Air Quality

Information to help learners and teachers to have a better understanding of air and air pollution.

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

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THE AIR AROUND US

When we breathe, we take up oxygen through our lungs and exhale carbon dioxide.

Plants take up carbon dioxide and release oxygen into the atmosphere.

Nitrogen is needed by living organisms. As a gas, it is absorbed into the soil, where bacteria convert it into a solid form that plants can use.

The water and gases in the atmosphere allow the sun's rays to reach the earth's surface while trapping the radiation released by the earth. The trapping of radiation, known as the natural greenhouse effect, makes the layer of the atmosphere close to the earth's surface warm enough to support the life on Earth.

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The Department of Environment, Forestry and Fisheries.
For queries or further information please contact:
+27 (0) 86 111 2468 or email: callcentre@environment.gov.za

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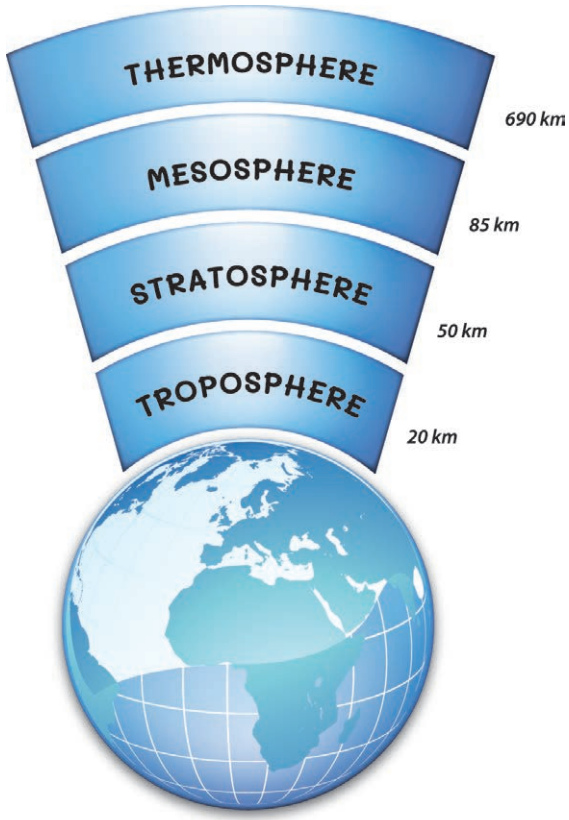
PART 1: THE EARTH'S ATMOSPHERE

THE LAYERS OF THE EARTH'S ATMOSPHERE

Earth's atmosphere consists of several layers: the troposphere, stratosphere, mesosphere and thermosphere.



Different layers of the atmosphere

Troposphere: This is the first layer of the atmosphere where people, plants and animals live. It consists of the gases that we breathe every day. This part of the atmosphere is warmer than the stratosphere and mesosphere because the air is heated by the surface of the earth, which absorbs the sun's energy.

Stratosphere: Aeroplanes fly in this layer above the troposphere and the ozone layer is found here. The ozone layer is important, as it absorbs harmful ultraviolet (UV) rays from the sun, protecting life (including humans) in the troposphere.

Mesosphere: This layer extends upward above the stratosphere. It is the coldest part of our atmosphere, with temperatures in this layer reaching as low as –90°C.

Thermosphere: Though the air is incredibly thin in this layer of the atmosphere, the temperatures are very high since many of the sun's high-energy X-rays and UV rays are absorbed in this layer.

WHAT ARE THE COMMON GASES IN THE AIR WE BREATHE?

Air is essential to all life on Earth. The air that animals and people breathe is found in the troposphere. The air comprises mostly of nitrogen (N2) and oxygen (O2), along with water vapour/droplets, fine particles and a small amount of other gases, such as carbon dioxide (CO2), nitrous oxide (N2O), methane (CH4), ammonia (NH3) and argon (Ar).

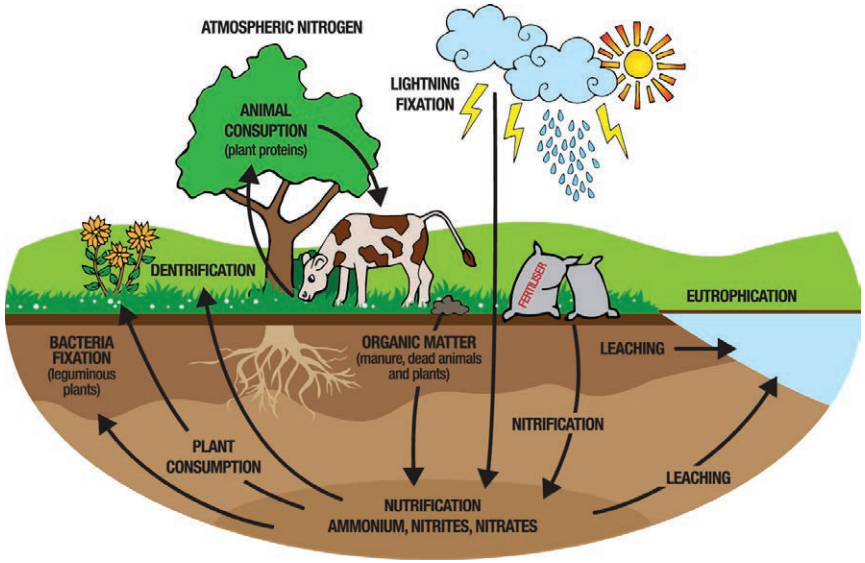
Atmospheric gases	Volume %
Nitrogen	78.084
Oxygen	20.946
Argon	0.930
Carbon dioxide	0.034
Others	0.006

When people and animals breathe, they inhale oxygen and exhale carbon dioxide. During a process called photosynthesis, plants take carbon dioxide from the air and use it, along with water and the sun's energy, to produce glucose as food and release oxygen back into the air. A lot of the carbon from the carbon dioxide becomes part of the plant.

