ronmental Code of Practice

Extractive Industries

Environmental Protection Authority

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Western Australia — an environment worth protection

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Foreword

A major element of the Environmental Charter for Western Australia is the series of Environmental Codes of Practice issued by the Environmental Protection Authority.

The codes are intended to encourage a strong environmental ethic within industry. They are not intended to be regulations or to encroach on any other areas of legislative responsibility. They are advisory and educational.

This Environmental Code has been prepared with the help of other government agencies and industry. The aim has been to produce a workable code with emphasis on reasonably practicable techniques to prevent pollution.

It is fair to say that the code can be applied in a relaxed manner if an extractive industry is a reasonable distance from housing or other sensitive land uses. However, if the extractive industry is near a residential area or other sensitive land uses, the code should be applied diligently.

B. A. Carbon
Chairman
1990

Environmental Code of Practice for Extractive Industries

1 Introduction

Extractive industries ranging from simple sand excavation to relatively complex hard-rock mining operate throughout Western Australia. Hard-rock mining involves drilling, blasting, crushing, screening and stockpiling. It requires a great deal of mining expertise and material handling skills.

The requirements for pollution control vary widely across the extractive industry. Relatively simple measures are adequate in sand pits but sophisticated control equipment and careful maintenance are essential in hard-rock quarries and the associated plant, especially near homes or other sensitive areas.

The Environmental Protection Authority is essentially concerned with the extraction of five basic raw materials — sand, limestone, gravel, clays and hard-rock. It is recognised that there is a need for some of these raw materials to be available relatively close to Perth and other urban areas, because in all cases, transport costs are a major factor. However, the siting of an extractive industry close to an urban area imposes severe restraints on the operation of the extractive industry in terms of pollution control and noise.

Under the Environmental Protection Act 1986, the occupier of the premises is required to take all reasonable and practicable measures to prevent the discharge of waste and the emission of noise, odour and electromagnetic radiation.

Various aspects of the operations of extractive industries come under the following Acts:

State Planning Commission Act 1985
Local Government Act 1960-1982
Mining Act 1978
Mines Regulations Act 1946-1974
Water Authority Act 1984
Waterways Conservation Act 1976
Health 1911-1979

Extractive industry operators and concerned parties may also wish to refer to the following existing and proposed publications for more information:

"Guidelines for the Assessement of Hardrock Quarries" State Planning Commission, April 1987

"Basic Raw Materials Resource Protection Strategy" Perth Metropolitan Region — State Planning Commission

Report of the Department of Mines Quarry Rehabilitation Working Group.

"Guidelines for Planning, Operation and Rehabilitation of Borrow Pits" Main Roads Department, Perth, Western Australia

1.1 Brief description of operations

A traditional definition of an extractive industry is:

"Extractive industry" includes the extraction of sand, gravel, clay, turf, soil, rock, stone minerals or similar substance from the land, and also the manufacture of products from such matter when the manufacture is done on the land or adjacent area from which any material is extracted.

An area is stripped of the over-burden, including the vegetation, and the sand, clay or rock extractd and trucked from the site.

During the operation of the pit or quarry, the major commercial aspect is the separation of the produce, sand, limestone, clay or rock from the waste material and the "fines" (dusty material) produced by attrition of the product. In many instances the waste material and fines have no value and will seriously detract from the value of the product if allowed to contaminate it.

1.2 Some of the problems

Dust from extractive industries can cause problems ranging from minor nuisance to personal injury. People will not accept soiled laundry and incessant deposits of dust throughout their homes. Any dustfall can interfere markedly with other uses, such as inhibiting fruit development in orchards and vineyards during the period of active growth.

It must be kept in mind that in some rural areas certain agricultural activities can cause intense short-term clouds of dust, such as during fallowing of the soil between rows of vines during the late summer. To the quarry manager, the everyday dust emission from the quarry seems insignificant when compared with such dust clouds, but quarries or other extractive industries have the potential to pollute all year round and therefore should be strictly controlled.

Most breaches of pollution control regulations or conditions of licence involve exceeding an air quality standard based on a quantitative measurement. This is not so with dust escaping from an extractive industry. Excessive levels of dust are usually based on the subjective attitude of the public involved and the investigating pollution control officer.

It is unfortunate that relations between the public and the extractive industry are particularly sensitive and it is often very difficult to resolve such problems.

Excessive levels of surface dust and erosion often persist throughout the life of an extractive industry because of the excessive clearing of land near the pit or quarry at the initial stages of development. Because of the large heaps of sand, gravel, clay or

aggregates stockpiled in the vicinity of the pit is a dust nuisance caused when they are being reclaimed, especially if they have dried out in depth.

Uncontrolled stormwater flowing in and out of the quarry or pit area can cause severe pollution of water resources. Erosion can result in excessive quantities of silt being carried into creek systems, rivers, irrigation canals and water storage dams. Waste oil and grease carelessly discarded can contaminate the water leaving the site and entering creeks. People who see turbid water or oily sheens on the surface causing injury to plants, aquatic animals and the amenity quickly develop an antipathy to the extractive industry. Only responsible attitudes and a diligent approach to pollution control can break down existing barriers.

