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DEFINITIONS

DM	Dubai Municipality
DWC	Dubai World Centre
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
EMS	Environmental Management System
FFDC	Fabric Filter Dust Collector
HGV	Heavy Goods Vehicles
IFC	International Finance Corporation
NSR	Noise Sensitive Receivers
TG	Technical Guideline
UAE	United Arab Emirates
WHO	World Health Organisation
WMP	Waste Management Plan

1. Objective

1.1 Purpose of Document

This guideline establishes a set of standards for the establishment and operation of concrete batching plants. This Guideline is intended for use by Contractors during the construction of the Dubai World Centre (DWC).

These Guidelines must be read in conjunction with the '*Dubai World Central. Construction Environmental Management Guidelines (CEMP)*'. The Guidelines are designed to complement the CEMP.

The Contractor should be aware that these guidelines do not supersede the environmental regulations within Dubai Municipality (DM). Compliance with DM environmental regulations, the Construction Environmental Management Plan and these guidelines is expected to be demonstrated within the Environmental Management System (EMS) to be prepared by the Contractor.

The guidelines provide DWC and the contractors with a mechanism to ensure concrete batching plans achieve the required environmental standards in line with the Dubai Municipality Environmental Department Technical Guideline Number 42 '*Requirements for Concrete Batching Plants'* (TG 42) as well as other Dubai Municipality (DM) guidelines and standards.

However, at the request of DWC, these guidelines are intended to promote good international practice and therefore, in some instances, go beyond the requirements of TG 42.

The guidelines require the Contractor to develop Site Plans and an operational EMS for the operation of the concrete batching plant over the life time of its function. The Site Plans and EMS will be reviewed and approved by the Principal Consultant.

1.2 Responsibilities

1.2.1 Contractor

- The Contractor must comply with the requirements of these guidelines.
- These guidelines do not however, negate the Contractors responsibility to comply with the laws and regulations of the UAE and DM, as well as any additional requirements placed on the contractor through the provisions of the Construction Environmental Management Plan for DWC.
- Applicable regulations and standards are covered within these guidelines. The responsibility for any obtaining any approvals or permits rests with the Contractor.
- The Contractor shall identify personnel that will be responsible for the implementation of these guidelines and the monitoring of the operations of these plants to ensure they remain compliant with these guidelines. These personnel will be approved by the Principal Consultant.
- Copies of the Site Plan and the EMS are to be kept on site at all times. No changes to the site layout can be made by the Contractor until written approval has been granted by the Principal Consultant. The Contractor must submit any revised site plans and a written explanation as to why the changes are required.
- The Contractor is required to self audit the site once every 40 days.
- The Contractor will monitor the site to ensure emissions arising from activities on the site remain within DM or international best practice guidelines.
- The Contractor must submit as part of the EMS a monitoring plan outlining how this will be achieved.
- Monitoring of the site must be continuous with the results of the monitoring to be submitted to the Principal Consultant on a monthly basis.

1.2.2 Principal Consultant

- The Principal Consultant will approve the Site Plan and the EMS for each concrete batching plant to be installed onsite prior to commencement of operations.
- Any changes to the site layout can only be implemented upon approval by the Principal Consultant.

- The Principal Consultant will undertake monitoring independent of the Contractor. This will be on a quarterly basis.

2. Approach

In the preparation of these guidelines, the precautionary principle has been invoked, and the guidelines prohibit any item or activity that may contribute or cause a significant environmental impact. The Guidelines adopts international best practices as well as applicable environmental standards from DM.

Poorly managed concrete batching plants have the potential to discharge highly alkaline wastewater, dust and excessive noise levels. The guidelines provide the Contractor with:

- An outline of the potential impacts generated by concrete batching operations and their impacts on particular environmental attributes.
- Environmental performance objectives for each environmental attribute.
- Measures to avoid adverse environmental impacts.
- Sufficient flexibility to meet the environmental objectives by other measures, as long as they achieve equivalent outcomes.

These guidelines will assist the Contractor in their operation of concrete batching plants to:

- Comply with the legislative requirements of DM and the UAE.
- Use and maintain appropriate technology to minimise the impact of their operations on the environment.
- Identify potential environmental problems and to monitor and resolve these problems.
- Understand their plant management responsibilities.

The implementation of these guidelines may also result in:

- Reduction in unit costs.
- 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).

3. How to Use the Guideline

The Guideline is divided between the key environmental impacts that the Contractor is expected to manage.

Section 4 outlines the objectives for environmental management for each attribute, and where applicable any environmental standards that should be meet. This is followed by suggested methods to achieve these objectives.

Section 5 outlines the requirements for the EMS that the contractor must submit to the Principal Consultant.

The Contractor will compile the EMS and site plans for submission to the Principal Consultant who will approve or supply comments for improvement within 5 working days of receipt of the documents.

