

## **A regulator's view of policy changes required in England and Wales to control the problems arising from abandoned mines.**

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### **ABSTRACT**

The National Rivers Authority (NRA) regulates aquatic environmental quality in England and Wales. Over the past three years, several events have caused us to reconsider our position with respect to abandoned mines. The discharge from Wheal Jane, the proposed and actual closure of a large number of coal mines, and the Government's intention to privatise the remainder of the coal industry, focused our attention on the difficulties of providing adequate environmental protection.

The present legislation is insufficient. Rules covering abandonment exist only in relation to working conditions and safety within mines. Discharges from abandoned mines are effectively exempt from the normal controls which can be exerted whilst the mines are operational. Although we have powers to carry out works to prevent or remedy any pollution, and recover reasonable expenses, these cannot be recovered from anyone in respect of water permitted to escape from an abandoned mine.

The scale of the problem is unclear. There are no records of abandonment prior to 1872 and records since then are not easily accessible. Problems from coal fields occur in many areas, affecting at least 198 km of rivers, mostly in South Wales and Northern England. Metal mine problems are also widespread, affecting at least 410 km mostly in South West England and Wales. Small watercourses have not been included in this assessment.

There are several ways in which the situation could be improved. Consideration should be given to defining abandoned mines for the purposes of the laws relating to environmental protection. Similarly, the duties of mine owners with respect to abandonment programmes need to be addressed. Consideration should also be given to changes in the planning system, so that full provision is made in advance of mine opening, for its aftercare when the mine eventually closes. Discharges from long abandoned mines need to be assessed within catchment management plans designed to achieve water quality objectives. Those significant discharges may be candidates for inclusion in a treatment programme. With the large number likely to be involved, the NRA could rapidly acquire a long list of costly management problems - clearly an unsatisfactory situation. In many ways, however, long abandoned mines present a problem not dissimilar from that of contaminated land, and both may need to be tackled within a similar national framework.

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### **INTRODUCTION**

The National Rivers Authority (NRA) is the regulatory body concerned with aquatic environmental quality in England and Wales. It is shortly to become part of a larger Environmental Agency, which will inherit the NRA's duties, powers and responsibilities. One of the many factors affecting environmental water quality is the discharge of contaminated water from abandoned mines. The present legislation exempts these from the normal controls exerted through the discharge licensing process.

Recent events have highlighted the potential and actual environmental damage resulting from abandoned mines, and the legal and practical difficulties which the NRA faces in its efforts to prevent and clean-up pollution arising from such mines. The discharge from Wheal Jane, the proposed and actual closure of a large number of coal mines, and the Government's intention to privatise the remainder of the coal industry have focused our attention on the difficulties of providing adequate environmental protection.

The first need is to establish the extent to which existing discharges from abandoned mines affect water quality prior to assessing how they may be dealt with. Secondly, there is a need to ensure that abandonment of existing operational mines does not cause major environmental problems and thirdly, it is important to ensure that mining activities in the future are properly controlled.

These issues have been the subject of much recent debate. The NRA has given evidence to several Government committees dealing with coal mining and water pollution, repeatedly calling for changes in the legal position of mine abandonment, and saying that the entire cycle of mine planning, opening, closure and possible re-opening needs to be re-examined. The whole issue is debated in an NRA report on abandoned mines and the water environment [1]. In "This Common Inheritance" [2], the Government recognised this by saying that it is "..... considering the framework of legal responsibility for pollution in abandoned mines". Subsequently, this issue has been addressed in the Coal Bill.

### **THE LEGAL POSITION**

#### **National Legislation**

The Mines Inspection and Regulation Act (1870) was the first to require the recording of abandonment within two months of ceasing operations. Further Regulations in 1872 required that all abandoned mines be recorded for health and safety reasons, and that accurate mine plans be submitted for planning control and development purposes. The basis of defining an abandoned mine has been retained in the present legislation, the Mines and Quarries Act 1954, and the requirements for notification exist only in relation to working conditions and safety within mines. They have little or nothing to do with the environmental impacts of abandonment.

Discharges from working mines in England and Wales are controlled through consents issued by the NRA under the Water Resources Act 1991. When the mine stops operating, the owner can ask for the consents to be revoked. If pollution subsequently occurs, it may be that a person has committed an offence by causing or knowingly permitting poisonous, noxious or polluting matter or solid waste matter to enter controlled waters. A defence exists in that a person

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shall not be guilty by reason only of his permitting water from an abandoned mine to enter into controlled waters. (This has never been tested satisfactorily in the courts).