The carbon is then passed along the food chain and returned back to the atmosphere as carbon dioxide when people and animals breathe it out. Most of the remaining carbon is returned to the atmosphere when plants, animals and people die and decompose. This is referred to as the **carbon cycle.**

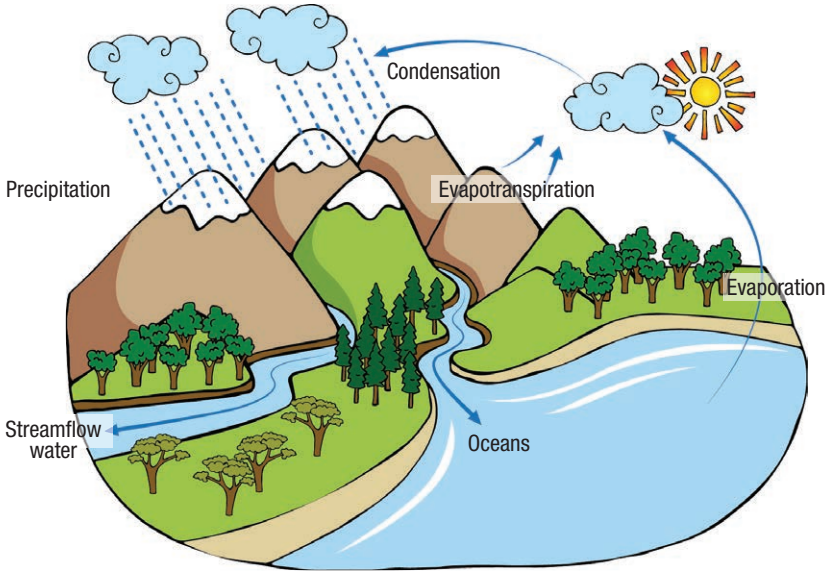
Nitrogen is the most abundant gas in the lower atmosphere and is needed by living organisms. But how does it move from the air into the organisms?

Since nitrogen is a gas, it first needs to be converted into a chemical form that plants can use as nutrients. Nitrogen is absorbed into the soil, where bacteria turn it into ammonia and ammonium, which the plants use to build proteins and other essential chemicals. When animals eat the plants, the nitrogen is transferred to them. Nitrogen returns to the soil in the urine and faeces from animals, or when dead plants and animals decompose. In the soil, bacteria convert compounds back into ammonia again. Some bacteria also return nitrates in the soil back into the air as nitrogen gas. This is called the **nitrogen cycle.**



Nitrogen Cycle

Water vapour, the gaseous phase of water, is also important as it allows the sun's rays to reach the earth's surface but traps the radiation (heat) released from the earth in the atmosphere. Water vapour is responsible for the formation of clouds and rain. When the sun warms water from rivers and oceans, it evaporates and becomes water vapour. Since warm air holds more water vapour than cold air, the concentration of water vapour increases during the day, and the warm air moves upwards. As it cools down higher in the atmosphere, it condenses, and clouds are formed. Eventually, the water from the clouds falls as precipitation (rain, snow, hail and sleet) down to Earth's surface.



The Water Cycle

LET'S TALK ABOUT IT.

Discuss the water cycle in your classroom. The water cycle describes how water is exchanged through Earth's land, oceans, and atmosphere.

Discuss the major processes that are involved in the water cycle: evaporation, condensation, and precipitation.

PART 2: AIR POLLUTION

WHAT IS AIR POLLUTION?

Air pollution is contamination of the air by any chemical or compound that changes the natural characteristics of the atmosphere. This includes harmful substances in the air that may negatively affect human, animal and plant life. The substances that cause air pollution are called pollutants. **Pollutants** that are released directly from sources are called **primary air pollutants.** Examples include carbon monoxide (CO) from vehicle exhausts and sulphur dioxide (SO2) from burning coal.

When primary pollutants react with each other and with other gases in the atmosphere, **secondary pollutants** like ground level ozone (O3) are formed. This is "bad ozone" found close to Earth's surface, and should not be confused with the "good ozone" that provides protection from the harmful ultraviolet radiation of the sun.

Air pollutants can be gases, like carbon monoxide, sulphur dioxide, oxides of nitrogen and chemical vapours, or very small particles, like dust, bacteria, viruses, plant materials, dead skin cells or pieces of hair.

WHAT CAUSES AIR POLLUTION?

Air pollution is caused by natural processes and human activities. Natural events that result in air pollution include volcanic eruptions and veldfires, which release particles and gases into the air. Weather conditions like wind and rain quickly disperse these pollutants and maintain the atmosphere's natural balance.

In modern times, population growth, urbanisation and industrialisation are causing more pollution than natural air cleaners can manage. Human activities that contribute to air pollution are burning/fires, industrial emissions (especially from burning fossil fuels), vehicle emissions, waste incineration and combustion on mine dumps.

SOURCES OF AIR POLLUTION

Combustion (burning of substances that contain hydrogen and carbon) emits carbon dioxide. Industrial processes that involve burning coal, oil or other fuels can thus cause serious air pollution.

Industrial plants such as brickworks, steelworks, plants converting coal into oil, chemical plants, sawmills, paper mills and cement manufacturers are among those that can produce harmful pollutants.

Power stations that produce energy by the burning of fossil fuels such as coal, gas and oil also contribute to air pollution. Most of South Africa's electricity comes from the combustion of coal. The emissions produced include sulphur dioxide, carbon monoxide, various nitrogen oxides (NOx), mercury (Hg) and tiny particles, such as ash.

Mining processes such as mine dumps, ore handling, drilling, blasting and mine vehicle traffic travelling on unpaved roads are mainly responsible for air pollution in the form of dust, especially in open mines, which are not covered with vegetation. Blasting operations and unplanned burning also release gases such as carbon monoxide, various nitrogen oxides and sulphur dioxide. Asbestos mine dumps are a serious health hazard, and poorly managed coal mines can leak methane into the atmosphere. Coal waste contains materials that can burn on their own (self-combustion) and produce poisonous particles and gases.