The EMS must follow the guidelines contained within Section 5. The site plans must contain as a minimum:

- All components of the concrete batching plant on the site.
- North point.
- Scale.
- Topography.
- Access roads.

4. Guidelines

4.1 Site Selection

4.1.1 Objective

To minimise environmental impacts by appropriate site selection to ensure any concrete batching plants are located away from any sensitive environmental receptors or surrounding populations/ settlements.

The layout must be designed to site all activities generating waste water and runoff (excluding sewage) in one area which can be bunded to allow for collection of runoff for treatment and reuse.

4.1.2 Suggested Measures

Mitigation measures will be required to eliminate or reduce adverse impacts resulting from the construction and operation of the batching plant. Suggested measures include:

- 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.

Wastewater with an elevated alkaline content, dust emissions and elevated noise levels are the key potential impacts associated with concrete batching plants. These impacts must be taken into account when locating any concrete batching plants.

The batching plants should be located to ensure contaminated stormwater and process wastewater is retained onsite for treatment and reuse or disposal. The site should not be prone to flooding of any kind.

The impacts of dust on surrounding populations can be minimised by siting the concrete batching plant downwind or leeward of the prevailing winds to any such sensitive receptors.

Natural or existing artificial wind barriers (fences/ barriers) can be employed to help control the spread of dust emissions, especially fugitive dust.

A minimum buffer distance of 100 metres between batching plants and sensitive land uses is recommended. Sensitive land uses include residential areas and zones, hospitals, schools etc.

Such buffers do not eliminate the need for effective point source emission control.

Access and exit routes for heavy goods vehicles (HGV) should be planned to minimise impacts on the environment and amenity of the surrounding areas. The Environmental Management System should include measures to ensure regular inspection/cleaning of all access roads.

4.2 Air Quality

The Contractor must avoid or reduce dust emission from the site.

4.2.1 Standards

The Contractor must comply with DM Environmental Technical Guideline No. 42 '*Requirements for Concrete Batching Plants'*.

In addition to TG 42, the contractor must ensure all emissions comply with the Allowable Emission Limits from Stationery Sources defined in DM Information Bulletin 05 (2003).

4.2.2 Source of Impact

Potential dust emission sources can 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.
- The leakage or spillage of raw materials from silos, inspection covers and duct work.
- Exhausts from trucks, plant and any other machinery burning hydrocarbon based fuels.

4.2.3 Mitigation

Mitigation depends on the activities carried out by the Contractor. Possible mitigation measures can include:

- Keeping sand and aggregates damp.
- Cover or enclose conveyor belts and hoppers.
- Keep pavements and surfaces clean.
- Fit cement silos with high level alarms, airtight inspection hatches and automatic cut-off 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.
- Provide sufficient lighting near cement and/or fly ash silo filter exhausts to observe visible emissions performance during fills that occur during non-daylight hours.

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 the wind. The bunker should enclose the stockpile on three sides, with the opening on the leeward side. 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. The water content of the stockpile should be monitored to ensure it is maintained in a damp condition.

An alternative to continuous watering of the stockpile is the installation of roofing and entry curtains.

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. Conveyor transfer points and hopper discharge areas should be fully enclosed. Curtain seals are recommended for transfer point outlets to prevent dust emissions.

Conveyor belts should be fitted with belt cleaners on the return side of the belt. Any raw material collected by the belt cleaners needs to be contained.

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 dampened if not already from a dampened stockpile.

Cement Transfer and Storage

Cement should be stored in sealed, air tight storage silos. All hatches, inspection points and duct work should be air tight. Cement should be delivered in sealed vehicles equipped with pneumatic transfer systems from the vehicle to the cement storage silo.

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

Cement Delivery

Cement 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. 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 shutdown switch to prevent overfilling. The high level alarm set point should be at a level which ensures the silo is not overfilled.

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.

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). Alternative dust control technology can be used as long as equivalent or better performance is achieved.

Equipment needs to be maintained properly, in accordance with manufacture's instructions to ensure appropriate performance. A description of an adequate FFDC system follows:

- 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 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 should be controlled by an on/off valve. The control valve should be open air sprung, to close on failure of air pressure or electric power. The control valve should be fitted 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 to ensure product can be stopped if a flexible joint fails. All flexible connections between the silo and the weigh hoppers should 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 occurs (i.e. failure of a flexible joint, failure of the discharge valve).

The plant operator should also 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 shutdown 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 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 alkaline 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.

The loading bay should be 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.

