EPA VICTORIA

ENVIRONMENTAL GUIDELINES FOR THE CONCRETE BATCHING INDUSTRY

Environment Protection Authority
State Government of Victoria

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FOREWORD

This Best Practice Environmental Management (BPEM) Guideline was developed in consultation with the concrete batching industry and describes a forward looking approach to waste management issues for this industry. It builds on steps already taken by the industry to improve its environmental performance and seeks to integrate economic and environmental objectives. EPA acknowledges the contribution of the Australian Pre-Mixed Concrete Association to these Guidelines.

The philosophy behind BPEM is that of continual improvement. As industry looks for better ways to operate, it should also seek better ways to protect the environment.

Industry is encouraged to adopt the BPEM practices outlined in this BPEM Guideline so that both the industry and the environment can improve.

EPA will be pleased to receive comments on these guidelines from the concrete batching industry. Comments will, where appropriate, be incorporated in future editions.

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Acknowledgment

These guidelines were drafted by Gregory M Haywood (Deakin University)

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1 INTRODUCTION

This publication is intended to help the concrete batching industry operate without causing adverse environmental impacts.

Poorly controlled concrete batching plants may discharge highly alkaline wastewater, dust and excess noise, but plants operated in accordance with these guidelines should operate in harmony with the environment and neighbouring communities.

Best practice environmental management (BPEM) is synonymous with best practice business management. Both aim to maximise the efficiency of raw material usage, while minimising waste generation and the consumption of energy, water and auxiliary chemicals.

BPEM is not driven by regulatory compliance, but by the recognition that efficient resource usage results in increased productivity as well as reduced environmental impact.

1.1 OBJECTIVE

These guidelines will assist the concrete batching industry to achieve the best practical environmental outcome, while allowing flexibility as to how this will be achieved. Thus, the guidelines provide the industry and regulators with:

- a statement of the potential impacts of concrete batching operations on each element of the environment
- a clear environmental performance objective for each element of the environment
- suggested measures to avoid adverse environmental impacts and thus meet the performance objective
- the flexibility to meet the environmental objectives by other measures, as long as they achieve equivalent or better outcomes.

1.2 SCOPE OF THE GUIDELINES

These guidelines will assist concrete batching plant managers and operators to:

- comply with the legislative requirements of the Victorian Government
- use and maintain appropriate technology to minimise the impact of their operations on the environment and the amenity of the local community
- identify potential environmental problems and the tools to monitor and solve these problems
- understand their plant management responsibilities.

These guidelines apply to concrete batching plants of all scale – regardless of whether they are subject to EPA works approval.

The guidelines permit and encourage innovative, effective and improved solutions for the environmental management of concrete batching.

A checklist is provided in Appendix 1 to enable the manager of the facility to check that all relevant environmental issues have been addressed in accordance with these guidelines. This checklist is derived from one developed by the Environmental Sub-Committee (Victoria) of the peak body – the Australian Pre-Mixed Concrete Association – to determine the winner of the industry's annual Environmental Performance Award.

1.3 BEST PRACTICE ENVIRONMENTAL MANAGEMENT

BPEM means managing an organisation or activity to achieve a high level of environmental performance which is sustainable, continuously improves and is consistent with business or economic objectives. BPEM needs to be integrated with overall management philosophy and practice.

The BPEM publication series comprises guidelines and codes of practice for industry sectors or activities, which outline what is needed to achieve optimum environmental outcomes, consistent with the industry's economic viability.

BPEM may encompass:

- site selection
- process design
- technology choice
- key operating parameters and procedures
- contingency arrangements
- monitoring and auditing aspects.

BPEM publications outline key environmental objectives relevant to the industry or activity, and provide suggested measures to achieve these objectives. Satisfactory implementation of the suggested measures will be deemed to achieve compliance with the objectives. However, operators are encouraged to consider alternative ways to meet the objectives and to apply the best site-specific solution equivalent to, or better than, the suggested measure. Thus, innovation is not stifled and flexibility is provided, while those seeking greater direction or certainty can simply apply the suggested measures.

The underlying philosophy of BPEM guidelines and codes is to provide a forward looking approach, rather than simply reflect what is presently the norm. Where problems or issues occur within the industry, a direction or solution to these will be included.

A comprehensive environmental management system – preferably in accordance with the principles outlined in the International Organisation for Standardisation (ISO) 14000 series – is an integral part of BPEM. These principles include the determination of all environmental aspects associated with the company's activities, and a process of continual improvement in environmental performance.

BPEM provides the opportunity to harness the following benefits:

- reduction in unit costs
- opportunities for eco-marketing
- possible preferred supplier status
- potential reduction in resource consumption
- sustainable improvements in environmental performance
- improved community perceptions and relations
- increased compliance with regulatory requirements
- reduced exposure to risk (occupational safety and health as well as environmental).

A BPEM guideline or code is not of itself mandatory, but the potential exists to call up such a document in approvals, licences or permits. Regulatory authorities generally expect forward-looking manufacturers, committed to continuous improvement through a total quality management approach, to voluntarily adopt BPEM guidelines and codes.

2 CONCRETE BATCHING INDUSTRY

2.1 DEFINITION

A mixture of cement, water, sand and aggregate is called concrete. The product is named 'Portland Cement' because after hardening the product resembles a natural limestone quarried at Portland, England.

Components of concrete

The process for making Portland Cement is relatively simple, but the chemistry of cement manufacture is complex.

