Remediation of contaminated soils

Soil remediation involves the improvement of contaminated land to achieve soil that is the same as it was before the contamination.

There are two main approaches to cleaning soil. One way is to 'wash' the contaminants out of the soil.
The other is to chemically degrade the pollutants.
The first relies on knowledge of the physical properties of the pollutant.
The second relies on knowledge of the chemical properties of the pollutant.

Soil remediation using physical properties

Pollutants can move through the soil by diffusion or convection.

Diffusion occurs where there are concentration differences in molecules, spreading out the contamination.

Convection occurs when molecules are driven by a fluid such as rain or wind.

Water picks up particles as it moves through the soil, carrying them further from the initial spill.

These mechanisms that spread the spillage can help the process of cleaning up the contaminated soil.

In order to wash pollutants from the ground, a suitable solvent must be chosen that will dissolve the contaminant.

To wash out oil-based contaminants such as diesel fuel, a trick can be borrowed from the oil industry.

Before an oil well is completely dry, the oil needs to be forced out and a viscose polymer solution is used.

To flush contaminants from the ground, a similar viscous fluid or foam can be pumped through the soil from a hole on one side of the region and pumped out of a hole on the other side, with contaminants dissolved in the foam.
Similarly, gases can be used instead of liquids to transport the pollutant through the soil.
Some contaminant chemicals are volatile and can be flushed out of the soil by pumping air through.
Other contaminants can be made to vapourise by heating the soil with warm air and heating coils.
Another property of contaminants that can be exploited is electrical charge.
By inserting electrodes into soil, any charged or polar contaminants can be made to move towards one electrode, depending on whether they are positively or negatively charged.
A disadvantage is that other molecules in the soil will also be charged and move towards the electrodes.
When this method is used, the soil near the electrode is removed and treated further before being returned.

Soil remediation using chemical properties

Some soil remediation will happen of its own accord as bacteria in the soil break down complex organic chemicals into CO_2.
This process is fairly slow and while it can be sped up by adding oxygen or nutrients for the bacteria, it can still take one or two years.

Another way of breaking down the contaminants is to add chemicals to the soil.

Polyaromatic hydrocarbons (PAHs) are a major pollutant of contaminated soils.

They result from incomplete burning of carbon-containing materials and have structures based on benzene rings.
PAHs are frequently carcinogenic.
Ozone has been shown to break dow PAHs and can be pumped into the ground to degrade the pollutants as it passes through the soil.

(carcinogenic: cancer causing)