725. PMID 36303316.
13. ^ Daniel A. Vallero (2014). *Fundamentals of Air Pollution*. Academic Press. pp. 43, 122, 215. ISBN 978-0-12-404602-3.
14. ^ a b c d Fuller R, Landrigan PJ, Balakrishnan K, Bathan G, Bose-O'Reilly S, Brauer M, et al. (June 2022). "Pollution and health: a progress update". *The Lancet Planetary Health*. **6** (6): e535–e547. doi:10.1016/S2542-5196(22)00090-0. PMID 35594895. S2CID 248905224.

15. ^ Juginovi A, Vukovi M, Aranza I, Biloš V (18 November 2021). "Health impacts of air pollution exposure from 1990 to 2019 in 43 European countries". *Scientific Reports*. **11** (1): 22516. Bibcode:2021NatSR..1122516J. doi:10.1038/s41598-021-01802-5. eISSN 2045-2322. PMC 8602675. PMID 34795349.
16. ^ a b Lelieveld J, Pozzer A, Pöschl U, Fnais M, Haines A, Münzel T (1 September 2020). "Loss of life expectancy from air pollution compared to other risk factors: a worldwide perspective". *Cardiovascular Research*. **116** (11): 1910–1917. doi:10.1093/cvr/cvaa025. ISSN 0008-6363. PMC 7449554. PMID 32123898.
17. ^ "Energy and Air Pollution" (PDF). *lea.org*. Archived from the original (PDF) on 11 October 2019. Retrieved 12 March 2019.
18. ^ "Study Links 6.5 Million Deaths Each Year to Air Pollution". *The New York Times*. 26 June 2016. Retrieved 27 June 2016.
19. ^ Lelieveld J, Klingmüller K, Pozzer A, Burnett RT, Haines A, Ramanathan V (25 March 2019). "Effects of fossil fuel and total anthropogenic emission removal on public health and climate". *Proceedings of the National Academy of Sciences of the United States of America*. **116** (15): 7192–7197. Bibcode:2019PNAS..116.7192L. doi:10.1073/pnas.1819989116. PMC 6462052. PMID 30910976. S2CID 85515425.
20. ^ Silva RA, West JJ, Zhang Y, Anenberg SC, Lamarque JF, Shindell DT, et al. (2013). "Global premature mortality due to anthropogenic outdoor air pollution and the contribution of past climate change". *Environmental Research Letters*. **8** (3): 034005. Bibcode:2013ERL.....8c4005S. doi:10.1088/1748-9326/8/3/034005.
21. ^ a b "9 out of 10 people worldwide breathe polluted air, but more countries are taking action". *World Health Organization*. 2 May 2018. Retrieved 18 May 2021.
22. ^ "Cheap air pollution monitors help plot your walk". *European Investment Bank*. Retrieved 18 May 2021.
23. ^ "Assessing the risks to health from air pollution". *www.eea.europa.eu*. European Environment Agency. Retrieved 18 May 2021.
24. ^ a b c World Bank, Institute for Health Metrics and Evaluation at University of Washington – Seattle (2016). *The Cost of Air Pollution: Strengthening the Economic Case for Action* (PDF). Washington, D.C.: The World Bank. xii.
25. ^ a b c McCauley L (8 September 2016). "Making Case for Clean Air, World Bank Says Pollution Cost Global Economy \$5 Trillion". *Common Dreams*. Retrieved 3 February 2018.
26. ^ a b "The Rising Cost of Smog". *Fortune*: 15. 1 February 2018. ISSN 0015-8259.
27. ^ Batool R, Zaman K, Khurshid MA, Sheikh SM, Aamir A, Shoukry AM, et al. (October 2019). "Economics of death and dying: a critical evaluation of environmental damages and healthcare reforms across the globe". *Environmental Science and Pollution Research International*. **26** (29): 29799–29809. Bibcode:2019ESPR...2629799B. doi:10.1007/s11356-019-06159-x. ISSN 1614-7499. PMID 31407261. S2CID 199528114.

28. ^ Bherwani H, Nair M, Musugu K, Gautam S, Gupta A, Kapley A, et al. (10 June 2020). "Valuation of air pollution externalities: comparative assessment of economic damage and emission reduction under COVID-19 lockdown". *Air Quality, Atmosphere & Health*. **13** (6): 683–694. Bibcode:2020AQAH...13..683B. doi:10.1007/s11869-020-00845-3. ISSN 1873-9318. PMC 7286556. PMID 32837611.
29. ^ Boubel R, Vallero D, Fox D, Turner B, Stern A (2013). *Fundamentals of Air Pollution* (Third ed.). Elsevier. pp. 447–522. ISBN 9780080507071. Retrieved 10 April 2024.
30. ^ *Regulating Air Quality: The First Global Assessment of Air Pollution Legislation*. Nairobi, Kenya: United Nations Environment Programme. 2021. ISBN 978-92-807-3872-8. Retrieved 10 April 2024.
31. ^ Brimblecombe P (2006). "The clean air act after 50 years". *Weather*. **61** (11): 311–314. Bibcode:2006Wthr...61..311B. doi:10.1256/wea.127.06. Retrieved 11 April 2024.
32. ^ "Progress Cleaning the Air and Improving People's Health". US Environmental Protection Agency. 8 June 2015. Retrieved 11 April 2024.
33. ^ Environment UN (29 October 2018). "About Montreal Protocol". Ozonation. Retrieved 7 June 2022.
34. ^ "The Montreal Protocol on Substances That Deplete the Ozone Layer". United States Department of State. Retrieved 7 June 2022.
35. ^ "Protocol On Further Reduction Of Sulphur Emissions To The Convention On Long-Range Transboundary Air Pollution | International Environmental Agreements (IEA) Database Project". *iea.uoregon.edu*. Retrieved 7 June 2022.
36. ^ Nations U. "ClimateChange". United Nations. Retrieved 7 June 2022.
37. ^ "Climate change". *www.who.int*. World Health Organization. Retrieved 7 June 2022.
38. ^ "Global Climate Agreements: Successes and Failures". Council on Foreign Relations. Retrieved 7 June 2022.
39. ^ "Basic Information about NO₂". US Environmental Protection Agency. 6 July 2016. Retrieved 12 April 2024.
40. ^ "Radon". World Health Organization. Retrieved 12 April 2024.
41. ^ Manisalidis I, Stavropoulou E, Stavropoulos A, Bezirtzoglou E (2020). "Environmental and Health Impacts of Air Pollution: A Review". *Front Public Health*. **8**: 14. doi:10.3389/fpubh.2020.00014. PMC 7044178. PMID 32154200.
42. ^ Perera F (23 December 2017). "Pollution from Fossil-Fuel Combustion is the Leading Environmental Threat to Global Pediatric Health and Equity: Solutions Exist". *International Journal of Environmental Research and Public Health*. **15** (1): 16. doi:10.3390/ijerph15010016. ISSN 1660-4601. PMC 5800116. PMID 29295510.
43. ^ "Mapping methane emissions on a global scale". ESA. Archived from the original on 3 February 2022.

44. ^ "Climate change: Satellites map huge methane plumes from oil and gas". *BBC News*. 4 February 2022. Retrieved 16 March 2022.
45. ^ "Cracking down on methane 'ultra emitters' is a quick way to combat climate change, researchers find". *The Washington Post*. Retrieved 16 March 2022.
46. ^ Lauvaux T, Giron C, Mazzolini M, d'Aspremont A, Duren R, Cusworth D, et al. (4 February 2022). "Global assessment of oil and gas methane ultra-emitters". *Science*. **375** (6580): 557–561. arXiv:2105.06387. Bibcode:2022Sci...375..557L. doi:10.1126/science.abj4351. ISSN 0036-8075. PMID 35113691. S2CID 246530897.
47. ^ Rentschler J, Leonova N (2023). "Global air pollution exposure and poverty". *Nature Communications*. **14** (1): 4432. Bibcode:2023NatCo..14.4432R. doi:10.1038/s41467-023-39797-4. PMC 10363163. PMID 37481598.
48. ^ Pennise D, Smith K. "Biomass Pollution Basics" (PDF). World Health Organization. Archived from the original (PDF) on 9 July 2012.
49. ^ "Indoor air pollution and household energy". WHO and UNEP. 2011.
50. ^ Hawkes N (22 May 2015). "Air pollution in UK: the public health problem that won't go away". *BMJ*. **350** (may22 1): h2757. doi:10.1136/bmj.h2757. PMID 26001592. S2CID 40717317.
51. ^ "Wood burning heaters and your health - Fact sheets". www.health.nsw.gov.au.
52. ^ Tsiodra I, Grivas G, Tavernaraki K, Bougiatioti A, Apostolaki M, Paraskevopoulou D, et al. (7 December 2021). "Annual exposure to polycyclic aromatic hydrocarbons in urban environments linked to wintertime wood-burning episodes". *Atmospheric Chemistry and Physics*. **21** (23): 17865–17883. Bibcode:2021ACP...2117865T. doi:10.5194/acp-21-17865-2021. ISSN 1680-7316. S2CID 245103794.
53. ^ Nace T. "China Shuts Down Tens Of Thousands Of Factories In Widespread Pollution Crackdown". *Forbes*. Retrieved 16 June 2022. "... it is estimated that 40 percent of all China's factories have been shut down at some point in order to be inspected... [and] over 80,000 factories have been hit with fines and criminal offenses as a result of their emissions."
54. ^ Huo H, Zhang Q, Guan D, Su X, Zhao H, He K (16 December 2014). "Examining Air Pollution in China Using Production- And Consumption-Based Emissions Accounting Approaches". *Environmental Science & Technology*. **48** (24): 14139–14147. Bibcode:2014EnST...4814139H. doi:10.1021/es503959t. ISSN 0013-936X. PMID 25401750.
55. ^ Huo H, Zhang Q, Guan D, Su X, Zhao H, He K (16 December 2014). "Examining Air Pollution in China Using Production- And Consumption-Based Emissions Accounting Approaches". *Environmental Science & Technology*. **48** (24): 14139–14147. Bibcode:2014EnST...4814139H. doi:10.1021/es503959t. ISSN 0013-936X. PMID 25401750.
56. ^ "EMEP/EEA air pollutant emission inventory guidebook 2019".
57. ^ "Particulate Matter (PM), US EPA". 19 April 2016.

58. ^ "GovHK: Green Tips for Home Renovation". GovHK. 16 September 2024. Retrieved 22 September 2024.
59. ^ "Health crisis: Up to a billion tons of waste potentially burned in the open every year". *phys.org*. Retrieved 13 February 2021.
60. ^ Cook E, Velis CA (6 January 2021). "Global Review on Safer End of Engineered Life". *Global Review on Safer End of Engineered Life*. Retrieved 13 February 2021.
61. ^ "Combustion Pollutants in Your Home - Guidelines". California Air Resources Board. Retrieved 16 June 2022. "'... most furnaces, wood stoves, fireplaces, gas water heaters, and gas clothes dryers, usually vent (exhaust) the combustion pollutants directly to the outdoors. However, if the vent system is not properly designed, installed, and maintained, indoor pollutants can build up quickly inside the home."
62. ^ "Overview of Air Pollution from Transportation". US Environmental Protection Agency. 15 December 2021. Retrieved 16 June 2022.
63. ^ Ryan RG, Marais EA, Balhatchet CJ, Eastham SD (June 2022). "Impact of Rocket Launch and Space Debris Air Pollutant Emissions on Stratospheric Ozone and Global Climate". *Earth's Future*. **10** (6): e2021EF002612. Bibcode:2022EaFut..1002612R. doi:10.1029/2021EF002612. ISSN 2328-4277. PMC 9287058. PMID 35865359.
64. ^ Yeung J. "Microplastics in our air 'spiral the globe' in a cycle of pollution, study finds". CNN. Retrieved 4 August 2022.
65. ^ Wang J, Wu Q, Liu J, Yang H, Yin M, Chen S, et al. (2019). "Vehicle emission and atmospheric pollution in China: problems, progress, and prospects". *PeerJ*. **7** : e6932. doi:10.7717/peerj.6932. PMC 6526014. PMID 31143547.
66. ^ Air Quality Expert Group (2004). *Nitrogen Dioxide in the United Kingdom (PDF)*. Department for Environment, Food and Rural Affairs. Retrieved 12 April 2024.
67. ^ Aggarwal P, Jain S (2015). "Impact of air pollutants from surface transport sources on human health: A modeling and epidemiological approach". *Environ Int* . **83**: 146–57. Bibcode:2015EnInt..83..146A. doi:10.1016/j.envint.2015.06.010. PMID 26142107.
68. ^ "NASA GISS: NASA News & Feature Releases: Road Transportation Emerges as Key Driver of Warming". *www.giss.nasa.gov*. Retrieved 4 August 2022.
69. ^ "Car Emissions & Global Warming | Union of Concerned Scientists". *www.ucsusa.org*. Retrieved 4 August 2022.
70. ^ "NASA's AIRS Maps Carbon Monoxide from Brazil Fires". NASA Jet Propulsion Laboratory (JPL). Retrieved 4 August 2022.
71. ^ Harper AR, Doerr SH, Santin C, Froyd CA, Sinnadurai P (15 May 2018). "Prescribed fire and its impacts on ecosystem services in the UK". *Science of the Total Environment*. **624**: 691–703. Bibcode:2018ScTEn.624..691H. doi:10.1016/j.scitotenv.2017.12.161. ISSN 0048-9697. PMID 29272838.
72. ^ George Neary D, McMichael Leonard J (8 April 2020), Missiakô Kindomihou V (ed.), "Effects of Fire on Grassland Soils and Water: A Review", *Grasses and*