The components of concrete include calcium, silica, alumina, magnesia, iron oxide and sulfur dioxide compounds along with:

- fly ash – a glass-like substance used in good quality cement products
- aggregates consisting of gravel and sand, which comprise the major raw material of concrete (aggregates are graded according to their size and character)
- admixtures – compounds added to the concrete in small quantities to modify its properties.

The amount of water required to chemically combine the cement is about 16% by weight, but for more efficient mixing a greater amount is used. Adding more water weakens the concrete, but makes it easier to work with.

In a concrete batching plant, the raw materials are mixed in one of the ways discussed below.

2.2 FRONT END LOADER CONCRETE BATCHING

In front end loader plants, a front end loader is used to transport coarse and fine aggregates from a ground level storage bin to an aggregate weigh hopper. The aggregate is then added to an agitator. Cement and fly ash are weighed in a separate hopper and transferred to the agitator. The correct proportion of water is added to the agitator. The concrete is mixed, ready for final slumping, inspection and transportation to the customer.

2.3 OVERHEAD BIN CONCRETE BATCHING

In overhead bin batching plants, coarse and fine aggregates are stored in separate bins. Aggregates are transported from the bins to a compartmentalised overhead storage hopper by conveyor belts. A weigh hopper is situated directly beneath the overhead storage hopper, where aggregate is weighed and transferred to the agitator.

Cement and fly ash are stored in separate overhead silos. They are weighed in a separate hopper and dropped into the agitator. The correct proportion of water is added, along with any required admixtures and the concrete is mixed, ready for final slumping, inspection and transportation to the building site.

3 STATUTORY REQUIREMENTS

Legislation

The *Environment Protection Act 1970* provides for the control of water, air and land pollution, industrial waste and noise. The Act is administered by EPA.

Under the Act, discharges of wastes into the environment must accord with State environment protection policies (SEPPs), which identify beneficial uses for particular segments of the environment, and establish ambient objectives and discharge limits.

Policies

The *Industrial Waste Management Policy (Waste Minimisation) 1990*, specifies objectives for minimising industrial waste generation through avoidance and reduction in preference to recycling and reclamation. Best available technology can be required for priority wastes. EPA can require industry to conduct waste audits and prepare waste management plans.

The *State Environment Protection Policy (The Air Environment)*, which applies to Victoria's air environment, sets out:

- beneficial uses
- air quality objectives
- design ground level concentrations
- plume calculation (dispersion modelling) procedures
- control requirements for specific industry groups.

Schedules in the SEPP set out the control requirements for specific industries. Schedule F-2 describes minimum requirements to control discharges of waste to air from concrete batching plants.

EPA has discretion to exempt operations from compliance with Schedule F in certain circumstances. These include situations where compliance would preclude innovative control or energy saving technologies. This is discussed further in section 5.3.

The *State Environment Protection Policy (Waters of Victoria)* applies to all surface waters within Victoria. The policy defines:

- segments of the environment
- beneficial uses
- water quality indicators and objectives
- emission limits for waste discharges to surface waters – including a requirement that the pH of discharges be in the range 6.0 to 9.0.

The *State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade) No. N-1*, specifies noise limits in noise sensitive areas (for example, dwellings, hospitals, hotels, motels), based on land use, planning zones, background noise levels, plant operating periods and the nature of the noise source. The policy applies in the Melbourne metropolitan area, but is used as a guide elsewhere.

Regulations

The *Environment Protection (Scheduled Premises and Exemptions) Regulations 1996* describe premises which are scheduled, and are thus required to comply with the licensing and works approval provisions of the *Environment Protection Act 1970*. Specific discharges which are exempt from the licensing provisions are also listed.

Concrete batching plants with a design throughput of at least 100 tonnes per week are scheduled and require a works approval from the EPA before they are constructed or undergo major modification. Licences are not required to operate concrete batching plants, but plants must accord with Policy requirements.

The *Environment Protection (Prescribed Waste) Regulations 1998* classify certain industrial and domestic wastes as prescribed waste. Prescribed waste can only be removed from a site by an approved waste transporter. Concrete batching plants may generate prescribed waste (for example, waste oil and alkaline sludges). Operators should confirm the status of specific waste streams and their responsibilities with EPA.

4 WASTE MINIMISATION

Waste minimisation is an integral part of BPEM. By focussing on waste avoidance and reduction through the use of better processes and practices, pollution control and waste disposal costs can be lowered.

4.1 WASTE MINIMISATION

The *Waste Minimisation Policy* sets out the following hierarchy for industrial waste management options:

- waste avoidance/reduction
- reuse, recycling and reclamation
- waste treatment
- waste disposal.

Preference should be given to waste avoidance or reduction, ahead of recycling and reuse. Treatment and the least preferred alternative of waste disposal should only be considered if these actions are not possible.

Waste minimisation includes good housekeeping practices and staff attitudes, as well as technical factors. Actions as simple as reducing the volume of water used during washouts may significantly reduce waste generation. The potential impact of such straightforward measures should not be underestimated.

Some of the smaller incremental improvements are easy to gain, but difficult to maintain. Teamwork and commitment from production staff, supported by strong management and effective management systems, should enable sustainable and continuous performance improvement.

Another essential part of waste minimisation is understanding what wastes are being produced and the processes which generate them. As well as establishing a baseline against which improvements can be assessed, this data will allow waste reduction options to be evaluated.

