

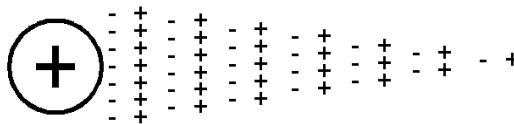
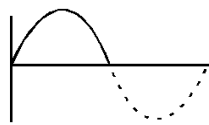
# Important ways in which powerlines are able to increase exposure to air pollution

## 1. Corona ion emission from high voltage powerlines

The primary way in which electrical power is transmitted and distributed around the country is by means of cables suspended between pylons. These cables usually carry a very high voltage, for example in Britain, 132,000 or 400,000 volts.

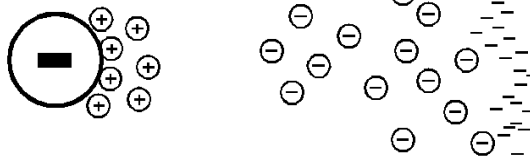
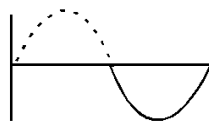
The high voltage carried by these cables is sufficient to break up the air, separating electrons from individual air molecules. This is the buzzing noise that is often heard from powerline cables. This process is known as ionisation, and it results in the creation of electrically charged particles near to the powerline cable but which may be carried well away from the cable by the wind. These electrically charged particles have the ability of sticking to surfaces in the same way that dust particles may stick to a television or computer screen. In air, however, these electrically charged particles, known as *corona ions* (Figure 1) or more technically as *small ions*, usually attach themselves to microscopic particles which are present in the air and which make up the air pollution around us. These microscopic particles now have an electric charge which enables them to stick to surfaces more easily.