Household cooking and heating: Some communities within South Africa burn coal, wood or paraffin to warm their homes or cook.

Pollutants from the burning of wood include fine particles, nitrogen oxides, carbon monoxide, etc. The burning of paraffin produces pollutants such as nitrogen dioxide, particles, carbon monoxide, formaldehyde and sulphur dioxide.

The burning of these fuels increases during winter as there is a need for heating. This results in poor air quality and an unhealthy environment.

Vehicles and aeroplanes that run on petrol and diesel are the main sources of carbon monoxide and nitrogen oxide emissions. Diesel cars produce more particles than cars with petrol engines. The combustion in engines produces hydrocarbons and contributes to nitrogen oxide emissions.

Farming also contributes to air pollution. Methane arises from animal dung, biological decay and fermentation in the stomachs of ruminants, such as cows and sheep. Agricultural activities such as ploughing and harvesting produce dust particles. Large-scale burning to clear agricultural fields also adds significantly to air pollution.

The use of chemicals, pesticides (that kill insects) and herbicides (that kill weeds) on crops to improve crop quality also contributes to air pollution. These chemicals remain in the soil and air, killing plants and animals and affecting ecosystem.

Refuse burning is very dangerous, as refuse is a mixture of many different materials. For example, if you burn plastics or tyres, dangerous substances are given off that can harm the environment.

In addition to man-made sources, large quantities of air pollutants are released from natural sources.

Veld and forest fires are common man-made and natural sources of air pollution. They spread quickly and have a large impact on the atmosphere's chemistry, emitting pollutants such as carbon monoxide, nitrogen oxides, sulphur dioxide and tiny particles into the atmosphere. Significant quantities of pollutants are also released from natural sources such as animals, marshes, pollen and soil.

Volcanic eruptions produce gases such as carbon dioxide, sulphur dioxide and hydrogen fluoride (HF), as well as ash particles. Eruptions release the pollutants high into the atmosphere, where they can travel long distances and cause disruptions.

Wind erosion: Dust particles are released from soil surfaces in windy conditions, especially where there are few plants and dry soil, e.g. in deserts.

LET'S TALK ABOUT IT.

Discuss the different causes of air pollution in your classroom.

In addition to man-made sources, large quantities of air pollutants are released from natural sources.

Can you list the different causes that are natural versus man-made?

PART 3: POLLUTION PROBLEMS

Air pollution causes health-related problems and negatively affects the environment. The main problems related to air pollution are acid rain, poisonous particles and gases in the air, climate change, smog and the depletion of ozone.

HEALTH-RELATED ISSUES

Exposure to pollution may cause various health problems. It can make your nose burn, irritate your throat and eyes and make breathing difficult. Tiny particles of dust and smoke often get deep into a person's lungs and cause problems like wheezing and coughing. Other health problems include asthma, cancer, heart diseases, skin irritations, headaches, dizziness, fatigue, nervous disorders and birth defects.

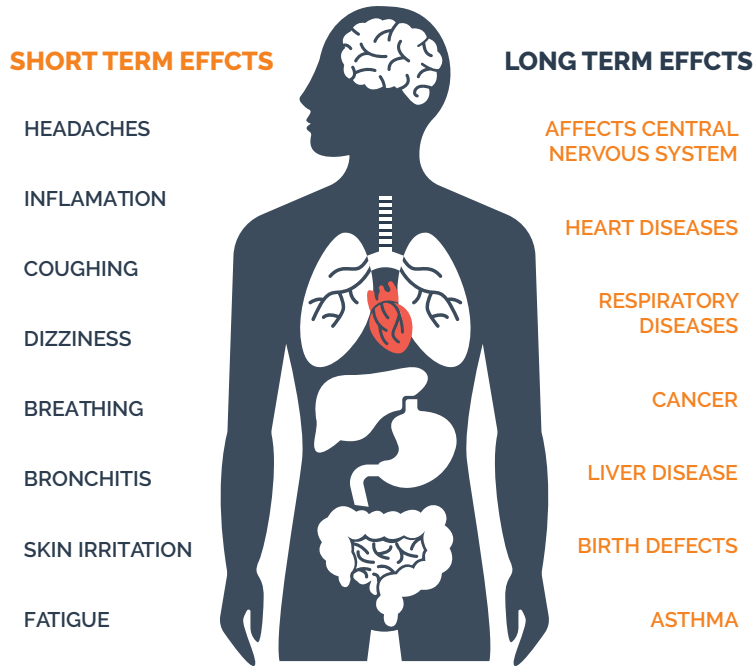
Carbon monoxide and carbon dioxide

Carbon monoxide is a poisonous gas that is difficult to detect because it is odourless, colourless and tasteless, and is not an irritant. The highest concentration of carbon monoxide exists in areas close to the earth's surface. It is found in streets full of traffic, in closed garages, in stuffy rooms with burning coal and wood and in tobacco smoke.

Carbon monoxide has devastating effects on the respiratory system. Haemoglobin is the molecule in red blood cells that is responsible for carrying oxygen to the rest of the body. However, carbon monoxide has a 210 times greater attraction to haemoglobin than oxygen, so when carbon monoxide occupies the haemoglobin, cells throughout the body become starved of oxygen. This leads to headaches, nausea, dizziness, lethargy and weakness, seizures, impaired vision and, in severe cases, coma and death. The most vulnerable people are unborn babies, elderly persons and those already suffering from heart and respiratory problems.

Carbon dioxide is a natural part of the atmosphere. Like carbon monoxide, it has no colour, but it has a slightly acidic, sour flavour and smell. It doesn't burn and is heavier than air. In high concentrations, carbon dioxide is poisonous and can cause death.

