



## 9 Pollution



Buildings, vehicular transport, agriculture and industry can affect the external environmental quality, the health and safety of residents and the natural environment by causing air, noise and light pollution and by increasing the urban heat island effect.

**Noise pollution** is classified as excessive noise from trucks, industry, motor vehicles and machinery which disturbs work and sleep causing undue stress. Noise pollution may also impact the occupants of a building and this is discussed further in the section on Indoor Environmental Quality.

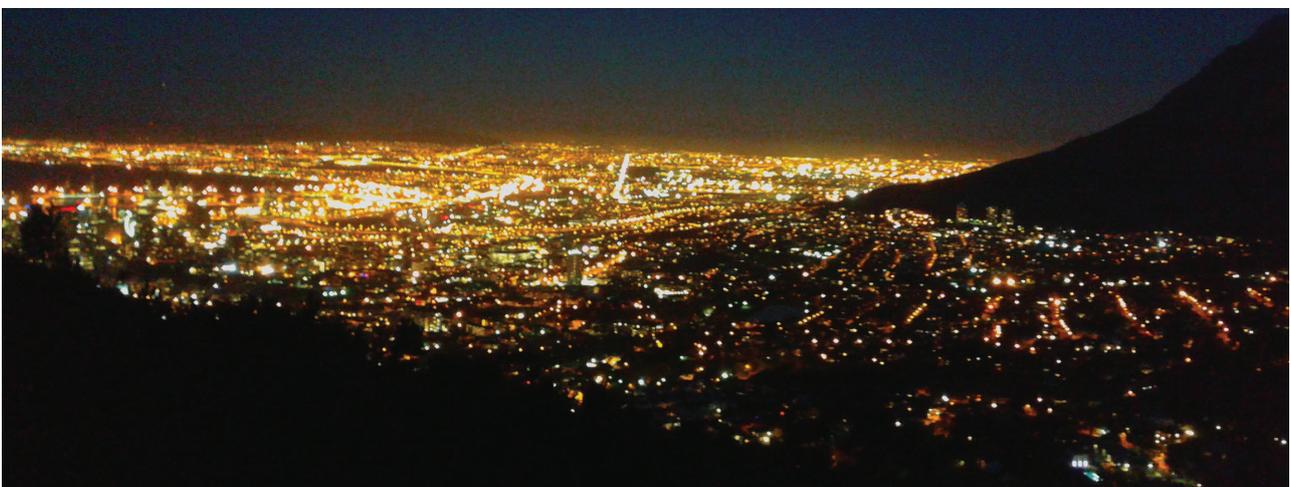
**Air quality** refers to the level of smoke, dust and harmful chemicals in the air which come from vehicle exhausts, smelting metals, burning wood and agriculture by-products, open cast mines and power plants. This can then be made worse by naturally occurring weather events such as fog from the coast or in a basin between mountain ranges which traps this pollution. Constant exposure to poor air quality can be dangerous to residents, especially the young, elderly and pregnant, as breathing these air pollutants is known to cause

respiratory problems and other health risks. This can, in turn, put extra strain on the provision of health services.

**Light pollution** is classified as light from electrical lighting that spills upwards into the night sky or on to neighbouring properties. This can be harmful to the natural environment by disturbing nocturnal ecosystems such as disorientating migratory birds which use the stars for navigation, disrupting biological rhythms of animals and insects, and depriving the public of views of the night sky. Light emitted upwards is considered as wasted light and is therefore a waste of electricity too, and can pose a hazard to air traffic and impact on avian activity.

The **urban heat island effect** refers to a change of the microclimate in urban areas where temperatures are higher than in rural areas. This is due to the increased cover of dry, impermeable surfaces and an increase in the thermal mass in urban areas from buildings, roads and other infrastructure which holds on to heat for longer periods of time and releases it at night rather than absorbing it as occurs in rural areas.

*Figure 17: The visual effect of light pollution from urban areas*





### Fast Fact:

#### Impact of air pollutants on health

An average South African breathes in 7.6 litres of air per minute which means around 12 870 litres of air each day.

Pollutants that are released into the air, as opposed to land and water pollutants, are the most harmful.

People who live near high traffic roads face greater risk of cancer, heart disease, asthma and bronchitis as these places contain more concentrated levels of air pollution.