- Grassland Aspects, IntechOpen, doi:10.5772/intechopen.90747, ISBN 978-1-78984-949-3, S2CID 213578405, retrieved 7 June 2022
73. ^ Hussein R, Aboah DT, Issifu H (1 March 2020). "Fire control systems in forest reserves: An assessment of three forest districts in the Northern region, Ghana". *Scientific African*. **7**: e00245. Bibcode:2020SciAf...700245H. doi:10.1016/j.sciaf.2019.e00245. ISSN 2468-2276. S2CID 213400214.
 74. ^ Reyes O, Casal M (November 2004). "Effects of forest fire ash on germination and early growth of four pinus species". *Plant Ecology*. **175** (1): 81–89. Bibcode:2004PIEco.175...81R. doi:10.1023/B:VEGE.0000048089.25497.0c. ISSN 1385-0237. S2CID 20388177.
 75. ^ Chatterjee R (15 February 2018). "Wall Paint, Perfumes and Cleaning Agents Are Polluting Our Air". NPR. Retrieved 12 March 2019.
 76. ^ "Basic Information about Landfill Gas". US Environmental Protection Agency. 15 April 2016. Retrieved 9 August 2022. "Landfill gas (LFG) is a natural byproduct of the decomposition of organic material in landfills. LFG is composed of roughly 50 percent methane..."
 77. ^ "Open waste burning prevention | Climate & Clean Air Coalition". www.ccacoalition.org. 7 September 2023. Retrieved 22 December 2023.
 78. ^ Hafemeister D (2016), "Biological and Chemical Weapons", *Nuclear Proliferation and Terrorism in the Post-9/11 World*, Cham: Springer International Publishing, pp. 337–351, doi:10.1007/978-3-319-25367-1_15, ISBN 978-3-319-25365-7, PMC 7123302
 79. ^ Sun F, Dai Y, Yu X (December 2017). "Air pollution, food production and food security: A review from the perspective of food system". *Journal of Integrative Agriculture*. **16** (12): 2945–2962. Bibcode:2017JIAgr..16.2945S. doi:10.1016/S2095-3119(17)61814-8.
 80. ^ Lelieveld J, Evans JS, Fnais M, Giannadaki D, Pozzer A (September 2015). "The contribution of outdoor air pollution sources to premature mortality on a global scale". *Nature*. **525** (7569): 367–371. Bibcode:2015Natur.525..367L. doi:10.1038/nature15371. ISSN 1476-4687. PMID 26381985. S2CID 4460927. "Whereas in much of the USA and in a few other countries emissions from traffic and power generation are important, in eastern USA, Europe, Russia and East Asia agricultural emissions make the largest relative contribution to PM2.5, with the estimate of overall health impact depending on assumptions regarding particle toxicity."
 81. ^ Diep F (31 January 2018). "California's Farms Are an Even Larger Source of Air Pollution Than We Thought". *Pacific Standard*. Retrieved 2 February 2018.
 82. ^ Nemecek T, Poore J (1 June 2018). "Reducing food's environmental impacts through producers and consumers". *Science*. **360** (6392): 987–992. Bibcode:2018Sci...360..987P. doi:10.1126/science.aag0216. ISSN 0036-8075. PMID 29853680. S2CID 206664954.
 83. ^ "Education Data, Visualizations & Graphics on particulate pollution". www.cleanairresources.com. Archived from the original on 20 March 2019.

- Retrieved 20 March 2019.
84. ^ Goldstein AH, Koven CD, Heald CL, Fung IY (5 May 2009). "Biogenic carbon and anthropogenic pollutants combine to form a cooling haze over the southeastern United States". *Proceedings of the National Academy of Sciences*. **106** (22): 8835–40. Bibcode:2009PNAS..106.8835G. doi:10.1073/pnas.0904128106. PMC 2690056. PMID 19451635.
 85. ^ Fischetti M (2014). "Trees That Pollute". *Scientific American*. **310** (6): 14. Bibcode:2014SciAm.310f..14F. doi:10.1038/scientificamerican0614-14. PMID 25004561.
 86. ^ "Volcanic Pollution |". Retrieved 27 February 2022.
 87. ^ "Air Pollution Emissions". US EPA. 2016. Retrieved 7 June 2022.
 88. ^ Environment and Climate Change Canada (14 June 2010). "Air pollutant emissions". Canada.ca. Retrieved 7 June 2022.
 89. ^ Manisalidis I, Stavropoulou E, Stavropoulos A, Bezirtzoglou E (20 February 2020). "Environmental and Health Impacts of Air Pollution: A Review". *Frontiers in Public Health*. **8**: 14. doi:10.3389/fpubh.2020.00014. ISSN 2296-2565. PMC 7044178. PMID 32154200.
 90. ^ "AP 42, Volume I". US Environmental Protection Agency. Archived from the original on 24 September 2010. Retrieved 29 August 2010.
 91. ^ "United Kingdom's emission factor database". Naei.org.uk. Archived from the original on 7 July 2010. Retrieved 29 August 2010.
 92. ^ "EMEP/EEA air pollutant emission inventory guidebook—2009". Eea.europa.eu . European Environmental Agency. 19 June 2009. Retrieved 11 December 2012.
 93. ^ "Environmental Pollution". Theenvironmentalblog.org. 16 December 2011. Retrieved 11 December 2012.
 94. ^ "Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories (reference manual)". Ippc-nggip.iges.or.jp. Archived from the original on 21 March 2008. Retrieved 29 August 2010.
 95. ^ US EPA O (10 December 2015). "Managing Air Quality - Air Pollutant Types". www.epa.gov. US Environmental Protection Agency. Retrieved 27 February 2022 .
 96. ^ Hidy G (2012). *Aerosols: An Industrial and Environmental Science*. Elsevier. p. 1. ISBN 978-0-323-14251-9.
 97. ^ Carrington D (4 November 2021). "Ammonia from farms behind 60% of UK particulate air pollution – study". *The Guardian*. Retrieved 7 November 2021.
 98. ^ "The Effect of Changing Background Emissions on External Cost Estimates for Secondary Particulates". *Open environmental sciences*. 2008.
 99. ^ Johnson K (18 April 2009). "How Carbon Dioxide Became a 'Pollutant'". *Wall Street Journal*.
 100. ^ "Carbon dioxide". *The National Institute for Occupational Safety and Health (NIOSH)*. U.S. Department of Health & Human Services. 30 October 2019. Retrieved 19 April 2023.

101. ^ **a b** "General hazards of Carbon Dioxide". Health and Safety Executive. UK Government. Retrieved 19 April 2023. "For over a century CO₂ has been recognised as a workplace hazard at high concentrations. CO₂ is naturally present in the air we breathe at a concentration of about 0.037% and is not harmful to health at low concentrations."
102. ^ Air Quality Guidelines Global Update 2005: Particulate matter, ozone, nitrogen dioxide and sulfur dioxide. Copenhagen, Denmark: World Health Organization. 2006. p. 12. ISBN 92-890-2192-6. "Some pollutants, and especially those associated with greenhouse warming effects (carbon dioxide, nitrous oxide and methane)..."
103. ^ Vaidyanathan G. "The Worst Climate Pollution Is Carbon Dioxide". Scientific American.
104. ^ Barbalace RC (7 November 2006). "CO₂ Pollution and Global Warming: When does carbon dioxide become a pollutant?". Environmentalchemistry.com.
105. ^ Friedman L (22 August 2022). "Democrats Designed the Climate Law to Be a Game Changer. Here's How". The New York Times. Retrieved 19 April 2023.
106. ^ "Graphic: The relentless rise of carbon dioxide". Climate Change: Vital Signs of the Planet. NASA.
107. ^ "How much of U.S. carbon dioxide emissions are associated with electricity generation?". Retrieved 16 December 2016.
108. ^ "Full Mauna Loa CO₂ record". Earth System Research Laboratory. Retrieved 10 January 2017.
109. ^ "OECD Test Guidelines for Chemicals".
110. ^ "The Strange Lake Nyos CO₂ Gas Disaster: Impacts and The Displacement and Return of Affected Communities".
111. ^ "Carbon Monoxide Poisoning – NHS". 17 October 2017.
112. ^ US EPA O (5 June 2017). "Basic Ozone Layer Science". www.epa.gov. US Environmental Protection Agency. Retrieved 7 June 2022.
113. ^ "Chlorofluorocarbons (CFCs) are heavier than air, so how do scientists suppose that these chemicals reach the altitude of the ozone layer to adversely affect it?". Scientific American. Retrieved 7 June 2022.
114. ^ "What is Particulate Matter? | Urban Environmental Program in New England". US EPA. 29 March 2022. Archived from the original on 7 June 2022. Retrieved 7 June 2022.
115. ^ Munsif R, Zubair M, Aziz A, Nadeem Zafar M (7 January 2021), Viskup R (ed.), "Industrial Air Emission Pollution: Potential Sources and Sustainable Mitigation", Environmental Emissions, IntechOpen, doi:10.5772/intechopen.93104, ISBN 978-1-83968-510-1, S2CID 234150821, retrieved 7 June 2022
116. ^ "Evidence growing of air pollution's link to heart disease, death". Archived from the original on 3 June 2010. Retrieved 18 May 2010. // American Heart Association. 10 May 2010
117. ^ Balmes J, Fine J, Sheppard D (1987). "Symptomatic bronchoconstriction after short-term inhalation of sulfur dioxide". American Review of Respiratory Disease.