4.2 IMPLEMENTING WASTE MINIMISATION

In the concrete batching industry, waste minimisation principles can be applied to water, cement, aggregate and all other inputs. Significant cost savings have been achieved by plants using this approach.

A useful starting point for a waste minimisation program is to prepare a waste management plan (WMP). The first step to preparing a WMP is a waste audit, which involves identifying the sources, types and quantities of wastes generated by a concrete batching plant. The waste audit should:

- identify all waste streams
- quantify and characterise them
- establish how each waste stream is generated.

After the waste audit is completed, a waste assessment is conducted. This involves identifying the options available to minimise each of the waste streams.

A technical and economic feasibility analysis is then conducted to determine which of the identified waste minimisation opportunities should be adopted.

The WMP contains an implementation timetable and description of the method of implementation, and the anticipated costs and environmental benefits.

The waste minimisation program should not be a one-off activity. It should be periodically reviewed to ensure the WMP is being adhered to, and to identify any new waste minimisation opportunities.

The waste minimisation program should be an integral part of the company's approach to environmental management: it should be a key element when an environmental management system is established.

Further guidance on specific waste minimisation measures can be found in sections 5.2, 5.3 and 5.5.

More information can be found in:

- *Guidelines for Preparing Waste Assessments – A Practical Guide Towards Cleaner Production* (EPA Publication 277)
- *Guidelines for Preparation of Waste Management Plans* (EPA Publication 383)
- *Waste Minimisation, Assessments and Opportunities for Industry* (EPA Publication 351).

WASTE MINIMISATION

Objective

To minimise waste generation and maximise economic benefits.

Suggested measures

- Establish a management policy supporting waste minimisation.
- Establish a waste management team.
- Conduct a waste audit.
- Assess viable waste minimisation projects.
- Prepare and implement a WMP.
- Monitor and evaluate the effectiveness of the WMP.

5 ENVIRONMENTAL ELEMENTS

Environmental issues relating to the concrete batching industry – such as plant location, water quality, air quality, noise and solid waste – are set out in the following sections.

5.1 SITE CONSIDERATIONS

Concrete batching plants must be located in an area where they will not pose a hazard to the environment or the amenity of the local community.

Highly alkaline wastewater, dust emissions and noise are the key potential impacts associated with concrete batching plants. These problems need to be considered when planning new operations and major upgrades of existing sites. Plants should be located so that contaminated stormwater and process wastewater can be retained on-site. The land should not be flood-prone (it should have a flood average recurrence interval less than 100 years). These measures will help to ensure that wastewater is not discharged to waterways.

Dust problems can be minimised by siting the concrete batching plant out of prevailing high winds. The prevailing wind direction should be considered during the planning proposal, to ensure that bunkers and conveyors are sited in the leeward direction to minimise the effects of the wind. The provision of natural or artificial wind barriers – such as trees, fences and landforms – to help control the emission of dust from the plant should be considered during the planning process.

To protect amenity, buffers should be provided between batching plants and sensitive land uses. Buffers are designed to minimise any potential impacts due to accidental or fugitive air emissions. They assume that good control practices will be followed and do not eliminate the need for effective point source emission control.

A minimum buffer distance of 100 metres between batching plants and sensitive land uses is included in *Recommended Buffer Distances for Industrial Residual Air Emissions* (EPA Publication AQ 2/86 – as revised in July 1990). Sensitive land uses include residential areas and zones, hospitals, schools, caravan parks or other similar uses.

Access and exit routes for heavy transport vehicles should be planned to minimise impacts on the environment and amenity of the locality.

Thoughtful site selection and planning will mean fewer problems for future environmental management.

SITING

Objective

To minimise environmental impacts by appropriate site selection.

Suggested measures

- Batching plants should be sited on land that is not flood prone.
- Consider the current and future proximity of sensitive land uses.
- Establish and maintain buffer distances >100 metres.
- Provide vehicle access routes which minimise impacts.

5.2 WATER QUALITY

Potential pollutants in batching plant wastewater include cement, sand, aggregates and petroleum products. These substances can adversely affect the environment by:

- increasing soil and water pH
- increasing the turbidity of waterways (turbidity is a measure of the cloudiness of a suspension).

Increased turbidity results in less light entering an aquatic environment. This in turn affects the rate of photosynthesis by plants, and reduces the visibility of aquatic organisms. Turbidity can also clog fish gills, smother bottom feeding flora and fauna and generally decrease the amenity of an area.

Wastewater management – principles

Using the waste minimisation approach, the keys to avoiding adverse impacts on water quality are to minimise wastewater generation and to recycle the wastewater which is generated. These steps require that:

- the area of the site which generates contaminated stormwater is minimised
- separate dedicated drainage systems are provided for contaminated and clean stormwater
- all contaminated stormwater and process wastewater is collected and recycled.

Wastewater generation

The main sources of wastewater at batching plants are:

- contaminated stormwater runoff
- dust control sprinklers
- the agitator washout station
- the agitator charging station
- the slumping station
- cleaning and washing.

The site should be designed to minimise the areas which are contaminated with cement dust and thus have the potential to generate contaminated stormwater runoff.

Clean stormwater runoff – such as that from office buildings and staff car parks – should be separated from contaminated stormwater, or it will add to the volume of wastewater needing management. Separate drains should be provided for clean stormwater runoff.

All contaminated stormwater and process wastewater should be collected and retained on site. All sources of wastewater should be paved and bunded. (A bund is a small wall of concrete or another impervious material, similar to the curb beside a bitumen road. Bunds serve the dual purpose of ensuring all wastewater is captured and excluding clean stormwater runoff.)