Source: : <http://www.conserve-energy-future.com/various-air-pollution-facts.php>

## 9.1 What changes do we need?

Air quality and noise and light pollution can be managed and improved through a wide range of initiatives which reduce and control the activities associated with the generation of noise, dust, harmful chemicals and excessive light. In KwaDukuza, to aid the transition to low emission development, it is necessary to put measures in place to improve on current levels of air, noise and light pollution and reduce the urban heat island effect thereby creating a healthier and more comfortable external environment for residents with reduced impact on local ecosystems.

## 9.2 How do we design our buildings?

### 9.2.1 Reduce Air Pollution

**Green roofs and landscaping:** Trees and other vegetation absorb carbon dioxide and release oxygen. Thus planting more trees and designing for more landscaped areas on-site can help to reduce the amount of harmful greenhouse gas emissions in the atmosphere. Trees and vegetation also help to settle out, trap and hold particle pollutants that are in the air (such as dust, smoke, pollen and ash) which would otherwise damage human lungs and cause breathing problems.

To help this, increase the amount of the site that is covered by trees and soft landscaping, including consideration of designing a green roof.

**Reduce harmful emissions: GHG emissions in air-conditioning:** Good building design ensures that the harmful emissions from air conditioning and insulants are minimised. This is discussed in more detail in the section on Internal Environmental Quality.





### 9.2.2 Reduce the urban heat island effect

By reducing the heat islands caused by buildings and impermeable surfaces, there is a reduced impact on microclimates, enabling cities to become cooler and more comfortable. Strategies to do so include:

**Reduce impermeable surface cover:** Reduce the number of impermeable surfaces such as car parks, pavements and kerbs, and roofs, which retain more heat for longer in comparison to permeable surfaces and contribute towards the heat island effect.

**Increase soft landscaping and shading:** Create shaded areas on or around the site with trees or other structures and increase the site area designated for soft landscaping.

**Roof colour and material:** Specify light-coloured roofing materials or install a green roof. Often buildings are left with roof areas painted black from the waterproofing – this absorbs heat and contributes to the heat island effect. Painting these a lighter colour will have a major impact on the air conditioning load (and hence energy usage) of the building. The use of a green roof has the additional benefit of increasing the usable area for a commercial building, as it can create additional staff resources.

### 9.2.3 Reduce the effects of noise pollution

**Site layout for noise reduction:** The arrangement of buildings on a site can be used to minimise noise impacts. If incompatible land uses already exist, or if a noise sensitive activity is planned, acoustical site planning often provides a successful technique for noise impact reduction. Many site planning techniques can be employed to shield a residential

development from noise. These can include:

- Increasing the distance between the noise source and the receiver.
- Placing non-residential land uses such as parking lots, maintenance facilities, and utility areas between the noise source and the receiver.
- Locating barrier-type buildings parallel to the noise source (such as a busy road).
- Orienting the residences away from the noise.

**Noise barriers:** A noise barrier is an obstacle placed between a noise source and a receiver which interrupts the path of the noise. These can be made out of many different substances which include sloping mounds of earth, called berms; walls and fences made of various materials including concrete, wood, metal, plastic, and stucco; regions of dense plantings of shrubs and trees; and combinations of these techniques.

**Materials for noise management within buildings:** Certain building systems, such as generators and HVAC systems, can emit high volumes of noise and disturb surrounding residents and other buildings, especially when placed on the outside or on the roof of the building. To minimise this it is therefore necessary to specify the use of noise reduction materials that are able to absorb the noise sufficiently to prevent the noise disturbance.

### 9.2.4 Prevent light pollution

**Reduction of lights shining outwards from the building:** When designing internal lighting for the building ensure the design prevents light from being emitted from the building, especially at night. This can be incorporated through the provision