- 136 (5): 1117–21. doi:10.1164/ajrccm/136.5.1117. PMID 3674573.
118. ^ Singh R, Kumar S, Karmakar S, Siddiqui AJ, Mathur A, Adnan M, et al. (2021). "2: Causes, Consequences, and Control of Persistent Organic Pollutants". In Kumar N, Shukla V (eds.). *Persistent Organic Pollutants in the Environment: Origin and Role*. CRC Press. pp. 31–54. ISBN 978-1-003-05317-0. Retrieved 11 June 2022.
 119. ^ "Newly detected air pollutant mimics damaging effects of cigarette smoke" (PDF). *Physorg.com*. Retrieved 29 August 2010.
 120. ^ "Infant Inhalation Of Ultra-fine Air Pollution Linked To Adult Lung Disease". *Sciencedaily.com*. 23 July 2009. Retrieved 29 August 2010.
 121. ^ Kim KH, Jahan SA, Kabir E, Brown RJ (1 October 2013). "A review of airborne polycyclic aromatic hydrocarbons (PAHs) and their human health effects". *Environment International*. **60**: 71–80. Bibcode:2013EnInt..60...71K. doi:10.1016/j.envint.2013.07.019. ISSN 0160-4120. PMID 24013021.
 122. ^ "Technical Overview of Volatile Organic Compounds". *US Environmental Protection Agency*. 14 March 2023. Retrieved 20 April 2023.
 123. ^ Read "Rethinking the Ozone Problem in Urban and Regional Air Pollution" at *NAP.edu*. 1991. doi:10.17226/1889. ISBN 978-0-309-04631-2.
 124. ^ "ESS Topic 6.3: Photochemical Smog". *Amazing World of Science With Mr. Green*. Retrieved 7 June 2022.
 125. ^ *Arkansas Energy Department of Energy and Environment*. "Cars and Air Pollution". *www.adeq.state.ar.us*. Retrieved 24 August 2024.
 126. ^ Acharya B (1 January 2018), Basu P (ed.), "Chapter 10 - Cleaning of Product Gas of Gasification", *Biomass Gasification, Pyrolysis and Torrefaction (Third Edition)*, Academic Press, pp. 373–391, ISBN 978-0-12-812992-0, retrieved 7 June 2022
 127. ^ "smog | National Geographic Society". *education.nationalgeographic.org*. *National Geographic*. Retrieved 7 June 2022.
 128. ^ "Hazardous Air Pollutants". *US Environmental Protection Agency*. 9 February 2023. Retrieved 29 April 2023.
 129. ^ "Air quality standards". *European Environment Agency*. Retrieved 29 April 2023
 130. ^ **a b c d e** Vallero DA (1 October 2007). *Fundamentals of Air Pollution (4th ed.)*. Academic Press. ISBN 9780124054813.
 131. ^ Dons E (2011). "Impact of time-activity patterns on personal exposure to black carbon". *Atmospheric Environment*. **45** (21): 3594–3602. Bibcode:2011AtmEn..45.3594D. doi:10.1016/j.atmosenv.2011.03.064.
 132. ^ Dons E (2019). "Transport most likely to cause air pollution peak exposures in everyday life: Evidence from over 2000 days of personal monitoring". *Atmospheric Environment*. **213**: 424–432. Bibcode:2019AtmEn.213..424D. doi:10.1016/j.atmosenv.2019.06.035. hdl:10044/1/80194. S2CID 197131423.
 133. ^ Carrington D (22 September 2021). "WHO slashes guideline limits on air pollution from fossil fuels". *The Guardian*. Retrieved 22 September 2021.

134. ^ "Most of the World Breathes Unsafe Air, Taking More Than 2 Years Off Global Life Expectancy". AQLI. 14 June 2022. Retrieved 12 July 2022.
135. ^ **a b** "Taking an Exposure History: What Are Possible Sources of Indoor Air Pollution | Environmental Medicine | ATSDR". www.atsdr.cdc.gov. 9 February 2021. Retrieved 8 July 2024. Public domain
made his article incorporate text from this source, which is in the public domain.
136. ^ **a b** Duflo E, Greenstone M, Hanna R (26 November 2008). "Indoor air pollution, health and economic well-being". *S.A.P.I.EN.S.* **1** (1). Retrieved 29 August 2010.
137. ^ **a b** "Improved Clean Cookstoves". Project Drawdown. 7 February 2020. Retrieved 5 December 2020.
138. ^ Twilley N (1 April 2019). "The Hidden Air Pollution in Our Homes". *The New Yorker* – via www.newyorker.com.
139. ^ "Bucknell tent death: Hannah Thomas-Jones died from carbon monoxide poisoning". BBC News. 17 January 2013. Retrieved 22 September 2015.
140. ^ "Chapter 6.2. Asbestos. Air quality guidelines, Second edition" (PDF). World Health Organization Europe. Archived from the original (PDF) on 24 May 2011.
141. ^ **a b** Carrington D (18 May 2021). "Air pollution linked to 'huge' rise in child asthma GP visits". *The Guardian*. Retrieved 22 May 2021.
142. ^ Kampa M, Castanas E (1 January 2008). "Human health effects of air pollution". *Environmental Pollution. Proceedings of the 4th International Workshop on Biomonitoring of Atmospheric Pollution (With Emphasis on Trace Elements)*. **151** (2): 362–367. Bibcode:2008EPoll.151..362K. doi:10.1016/j.envpol.2007.06.012. ISSN 0269-7491. PMID 17646040. S2CID 38513536.
143. ^ Dovjak M, Kukec A (2019). "Health Outcomes Related to Built Environments". *Creating Healthy and Sustainable Buildings*. Switzerland: Springer International Publishing. pp. 43–82. doi:10.1007/978-3-030-19412-3_2. ISBN 978-3-030-19411-6. OCLC 1285508857. S2CID 190160283.
144. ^ "Long-Term Exposure to Low Levels of Air Pollution Increases Risk of Heart and Lung Disease". Science Daily. 22 February 2021.
145. ^ Vohra K, Vodonos A, Schwartz J, Marais EA, Sulprizio MP, Mickley LJ (1 April 2021). "Global mortality from outdoor fine particle pollution generated by fossil fuel combustion: Results from GEOS-Chem". *Environmental Research*. **195**: 110754. Bibcode:2021ER....19510754V. doi:10.1016/j.envres.2021.110754. ISSN 0013-9351. PMID 33577774.
146. ^ "Air quality and health". Who.int. World Health Organization. Retrieved 26 November 2011.
147. ^ US EPA O (22 February 2013). "Regulatory and Guidance Information by Topic: Air". www.epa.gov. Retrieved 10 November 2022.
148. ^ Majumder N, Kodali V, Velayutham M, Goldsmith T, Amedro J, Khramtsov VV, et al. (2022). "Aerosol physicochemical determinants of carbon black and ozone inhalation co-exposure induced pulmonary toxicity". *Toxicological Sciences*. **191** (1): 61–78. doi:10.1093/toxsci/kfac113. PMC 9887725. PMID 36303316.

149. ^ Ritchie H, Roser M (2021). "What are the safest and cleanest sources of energy?". *Our World in Data*. Archived from the original on 15 January 2024. Data sources: Markandya & Wilkinson (2007); UNSCEAR (2008; 2018); Sovacool et al. (2016); IPCC AR5 (2014); Pehl et al. (2017); Ember Energy (2021).
150. ^ Roser M (18 March 2024). "Data review: how many people die from air pollution?". *Our World in Data*.
151. ^ Whitacre P (9 February 2021). "Air Pollution Accounts for 1 in 8 Deaths Worldwide, According to New WHO Estimates". *National Institute of Environmental Health Sciences*. Archived from the original on 4 November 2022. Retrieved 18 February 2022.
152. ^ Lelieveld J, Klingmüller K, Pozzer A, Burnett RT, Haines A, Ramanathan V (9 April 2019). "Effects of fossil fuel and total anthropogenic emission removal on public health and climate". *Proceedings of the National Academy of Sciences*. **116** (15): 7192–7197. Bibcode:2019PNAS..116.7192L. doi:10.1073/pnas.1819989116. ISSN 0027-8424. PMC 6462052. PMID 30910976.
153. ^ a b Carrington D (12 March 2019). "Air pollution deaths are double previous estimates, finds research". *The Guardian*. Retrieved 12 March 2019.
154. ^ Dickie G (18 May 2022). "Pollution killing 9 million people a year, Africa hardest hit - study". *Reuters*. Retrieved 23 June 2022.
155. ^ World Health Organisation (29 October 2018). "More than 90% of the world's children breathe toxic air every day". *www.who.int*. Retrieved 13 August 2024.
156. ^ a b "Ambient (outdoor) air pollution". *www.who.int*. World Health Organization. Retrieved 20 December 2021.
157. ^ Baccarelli AA, Hales N, Burnett RT, Jerrett M, Mix C, Dockery DW, et al. (1 November 2016). "Particulate Air Pollution, Exceptional Aging, and Rates of Centenarians: A Nationwide Analysis of the United States, 1980–2010". *Environmental Health Perspectives*. **124** (11): 1744–1750. doi:10.1289/EHP197. PMC 5089884. PMID 27138440.
158. ^ Pope CA (15 December 2003). "Cardiovascular Mortality and Long-Term Exposure to Particulate Air Pollution: Epidemiological Evidence of General Pathophysiological Pathways of Disease". *Circulation*. **109** (1): 71–77. doi:10.1161/01.CIR.0000108927.80044.7F. PMID 14676145.
159. ^ Harris G (25 January 2014). "Beijing's Bad Air Would Be Step Up for Smoggy Delhi". *The New York Times*. ISSN 0362-4331. Retrieved 28 April 2023.
160. ^ Owusu PA, Sarkodie SA (10 November 2020). "Global estimation of mortality, disability-adjusted life years and welfare cost from exposure to ambient air pollution". *Science of the Total Environment*. **742**: 140636. Bibcode:2020ScTEen.74240636O. doi:10.1016/j.scitotenv.2020.140636. ISSN 0048-9697. PMID 32721745. S2CID 220848545.
161. ^ "Lancet study: Pollution killed 2.3 million Indians in 2019". *BBC News*. 18 May 2022. Retrieved 28 April 2023.
162. ^ Mr Chen's claim was made in *The Lancet* (December 2013 issue) and reported in *The Daily Telegraph* 8 January 2014 p. 15 'Air pollution killing up to 500,000

Chinese each year, admits former health minister.

163. ^ Feng T, Chen H, Liu J (15 December 2022). "Air pollution-induced health impacts and health economic losses in China driven by US demand exports". *Journal of Environmental Management*. **324**: 116355. Bibcode:2022JEnvM.32416355F. doi:10.1016/j.jenvman.2022.116355. ISSN 0301-4797. PMID 36179470.
164. ^ **a b** "Car emissions: taking tests out of the lab and onto the road – News". European Parliament. 25 February 2016. Retrieved 11 January 2018.
165. ^ "Air pollution causes early deaths". BBC. 21 February 2005. Retrieved 14 August 2012.
166. ^ "Complete Guide To The 'Toxin Tax' For Diesel Cars". Motorway. Retrieved 25 May 2017.
167. ^ "Study links traffic pollution to thousands of deaths". *The Guardian*. London, UK. 15 April 2008. Archived from the original on 20 April 2008. Retrieved 15 April 2008.
168. ^ Mailloux NA, Abel DW, Holloway T, Patz JA (16 May 2022). "Nationwide and Regional PM_{2.5}-Related Air Quality Health Benefits From the Removal of Energy-Related Emissions in the United States". *GeoHealth*. **6** (5): e2022GH000603. Bibcode:2022GHeal...6..603M. doi:10.1029/2022GH000603. PMC 9109601. PMID 35599962.
169. ^ **a b** Henneman L, Choirat C, Dedoussi I, Dominici F, Roberts J, Zigler C (24 November 2023). "Mortality risk from United States coal electricity generation". *Science*. **382** (6673): 941–946. Bibcode:2023Sci...382..941H. doi:10.1126/science.adf4915. PMC 10870829. PMID 37995235.
170. ^ **a b** Nansai K, Tohno S, Chatani S, Kanemoto K, Kagawa S, Kondo Y, et al. (2 November 2021). "Consumption in the G20 nations causes particulate air pollution resulting in two million premature deaths annually". *Nature Communications*. **12** (1): 6286. Bibcode:2021NatCo..12.6286N. doi:10.1038/s41467-021-26348-y. ISSN 2041-1723. PMC 8563796. PMID 34728619.
171. ^ Vohra K, Vodonos A, Schwartz J, Marais EA, Sulprizio MP, Mickley LJ (1 April 2021). "Global mortality from outdoor fine particle pollution generated by fossil fuel combustion: Results from GEOS-Chem". *Environmental Research*. **195**: 110754. Bibcode:2021ER....19510754V. doi:10.1016/j.envres.2021.110754. ISSN 0013-9351. PMID 33577774. S2CID 231909881. Retrieved 5 March 2021.
172. ^ Mackenzie J, Turrentine J (22 June 2021). "Air Pollution: Everything You Need to Know". NRDC. Retrieved 18 June 2022.
173. ^ Farrow A, Miller KA, Myllyvirta L (February 2020). *Toxic air: The price of fossil fuels (PDF)*. Seoul: Greenpeace Southeast Asia.
174. ^ Lucking AJ, Lundback M, Mills NL, Faratian D, Barath SL, Pourazar J, et al. (2008). "Diesel exhaust inhalation increases thrombus formation in man". *European Heart Journal*. **29** (24): 3043–51. doi:10.1093/eurheartj/ehn464. PMID 18952612.

