

MINERAL EXTRACTION AND THE WATER ENVIRONMENT

- Water and minerals are important natural resources, vital to economic and social well-being. But mineral extraction and processing uses water and may adversely affect supply and quality. Careful management of water is required to ensure sustainable and secure supplies, balancing needs of users against environmental impacts. Regulation aims to ensure sustainable supplies of clean water from the whole water environment including surface waters, such as rivers and lakes, and groundwater. Environmental assessment, including consideration of the water environment, is therefore an important part of minerals planning and applications for new extraction.



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Extraction and processing

Where minerals are extracted from below the water table, it is sometimes necessary to pump workings dry. The water is treated and returned into the underground aquifer or discharged into an adjacent watercourse. Dewatering was formerly exempt from licensing but, under the Water Act (2003), new mineral operations that require dewatering now need a Transfer Licence.

Extraction of some minerals uses large amounts of water controlled by an abstraction licence. For example, in Cornwall, china clay is usually flushed from the host rock by high-pressure water jets. Clay is then separated by

settling from suspension. In Cheshire, salt is extracted as brine through controlled pumping. Salt is then crystallised from the resultant brine. Once the mineral is removed, the clean water is returned to the environment.

Following extraction, minerals often require additional processing to provide specific products. For example, silica sand is washed and wet screened so that it is sufficiently pure for use in the glass industry. Other minerals, such as barytes, are separated from ore by flotation methods. The lighter waste material is skimmed off the surface of a mineral-water mixture, while the heavier economic mineral settles out. Large volumes of water are used but, once minerals have been separated, the water is cleaned and then either recycled through the plant or returned to the environment.

Potential impacts

Discharges of large volumes of extraction or processing water containing dissolved or suspended minerals can damage fisheries and wildlife habitats. This may take place over many years through gradual leaching of substances from active or abandoned mineral workings and tips. For instance, mining of coal and some metals below the water table can cause oxidation where mine waters interact with sulphide minerals, such as pyrite. The resultant water can become highly acidic and contain high levels of iron. This 'acid mine drainage' may produce unsightly brown coatings on exposure to the atmosphere and can destroy local plant and animal life. Outflow from coal and metal mines must be carefully monitored, and remediation undertaken if the chemistry of the water deviates from prescribed limits. However mine drainage can also be used for water supply if quality permits. Contamination can also occur as a result of sudden outflows of mine water or tailings. To avoid such accidents, mining operations and tailings installations must be designed carefully and monitored. If quarries are poorly located and designed, they may increase the flood risk and potential impacts of flooding.



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Rehabilitation

Quarries can be restored to create new habitats and recreational facilities. Many restored gravel quarries are now used as water sports facilities, while new wetland areas may enhance biodiversity. Elsewhere, large areas of floodplains from which minerals have been extracted have been left as 'washlands', areas that can store water during periods of intense rain to protect inhabited areas from inundation. If a quarry is intended for restoration to a wetland after use, consideration needs to be taken of the potential for birds attracted by water to cause a hazard to aircraft. Specific design criteria may be needed to ensure that certain species of bird are not encouraged.

The legislative and regulatory framework

Controls on the effects of abstraction on water quality and quantity are enforced through national and European legislation. The EU Water Framework Directive (WFD) aims to protect water resources and the water environment. It requires Member States to produce River Basin Management Plans. Each plan should specify the definition, monitoring and management of the ecology of the water environment and the quantity and chemical status of water within the river basin. It should also review the impact of human activity on the water resources. These plans provide baseline data for monitoring changes and for predicting the effects of new developments. Completed River Basin Management Plans should be in place by 2009.