HEALTH EFFECTS OF AIR POLLUTION



Carbon dioxide is essential for the existence of all ecosystems. It is a reactant in the process of photosynthesis, where it is built into glucose molecules first, and into other compounds subsequently. Carbon dioxide is the most significant greenhouse gas. It is a major contributor to the insulating layer of the atmosphere which maintains Earth's temperature. Though the greenhouse effect in itself is not a bad thing, it becomes a problem when carbon dioxide levels in the atmosphere become too high and increase the insulating effects of the atmosphere, raising average global temperatures.

Particles in the air

Particles, called aerosols or particulate matter (PM), consist of different materials, such as specks of dust, ash, soot, sea spray, minute sand particles and pollen from plants. These particles in the air are needed for the process of forming clouds, and reflect a significant amount of sunlight. Though some particles in the air are natural, too many of them can cause environmental problems and negatively affect human health.

As we breathe in tiny particles, they can remain in the lungs and cause tissue damage. Allergies, asthma, bronchitis, persistent coughs and even lung cancer can result. Many dust particles carry poisonous materials (for example, lead, cadmium or nitrate) that are harmful to health.

Dust particles originate from many different sources, such as pets, plant matter, dead skin cells, cigarettes and mines. Dust particles are firm, consistently arranged particles from 0,0001 mm in size (particles in tobacco smoke) to 0,1 mm (cement dust, pollen). Chunky dust with a diameter greater than 100 µm (0,1 mm) can remain airborne for only a short time before falling to the ground. Particles smaller than 5 µm can stay in the air for days to weeks before they fall to the ground. There are two sizes of particulate matter of concern: PM10 (particles of 10 µm and smaller) and PM2.5 (particles of 2,5 µm and smaller).

It is not only people who suffer the effects of particulate matter in the air. In plants, tiny holes on leaf surfaces, essential for the exchange of gases, can get blocked. Consequently, less photosynthesis occurs, making less energy available to the plants.

Other pollutants

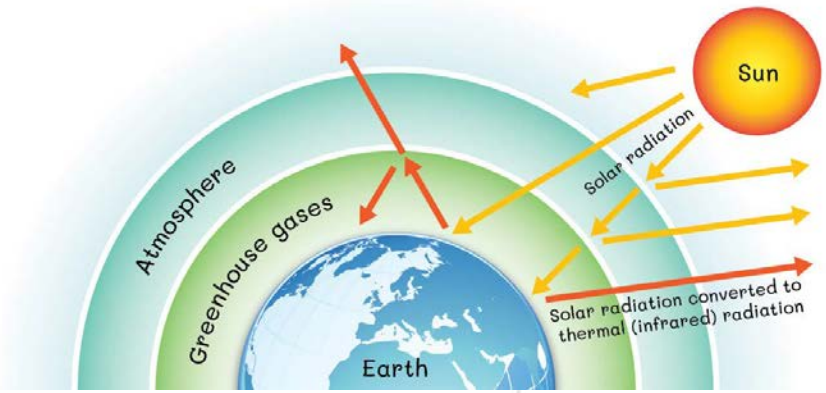
Exposure to other pollutants such as sulphur dioxide, ground level ozone, nitrogen oxides, mercury, lead (Pb), asbestos and benzene (C6H6) contributes to most respiratory related problems as explained above.

ENVIRONMENTAL EFFECTS

The “greenhouse effect” is the name given to the warming effect of gases in the earth’s atmosphere. These “greenhouse gases” are water vapour, carbon dioxide, methane, nitrous oxide and chlorofluorocarbons (CFCs). All of these (besides the CFCs, which are man-made) occur naturally in the atmosphere. The greenhouse gases in the atmosphere allow the sun’s rays to reach the earth’s surface while trapping the radiation (heat energy) released by the earth. The trapping of radiation, known as the natural greenhouse effect, makes the layer of the atmosphere closest to the earth’s surface warm enough (an average of 14°C) to support life on Earth.

However, the greenhouse effect is being disrupted and is causing global warming, which contributes significantly to climate change. Human activities such as certain agricultural practices, the burning of fossil fuels and the destruction of natural vegetation are contributing to higher levels of greenhouse gases, such as carbon dioxide and methane. The build-up of these gases acts like a blanket that traps heat closest to the earth’s surface, increasing the temperature and thus warming Earth.

Already, Earth’s temperature is an average of 1°C warmer than pre-industrial levels. Scientists expect this to rise to 1,5°C between 2030 and 2052 if the current rate continues. By 2100, a total increase of 3°C is expected. Having the planet just a few degrees warmer could result in the earth’s ice caps melting, ocean levels rising, extreme weather conditions (floods/droughts) and an increase in species extinction.



ACID RAIN

Acid rain or deposition is formed when sulphur dioxide and nitrogen oxides are released into the atmosphere. When these gases come into contact with water vapour and sunlight, they form sulphuric acid and nitric acid. This makes rain more acidic. The pH range of normal rain is already slightly acidic – between 5 and 7. Rain that falls below 5 on the pH scale is usually considered acid rain. All types of precipitation can be acidic – so, it is possible to get acid snow and acid hail. When acid precipitation falls to Earth's surface, it soaks into the ground and increases the soil's acidity.

Human health can be severely affected by acid rain. Not only can it increase the acidity of drinking water, but high concentrations of toxic metals such as lead, copper and aluminium can also get into drinking water.

Acid rain accelerates the erosion of stones such as sandstone, limestone and marble. Buildings and monuments made of these materials are damaged. Plant life is negatively affected by acid rain or acid deposition. Trees and forests have been known to die but more commonly, it damages leaves and weakens plants.

Aquatic animals (animals living in water) are especially sensitive to pH change caused by acid rain. The death rate is high when the watery environment becomes too acidic to support normal life processes.

The spreading of acid air pollution depends on the strength and direction of the wind. High factory chimneys are often responsible for acid rain in areas far away from the pollutant source. Pollutants from South Africa can travel as far as Mozambique, Swaziland, Lesotho and beyond.