Wheel Wash

- Design wheel washes to account for the maximum extended tire length expected
- Locate wheel washes in an area that provides a sufficient track-out distance before exit from the property
- Minimize off-property track-out by providing a large aggregate or paved roadway immediately after the wheel wash within property boundaries
- Install motion sensor on wheel wash units to provide water only on-demand

4.2.4 Monitoring

The Contractor is required to undertake monitoring of the site to ensure dust emissions are within limits as stipulated in TG 42 and the IFC EHS Guidelines on Air Emissions and Ambient Air Quality. The Contractor can refer to this document for guidance on monitoring.

In addition, an inspection of all dust control components should be performed routinely, at least weekly. This will help identify any potential problems before a leak or spill occurs. Record date and time of all inspections and note any required corrective action. The use of a checklist including the suggested requirements of this guide may be useful.

Regular alarm tests and emergency response drills should be undertaken on a monthly basis. Section 6 shows a checklist that can be used as the basis for the inspection.

The Monitoring Plan shall be included in the EMS and will be approved by the Principal Consultant. Results of the monitoring shall be submitted monthly for review by the Principal Consultant.

4.3 Runoff and Waste Water

The Contractor must ensure contaminated wastewater is not discharged from the site to surface waters, groundwater or land. This includes runoff and industrial water.

4.3.1 Standards

The Contractor should ensure they comply with DM *Technical Guideline No. 13 'Industrial Waste Water Disposal'* (Revised October 1997).

In addition to TG 13, the contractor must ensure all emissions comply with the IFC Environmental, Health and Safety (EHS) Guidelines relating to Wastewater and Ambient Water Quality. The Contractor must ensure emissions do not result in pollution concentrations that reach or exceed relevant ambient quality guidelines.

4.3.2 Source of Impact

Potential pollutants in batching plant wastewater include:

- Cement
- Sand
- Aggregates
- Petroleum products

These substances can adversely affect water quality in the receiving environment by increasing the pH in soil and water as well as the turbidity of any receiving waters, and by contaminating water and sediments with hydrocarbons.

The main sources of wastewater generation at batching plants are:

- stormwater runoff
- dust control sprinklers
- agitator washout station
- agitator charging station
- slumping station
- cleaning and washing of equipment

4.3.3 Mitigation

The Contractor must minimise the area of the site which generates contaminated stormwater runoff. This will mean creating a dedicated area in which waste water will be generated. This will be bunded to contain wastewater within the area. Within this dedicated area, the Contractor will be provided to:

- Drain all contaminated stormwater and process wastewater to a collection pit for recycling.
- Regularly clean out solids that accumulate in the pit. Ensure these solids are disposed off to an appropriate facility.
- The wastewater recycling system must be able to store the contaminated runoff generated over a 24 hour period and be sufficient to contain spills from any storage facilities on site.
- Use wastewater stored in the recycling system at the earliest possible opportunity.
- Monitor wet weather discharges for pH and suspended solids. Retain the records.

The best approach to avoiding adverse impacts on water quality is to avoid or reduce wastewater generation. This can be achieved through:

- Minimising the area of the site which generates contaminated stormwater.
- Wherever possible, collect and recycle contaminated stormwater and process wastewater.

The site should be designed to minimise the areas which are contaminated with cement dust as well as any other potential pollutants (oil, grease etc.) to avoid/ reduce the potential to generate contaminated stormwater runoff.

The area generating wastewater should be paved and bunded. All bunds should be walled and made of concrete or another impervious material. The specific areas that should be paved and bunded include:

- agitator washout area,
- truck washing area,
- concrete batching area, and
- any other area that may generate contaminated stormwater.

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 runoff from all bunded areas generated over a 24 hour period.

- 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 any excess runoff from the bunded area when the pit fills due to heavy flows (i.e. spills) to an overflow pit.
- 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 a primary pump triggered by a float switch and a backup pump which automatically activates if the primary pump 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.

Stored wastewater should be reused at the earliest possible opportunity. This will help maintain the system's storage capacity. Uses for recycling tank water include:

- Concrete batching.
- Spraying over stockpiles for dust control.
- Washing agitators.

If the water level exceeds the capacity of the recycling tank, the wastewater must be taken to an appropriate facility for treatment and disposal.

4.3.4 Monitoring

The Contractor is required to undertake monitoring of the site to ensure wastewater is controlled as per DM *Technical Guideline No. 13 'Industrial Waste Water Disposal'* and is inline with the EHS Guidelines relating to Wastewater and Ambient Water Quality.

The Monitoring Plan shall be included in the EMS and will be approved by the Principal Consultant. Results of the monitoring shall be submitted monthly for review by the Principal Consultant.

4.4 Noise Emissions

The Contractor must ensure no noise impacts from the concrete batching plant are avoided or reduced to an acceptable level wherever possible.