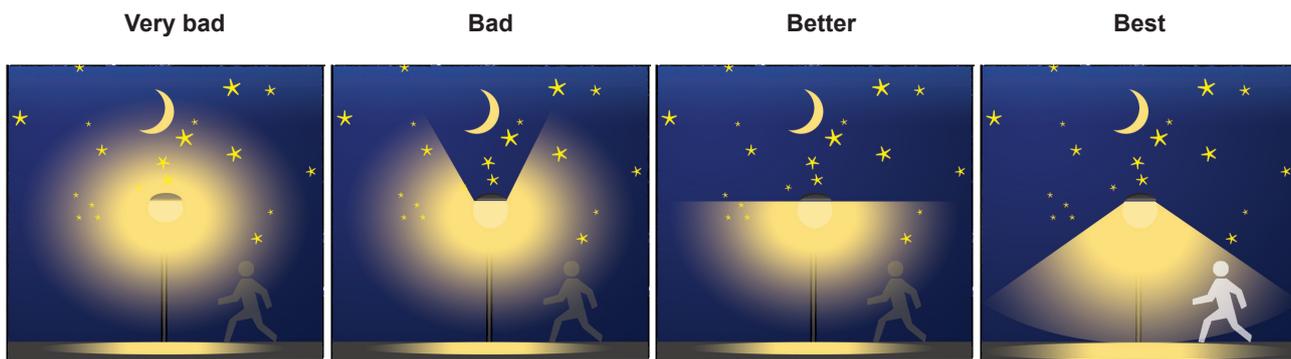
of targeted lighting options available for use by occupants at night and by ensuring that the lighting levels for each floor are not excessive. This is beneficial to the indoor environmental quality too, as noted in that section of the guidelines.

**No internal lighting shining upwards into the night sky:** Ensure that all internal lighting from offices and atrium spaces in the building is prevented from being emitted outwards directly into the night sky. This can be done through either aiming the light downwards or by ensuring that the

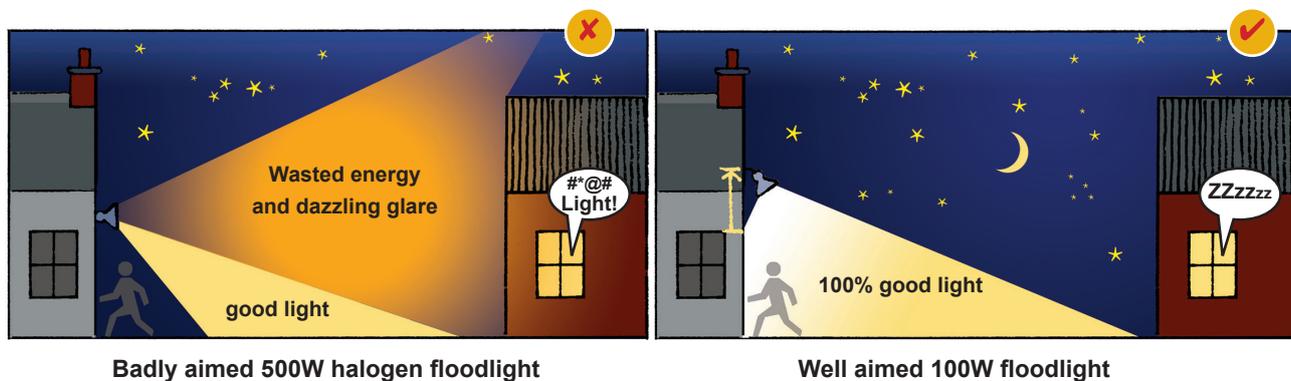
light's full beam angle is reflected off a surface or shaded by the light fixture.

**No external lights shining upwards into the night sky:** External lighting can include lighting for balconies, parking lots, decorative facade, signage and landscape lighting, walkway lighting, and garage, building and site entrance lighting. To ensure that no light is directed upwards into the night sky and into surrounding buildings, ensure that the full beam angle for each light is positioned to aim downwards or is reflected off a surface or light fixture.

Figure 18 : Good street and building lighting to minimise light pollution



Source: <https://www.jmu.edu/planetarium/light-pollution.shtml>



Source: <http://kerrydarksky.com/light-pollution/>



## 9.3 How do we construct our buildings?

### 9.3.1 Reduce air pollution

#### **Cover and damp down construction materials:**

Dust particles from the storage and use of materials on construction sites can easily become a harmful pollutant to surrounding residents if they are not properly managed. To prevent this ensure that all piles of sand and other small particles of construction material, wood and concrete dust, are dampened and covered with a textile that prevents wind blowing it off the site.