Stratospheric ozone depletion

Ozone is an unstable molecule with three oxygen atoms that occurs naturally in the stratosphere (upper atmosphere), about 20–50 km above Earth's surface. This ozone in the stratosphere is essential to life, as it protects living things by blocking most of the sun's dangerous ultraviolet radiation from reaching Earth's surface. Without this "ozone layer", much more UV-B radiation would reach Earth's surface and would suppress photosynthesis in plants, stunt animal growth, suppress animal and human immune systems and increase the risk of skin cancer and cataracts.

Unfortunately, the protective ozone layer is being thinned by chemicals known as ozone-depleting substances, which result from human activities. These include CFCs (chlorofluorocarbons), halons, methyl chloroform, carbon tetrachloride, methyl bromide and hydrochlorofluorocarbons. Until recent years, CFCs were widely used in aerosol cans, refrigerators, fire extinguishers and air-conditioning units.

The international Montreal Protocol, to which South Africa is a signatory, has ensured that countries are reducing their usage of ozone-depleting substances like CFCs and have phased out most of them. Even so, their stable chemical nature means that they will remain in Earth's atmosphere for up to 200 years.

Smog

Smog is produced when air pollutants such as nitrogen oxides from vehicle and industry emissions and volatile organic compounds (VOCs) emitted by vehicles react in the presence of sunlight.

In South Africa, smog can be seen as a brownish haze over cities. It reduces visibility, mostly in the mornings and late afternoons. If ground temperatures are lower than those of the upper atmospheric layers, the smog stays near the ground without spreading for a number of days.

LET'S TALK ABOUT IT.

Discuss the effects of air pollution in your classroom.

Air pollution has detrimental effects to the environment, animals, plants and humans.

Discuss some of these and how we can prevent them.

PART 4: WHAT CAN BE DONE?

WHAT IS THE GOVERNMENT DOING TO ADDRESS AIR POLLUTION?

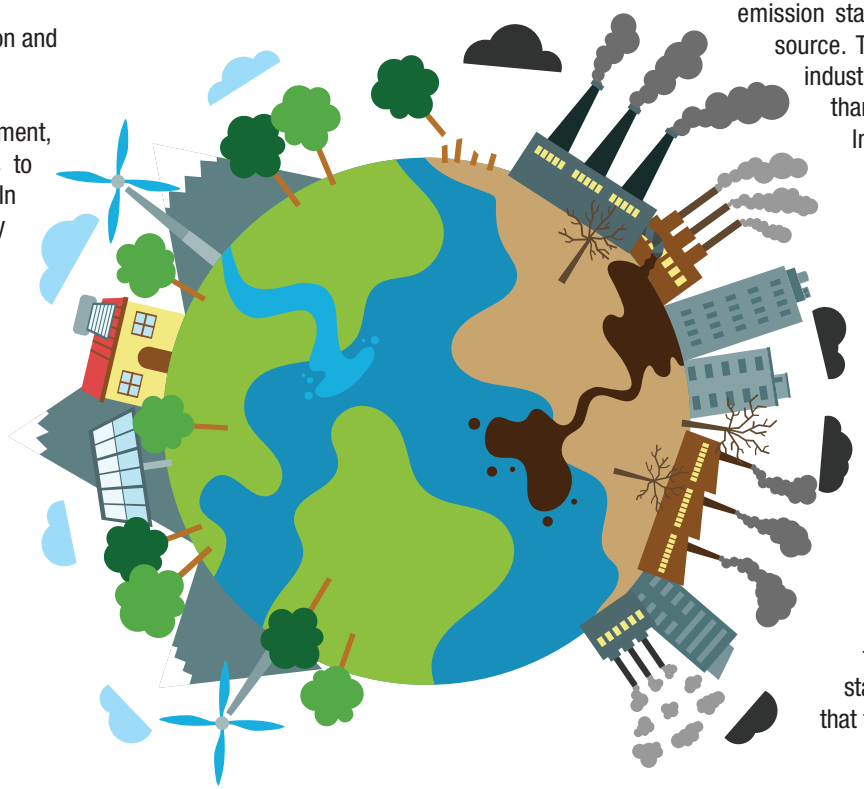
Air quality is so significant that it is even part of our constitution. Section 24 of the Republic of South Africa's constitution provides that:

- Everyone has the right to an environment that is not harmful to their health or well-being.
- The environment is protected for the benefit of present and future generations.
- There is legislation and measures to prevent pollution and ecological degradation.

One of the functions of The Department of Environment, Forestry and Fisheries is to make policies and laws to protect the environment from degradation and pollution. In 2005, the National Environmental Management Air Quality Act (No. 39 of 2004) came into operation, and the Air Quality Act came into full effect on 1 April 2010. This new Act provides the government with the necessary tools to protect the right of every South African as a constitutional right.

The Air Quality Act is important to South Africa, because it helps the government to:

- Regulate and manage air pollution in the country.
- Monitor the pollutants to ensure that air quality is improved.
- Enhance the quality of ambient air in order to secure an environment that is not harmful to the health and well-being of people.



SETTING AIR QUALITY STANDARDS

Emission standards

Different sources of air pollution have been discussed. In order to reduce air pollution emissions from these sources, the government has published a list of sources/ activities which have significant effects on the environment.

These sources require an atmospheric emission licence before they can operate. For these sources, the government sets limits on the amount of emissions each source is allowed to release into the atmosphere. These are called emission standards and they are specific to each pollutant and source. There are different emission standards, for different industries. By law, it is an offence for a source to emit more than this emission limit. The Environmental Management Inspectors (Green Scorpions) from the Department of Environmental Affairs and other authorities conduct compliance and monitoring exercises to ensure that emission standards are met.

Ambient air quality standards

To differentiate between air that is harmful to health and well-being and that which is not, the government has also set ambient air quality standards (ambient air is basically outdoor air). These are used to measure whether the air is safe for human health.

