CRC CARE FACT SHEET 4

Bioremediation

Bioremediation is any process that uses microbes, fungi, plants or their enzymes to make a contaminated site safe for human use or environmentally healthy.

Examples of bioremediation include the familiar compost heap, in which plant waste is broken down by microbes into fertile soil, and the use of special bacteria to break down oil or chemical spills.

Bioremediation is a natural process used worldwide to clean up harmful chemicals in the environment. Certain microbes that live in soil and groundwater like to eat chemicals, such as those found in gasoline and oil spills. When the microbes completely digest these chemicals, they change them into non-toxic products such as water and carbon dioxide.

In order for microbes to clean up harmful chemicals, the right temperature, nutrients and amount of oxygen must exist in the soil and groundwater. These conditions allow the microbes to multiply—and break down more chemicals. When conditions are unfavourable, the microbes multiply too slowly or else die. If conditions at a site are unfavourable, clean-up experts can improve them by pumping air and nutrients underground to encourage the clean-up microbes.

Sometimes they may add more microbes, or a particular microbe suited to the target chemical, if the ones naturally present in the soil are not sufficient.

Ideal conditions for bioremediation cannot always be achieved underground. At such sites, clean-up experts may dig up the soil in order to treat it above ground where conditions can be more easily controlled. After the soil is dug up, the proper nutrients are added. Oxygen also may be added by stirring the mixture or by forcing air through it. However, some microbes work better without oxygen. With the right temperature and amount of oxygen and nutrients, microbes can go to work to bioremediate the harmful chemicals.

Any process that uses microbes fungi, plants or their enzymes to make a contaminated site safe

Sometimes mixing soil can cause harmful chemicals to evaporate before the microbes can eat them. To prevent these chemicals from polluting the air, some environmental clean-up agencies mix the soil inside a special tank or building where any chemicals given off can be collected and treated.

Microbes can help clean polluted groundwater as well as soil. To do this, the clean-up squad drills wells and pumps some of the groundwater into tanks. Here, the water is mixed with nutrients and air before it is pumped back into the ground. The added nutrients and air help the microbes to cleanse the groundwater. Groundwater can also be mixed underground by pumping nutrients and air into the wells. Once harmful chemicals are cleaned up and microbes have eaten their available “food”, they decline to their natural numbers again.

Bioremediation is very safe because it relies on microbes that naturally occur in soil and which pose no threat to people at the site or in the community.

No dangerous chemicals are used in bioremediation. The nutrients added to make microbes grow are fertilisers commonly used on lawns and gardens. Because bioremediation changes the harmful chemicals into water and harmless gases, the harmful chemicals are completely destroyed.

To ensure that bioremediation is working, the Environment Protection Authority (EPA) or clean-up company tests samples of soil and groundwater.

The time it takes to bioremediate a site depends on several factors:

- types and amounts of harmful chemicals present
- size and depth of the polluted area
- type of soil and the conditions present
- whether clean-up occurs above ground or underground.

These factors vary from site to site. It may take anything from a few months to several years for microbes to process enough of the harmful chemicals to clean up the site.

Clean-up companies often use bioremediation because it takes advantage of natural processes. Polluted soil and groundwater can be cleaned at the site without having to move them somewhere else. If the right conditions exist or can be created underground, soil and groundwater can be cleaned without having to dig or pump it up at all. This avoids clean-up workers having to contact polluted soil and groundwater. It also prevents the release of harmful gases into the air. Because microbes change the harmful chemicals into water and harmless gases, few if any wastes are created.

Another advantage of bioremediation is that it does not require as much equipment or labor as other methods for treating contaminated land and is usually cheaper. Bioremediation has been used to successfully clean up many polluted sites in Australia, North America and Europe and is a widely accepted technique for making society safer and healthier.

Our role

CRC CARE is at the forefront in developing new technologies and partnerships for bio- and other forms of remediation.

Cooperative Research Centre for Contamination Assessment and Remediation of the Environment (CRC CARE)

University of South Australia
Mawson Lakes
SA 5095 Australia

P.O. Box 486
Salisbury South
SA 5106 Australia

Tel: +61 (0) 8 8302 5038
Fax: +61 (0) 8 8302 3124
Email: admin@crccare.com
Web: www.crccare.com

CRC CARE is a partnership of organisations providing research, technologies and knowledge in assessing, preventing and remediating contamination of soil, water and air.

Established and supported under the Australian Government's Cooperative Research Centres Programme

04/09