CEMENT INDUSTRY

1. In systems with furnaces and producing cement by wet or dry from limestone and facilities with lightweight aggregate kilns using slate or shale are classified in the cement. Rotary kilns are used for processing the materials at temperatures of about 1400 ° C. Raw materials consist mainly of limestone, silica sand, clay, shale, marl and chalk oxide which is added silica, aluminum and iron in the form of sand, clay , bauxite, shale, iron ore and slag from furnaces. Of the gypsum is then added in the final phase of the process. All raw materials arrive and are stored in bulk. The technology of cement kilns is universally used. Cement plants are usually located near limestone quarries, in order to reduce as far as possible, the transportation costs of the raw material. Whether they are closely related, yet he should consider the effects that represent a quarry in the impact assessment of a cement factory. The diagram in the figure below presents the usual process of cement manufacturing wet or dry.

Potential impacts on the environment

Positives impacts

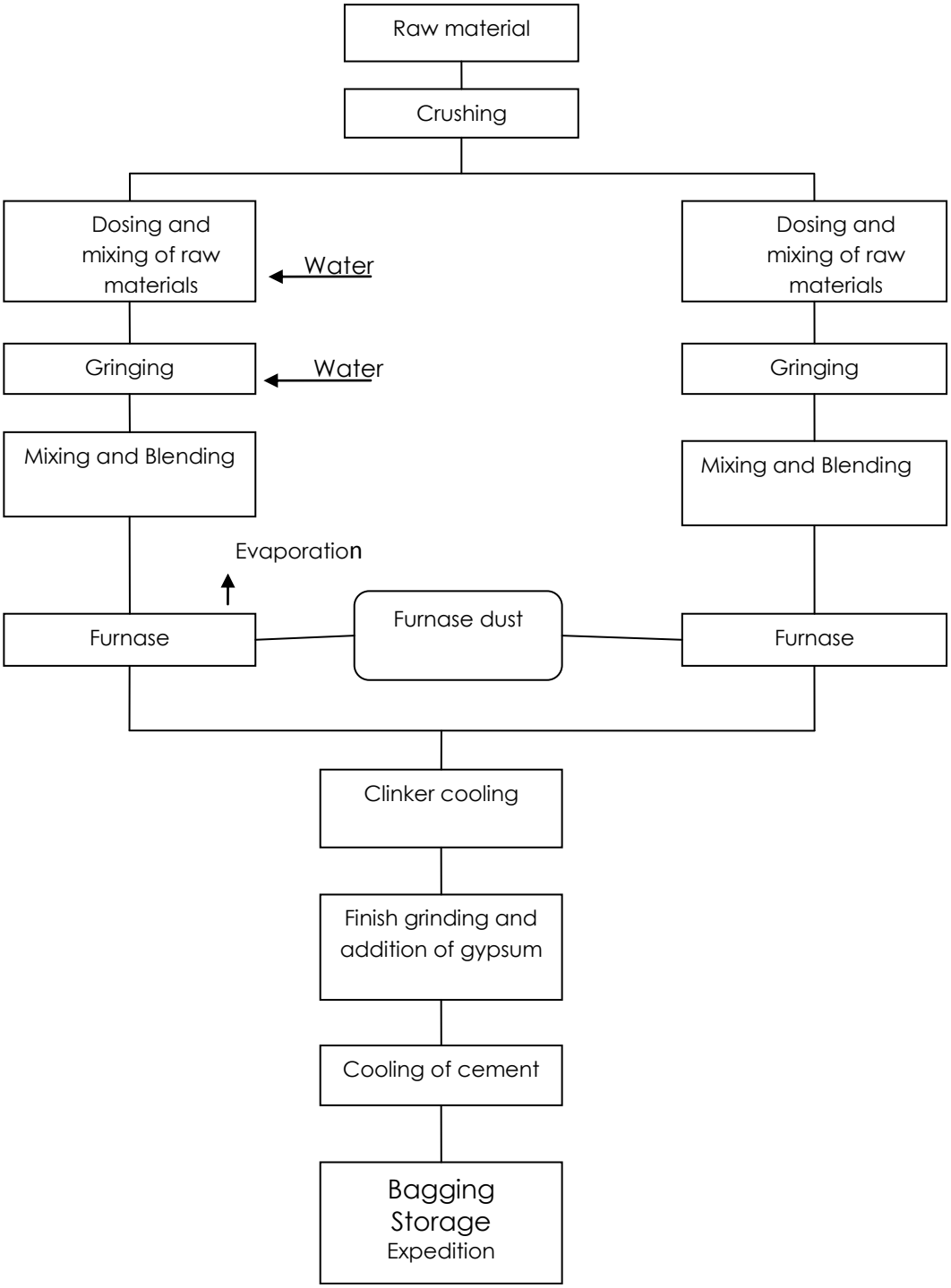
2. Cement factories may, in terms of waste management, a beneficial effect on the environment. This technology and its manufacturing process are well suited for reuse or destruction of a number of wastes, including hazardous waste (see BOAD guidelines on the management of hazardous waste). In addition, if they are not recycled factory furnace dust produced can be used for liming soil to neutralize acid mine effluents to stabilize hazardous waste or be used as a filler product of asphalt pavements.

