MINERAL EXTRACTION
CODE OF PRACTICE FOR THE OWNERS AND OPERATORS OF QUARRIES AND OTHER MINERAL EXTRACTION SITES

Water Environment (Controlled Activities) (Scotland) Regulations, 2005

Version 1 July 2006

Contents

EXECUTIVE SUMMARY

The extraction of minerals by open-cast methods, deep mining or quarrying has the potential to cause pollution of the water environment by mineral solids, pH and, depending upon the mineral extracted, metals. Hydrocarbons, pesticides and fertilisers may also be of concern.

This Code of Practice provides straightforward guidance on good practice for mineral extraction sites to prevent pollution of the water environment, and in particular groundwater. It applies to all operations to extract natural mineral resources from the ground, including hard rock quarrying, coal mining, sand and gravel extraction, underground workings and peat extraction. It is for use by those who plan, own and / or operate mineral extraction sites, planning officers reviewing planning applications and SEPA.

The Code converts the Scottish Executive's March 2003 (Paper 2003/12) Code of Practice under the Groundwater Regulations (1998) into a document consistent with the Water Environment (Controlled Activities) (Scotland) Regulations 2005, referred to hereafter as CAR (2005). From 1st April 2006, CAR (2005) supersedes both the Groundwater Regulations (1998) and parts of the Control of Pollution Act (COPA, as amended).

The Code applies to activities which, if carried out in accordance with good practice, should not normally cause pollution of the water environment e.g. the storage of chemicals. It does not specifically deal with intentional discharges to the water environment from mineral extraction sites or with impacts on the water environment from abstractions or impoundment activities. These activities are dealt with as CAR (2005) authorisations (General Binding Rules, Registrations or Licences).

It should be used by:

- Owners and operators of mineral extraction sites.
- The Scottish Environment Protection Agency (SEPA). When deciding whether or not to issue an Enforcement Notice under CAR (2005), SEPA will consider whether or not guidance contained within this Code has been, or is likely to be, followed.
- Planning officers considering planning applications for mineral extraction activities.
- Those concerned with the planning of mineral extraction sites

A comprehensive list of activities which may give rise to pollution if undertaken without appropriate precautions is considered. Potential pollutants include oils, fuels, diesel and hydraulic fluids related to plant and machinery, explosives, metals leached from backfilled waste rock and overburden, flocculants used in settlement lagoons and pesticides and fertilisers used in site restoration.

The Code opens with a summary of the '*Dos*' and '*Don'ts*' of the best practice and is then followed by an overview on pertinent legislation, the surface water and groundwater aspects of the water environment, and risk assessment. Following this overview more detailed discussion is given on each of the possible polluting activities and best practice to reduce their risk of polluting the water environment. These more

detailed discussions include a summary of an assessment methodology, prepared for SEPA, for evaluating the polluting potential of material excavated and then usually backfilled during opencast coal working entitled '*Evaluating the potential impact of opencast coal mining on water quality (Groundwater Regulations, 1998): An assessment framework for Scotland*' (Younger and Sapsford (2004)'.

The document closes with a flow chart showing the basic decision making process that should be used when considering site operations with respect to CAR (2005). It is recognised that the magnitude of each identified risk will differ between sites and local conditions should be taken into account.

In the event of a discharge of a polluting substance SEPA should be contacted immediately on 0800 80 70 60

DO

- Ensure staff are aware of the 'Controlled Activities' Regulations (CAR) 2005
- Consult with SEPA if there is to be any dewatering or water abstraction, impoundment or discharge.
- Undertake a risk assessment of site procedures in relation to pollution of the water environment.
- Minimise as far a practicable the area of exposed ground and stockpiles.
- Regularly clean site roads to keep them free from dust and mud deposits
- Intercept clean surface water from the surrounding land using cut off ditches and divert to the nearest watercourse.
- Ensure contaminated water is properly treated.
- Follow PPG2 guidance on oil storage
- Follow guidance in Quarry Regulations 1999 on the use and storage of explosives
- Evaluate the potential for waste rock to leach pollutants into the water environment.
- Follow PPG9 guidance on the use of pesticides (including herbicides)
- Follow good fuelling practice and undertake routine plant maintenance to prevent spillage or leakage of oils and fuels
- Have and follow a documented site emergency procedure for dealing with spillages
- Maintain communication with SEPA throughout operations, from planning to site restoration

DO NOT

- Refuel plant or machinery in permeable areas
- Store oils or fuels on site except in designated low permeability bunded areas
- Use machinery or plant that is leaking oil
- Use pesticides without first checking their suitability to the specific site conditions
- Allow water containing silt to be discharged to surface waters
- Store stockpiles of waste rock / overburden or product that could leach polluting substances to groundwater in permeable areas or to surface waters from runoff.
- Backfill waste rock without first ensuring that it does not have the potential to pollute the water environment.

1. INTRODUCTION

Owners and operators of mineral extraction sites have responsibility for any water pollution caused directly or indirectly from their site.

The Code of Practice will:-

- Help operators of mineral extraction sites to comply with the Water Environment (Controlled Activities) (Scotland) Regulations 2005, referred to hereafter as CAR (2005).
- Provide planners with guidelines as to conditions that may be imposed as part of a planning permission to ensure the protection of the water environment.
- Assist SEPA in deciding whether it is necessary to exercise their power to serve a CAR Enforcement Notice. Following the guidance set out in the Code of Practice should minimise the need for such notices to be issued.

1.1 Background

Scotland is a country rich in mineral resources and mineral extraction is vital to the country's economy and development. However, the process of mineral extraction carries a potential risk of pollution to the water environment. By following good practice, mineral extraction can be undertaken, and the impacts on the water environment can be minimised.

A wide range of mineral extraction activities occur across Scotland due to the varied geology. The most common types of mineral extraction include opencast coal mining, hard rock quarrying, sand and gravel extraction and peat extraction. However other activities such as barytes mining, gold mining and silica sand extraction occur on a smaller scale.

The establishment of guidelines on good practice should reduce the risk of breaching CAR (2005) due to any lack of understanding or awareness in the minerals extraction industry and will assist SEPA in assessing whether activities are taking account of the risks to the water environment and the legal requirements.

1.2 Legislation Protecting the Water Environment Relevant to this Code

The Water Framework Directive (2000/60/EC), which aims to protect the quantity and quality of water in the whole water environment, was transposed into Scottish Law by the Water Environment and Water Services (Scotland) (WEWS) Act (2003). The WEWS Act (2003) gave Scottish Ministers powers to introduce regulatory controls over activities in order to protect and improve Scotland's water environment.

The Water Environment (Controlled Activities) (Scotland) Regulations (CAR) 2005, which fully came into force on 1st April 2006 provides details of these regulatory controls and applies to:

- discharges to all surface waters and groundwaters (replacing the Control of Pollution Act 1974 and Groundwater Regulations 1998);
- abstractions from all surface waters and groundwaters;

- impoundments (dams and weirs) of rivers, lochs, wetlands and transitional waters;
- engineering works in inland waters

Under CAR (2005) discharges which would, prior to 1st April 2006, have been regulated through the Control of Pollution Act (COPA) (as amended) or the Groundwater Regulations 1998 will now be regulated through CAR authorisations.

CAR requires that the Groundwater Directive (80/68/EEC) and the Water Framework Directive (2000/60/EC) be complied with.

The Groundwater Directive (80/68/EEC), implemented from 1st April 2006 through CAR (2005), identifies potential pollutants against which groundwater needs protecting. These potential pollutants are grouped together under List I and List II substances. List I substances are particularly harmful pollutants and must be prevented from entering groundwater. List II substances have the potential to cause pollution. The input of List II substances to groundwater must be limited to avoid pollution.

A CAR authorisation is not generally required for activities which should not normally cause pollution of the water environment such as the storage of chemicals. SEPA will control these activities by the use of a CAR Enforcement Notice prohibiting or imposing conditions if it is considered that the activity:

- has caused, is causing or is likely to cause significant adverse impacts on the water environment or any part of it; or
- has caused, is causing or is likely to cause a direct or indirect discharge into groundwater of any of the substances listed in Schedule 2 of CAR

This Code has been written to provide operators with guidance on how to reduce the risk of pollution of the water environment. This means that when deciding whether or not to issue an Enforcement Notice, SEPA will consider whether or not guidance contained within this Code has been, or is likely to be, followed.

Although contravention of this Code does not in itself give rise to any criminal or civil liability, it may be taken into account in any legal proceeding involving a water pollution offence.

Compliance with the Code will not act as a defence should a case be brought for causing or knowingly permitting water pollution.

The Town and Country Planning (Scotland) Act 1997 is the primary legislation governing the operation of land use planning in Scotland. Scottish Planning Policy 1 (SPP 1) *The Planning System* explains how it operates and its relationship to other legislation. National planning policies for mineral workings are set out in SPP 4. SPP 16 deals specifically with the planning aspects of opencast of opencast coal. In addition, proposals for mineral working fall within the scope of the Environmental Impact Assessment (Scotland) Regulations 1999 (see SEDD Circular 15/1999 and Planning Advice Note (PAN) 58 for general guidance and PAN 50 for specific reference to surface mineral workings).