South Africa has standards for major pollutants such as sulphur dioxide, carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter (PM) and benzene. If the levels of pollution are higher than the levels set in the standards, the air is considered to be unsafe. This means that the pollution level poses a health risk.

WHAT CAN BE DONE TO REDUCE AIR POLLUTION?

Industry:

- Pollution control equipment on stacks (industrial chimneys)
- Switching to alternative fuels (for example using gas instead of coal)
- Changing to cleaner technology
- Setting stricter emission limits for stacks

Power stations / electricity generation

- Pollution control equipment on stacks
- Finding alternatives to fuel combustion
- Switching to renewable energy
- Setting stricter emission limits for stacks

Mining:

- Control of fugitive dust emissions by watering or chemical suppression
- Vegetation on mine dumps

Household:

- Switching to cleaner fuels, such as gas, for cooking and heating
- Using solar energy, e.g. solar water heaters

Transportation:

- Cleaner, more fuel-efficient vehicles
- Changing to alternative fuels
- Scrapping of old, polluting vehicles
- Improved vehicle maintenance

Individuals:

You have seen that air pollution is a vast problem with many different causes and effects. One person's efforts might not make much difference in reducing the major sources of pollution, but collective efforts by whole communities can make a difference.

Wise environmental management and lifestyle choices can lead to cleaner air, which has direct health benefits for everyone. Here are some ideas of what you can do, but try to think of other ways, too.

If you live in a house with smokers, ensure that the rooms are well ventilated or, better still, ask people to smoke outside. Similarly, houses which use gas heaters, fuel stoves or open fires should also be well-ventilated to allow stale, pollutant-carrying air to escape.

Investigate strange smells in your area. Don't just accept that the odour or particles in the air come from a nearby factory or dump. Find out why these pollutants are being emitted, how harmful they are and how long they will persist.

Many buses, taxis, trucks and cars emit clouds of diesel fumes which pollute the air in our towns and cities. Where possible, politely discuss the health consequences of this pollution with the vehicle's driver.

Dispose of rubbish wisely and avoid burning it. Burning plastics can be especially harmful, because they emit toxic chemicals.

Protect trees in your area, and plant indigenous trees where possible. These trees will help to filter impurities from the air and balance the levels of oxygen and carbon dioxide.

The DEA recognises the importance of public awareness and education of communities on air quality issues, so that everyone can take a role in looking after the environment.

Environmental Forums (committees) have been formed in the national priority areas and other "hot spots", so that air quality issues can be discussed, problems can be identified and solutions can be found. These Environmental Forums are quite successful, because people, at least in those areas, are now aware of air pollution issues.

LET'S TALK ABOUT IT.

Discuss in your classroom or small group on how industry, power stations, mines, and farming communities can reduce their emissions that contribute to overall air pollution.

Discuss how your school can be involved in the fight against air pollution.

PART 5: AIR QUALITY MONITORING

In order to manage air quality, it is important to understand the amounts and types of pollutants present in the atmosphere. This is achieved by ambient air quality monitoring. Special instruments are used to measure the levels of different pollutants.

Each pollutant is measured by a specific instrument, and these instruments are housed in a monitoring station. Usually, there are several instruments at each station, for example, an instrument to measure sulphur dioxide, another one for carbon monoxide and so on.

Currently, there are over a hundred air quality monitoring stations across the country. These stations belong to national, provincial, district, metropolitan and local departments responsible for air quality management. Some industries and other private organisations also have their own monitoring stations. Most of these stations measure pollutants such as sulphur dioxide, carbon monoxide, nitrogen dioxide, particulate matter, lead, benzene and ozone.

A monitoring station which houses special instruments to measure air pollutants.

HOW DOES AIR POLLUTION INFORMATION REACH THE PUBLIC?

Air quality measurements from the monitoring stations are transmitted to the South African Air Quality Information System (SAAQIS), a partnership between the Department of Environmental Affairs (DEA) and the South African Weather Service (SAWS).

The measurements are collected in REAL TIME (LIVE) every five minutes. These are made available through the SAAQIS website https://saaqis.environment.gov.za and an innovative mobile application tool called SAAQIS. To date, over 65 government stations are reporting LIVE to the SAAQIS, and the number will continue to increase as more stations are connected to the system.

Understanding how air pollution measurements translate to the quality of the air we breathe and the associated health effects is very complex. The government has, therefore, developed a country-specific Air Quality Index (AQI) in line with international best practices. The AQI translates technical air quality measurements into simple, understandable language on SAAQIS.

Locations of ambient air quality monitoring stations across the country.

The index informs the public on how clean or polluted the air is and what associated health effects might be of concern. The higher the AQI, the greater the level of air pollution, and hence the greater the health concerns from exposure to poor quality air. The health messages are designed to help citizens take practical, protective actions to avoid or reduce exposure to pollution on days when unhealthy air quality is observed.

The AQI:

- Provides guidance on what associated health effects might be of concern to the general population. It focuses on sensitive groups such as children, the elderly and people with medical conditions that can be exacerbated by poor air quality.
- Sends a clear and consistent message to the public on the state of air quality.
- Will be used for communicating air quality forecasting in the future developments of SAAQIS.

HOW IS THE AIR QUALITY INDEX CALCULATED?

The AQI is calculated from six pollutant criteria (particulates PM10 and PM2.5 CO, O3, SO2 and NO2) on a scale of 1 (for good air quality) to 10 (for hazardous air quality). Every five minutes, the data from air pollution sensors at the stations is transmitted to SAAQIS. Here, data is automatically quality-controlled to remove data that shouldn't be there. All data changes are noted in the database for further verification by data specialists. The data is averaged for the hour, and the pollutant levels are converted to an AQI score based on the bands in the AQI table. The highest AQI for that hour from all pollutants recorded is then reported as the AQI of the hour. This process is undertaken for data from each monitoring station, and the data is reported on the SAAQIS website and application.

LET'S TALK ABOUT IT.