The specific areas that should be paved and bunded include:

- the agitator washout area
- the truck washing area
- the concrete batching area
- any other area that may generate stormwater contaminated with cement dust or residues.

Wastewater capture and reuse

Contaminated stormwater and process wastewater should be captured and recycled by a system with the following specifications.

- The system's storage capacity must be sufficient to store the runoff from the bunded areas generated by 20 mm of rain.
- Water captured by the bunds should be diverted to a collection pit and then pumped to a storage tank for recycling.
- An outlet (overflow drain) in the bund, one metre upstream of the collection pit, should divert excess rainwater from the bunded area when the pit fills due to heavy rain (more than 20 mm of rain over 24 hours).
- Collection pits should contain a sloping sludge interceptor, to separate water and sediments. The sloping surface enables easy removal of sludge and sediments.
- Wastewater should be pumped from the collection pit to a recycling tank. The pit should have an primary pump triggered by a float switch and a backup pump which automatically activates if the primary fails.
- Collection pits should be provided with two visual alarms. The first should activate when the primary pump fails. The second should activate when water reaches the high level mark in the pit. Both alarms should activate warning devices on the operator's console.

Wastewater stored in the recycling tank needs to be reused at the ***earliest possible*** opportunity. This will restore the system's storage capacity, ready to deal with wastewater generated by the next rainfall event.

Many of the problems with wastewater management at batching plants have been caused by failure to recycle stored wastewater as quickly as possible. Uses for recycling tank water include concrete batching, spraying over stockpiles for dust control and washing out agitators.

If the water level exceeds the capacity of the recycling tank, the wastewater must be taken to a waste treater licensed by EPA for this type of waste.

As the wastewater system captures and recycles process water, wastewater must not be discharged from concrete batching plants in dry weather.

Runoff after heavy rainfall (more than 20 mm over 24 hours) contains very small quantities of wastes and is unlikely to pose a significant threat to the environment.

As specified in the *State Environment Protection Policy (Waters of Victoria)*, the pH of wet weather discharges must be in the range 6.0 to 9.0, and suspended solids must be less than 80 milligrams per litre.

Whenever wet weather discharges occur, they should be monitored for pH and suspended solids, and records retained. If unacceptable levels are found:

- an investigation should be carried out to determine the causes
- remedial actions should be identified and implemented.

Equipment and training should be provided, so that staff can carry out pH testing and take suspended solids samples for laboratory analysis (turbidity monitoring may also be used to provide an immediate indicator of discharge quality).

WATER QUALITY

Objective

To ensure contaminated wastewater is not discharged from the concrete batching plant to surface waters, groundwater or land.

Suggested measures

- Minimise the area of the site which generates contaminated stormwater runoff.
- Provide a separate dedicated drainage system to discharge clean stormwater from the site.
- Drain all contaminated stormwater and process wastewater to a collection pit for recycling.
- Regularly clean out solids that accumulate in the pit.
- The wastewater recycling system must be able to store the contaminated runoff generated by 20 mm of rain in 24 hours.
- Use wastewater stored in the recycling system at the earliest possible opportunity.
- There must be no dry weather wastewater discharges from the site.
- Monitor wet weather discharges for pH and suspended solids. Retain the records.

5.3 AIR QUALITY

Dust from cement, sand and aggregates is a pollutant. Fine dust particles can enter neighbouring premises and adversely affect amenity. Dust must be controlled so there are no significant emissions from the plant.

The following controls are consistent with those in Schedule F2 of the *State Environment Protection Policy (The Air Environment)*, but they include additional requirements which represent best practice.

Dust emission sources

Potential sources of dust pollution include:

- delivery of raw materials in trucks, trailers and tankers
- storage of raw materials in bunkers and stockpiles
- transfer of raw materials by front end loaders, conveyors, hoppers and agitators
- leakage or spillage of raw materials from silos, inspection covers and duct work.

The best way to avoid offsite dust problems is to prevent the release of the dust through good design and management techniques.

Ground pavement

The entire plant compound traversed by vehicles – including driveways leading into and out of the plant – should be paved with a hard, impervious material.

Unsealed surfaces should be protected with barriers to exclude vehicles. The pavement should be kept clean and dust-free. Spills and leaks must be contained and cleaned up immediately, before dust is generated.

Sand and aggregate stockpiles

Sand and aggregates should be delivered in a dampened state, using covered trucks. If the materials have dried out during transit they should be re-wetted before being dumped into the storage bunker.

Sand and aggregates should be stored in a hopper or bunker which shields the materials from winds. The bunker should enclose the stockpile on three sides. The walls should extend one metre above the height of the maximum quantity of raw material kept on site, and extend two metres beyond the front of the stockpile.

The hopper or bunker should be fitted with water sprays which keep the stored material damp at all times. Monitor the water content of the stockpile to ensure it is maintained in a damp condition.

If a combination of wall height and length coupled with water sprinklers is unable to contain the material, roofing and/or rubber entry curtains should be installed.

In-ground storage bunkers minimise dust emissions from stockpiles. Where these are filled by drive-over deliveries, the bunker should be shielded on two sides by shrouds or walls that are at least 0.5 metres high and extend the entire length of the bunker.

It is still essential to ensure the raw ingredients are damp on receipt and before they are delivered to the in-ground bunkers.

