

Guidelines: Cement Works

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11.1 Introduction

Cement is a finely ground, non-metallic, inorganic powder when mixed with water forms a paste that sets and hardens. This hydraulic hardening is primarily due to the formation of calcium silicate hydrates as a result of the reaction between mixing water and the constituents of the cement. In the case of aluminous cements hydraulic hardening involves the formation of calcium aluminum hydrates.

Cement is a basic material for building and civil engineering construction. In Europe, the use of cement and concrete (a mixture of cement, aggregates, sand and water) in large civic works can be traced back to antiquity. Portland cement, the most widely used cement in concrete construction, was patented in 1824. Output from the cement industry is directly related to the state of the construction business in general and therefore tracks the overall economic situation closely.

The world's five largest cement producers are the four West European groups; Holderbank, Lafarge, Heidelberger and Italcementi, together with Cemex from Mexico. Apart from producing cement, these companies have also diversified into several other building materials sub-sectors such as aggregates, concrete products, plasterboard, etc.

These notes apply to works in which:

- Cement clinker is produced; or
- Cement clinker is handled and ground; or
- Ground cement is packed, or loaded into vehicles in bulk

The definition above includes the handling, storing and processing of raw materials used in cement works.

11.2 Sampling, Measurement of Emissions and Monitoring

- As part of proper supervision, the owners shall make tests and inspections of the process to ensure that the equipment is achieving the required results. The results of tests and inspections shall be recorded for examination by the Authority representative.
- Emissions of particulate matter from kilns and clinker coolers and any other outlet considered by the Authority to be significant, shall be continuously monitored, preferably by optical density measurement.
- Check tests shall be carried out at least once every six months on chimney emissions monitored continuously, to ensure that the calibration has not changed.

11.3 Emission Limits and Controls

- The concentration of particulate matter in emissions to the air from kiln waste gases shall not exceed fifty (50) mg/m³, in normal operation.
- The concentration of particulate matter in emissions to air from all other contained sources shall not exceed fifty (50) mg/m³, in normal operation.
- The concentration of hydrogen sulfide in kiln exhaust gases shall normally be absent and in any case shall not exceed five (5) ppm (v/v).
- The oxygen content of the kiln waste gases shall be controlled so as not to fall below 1.5% oxygen.
- The kiln waste gases shall be maintained free from visible smoke and in any case not more than fifty (50) mg/m³.
- Fugitive dust from miscellaneous operations shall be substantially free from visible emissions as judged with the naked eye.

11.4 Miscellaneous Cement Works Operations

- Roads and operating areas shall not be of interlock bricks but be hard surfaced and kept clean, and high standards of housekeeping shall be maintained throughout the works.
- Operations such as clinker cooling, grinding, handling and storage, and cement packing, bulk loading and storage, shall be fitted with filters to prevent emissions of dust. Bulk storage silos shall be vented to air through bag filters.
- Special attention shall be paid to methods of handling if and when clinker has to be stored temporarily in the open in an emergency in order to minimize dust emissions.
- All transfer points shall be fully enclosed. The enclosures from all sides with the provision for access doors, which shall be kept, closed during operation. Spillages should be periodically removed.
- Airborne dust at all transfer operations / points should be controlled either by spraying water or by extracting to bag filter. Either water spray system should be provided for suppressing the air borne dust or dry extraction cum bag filter with adequate extraction volume.
- Water should be periodically sprayed on the stockpiles so as to retain some moisture in the top layer. Spray sufficient quantity of water to moist the top layer to avoid wind blowing of fines.
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- Conveyors above ground shall be enclosed or fitted with wind-boards to prevent wind-whipping and where dusty materials are being conveyed shall be enclosed and fitted with dust extraction and filtration equipment at changeover points.
- Collected dust shall be disposed of in a manner which is harmless and inoffensive.

- Vehicle speeds in the works should be limited to ten (10) kilometers/hour and downward pointing exhausts should be discouraged.
- An adequate supply of essential spares should be held and duplicate equipment should be installed whenever practicable and necessary to maintain continuity of operations whilst minimizing emissions to air.