Discuss how to calculate the Air Quality Index (AQI) and the SAAQI app.

What information can you find using the SAAQI app and what do the five bands/ colours indicate?

Discuss how to use the app to identify and understand the meaning of the values.

WHAT DO THE AIR QUALITY INDEX VALUES MEAN?

The table below shows how the data is translated to the AQI based on the colours of the circles. The index has five bands indicating "Low", "Moderate", "High", "Very High" and "Hazardous" levels of air pollution. For each of the pollutants, the bands are further divided into a ten-point scale to provide a gradation of air pollution levels.

- **Low bands (AQI of 1 to 3)** indicate air pollution levels where it is unlikely that anyone will suffer any adverse effects from short-term exposure to air pollution, including people with lung or heart conditions who may be more susceptible to the effects of air pollution. Where South African air quality standards are defined for different averaging periods (8 hours for ozone or 24 hours for PM10/PM2,5), the hourly equivalent thresholds are estimated using best practices and leaning on ensuring the protection of human health.
- **Moderate bands (AQI of 4 to 5)** represent levels of air pollutants at which there are likely to be minor effects for susceptible people. However, the general public is likely not affected.
- **High bands (AQI of 6 and 7)** are associated with significant effects in susceptible people. However, the general public is likely not affected.
- **Very High bands (AQI of 8 and 9)** are levels of air pollution under which even healthy individuals may experience adverse effects from short-term exposure. Members of sensitive groups may experience more serious health effects.
- **Hazardous bands (AQI of 10)** are those levels that may trigger health warnings of emergency conditions as all persons may likely be affected with serious health effects.

When the AQI is...	...Air pollution will be	Station will be reflected as this circle	Colour of circle
Low	Good		Green
Moderate	Moderate		Yellow
High	Unhealthy		Orange
Very High	Very Unhealthy		Red
Hazardous	Hazardous		Purple

HOW DO I PROTECT MY HEALTH?

The AQI is accompanied by health messages as shown in the table below. The messages help the public to make decisions about outdoor activities in light of the air quality. Children, the elderly and persons with health concerns are defined as at-risk individuals, because they are more sensitive to pollution than the rest of the population.

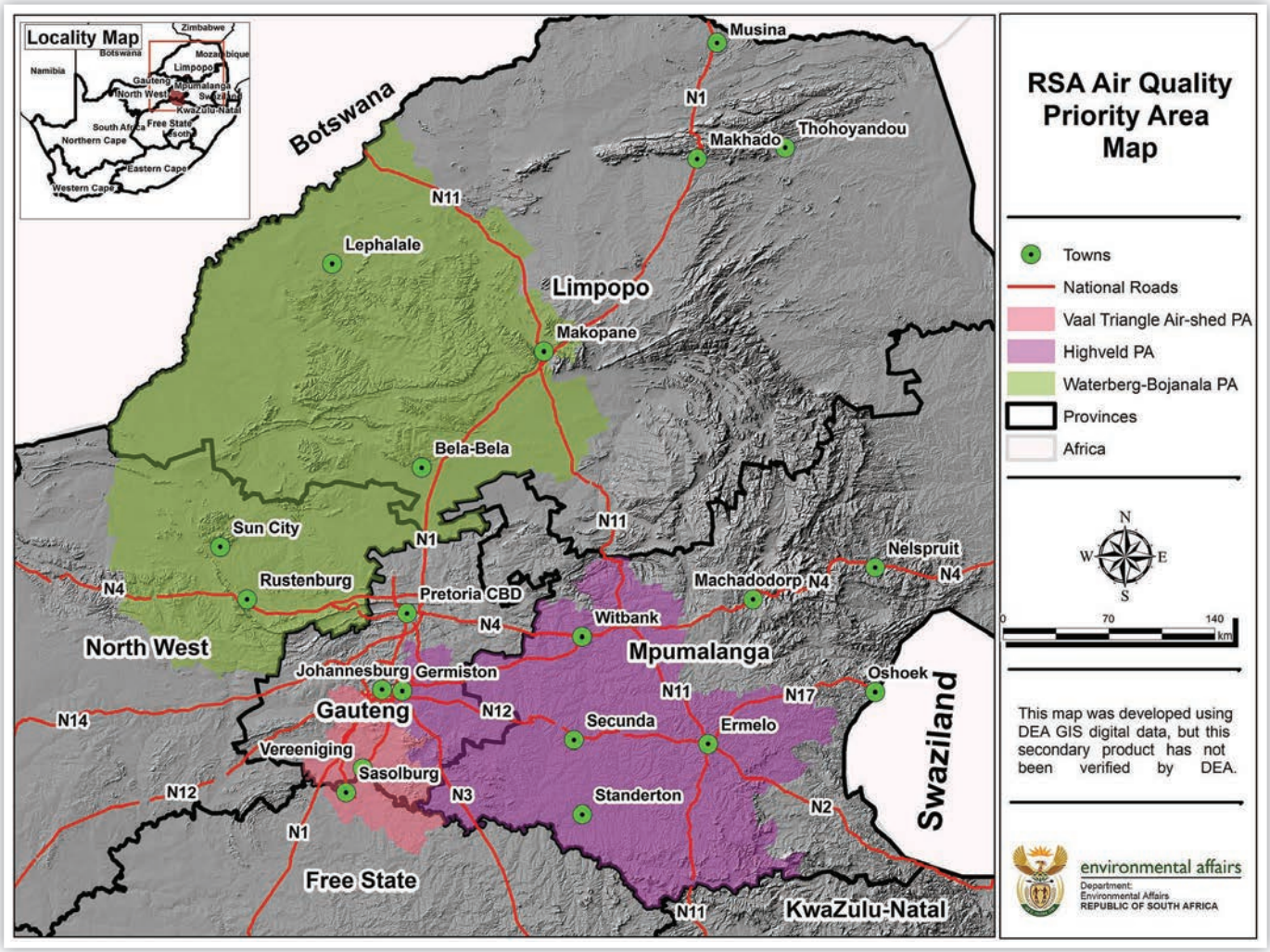
When the AQI is...	At risk individuals such as children, the elderly and persons with health concerns should...	The general population should...
Low (Green)	Enjoy your usual outdoor activities.	Enjoy your usual outdoor activities.
Moderate (Yellow)	Adults and children with lung problems, and adults with heart problems, who experience symptoms, should consider reducing strenuous physical activity, particularly outdoors.	Enjoy your usual outdoor activities.
High (Orange)	Adults and children with lung problems, and adults with heart problems, should reduce strenuous physical exertion, particularly outdoors, and particularly if they experience symptoms. People with asthma may find they need to use their reliever inhaler more often. Older people should also reduce physical exertion.	Anyone experiencing discomfort such as sore eyes, coughing or a sore throat should consider reducing activity, particularly outdoors.
Very High (Red)	Adults and children with lung problems, adults with heart problems, and older people, should avoid strenuous physical activity. People with asthma may find they need to use their reliever inhaler more often.	Reduce physical exertion, particularly outdoors, especially if you experience symptoms such as coughing or a sore throat.
Hazardous (Purple)	Adults and children with lung problems, adults with heart problems, and older people, should avoid strenuous physical activity. People with asthma may find they need to use their reliever inhaler more often.	Reduce physical exertion, particularly outdoors, especially if you experience symptoms such as coughing or a sore throat.