The extractive industry does have adverse environmental effects and this Environmental Code of Practive is intended to assist the operators to carry out their business in such a manner that the adverse effects are minimised and the quarry or pit operates as a good neighbour to surrounding land users.

2 General principles of environmental management

Early in planning for an extractive industry site, a mining and rehabilitation programme should be prepared identifying the following issues.

2.1 Stages of a mining and rehabilitation programme

2.1.1 Site selection to minimise environmental impacts and establishment of the infrastructure

a geological survey
b hydrology survey
c flora and fauna survey
d other land uses and archaeological survey
e determine end-use of site after rehabilitation

2.1.2 Development of the quarry

a construction activities — roads
— clearing
— water supply and drainage
— power supply
— building support structures and plant
b removal and storage of vegetation and top-soil
c removal and storage of overburden

2.1.3 Normal operation — environmental impacts

a drilling and blasting
b loading and haulage
c grinding, milling and screening
d stockpiling and loading

2.1.4 Rehabilitation in accordance with end-use

a progressive rehabilitation
b terminal rehabilitation

2.2 Site selection

It is imperative that when an extractive industry site is established, an adequate distance is maintained between the site, including associated roads and access ways, and nearby homes or other sensitive areas. This is in the interests of the occupier of the extractive industry premises, because the closer the industry is to homes or sensitive areas, the greater potential for adverse effects, hence the pollution control requirements are more stringent and proportionately more costly.

Careful planning can minimise the environmental effects of an operation, ie by siting over-burden dumps well away from stream lines or siting screening operations on the lee side of a hill or in a well vegetated area to minimise dust movement. A component of such planning is deciding on the end land use of the site at the completion of mining. In many cases there are opportunities to benefit from the excavation, such as the opportunity to use the pit as a dam or wetland area or sanitary landfill site rather than giving it a face-lift and restoring the area to an approximation of what existed before mining. To take advantage of these opportunities, all the options need to be explored during planning and site selection.

2.3 Visual impact and windbreaks

Shrubs planted between the taller trees can lessen the visual impact of the quarry and plant areas, as well as providing an effective windbreak.

A well planned and landscaped feature garden developed around a permanent site can vastly improve the aesthetics of a quarry and plant complex.

2.4 Rehabilitation

Generally, extractive industries are temporary land users, sometimes up to only a year. During their tenure, they can significantly modify the natural environment in which they are working.

Wherever possible, vegetation should be preserved and used for screening. Vegetation between the pit and the plant should be preserved and fenced or well delineated to prevent access by vehicles and disturbance. Any areas of significance determined in a pre-operational survey of flora and fauna should be protected.

A rehabilitation programme should be designed at an early stage of development of the extractive industry. This would require information on local vegetation suited to the site, physical and

chemical analysis of the soil types, (particularly of revegetation overburden dumps), land form and depends on the final land use.

All topsoil and overburden should be retained for use in the rehabilitation process and stored on site for that purpose. Removal from the site of any material is likely to create a deeper depression in the landscape when the area is rehabilitated. Vegetation, particularly natural woody species, should be removed and stored separately to the topsoil or overburden. This allows for better respreading of topsoil and placement of vegetation litter over the top of the rehabilitated area to encourage the migration of fauna into the area.

Areas which have been sand mined can benefit from an imtermediate crop for stabilisation before restoring the native vegetation.

All restored areas should be deep-ripped to a minimum depth of half a metre and not more than two metres apart and at right angles to the slope of the surface where applicable. If steep slopes are unavoidable, contour control banks of at least one metre high and two metres wide and spaced to give a height difference of about one metre between adjacent crests should be constructed. All contour drains should slope gently towards the nearest natural drains.

Deep ripped restored areas should be covered with topsoil and fertilised and watered as necessary to promote revegetation.

If the overburden is not going to be used for the rehabilitation of the pit, it should be dumped in an area in such a manner that it blends with the surroundings and can be readily revegetated.

Overburden dumps should be temporarily stabilised until returned to the pit before rehabilitation. It the overburden dumps are permanent and not for back-fill, they should be stabilised as soon as practicable and revegetated.

If the vegetation will not readily take on the dump, **new** topsoil should be spread over the overburden dump as soon as possible and watered to promote rapid germination of the vegetation to prevent erosion and dust lift-off.

Top soil stockpiles should be clearly marked on the pit plan, because topsoil constitutes a valuable resource and can easily be covered with over-burden or otherwise disturbed if not protected. Seeds stored in the top soil deteriorate rapidly and if the top soil is stored for more than 12 months, a seed-mix will need to be applied to the rehabilitation area.

Top soil stockpiles should be kept as low as possible, not exceeding 1 metre in height, given space consideration, a soil structure is heavily modified in large high stockpiles, thus reducing the long-term value of the top soil.

2.5 Occupational health and safety

Attention should be given to occupational health, safety and welfare legislation, particularly Section 19 of the Occupational Health, Safety and Welfare Act, 1984. This states that an employer shall, as far as practicable, provide and maintain a working environment in which employees are not exposed to hazards.