An "abandoned mine" is not defined in the Water Resources Act 1991, but a "mine" is said to have the same meaning as that in the Mines and Quarries Act 1954. Whilst it could be argued that the act of abandonment causes pollution if, subsequent to such action, contaminated water enters controlled waters, such an action is likely to be only one link in a long chain of events. When a mine has a long and complex history of ownership and operation, it is unlikely that the final owner or operator can be proved to have caused pollution. Clearly, prosecution for polluting under these circumstances is difficult. The NRA has powers under the Water Resources Act 1991 to carry out works to prevent or mitigate pollution, and to recover its costs from anyone causing or knowingly permitting the pollution, but not if the water was permitted to enter controlled waters from an abandoned mine.

Planning permission is required to work minerals. This may be granted by Planning Authorities after consultation and consideration of local mineral and development plans, drawn up under the Town and Country Planning Act 1990 as amended by the Planning and Compensation Act 1991. Permission is usually subject to a number of conditions designed to minimise or prevent environmental effects during operation, and is now time limited. British Coal is in a unique position, having unconditional development rights for unlimited extensions to underground mines started before 1 July 1948 but, under the General Development Order Amendment (No. 6) Order 1992, these rights are now confined to designated seam areas which can be worked from an access existing on 13 November 1992. Guidance on Coal Mining and colliery spoil is given in the Department of the Environment/Welsh Office's Minerals Planning Guidance 3.

### **European legislation**

As a member of the European Community (EC), the UK Government is required to comply with EC legislation. The relevant Directives are those concerned with dangerous substances, in particular the metals cadmium and mercury. The requirements of these Directives have been incorporated into national law through the Surface Waters (Dangerous Substances) (Classification) Regulations 1989, which specified standards for fresh and coastal waters. The NRA has duties under these Regulations relating to the consenting of discharges containing the substances listed, and the implementation of a monitoring and analysis programme by which compliance with standards can be demonstrated.

If the NRA believes that surface waters are liable to fail the requirements of an annual mean standard, it has to provide the DoE with all relevant information as to the nature and circumstances of the failure, and the actions which the NRA has taken, or proposes to take, to restore the quality of the water. If such steps are unlikely to be effective within twelve months, the DoE can determine an appropriate emission standard in accordance with the relevant Council Directive. The EC Directives relate to controllable industrial discharges, but the DoE's direction is less clear about whether or not the Regulations relate only to areas influenced by controllable discharges. It has been the practice for previous Water Authorities and subsequently the NRA to monitor sites affected by discharges from mining operations, including those which have been abandoned.

If the issue of abandoned mines is not addressed, compliance with the requirements of other Directives may be affected. These include the Freshwater Fisheries Directive, the Abstraction of Drinking Water Directive, the Shellfish Water Directives and the Groundwater Directive.

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There are also international agreements with respect to reducing the totality of certain substances entering coastal waters, but the extent to which abandoned mines contribute to such inputs is yet to be evaluated.

### **THE SCALE OF THE PROBLEM**

Water enters mines by natural downward movement of rainwater through the ground, and by lateral movement through fissures, faults and worked voids. In operating mines it has to be actively removed by pumping. Abandoned mines eventually flood to the point of natural drainage, usually an adit but sometimes a fault of fissure, and then discharge to a watercourse. The period of discharge is dependant on the fluctuating position of the water table. The volume of discharge can vary enormously from a few litres a day to many thousands of cubic metres a day.

Chemical quality is also variable. Where the rock contains much metal sulphide, oxidation and hydrolysis leads to the generation of acidic mine water which typically has high concentrations of dissolved metals. Since pyrite (ferrous sulphide) is so widespread, many abandoned mines, both coal and metal, exhibit ochreous deposits (of ferric oxyhydroxide) downstream of the discharge.

Manganese is a common mineral associated with iron deposits and hence occurs in high concentrations in the discharges from many abandoned mines. Metal mine discharges are characteristically rich in several metals, depending on the ores present in the rock. Not all discharges are acidic, indeed some coal mine discharges are circum-neutral or mildly alkaline. High concentrations of chloride and sulphate create saline conditions. Exceptionally, mine water may have an elevated temperature or be rich in natural nucleides. If shafts are left uncapped, they are occasionally used for fly tipping. Mine waters in such circumstances may be contaminated by a wide range of toxic compounds.

One of the immediate consequences of mine abandonment is the reduced volume of flows in receiving watercourses. This may adversely affect the amenity value of the watercourse, could reduce the availability of water for abstraction, and reduce the dilution available for other consented discharges, thereby resulting in pollution not previously observed or anticipated. The impact of discharges from abandoned mines on receiving waters can vary from beneficial to severe. Some mines take many years to fill and, when uncontrolled discharge eventually occurs, this could lead to localised flooding problems. The precipitation and deposition of ferric hydroxide is the most commonly observed visual impact, turning many rivers yellow or orange and also affecting the amenity value.