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Key issues for the minerals industry that are addressed by the WFD include:

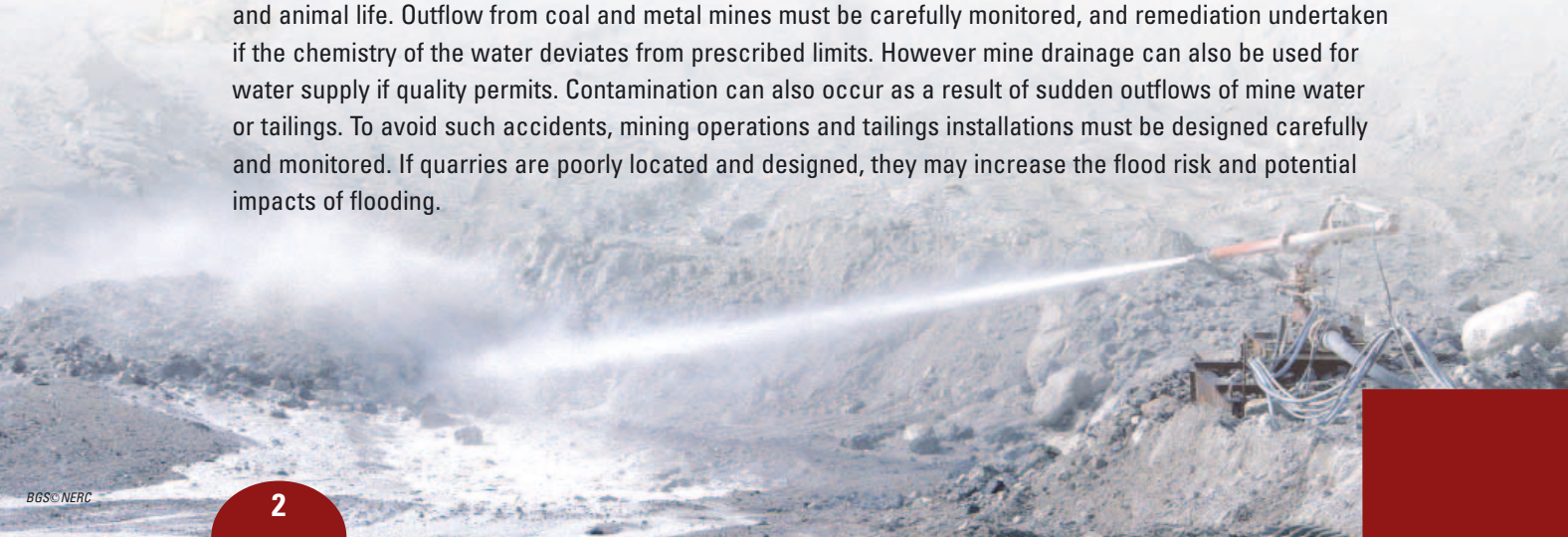
- Ensuring that abstraction of water for mineral extraction does not result in a significant reduction of flow in rivers or decrease of groundwater levels, which might affect downstream wetland areas or supplies of drinking water.
- Decreasing the physical impact of mineral extraction on the ecology of the water environment, by ensuring that any water returned to the environment following use is free from suspended solids.
- Reducing the risk of long-term chemical contamination of groundwater and surface water from mine drainage by careful monitoring and implementing measures to mitigate against sudden outflow, such as the mechanical failure of a dam containing waste water.



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The groundwater environment is particularly targeted in the WFD since it is very difficult to reverse chemical changes to water buried deep beneath the ground, and recharge of aquifers tends to be very slow.

The Environment Agency (EA) is responsible for protecting and improving, and monitoring changes to, the water environment in England and Wales. The EA operates a system of Catchment Abstraction Management Strategies (CAMS). These provide a consistent and structured approach to local water resource management, balancing the needs of the abstractors and those of the aquatic environment through consultation with all interested parties. Under this framework, the EA licenses water abstraction. But any planning application for new mineral workings must also assess the potential impacts of the proposed activities on the water environment and identify measures for their mitigation. Such matters are considered again under the Minerals Review, when the planning permission is re-considered after 15 years of operation.

The new EU Mine Waste Directive will introduce stricter controls across Europe on the disposal of waste from mines. The Directive was drafted following large-scale pollution incidents from metal mine tailings caused by containment failure at Aznalcóllar, Spain in 1998, and by overflow during heavy rainfall at Baia Mare, Romania in 2000. This legislation will set the minimum requirements for safe containment of mine waste with respect to human and environmental health and safety, including the water environment. In the UK, current regulations already ensure that such standards are met.



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