This includes maintenance of workplaces, plant, and work systems; provision of information, instruction and training enabling employees to work without hazards; consulting employee-elected health and safety representatives and/or other employees about occupational health, safety and welfare; providing adequate personal protective clothing and equipment; and ensuring all work procedures are done without exposing workers to hazards.

Workplace accidents resulting in the death of an employee, or injury as detailed in the Occupational Health, Safety and Welfare Regulations, 1988, must be reported to the Commissioner for Occupational Health, Safety and Welfare (telephone (09) 327 8800).

For more information, contact the Department of Occupational Health, Safety and Welfare (telephone (09) 327 8777).

2.6 Environmental commitment

All personnel, both management and operators should be encouraged to develop a commitment to being good environmental managers, good neighbours and preventing pollution. All plant supervisors and operators should be aware of any emission of dust, discharge of dirty water or plant causing unreasonable noise and take immediate action to prevent the dust, water pollution or excessive noise continuing.

3 Basic control requirements

A The least possible area should be cleared of vegetation at any one time and all remaining peripheral trees and shrubs should be protected from possible damage by vehicles and machinery. Old tyres should not be used to burn green vegetation heaps.

B All topsoil removed from the overburden should be stored for use for future rehabilitation and as the pit or quarry is developed, the topsoil should be spread out over replaced overburden in the worked out area as soon as possible to promote maximum germination of vegetation. Topsoil stored until the conclusion of the pit operation should be stored in an area isolated from any activity and on an area of minimum vegetation coverage.

C The smallest practicable area of the quarry or pit should be worked at any time.

D Access ways for vehicles should be defined by placing markers, at least one metre high at each side of the access way, spaced at not more than three metres apart to ensure all vehicles remain on the controlled surface to minimise dust.

E The defined access ways should be regularly watered or treated with a surface binding material to minimise dust.

F Any stockpiles should be kept damp with sprinklers or stabilised in an appropriate manner to minimise dust.

G Extraction operations should be suspended during periods of strong winds if sand, limestone or clay dust affects residential areas or any other sensitive land use.

H The performance of all machinery and vehicles on site should be monitored regularly to ensure that the noise emissions are acceptable and in accordance with the manufacturer's specifications.

I The hours of operation should be established under individual licence conditions. Extractive industry operators should familiarise themselves with the noise abatement regulations. A copy of "assigned outdoor neighbourhood noise levels" is attached as Appendix A.

J The occupier of the premises should endeavour to maintain all internal access ways in a manner which will prevent undue noise from empty trucks.

K Trucks entering and leaving the premises on quarry or pit access ways should be limited to a moderate speed to prevent undue noise from empty trucks.

L Loaded trucks leaving the premises should not be over-filled resulting in spillage on roads off-site.

M Truck drivers should be encouraged to use any alternative route which will avoid nearby residences.

N The hours during which trucks can approach and leave the quarry should be consistent with the hours of operation of the quarry.

O The truck drivers should be encouraged travel at moderate speeds when approaching and leaving the quarry.

P Stormwater run-off from outside the disturbed area should be diverted away from the quarry or pit and not allowed to enter any excavation or working. Excess water should be channelled into a dam or equivalent storage and used for road watering or dust control.

Q Drainage from within the excavation, working area or roads and access ways should only discharge into a settling pond of sufficient size to allow only clean water to run from the pond and not cause turbidity or any deterioration of any water resource. In the case of colloidal clays being discharged into a settling pond, and it is unlikely clear water will leave the pond, discharges of water from the settling ponds should occur only during river flow conditions to minimise the impact of the colloidal waters on the water course.

R Where practicable refuelling of vehicles should take place offsite and from bunded fuel tanks. However, if fuelling does take place onsite from permanent fuel tanks the tanks should be bunded and any spillage should be contained.

An oil skimmer and separator should be installed in the drainage flow from any area where spillage or leakage of oils or greases can occur to prevent oil contamination of any water resource.

S At the conclusion of mining of a particular area or pit the area should be restored to smooth gentle slopes consistent with the surrounding areas and/or consistent with the rehabilitation plan lodged with the relevant decision-making authority.

T During operation rubbish should not be allowed to accumulate on the site and before leaving the site, all rubbish, empty drums, cans, plastic containers, scrap metal and old tyres should be removed from the area.

4 Specific areas of concern

4.1 Sand pits

Sand grains are usually too heavy to be moved except in the strongest winds. Sand containing significant quantities of fines or clays is not usually mined other than for landfill and the product is rarely subjected to any processing.

Sand mined for export for glass manufacture, for use as moulding sands, construction uses or abrasive blasting is usually screened, and in some cases dried at the excavation site. Special care is needed to prevent nuisance from wind blown sand or dust from screening operations.

Usually, freshly excavated sand is damp and can be passed through a trommel and screens under most wind conditions without causing nuisance. A combination of dry sand and strong winds can be a problem.

During periods of strong winds, large tracts of relatively level or gently contoured sand surfaces remaining at the completion of excavation have in the past caused severe "sand blasting" problems to vegetation and property in nearby areas. Action under both the Soil Conversation Act and the Environmental Protection Act has been necessary in some cases.

Special control requirements

A Where dust is seen to be impacting on any neighbouring premises screens erected for screening sand should be enclosed or some other method adopted to minimise dust emissions.