Overhead bins

Overhead storage bins should be totally enclosed. The swivel chute area and transfer point from the conveyor should also be enclosed.

Rubber curtain seals may be needed to protect the opening of the overhead bin from winds.

Conveyor belts and raw material transfer

Conveyor belts which are exposed to the wind and used for raw material transfer should be effectively enclosed, to ensure dust is not blown off the conveyor during transit.

Conveyor transfer points and hopper discharge areas should be fully enclosed. Double rubber curtain seals are recommended for transfer point outlets to prevent dust from raw materials escaping into the atmosphere.

Conveyor belts should be fitted with belt cleaners on the return side of the belt. It is important that any raw material collected by the belt cleaners is contained, so that dust is not discharged.

Aggregate weigh bins

Weigh hoppers at front end loader plants should be roofed and have weigh hoppers shrouded on three sides, to protect the contents from the wind. The raw materials transferred by the front end loader should be damp, as they are taken from a dampened stockpile.

Cement transfer and storage

Store cement in sealed, dust-tight storage silos. All hatches, inspection points and duct work should be dust-tight.

Cement should be delivered in sealed vehicles equipped for pneumatic transfer from the vehicle to the cement storage silo.

Any cement spills should be cleaned up as soon as they are detected.

Cement delivery

The silo feed pipe must be made of material able to withstand the effects of cement. The delivery pipes should be clearly labelled with the silo identification and material stored inside the silo. The silo delivery pipe should be kept locked at all times except when a delivery is in progress.

The infill pipe should be fitted with a fail-safe valve, which is 'tight shut-off', made of wear resistant materials, able to withstand high velocity product delivery. The valve should be located less than one metre above the fill point.

Silo over-fill protection

Silos should be equipped with a high level sensor alarm and an automatic delivery shut-down switch to prevent overfilling.

The high level alarm set point should be at a level which ensures the silo is not overfilled. The following points should be considered when setting the high level alarm:

- silo profile
- maximum fill rate
- the response time of the shut-down system
- volume of delivery vehicles.

An automatic shut-down switch should stop the flow of cement to the silo within 60 seconds of the high level alarm's activation.

Twin radio frequency probes are recommended for high level alarms. The silo over-fill protection system should incorporate a 30 minute reset time delay.

The high level alarm should be audible (or visual only, in areas sensitive to excess noise). There should be a test circuit to test the operation of the high level alarm sensor, which is tested before every delivery of cement to the silo.

Silo dust control

Cement dust emissions from the silo during filling operations must be minimised. The minimum acceptable performance is obtained using a fabric filter dust collector (FFDC). Equivalent or better performance using alternative dust control technology is acceptable.

Whichever technology is employed, it needs to be maintained properly, in accordance with the manufacture's instructions, to ensure adequate performance. A description of an adequate FFDC system follows.

Fabric filter dust collector (FFDC)

- The FFDC should be sized so that the dust collector bags are not subject to clogging. Install an appropriately sized multibag pulse jet filter in the silo, which is fitted and used in accordance with the manufacturer's recommendations. The cloth area of the filter must be adequate for the displaced air volume.
- The FFDC should be completely protected from the weather.
- The FFDC needs to be made of a material which can withstand continuous exposure to cement – such as polyester and polypropylene.
- The filter elements should be cleaned automatically at the end of the silo filling cycle. A source of high pressure, moisture- and oil-free air is required to operate the filters effectively.
- The FFDC should be able to withstand the maximum pressure differential which may be encountered. A differential pressure indicator should be fitted to an alarm to indicate bag filter pressure in excess of 1.0 kPa.
- Silos should be protected against internal pressures exceeding the design pressure. Positive type relief valves set at appropriate pressures should be installed. The relief valve should be ducted to a container on the ground, able to collect dust particles.
- The exhaust air from the silo filters should be ducted to a dust collection container on the ground. Confirm the exhaust discharge points are visible and monitored by the driver during silo filling operations. If dust is discharged from the duct work, the driver must immediately stop filling the silo.
- Burst bag detectors should be installed in all batching plants. The burst bag detector should be connected to the automatic silo overfill protection circuit to stop the flow of cement if a filter bag bursts.
- The FFDC should be inspected at least once a week and any necessary repairs carried out immediately.

Silo discharge

Silo discharge is controlled by an on/off valve. The valve is generally fitted above the weigh hopper. The control valve should be open air sprung, to close on failure of air pressure or electric power. The control valve should be fitted before (upstream of) any flexible joints in the pipe line and as close as possible to the silo outlet point at the base of the silo cone. This ensures that product can be stopped if a flexible joint fails. All flexible connections between the silo and the weigh hoppers must be sleeved in metal.

Silo discharge emergency shut-down

A back-up discharge emergency shut-down valve should be installed to ensure the flow of cement can be stopped if an emergency – such as failure of a flexible joint or failure of the discharge valve – occurs. The emergency shut-down valve should be similar in location and design to the silo discharge valve.

The plant operator should be able to shut-down product discharge by using an override button located at the silo operation area and from inside the control room. The emergency shut-down valve should operate with the silo discharge control valve. The two systems working in tandem provide extra security from accidental product discharge.

Cement weigh hoppers

Dust control

- Totally enclose the cement weigh hopper, to ensure that dust cannot escape to the atmosphere.
- The weigh hopper should be fitted with a dedicated FFDC, or equivalent dust control device, of similar design and specification to the dust control device installed to the silo.

