Where does acid rain come from?

There are many different chemical reactions in the air which lead to acid rain. We believe that the main causes are oxides of sulphur and nitrogen in the air. The most important oxides are:

sulphur dioxide, SO_2

sulphur trioxide, SO_3

nitrogen monoxide, NO

nitrogen dioxide, NO_2

Where do the oxides of sulphur and nitrogen come from?

Some sulphur dioxide enters the air naturally from volcanoes and the decay of dead plants. But in Europe about 90 per cent of sulphur dioxide in the air comes from human activities (figure 2).

Coal and oil contain sulphur. When these fuels burn, the sulphur turns to sulphur dioxide. Unless the sulphur dioxide is removed, it is released with the other products of combustion.

$$S(s) + O_2(g) \longrightarrow SO_2(g)$$

Once the sulphur dioxide is in the air, other reactions turn it to sulphur trioxide, SO_3.

Burning fuels also produce oxides of nitrogen, NO and NO_2. Motor vehicles are major producers of these oxides. Power stations which burn fossil fuels also produce a lot. The oxides are formed because nitrogen and oxygen from the air combine together at the high temperatures inside the engine or furnace. For example:

$$N_2(g) + O_2(g) \longrightarrow 2NO(g)$$

Once the NO is in the air, other reactions turn it to NO_2.

Sulphur trioxide and nitrogen dioxide react with air and water to make acids. The main acids formed are sulphuric acid, H_2SO_4, and nitric acid, HNO_3.

Sulphur trioxide reacts with water to make sulphuric acid:

$$SO_3(g) + H_2O(1) \longrightarrow H_2SO_4(aq)$$

Nitrogen dioxide reacts with water and air to make nitric acid:

$$4NO_2(g) + 2H_2O(1) + O_2(g) \longrightarrow 4HNO_3(aq)$$

The effect of these reactions is to produce sulphuric acid and nitric acid, which make the rain acidic.

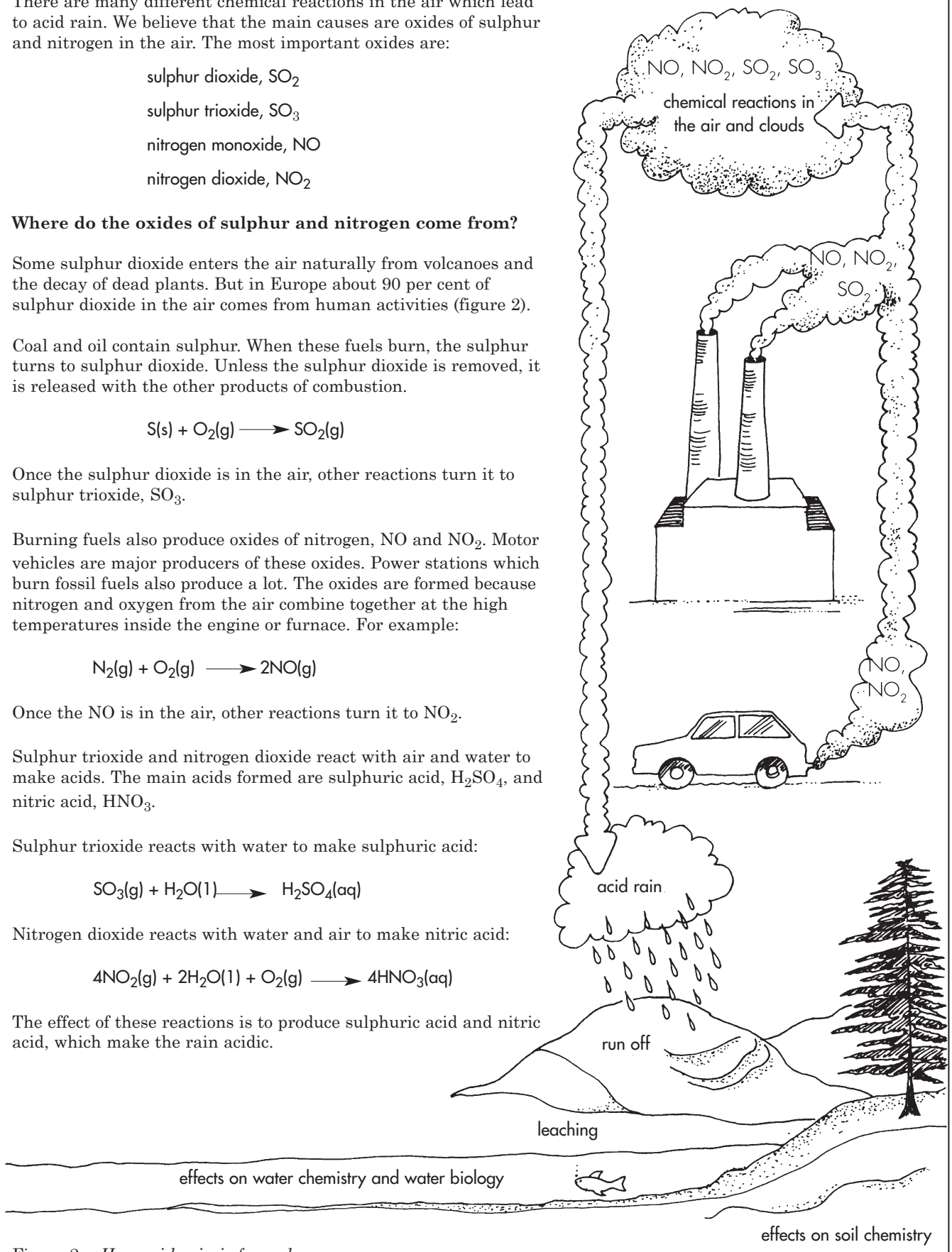

Figure 2 *How acid rain is formed*