Many users of water can be affected, including the aquatic animals and plants whose life may be threatened, water abstractors who may find the reduced quality unsuitable for their purpose, and recreational users whose pleasure in their chosen activity may be diminished. These are real concerns and have an economic importance which can be substantial.

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### **Abandoned Coal Mines**

Despite the legal requirement to record the abandonment of mines, the Mines and Quarries Inspectorate does not hold records of abandoned coal mines. These are maintained by British Coal which has records of approximately 10,000 abandoned workings. Relatively few of these discharge water causing a problem in receiving watercourses. Table 1 shows that 100 discharges cause significant pollution i.e. give rise to complaint, deterioration in water quality and failure of Environmental Quality Standards, in some 200 km of rivers. Only four of these discharges are from working mines.

**Table 1. Discharges from Coal Mines which cause significant pollution problems**

Region	Number of Discharges	River km affected	Working	Abandoned
Northumbria	15	18	4	11
North West	24	57	0	24
Severn Trent	4	19	0	4
Welsh	21	54	0	21
Yorkshire	36	50	0	36
<b>TOTAL</b>	<b>100</b>	<b>198</b>	<b>4</b>	<b>96</b>

These data need to be seen in perspective. For instance, in Welsh Region, 21 discharges affect about 1% of the Region's monitored river length, but most of these discharges are in the South Wales coalfield, and 4.5% of the river length in that area is affected. Small, unmonitored streams have not been included in this assessment and the full extent of effect is unknown. A more recent survey of abandoned mine water discharges in Welsh Region, partly funded by the Welsh Office, has identified 90 ferruginous discharges affecting 59.4 kilometres of river. The worst 15 are subject to detailed investigation to identify the causes of the problems, potential solutions and approximate costs and benefits.

The colliery closure programme being implemented by British Coal gave the NRA considerable concern. Since there is limited scope for dealing with abandoned mines within the existing legislation, an agreement was sought to ensure early warning of and discussions about intended closures. A Memorandum of Understanding between both parties has been agreed and is working well.

### **Abandoned Metal Mines**

Metal mining has a very long history in some areas. Many mines have been consolidated, abandoned, re-opened and re-abandoned. Underground workings can be extensive, complex and, apart from modern workings, are rarely well recorded.

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Table 2 shows that a large number of discharges affect over 400 km of river. The majority of metal mines are abandoned, only five remaining in production. Again, small unmonitored rivers have not been included in this analysis, and the extent of the problem is likely to be larger than that described here. This is particularly the case in the Welsh Region where there are over 500 abandoned mines, and in the South Western Region where the number of abandoned mines is large, about 1700, and the number of discharges having an impact on river water quality is simply unknown.

**Table 2. Discharges from Metal Mines which cause significant pollution problems**

Region	Number of Discharges	River km affected
Northumbria	20	43
North West	5	36
Severn Trent	2	5
South West	Unknown	212
Welsh	44	114
<b>TOTAL</b>	<b>&gt; 71</b>	<b>410</b>

### **THE WAY AHEAD**

#### **Changes in the Law**

On mine abandonment, water rebounds to its pre-mining level and may then be permitted to flow into controlled waters without treatment and without a consent. The question is whether the action of switching off the dewatering pumps causes pollution. It may be argued that allowing the water to rebound is simply permitting the water to return to its previous level and thus its natural state. In which case the unnatural state of drawdown must have been caused by switching the pumps on in the first place, so the principal cause of pollution which arises from the abandonment of a mine is the creation of the mine itself. The whole sequence of opening a mine, pumping it, closing it, and then no longer pumping it so that pollution occurs may be argued as being the cause of the pollution. But mining operations are seldom so clearly defined. In many areas, mining has been conducted for centuries, with operators making opportunistic use of preceding activities. This may involve dewatering sections mined by others. Matters are dealt with pragmatically, but the end result may be that the last mine in the area to close may well have been pumping water from areas which neither the current mine owners, nor even their immediate predecessors, had actively mined. This was the case with the abandonment of Wheal Jane.

There may be cases where the manner in which the mine was abandoned was such that the resultant effect was worse than it might have been. For example, potentially polluting materials or chemicals which could have been removed may have been left in the mine. Obtaining satisfactory evidence to prove the "foreseeability" aspects of such cases would be difficult. But responsibility for the environmental consequences of abandoning a mine must remain with the

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mine owner. The NRA will not hesitate to take legal action where it considers that certain steps which could reasonably have been avoided had caused pollution and, where pollution could be caused, will seek to prevent it by way of a High Court injunction.