Negatives impacts

3. The negative impacts of cement production are associated with the handling and storage of materials (particles), their grinding (particles) and the operation of furnaces and clinker coolers (particles or "kiln dust" and flue gas containing carbon monoxide, carbon dioxide, hydrocarbons, aldehydes, ketones, sulfur oxides and nitrogen). Releases loads ovens (high pH, suspended solids, dissolved solids, mainly potassium and sulfates) and cooling water (waste heat) are sources of water pollution. Leachate flowing stored materials and waste disposal areas can pollute surface and groundwater. (The table shows other examples of the negative effects of this industry on the environment and proposes measures to avoid or mitigate them.)

4. Dust emissions, especially silica, constitute a serious danger to the health of plant personnel. Noise levels to which employees are exposed also pose a risk. Noise and truck traffic can be a source of annoyance to the surrounding communities.

Figure1: Organizational processes typical of cement manufacturing wet and dry methods



Specific stakes

Particulate emissions in the atmosphere

5. Cement manufacturing involves transport activities dusty or powdered materials from limestone mining and loading and delivery of the finished product. Particulate emissions are the main source of negative effects on the environment. Electrostatic precipitators and bag filters are routinely required equipment to fight against the emission of particles given off ovens. The issue of control caused by the transport of dust materials is much more complex to resolve, conveyors, piles of stored and road transport materials can cause a further deterioration of the air quality that generated by the mills and ovens gas. It would be important to provide shredders, conveyors and loading facilities mechanical dust collectors, when it proves effective. In general, the collected dust can be recycled, which reduces costs and solid waste. The use of vacuum or sprinklers should ensure the cleanliness of the roads of the factory and prevent dust from traffic and wind. Whenever possible, the batteries stored materials should be covered and trucks used to transport materials provided with tarpaulins and subject to speed limits.

Discharges of liquid waste

6. In cement factories whose production is done by so-called "dry", the furnaces are fed dry raw materials. The only effluent is cooling water that can be treated using towers or cooling ponds. In the manufacture by "wet", the raw materials which supply the furnaces are in the form of paste. A small number of plants leach dust emitted from the furnaces to get rid of

soluble alkalis and recharges ovens. In such plants, leachate overflowing clarifiers during the operation of leaching is the most serious cause of water pollution and therefore requires their neutralization (using perhaps a carbonation process) before rejection.

Use of cement kilns for recycling or disposal of waste

7. Waste oils, solvents, paint residues and other waste fuels were used as fuel supplement in cement kilns. Industries have developed this practice (if the United States in 1979) as a means of conserving energy and reducing fuel costs, were satisfactory as well as the quality of the product results from its impact on environment. Solid waste such as used tires can also be used as fuel. Waste products from other industries can partially meet the requirements for raw materials and are also commonly used: the gypsum produced by the phosphoric acid plants, roasted pyrites from the production of sulfuric acid, slag from the blast furnace and fly ash discharged from coal-fired plants.

8. The temperature generated by the flames and the nature of the product are cement kilns interesting ways to eliminate a variety of hazardous organic materials. These furnaces are much more economical than waste incinerators option. Number of toxic metal compounds can also be burned in cement kilns if the quantities are small enough not to affect the product quality or safety; they are incorporated into the clinker and become a component of the product. Lead, however, requires special care when considering that more than half the quantity introduced into the furnace dissipate and settle by precipitation with cement kiln dust. Dust recycling contributes to the lead concentration to the point where it mixes also clinker; although a small fraction (0.2 to 1.0 p. 100) evaporates in the form of gases. A metal such as thallium not be combined with solid and dissipate

with other gas-burning oven; studies on the behavior of mercury fail to bring meaningful conclusions.

9. The use of cement kilns for disposing of hazardous waste requires a number of specific provisions on plant operating procedures, employee recruitment and protection, public health and environmental quality. It also requires the establishment of emergency and community participation programs may be affected. For further details, consult the guidelines of the BOAD on industrial risk management and guidelines on the management of hazardous materials.