Overfill protection

- Protect the weigh hopper against overfill by installing a radio frequency type high level alarm probe at the top of the hopper.
- The alarm should automatically shut-down the product delivery system to the weigh hopper.

Agitator loading bay

The load point must be fitted with either a:

- telescopic chute (preferred) or
- flexible sleeve.

The chute or sleeve needs to be long enough to enter agitator hatches. A flexible sleeve should be made of material capable of withstanding continuous exposure to concrete ingredients such as cement slurries and abrasive aggregates.

There must be no significant emission of dust particles from the load point. This can be achieved by installing water sprays in the perimeter of the load point, set to start automatically whenever a batch is discharged. Alternatively, an effective dust extraction system can be fitted to the load point.

Ensure the loading bay is roofed and enclosed on at least two sides. Flexible doors should be fitted to the open sides of the loading bay. A drive-through type bay with flexible doors at the entrance and exit is recommended.

It is important to ensure there is no leakage or spillage of cement during either the filling or dispensing of cement from the silo. Any cement product that escapes during the filling process must be cleaned up immediately.

Inspection program

An inspection of all dust control components should be performed routinely – for example, at least weekly. This will help identify any potential problems before a leak or spill occurs. The use of a checklist including the suggested requirements of this guide may be useful. Appendix 1 shows a checklist that can be used as the basis for the inspection.

Alternative technology

As previously noted, Schedule F2 of the *State Environment Protection Policy (The Air Environment)* sets out emission controls for concrete batching plants. However, the Policy allows EPA to exempt sites from compliance with Schedule F, subject to ambient objectives being met.

The Policy identifies the following matters as being relevant when considering exemptions:

- compliance with Schedule F would increase or create waste disposal problems
- compliance would preclude the use of energy saving technology or innovative controls
- compliance cannot be achieved by reasonably available technology
- maximum ground level concentrations will not be exceeded and the discharge will not adversely affect any beneficial use of the environment.

When considering an exemption, EPA will look at how effectively the proposed alternative technology will control emissions compared with the controls set out in Schedule F2.

AIR QUALITY

Objective

To avoid or substantially reduce dust emissions so there is no loss of amenity.

Suggested measures

- Keep sand and aggregates damp.
- Cover or enclose conveyor belts and hoppers.
- Keep pavements and surfaces clean.
- Fit cement silos with high level alarms, multibag pulse jet filters, airtight inspection hatches and automatic cutoff switches on the filler lines.
- Keep duct work airtight.
- Enclose the loading bay.
- Develop and implement an inspection regime for all dust control components.
- Clean up spills immediately.

5.4 NOISE EMISSIONS

Noise is a form of pollution and a potential source of conflict between the operators of a concrete batching plant and the local community. Noise emitted from a concrete batching plant must be managed as carefully as other discharges from the site. Batching plants in the Melbourne metropolitan area must comply with the *State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade) No. N-1*.

Because of the potential for noise to affect residential amenity, management should give high priority to liaising with the local community so that it can be aware of, and resolve, noise issues.

Definition of noise

Noise is unwanted sound. The disturbing effects of noise depend on the level of the noise and its character – such as tones, intermittency, and so on. Higher frequency tones are more disturbing than lower frequency tones, but lower frequency tones are not easily controlled and can penetrate buildings, such as houses. Noise can cause stress in both employees and neighbours of the plant.

Sound levels are measured in units of decibels, dB(A). The ‘A’ weighting of a measured sound level approximates how the human ear perceives sound. If a sound is intensified by 10 dB(A), human ears would perceive the sound to have doubled in loudness.

Noise sources at concrete batching plants

Major noise sources at batching plants include:

- truck and front end loader engine noise
- hydraulic pumps
- aggregate delivery to bunkers and hoppers
- conveyor belts
- air valves
- truck air brakes
- filters
- alarms
- amplified telephones
- public address system
- compressors
- swinging, scraping, loading devices
- opening and closing gates
- radios
- reverse warning devices.

Noise mitigation measures

Noise abatement can often be achieved by relatively simple measures such as:

- locating noisy equipment away from potential sources of conflict
- locating noisy equipment behind sound barriers or sound absorbers – for example, gravel stockpiles or constructed barriers
- using self cleaning weigh hoppers
- enclosing compressors and pumps
- fitting silencing devices to all pressure operated equipment
- lining hoppers with a sound absorbing material such as rubber
- sealing roads and plant site with concrete or bitumen
- positioning access and exit points away from noise sensitive areas
- fitting efficient muffling devices to all engines
- using visual alarms in preference to audible alarms
- using a personal paging service instead of hooters to gain attention of staff
- relocating sirens to face away from residences
- weighing fine aggregates before coarse aggregates
- ensuring that maintenance is conducted in enclosed sheds, away from sources of conflict
- ensuring an adequate buffer is kept between the plant and neighbours
- erecting screens and barriers to reduce noise transmission
- storing aggregates below ground level where possible
- limiting operations to between 7.00am and 6.00pm Monday to Friday, and 7.00am and 1.00pm on Saturday if other noise mitigation measures are inadequate.

Where noise abatement requires more detailed analysis and control, an acoustic consultant should be used.

Table 1: Typical noise limits for various types of land uses

	Noise limits dB(A)		
Land use	**M-F 7am-6pm* Sat 7am-1pm***	**All nights 10pm-7am**	**All other times**
Quiet rural areas	45	32	37
Mainly residential	50-54	39-43	44-48
Residential, commercial and industrial	54-59	39-43	48-52
Commercial and industrial	56-59	47-52	58-52
Industrial	63-68	52-56	57-61

* Excludes public holidays.