### (a) Positive half cycle



Electrons drawn to the positive line undergo avalanche multiplication

### (b) Negative half cycle

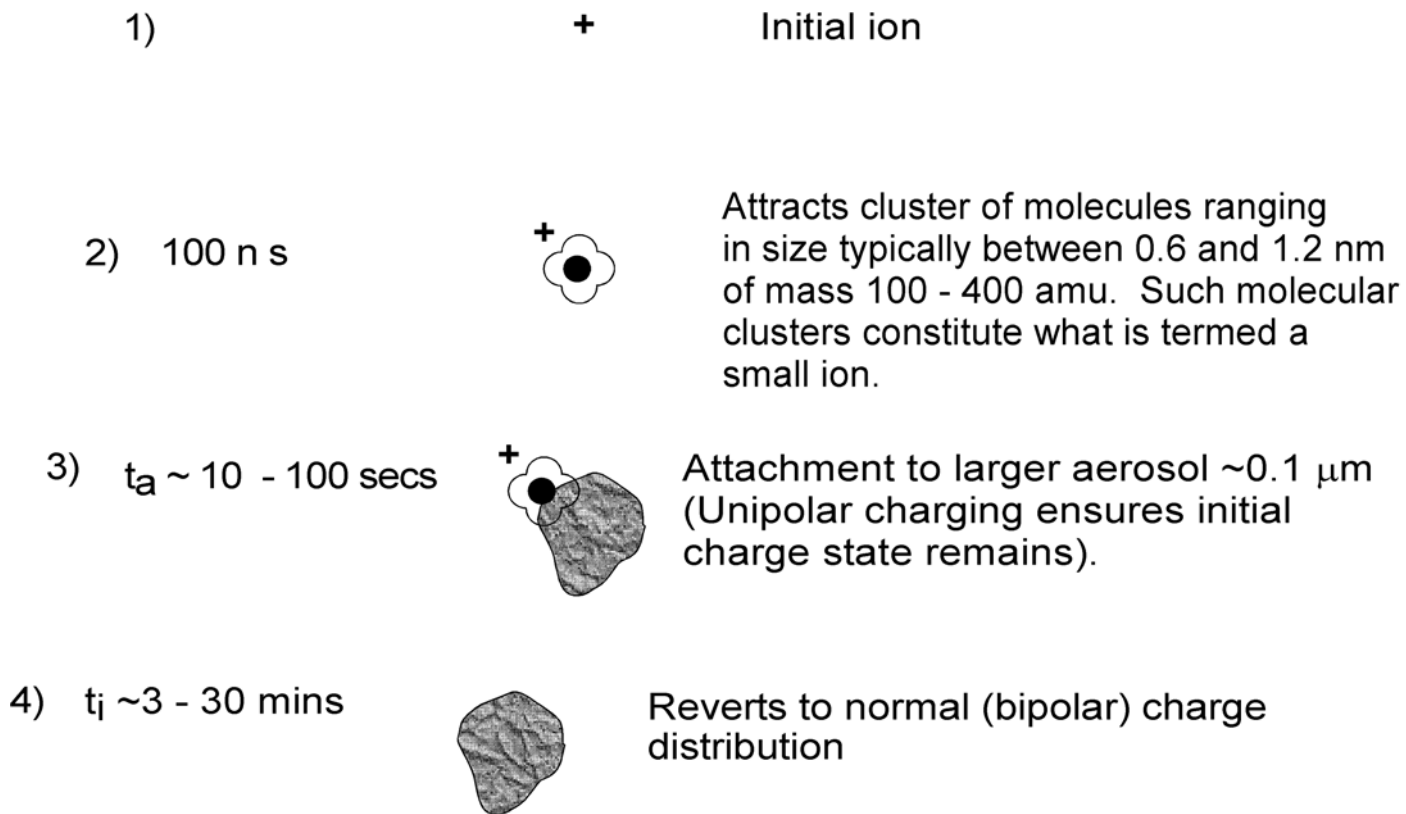


Electrons repelled from the powerline undergo avalanching which is limited by the diminishing field away from the line

**Figure 1.** Schematic outline of the formation of powerline corona ions.

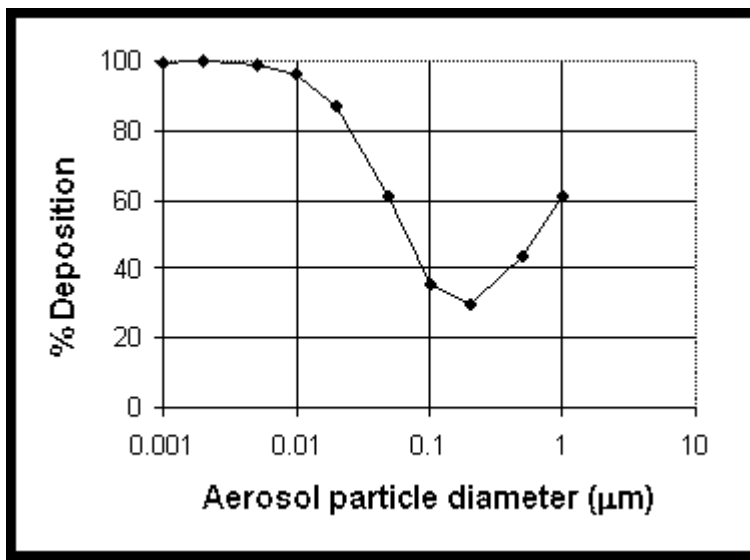
In outdoor conditions these microscopic particles of air pollution which have been electrically charged by the attachment of small ions can be carried well away from the

powerline by the wind (Figure 2). Electrically charged particles are commonly found up to 400 metres from powerlines although in exceptional cases they have been found several kilometres away.



**Figure 2.** Schematic diagram showing corona ion dispersion in the atmosphere

When particles in the air are inhaled not all of them are trapped in the lung. For example, if you watch a cigarette smoker, they may breathe in the cigarette smoke but some of the smoke may be breathed out again. For some particles, only one third (30%) of what is breathed in is trapped in the lung. It is known that when you breathe in electrically charged particles, they have a greater chance of being trapped. Therefore if you breathe in particles that have been electrically charged by small ions then these particles too will have a greater chance of being trapped in the lung. This is the way in which small ions emitted from high voltage powerlines act to increase exposure to air pollution, by increasing the amount of air pollution we retain when it is inhaled (Figure 3).



**Figure 3.** Graph to show the proportion of inhaled particles trapped in the lung dependent on the size of the particles. In some cases only 30% of inhaled particles are trapped, the remainder are exhaled.

We are investigating the way in which powerlines emit small ions, how they attach themselves to particles of air pollution and the level of increased amount of air pollution that is trapped in the lung of people living near powerlines. We are then investigating the consequences of this increased exposure to air pollution. Given that a number of illnesses are known to be linked to air pollution, people living near powerlines might be at greater risk of these illnesses.

## ***2. Oscillation of aerosols in a 50 Hz powerline electric field***

The possible consequences of this increased exposure are discussed in our [summary of a paper](#) in *Medical Hypotheses*, **59**, 39-51, 2002: Does our electricity distribution system pose a serious risk to public health? D. L. Henshaw

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*Any comments or corrections please e-mail [Paul Keitch](#)*