CHAPTER 6
ONLINE CASE
STUDY

Bioremediation of creosote-contaminated soil in South Africa by land farming

A number of sites in South Africa with varying levels of contamination in the groundwater and soil were identified in the early 1990s (Pearce et al., 1995). This included creosote-contaminated soils. **Creosotes** are chemicals formed from the distillation of tar. They are the most widely used preservative for treating structural timber that will be exposed to the elements, including railway cross ties, pylons, telegraph poles, and fencing timbers. A major source of pollution comes from the dripping of creosote-treated timbers that are left in the open air to dry (Figure A).

The treatment plant chosen to develop and test techniques was in the province of KwaZulu-Natal and had been treating timbers for 14 years. At the time of the study there were no nationally set levels in South Africa for acceptable levels of creosote in soil. The researchers instead used the standards set by the USA Environmental Protection Agency (Atagana, 2004).

Preliminary testing revealed that the topsoil was contaminated with creosote and that this overlay a relatively impermeable layer of shale, the uppermost portion of which was also contaminated. Overall, contamination reached a depth of 35 cm. An area 40 × 25 m was excavated to a depth of 45 cm and samples were taken to ensure that what remained was not contaminated. A clay and water layer was added to the shale to form an impermeable barrier, and the excavated soil and shale pieces (which provided aeration) were put back and ploughed to ensure thorough mixing. ***In situ*** treatment was suitable here because the site was level, the treatment bed relatively isolated by the clay-capped shale beneath, and the nearest surface water was more than 5 km away.

Various treatments were undertaken to enhance degradation, and their effects were compared with an untreated control site:

- **Aeration**: mechanical ploughing every two weeks.
- **pH**: lime treatment to raise pH to 7 (monitored monthly).
- **Moisture**: added by spraying weekly.
- **Nutrients**: monoammonium phosphate (MAP) was added initially (2000 kg/ha), 500 kg of sewage sludge was ploughed into the treatment bed in months two and six, and a further 1000 kg MAP/ha was added in month five.

Online Case Study 6 Figure A Creosote-treated timber left to dry in treatment yards drip creosote and lead to contaminated soils and groundwater.

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The approach is *in situ* **land farming** with **bioaugmentation** and **biostimulation**. After 10 months of land farming, total creosote had been reduced by more than 90% and the rate of degradation was highest after the addition of sewage sludge (although sewage sludge can itself be a source of heavy metal pollutants). Land farming, although conceptually simple, can be a highly effective technique. Careful and active management together with pollutant monitoring can enhance the rate of remediation and produce results within an acceptable time frame at relatively low cost.

REFERENCES

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