Table: Summary of potential negative impacts and their mitigation

	Potential Negative Impacts	Mitigation Measures
Direct impacts: Choice of location		
1	Location of the plant on or near sensitive habitats, such as mangroves, estuaries, wetlands and coral reefs.	• Choose a location that is as far as possible, in an industrial area, so as to reduce or concentrate pressure on local resources and to facilitate the control of substances released. • Involve natural resource agencies to choose the location for the consideration of alternatives.
2	Location of facilities along the river can cause degradation.	• The choice of location should include minimizing the potential consequences for the environment and does not impede the use of water. • There is a need to locate facilities that emit liquid waste near a stream with a capacity to assimilate waste is adequate.
3	Location can create severe weather problems in the region.	• Locate facilities in an area that is not subject to air inversions, which does not collect pollutants and where prevailing winds are moving towards relatively unpopulated areas..

4	Location could exacerbate problems of solid waste disposal in a region.	• The siting should evaluate it in light of the following guidelines: ✓ lot size for a landfill or disposal site ✓ sufficient discharge near ✓ accessibility for the public and private services may collect and transport solid waste to its final destination

Direct impacts : Plant operation

5	• Water pollution caused by the discharge of liquid effluents and cooling water or runoff from the accumulation of waste. • Factory: Suspended Solids (TSS), total dissolved solids, temperature, pH • dribbles from piles of materials stored: MES, pH	• Laboratory analysis of liquid effluent should include a review of the dissolved solids, total suspended particles, salts, the alkali content of potassium sulphate. A temperature control of the pH on site should be conducted. <u>For all plants</u> • Do not allow water cooling . If recycling is not feasible watch , reject water cooling as long as the rise in temperature of the receiving water does not exceed 3 ° C. • Do not discharge the sludge in the tank drain . • Maintain pH level of effluent discharge between 6.0 and 9.0 .

		For plants that do not practice leaching • Suspended solids <150 g / tonne of production • Content of total dissolved salts do not exceed the levels contained in the operation of the plant water . For plants that perform leaching • Suspended solids <150 g / tonne of production • total dissolved salt content <1.5 kg / tonne of production Batteries stored materials • Ensure that rainwater and runoff infiltrates the least possible in batteries causing percolation phenomena. • Install a sealing of the storage system. Cleaning equipment , washing of roads or other • <150 g / tonne of production when cleaning equipment or during periods of rain. • Maintenance of cement methods must match the desired degree of attenuation.
6	Particulate emissions produced by all activities of the plant (crushing, material handling,	• Install fabric filter collectors. • Establish electrostatic precipitators with humidifiers necessary drying

	commissioning activity kilns and clinker coolers) released into the atmosphere.	operations. • Ensure control dry particles from the following facilities: • oven, 150 g / tonne load • clinker cooler, 50 g / tonne load • the ground, outside the enclosure 80 µg/m3 • fireplace, 100 µg/m3
7	Particulate emissions from sources present in soil (fugitive dust particles), roads and piles.	Provide control measures such as: • treatment of roads • watering bunch Use of industrial vacuum cleaners • speed limit not exceeding 20 km /h
8	S0x emissions into the atmosphere from the combustion of fuel used in the furnaces.	Absorb alkaline substances intensified by the use of heating feed furnaces using natural cleaning operations and use of exhaust gas for drying and grinding of raw materials. • An analysis of raw materials during the feasibility study of the project can determine sulfur levels to develop effective emissions control equipment.

		Inside the housing • Annual Arithmetic mean 100 µg/m3 • Maximum peak by 24 hours: 1 000µg/m3 **Outside the enclosure** • Annual Arithmetic mean 100 µg/m3 • Maximum peak by 24 hours: 1 000µg/m3
9	NOx emissions in the atmosphere from the combustion of fuel oil used in furnaces.	• Absorb NOx emissions by using coal as fuel and furnace preheating or calcining. • It would be important to examine the use of vegetable materials or chemical waste from other local industries to the extent that these fuels may increase NOx emissions in the atmosphere carefully.
10	Air pollution caused by the commissioning of the furnace does not have an electrostatic	• Begin at the start, if possible, where the winds do not point towards

	precipitator.	populated or environmentally sensitive areas.
11	Air pollution due to malfunctioning of the electrostatic precipitator.	• Develop equipped with electrostatic precipitators parallel chambers so that one is in use while the other is being repaired. Enforce the law prohibiting the commissioning of the oven if the electrostatic precipitator has been shut down.
12	Air pollution by toxic substances such as products of incomplete combustion and metals such as lead from the combustion of hazardous wastes or waste oils used as fuel surcharges.	Studies have shown that most organic substances are destroyed to 99.99% and the metals are retained by the cement dust collected by the system to fight against pollution. • Ensure that (a) hazardous waste and waste oils are analyzed before approving combustion and (b) furnace efficiency is maintained. • Place waste in the "hot" side of the oven. • Establish procedures for handling hazardous waste and emergency plans (see "Hazardous Materials Management").
13	Surface runoff of leachate from kiln dust, raw materials, clinker coolers, coal and substances typically stored in a heap on the grounds of the facility could pollute surface water or seep into groundwater.	• It is possible to control the infiltration of rainwater and seepage of solid materials, fuels and the accumulation of waste by collecting or using methods of containment, so that the water surface and groundwater are not polluted. • Ensure that containment work is large enough to contain the rain falls