NOISE

Objective

To ensure no noise nuisance results from the facility.

Suggested measures

- Liaise with the local community to identify noise issues.
- Select quieter equipment.
- Alter or enclose equipment to reduce noise at the source.
- Use sound absorbing materials to prevent the spread of noise by isolating the source.
- Ensure hooters are used for emergencies only.
- Avoid public address systems for paging staff.

5.5 SOLID WASTES

The main solid waste generated by batching plants is waste concrete. Waste minimisation is the preferred approach to dealing with this problem. Careful matching of orders with production could minimise the need to return unused concrete to the batching plant.

It may be possible to use waste concrete for construction purposes at the batching plant. If this is not possible, direct the waste concrete to a fully enclosed pit where it can be dried and collected. It should then be reused, or taken to a recycling facility or licensed landfill site. Producers should satisfy themselves the reuse of such wastes avoids adverse environmental impacts – for example, any reuse as a road base or other beneficial use must avoid situations where there can be significant runoff.

Concrete agitator mixers and chutes must not be rinsed out to the stormwater system or roadways. It may be possible to add water and agitate the mixer during the return trip to the plant – making cleaning easier and enabling excess material to be reused.

It is recommended the driver of the agitator mixer obtain a signature from the purchaser declaring the amount of concrete received. This can be compared with the batch amount originally delivered. All concrete should be accounted for, to ensure proper disposal of the waste product.

Aluminium cans, glass bottles, paper, other office waste and packaging materials such as plastic and cardboard should be considered in the waste minimisation program. Recycling of these materials is part of best practice.

SOLID WASTE REDUCTION

Objective

To minimise solid waste generation and to reuse/recycle wherever possible.

Suggested measures

- Investigate ways to minimise the generation of waste concrete.
- Investigate ways to recycle excess material from agitators.
- Include solid waste streams in the WMP.
- Establish recycling programs for aluminium cans, glass bottles, packaging materials, cardboard and office paper.

6 ENVIRONMENTAL MANAGEMENT

A concrete batching plant must be well managed if it is to achieve consistently sound environmental performance. This is best done by an environmental management system (EMS), which is part of best practice.

6.1 ELEMENTS OF AN EMS

An EMS can be part of a wider quality management system. The EMS and (if applicable) the quality management system may use the International Standards ISO 14001 and ISO 9001 respectively, as guides to good management systems.

Key elements of an EMS are outlined below.

Management commitment

It is essential that senior management demonstrates its commitment to an environmental policy and that the policy is communicated to all staff. The policy should contain clear objectives detailing what the policy aims to achieve. The policy must be evaluated and reviewed regularly.

Environmental review and improvement plan

A thorough review of the plant's environmental impacts should be carried out. A plan – which includes specific objectives and targets – to reduce impacts can then be prepared.

Use *Section 5* as a guide to the range of environmental impacts associated with batching plants and ways to reduce them. *Appendix 1* sets out a checklist which can be used during the review.

Mechanisms to implement improvements

The management system should address responsibilities, communication processes, document control and operational procedures.

A manager at the plant should have the skills, authority and accountability to deal with environmental issues.

Maintenance and monitoring

Systems should be established to regularly maintain operations, and to monitor and review environmental performance. This should include the following.

Water quality

- Bund integrity
- Efficiency of the pumps in the collection pit
- Operation of the warning devices and alarms in the collection pit
- Confirm the collection pit is maintained to ensure adequate capacity is available when rain falls
- Check there is no dry weather flow to storm water
- pH and suspended solids are monitored and recorded during offsite discharges

Air quality

- Aggregates and sand are kept damp
- Pavements and other surfaces are not dust sources
- Warning devices and alarms systems are operating correctly
- Dust control devices are properly maintained and working correctly
- Duct work is airtight

Noise emissions

- Monitor noise impact on the neighbourhood.
- Maintain equipment.

System reviews

The EMS should be regularly reviewed to verify performance and identify areas for improvement.

Commitment to continuous improvement

The principle of continuous improvement is an integral part of good environmental management.

The development and implementation of an EMS is an essential part of best practice. Larger companies which operate a number of sites can develop a company-wide EMS which applies to all sites.

6.2 COMMUNITY LIAISON

A well managed facility should have an open attitude to the community. Industry should establish mechanisms and procedures to liaise with the community on a continuing basis. The scale of this liaison should reflect the impact of the site, the proximity of sensitive land uses and the level of community interest.

A key part of sound community liaison is an effective system to respond to complaints. It is important to document each complaint. The proforma in *Appendix 2* can be used.

The document should include the name and address of the complainant, time and date of the incident. The document must clearly state the problem or complaint, the outcome of the resulting investigation, solutions to the problem and the name of the person dealing with the complaint.

ENVIRONMENTAL MANAGEMENT

Objective

To achieve a consistently high level of environmental performance by good management of the operation.

Suggested measures

- Obtain a commitment to sound environmental management from senior company staff.
- Have an EMS.
- Carry out regular environmental audits which extend to all activities at the site.
- Establish mechanisms for continuing liaison with the community.

APPENDIX 1: ENVIRONMENTAL PERFORMANCE CHECKLIST FOR CONCRETE BATCHING PLANTS

SITING OF THE PLANT

Issue	Requirement
Buffer zone	At least 100 metre buffer between plant and residential zone.
Groundwater	No shallow groundwater in the plant's vicinity.
Winds	Bunkers located out of prevailing winds.
Access	Plant access minimises potential impacts on amenity.
Amenity	Batching plant does not detract from local amenity.