175. ^ Törnqvist HK, Mills NL, Gonzalez M, Miller MR, Robinson SD, Megson IL, et al. (2007). "Persistent Endothelial Dysfunction in Humans after Diesel Exhaust Inhalation". *American Journal of Respiratory and Critical Care Medicine*. **176** (4): 395–400. doi:10.1164/rccm.200606-872OC. PMID 17446340.
176. ^ "Air pollution from G20 consumers caused two million deaths in 2010". *New Scientist*. Retrieved 11 December 2021.
177. ^ Tankersley J (8 January 2010). "EPA proposes nation's strictest smog limits ever". *Los Angeles Times*. Retrieved 14 August 2012.
178. ^ "EPA slideshow" (PDF). Retrieved 11 December 2012.
179. ^ "EPA Strengthens Ozone Standards to Protect Public Health/Science-based standards to reduce sick days, asthma attacks, emergency room visits, greatly outweigh costs (10/1/2015)". *Yosemite.epa.gov*. Retrieved 11 January 2018.
180. ^ Grossni M (13 November 2008). "Human cost of valley's dirty air: \$6.3 billion". *Sacramento Bee*. Archived from the original on 16 December 2008. Retrieved 14 August 2012.
181. ^ Sahagun L (13 November 2008). "Pollution saps state's economy, study says". *Los Angeles Times*. Retrieved 14 August 2012.
182. ^ Kay J (13 November 2008). "Bad air costing state's economy billions". *San Francisco Chronicle*. Retrieved 14 August 2012.
183. ^ "Human health may be at risk from long-term exposure to air pollution below current air quality standards and guidelines". *British Medical Journal*. Retrieved 18 October 2021.
184. ^ Strak M, Weinmayr G, Rodopoulou S, Chen J, Hoogh Kd, Andersen ZJ, et al. (2 September 2021). "Long term exposure to low level air pollution and mortality in eight European cohorts within the ELAPSE project: pooled analysis". *BMJ*. **374**: n1904. doi:10.1136/bmj.n1904. ISSN 1756-1833. PMC 8409282. PMID 34470785.
185. ^ Cohen AJ, Brauer M, Burnett R, Anderson HR, Frostad J, Estep K, et al. (May 2017). "Estimates and 25-year trends of the global burden of disease attributable to ambient air pollution: an analysis of data from the Global Burden of Diseases Study 2015". *The Lancet*. **389** (10082): 1907–1918. Bibcode:2017Lanc..389.1907C. doi:10.1016/S0140-6736(17)30505-6. ISSN 0140-6736. PMC 5439030. PMID 28408086.
186. ^ a b de Bont J, Jaganathan S, Dahlquist M, Persson Å, Stafoggia M, Ljungman P (8 March 2022). "Ambient air pollution and cardiovascular diseases: An umbrella review of systematic reviews and meta-analyses". *Journal of Internal Medicine*. **291** (6): 779–800. doi:10.1111/joim.13467. eISSN 1365-2796. ISSN 0954-6820. PMC 9310863. PMID 35138681.
187. ^ a b Mayor S (12 June 2016). "Air pollution is a leading risk factor for stroke, global study shows". *BMJ*. **353**: i3272. doi:10.1136/bmj.i3272. eISSN 1756-1833. PMID 27298274.
188. ^ Feigin VL, Roth GA, Naghavi M, Parmar P, Krishnamurthi R, Chugh S, et al. (August 2016). "Global burden of stroke and risk factors in 188 countries, during

- 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013". *The Lancet Neurology*. **15** (9): 913–924. doi:10.1016/S1474-4422(16)30073-4. hdl:10292/14061. ISSN 1474-4422. PMID 27291521.
189. ^ Miller KA, Siscovick DS, Sheppard L, Shepherd K, Sullivan JH, Anderson GL, et al. (2007). "Long-term exposure to air pollution and incidence of cardiovascular events in women". *The New England Journal of Medicine*. **356** (5): 447–58. doi:10.1056/NEJMoa054409. PMID 17267905.
190. ^ Andersen ZJ, Kristiansen LC, Andersen KK, Olsen TS, Hvidberg M, Jensen SS, et al. (2011). "Stroke and Long-Term Exposure to Outdoor Air Pollution From Nitrogen Dioxide: A Cohort Study". *Stroke*. **43** (2): 320–25. doi:10.1161/STROKEAHA.111.629246. PMID 22052517.
191. ^ Provost E, Madhloum N, Int Panis L, De Boever P, Nawrot T (May 2015). "Carotid intima-media thickness, a marker of subclinical atherosclerosis, and particulate air pollution exposure: the meta-analytical evidence". *PLOS ONE*. **10** (5): e0127014. Bibcode:2015PLoSO..1027014P. doi:10.1371/journal.pone.0127014. PMC 4430520. PMID 25970426. S2CID 11741224.
192. ^ Brook R, Rajagopalan S, Pope Cl, Brook J, Bhatnagar A (2010). "Particulate matter air pollution and cardiovascular disease: An update to the scientific statement from the American Heart Association". *Circulation*. **121** (21): 2331–78. doi:10.1161/cir.0b013e3181d8e3e1. hdl:2027.42/78373. PMID 20458016.
193. ^ Louwies T, Int Panis L, Kicinski M, De Boever P, Nawrot TS (2013). "Retinal Microvascular Responses to Short-Term Changes in Particulate Air Pollution in Healthy Adults". *Environmental Health Perspectives*. **121** (9): 1011–16. doi:10.1289/ehp.1205721. PMC 3764070. PMID 23777785. S2CID 6748539.
194. ^ Gehring U, Wijga AH, Brauer M, Fischer P, de Jongste JC, Kerkhof M, et al. (2010). "Traffic-related air pollution and the development of asthma and allergies during the first 8 years of life". *American Journal of Respiratory and Critical Care Medicine*. **181** (6): 596–603. doi:10.1164/rccm.200906-0858OC. PMID 19965811.
195. ^ Andersen ZJ, Hvidberg M, Jensen SS, Ketzel M, Loft S, Sorensen M, et al. (2011). "Chronic obstructive pulmonary disease and long-term exposure to traffic-related air pollution: a cohort study. [Research Support, Non-U.S. Gov't]". *American Journal of Respiratory and Critical Care Medicine*. **183** (4): 455–461. doi:10.1164/rccm.201006-0937OC. PMID 20870755. S2CID 3945468.
196. ^ Committee of the Environmental and Occupational Health Assembly of the American Thoracic Society (1996). "Health effects of outdoor air pollution". *American Journal of Respiratory and Critical Care Medicine*. **153** (1): 3–50. doi:10.1164/ajrccm.153.1.8542133. PMID 8542133.
197. ^ Andersen ZJ, Bonnelykke K, Hvidberg M, Jensen SS, Ketzel M, Loft S, et al. (2011). "Long-term exposure to air pollution and asthma hospitalisations in older adults: a cohort study". *Thorax*. **67** (1): 6–11. doi:10.1136/thoraxjnl-2011-200711. PMID 21890573.

198. ^ Zoidis JD (1999). "The Impact of Air Pollution on COPD". RT: For Decision Makers in Respiratory Care.
199. ^ World Health Organisation. "Ambient air pollution". www.who.int. Retrieved 10 November 2023.
200. ^ "Understanding Air Pollution". Respiratory Health Association. Retrieved 15 August 2022.
201. ^ Holland WW, Reid DD. "The urban factor in chronic bronchitis" *Lancet* 1965;i:445–448.
202. ^ Gauderman W (2007). "Effect of exposure to traffic on lung development from 10 to 18 years of age: a cohort study". *The Lancet*. **369** (9561): 571–77. CiteSeerX 10.1.1.541.1258. doi:10.1016/S0140-6736(07)60037-3. PMID 17307103. S2CID 852646.
203. ^ Int Panis L (2017). "Short-term air pollution exposure decreases lung function: a repeated measures study in healthy adults". *Environmental Health*. **16** (1): 60. Bibcode:2017EnvHe..16...60I. doi:10.1186/s12940-017-0271-z. PMC 5471732. PMID 28615020. S2CID 20491472.
204. ^ Sunyer J (2001). "Urban air pollution and Chronic Obstructive Pulmonary disease: a review". *European Respiratory Journal*. **17** (5): 1024–33. doi:10.1183/09031936.01.17510240. PMID 11488305.
205. ^ **a b** "Cancer breakthrough is a 'wake-up' call on danger of air pollution". *The Guardian*. 10 September 2022. Retrieved 11 September 2022.
206. ^ Hill W, Lim EL, Weeden CE, Lee C, Augustine M, Chen K, et al. (5 April 2023). "Lung adenocarcinoma promotion by air pollutants". *Nature*. **616** (7955): 159–167. Bibcode:2023Natur.616..159H. doi:10.1038/s41586-023-05874-3. ISSN 1476-4687. PMC 7614604. PMID 37020004.
207. ^ "Education Data, Visualizations & Graphics on Air Quality and PM2.5". www.cleanairresources.com. Retrieved 19 September 2019.
208. ^ Gallagher J (17 December 2015). "Cancer is not just 'bad luck' but down to environment, study suggests". *BBC*. Retrieved 17 December 2015.
209. ^ **a b** Chen H, Goldberg M, Villeneuve P (October–December 2008). "A systematic review of the relation between long-term exposure to ambient air pollution and chronic diseases". *Reviews on Environmental Health*. **23** (4): 243–97. doi:10.1515/reveh.2008.23.4.243. PMID 19235364. S2CID 24481623.
210. ^ Saber E, Heydari G (May 2012). "Flow patterns and deposition fraction of particles in the range of 0.1–10 μ m at trachea and the first third generations under different breathing conditions". *Computers in Biology and Medicine*. **42** (5): 631–38. doi:10.1016/j.combiomed.2012.03.002. PMID 22445097.
211. ^ Raaschou-Nielsen O, Andersen ZJ, Hvidberg M, Jensen SS, Ketzel M, Sorensen M, et al. (2011). "Lung cancer incidence and long-term exposure to air pollution from traffic. [Research Support, Non-U.S. Gov't]". *Environmental Health Perspectives*. **119** (6): 860–65. doi:10.1289/ehp.1002353. PMC 3114823. PMID 21227886. S2CID 1323189.

212. ^ Raaschou-Nielsen O, Andersen ZJ, Hvidberg M, Jensen SS, Ketzel M, Sorensen M, et al. (2011). "Air pollution from traffic and cancer incidence: a Danish cohort study". *Environmental Health*. **10** (1): 67. Bibcode:2011EnvHe..10...67R. doi:10.1186/1476-069X-10-67. PMC 3157417. PMID 21771295. S2CID 376897.
213. ^ Yacong Bo (2021). "Reduced Ambient PM2.5 Was Associated with a Decreased Risk of Chronic Kidney Disease: A Longitudinal Cohort Study". *Environmental Science & Technology*. **55** (10): 6876–6883. Bibcode:2021EnST...55.6876B. doi:10.1021/acs.est.1c00552. PMID 33904723. S2CID 233408693.
214. ^ Blum MF, Surapaneni A, Stewart JD, Liao D, Yanosky JD, Whitsel EA, et al. (6 March 2020). "Particulate Matter and Albuminuria, Glomerular Filtration Rate, and Incident CKD". *Clinical Journal of the American Society of Nephrology*. **15** (3): 311–319. doi:10.2215/CJN.08350719. ISSN 1555-9041. PMC 7057299. PMID 32108020.
215. ^ **a b c d e f** Conforti A, Mascia M, Cioffi G, De Angelis C, Coppola G, De Rosa P, et al. (30 December 2018). "Air pollution and female fertility: a systematic review of literature". *Reproductive Biology and Endocrinology*. **16** (1): 117. doi:10.1186/s12958-018-0433-z. ISSN 1477-7827. PMC 6311303. PMID 30594197.
216. ^ Canipari R, De Santis L, Cecconi S (January 2020). "Female Fertility and Environmental Pollution". *International Journal of Environmental Research and Public Health*. **17** (23): 8802. doi:10.3390/ijerph17238802. ISSN 1660-4601. PMC 7730072. PMID 33256215.
217. ^ da Silva Junior FC, Felipe MB, Castro DE, Araújo SC, Sisenando HC, Batistuzzo de Medeiros SR (1 June 2021). "A look beyond the priority: A systematic review of the genotoxic, mutagenic, and carcinogenic endpoints of non-priority PAHs". *Environmental Pollution*. **278**: 116838. Bibcode:2021EPoll.27816838D. doi:10.1016/j.envpol.2021.116838. ISSN 0269-7491. PMID 33714059. S2CID 232222865.
218. ^ Plunk EC, Richards SM (January 2020). "Endocrine-Disrupting Air Pollutants and Their Effects on the Hypothalamus-Pituitary-Gonadal Axis". *International Journal of Molecular Sciences*. **21** (23): 9191. doi:10.3390/ijms21239191. ISSN 1422-0067. PMC 7731392. PMID 33276521.
219. ^ Perono GA, Petrik JJ, Thomas PJ, Holloway AC (1 January 2022). "The effects of polycyclic aromatic compounds (PACs) on mammalian ovarian function". *Current Research in Toxicology*. **3**: 100070. Bibcode:2022CRTox...300070P. doi:10.1016/j.crttox.2022.100070. ISSN 2666-027X. PMC 9043394. PMID 35492299.
220. ^ **a b** Jurewicz J, Dziewirska E, Radwan M, Hanke W (23 December 2018). "Air pollution from natural and anthropic sources and male fertility". *Reproductive Biology and Endocrinology*. **16** (1): 109. doi:10.1186/s12958-018-0430-2. ISSN 1477-7827. PMC 6304234. PMID 30579357.