B On restoration of the excavation site after completion of the sand mining, all vehicles should be prevented from entering the area and the area stabilised until a permanent vegetation cover can be established.

4.2 Limestone quarries

Limestone mined in quarries contains on average about 5% moisture when freshly mined and does not dust readily. Unfortunately, the limestone crushes fairly readily under the tyres of loaders and trucks and under the tracks of bulldozers and similar machines.

The final calcium carbonate powder blows up in the slightest breeze following any movement unless the surface is continually wetted. During weekends and holiday periods, when sprinklers are not maintained, wind eddies in the quarry and surrounding areas, pick up dust and blow it across nearby areas.

Special control requirements

During dry periods access ways and work areas should be kept damp by srinklers and maintained over extended public holiday periods or the access ways treated with a surface binding agent if there is any house or amenity within 250 metres of the quarry.

4.3 Gravel borrow pits

See "Guidelines for Planning, Operation and Rehabilitation of Borrow Pits" Main Roads Department, Perth, Western Australia.

4.4 Clay pits

Most of the clay extracted in Western Australia is used in the manufacture of bricks and tiles. The clay pits are usually operated by the brick or tile manufacturer. Small amounts of clay are extracted by independant operators for lining dams and waste water lagoons and for use in manufacture of cement.

Clays are usually reasonably wet when dug up and loaded. If split clay dries out in the pit or in an access way it will be reduced to a fine powder and blows freely in the wind. During rehabilitation to new or original contours the reworking of dry overburden or poor grade clays can readily generate dust.

Any clay introduced into a stream or waterway will cause turbidity of that water course.

Special control measures

A All working areas and access ways should be kept damp at all times the pit is being worked or regularly treated with a surface binding agent.

B Sprinklers or other suitable waterers should be used to constantly dampen the overburden or below-grade clays to minimise dust emissions during back-fill and contour grading.

C It is essential that all stormwater should be diverted away from the pit area and from any disturbed clay surfaces,

D Erosion of clay heaps and overburden areas should be prevented and all surface run off from these areas and the pit area should be contained and diverted to silt traps to prevent any clay suspension causing turbidity in any water course.

5 Hard-rock quarries

The hard rock mining industry has progressed during the past fifteen years of so from dusty and often hazardous industries to relatively high technology plants. Dust suppression and collection, water pollution and noise control are now routine practices in most quarries. However, there are still some small hard-rock quarries lagging behind the times and are the source of complaint over dust, water pollution or excessive noise.

When many of the existing quarries were established, they were isolated from public view and remote from residential areas. Often the only people affected by whatever pollution was generated by those operations were those whose livelihood depended on the quarries. Because quarries can have a life of up to 30 years or more, many population centres have expanded and are now close to quarries.

The proximity of population centres and increased concerns with environmental matters have resulted in a need for much more stringent controls over hard-rock quarrying operations.

Continued control on dust emissions, blasting and machining noise and water discharges are now mandatory.

5.1 Dust control

Every stage in the operation of a hard-rock quarry produces "fines", mainly powdery dust. By blasting, crushing and constant handling through conveyers, screens, storage and loading out, attrition of the product occurs producing fine dust.

Within the quarry operations the main sources of dust are:

- drilling;
- blasting in the pit;
- rock loading and hauling;
- vehicle movements;
- uncovered conveyors;
- unhooded dumping and transfer points;
- stockpiles;
- areas stripped of vegetation; and
- waste dumps

The emissions from some of the above areas can be seasonal in nature. Meteorological factors cause large variations from day to day, ie from rain to dry hot days with strong winds blowing all day.

In the quarrying operations dust can be contained, collected and suppressed in all cases except that of blasting. The dust from blasting cannot be collected or suppressed and dilution of the dust through dispersion in strong winds, and preferably away from residential area, provides a mitigating mechanism.

The containment and collection of dust is always preferred over dust suppression, however, it is recognised that properly designed and well maintained suppression techniques as an alternative means of dust control can almost be as effective as containment and collection.

Fully enclosed systems are necessary to almost completely prevent dust emissions.

Due to the comparatively low initial cost, dust suppression techniques are still widely used in the hard-rock quarrying industry to control dust. When diligently applied, wetting of the dust with water and chemical additives has proved to be a reliable control method. Fogging sprays and wetting agents can capture and settle large quantities of dust with little overall added moisture to the product. Wetting agents in the water reduce the surface tension of the water and allow the moisture to gather up more dust particles.

Synthetic surfactants are used as crusting agents and can be sprayed over stockpiles and when dry forms a synthetic crust, which will enclose the stockpile for many months and prevent windblown dust. A word of caution, in relying on dust suppression, water sprays will wet the product and the fine dust will adhere to the relative large aggregate pieces. If at any stage later on this aggregate is allowed to dry out, that dust will be dislodged during handling or by strong winds and become airborne. If dust suppression is relied on to control dust in the intial stages of product processing or handling then the product must be kept wet until the end use of the product. This could be in a concrete batching plant in a light industrial area where any dust emission cannot be tolerated.

Totally wet plants, involving wet screening will effectively eliminate dust from nearly all operations. In dry plants dust collectors must be used effectively or a combination of suppression and collection to remove and retain the fine dust from the product.