WATER QUALITY

Issue	Requirement
Paving	All working areas are paved in hard non-porous surface.
Bunding	Bunding is able to contain runoff.
Collection pit and recycle tank	Primary and secondary pumps fitted to collection pit.
	Excess water pumped to recycle tank.
	Collection pit empty of water, sand and gravel.
	Level controls working properly.
	Recycle tank large enough to store runoff from 20 mm rainfall event.
Monitoring offsite discharges	Visual alarms on console – to indicate when water is discharged from site – are installed and operable
	pH of offsite wastewater discharges between 6.0 and 9.0.
	Suspended solids levels of wastewater discharges less than 80 mg/L.
Fuel and chemical storage	Chemicals and fuels are stored in a dedicated and adequately protected store.
	Bund around the storage facility is adequate.
	Material Safety Data Sheet available for all chemicals.
	Underground storage tanks tested in accordance with applicable Regulations.

AIR QUALITY

Issue	Requirement
Aggregates	Aggregates are damp at all times.
	Wind shields are in place and offer adequate protection from the wind.
Silos	Filler caps are clearly identified and capped.
	Filler cut-off valve is installed and operating.
	High level alarms are installed and operating.
	Adequate test circuit.
	Hatches are air-tight.
	Dipping points are air-tight.
	Filter vents and silo protection valves are ducted to a ground level collection point.
	Cement discharge valves have fail-safe actuators.
	Flexible joints downstream of valves.
Conveyors	Conveyors covered and protected from winds.
	Transfer points fully enclosed.
	Conveyor spillage control provided.
	Conveyors fitted with belt cleaners.
Filters	Filter system in correct operating condition (service and maintenance records complete).
Weigh hoppers	Separate filters on cement silo and weigh hoppers.
	Overfill protection installed and operational.
Emergency shut-down	Emergency shut-down system operates from console and silo delivery point.
Loading bay	Loading bay is enclosed.

NOISE EMISSIONS

Issue	Requirement
Process equipment	Noisy equipment fitted with suitable enclosures.
	No excess noise emissions apparent.
Warning devices	No excess noise emissions apparent.

SOLID WASTE MANAGEMENT

Issue	Requirement
Waste concrete	All concrete wastes should be returned to the plant.
	Concrete waste return and disposal are monitored and documented.
	Waste concrete is reclaimed or recycled.
	Wastes disposed in storage pit, dried, then removed for recycling or to a licensed landfill.

ENVIRONMENTAL MANAGEMENT

Issue	Requirement
Waste minimisation	WMP developed and implemented.
EMS	Environmental policy developed and widely disseminated to staff.
	EMS developed, implemented and continuously reviewed.
Community liaison	Complaints are recorded, investigated and the complainant is advised of the outcome.
	Mechanisms are in place for community liaison.

APPENDIX 2: ENVIRONMENTAL COMPLAINT OR INCIDENT REPORT

COMPANY NAME: ....

ENVIRONMENTAL INCIDENT OR COMPLAINT REPORT	**Report Nos:** ....
Location: .... Date:	
Incident/Complaint Details:	
Reported by (PRINT): .... Signed:	
Complainant Name: .... Telephone Nos:	
Address:	

Incident Ranking (indicate which applies (x))
(EPA notification required for Level 2 to 4; company to nominate officer)

Level 1	**Level 2**	**Level 3**	**Level 4**
• Minor incident. • No external activity required. • Instigate clean up as appropriate. • Complete report.	• External contact made (regulator or neighbour) – for example, dust, noise, water, pollution. • Verbally report details to a more senior officer of the company. • Complete report within two days.	• Clean up or potential costs to exceed $5,000. • Immediately report details verbally to a more senior officer of the company. • Complete this report within stipulated timeframe.	• Clean-up or potential costs to exceed $50,000. • Immediately report details verbally to a more senior officer of the company and CEO. • Await directions from those advised.

CORRECTIVE ACTION/S
Short Term: ....
....
....
Long Term: ....
....
....
VERIFICATION OF EFFECTIVENESS OF CORRECTIVE ACTION
Reporting Officer: .... Date:
Senior Officer: .... Date:
Environmental Officer: .... Date:

REFERENCES

AS 3901/ISO 9001, *Quality Systems for Design, Development, Production, Installation and Servicing*

Guidelines for Preparation of Waste Management Plans, EPA Publication 383, August 1993

Guidelines for Preparing Waste Assessments – A Practical Guide Towards Cleaner Production, EPA Publication 277, October 1994

ISO 14001, *Environmental Management Systems – Specification with Guidance for Use*

Recommended Buffer Distances for Industrial Residual Air Emissions, EPA Publication AQ 2/86, July 1990

Technical Guidelines: Concrete Batching Plants, EPA Publication TG 204/91, September 1991

Waste Minimisation, Assessments and Opportunities for Industry, EPA Publication 351, July 1993

Industrial waste management policy

Industrial Waste Management Policy (Waste Minimisation) 1990.

State environment protection policies

State Environment Protection Policy (The Air Environment) (particularly Schedule F2).

State Environment Protection Policy (Groundwaters of Victoria)

State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade).

State Environment Protection Policy (The Waters of Victoria).

State Government Victoria

EPA Publication 628