221. ^ Frutos V, González-Comadrán M, Solà I, Jacquemin B, Carreras R, Checa Vizcaíno MA (2 January 2015). "Impact of air pollution on fertility: a systematic review". *Gynecological Endocrinology*. **31** (1): 7–13. doi:10.3109/09513590.2014.958992. ISSN 0951-3590. PMID 25212280. S2CID 41594539.
222. ^ Checa Vizcaíno MA, González-Comadrán M, Jacquemin B (September 2016). "Outdoor air pollution and human infertility: a systematic review". *Fertility and Sterility*. **106** (4): 897–904.e1. doi:10.1016/j.fertnstert.2016.07.1110. ISSN 0015-0282. PMID 27513553.
223. ^ **a b c** Carré J, Gatimel N, Moreau J, Parinaud J, Léandri R (28 July 2017). "Does air pollution play a role in infertility?: a systematic review". *Environmental Health*. **16** (1): 82. Bibcode:2017EnvHe..16...82C. doi:10.1186/s12940-017-0291-8. ISSN 1476-069X. PMC 5534122. PMID 28754128.
224. ^ Jurewicz J, Dziewirska E, Radwan M, Hanke W (2018). "Air pollution from natural and anthropic sources and male fertility". *Reproductive Biology and Endocrinology*. **16** (1): 109. doi:10.1186/s12958-018-0430-2. PMC 6304234. PMID 30579357. S2CID 57376088. Retrieved 5 October 2022.
225. ^ **a b** Air pollution and child health: prescribing clean air. Summary. Geneva: World Health Organisation. 2018. pp. 2–6.
226. ^ **a b** Gordon B, Mackay R, Rehfuess E (2004). "Polluted Cities: The Air Children Breathe". *Inheriting the World: The Atlas of Children's Health and the Environment*. World Health Organisation.
227. ^ Pieters N, Koppen G, Van Poppel M, De Prins S, Cox B, Dons E, et al. (March 2015). "Blood Pressure and Same-Day Exposure to Air Pollution at School: Associations with Nano-Sized to Coarse PM in Children". *Environmental Health Perspectives*. **123** (7): 737–42. doi:10.1289/ehp.1408121. PMC 4492263. PMID 25756964.
228. ^ Perera FP, Tang D, Wang S, Vishnevetsky J, Zhang B, Diaz D, et al. (1 June 2012). "Prenatal Polycyclic Aromatic Hydrocarbon (PAH) Exposure and Child Behavior at Age 6–7 Years". *Environmental Health Perspectives*. **120** (6): 921–926. doi:10.1289/ehp.1104315. PMC 3385432. PMID 22440811.
229. ^ Perera FP, Chang Hw, Tang D, Roen EL, Herbstman J, Margolis A, et al. (5 November 2014). "Early-Life Exposure to Polycyclic Aromatic Hydrocarbons and ADHD Behavior Problems". *PLOS ONE*. **9** (11): e111670. Bibcode:2014PLoSO...9k1670P. doi:10.1371/journal.pone.0111670. ISSN 1932-6203. PMC 4221082. PMID 25372862.
230. ^ Becerra TA, Wilhelm M, Olsen J, Cockburn M, Ritz B (1 March 2013). "Ambient Air Pollution and Autism in Los Angeles County, California". *Environmental Health Perspectives*. **121** (3): 380–386. doi:10.1289/ehp.1205827. PMC 3621187. PMID 23249813.
231. ^ Carter SA, Rahman MM, Lin JC, Shu YH, Chow T, Yu X, et al. (1 January 2022). "In utero exposure to near-roadway air pollution and autism spectrum disorder in children". *Environment International*. **158**: 106898.

- Bibcode:2022EnInt.15806898C. doi:10.1016/j.envint.2021.106898. ISSN 0160-4120. PMC 8688235. PMID 34627014.
232. ^ Flanagan E, Malmqvist E, Rittner R, Gustafsson P, Källén K, Oudin A (8 March 2023). "Exposure to local, source-specific ambient air pollution during pregnancy and autism in children: a cohort study from southern Sweden". *Scientific Reports*. **13** (1): 3848. Bibcode:2023NatSR..13.3848F. doi:10.1038/s41598-023-30877-5. ISSN 2045-2322. PMC 9995328. PMID 36890287.
233. ^ Ritz B, Liew Z, Yan Q, Cuia X, Virk J, Ketzel M, et al. (December 2018). "Air pollution and autism in Denmark". *Environmental Epidemiology*. **2** (4): e028. doi:10.1097/EE9.0000000000000028. PMC 6474375. PMID 31008439.
234. ^ Perera F, Herbstman J (1 April 2011). "Prenatal environmental exposures, epigenetics, and disease". *Reproductive Toxicology. Prenatal Programming and Toxicity II (PPTOX II): Role of Environmental Stressors in the Developmental Origins of Disease*. **31** (3): 363–373. Bibcode:2011RepTx..31..363P. doi:10.1016/j.reprotox.2010.12.055. ISSN 0890-6238. PMC 3171169. PMID 21256208.
235. ^ Papamitsou T, Sirak S, Kavvadas D (January–March 2020). "Air pollution and preterm birth: a recommendation for further study in Greece". *Hippokratia*. **24** (1): 44. PMC 7733367. PMID 33364740.
236. ^ Fleischer NL, Meriardi M, van Donkelaar A, Vadillo-Ortega F, Martin RV, Betran AP, et al. (1 April 2014). "Outdoor air pollution, preterm birth, and low birth weight: analysis of the World Health Organization global survey on maternal and perinatal health". *Environmental Health Perspectives*. **122** (4): 425–30. doi:10.1289/ehp.1306837. ISSN 1552-9924. PMC 3984219. PMID 24508912. S2CID 3947454.
237. ^ **a b c** Malley CS, Kuylenstierna JC, Vallack HW, Henze DK, Blencowe H, Ashmore MR (1 April 2017). "Preterm birth associated with maternal fine particulate matter exposure: A global, regional and national assessment" (PDF). *Environment International*. **101**: 173–82. Bibcode:2017EnInt.101..173M. doi:10.1016/j.envint.2017.01.023. ISSN 1873-6750. PMID 28196630.
238. ^ Bank EI (19 October 2022). *Finance in Africa - Navigating the financial landscape in turbulent times*. European Investment Bank. ISBN 978-92-861-5382-2.
239. ^ "Silent Suffocation in Africa - Air Pollution is a Growing Menace, Affecting the Poorest Children the Most" (PDF). UNICEF.
240. ^ "The cost of air pollution in Africa". *Africa Renewal*. Retrieved 31 October 2022.
241. ^ Wang X, Ding H, Ryan L, Xu X (1 May 1997). "Association between air pollution and low birth weight: a community-based study". *Environmental Health Perspectives*. **105** (5): 514–20. doi:10.1289/ehp.97105514. ISSN 0091-6765. PMC 1469882. PMID 9222137. S2CID 2707126.
242. ^ Brauer M, Lencar C, Tamburic L, Koehoorn M, Demers P, Karr C (1 May 2008). "A Cohort Study of Traffic-Related Air Pollution Impacts on Birth Outcomes". *Environmental Health Perspectives*. **116** (5): 680–6. doi:10.1289/ehp.10952.

- PMC 2367679. PMID 18470315. S2CID 7721551.
243. ^ Bos I, De Boever P, Int Panis L, Meeusen R (2014). "Physical Activity, Air Pollution and the Brain". *Sports Medicine*. **44** (11): 1505–18. doi:10.1007/s40279-014-0222-6. PMID 25119155. S2CID 207493297.
244. ^ Air pollution linked to much greater risk of dementia *The Guardian*
245. ^ Julvez J, López-Vicente M, Warembourg C, Maitre L, Philippat C, Gützkow KB, et al. (1 September 2021). "Early life multiple exposures and child cognitive function: A multi-centric birth cohort study in six European countries". *Environmental Pollution*. **284**: 117404. Bibcode:2021EPoll.28417404J. doi:10.1016/j.envpol.2021.117404. ISSN 0269-7491. PMC 8287594. PMID 34077897.
246. ^ **a b** Costa LG, Cole TB, Dao K, Chang YC, Coburn J, Garrick JM (June 2020). "Effects of air pollution on the nervous system and its possible role in neurodevelopmental and neurodegenerative disorders". *Pharmacology & Therapeutics*. **210**: 107523. doi:10.1016/j.pharmthera.2020.107523. ISSN 1879-016X. PMC 7245732. PMID 32165138.
247. ^ Volk HE, Perera F, Braun JM, Kingsley SL, Gray K, Buckley J, et al. (1 May 2021). "Prenatal air pollution exposure and neurodevelopment: A review and blueprint for a harmonized approach within ECHO". *Environmental Research*. **196** : 110320. Bibcode:2021ER...19610320V. doi:10.1016/j.envres.2020.110320. ISSN 0013-9351. PMC 8060371. PMID 33098817.
248. ^ Shang L, Yang L, Yang W, Huang L, Qi C, Yang Z, et al. (1 July 2020). "Effects of prenatal exposure to NO₂ on children's neurodevelopment: a systematic review and meta-analysis". *Environmental Science and Pollution Research*. **27** (20): 24786–24798. Bibcode:2020ESPR...2724786S. doi:10.1007/s11356-020-08832-y. ISSN 1614-7499. PMC 7329770. PMID 32356052. S2CID 216650267.
249. ^ Allen JL, Liu X, Pelkowski S, Palmer B, Conrad K, Oberdörster G, et al. (5 June 2014). "Early Postnatal Exposure to Ultrafine Particulate Matter Air Pollution: Persistent Ventriculomegaly, Neurochemical Disruption, and Glial Activation Preferentially in Male Mice". *Environmental Health Perspectives*. **122** (9): 939–945. doi:10.1289/ehp.1307984. ISSN 0091-6765. PMC 4154219. PMID 24901756.
250. ^ McEnaney M (7 June 2014). "Air pollution link discovered to autism, schizophrenia risks". *Tech Times*. Retrieved 8 June 2014.
251. ^ "New evidence links air pollution to autism, schizophrenia". *ScienceDaily*. 5 June 2014. Retrieved 28 August 2024.
252. ^ Persico C, Marcotte DE (November 2022). *Air Quality and Suicide*. Working Paper Series. National Bureau of Economic Research. doi:10.3386/w30626. cite book: CS1 maint: date and year (link)
253. ^ Symons A (15 December 2022). "Suicide rates rise as air quality worsens, study finds". *euronews*. Retrieved 19 December 2022.
254. ^ "New Study Demonstrates Indoor Building Environment Has Significant, Positive Impact on Cognitive Function". *The New York Times*. 26 October 2015.