It is noted that waste resulting from prospecting, extraction, treatment and storage of mineral resources and the working of quarries is exempt from the provisions of to the European Waste Framework Directive (75/442/EEC, as amended by 91/156/EEC). However, Directive 2006/21/EC on the management of waste from extractive industries, does cover waste arising from the prospecting, extraction (including the pre-production development stage), treatment and storage of mineral resources and from the working of quarries. The Directive makes the operator responsible for taking appropriate measures in order to, amongst other things; prevent the pollution of soil, surface water and groundwater when placing extractive waste back into the excavation voids for rehabilitation and construction purposes.

The Quarries Regulations 1999 remain the primary legislation governing quarrying operations in terms of health and safety.

Oils are currently one of the most significant causes of groundwater pollution in Scotland. The Water Environment (Oil Storage) (Scotland) Regulations 2006 will tighten controls on the storage of oil (including waste oil) in order to prevent pollution of the water environment and will apply to all operations using and/or storing oils on site.

2. POTENTIAL IMPACTS OF MINERAL EXTRACTION ON THE WATER ENVIRONMENT

The '*water environment*' includes all surface waters (rivers, streams, burns and canals, lochs, lakes, transitional waters and coastal waters), groundwaters and wetlands. These parts of Scotland's water environment provide an invaluable national source of drinking water as well as supporting ecosystems and being important for fisheries, farming, sport and recreation.

2.1 Surface Waters

Pollution of surface waters can sometimes be visible through the presence of suspended solids, iron ochre, hydrocarbon sheens or more dramatically through dead or dying fish, but, without being visible, pollution can also significantly reduce the diversity of surface water ecosystems or lead to a need for costly treatment of the water before use. Although polluted water will flow out of a water course, once the source of pollution is removed, it may still take a number of years until the ecosystem recovers. In large lochs the affect may be much longer lasting.

At mineral working sites, pollution of surface waters can occur as a result of runoff of rainfall from the land area, washing off hydrocarbon or herbicide spills, excess herbicide or fertiliser applications or soil and spoil heap particles containing toxic metals and phosphates. Potential runoff pathways to surrounding surface waters are usually easy to predict from ground slopes and are often visible during heavy rainfall. As a result it is generally easy to envisage, evaluate and limit the potential impacts to surface waters from rainfall runoff.

Pollution of surface waters can, however, also occur indirectly by pollutants being transported in groundwater.

2.2 Groundwater

Groundwater is a valuable and protected natural resource. It has been estimated that 23 million cubic metres of water per year are abstracted for drinking water from groundwater sources, approximately 5% of the total supply for Scotland, and is especially important in rural areas. Farmers may rely on groundwater resources for irrigation, and groundwater is also abstracted and bottled, generating valuable revenue for the Scottish economy. Groundwater also helps to keep streams, burns and rivers flowing and wetlands replenished with often high quality water during dry weather. It is therefore also vitally important to Scotland's aquatic ecology as well as its surface water users.

Any pollution to groundwater can have serious consequences, in terms of health, economic and resource issues, since it is difficult and expensive – sometimes impossible – to clean up. Pollution of groundwater occurs slowly, often unsuspected, and it can be many years before the true extent of the problem is known. Surface water courses receiving significant groundwater flows can subsequently be affected for decades.

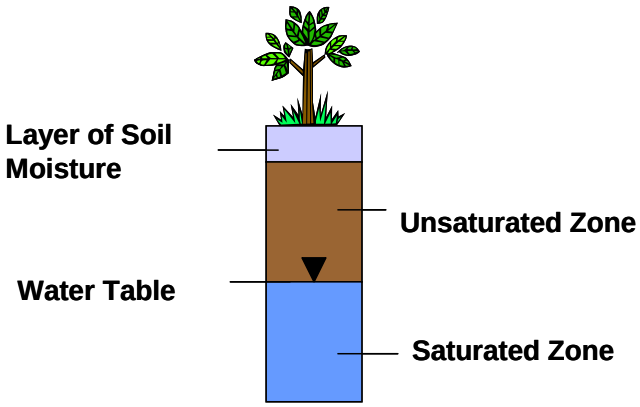
The term groundwater refers to all water which is below the surface of the ground in the saturated zone and which is in direct contact with the ground or subsoil. The saturated zone is where all the cracks of the rock and all the spaces between the grains of rock or within the soil are filled with water. The upper limit of the saturated zone may be thought of as the water table. The zone above the water table, where the pore spaces contain both air and water, is known as the unsaturated zone.

Groundwater - All water occurring beneath the water table in direct contact with soils and rocks.

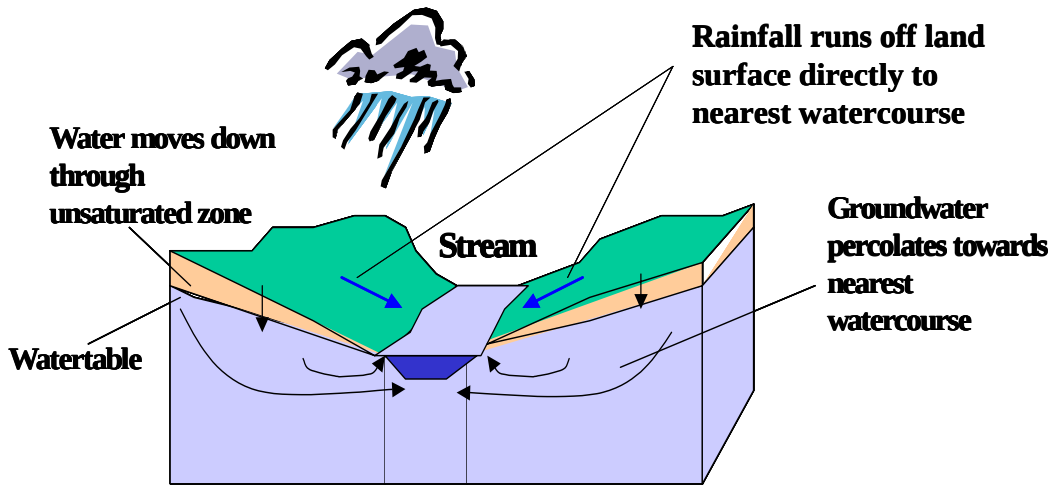
Groundwater Basics

Groundwater is <u>always</u> present beneath the surface even if the water table is at great depth or if the quantities are small.

Subsurface Profile



Rainfall, that does not runoff the land surface or evaporate, infiltrates the subsurface and percolates down through the soil and rocks eventually reaching the water table and becoming groundwater. This groundwater is generally mobile and slowly moves to feed rivers and lochs. Thus any contaminants in groundwater can potentially cause pollution in surface waters and terrestrial habitats.



Mineral extraction by its very nature poses risks to groundwater. Removal of the overlying strata in the working area means that the vulnerability of the groundwater to pollution is increased as the natural protection is removed. Working below the water table effectively removes all natural protection which would otherwise be offered by the soils and unsaturated zone. Therefore it is vitally important that proper precautions are taken to ensure the risk of pollution is minimised.

2.3 Possible Pollutants

The following substances have been identified as potential pollutants that may be present or in common use in mineral extraction operations. These substances include List I substances as defined by the Groundwater Directive, List I substances are replicated in Schedule 2 of CAR (2005). Appendix 1 provides a list these substances and provides summary tables detailing the likely sources of potential pollutants in a mineral extraction environment. It would be good practice for an operator to develop their own inventory of potentially polluting substances used or generated on site and a management plan for each of the identified risks.

LIST I (CAR, 2005 Schedule 2) Substances

Oils, fuels and hydraulic fluids Metals such as Cadmium (Cd) and Mercury (Hg) associated with mining activity (acid rock drainage) Pesticides (including herbicides)

Other Pollutants

Those metals (other than Cd and Hg) and their compounds associated with water pollution from mining activities (spoil tips, bings, mine drainage, backfilling) Explosives Some flocculants used in settlement ponds Leakage of metals from old electrical components Nitrates and phosphates released from topsoil stockpiles or associated with fertilisers used during

List I substances (CAR Schedule 2 substances) are potentially very harmful pollutants and must be prevented from entering groundwater either by direct or indirect discharge. The entry of other pollutants into the water environment must also be limited so as to avoid pollution.

Direct discharge – The introduction of a listed substance to groundwater without percolation through the ground or subsoil.
Indirect discharge – The introduction of a listed substance to groundwater after percolation through the ground or subsoil.

The highest risks of pollution to the water environment from mineral extraction activities are due to:

- The washing off of particulates from working areas or material stockpiles into surface waters.

- Leakage of fluids (fuels, oils, antifreeze and hydraulic fluids) from fixed or mobile plant or storage systems. Fuels, oils and hydraulic fluids (List I substances) will be present on all sites due to the use of various plant, machinery and vehicles and represent a high risk of water pollution.

- Weathered (or acid) rock drainage. Material which is innocuous when undisturbed in the ground can release metals once disturbed and exposed to the air. Leaching from rock, removed to allow extraction of the underlying mineral resource then backfilled after extraction, can potentially lead to pollutants entering groundwater and subsequently discharging into surface waters. Weathered rock drainage containing pollutants may arise from stockpiles of crushed rock, spoil heaps and bings, waste rock which is backfilled into the void and from abandoned underground mines (mine drainage).