Technology available for dust collection is more than adequate. Although an emission limit may appear on the quarry licence conditions, and an allowable emission may be specified somewhere between 100 and 250 miligrams per cubic metre of air, emissions

from most modern dust collectors conform with the "no visible emission" standard, when correctly operated and are well maintained (see Appendix B for some brief notes on dust collectors).

5.1.1 General control measures

A All management and operators should observe, by eye or remote TV camera, all emission points from the dust collectors and when any emission of dust is visible, take whatever action is necessary to ensure that the operating conditions of the dust collector are immediately checked and any faults immediately rectified.

B The settling ponds should be inspected weekly for build-up of settled mud and the flow diverted to a clean pond if the mud level rises to an unacceptable level.

5.1.2 Dust control in the plant area

Primary crusher dump bin

A The dumping bins should be surrounded with large volume water sprays, alternative sprays being angled up and down and are switched on remotely by the reversing dump truck, and should remain on for not less than 30 seconds after the truck has departed.

B Wind shields should be situated on three sides of the dump bin and the top effectively roofed.

Conveyor belts and transfer points

If collection of dust with dry collectors is relied on:

A All conveyors and transfer points should be completely enclosed.

B Insertable type dust collectors or take-off points to a central dust collection system should be installed at each transfer point.

If suppression by water sprays for dust control is relied on:

C Fine misting sprays should be installed at each transfer point. The water pressure and spray operation at each transfer point should be checked daily and any defective sprays replaced immediately.

D Under belt scrapers should be intstalled at each transfer point and the dust and "mud" from the scraper should discharge into the transfer chute, not on to the ground.

E The condition of the scraper blade, discs or bristles should be checked weekly and replaced if worn.

Dry crushing and screening plant

A The crushing and screening equipment should be totally enclosed and ducted to a dust collector.

B All inspection covers and plates should be secured and the plant inspected daily to ensure all such covers have been replaced and are secure and not leaking dust.

C The flexible ducting from a vibratory screen to the dust collector should be inspected daily and if any signs of leaks or wear, it should be replaced immediately.

Wet crushing and screening plants

An adequate water supply should be available at all times.

Storage and loadout bins and silos

A Product storage, surge and loadout bins should be enclosed and ducted to a dust collector.

B Single access load out bays should be enclosed on three sides and drive-through loadout bays should be enclosed on two sides and light weight rubber flaps hung at the openings to reduce wind effects. The loadout bay should be ducted to a dust collector; or the loadout chute surrounded by water sprays.

Roads and access ways in the plant area

A Permanent roads within the plant area should be sealed and regularly swept with a road sweeper with a self contained dust collector or washed and the waste water channelled to the settling ponds.

B Speed limits should be imposed an all plant roads to minimise dust (and noise)

5.1.3 Dust control in the pit and on the haul roads.

Drilling

Where wet drilling is not employed then the drilling dust should be collected in an efficient dust collector.

Pit floor and broken rock

A Mobile sprinklers should be maintained to keep all areas of the pit floor used for loader and vehicle movements in a damp state.

B Sprinklers should be used over broken rock for a sufficient time to dampen any dust.

Haulage roads

Haulage roads should be watered regularly with a water truck or sprinklers or a surface binding agent such as an oil emulsion or chemical surfactant should be applied to the road on a regular basis.

5.1.4 Dust control in the stockpile area

A Where materials are likely to emit dust, stacking elevators should discharge into a rill tower with 'swinging trap' doors at various levels or telescopic chutes or 'elephant trunks' to prevent the free fall of the product.

B Under-pile reclaiming should be used where practicable and conveyors should be totally enclosed.

C Stockpiles should be regularly watered with irrigation-type sprinklers and maintained always in a damp condition. Sprinklers should be programmable and varied to match the weather conditions.

D During reclaiming stockpiles with a front-end loader, portable sprinklers should be used over the working area to keep the exposed surfaces damp.

E Static stockpiles should be sealed with a crusting agent and the surface checked regularly for stability.

5.1.5 Disposal of dry dust

Having collected the unwanted dry dust in a fabric dust collector, the dust must be disposed without creating another nuisance.

A Dry dust from bag houses should be discharged through a rotary valve to a vertical vortex mixer with tangential water nozzles.

B The slurry from the vortex mixers should be pumped to settling ponds or taken to a back-fill area.

5.2 Waste water control

In quarries using wet scrubbers and dust suppression water is a valuable resource and every effort should be made to capture as much stormwater as possible.

Water running through the plant, pit and stockpile areas will pick up fines, which if carried off the site into adjacent water courses, will result in turbity problems in surrounding water resources.

Hard-rock quarries involve a large number and variety of vehicles and machines, bulldozers, drilling machines, front-end loaders, dump trucks etc, and because of leakage, breakdowns, permanent workshops and routine field maintenance oil is often seen on top of drainage water.

5.2.1 Water conversion

A Whenever possible all water run-off should be channelled into dams or equivalent storage for use throughout the quarry and plant.

B All used plant water, other than from ablutions, should be channelled to settling ponds of sufficient size to allow suspended particulates to settle and the water to be re-used.