- Archived from the original on 9 November 2020. Retrieved 10 November 2015.
255. ^ Allen JG, MacNaughton P, Satish U, Santanam S, Vallarino J, Spengler JD (2015). "Associations of Cognitive Function Scores with Carbon Dioxide, Ventilation, and Volatile Organic Compound Exposures in Office Workers: A Controlled Exposure Study of Green and Conventional Office Environments". *Environmental Health Perspectives*. **124** (6): 805–12. doi:10.1289/ehp.1510037. PMC 4892924. PMID 26502459. S2CID 12756582.
 256. ^ Cedeño Laurent JG, MacNaughton P, Jones E, Young AS, Bliss M, Flanigan S, et al. (1 September 2021). "Associations between acute exposures to PM2.5 and carbon dioxide indoors and cognitive function in office workers: a multicountry longitudinal prospective observational study". *Environmental Research Letters*. **16** (9): 094047. Bibcode:2021ERL....16i4047C. doi:10.1088/1748-9326/ac1bd8. ISSN 1748-9326. PMC 8942432. PMID 35330988. S2CID 237462480.
 257. ^ Qian D (29 June 2017). "Air Pollution and Mortality in the Medicare Population". *New England Journal of Medicine*. **376** (26): 2513–2522. doi:10.1056/NEJMoa1702747. PMC 5766848. PMID 28657878. S2CID 12038778.
 258. ^ Pathak M, Kuttippurath J (2022). "Air quality trends in rural India: analysis of NO2 pollution using satellite measurements". *Environmental Science: Processes & Impacts*. **24** (12): 2437–2449. doi:10.1039/D2EM00293K. ISSN 2050-7887. PMID 36413251. S2CID 253261324.
 259. ^ Woodyatt A (3 June 2020). "Scientists say they have found the cleanest air on Earth". CNN. Retrieved 3 June 2020.
 260. ^ Hong C, Mueller ND, Burney JA, Zhang Y, AghaKouchak A, Moore FC, et al. (2020). "Impacts of ozone and climate change on yields of perennial crops in California". *Nature Food*. **1** (3): 166–172. doi:10.1038/s43016-020-0043-8. S2CID 216425480.
 261. ^ Li H, Tang M, Cao A, Guo L (2022). "Assessing the relationship between air pollution, agricultural insurance, and agricultural green total factor productivity: evidence from China". *Environmental Science and Pollution Research*. **29** (52): 78381–78395. Bibcode:2022ESPR...2978381L. doi:10.1007/s11356-022-21287-7. ISSN 0944-1344. PMID 35689771. S2CID 249551277.
 262. ^ Kashyap R, Kuttippurath J, Patel VK (2023). "Improved air quality leads to enhanced vegetation growth during the COVID–19 lockdown in India". *Applied Geography*. **151**: 102869. Bibcode:2023AppGe.15102869K. doi:10.1016/j.apgeog.2022.102869. ISSN 0143-6228. PMC 9805897. PMID 36619606. S2CID 255439854.
 263. ^ Kuttippurath J, Singh A, Dash SP, Mallic N, Clerbaux C, Van Damme M, et al. (2020). "Record high levels of atmospheric ammonia over India: Spatial and temporal analyses". *Science of the Total Environment*. **740**: 139986. Bibcode:2020ScTEen.74039986K. doi:10.1016/j.scitotenv.2020.139986. ISSN 0048-9697. PMID 32927535. S2CID 221722300.

264. ^ RWDI Consulting (2005). "Health and air quality 2005 – Phase 2: Valuation of health impacts from air quality in the lower Fraser Valley airshed" (PDF). Archived from the original (PDF) on 15 May 2011. Retrieved 29 August 2010.
265. ^ UN Environment (11 October 2018). "Air pollution linked to "huge" reduction in intelligence". UN Environment. Retrieved 1 July 2019.
266. ^ Lavy V, Rachkovski G, Yoresh O (2022). *Heads Up: Does Air Pollution Cause Workplace Accidents? (Report)*. Cambridge, MA: National Bureau of Economic Research. doi:10.3386/w30715.
267. ^ Smith A (12 February 2021). "Pollution on other planets could help us find aliens, Nasa says". *The Independent*. Archived from the original on 12 February 2021. Retrieved 6 March 2021.
268. ^ "Can Alien Smog Lead Us to Extraterrestrial Civilizations?". *Wired*. Retrieved 6 March 2021.
269. ^ Kopparapu R, Arney G, Haqq-Misra J, Lustig-Yaeger J, Villanueva G (22 February 2021). "Nitrogen Dioxide Pollution as a Signature of Extraterrestrial Technology". *The Astrophysical Journal*. **908** (2): 164. arXiv:2102.05027. Bibcode:2021ApJ...908..164K. doi:10.3847/1538-4357/abd7f7. ISSN 1538-4357. S2CID 231855390.
270. ^ Chakrabarti S. "20th anniversary of world's worst industrial disaster". Australian Broadcasting Corporation.
271. ^ Bell ML, Davis DL, Fletcher T (January 2004). "A Retrospective Assessment of Mortality from the London Smog Episode of 1952: The Role of Influenza and Pollution". *Environ Health Perspect*. **112** (1): 6–8. doi:10.1289/ehp.6539. PMC 1241789. PMID 14698923. S2CID 13045119.
272. ^ Meselson M, Guillemin J, Hugh-Jones M (November 1994). "The Sverdlovsk anthrax outbreak of 1979" (PDF). *Science*. **266** (5188): 1202–08. Bibcode:1994Sci...266.1202M. doi:10.1126/science.7973702. PMID 7973702. Archived from the original (PDF) on 21 September 2006.
273. ^ Davis D (2002). *When Smoke Ran Like Water: Tales of Environmental Deception and the Battle Against Pollution*. Basic Books. ISBN 978-0-465-01521-4.
274. ^ Landrigan P (25 November 2016). "Air pollution and health". *Lancet*. **2** (1): E4–E5. doi:10.1016/S2468-2667(16)30023-8. PMID 29249479.
275. ^ Camahan JV, Thurston DL (1998). "Trade-off Modeling for Product and Manufacturing Process Design for the Environment". *Journal of Industrial Ecology*. **2** (1): 79–92. Bibcode:1998JInEc...2...79C. doi:10.1162/jiec.1998.2.1.79. ISSN 1530-9290. S2CID 154730593.
276. ^ Jacobson MZ, von Krauland AK, Coughlin SJ, Palmer FC, Smith MM (1 January 2022). "Zero air pollution and zero carbon from all energy at low cost and without blackouts in variable weather throughout the U.S. with 100% wind-water-solar and storage". *Renewable Energy*. **184**: 430–442. Bibcode:2022REne..184..430J. doi:10.1016/j.renene.2021.11.067. ISSN 0960-1481. S2CID 244820608.

277. ^ Gielen D, Boshell F, Saygin D, Bazilian MD, Wagner N, Gorini R (1 April 2019). "The role of renewable energy in the global energy transformation". *Energy Strategy Reviews*. **24**: 38–50. Bibcode:2019EneSR..24...38G. doi:10.1016/j.esr.2019.01.006. ISSN 2211-467X. S2CID 135283552.
278. ^ Burns J, Boogaard H, Polus S, Pfadenhauer LM, Rohwer AC, van-Erp AM, et al. (20 May 2019). "Interventions to Reduce Ambient Particulate Matter Air Pollution and Their Effect on Health". *Cochrane Database of Systematic Reviews*. **2019** (5): CD010919. doi:10.1002/14651858.CD010919.pub2. PMC 6526394. PMID 31106396.
279. ^ Connolly K (30 August 2022). "Germany's €9 train tickets scheme 'saved 1.8m tons of CO₂ emissions'". *The Guardian*. Retrieved 6 December 2022.
280. ^ Fensterstock JC, Kurtzweg JA, Ozolins G (1971). "Reduction of Air Pollution Potential through Environmental Planning". *Journal of the Air Pollution Control Association*. **21** (7): 395–399. doi:10.1080/00022470.1971.10469547. PMID 5148260.
281. ^ Fensterstock, Ketcham and Walsh, *The Relationship of Land Use and Transportation Planning to Air Quality Management*, Ed. George Hagevik, May 1972.
282. ^ "The Importance of Development Plans/Land Use Policy for Development Control". www.oas.org. Retrieved 17 June 2022.
283. ^ Kuttippurath J, Patel VK, Pathak M, Singh A (2022). "Improvements in SO₂ pollution in India: role of technology and environmental regulations". *Environmental Science and Pollution Research*. **29** (52): 78637–78649. Bibcode:2022ESPR...2978637K. doi:10.1007/s11356-022-21319-2. ISSN 1614-7499. PMC 9189448. PMID 35696063. S2CID 249613744.
284. ^ Palmer J (12 November 2011). "'Smog-Eating' Material Breaking into the Big Time". *BBC News*.
285. ^ "Nanotechnology to gobble up pollution". *BBC News*. 15 May 2014. Retrieved 29 October 2014.
286. ^ **a b** Jacobson MZ (2015). "100% clean and renewable wind, water, and sunlight (WWS) all-sector energy road maps for the 50 United States". *Energy and Environmental Science*. **8** (7): 2093–2117. doi:10.1039/C5EE01283J.
287. ^ Krelling C, Badami MG (1 January 2022). "Cost-effectiveness analysis of compressed natural gas implementation in the public bus transit fleet in Delhi, India". *Transport Policy*. **115**: 49–61. doi:10.1016/j.tranpol.2021.10.019. ISSN 0967-070X.
288. ^ Landrigan PJ (1 January 2017). "Air pollution and health". *The Lancet Public Health*. **2** (1): e4–e5. doi:10.1016/S2468-2667(16)30023-8. ISSN 2468-2667. PMID 29249479.
289. ^ Lyons TJ, Kenworthy JR, Newman PW (1 January 1990). "Urban structure and air pollution". *Atmospheric Environment. Part B. Urban Atmosphere*. **24** (1): 43–48. Bibcode:1990AtmEB..24...43L. doi:10.1016/0957-1272(90)90008-I. ISSN 0957-1272.

290. ^ McVeigh K (28 September 2021). "False choice: is deep-sea mining required for an electric vehicle revolution?". *The Guardian*. Retrieved 24 October 2021.
291. ^ Opray M (24 August 2017). "Nickel mining: the hidden environmental cost of electric cars". *The Guardian*. Retrieved 24 October 2021.
292. ^ "Los Angeles Airport Pollutes City Air For Miles Downwind". *Chemical and Engineering news*. 30 May 2014. Retrieved 13 December 2019.
293. ^ "NASA Confirms Biofuels Reduce Jet Emissions". *Flyingmag.com*. 23 March 2017. Retrieved 11 January 2018.
294. ^ "Interseasonal Heat Transfer – Seasonal Heat Storage – GSHC – Renewable Heat & Renewable Cooling from ThermalBanks – Efficient Renewable Energy – Hybrid Renewable Energy Systems". *Icax.co.uk*. Retrieved 11 January 2018.
295. ^ Ahuja D, Tatsutani M (7 April 2009). "Sustainable energy for developing countries". *S.A.P.I.EN.S (in French)*. **2** (1). ISSN 1993-3800.
296. ^ Oyedepo SO (23 July 2012). "Energy and sustainable development in Nigeria: the way forward". *Energy, Sustainability and Society*. **2** (1): 15. Bibcode:2012ESusS...2...15O. doi:10.1186/2192-0567-2-15. ISSN 2192-0567. S2CID 40436190.
297. ^ "Road Rubber". *Sciencenetlinks.com Science Updates – Science NetLinks*. Retrieved 11 January 2018.
298. ^ Simeonova E (March 2018). "Congestion Pricing, Air Pollution and Children's Health". *National Bureau of Environmental Research. Working Paper Series*. doi:10.3386/w24410.
299. ^ Academy S (16 April 2022). "Impact Of Air Pollution On The Environment". *Samphina*. Retrieved 18 June 2022.
300. ^ "Subway air pollution damages passenger health". *Chemistryworld.com*. Retrieved 11 January 2018.
301. ^ Singla S, Bansal D, Misra A, Raheja G (31 August 2018). "Towards an integrated framework for air quality monitoring and exposure estimation-a review". *Environmental Monitoring and Assessment*. **190** (9): 562. Bibcode:2018EMnAs.190..562S. doi:10.1007/s10661-018-6940-8. ISSN 1573-2959. PMID 30167891. S2CID 52135179.
302. ^ Zarrar H, Dyo V (1 October 2023). "Drive-by Air Pollution Sensing Systems: Challenges and Future Directions". *IEEE Sensors Journal*. **23** (19): 23692–23703. Bibcode:2023ISenJ..2323692Z. doi:10.1109/JSEN.2023.3305779. hdl:10547/625961. S2CID 261152934.
303. ^ Kaivonen S, Ngai EC (1 February 2020). "Real-time air pollution monitoring with sensors on city bus". *Digital Communications and Networks*. **6** (1): 23–30. doi:10.1016/j.dcan.2019.03.003. ISSN 2352-8648. S2CID 88485659.
304. ^ Zhang R, Zhang Y, Lin H, Feng X, Fu TM, Wang Y (April 2020). "NOx Emission Reduction and Recovery during COVID-19 in East China". *Atmosphere*. **11** (4): 433. Bibcode:2020Atmos..11..433Z. doi:10.3390/atmos11040433. S2CID 219002558.