In the event of a spillage, discharge or release of oil or other pollutant, the substance will directly enter groundwater if the release takes place below or at the water table or indirectly if it percolates (as a liquid or carried by water) down through the subsoil to the water table. The pollutants may be transported and dispersed by the groundwater resulting in a plume of contamination (Figure 1). If the groundwater contributes to the flow of a local burn or loch this pollution may also pollute surface waters and impact on the ecological systems and users downstream. Spills of pollutants on impermeable strata or hardstanding can also lead to these pollutants readily being washed into surface water courses by rainfall runoff.

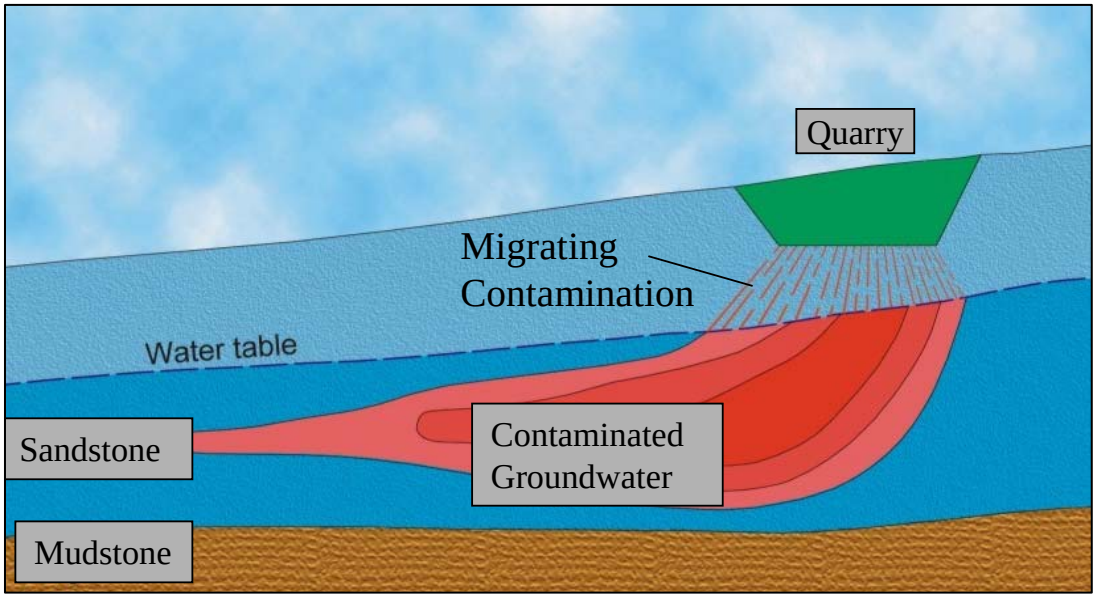


Figure 1 Schematic representation of groundwater pollution (adapted from UK Groundwater Forum)

The rate at which the substance reaches groundwater and the rate and extent at which the plume of contamination will travel and disperse depends on the thickness of the unsaturated zone and the nature of the rock itself. Water moves through spaces between rock grains or along fractures. The more interconnected and larger the spaces or fractures the more permeable the rock is and the more quickly water can generally pass through it.

Permeability –the rate at which water/ fluids pass through soil or rock.

Compared to surface waters, the rate of movement of groundwater is slow. However, water moves easily through rock fissures in many parts of Scotland. These fissures and other pathways, such as old mine workings, provide for rapid movement of groundwater.

Mining activities often involve the pumping of groundwater. If this water is discharged to the water environment this will require an authorisation from SEPA under CAR (2005). Actions resulting in the alteration of the groundwater flow regime and surface runoff patterns do have environmental impacts and should be taken into account in working practice. For example, drainage dewatering can dry up springs and reduce the flow of watercourses, and thus have a serious detrimental impact on dependent ecosystems and habitats. Abstraction controls have been introduced by the Water Environment and Water Services (Scotland) Act 2003 through CAR (2005) from 1st April 2006. SEPA should be contacted for advice where abstraction from mineral workings is intended.

3. MINIMISING THE RISK OF POLLUTION OF THE WATER ENVIRONMENT BY GOOD PRACTICE

3.1 Risk Assessment

The basic model for assessing risk is to consider the source, pathway and receptor. In terms of this Code, the source will be any activity involving the storage, transport, handling and use of polluting substances on site, the receptor will be water environment and there will be various pathways between the source and the receptor. As well as being a receptor in its own right, groundwater can act as a pathway to other receptors, such as a surface water, sensitive ecosystem or drinking water abstraction. The key to minimising risks is to, where possible, address the source or improve management at source. Where this is not possible, control measures can be implemented to remove the pathway.

Risk - A combination of the probability, or likelihood, of the occurrence of a defined hazard and the magnitude of the resulting consequences.

Hazard - An event or situation (including a contaminant source) that has the potential to cause harm to receptors of concern, be they human, ecological, physical, financial or psychological.

Risk assessment - A process to determine the potential for a receptor to be adversely affected by a hazard and to assess the magnitude of the impact.

3.2 Pre-Operational Phase

The pre-operational phase for mineral extraction operations is of high importance. Potential impacts can be identified at this stage and measures included within the Planning Application to mitigate against these impacts. The following points have been identified as fundamental in terms of good practice for any new sites.

- Early and effective consultation between the prospective mineral operator, the planning authority and SEPA, is essential prior to significant site investigation works. Consultation is obligatory as part of any Environmental Impact Assessment (EIA) if one is required. The EIA must describe:
    - The characteristics of development (including size, use of natural resources, waste produced etc).

- The environmental sensitivity of geographical areas likely to be affected by development (including existing land use, presence of sensitive areas, relative abundance of natural resource in the area etc).
- The potential significant effects of development (including extent, magnitude, probability etc).

The EIA should therefore identify those high risks which will require more detailed investigation.

- Where the site is located within a natural heritage designation, such as a SSSI or a National Park, consultation between Scottish Natural Heritage and the relevant authority will also be necessary.

- PAN 50 *Controlling the Environmental Effects of Surface Mineral Workings* (1996) briefly discusses the principal changes in the water environment regime that may arise from mineral working and provides a summary of good practice for the guidance of planning authorities and operators. This is available by calling the Scottish Executive's Planning Helpline on 08457 741741. Further detailed information is provided in the research report: *Reducing the Effects of Surface Mineral Workings on the Water Environment* prepared by Symonds Travers Morgan for DETR (1998).

- Undertake a full site investigation, including a survey of the water interests to identify drinking water supplies or sensitive receptors which may be at risk. This should include consideration of the location of any *Protected Areas*[1]. Baseline groundwater level and quality monitoring is required in order to establish initial conditions and the local hydrogeological regime, including hydraulic gradients and water balance. When installing groundwater monitoring boreholes care should be taken not to inadvertently interconnect two aquifers that were previously isolated. Similarly any mineral exploration boreholes not being used for groundwater monitoring should be sealed where sealing would prevent them acting as conduits for groundwater flow and potential pathways for pollution.

- Pre-operation monitoring provides an understanding of the existing groundwater regime against which to gauge any future impacts of the workings. Additionally it will provide useful information to select the most appropriate method of working and provide the information necessary to allow the Planning Authority, on advice from SEPA, to impose any conditions on the site activities within the Planning permission.

- Assessment of the groundwater vulnerability of the area. The removal of superficial cover will increase the natural vulnerability of the site to pollution.

[1] Protected Areas are defined in the Water Framework Directive as "Areas that have been designated as requiring special protection under Community legislation for the protection of their surface waters and groundwater or for the protection of habitats and species directly depending on water".

- Identify any old mineral workings beneath the site (or other rapid flow paths) and their associated risks.

- Assessment of the pollution potential of the activities to be undertaken including the characterisation of material on site and any changes which may occur due to mineral extraction or associated activity to allow the prediction of long term behaviour, e.g. the chemical composition of any material to be backfilled and the predicted impacts on water quality (see Section 3.4.6 for more detail on backfill risk assessment).

- The design should take account of the impact of site facilities, such as septic tanks and car parking, on the water environment, including the potential for pollutants to be washed off into surface waters during heavy rainfall. .

3.3 Training and Awareness

Staff training and awareness of this Code are critical throughout all stages of mineral extraction operations, from planning to site restoration, if pollution of the water environment is to be prevented.

Training and Awareness **GOOD PRACTICE**

- Site staff should be provided with training on the causes and effects of pollution, and on good practice, and be made aware of their roles and responsibilities in relation to this Code.
- Effective communication with SEPA should be maintained throughout operations.
- All relevant staff should be provided with training to ensure that they have a basic understanding of the water environment, including groundwater, and pollution issues, and are aware of the legal requirements.

3.4 Operational and Restoration Phases

During the operational phase of mineral extraction sites the key objectives to ensure compliance with CAR (2005) is to prevent the entry of List I (CAR Schedule 2) substances into groundwater, and to prevent pollution of the water environment by other pollutants. Compliance also requires meeting the conditions within any CAR authorisation for discharges, abstractions, impoundments or engineering. During the operational and restoration phases all conditions and restrictions set in Planning permission for the site should also be adhered to. Should an accidental discharge occur SEPA should be contacted immediately.