4.4.1 Standards

Under 'Local order No. 61 of 1991 on the Environmental Protection Regulation in the Emirate of Dubai', Article 75 states '*that it is the duty of the occupier of any premises or person operating mechanical devices etc. to adopt the best practicable means of ensuring that the emission of noise from the premises does not exceed 55 decibel during the period 7am to 8pm and 45 decibels during the period between 8pm to 7am'*.

4.4.2 Source of Impact

The definition of noise is unwanted sound, the impact depends upon the level of the noise and its character (i.e. tones, intermittency). Higher frequency tones are more disturbing than those of a lower frequency, but lower frequency tones are not easily controlled and can penetrate buildings.

Noise can cause stress in both employees and neighbouring populations. 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.

4.4.3 Mitigation

- Select quiet equipment that complies with the above standards.
- 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.
- Controlled operating hours for noisy activities such as deliveries, loading, unloading etc.

The contractor should investigate noise mitigation which can be achieved by relatively simple measures such as:

- locating noisy equipment away from Noise Sensitive Receivers (NSRs),
- locating noisy equipment behind sound barriers or sound absorbers, i.e. 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,

- relocating sirens to face away from residences,
- weighing fine aggregates before coarse aggregates,
- ensuring that maintenance is conducted in enclosed sheds, away from NSR's,
- ensuring an adequate buffer is kept between the plant and NSR's,
- erecting screens and barriers to reduce noise transmission, and
- storing aggregates below ground level where possible.

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

4.4.4 Monitoring

The Contractor is required to undertake monitoring of the site to ensure noise generated at the site is in accordance with Local order No. 61 of 1991 on the Environmental Protection Regulation in the Emirate of Dubai', Article 75.

The Monitoring Plan shall be included in the EMS and will be approved by the Principal Consultant. Results of the monitoring shall be submitted monthly for review by the Principal Consultant.

4.5 Waste Management

The Contractor must minimise solid waste generation, reuse or recycle wastes wherever possible, and ensure appropriate treatment and disposal of any generated solid waste.

4.5.1 Standards

The Contractor must comply with the DM Environmental Technical Guideline No. 42 '*Requirements for Concrete Batching Plants'* requirements for wastewater reuse.

In addition to ETG 42, the Contractor must also comply with Local Order No. 7 (2002) '*Management of Waste Disposal Sites'*.

4.5.2 Source of Impact

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 will minimise the need to return unused concrete to the batching plant.

4.5.3 Mitigation

The contractor must:

- 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.

It may be possible to use waste concrete for construction purposes at the batching plant. If this is not possible, waste concrete should directed 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.

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.

Waste Minimisation

In the concrete batching industry, waste minimisation principles can be applied to all inputs including water, cement, and aggregates. Achieving waste minimisation relies on good housekeeping practices and contractor attitudes, as well as technical factors. The potential impact of simple measures should not be underestimated i.e. reducing the volume of water used during washouts may significantly reduce waste generation.

A Waste Management Plan (WMP) should be prepared by the contractor as part of the overall EMS. The first step is preparing the WMP is undertaking a waste audit to identify all sources, types and quantities of wastes generated by a concrete batching plant. This audit should:

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

After the audit, a waste assessment should be undertaken which involves identifying options available to minimise each waste streams looking at both technical and economic feasibility.

The WMP should be regularly audited to ensure any requirements are being adhered to and to identify any new waste minimisation opportunities.

4.5.4 Monitoring

The Contractor is required to undertake monitoring of the site and activities to ensure waste management at the site is in accordance with Environmental Technical Guideline No. 42 '*Requirements for Concrete Batching Plants'* and Local Order No. 7 (2002) '*Management of Waste Disposal Sites'*.

The Monitoring Plan shall be included in the EMS and will be approved by the Principal Consultant. Results of the monitoring shall be submitted monthly for review by the Principal Consultant.

5. Operational Environmental Management System

A concrete batching plant must be well managed if it is to achieve consistently sound environmental performance. This is best done by the development and implementation of an operational Environmental Management System (EMS).

5.1 Elements of the EMS

An EMS can be part of a wider quality management system. Key elements of an EMS are outlined below.

Environmental Review and Improvement Plan

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

Use Section 4 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 EMS 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 as per Section 4 above.

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.

6. References

Dubai Municipality Information Bulletin 05 (2003)

Dubai Municipality Environmental Department. Technical Guideline No. 42 'Requirements for Concrete Batching Plants.'

Dubai Municipality Technical Guideline No. 13 'Industrial Waste Water Disposal' (Revised October 1997).

Environment Protection Authority, State Government of Victoria. 'Environmental Guidelines for the Concrete Batching Industry.' June 1998.

IFC Environmental, Health and Safety (EHS) Guidelines relating to Wastewater and Ambient Water Quality

Local Order No. 61 of 1991 on the Environmental Protection Regulation in the Emirate of Dubai'.

Local Order No. 7 (2002) 'Management of Waste Disposal Sites'.