305. ^ "Airborne Nitrogen Dioxide Plummets Over China". *earthobservatory.nasa.gov*. 28 February 2020. Archived from the original on 2 April 2020. Retrieved 6 April 2020.
306. ^ "Analysis: Coronavirus temporarily reduced China's CO₂ emissions by a quarter". *Carbon Brief*. 19 February 2020. Archived from the original on 4 March 2020. Retrieved 6 April 2020.
307. ^ "New monitoring technologies can help cities combat air pollution". *World Economic Forum*. 15 April 2021. Retrieved 24 October 2021.
308. ^ Yu T, Wang W, Ciren P, Sun R (18 October 2018). "An assessment of air-quality monitoring station locations based on satellite observations". *International Journal of Remote Sensing*. **39** (20): 6463–6478. Bibcode:2018IJRS...39.6463Y. doi:10.1080/01431161.2018.1460505. ISSN 0143-1161. S2CID 135457028.
309. ^ "Pollution is Personal". *The Atlantic*. Retrieved 20 December 2021.
310. ^ "World Air Map: Live air quality everywhere in the world". *Plume Labs Air Report*. Retrieved 20 December 2021.
311. ^ "Live Animated Air Quality Map (AQI, PM2.5...) | AirVisual". *IQAir*. Retrieved 27 January 2022.
312. ^ *European Commission* (11 May 2011). "European Commission - Environment - Air - Air quality". Archived from the original on 11 May 2011.
313. ^ *Canada.ca* (10 September 2007). "About the Air Quality Health Index". *Canada.ca*. Retrieved 27 February 2022.
314. ^ "Environment Canada – Air Quality". *Ec.gc.ca*. 10 September 2007. Retrieved 11 November 2011.
315. ^ "Environment Canada – AQHI categories and explanations". *Ec.gc.ca*. 16 April 2008. Retrieved 11 November 2011.
316. ^ "German TA-Luft is guaranteed by us". *centrotherm clean solutions*. Archived from the original on 29 June 2022. Retrieved 27 February 2022.
317. ^ **a b** *Europa* (1996). "Summaries of EU legislation – Management and quality of ambient air". Retrieved 24 January 2015.
318. ^ "PRESS RELEASE No 58/08 Judgment of the Court of Justice in Case C-237/07" (PDF). *European Court of Justice*. 2008. Retrieved 24 January 2015.
319. ^ Overview of relevant case law and critical state of air pollution protection in the EU: Winfried Huck, Jennifer Maaß, Saparya Sood, Tahar Benmaghnia, Alexander Schulte, Sarah Heß and Marc-Anthony Walter, The Right to Breathe Clean Air and Access to Justice - Legal State of Play in International, European and National Law (2021) in 8(22) *International Institutions: Transnational Networks eJournal*, available at: <http://dx.doi.org/10.2139/ssrn.3808572>
320. ^ *European Commission*. "Air quality: Commission sends final warning to UK over levels of fine particle pollution". Archived from the original on 11 May 2011. Retrieved 7 April 2011.
321. ^ *House of Commons Environmental Audit Committee* (2010). "Environmental Audit Committee – Fifth Report Air Quality". Retrieved 24 January 2015.

322. ^ **a b** Mulholland H (11 March 2011). "Britain fends off threat of £300m fine over London air pollution". *The Guardian*. Retrieved 24 January 2015.
323. ^ "Every Breath You Take" (PDF). London Assembly Environment Committee. May 2009. Archived from the original (PDF) on 22 February 2015. Retrieved 22 February 2015.
324. ^ BBC (6 December 2010). "Threat to sue over London congestion charge scrapping". *BBC News*. Retrieved 24 January 2015.
325. ^ Risse-Kappen T (1995). *Bringing transnational relations back in: non-state actors, domestic structures, and international institutions*. Cambridge: Cambridge University Press. pp. 3–34.
326. ^ **a b** Pattberg P, Stripple J (2008). "Beyond the public and private divide: remapping transnational climate governance in the 21st century". *International Environmental Agreements: Politics, Law and Economics*. **8** (4): 367–388. Bibcode:2008IEAPL...8..367P. doi:10.1007/s10784-008-9085-3. S2CID 62890754.
327. ^ Roman M (2010). "Governing from the middle: the C40 Cities Leadership Group". *Corporate Governance*. **10** (1): 73–84. doi:10.1108/14720701011021120.
328. ^ "Tribes do their part to keep air clean. Now, they want to make sure pollution from afar doesn't put that at risk". *USA TODAY*. Retrieved 16 April 2024.
329. ^ "Air pollution hot spot". Retrieved 24 April 2014.
330. ^ Pettit D (14 December 2014). "Global Toll of Air Pollution: Over 3 Million Deaths Each Year". Switchboard NRDC. Archived from the original on 8 May 2014.
331. ^ "Watch air pollution flow across the planet in real time". *Science Magazine News*. 28 November 2016.
332. ^ **a b** Drury R, Belliveau M, Kuhn JS, Shipra B (Spring 1999). "Pollution Trading and Environmental Justice: Los Angeles' Failed Experiment in Air Pollution Policy". *Duke Environmental Law & Policy Forum*. **9** (231).
333. ^ **a b** Morello-Frosch R, Zuk M, Jerrett M, Shamasunder B, Kyle AD (2011). "Understanding the Cumulative Impacts of Inequalities in Environmental Health: Implications for Policy". *Health Affairs*. **30** (5): 879–87. doi:10.1377/hlthaff.2011.0153. PMID 21555471.
334. ^ Mohai P, Lantz P, Morenoff J, House J, Mero R (2009). "Racial and Socioeconomic Disparities in Residential Proximity". *American Journal of Public Health*. **99** (3): S649–56. doi:10.2105/ajph.2007.131383. PMC 2774179. PMID 19890171.
335. ^ Lerner S (2010). "Sacrifice Zones: The Front Lines of Toxic Chemical Exposure in the United States". Port Arthur, Texas: Public Housing Residents Breathe Contaminated Air from Nearby Refineries and Chemical Plants. MIT Press.
336. ^ Vohra K, Marais EA, Bloss WJ, Schwartz J, Mickley LJ, Van Damme M, et al. (8 April 2022). "Rapid rise in premature mortality due to anthropogenic air pollution in fast-growing tropical cities from 2005 to 2018". *Science Advances*. **8** (14): eabm4435. Bibcode:2022SciA....8M4435V. doi:10.1126/sciadv.abm4435. ISSN 2375-2548. PMC 8993110. PMID 35394832.

337. ^ Michelozzi P, Forastiere F, Fusco D, Perucci CA, Ostro B, Ancona C, et al. (1998). "Air Pollution and Daily Mortality in Rome, Italy". *Occupational and Environmental Medicine*. **55** (9): 605–10. doi:10.1136/oem.55.9.605. JSTOR 27730990. PMC 1757645. PMID 9861182.
338. ^ The Daily Telegraph 8 January 2014 'Air pollution killing up to 500,000 Chinese each year, admits former health minister'.
339. ^ "World's Most Polluted Cities in 2020 - PM2.5 Ranking | AirVisual". www.iqair.com. Retrieved 1 February 2022.
340. ^ "World Air Quality Index (AQI) Ranking | IQAir". www.iqair.com. Retrieved 24 May 2022.
341. ^ Darame M (29 November 2019). "En Afrique de l'Ouest, une pollution mortelle mais d'ampleur inconnue" [In West Africa, deadly pollution but of unknown magnitude]. *Le Monde* (in French).
342. ^ Organisation for Economic Co-operation and Development (1 March 2012). "Environmental Outlook to 2050 - OECD" (PDF). OECD.

Further reading

[edit]

Library resources about

Air pollution

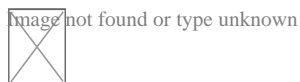
- Resources in your library
- Resources in other libraries
- Brimblecombe P (1987). *The Big Smoke: A History of Air Pollution in London Since Medieval Times*. Routledge. ISBN 978-1-136-70329-4.
- Brimblecombe P (1995). "1: History of air pollution". In Singh H (ed.). *Composition, chemistry, and climate of the atmosphere*. New York: John Wiley & Sons. pp. 1–18. ISBN 978-0-471-28514-4. OCLC 43084000.
- Brimblecombe P, Makra L (2005). "Selections from the history of environmental pollution, with special attention to air pollution. Part 2*: From medieval times to the 19th century". *International Journal of Environment and Pollution*. **23** (4): 351–67. doi:10.1504/ijep.2005.007599.
- Cherni, Judith A. *Economic Growth versus the Environment: The Politics of Wealth, Health and Air Pollution* (2002) online
- Corton, Christine L. *London Fog: The Biography* (2015)
- Currie, Donya. "WHO: Air Pollution a Continuing Health Threat in World's Cities", *The Nation's Health* (February 2012) 42#1 online
- Dewey, Scott Hamilton. *Don't Breathe the Air: Air Pollution and US Environmental Politics, 1945–1970* (Texas A & M University Press, 2000)
- Gonzalez, George A. *The politics of air pollution: Urban growth, ecological modernization, and symbolic inclusion* (SUNY Press, 2012)
- Grinder RD (1978). "From Insurgency to Efficiency: The Smoke Abatement Campaign in Pittsburgh before World War I.". *Western Pennsylvania Historical*

Magazine. **61** (3): 187–202.

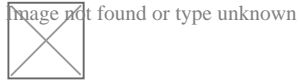
- Grinder, Robert Dale. "The Battle for Clean Air: The Smoke Problem in Post-Civil War America" in Martin V. Melosi, ed., *Pollution & Reform in American Cities, 1870–1930* (1980), pp. 83–103.
- Kumar P, Pirjola L, Ketznel M, Harrison RM (2013). "Nanoparticle emissions from 11 non-vehicle exhaust sources – A review". *Atmospheric Environment*. **67**. Elsevier BV: 252–277. Bibcode:2013AtmEn..67..252K. doi:10.1016/j.atmosenv.2012.11.011. ISSN 1352-2310.
- Lundqvist LJ (1980). *The Hare and the Tortoise: Clean Air Policy in the US and Sweden*. Ann Arbor, MI: University of Michigan Press. ISBN 978-0-472-09310-6.
- Mingle, Jonathan, "Our Lethal Air" [review of Gary Fuller, *The Invisible Killer...*; Beth Gardiner, *Choked...*; Tim Smedley, *Clearing the Air...*; U.S. Environmental Protection Agency, *Integrated Science Assessment for Particulate Matter (External Review Draft, 2018)*; and Chartered Clean Air Scientific Advisory Committee, *Letter to EPA Administrator on the EPA's Integrated Science Assessment for Particulate Matter, 11 April 2019*], *The New York Review of Books*, vol. LXVI, no. 14 (26 September 2019), pp. 64–66, 68. "Today, 91 percent of people worldwide live in areas where air pollution levels exceed the World Health Organization's recommended limits. ... [T]here is no safe level of exposure to fine particulate matter. ... Most of these fine particles are a by-product of ... burning ... coal, gasoline, diesel, wood, trash ... These particles can get past the defenses of our upper airways to penetrate deep into our lungs and reach the alveoli ... From there, they cross into the bloodstream and spread throughout the body. They can travel through the nose, up the olfactory nerve, and lodge ... in the brain. They can form deposits on the lining of arteries, constricting blood vessels and raising the likelihood of ... strokes and heart attacks. [T]hey exacerbate respiratory illnesses like asthma and chronic obstructive pulmonary disease ... There's ... evidence linking air pollution exposure to an increased risk of Alzheimer's and other forms of dementia." (p. 64.)
- Mosley, Stephen. *The chimney of the world: a history of smoke pollution in Victorian and Edwardian Manchester*. Routledge, 2013.
- Schreurs, Miranda A. *Environmental Politics in Japan, Germany, and the United States* (Cambridge University Press, 2002) online
- Thorsheim, Peter. *Inventing Pollution: Coal, Smoke, and Culture in Britain since 1800* (2009)

External links

[edit]



Wikimedia Commons has media related to ***Air pollution***.



Wikivoyage has travel information for ***Air pollution***.