11.5 Chimneys

The minimum height of a new chimney for kiln waste gases shall be sixty (60) meters and not less than the heights shown below, as extrapolated for intermediate throughputs.

CLINKER THROUGHPUT TPH	DRY PROCESS (meters)
30	60
60	73
90	85
120	94
240	126

The chimney height so obtained might need to be further adjusted to take care of exceptional local circumstances.

Chimneys should be adequately insulated to avoid condensation on inner surfaces which may lead to the emissions of agglomerates.

11.6 Control of Fugitive Emissions

- Clinker Open Storage Section
 - ⇒ Air borne fines extracted from clinker cooler shall be separated and sent to last possible destination directly or safely disposed. The unit may need to add on / install necessary

provisions for separating fine particulates from the clinker cooler collection. Fines separation may be achieved by passing collected dust through cyclone, the fines escaping cyclone to be separated, cyclone collection (coarse particles) could be recycled. The fines shall be recycled to the last possible destination (like clinker day silo) suitable or safely disposed.

- ⇒ Provide cover on stockpiles. During the period when the stockpile is inactive, it should be covered fully by HDPE or tarpaulin type sheets to prevent wind blowing of fugitive dust.
 - ⇒ Provide windbreak walls or greenbelt on three sides of open stock piles. Install three sided enclosures with walls with less than 50% porosity, which extend to average height of the stockpile.
 - ⇒ Provide partial enclosure for retrieving area. Flexible type wind breaking enclosure should be provided covering the clinker retrieval area as wind barrier to prevent dusty carry over wind. The enclosure could be of lightweight material like molded plastic material or similar, which could be dismantled / assembled and shifted from one place to other.
 - ⇒ The travel path of pay loaders should be paved and frequently swept and kept sufficiently moistened to prevent emissions. Travel areas path used by the front – end pay loader shall be paved with concrete. It should be regularly swept manually or by high efficiency vacuum sweeper to minimize the material build – up. In addition, these areas should be watered as necessary.
 - ⇒ Provide loading of clinker by pay loaders into trucks / trailers be carried out in an enclosure vented to a bag filter. An enclosure fitted with bag filter could be located at the most central place adjacent to the clinker storage area. The enclosure could be on wheels such that it could be shifted as required. The pay loader moves to the fixed loading area from one end of the enclosure and the truck/trailer enters the enclosure from other end.
- Storage of Limestone, Gypsum and other additives
 - ⇒ The storage should be done under covered shed. The enclosure walls shall cover minimum two sides up to roof level.

- ⇒ Fly ash shall be transported by closed tankers. Fly ash shall be pumped directly from the tankers to silos pneumatically in closed loop or mechanically such that fugitive emissions do not occur.
- ⇒ Fly ash shall be stored in silos only. If the wet fly ash is stored in open temporarily for the purpose of drying, necessary windbreak arrangement to avoid wind carryover of fly ash shall be provided. The fly ash should be removed immediately after drying and send to closed silos.
- Cement Packing Section
 - ⇒ Provide dust extraction arrangement for packing machines. The packing machines should be equipped with dust extraction arrangement such that the packing operation is performed under negative pressure. The dust may be captured in bag filters.
 - ⇒ Provide adequate ventilation for the packing hall. Adequate ventilation for the packing hall should be provided for venting out suspended particulars thereby ensuring dust free work environment.
 - ⇒ Spillage of cement on floor shall be minimized and cleared daily to prevent fugitive emissions. The spilled cement from the packing machine should be collected properly and sent for recycling. The spilled cement on the shop floor should be swept by vacuum sweeping machines periodically. Proper engineering controls to prevent the fugitive emissions may include arrangements like providing guiding plate, scrapper brush for removing adhered dust on cement bag, etc.
 - ⇒ Prevent emissions form the recycling screen by installing appropriate dust extraction system. The vibratory screen provided for screening/recycling spilled cement should be provided for screening/recycling spilled cement should be provided with a dust extraction arrangement to prevent fugitive emission.

- Silo Section

The silo vent must be provided with a bag filter type system to vent out the air borne filters. The bag filter should be operated and maintained properly, especially the cleaning of bags to avoid pressurization of silos thereby causing fugitive emissions form leakages, etc.