Emergency Contact

In the event of a discharge of pollutants contact:-

SEPA POLLUTION HOTLINE

(24 hrs a day / 7days a week)

0800 80 70 60

Alternatively during office hours contact your local SEPA office. Full list of contact details available at **www.sepa.org.uk/contact/index.htm**
or contact SEPA's head office on 01786 457700.

The responsibility of the operator does not end when extraction stops. There is a responsibility to leave the site in a state that will not cause environmental degradation, material damage or harm to human health. The Planning permission for a mineral operation will specifically deal with restoration, aftercare and after-use. Reference should also be made to the Executive's Planning Advice Note 64, Reclamation of Surface Mineral Workings, published in January 2003.

The following sections identify hazards associated with various aspects of the mineral extraction industry and recommend good practice to minimise the risk of a discharge of List I (CAR Schedule 2) substances into groundwater or pollution of the water environment by other pollutants.

3.4.1 Contractors

Site owners/ operators are responsible for the actions of all workers on their site, and any activities undertaken by a contractor on site that result in water pollution are the responsibility of the site owner/ operator.

Contractors **GOOD PRACTICE**

- Site owners / operators should ensure contractors are aware of and understand the requirements of this Code and CAR (2005).
- They should ensure contractors follow good practice and site safety procedures to minimise the risk of pollution of the water environment.

3.4.2 Spillage and Emergency Procedures

In the event of the spillage of any pollutant on site a documented emergency procedure should be followed.

Spillage and Emergency Procedures **GOOD PRACTICE**

- Emergency procedures for dealing with accidental spillages should be in place and any such spillages documented. Such a procedure should incorporate measures to minimise the impact of any spillage, including:-
  1. Stop the source of the spillage
  2. Prevent the spillage spreading.
  3. Prevent the spillage entering sewers and drains
  4. Clean up the spillage using a suitable absorbent material.
  5. Remove contaminated material and dispose of to a site authorised to accept such a material.
- Notify local SEPA office (see Appendix 2 for details)
- Appropriate cleanup materials should be available on site at all times.
- The site Spillage and Emergency Procedure should be detailed in writing, prominently displayed and all staff trained in its application.
- Risk should not be considered as a static entity as risks will vary as operations proceed. Risk assessments (see section 4) should be carried out regularly throughout operations particularly if a new source of potential pollutants is introduced at the site or if a new phase of work is commencing that may create additional or altered pathways for contamination to the water environment, for example, the construction of new fuelling areas or the deepening of operations to below the water table.

3.4.3 Oils, Fuels and Liquid Chemicals

Oils, fuels and other liquid chemicals such as antifreeze will be present on all sites and are a potential source of pollution to the water environment. The most likely causes are:-

- Leakage from a storage tank, pipework or delivery hose etc.
- Spillage from or damage to containers, or from their bunds.
- Leakage from fixed or mobile plant on a site.
- Spillage or leakage during refuelling of site vehicles or machinery, or during fuel delivery.
- Vehicle parking areas.

Storage and Delivery of Oils and Fuels **GOOD PRACTICE**

- Deliveries of oils and fuels should be closely supervised and there should be no unmanned filling of tanks.

- All oil, fuel and chemical storage tanks should be located on impermeable bases and surrounded by bunds to contain any spillage, in line with recommendations set out in SEPA's Pollution Prevention Guidelines, PPG2 Above Ground Oil Storage Tanks, (http://www.sepa.org.uk/guidance/ppg or available from the local SEPA office) and will be required to meet the forthcoming Water Environment (Oil Storage) (Scotland) Regulations 2006. All draw and fill tanks should be enclosed, tamper proof taps and valves used and any spillage collected and carefully disposed of in accordance with current good practice. If underground storage tanks are being used, these should be double skinned and meet proper safety standards (see Code of Practice on Underground Storage Tanks for Liquid Hydrocarbons). Storage facilities should be checked regularly for cracks, leaks or spillage.

- Waste oil and old filters should be transferred without delay to dedicated, enclosed storage facilities on an impermeable surface, which meet the above guidelines.

Fuelling and Maintenance

- Operators of plant should routinely check their machines for leaks at the start of their shift, during their shift if possible, and at the end of their shift. Immediate action should be taken to stop any leak if one is discovered.

- All site vehicles and plant should be frequently serviced and any oil leaks noted and repaired. Contractor's vehicles should be subject to similar procedures.

- Care should be taken when refuelling and servicing plant and vehicles. This should, where practical, be undertaken on a contained impermeable area with adequate fuel spill precautions to minimise the run-off and risk of downward percolation of any spilled contaminants.

- Staff involved in refuelling and servicing plant should be trained in safe fuelling procedures.

- Refuelling of mobile plant should be carried out in an impermeable pre-designated area with adequate fuel spill precautions. Where this is not possible adequate precautions should be taken to prevent spills, for example, the use of drip trays under mobile pumps.

- Any leakage of oil, fuel or hydraulic fluids has a high chance of percolating directly into the soil or rock strata below, particularly whilst plant is working in the extraction area. If the rock is fissured the potential risk is higher as a direct pathway allows pollutants to reach the groundwater table below. The use of drip trays can reduce this risk. Spilled or leaked pollutants also have the potential to be washed off directly into streams or into sumps which are subsequently pumped out to discharge to surface waters.

3.4.4 Pesticides (including herbicides)

Pesticides may be used to control weed growth during operations or as part of the site restoration and these are likely to contain pollutants, depending on the nature of the pesticide used.

Pesticides **GOOD PRACTICE**

- Consult SEPA for advice on the most suitable type of pesticide and the most appropriate application method.

- PPG9 – Prevention of Pollution by Pesticides provides useful advice on pesticide storage, application and disposal. This is available from http://www.sepa.org.uk/guidance/ppg/ppg09.pdf or your local SEPA office.

3.4.5 Fertilisers

When restoring sites, it is often necessary to apply fertiliser to the land. Different types and quantities of fertiliser will need to be applied depending on the needs of the soil and the planned land use. The fertiliser requirements when establishing vegetation on a restored site will also differ to those required for maintaining the vegetation. Fertilisers can cause pollution when applied incorrectly or at too high a rate. For example, when phosphate leaches into watercourses it can significantly affect ecosystem diversity, and high concentrations of nitrate can affect the potability of groundwater.

Organic wastes can sometimes be applied to land in place of inorganic fertilisers (e.g. sewage sludge, composts, paper mill sludges, etc.). The application of such waste to land, even for beneficial purposes, is regulated by SEPA and you may need to obtain a waste management licence or register an exemption from licensing requirements. Your local SEPA office must be contacted *before* any waste is used on a site.

Fertilisers **GOOD PRACTICE**

- Apply fertilisers only in accordance with the nutrient requirements of the site taking into account soil and plant requirements, site characteristics and pollution risks.
- Seek professional advice on fertiliser application rates and management for chosen restoration.
- If organic wastes are being considered, contact your local SEPA office in advance of the application to assess regulatory requirements.

3.4.6 Overburden, Storage of Excavated Material and Backfilling

Overburden – The layer of natural soil or rock on top of a deposit which must be removed to gain access to the mineral resource.

Waste Rock – Rock that has to be extracted to gain access and recover the mineral resource.

Definitions from EC working document on *The Management of Waste from the Extractive Industry*. (The definition of waste rock will include overburden.)

During mining or quarrying operations, soil and rock overlying the mineral deposit (overburden) may be temporarily removed to gain access to an underlying mineral resource. Overburden is normally stored at the surface prior to being backfilled into the resultant void. The period of storage can vary widely.

The backfilling of quarries, deep and opencast mines with mineral waste is an exempt disposal activity under the EC Waste Directive (75/442/EEC, as amended by 91/156/EEC). However, Directive 2006/21/EC on the management of waste from extractive industries, does cover waste arising from the prospecting, extraction (including the pre-production development stage), treatment and storage of mineral resources and from the working of quarries. The Directive makes the operator responsible for taking appropriate measures in order to, amongst other things; prevent the pollution of soil, surface water and groundwater when placing extractive waste back into the excavation voids for rehabilitation and construction purposes. SEPA also has recourse to Regulation 28 of CAR (2005) to control any threat to the water environment that this activity may have.

While works proceed, stockpiles of waste rock and overburden are exposed to the elements. Exposure to the air may cause oxidisation of minerals (e.g. pyrite) and the infiltration of rainwater into these stockpiles can lead to the release of metals into solution. The leachate generated in this manner can occasionally contain CAR Schedule 2 (List I) substances (Cadmium, Mercury) and more frequently other pollutants (e.g. Arsenic, Lead, Copper, and Zinc, Iron, Manganese and Aluminium). The inputs of List I substances to groundwater must be prevented, and the input of

other pollutants to the water environment must be limited to avoid pollution. Preventative measures should be considered where there is a risk of stockpile leachate contaminating the water environment. Preventative measures include stockpiling the material on low permeability strata (e.g. clay rich material) and collecting and treating any leachate before being discharged to surface water or compaction of the stockpile or waste heap to prevent oxidation and infiltration of rainwater.
These changes in mineral composition mean that waste rock and overburden returned to the ground as part of backfilling operations may also have the potential to leach pollutants. In many cases the void in which backfill is placed may be below the natural water table which has been lowered to facilitate extraction. As groundwater levels recover, this backfill may result in a direct discharge into groundwater of these pollutants. Pollution of surface waters can then occur through the discharge of these groundwaters into surface waters at natural discharge points.

