

Smog (HL) – Look at the section on primary air pollution above before reading this!

The word smog is a contraction of smoke and fog and has come to signify intense city air pollution. In fact there are two types, *reducing* (think London in the 1950s) and *photochemical* (think Los Angeles now).

Reducing Smog

In 1952, over a few short days, 4000 people died in London as a result of reducing smog. (The incident led to the Clean Air Act of 1956, and I am delighted to report that the air over London these days is enormously improved.) The name comes from the major culprit, SO₂ which is a reducing agent. In the 19th and early 20th century the citizens of London burnt sulphur rich coal to keep warm releasing vast amounts of SO₂ gas. Added to this were all the particulates from the coal and industry and the scene was set for a *synergistic effect*. This means that the interaction of two pollutants is far more serious than either would be alone. In this case the particulates acted as heterogeneous catalysts for the oxidation of SO₂ to SO₃, and this in turn produced deadly droplets of sulphuric acid which lodged inside people's lungs. Such droplets attack the alveoli causing pulmonary emphysema (which has a symptom of shortness of breath). The situation is worsened by the presence of NO_x which can also catalyse the formation of SO₃, this time by a free radical mechanism.

Changes in industry and strict rules about what can be burnt have removed both the particulates and the SO₂ from London's air and now catalytic converters have reduced the NO_x but this may not be true in other places in the world.

Photochemical Smog

This is a very different beast and centres around free radical reactions involving UV light from the sun. Photochemical smog often looks like a brown haze because of the NO₂ present. All the reactions involve homolytic fission producing chemically reactive species with *unpaired electrons*.

The primary pollutant is NO_x produced by car engines. You will note (if you count them up) that both NO and NO₂ are already free radicals as they have an odd number of electrons. However this is just the start of a complex series of reactions that produce a string of nasty secondary pollutants.