C Flocculents should be added to the settling pond water to accelerate the settling of the mud. Where the use of flocculents is inadvisable, the settling pond should be of adequate size to allow for sufficient retention periods to ensure settling of the mud.

D Settling ponds should be duplicated to allow regular clean out of one while the other is in use.

E Mud removed from the settling ponds should be disposed of in an appropriate place by covering with overburden or topsoil as quickly as possbible and not allowing the residue to dry out.

5.2.2 Erosion control

A Banks or diversion drains should be constructed to divert rain run-off from any working cleared areas, quarry, plant or stockpile area adopting all practicable measures to prevent unnecessary changes in any natural flow line or creek system.

B Rainwater run-off from any working area, quarry, plant and stockpile area should be channelled to a settling pond of adequate size to allow all silt to settle out.

C Water discharges from the settling pond outlet should be monitored for turbidity on a regular basis especially during periods of above average rainfall.

5.2.3 Workshop and oil wastes control

A All waste oil should be carefully collected and put in drums with secure bungs and removed from the site as soon as possible for recycling.

B All fuel and oil storage tanks should be bunded to contain the total contents of any tank or drum in the event of leakage from that container.

C Waste drains from any workshop and washdown area should be directed to an oil and grease trap and the trap cleaned out regularly. The collected oil and grease should be sealed in drums and removed from site in an approved manner.

D Cooling water from vehicle and machine radiators and other waste cooling water should be sealed in drums and disposed of off the site in an approved manner.

E Any waste waters containing or likely to contain surfactants or other emulsifiers should be treated in a manner necessary to reduce biological oxygen demand levels.

5.3 Noise control

Noise and airblast over pressure can result from four major areas of quarrying activity:

- blasting;
- plant;
- mobile equipment; and
- transport.

5.3.1 Blasting

Problems arise from a combination of effects:

- noise;
- ground vibration; and
- air blast overpressure.

As long as quarries are located near population centres, complaints from blasting will persist, but the severity of the effects can be minimised.

A Delays on all charges should be used with sequential timing to minimise the maximum instantaneous charge.

B The charge weight used in each hole should be carefully managed.

C All blast holes should be stemmed with coarse crushed aggregate (not fines) to prevent the venting of gas to the atmosphere.

D Blasting should take place only when the background noise level is at its highest and at a regular time.

E Air blast overpressure measured at the most affected residence should not exceed 115 db peak linear when measured using a 2 hertz lower limiting frequency.

F Blasting should be avoided when the atmospheric conditions are unfavourable, such as adverse wind directions and low cloud.

G Secondary blasting should not be carried out and any large rock should be broken only with impact hammers or rock breakers.

5.3.2 Control of plant noise

The noise perceived at a nearby residence or other sensitive land use will depend on the noise level generated by the plant, the distance between the source and the receiver and any alteration along the noise path.

A The hours of operation should be established under individual licence conditions. Quarry operators should be familiar with the noise abatement regulations. A copy of "assigned out door neighbourhood noise levels" is attached as Appendix A.

B All machinery should be of modern design and incorporate modern noise control techniques.

C All machinery should be fitted with silencers where applicable and maintained in an efficient manner.

D Wherever practicable, machinery should be located in acoustically designed buildings.

E Wherever practicable, wall or earth bunds should be erected as close a possible to the plant and between the line of sight of the machinery and the receiver.

5.3.3 Vehicles and mobile equipment

The layout and development of the quarry and plant area can provide natural barriers between areas of activity, haul roads etc, and adjacent residential areas. Advantage of any screening effect by land form etc can be taken to reduce 'line of sight' transmission of noise.

A Mobile equipment and vehicles should operate only within the hours of operation established under individual licence conditions.

B All mobile equipment and vehicles should be fitted with efficient silencers and tested regularly to ensure effective operation.

C Earth barriers or bunds should be built alongside any regularly used haul roads or plant access ways.

D Overburden or waste dumps should be located to screen any activity area from nearby residences.

6 The control of lighting

Light used to illuminate any areas of the site for security or any other reason should be angled or shaded in such a manner so that the light does not directly illuminate any nearby residential premises.

APPENDIX A

ASSIGNED OUTDOOR NEIGHBOURHOOD NOISE LEVEL DB(A)

Use of Premises at Place of Reception	Description of Neighbourhood in Which Place of Reception is Situated	Monday-Friday 0700-1900 hrs	Monday-Friday 1900-2200 hrs Weekends and Public Holidays	Always 2200-0700 hrs
Residential, domestic or Private Recreational	1. Only residences with schools, hospitals and the like or with medium transportation.	40	35	30
	2. Only or predominantly residences with infrequent transportation.	45	40	35
Residential, Educational, Hospital or the Like	1. Other residences with schools, hospitals and the like or with medium density transportation.	50	45	40
	2. Other residences with some commerce or some light industry, or with some places of light entertainment or public assembly, or with dense transportation.	55	50	45
	3. Predominantly commerce or light industry or places of entertainment or public assembly or with very dense transportation.	60	55	50
	4. Predominantly industry, or with extremely dense transportation.	65	60	55
Commercial, Entertainment or Public Assembly	1. Predominantly residential or with schools, hospitals and the like, or with medium density transportation.	50	45	40
	2. Some other commerce or some light industry, or with place of entertainment or public assembly, or with dense transportation.	55	50	45
	3. Predominantly commerce or light industry with very dense transportation.	60 at any time	60 at any time	60 at any time
	4. Predominantly industry, or with extremely dense transportation.	65 at any time	65 at any time	65 at any time
Industrial	1. Predominantly residential or with schools, hospitals and the like, or with medium density transportation.	55	50	45
	2. Predominantly commerce or other light industry, or places of entertainment or public assembly, or with dense transportation.	60	55	50
	3. Predominantly other comparable industry, or with very dense transportation.	65 at any time	65 at any time	65 at any time
	4. Predominantly heavy industry.	70 at any time	70 at any time	70 at any time