Waste from either on or off site sources which does not directly result from mineral extraction operations, including, for example, food waste, waste oil, end-of-life vehicles, spent batteries and accumulators and other such waste arisings, is not suitable for backfilling. Such wastes should be dealt with in accordance Duty of Care requirements of the Environmental Protection (Duty of Care) Regulations (1991) (as amended).

It is necessary to characterise the waste rock and overburden at a site, including an assessment of the risk of release of polluting substances from storage in stockpiles or backfilling, prior to the activity being undertaken. Guidance on how to do this, in relation to opencast coal mines, is provided in a document prepared for SEPA by Younger and Sapsford (March 2004) entitled: '*Evaluating the potential impact of opencast coal mining on water quality (Groundwater Regulations 1998): An assessment framework for Scotland*'. The key elements of this guidance are summarised below.

'Evaluating the potential impact of opencast coal mining on water quality (Groundwater Regulations, 1998): An assessment framework for Scotland' (Younger and Sapsford, 2004)

This document was prepared for SEPA and provides an assessment methodology for evaluating the pollution potential of material excavated and then usually backfilled during opencast coal working. The document sets out a staged approach with the following steps:

- **Step 1**: Development of an Outline Conceptual Model of the hydrogeology of the site;

  This step includes examining topographical and geological maps, mine abandonment plans and geological and groundwater level data from borehole logs. This information should be evaluated and illustrated using annotated maps and cross sections which indicate where the base of the working will be relative to current and likely recovered groundwater levels, the likely direction of groundwater flow, the locations of surface water bodies that receive this groundwater and how rainfall falling over the area will separate into runoff and infiltration into groundwater. The pathway for any leachate draining from backfill material into groundwater and via groundwater to surface waters should be defined. The document provides some illustrations of different site settings and also gives advice on how to estimate the abstraction rates likely to be needed for below water table working and the impact of such dewatering in terms of predicting drawdowns at different distances from the site.

- **Step 2**: Estimating Pollutant Source Strengths. This step is divided into levels as follows:

  Level 1: this uses water quality data for samples of drainage from former nearby opencast sites, which worked the same seam(s) of coal within a closely similar hydrogeological setting, i.e. data from an analogous site.

  Level 2: this is a geological screening of pollutant release potential and can be used in isolation, or to corroborate the findings of a Level 1 evaluation. The Level 2 evaluation has three tasks relating to the stratigraphy to be worked or dewatered. The first two tasks consider whether (a) local marine bands are present within the strata to be worked or dewatered or (b) regionally important marine bands are present within 100 m thickness (stratigraphically) of the seams to be worked. Where there are insufficient data to undertake these first two tasks, then the third task within Level 2 bases its polluting potential assessment on the sulphur content of the coal seams. Sulphur contents of coal seams are usually determined during exploration of coal reserves, as low sulphur coals have greater commercial value than high sulphur coals. Wherever the total sulphur content of a seam exceeds 1% there is a risk of significant polluting potential that needs assessing at Level 3.

  Level 3: this uses site-specific mineralogical and geochemical analysis to assess whether the sulphur present, particularly in the shales, occurs as sulphide minerals, especially pyrite, and whether there are carbonate minerals present that will help reduce the pollution potential of the strata. The mineralogical analysis involves a technique called quantitative X-Ray Diffraction (Q-XRD) with focussed analysis on those strata contiguous with the higher sulphur content coal seams. Used more broadly on the sequence to be worked is the geochemical analysis of total sulphur

and total sulphur according to BS1016 (1996, Section 106.5.1) and determination of the acid neutralising capacity (ANC) according to BS1377 (1990, Part 3: C16). ANC is a measure of the amount of carbonate minerals (calcite, dolomite, ankerite, but excluding siderite). Guidance is given on how to evaluate the results of such analysis.

Level 4: this level involves the use of column leaching tests and numerical evaluation and is only likely to be used on the rare occasions when Level 3 assessments show high pollution potential for the backfill, but the proposed development's commercial value still supports further, less conservative evaluation.

- **Step 3** Initial Assessment of Risks;

  Having evaluated the polluting potential of the source, this step aims to evaluate the potential impact on the water environment taking into account processes such as dilution and attenuation. The document indicates a wide range of approaches may be defensible as long as the approach used is based on scientific arguments and any risk calculations are transparent and auditable. Approaches could range from simple mass balance calculations to more complex geochemical modelling.

- **Step 4** Refining the Conceptual Model;

  It is normal that during Step 3, weaknesses in the conceptual model may be identified and so this step is recognition that it is prudent to revisit the conceptual model and make it consistent with the processes evaluated in Step 3.

- **Step 5** Planning for Risk Mitigation.

  European guidance (PIRAMID and ERMITE) on this matter is referenced. Risk mitigation measures discussed include:
  -ensuring coal-washing fines are buried deep in the void below the post mining water table;
  -addition of limestone to ensure alkaline conditions (but this is generally prohibitively expensive due to the scarcity of limestone in Scotland);
  -compaction of the backfill to reduce its permeability;
  -capping of the backfill with clay to reduce infiltration;

  Risk mitigation planning should be started as soon as possible as relatively inexpensive measures implemented during mining can often save against much higher expenditure post-closure.

- Step 6 – Contingency Planning and Monitoring.

  This comprises listing those low likelihood risks that cannot be eliminated altogether and preparing responses in advance for problems which may subsequently arise. After care periods of 5 to 10 years may be set by planning authorities for opencast sites and so this period can be used to evaluate whether residual risks are likely to be manifested.

  Monitoring of the recovery of groundwater levels and of water quality in monitoring boreholes and adjacent surface waters provides a check on the success of Steps 1-5 in minimising impacts to the water environment. Further guidance is given on the frequency of monitoring, parameters to monitor and the number and types of monitoring point.

The 75 pages of the document provides not only on the practical ways of implementing the different steps, but also background information pertinent to Scotland on opencast mining operations, a review of the science of pollutant release and attenuation, risk assessment techniques, and pollution prevention and treatment technologies.

PAN 64 *Reclamation of Surface Mineral Workings* provides advice on how mineral operators and planning authorities can ensure that mineral workings are reclaimed to a high standard as soon as possible after working has ceased. It contains a section on "Management of Soil Resources" which covers soil stripping and reinstatement, soil storage and soil handling machinery, for example.

Overburden, Storage of Excavated Material & Backfilling
GOOD PRACTICE

- Assess the risk of pollution to the water environment. (See Risk Assessment flowchart).
- If a risk of leaching pollutants is identified then technical precautions should be implemented to prevent pollution of the water environment. Suitable precautions for specific sites should be selected in consultation with SEPA.
- The effectiveness of these precautions should be regularly assessed and reviewed as necessary.

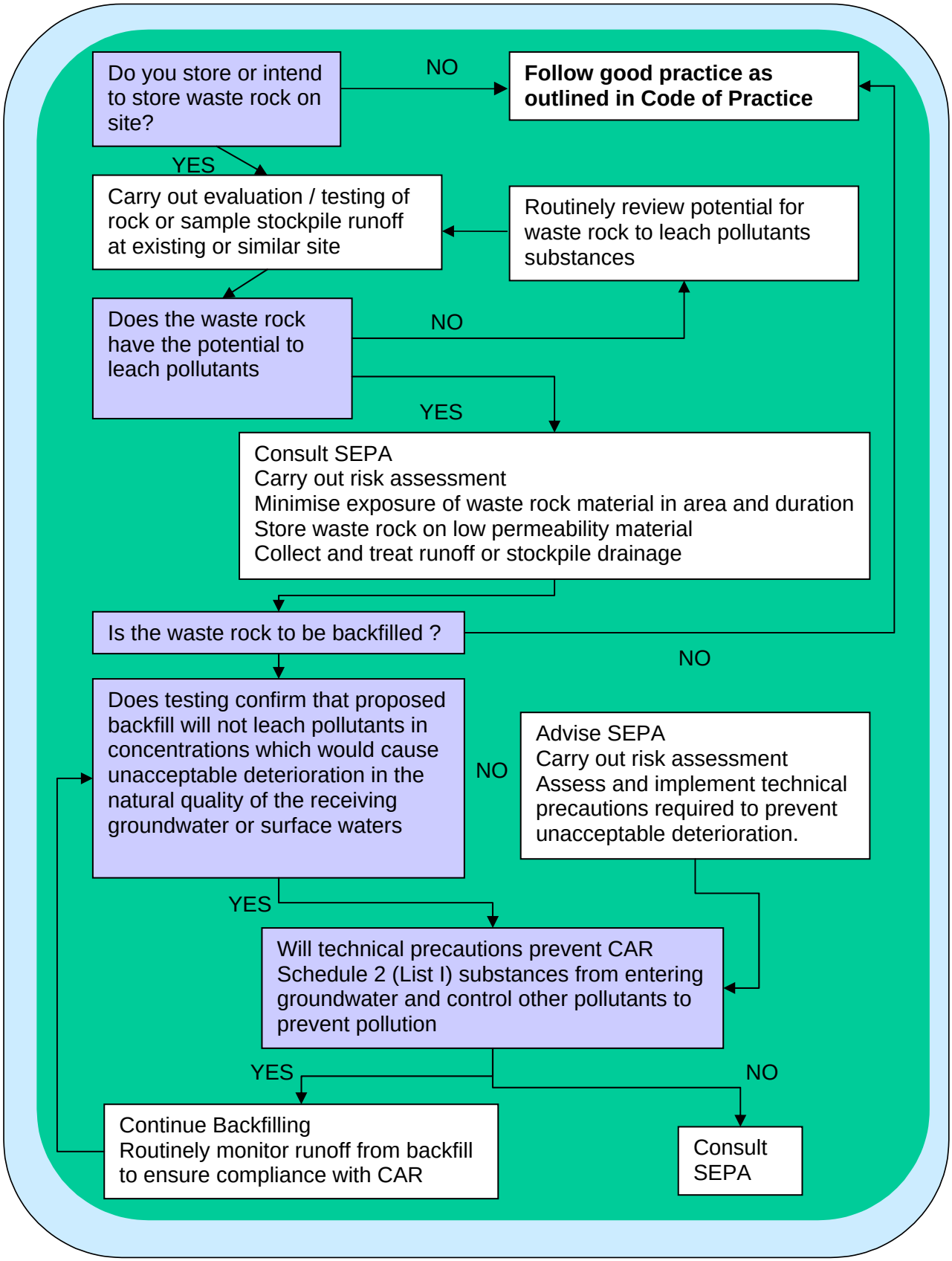
A variety of technical precautions are available to prevent pollution due to leaching including:-