### 9.3.2 Reduce noise pollution

#### **Restrict loud construction activities to working hours:**

Loud noises are disturbing to surrounding residents therefore ensure that loud construction activities are only undertaken during working hours of the week.

The use of sound meters can be used to track levels of noise generated by different activities and the reach of such sound, and this information can be put back into the construction programme to ensure the least impact on surrounding areas of the works.

### 9.3.3 Prevent Light pollution

#### **Ensure site lighting does not emit light upwards or into surrounding buildings:**

Site lighting is necessary for safety and security. However, it is necessary to ensure that the site is not lit up excessively and that lighting is angled downwards and away from neighbours' windows. This is to prevent light pollution emitted to surrounding neighbours and upwards into the night sky.



## 9.4 How do we manage our buildings?

### 9.4.1 Conduct an Emissions Audit

Conduct an audit to evaluate the level and source of emissions from the building with regard to air, light and noise pollution. Adopt and implement a pollution management plan as part of the operations and maintenance programme to identify opportunities and strategies to reduce emissions and to track progress.

**Eliminate noise pollution:** All generators which are installed as part of the operational or maintenance process, or were not previously adequately installed, should be fitted with noise attenuation to prevent them causing noise pollution to neighbours or neighbouring areas.

During major retrofits and alternations, noise meters should be used to assess the actual levels of noise generated and the reach thereof, and the activities correctly scheduled accordingly to be of least impact.



## 9.5 How do we enhance our communities?

### 9.5.1 Reduce air pollution and the urban heat island effect

**Tree planting and soft landscaping:** As mentioned, tree planting and soft landscaping helps to filter pollutants from air while producing oxygen. These benefits can be increased at the scale of a community and precinct as it offers the opportunity to plant trees and soft landscaping in public spaces and pathways between buildings. This also helps to compensate for building sites which have not got sufficient space on site for viable areas of landscaping.

#### Fast Fact:

**One soccer field planted with trees can:**

- absorb the same amount of carbon dioxide released from 42 000km of driving a car in a year
- provide enough oxygen for 20 people to breathe every day

Source: <http://urbanforestrynetwork.org/benefits/air%20quality.htm>

**Cooling areas:** The urban heat island effect can be reduced by shading impermeable surfaces such as roads, parking lots and pathways with trees and constructed shading devices. This helps to prevent heat absorption and retention by these surfaces. Other cooling areas can be provided by public open spaces which are covered by permeable surfaces, such as grass and other vegetation, and public water fountains, dams or lakes.

### 9.5.2 Reduce the effects of noise pollution

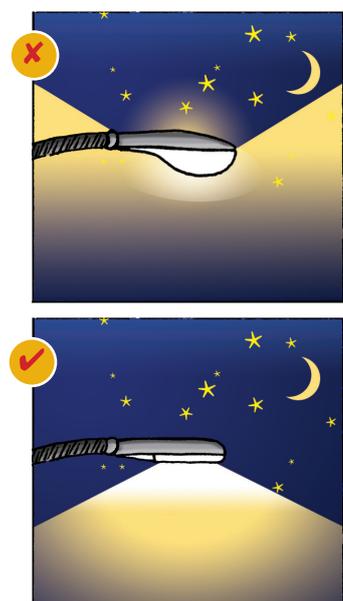
**Precinct layout:** When designing a new precinct, ensure that noise compatibility is taken into account. Residents or building typologies that are more sensitive to noise should not be located near to areas of high noise pollution.

**Noise buffers:** At the scale of a community, larger noise buffers (such as a tree cluster or hedge) can be used to shield a group of buildings from a harmful noise source, such as loud industry or mining. Consider the opportunity for these buffers to work as multi-functional spaces for public open space in the community too.

### 9.5.3 Prevent and eliminate light pollution

**Lighting for streets, walkways and parks:** The provision of public lighting should prevent the emission of direct light into the night sky. To prevent this, street and pathway lighting must be angled so that it points where light is needed and not upwards. Another design factor is the placement of lights where lights are evenly distributed to prevent overlap of lighting. The use of light emitting diode (LED) lamps can help reduce light pollution through providing more targeted street lighting.

Figure 19:  
Street lighting design to prevent light pollution.



Source: <http://physics.fau.edu/observatory/light-pol-prevent.html>