The figures above are being reviewed. In the interim, the EPA has recommended minimum protection for residences of:

50dB(A) from 7am-7pm, Monday to Saturday
45dB(A) from 7am-7pm, Sunday
45dB(A) from 7pm-10pm, every day; and
40dB(A) from 10pm-7am, every day.

The EPA considers that noise below these levels is not unreasonable provided it does not include tonal components, impulses or other intrusive characteristics.

APPENDIX B

Dry inertial dust collectors

Cyclones and multiclones are the most well known examples of this type and operate by inducing a change of velocity in the exhaust air which will throw the dust particles out of the air stream and mechanically prevent the dust particle being re-entrained.

It is not possible to simply 'add-on' more ducting and speed up the fan without consulting the manufacturer's specifications for the dust collector or the manufacturer's agent for advice.

Hence the speed of the air movement through the collector is critical and must be maintained within the design parameters for the collector to maintain its efficiency. Any blockages in the duct work or loss of fan efficiency through slipping belts or eroded blades will reduce the air flow and cause a loss of efficiency in the dust collector, and allow dust to escape to the environment.

Wet inertial dust collectors

In this type of collector, the mechanical design to prevent the dust being re-entrained into the air stream is relaxed and substituted with water sprays to maintain wet surfaces on which the dust is trapped after being thrown out, and then washed away.

Any loss of water flow or spray efficiency will almost immediately result in a dust emission.

Wet scrubbers

Operation of a wet scrubber depends on sufficient energy in the water sprays to produce a "curtain" of water through which the dirty air must pass, or sufficient energy in the air stream to mix the air with introduced water, as in a venturi scrubber. In both cases, a loss of energy, due to a loss in water pressure or a loss in air flow, will immediately allow a dust emission.

In the first case, any loss of water pressure will reduce the efficiency or spread of the sprays and blocked or eroded sprays themselves will both result in gaps in the water curtain and dust will escape without coming into contact with the water.

In the second case, the air flow must be kept up in the venturi scrubber to the manufacturer's minimum requirements and an adequate water flow to the unit maintained at all times.

All wet scrubbers produce an emission of water droplets being laden with "mud". This spray must be trapped and not allowed to escape, as once in the air, the water will evaporate and the dust will blow free. Hence most wet scrubbers are provided with eliminators, which are baffles to remove the excess water from the outgoing air.

The water introduced to the sprays or a venturi scrubber is nearly always recycled from a settling pond. The water must have adequate time for all the mud to settle out otherwise muddy water will be recirculated to the sprays and venturi scrubber. As some of the water always evaporates in the air stream, the released mud adds to the dust loading in the scrubber. Muddy water will rapidly erode the water pump, pipes and sprays, as well as blocking the sprays. Eroded pumps mean loss of pressure, and leaks from worn pipes and poor atomisation from eroded spray nozzles.

Fabric filter dust collectors

Fabric filters or bag houses are the most efficient of dust collectors, provided they are carefully maintained, as hard-rock quarry dust is very abrasive and can cause rapid wear to the fabrics used, such as woven or felted cotton, wool synthetics or glass fibre. It is essential that the fabrics are cleaned frequently by rapping mechanisms or a reverse pulse jet of air. This prevents a thick cake of dust building up on the fabric, which quickly reduces the flow of air through the filter and effectiveness of the system. The frequency of cleaning depends on the dust load in the air, the greater the amount of dust being collected, the more frequently the bags should be cleaned. If bags develop a hole or become blocked, they should be replaced immediately.

Modern bag houses will allow a single cell to be isolated and the bags replaced in that cell while the rest of the dust collector is still on-line, handling all the dirty air.

The pressure drop across a fabric filter dust collector can be monitored with a water manometer and a gradual increase indicates the bags are becoming blocked, while a sudden decrease suggestsd a bag has torn or developed a hole.

General maintenance schedule on dust control system

A Water pressure to spray systems in wet scrubbers and for dust suppression should be checked daily and the pressure logged and examined daily for trends which may indicate possible failure.

B All fans blades, driving belts condition and tensions should be checked weekly.

C Ducts should be examined weekly for any build-up of dust or mud.

D All pipe work delivering water to sprays in scrubbers or for dust suppression should be examined daily and any eroded or blocked sprays immediately changed.

E Wherever possible spray patterns should be observed daily and any eroded or blocked sprays immediately changed.