- Minimise exposure of waste rock material in area and duration.
- Stockpiles of potentially polluting waste should be located in areas of low permeability, be they manmade areas of hard standing or on naturally low permeability clay deposits.
- Grading of stockpiles to promote runoff without increase in silt load.
- Buffering acidic backfill with an alkaline mixer such as limestone chips.
- Capping overburden stockpiles to prevent infiltration and oxidation.
- Drainage and runoff from such stockpiles should be managed. Where suspended solids or particulate pollutants are the key issue, this runoff can sometimes be treated passively and diffusely by filtering through adjacent rough grassland. Alternatively, the drainage may need to be collected, and where necessary monitored and/ or treated before discharge to surface waters under a CAR authorisation. Any collection ponds/ lagoons should have basal seals to prevent leakage to groundwater.

The suitability of each measure will be dependent on site specific conditions and should be selected in consultation with SEPA.

The flowchart below demonstrates the basic process for assessment that should be followed to minimise risks. The risk assessment should be reviewed on a regular basis as operations proceed e.g. on commencement of a new phase.

EVALUATING WASTE ROCK STORAGE AND BACKFILLING ISSUES



3.4.7 Drill and Blast

Drill and blast operations involve the use of explosives, either in the form of an emulsion or cartridge, which commonly contain pollutants. After the explosion a small residue of explosive will remain. However the residue is likely to be removed when the rock is extracted. The use and storage of explosives is strictly controlled by the Quarries Regulations 1999, which are enforced by the Health and Safety Executive, and the risk of spillage of a large quantity of explosive is small.

Drill and Blast
GOOD PRACTICE

- The Quarries Regulations 1999 should be followed in the use and storage of explosives to minimise the risk of pollution to the water environment from explosives.

3.4.8 Sand and Gravel Extraction

Sand and gravel extraction – where the extraction is of fluvial deposits in flood plain areas the most consistent impact on the watercourse is the deposition of ochre. As the site is stripped the locked up iron is mobilised and migrates through ground water and deposits in the receiving water. The location of sand and gravel extraction is very important and a balance needs to be struck between exploitation of these deposits and protection of ground and surface water resources.

A series of silt settlement ponds are frequently utilised to settle out finer particles which are washed out from the sand and gravel during de-watering and mineral processing. Water in the settlement ponds may percolate through the base of the ponds and migrate to the water table. Where no additives or non-polluting additives are used for either mineral processing or silt settlement, no pollutants will be introduced into the groundwater regime by this process. If potentially polluting additives are used, settlement ponds will be required to prevent water loss into the ground. Water discharges from sand and gravel sites are dealt with in Section 3.4.13 *Treatment Lagoons*.

3.4.9 Opencast Coal Extraction

Opencast coal mining often occurs in areas previously exploited by deep coal mining activities. Such old workings can provide fast routes to groundwater and may be subject to rising groundwater levels as water levels rebound following the cessation of pumping.

This groundwater may contain elevated concentrations of soluble metal ions - due to leaching following the disturbance of the subsurface rock during mining. If spoil tips or past colliery surface developments from previous coal workings are disturbed during opencast extraction the likelihood of generating leachate with high

concentrations of metals is increased due to oxidation. Existing problems will not relax the allowable concentration of polluting substances to groundwater.

Opencast coal extraction generally involves the removal of the overlying rock (overburden) to reach the coal seams. This will be stockpiled then backfilled during restoration. See Section 3.4.6 **Overburden, Storage of Excavated Material and Backfilling** for good practice.

There is also a possibility of changes to surface flow regimes, such as diversion of burns, from opencast activities which may affect groundwater and vice versa.

Open Cast Coal Extraction
GOOD PRACTICE

- Undertake an assessment prior to commencement of opencast site to identify likelihood of old workings and to identify the potential for rapid flow paths.
- Undertake a baseline analysis of the groundwater regime
- Follow good practice on **Overburden, Storage of Excavated Material and Backfilling** (see section 3.4.6).

3.4.10 Underground Workings

Underground workings involve machinery being present at depth, often close to or below the groundwater table. Any workings below the water table have an increased risk of a direct discharge of polluting substances to groundwater. The risks associated with each operation should be assessed on a site specific basis.

Underground mines that are below the water table will be pumped during operations to allow working. On cessation of pumping groundwater levels will begin to recover, rising up through the mine shafts and workings. The exposed rock and any waste material will become saturated due to the presence of water; therefore there is the potential for polluting substances to be released directly into groundwater as a result.

Underground Workings
GOOD PRACTICE

- Follow good practice for fuelling and plant maintenance procedures to minimise the risk of spillage or leakage of oils and fuels. (See section 3.4.3 on **Oils, Fuels and Liquid Chemicals**).
- Undertake post-operational monitoring of any groundwater rebound and water quality

3.4.11 Peat Extraction

The general preparatory work usually involves stripping and drainage which can release humic acids and particulates and, as the peat dries out, mobilises iron which can cause deposits in the receiving watercourses. Peat extraction is a surface activity carried out by milling, although peat may be removed from up to several metres below the surface level. The removal of peat could hasten the entry of pollutants from other activities (such as oils and fuels from machinery) into the water environment. For example, any spillage or leakage of oils or fuels from plant machinery could percolate downwards to the groundwater table below and cause groundwater pollution or be washed off into streams and impact the surface water environment. Peat removal also has the potential to impact directly on the surface water regime by altering the hydrogeological conditions of the area.

3.4.12 Processes Using Bitumen

After extraction hard rock may be processed and treated with bitumen (which contains CAR Schedule 2 / List I substances) to provide road chippings. Bituminous coated chippings use a heavy grade of bitumen that, whilst relatively insoluble, should be treated with due care, and delivered to site quickly and efficiently to avoid possible contamination. Cutback bitumen used for temporary trench reinstatement is more soluble, and should always be stored on an impermeable base.

Processing Using Bitumen
GOOD PRACTICE

- Bitumen is fluid at high temperatures and in the event of a spillage the most practical method for clean up is to allow the bitumen to cool and solidify, then the spill can be collected and disposed of appropriately.

- Due to its viscous nature hydrocarbons from the bitumen are only likely to contaminate the near surface layers. In the event of contamination these layers should be removed.

3.4.13 Treatment Lagoons

Suspended solids and metals may be settled or precipitated out of solution in settlement lagoons or ponds. Discharges from settlement lagoons or ponds to watercourses require a CAR authorisation from SEPA. Such CAR authorisations replace discharge consents under CoPA 1974 (as amended). The quality of waters should be assessed, including additives such as flocculants and where there is a risk of CAR Schedule 2 (List I) substances entering groundwater or other pollutants causing groundwater pollution; then settlement ponds should be constructed to prevent leakage to groundwater.

Treatment Lagoons
GOOD PRACTICE

- A risk assessment should be undertaken to assess the risk of CAR Schedule 2 (List I) substances entering groundwater, and other substances causing groundwater pollution. Where there is a risk, then treatment lagoons may need to be lined, or other technical precautions taken. Discharges to water courses from treatment lagoons require a CAR authorisation through SEPA.

3.4.14 Site Security

Site security is important to prevent any theft or vandalism that could lead to pollution of the water environment. In such an event the owner/ operator of the site could be held responsible for the pollution incident if the court deems that insufficient precautions were in place to prevent a breach of site security.

Site Security
GOOD PRACTICE

- If the site is vacant or being kept on a care and maintenance basis, operators should ensure that it is kept secure from illegal disposal, such as abandoned vehicles containing substances that constitute a risk to the water environment or vandalism that leads to pollution incidents occurring, for example, intentional damage to plant. The responsibility for the removal of such vehicles or other waste would lie with the site operators. Consider security measures if necessary.

