science summary

Environment Agency

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Assessment of Metal Mining-Contaminated River Sediments in England and Wales

Science Summary: SC030136/SR4

The long history of metal mining in England and Wales has polluted sediments in rivers, estuaries and lakes, as well as floodplain soils. These sediments now threaten the objectives of the Water Framework Directive, which aim to ensure that our water resources reach and maintain 'good ecological status'. A new report by the Environment Agency recommends the setting of new sediment and soil quality guidelines, proposes a risk-based approach to investigating sediments and floodplain soils in catchments affected by mining activities, increased monitoring of these contaminated sediments, and strategies to manage and clean-up mine-contaminated areas.

This report reviewed literature on the sources, dispersal controls and storage of metal contaminants in mining-affected river systems. The study found numerous significant breaches of draft Environment Agency sediment quality guidelines (predicted effect levels or PEL) for cadmium, lead, copper, zinc and arsenic. This indicates adverse biological effects are likely to be occurring, with damage to ecosystem health. The most affected rivers are those draining abandoned metal mining areas including the Tyne, Wear (Northumbria River Basin District or RBD), Swale, Ouse (Humber RBD), Rheidol, Ystwyth, Conwy, Afon Goch Dulas (Western Wales RBD), Clywedog (Dee RBD), Wye, Yeo, Axe (Severn RBD), Fal, Fowey, Tamar (South West RBD), Newlands Beck (North West RBD) and Glenridding Beck (Solway-Tweed RBD).

Although metal discharges were greater during the peak period of active mining in the nineteenth century, significant inputs of dissolved and particulate metals still occur. Past discharges have left a substantial reservoir of highly contaminated sediments in lowland rivers many kilometres downstream of the mines, and these sediments are likely to be causing ecological damage. Re-suspension of the sediments during floods has the potential to cause additional harm to aquatic life, and to contaminate floodplain soils used for agriculture.

In this study, metal concentrations in floodplain soils affected by mining activities were compared with government guidelines for grazing livestock on former metal mines. Observed concentrations significantly exceeded these guidelines in many catchments, particularly for cadmium, lead and zinc. Climate change is expected to increase the frequency and magnitude of floods, leading to re-suspension of sediments high in metals and therefore encouraging the transfer of contaminated sediments from river channels to floodplain soils which are often used for agriculture.

Clear guidelines on the sediment metal concentrations that represent an unacceptable risk to ecosystem health are not available in England and Wales. This report makes recommendations on how the Environment Agency could reduce uncertainty over the risk to good ecological status posed by sediments (and soils) contaminated by abandoned metal mines. Where these risks are found to be unacceptable, we propose a tiered method to carry out catchment-scale risk assessments so that management and remediation (clean-up) strategies can be developed where necessary.

The recommendations of this report are to:

- Set sediment quality guidelines that can be used to assess harm to ecosystem health (and hence ecological status).
- Develop guideline metal concentrations in floodplain soils that represent an unacceptable risk for livestock or other agricultural uses.
- Investigate the impact of short-lived floods on the release of metals from sediments into the water column, and consequent effects on aquatic life.
- Review all Environment Agency sediment quality data (and ideally other sources) and compare with sediment quality guidelines. This should firstly be restricted to catchments that have been identified as being affected by abandoned metal mines.
- Where ecosystem health is threatened by contaminated sediments, apply the tiered catchment risk assessment method in this report.
- Carry out monitoring of contaminated sediments in affected catchments.

- Develop risk management strategies, including remediation measures, where necessary and following cost-benefit assessments.

This summary relates to information from Science Project SC030136, reported in detail in the following output:

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