F All sprays should be replaced on a routine basis and workshop tested before being used for replacements.

G Mist eliminator plates should be inspected weekly for any build-up of caked mud or deterioration through corrosion.

H The pressure drop across any bag houses should be observed and recorded daily and if any change outside of allowable limits occurs, action taken immediately to change a bag or bags.

I The bags in a bag house should be removed and physically cleaned on a routine basis and any worn or frayed bag repaired before re-use.

J Spare bags, sufficient for the total replacement within the baghouse should be kept on the premises at all times.

Other Environmental Codes of Practice in this series cover:

Concrete batching plants

Rendering works

Cement product works

Fibre-reinforced plastics plants

Cattle feedlots

Asphalt plants

Abrasive blasting works

Poultry industry

Piggeries

Foundries

Sawmills and joineries

Rabbitries

Scrap metal recycling works

To control plant and equipment noise the code sets down several measures which include:

- In general plants and vehicles near to homes should operate only from 7am to 7pm Monday to Saturday, in order to meet neighbourhood noise levels.
- All mobile equipment and vehicles should be fitted with efficient silencers and be regularly checked and maintained.
- Truck drivers should be encouraged to use alternative routes to avoid nearby residences.

Blasting poses its own special problems and while it is impossible to eradicate noise, many steps can be taken to minimise its impact on surrounding areas.

Blasting should occur only when atmospheric conditions are favourable — not when the quarry is upwind of residential areas, or if cloud is low.

It should be done as infrequently as possible and only when background noise is at its highest.

Further, the code asks that charge weights be carefully managed and delays on all charges be used with sequential timing to minimise a maximum instantaneous blast.

The code also outlines wastewater controls and water conservation practices.

These ensure water quality in waterways around a quarry and, because of the big amount of water used in dust suppression, that site water is used effectively.

The code of practice is not designed to deter extractive industries.

It offers a commonsense approach to allow these interests to operate without having a severe impact on the environment or people.

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Western Australia — an environment worth protection

Environmental Code of Practice

Extractive Industries

Environmental Protection Authority

The industry

The extraction or mining of sand, limestone, gravel, clay and rock have played an important role in the development of Western Australia.

Throughout the state, extractive industries involve a broad range of operations — from the simple removal of sand to complex rock mining that involves blasting, crushing, screening and stockpiling.

But because of the materials and processes involved, extractive industries pose potential environmental problems for people living near them.

Major concerns

- ❑ Dust — probably the most readily identifiable and most common cause for complaint.

  It can be a serious problem and requires vigilance and strict control at the pit or quarry site.

  Dust can be a minor nuisance through soiled laundry and dust in homes or it can be pose a health risk — dust can cause respiratory problems for quarry workers and nearby residents.

- ❑ Noise — the noise from drilling, blasting and equipment can be particularly annoying to nearby residents and can affect production of such agricultural pursuits as egg or dairy farming.
- ❑ Environmental degradation — the removal of overburden and plants, and mining itself can turn areas into eyesores.
- ❑ Water pollution — uncontrolled stormwater flow into and out of a quarry or pit can cause severe sediment pollution of nearby water resources.

To ensure that industry and the community can successfully co-exist, the Environmental Protection Authority has developed a code of practice for extractive industries.

The code is intended to help pit and quarry operators plan and develop their business so the impact on people and the environment is minimised.

It encourages managers and workers to develop a commitment to the environment and to safeguard those living nearby.

Key elements of the code

- ❑ Planning and site selection — careful planning and site selection are needed to ensure minimal environmental impact.

The code calls for adequate buffer zones between the site and nearby homes or sensitive land-use areas.

These are essential in controlling dust and noise.

- ❑ Rehabilitation — extractive industries, generally, are only temporary.

  The code sets down guidelines for planning and rehabilitating a pit or quarry using original top soil and overburden.

  Rehabilitation can be done progressively or after mining has ceased.

- ❑ Basic controls — these involve a range of commitments which include:
  - As little land as possible should be cleared and remaining trees and shrubs should be protected from vehicles or machinery.
  - All top soil and overburden should be stored for site rehabilitation.
  - The smallest possible area of the pit or quarry should be worked at any one time.
  - Vehicle access should be well-defined by markers.
  - Operations should stop during strong wind if material is blowing towards houses or sensitive areas.

  - Machinery and vehicles should be regularly monitored to ensure acceptable noise.

    Machinery should not be started before 7am or after 7pm if the operation is near houses.
  - Access roads should be maintained to prevent undue noise from empty trucks.
  - Stormwater run-off should be diverted away from the pit or quarry.

    Excess water should be dammed and used for road watering and dust control. Drainage from within excavation work areas or roads should be discharged into settling ponds.

    Only clean water can be released into local waterways.
  - After mining is completed the area should be restored consistent with surrounding areas.

The code of practice also lists general and specific requirements for extractive industries in controlling such issues as dust, noise and wastewater.

For example, in the quarrying industry the code calls for strict adherence to dust controls — the type of dust collectors to be used, operational specifications and maintenance requirements.

Similarly, the code seeks strict controls over noise from such operations, and covers all areas of operation — blasting, plant and equipment and transport.