3.4.14 Controlling Sediment in Runoff

Surface water drainage should be considered at the design stage. Adequate room needs to be assigned for silt settlement lagoons at the point of discharge to external water courses.

The removal of vegetation to expose the underlying strata and the excavation and working of the mined or quarried strata inevitably results in the generation of run-off contaminated by mineral solids. The movement of heavy plant and vehicles on the stone or clay surface also causes mineral solids contamination of the surface water drainage. Increased sediment loading can lead to increased turbidity and smothering of the stream bed, both of which can lead to reduced ecological diversity as well as looking unsightly.

Controlling Sediment in Runoff
GOOD PRACTICE

- Review the possible routes through the different stages of site development from which sediment may be transported in runoff e.g. vegetation removal, soil stockpiling, construction of site offices and processing plant, vehicles movements, sump dewatering and develop a plan to reduce sediment transport.

- Minimise the area of exposed ground and stockpiles.

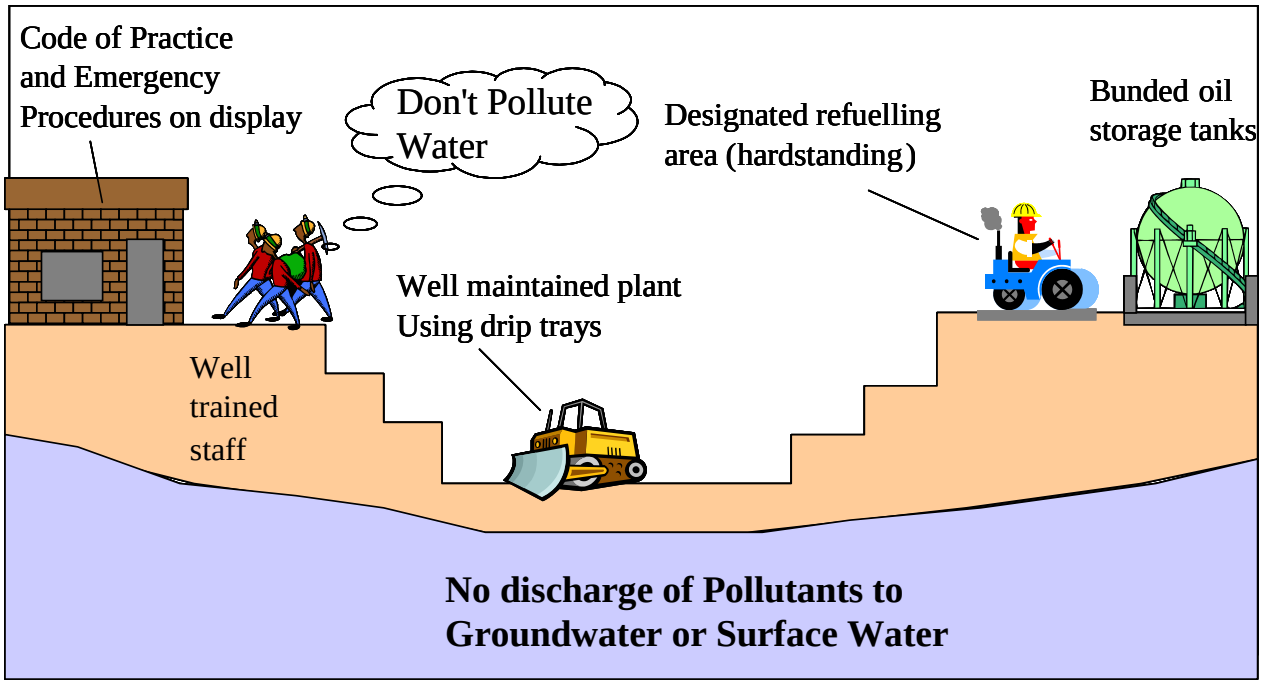
- Regularly clean site roads to keep them free from dust and mud deposits.

- Intercept clean surface water from the surrounding land using cut off ditches and divert to the nearest watercourse.

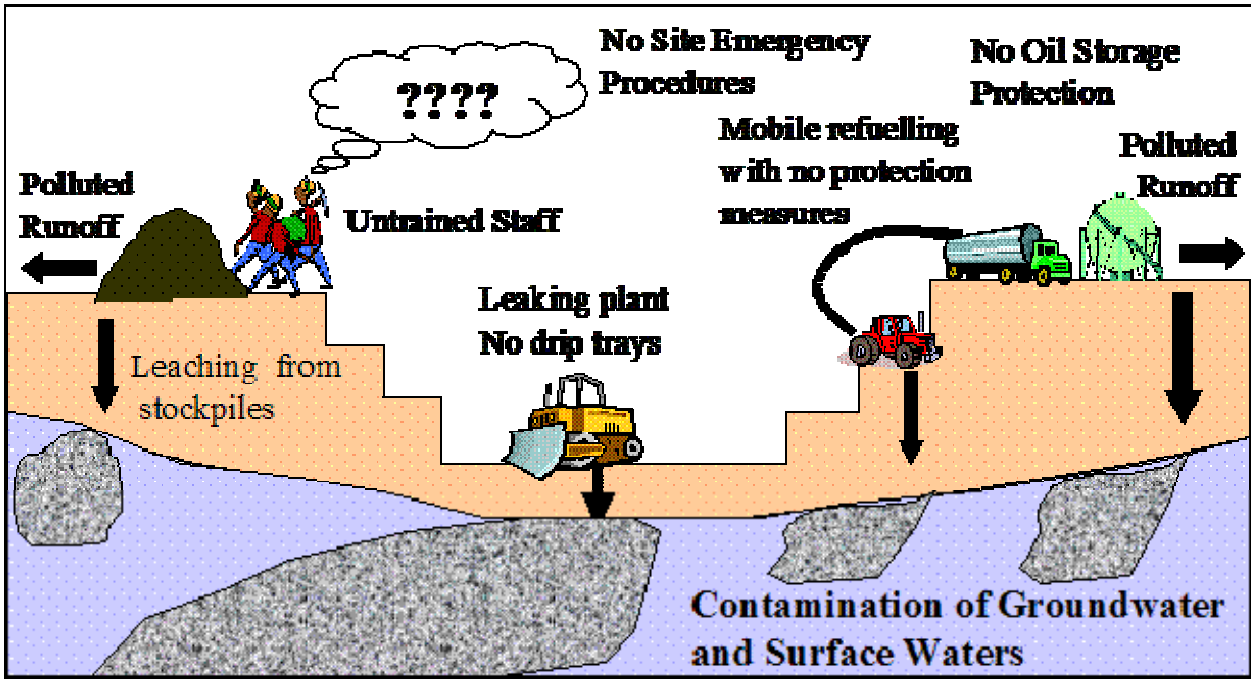
- Ensure contaminated water is properly treated e.g. by appropriately sized retention lagoons.