WHERE CAN I FIND THE AQI?

The AQI can be found on the SAAQIS website, https://saaqis.environment.gov.za and the SAAQIS application tool. By clicking on a station, the website/application displays more information about that station, pollutants monitored, time series plots of pollutants and meteorological (weather) parameters. Time series plots can be presented for any parameter, as shown for sulphur dioxide at Secunda in the diagram.

The SAAQIS website/application not only provides information on the state of air quality, but also gives educational information on pollutants in terms of what the pollutants are, typical pollutant sources and associated health effects. This educational tool will be further enhanced on the SAAQIS website to support primary educational programmes and information dispersal to the general public.

PART 6: NATIONAL PRIORITY AREAS



According to the Air Quality Act, the government is required to identify air pollution "hot spots" across the country that require special attention. These are referred to as priority areas when the ambient air quality standards in the area are being, or could be, exceeded.

To date, the Department of Environmental Affairs has identified the Vaal Triangle Airshed Priority Area, the Highveld Priority Area and the Waterberg-Bojanala Priority Area.

The Vaal Triangle Airshed Priority Area includes parts of the Free State and Gauteng provinces, while the Highveld Priority Area also includes part of Gauteng, as well as parts of Mpumalanga. The Waterberg Bojanala Priority Area includes parts of the Limpopo and North West provinces.

Priority areas require special air quality management plans to improve air pollution to acceptable levels. The plans contain specific air pollution reduction strategies and comprehensive ambient air quality monitoring programmes. There are a number of ambient monitoring stations in these priority areas most of which are located in schools.

CONTACT INFORMATION

THE DEPARTMENT OF ENVIRONMENT, FORESTRY AND FISHERIES

Private Bag X 447
PRETORIA
0001
Tel: 086 111 2468
Fax: 012 359 3625
www.environment.gov.za

PROVINCIAL CONTACTS

EASTERN CAPE

Department of Economic Development, Environmental Affairs and Tourism
Private Bag X 0054
BHISHO
5605
Telephone: (043) 605 7000
Website: www.dedea.gov.za

FREE STATE

Department of Economic, Small Business Development, Tourism and Environmental Affairs
Private Bag X 20801
BLOEMFONTEIN
9300
Tel: 0861 102 185
Fax: (051) 400 9593
Website: www.edtea.fs.gov.za

GAUTENG

Gauteng Department of Agriculture and Rural Development
PO Box 8769
JOHANNESBURG
2000
Tel: (011) 240 2500
Fax: 086 420 2187
Website: www.gdard.gpg.gov.za

KWAZULU-NATAL

Department of Economic Development, Tourism and Environmental Affairs
Private Bag X9059
PIETERMARITZBURG
3200
Tel: (033) 355 9100
Fax: (033) 355 9122
Website: www.kzndedt.gov.za

LIMPOPO

Department of Economic Development, Environment & Tourism
Private Bag X9484
POLOKWANE
0700
Tel: (015) 293 8300
Fax: (015) 293 8319
Website: www.ledet.gov.za

MPUMALANGA

Department of Agriculture, Rural Development, Land and Environmental Affairs
Private Bag X11219
MBOMBELA
1200
Tel: (013) 766 6082
Fax: (013) 766 8429
Website: www.dardlea.mpg.gov.za

NORTHERN CAPE

Department of Environment and Nature Conservation
Private Bag X6120
KIMBERLEY
8301
Tel: (053) 807 7300
Fax: (053) 807 7328
Website: www.denc.ncpg.gov.za

NORTH WEST

Department of Rural, Environment and Agricultural Development
Private Bag X2039
MBATHO
2735
Tel: (018) 389 5111
Fax: (018) 384 2679
Website: www.nwpg.gov.za

WESTERN CAPE

Department of Environmental Affairs and Development Planning
Private Bag X 9086
CAPE TOWN
8000
Tel: (021) 483 4091
Fax: (021) 483 3016
Website: www.westerncape.gov.za

WHERE CAN I GET MORE INFORMATION?

More information on air quality in South Africa can be found at:
https://saaqis.environment.gov.za or
www.environment.gov.za.
Questions on SAAQIS can be directed to:
SAAQIS@environment.gov.za.

THE DEPARTMENT OF ENVIRONMENT, FORESTRY AND FISHERIES.

Private Bag X 447
PRETORIA 0001

Tel: 086 111 2468
Fax: 012 359 3625
email: callcentre@environment.gov.za
www.environment.gov.za

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