It is certainly unsatisfactory that an abandoned mine is not defined anywhere in legislation dealing with environmental protection. Since abandoned mines may subsequently be used for other purposes, such as educational or tourist attractions, it is important that a clear definition is established, so that non-mining activities at least can be controlled.

Equally important is the need for the relevant authorities, including the NRA, to have advance information of abandonment, so that considered preparations can be made and implemented. A duty needs to be placed on a mine operator such that he must

- prepare a complete mine abandonment programme which includes an assessment of the likely subsequent impact on water quality and/or provisions made should these prove inaccurate;
- inform the NRA at least three months prior to the proposed cessation of active pumping; and
- carry out such below or above ground works, including any which the NRA may also reasonably request, in order to ameliorate the affects of the abandonment.

Provisions for an appeal system on the last of these should be made, but dewatering pumps should be kept running whilst the appeal is being considered. Grants should be made available to the mine operator to carry out such works when financial conditions warrant their application.

Perhaps the most useful changes which could be made are those relating to the future opening or re-opening of mines, such that full provision is made at the outset for the ultimate effects which the mining operations could have on the environment. The Town and Country Planning Act 1990 allows Local Authorities to enter into legally binding agreements with would-be developers, for the purpose of restricting or regulating the development or use of land. The agreement is bound not only to the landowner but also to the land. Financial bonds enable the Planning Authority to commission work if necessary, but relatively few mineral permissions have bonds attached and their release is likely to be difficult. Such bonds are likely to be of value only in the case of financial failure of the operator, in which case there may be competitive claims from other creditors. Bonds need to be either large enough to cover all likely requirements or specific to subsequent water quality problems.

### **Research and Development**

The NRA, as a regulator, does not intend to become involved in the long term operation of treating discharges from abandoned mines. However, the development of suitable treatment methods is an area in which the NRA has a role, and in which it is currently active.

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### **Catchment Management Planning**

The problem of discharges from long-abandoned mines should be considered together with other problems in the catchments in which they occur. It is through such plans that the NRA recommended to Government the setting of Statutory Water Quality Objectives. Priority needs to be given to those abandoned mines which

- cause a breach, or would prevent the achievement of a Statutory Water Quality Objective;
- can be shown to be a significant, i.e. >1%, contributor to the annual input of substances to coastal waters listed for target reduction; or
- are a unique cause of poor water quality in an otherwise good quality river.

If treatment is required, the NRA would only consider using its own resources for short-term remedial work or time-limited operational activities. Such remedial work would only normally be undertaken if it had been identified in the Catchment Management Planning process.

### **A New Framework**

When coal mines now in public ownership are privatised, it is essential that the responsibility for any legacy of water pollution is identified, and that any civil or criminal liabilities are clarified. The proposed Coal Authority should have that responsibility with a specific duty to act in such a way as to protect the aquatic environment and be adequately funded to enable it to provide long term remedial measures and to ensure their continued operation. The obvious vehicle for these actions is through catchment management plans.

This does not cover any potential problems caused by the abandonment of the few remaining metal mines. A similar Mines Authority would need to be established, with similar duties and adequate funding.

## **CONCLUSIONS**

This debate is about how we can ensure that the problems arising from abandonment of mines will not get worse, and what can be done about the long-standing inherited problem. A sensible and transparent legal framework is required and all relevant parties need to operate within it.

Changes in legislation are required to define both an abandoned mine and the steps to be taken in converting an active mine into an abandoned one.

A duty also needs to be placed on the mine operator to prepare an abandonment programme, to inform the relevant authority well in advance, and to carry out works to ameliorate the effects of permanent abandonment. Consideration must also be given to changes to the planning system so that full provision is made in advance for a mine's aftercare with respect to groundwater rebound.



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For long-abandoned mines, the NRA must determine the effects of these through the catchment management planning process, concentrating on those which cause breaches in water quality standards, make a significant contribution to coastal waters input, or which cause poor water quality in otherwise good quality rivers.

Finally, the new Coal Authority or a similar organisation should be identified as having the responsibilities and duties connected with abandonment and long-abandoned mines, and be properly funded to ensure that problems arising from them are dealt with adequately.

**REFERENCES**

1. National Rivers Authority. Abandoned mines and the water environment. Water Quality Series Report No. 14, HMSO, March 1994.
2. Department of the Environment. This Common Inheritance - Britain's environmental strategy. HMSO, September 1990.