3.5 Illustrations of Good and Bad Practice

GOOD PRACTICE



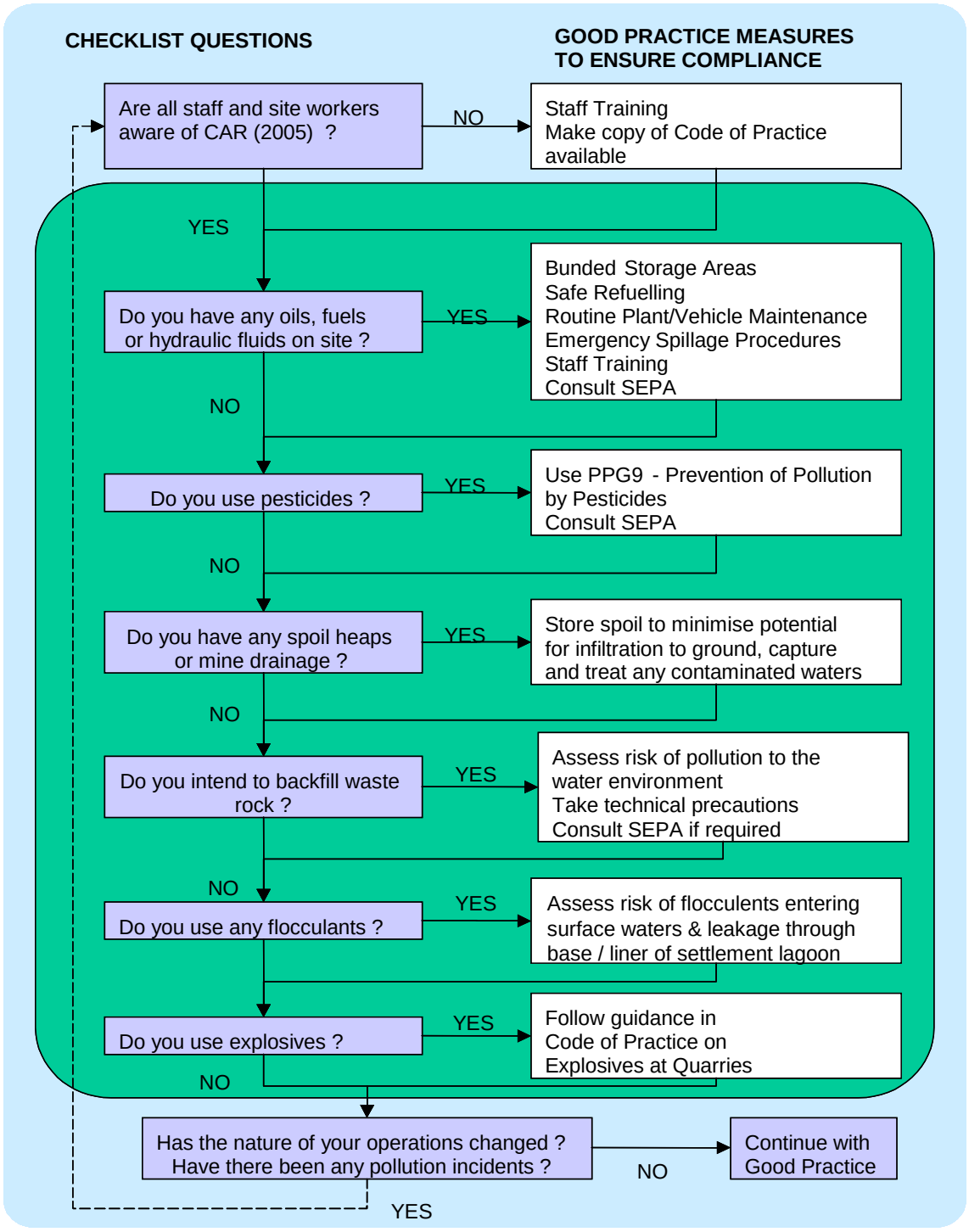
BAD PRACTICE



4. RISK ASSESSMENT PROCEDURE

The flowchart provides an outline of the basic decision making process that should be used when considering site operations with respect to CAR (2005). The magnitude of each identified risk will differ between sites and local conditions should be taken into
account.

CODE OF PRACTICE FOR MINERAL EXTRACTION



5. USEFUL GUIDANCE

The documents referenced by the Code of Practice are primary sources of guidance;

however other useful sources of information are outlined below.

SEPA publish a series of Pollution Prevention Guidelines, PPGs. (available at www.sepa.org.uk/guidance/ppg/index.htm). Of particular relevance to mineral extraction are:

- PPG1 General Guide to the Prevention of Water Pollution;
- PPG2 Above Ground Oil Storage Tanks;
- PPG5 Works in near or liable to affect watercourses;
- PPG8 Storage and Disposal of Used Oils;
- PPG9 Prevention of Pollution by Pesticides.

An overarching policy for protection of groundwater is provided in Environmental Policy Number 19: Groundwater Protection Policy for Scotland (December 2003) (available at http://www.sepa.org.uk/pdf/policies/19.pdf).

The Scottish Executive is in the process of replacing the National Planning Policy Guidelines (NPPGs) with a new series of Scottish Planning Policies (SPPs). Existing NPPGs have continued relevance to decision making, until such time as they are replaced by a SPP.

SPPs/NPPGs are available at www.scotland.gov.uk/about/planning/policy.aspx

Planning Advice Notices (PANs) provide advice on good practice and other relevant information and are available at www.scotland.gov.uk/Topics/Planning-Building/Planning/15243/1416 or by contacting the Scottish Executive Planning Helpline on 08457 741 741

The following are of particular relevance to the mineral extraction industry and water protection.

- SPP1 The Planning System
- SPP4 Planning for Minerals
- SPP16 Opencast Coal
- PAN 50: Controlling the Environmental Effects of Surface Mineral Workings
- PAN 64 Reclamation of Surface Mineral Workings

Reducing the Effects of Surface Mineral Workings on the Water Environment: A Guide to Good Practice was published in 1998 by the Department of the Environment, Transport and the Regions (now the Office of the Deputy Prime Minister) in conjunction with Symonds Travers Morgan.

Guidelines to ensure compliance with the Quarries Regulations 1999 may be found in: The Approved Code of Practice on Explosives at Quarries.

Evaluating the potential impact of opencast coal mining on water quality (Groundwater Regulations 1998): An assessment framework for Scotland (March 2004) was prepared by Younger and Sapsford for SEPA and provides information on how to assess the pollution potential of opencast coal extraction and backfilling.

A European Commission (July 2004) '*Reference Document on Best Available Technologies for Management of Tailings and Waste Rock*' (see http://eippcb.jrc.es/pages/FActivities.htm BREF 07.04) provides guidance on measures to prevent pollution of the water environment from mining.

6. REFERENCES

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LEGISLATION

The Water Environment and Water Services (Scotland) Act 2003
The Water Environment (Controlled Activities) (Scotland) Regulations 2005 (SSI2005No 348) = CAR (2005)
The Control of Pollution Act 1974 (as amended) superseded by CAR (2005) from 1st April 2006
The Groundwater Regulations 1998 (SI 1998/2746), superseded by CAR (2005) from 1st April 2006.
The Town and Country Planning (Scotland) Act 1997
The Environmental Protection (Duty of Care) Regulations 1991 (SI 1991/2839)
The Quarries Regulations 1999 (SI 1999/2024)

APPENDIX 1

CAR (2005) SCHEDULE 1

Indicative list of the main pollutants

1. Organohalogen compounds and substances which may form such compounds in the aquatic environment.

2. Organophosphorous compounds.

3. Organotin compounds.

4. Substances and preparations, or the breakdown products of such, which have been proved to possess carcinogenic or mutagenic properties or properties which may affect steroidogenic, thyroid, reproduction or other endocrine-related functions in or via the aquatic environment.

5. Persistent hydrocarbons and persistent and bioaccumulable organic toxic substances.

6. Cyanides.

7. Metals and their compounds.

8. Arsenic and its compounds.

9. Biocides and plant protection products.

10. Materials in suspension.

11. Substances which contribute to eutrophication (in particular, nitrates and phosphates).

12. Substances which have an unfavourable influence on the oxygen balance (and can be measured using parameters such as biochemical oxygen demand (BOD), and chemical oxygen demand (COD) etc.).

APPENDIX 2

CAR (2005) SCHEDULE 2

Substances referred to in regulations 4(1) (b) and 28(1) (b) (iii)
(The substances on this schedule are the same as those defined under List I by the EC Groundwater Directive 80\68\EEC)

1. Subject to paragraph 2, a substance is listed in this Schedule if it belongs to one of the following families or groups of substances–

(a) organohalogen compounds and substances which may form such compounds in the aquatic environment;

(b) organophosphorus compounds;

(c) organotin compounds;

(d) substances which possess carcinogenic, mutagenic or teratogenic properties in or via the aquatic environment;

(e) mercury and its compounds;

(f) cadmium and its compounds;

(g) mineral oils and hydrocarbons;

(h) cyanides.

2. A substance is not listed in this Schedule if it has been determined by SEPA to be inappropriate to be so listed on the basis of a low risk of toxicity, persistence and bioaccumulation.

3. SEPA shall publish any determination it makes under paragraph 2 in such manner as it considers appropriate to bring it to the notice of persons affected by, likely to be affected by, or interested in the determination and shall make copies of the determination available to the public free of charge.

APPENDIX 3
Potential occurrence of CAR Schedule 2 (List I) Substances on Mineral Extraction Sites

CAR Schedule 2 (List I) Substance	Materials likely to be present on site which may contain CAR Schedule 2 (List I) Substance(s)
Organohalogen compounds and substances which may form such compounds in aquatic environment	Polychlorinated biphenyls (PCBs) **Sources**: Leakage from old transformers either still in use or out of commission.
	Halogenated Pesticides **Sources**: Use of pesticides in after-care period.
Organophosphorus compounds	Organophosphorus Pesticides **Source**: Use of pesticides in after-care period.
Mercury and its compounds	Mercury (Hg) **Sources**: Mine drainage, Leaching and sediment runoff from slag heaps and bings, Leakage from old electrical components such as switching gear either still in use or out of commission.
Cadmium and its compounds	Cadmium (Cd) **Sources**: Mine Drainage, Leaching and sediment runoff from slag heaps and bings, Batteries
Mineral oils and hydrocarbons	Oil and Diesel **Sources**: Spillage/leakage of oils and diesel stored on site.
Cyanides	Cyanide based Pesticides* **Sources:** Use of pesticides in after-care period

Potential occurrence of Other Pollutants on Mineral Extraction Sites

Other Pollutants	Materials likely to be present on site which may contain Other Pollutants
Metalloids and metals and their compounds	A range of metals (e.g. lead, zinc and copper) depending on nature of mining and pH of water. **Sources**: Mine drainage, Leaching and sediment runoff from spoil tips and bings on site.
	Arsenical pesticides* **Sources**: Use of pesticides in after-care period.
Substances which have a deleterious effect on the taste or odour of groundwater	Ferric Hydroxide **Sources**: Leaching from bings, Mine drainage.
	Flocculants such as aluminium or ferric hydroxide **Sources**: Used in settlement ponds.
Inorganic compounds of phosphorus and elemental phosphorus	Phosphate **Sources**: Fertilisers

*These types of pesticide would not be commonly used.

Mineral Extraction Code Of Practice

For Owners And Operators Of Quarries And Other Mineral Extraction Sites