- WHO fact sheet on outdoor air pollution
 - Air Pollution: Everything You Need to Know Guide by the Natural Resources Defense Council (NRDC)
 - Global real-time air quality index map
 - Air Quality Index (AQI) Basics
 - AQI Calculator AQI to Concentration and Concentration to AQI for five pollutants
 - UNEP Urban environmental planning
 - European Commission > Environment > Air > Air Quality
 - Database: outdoor air pollution in cities from the World Health Organization
 - The Mortality Effects of Long-Term Exposure to Particulate Air Pollution in the United Kingdom, UK Committee on the Medical Effects of Air Pollution, 2010.
 - Hazardous air pollutants | What are hazardous pollutants at EPA.gov
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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 hazard
- Genetic pollution
- Introduced species
 - Invasive species
- Information pollution

Biological

Digital

Electromagnetic

Natural

Noise

Radiation

Soil

- Light
 - Ecological light pollution
 - Overillumination
- Radio spectrum pollution
- Ozone
- Radium and radon in the environment
- Volcanic ash
- Wildfire
- Transportation
 - Land
 - Water
 - Air
 - Rail
 - Sustainable transport
- Urban
- Sonar
 - Marine mammals and sonar
- Industrial
- Military
- Abstract
- Noise control
- Actinides
- Bioremediation
- Nuclear fission
- Nuclear fallout
- Plutonium
- Poisoning
- Radioactivity
- Uranium
- Electromagnetic radiation and health
- Radioactive waste
- 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
- Satellite
- Air travel
- Clutter (advertising)
- Traffic signs
- Overhead power lines
- Vandalism

Space

Visual

War

- Chemical warfare
- Herbicidal warfare (Agent Orange)
- Nuclear holocaust (Nuclear fallout - nuclear famine - nuclear winter)
- Scorched earth
- Unexploded ordnance
- War and environmental law
- 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
- Pollutants
 - Heavy metals
 - Paint
- Brain health and pollution

Water







Topics

Misc

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

Responses

Lists

 Categories (by country)  Commons  WikiProject Environment  WikiProject Ecology  Environment portal  Ecology portal

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Asia pollution topics

	Dust storm	<ul style="list-style-type: none"> ○ 2010 China dust storms ○ 1997 SEA haze ○ 1997 Indonesian forest fires ○ 2005 Malaysian haze ○ 2006 SEA haze ○ 2009 SEA haze ○ 2010 SEA haze
Notable incidents	Forest fires and haze	<ul style="list-style-type: none"> ○ 2013 SEA haze ○ 2015 SEA haze ○ 2016 Malaysian haze ○ 2016 SEA haze ○ 2017 SEA haze ○ 2019 SEA haze ○ 2019 Vietnam forest fires ○ 2024 Indo-Pakistani smog
Air pollution	Air radioactive contamination	<ul style="list-style-type: none"> ○ 1982 Bukit Merah radioactive pollution
	By countries	<ul style="list-style-type: none"> ○ China ○ Hong Kong ○ India ○ Macau ○ Malaysia ○ Taiwan
	Recurrent issues	<ul style="list-style-type: none"> ○ Asian brown cloud ○ Asian Dust ○ Shamal ○ Southeast Asian haze ○ ASEAN Agreement on Transboundary Haze Pollution
	Counter-measures	<ul style="list-style-type: none"> ○ Operation Haze ○ Pollutant Standards Index ○ Great Green Wall (China)

Water pollution
Notable incidents

Water radioactive contamination
Marine pollution

- 2011 Fukushima Daiichi nuclear disaster
- 2016 Vietnam marine life disaster
- 2019 Kim Kim River toxic pollution
- Pollution of the Pasig River

By countries

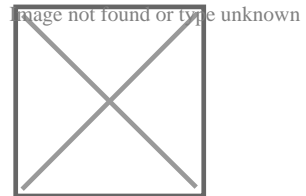
- China
 - Water crisis
- India
- Japan
- Philippines
- Vietnam

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Environmental science

Main fields

- Atmospheric science
- Biogeochemistry
- Ecology
- Environmental chemistry
- Geosciences
- Hydrology
- Limnology
- Oceanography
- Soil science



- Biology
- Chemistry
 - green
- Ecological economics
- Environmental design
- Environmental economics
- Environmental engineering
- Environmental health
 - epidemiology
- Environmental studies
- Environmental humanities
- Environmental statistics
- Environmental toxicology
- Geodesy
- Physics
- Radioecology
- Sustainability science
- Systems ecology
- Urban ecology
- Energy conservation
- Environmental technology
- Natural resource management
- Pollution control
- Public transport encouragement
- Recycling
- Remediation
- Renewable energy
- Road ecology
- Sewage treatment
- Urban metabolism
- Water purification
- Waste management
- Degrees
- Journals
- Research institutes
- Glossary
- Environment by year
- Human impact on the environment
- Sustainability
- Technogaianism

Related fields

Applications

Lists

See also

-  **Category**
 - scientists
-  **Commons**
-  **Environment portal**
-  **WikiProject**

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Public health

General

- Auxology
- Biological hazard
- Chief Medical Officer
- Cultural competence
- Deviance
- Environmental health
- Eugenics
 - History of
 - Liberal
- Euthenics
- Genomics
- Globalization and disease
- Harm reduction
- Health economics
- Health literacy
- Health policy
 - Health system
 - Health care reform
- Housing First
- Human right to water and sanitation
- Management of depression
 - Public health law
 - National public health institute
- Health politics
- Labor rights
- Maternal health
- Medical anthropology
- Medical sociology
- Mental health (Ministers)
- Occupational safety and health
- Pharmaceutical policy
- Pollution
 - Air
 - Water
 - Soil
 - Radiation
 - Light
- Prisoners' rights
- Public health intervention
- Public health laboratory
- Right to food
- Right to health
- Right to housing
- Right to rest and leisure
- Right to sit
- Security of person
- Sexual and reproductive health
- Social psychology

**Preventive
healthcare**

- Behavior change
 - Theories
- Family planning
- Health promotion
- Human nutrition
 - Healthy diet
 - Preventive nutrition
- Hygiene
 - Food safety
 - Hand washing
 - Infection control
 - Oral hygiene
- Occupational safety and health
 - Human factors and ergonomics
 - Hygiene
 - Controlled Drugs
 - Injury prevention
 - Medicine
 - Nursing
- Patient safety
 - Organization
- Pharmacovigilance
- Safe sex
- Sanitation
 - Emergency
 - Fecal–oral transmission
 - Open defecation
 - Sanitary sewer
 - Waterborne diseases
 - Worker
- School hygiene
- Smoking cessation
- Vaccination
- Vector control

Population health

- Biostatistics
- Child mortality
- Community health
- Epidemiology
- Global health
- Health impact assessment
- Health system
- Infant mortality
- Open-source healthcare software
- Multimorbidity
- Public health informatics
- Social determinants of health
 - Commercial determinants of health
 - Health equity
 - Race and health
- Social medicine
- Case-control study
- Randomized controlled trial
- Relative risk

Biological and epidemiological statistics

- Statistical hypothesis testing
 - Analysis of variance (ANOVA)
 - Regression analysis
 - ROC curve
 - Student's *t*-test
 - Z-test
- Statistical software
- Asymptomatic carrier
- Epidemics

Infectious and epidemic disease prevention

- List
- Notifiable diseases
 - List
- Public health surveillance
 - Disease surveillance
- Quarantine
- Sexually transmitted infection
- Social distancing
- Tropical disease
- Vaccine trial
- WASH

**Food hygiene
and
safety
management**

- Food
 - Additive
 - Chemistry
 - Engineering
 - Microbiology
 - Processing
 - Safety
 - Safety scandals
- Good agricultural practice
- Good manufacturing practice
 - HACCP
 - ISO 22000
- Diffusion of innovations
- Health belief model
- Health communication
- Health psychology
- Positive deviance
- PRECEDE–PROCEED model
- Social cognitive theory
- Social norms approach
- Theory of planned behavior
- Transtheoretical model

**Health
behavioral
sciences**

**Organizations,
education
and history**

Organizations

- Caribbean
 - Caribbean Public Health Agency
- China
 - Center for Disease Control and Prevention
- Europe
 - Centre for Disease Prevention and Control
 - Committee on the Environment, Public Health and Food Safety
- India
 - Ministry of Health and Family Welfare
- Canada
 - Health Canada
 - Public Health Agency
- U.S.
 - Centers for Disease Control and Prevention
 - Health departments in the United States
 - Council on Education for Public Health
 - Public Health Service
- World Health Organization
- World Toilet Organization
- (Full list)
- Health education
- Higher education

Education

- Bachelor of Science in Public Health
- Doctor of Public Health
- Professional degrees of public health
- Schools of public health

History

- Sara Josephine Baker
- Samuel Jay Crumbine
- Carl Rogers Darnall
- Joseph Lister
- Margaret Sanger
- John Snow
- Typhoid Mary
- Radium Girls
- Germ theory of disease
- Social hygiene movement

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- v
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Natural resources

Air

Pollution / quality

- Ambient standards (US)
- Index
- Indoor
- Law
 - Clean Air Act (US)
- Ozone depletion
- Airshed
- Trading
- Deforestation (REDD)

Emissions

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
- Desalination
- Floods
- Law
- Leaching
- Sanitation
 - improved
- Scarcity
- Security
- Supply

Aspects

- 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

- Common-pool
- Conflict (perpetuation)
- Curse
- Resource
 - Depletion
 - Extraction
 - Nationalism
 - Renewable / Non-renewable
 - Oil war
- Politics
 - Petrostate
 - Resource war

-  Category

Authority control databases  **Edit this at Wikidata**

- National**
 - Germany
 - United States
 - France
 - BnF data
 - Japan
 - Czech Republic
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 - Spain
- Other**
 - Israel
 - NARA

About Royal Supply South

Things To Do in Arapahoe County

Photo

Image not found or type unknown

Four Mile Historic Park

4.6 (882)

Photo

History Colorado Center

4.6 (2666)

Photo

Image not found or type unknown

Colorado Freedom Memorial

4.8 (191)

Photo

Image not found or type unknown

Cherry Creek Dam

4.3 (6)

Photo

Blue Grama Grass Park

4.4 (117)

Photo

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Cherry Creek Valley Ecological Park

4.7 (484)

Driving Directions in Arapahoe County

Driving Directions From Denver to Royal Supply South

Driving Directions From Wells Fargo ATM to Royal Supply South

Driving Directions From St. Nicks Christmas and Collectibles to Royal Supply South

[Mobile Home Hvac Service](#)

[Mobile home supply store](#)

[Air conditioning repair service](#)

[Air conditioning store](#)

[Air conditioning system supplier](#)

[Furnace repair service](#)

Driving Directions From Plains Conservation Center (Visitor Center) to Royal Supply South

Driving Directions From Blue Grama Grass Park to Royal Supply South

Driving Directions From Plains Conservation Center (Visitor Center) to Royal Supply South

Driving Directions From Meow Wolf Denver | Convergence Station to Royal Supply South

Driving Directions From Denver Zoo to Royal Supply South

Driving Directions From Cherry Creek Dam to Royal Supply South

[Mobile Home Furnace Installation](#)

[Mobile Home Air Conditioning Installation Services](#)

[Mobile Home Hvac Repair](#)

[Reviews for Royal Supply South](#)

Maintaining HVAC Gauges for Accurate Readings **[View GBP](#)**

Check our other pages :

- [Dressing for Extreme Temperatures during Repairs](#)
- [Filtering Particulates through Electrostatic Options](#)
- [Assessing Long Term Effects of Poor Air Quality](#)
- [Comparing Protective Gloves for Different Tasks](#)
- [Identifying Goggles Designed for Refrigerant Handling](#)

Frequently Asked Questions

How often should I calibrate my HVAC gauges to ensure accuracy?

Its recommended to calibrate your HVAC gauges at least once a year or whenever you suspect they may be giving inaccurate readings. Regular calibration ensures that your measurements are precise, which is crucial for efficient operation of your mobile homes HVAC system.

What are the common signs that my HVAC gauges may need maintenance or replacement?

Common signs include inconsistent readings, visible damage such as cracks or leaks in the hoses or connectors, and difficulty in zeroing out the needles. If you notice any of these issues, its time to inspect your gauges and perform necessary maintenance or consider replacing them.

What steps should I take to clean and store my HVAC gauges properly?

To clean your HVAC gauges, gently wipe them down with a damp cloth and mild detergent; avoid using harsh chemicals. Ensure all connections are dry before storing. Store them in a protective case to prevent physical damage and keep them away from extreme temperatures or humidity to maintain their longevity and accuracy.

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