		an average of 24 hours.
Indirects impacts		
1	• Diseases of work due to the emanation of fugitive dust, handling materials or other types of activities.	The plant should establish a program of health and protection for: • identify, assess, monitor and enforce specifically the control of risks to health and safety of employees • respond to the dangers to which the health and safety of workers are facing • adopt procedures to protect employees • provide training in safety
2	Problem regional solid waste exacerbated by a lack of adequate on-site storage.	• Provide appropriate exhaust on site or use the dust from furnaces and other by-products as materials filling areas, based on the principle that a thorough review of leachate has been undertaken and their characteristics are known. • Use dust from kilns to lime soils, neutralize acids or stabilize hazardous

		waste.
3	Disruption of transit circuits, noise emissions, increased traffic and increased risk of accidents to pedestrians that cause the up-and-coming trucks carrying raw materials, fuels and cement.	• Choose a location that can alleviate a number of these problems. • There is a need to carry out specific studies on transport in the feasibility of the project and that would determine the safest routes to mitigate the impacts. • Develop regulations concerning transport equipment and develop contingency plans to limit the risk of accidents during transport of residual fuels.
4	The local limestone mining for supply of cement may create conflicts with some industries such as building and construction uses the same materials. In addition, uncontrolled or unlimited exploitation may extend the erosion and sedimentation of waterways.	• Provide a plan where the quarrying of limestone is adapted to the quantities available and restrictions on operating methods. • Coordinate with the agency responsible for the study to the potential redevelopment of the site once the installation is dismantled. • Provide a plan for rehabilitation of limestone mines.

Alternatives to projects

Choosing a location

10. The nature of cement production is such that its impact on air quality and the effects produced by the extraction and transport of bulk materials entering or leaving the plant require one pays any attention to specific evaluation of alternative sites. Areas where the air quality is poor as well as the cities whose weather or topographic features result in a limited air circulation, containment area is not conducive to the installation of a cement industry. If the demand for raw materials means opening new careers, it would be appropriate to describe (if known), and examine their impact on the environment in the project. The proximity of waste supply sources can be used as fuel, raw materials to replace or supplement is a good thing when it comes to choosing a location. All things being equal, it is preferable to locate the cement factory near a limestone quarry in order to reduce transportation costs (one tonne of cement requires between 1.3 and 1.4 tonnes of limestone).

Alternative fuels

11. Cement kilns can be powered by coal, oil, gas or three at a time. Waste can be a supplementation fuels. The choice of fuel affects the quality of the environment and the importance of investments to be made in the fight against pollution.

(a) Fight against air pollution

- Collection Options kiln dust:
    - Electrostatic precipitator;
    - Filter.
- Options for collecting dust from the cooling of the clinker:

- gravel filter;
- electrostatic precipitator;
- Filter.

- Control Options issued by other operations dust:
  - Cover or enclose conveyors, crushers, transfer stations materials, storage areas;
  - Install mechanical precipitators or baghouses, if necessary;
  - take the roads leading to the plant;
  - clean the roads with vacuum sweepers;
  - use of sprinklers for these roads and heaps of stored materials;
  - stabilize the stored materials using laticiferous emulsions.

(b) Fight against water pollution

- Recycle water wet production to feed the furnace;
- install towers and cooling ponds;
- build containment structures to contain runoff from waste and raw materials stacked;
- Ensure that waste and raw materials are contained in sealed areas to prevent infiltration.

Management and Training

12. All manufacturing processes cement may compromise the quality of air and water due to leaching operations that they use, institutional support to undertake and oversee abatement measures and reduction waste effectively is essential. An engineer trained in the fight against pollution of water and air and knowing control technologies in use should be part of the team of plant personnel. If they so request, manufacturers are usually willing to offer training sessions explaining how to operate and maintain the

equipment. The standard operating procedures should be established and implemented by the factory management. Means of pollution control and monitoring of water and air quality should be a part as well as the cleaning of storage areas and roads leading to the plant, the processes of absorption of adverse effects that can occur when the start of the furnaces (where electrostatic precipitators do not work adequately) should also be as notification procedures and closing of the plant, as well as other measures are in place in failure of pollution control equipment.

13. There is a need to establish rules of hygiene and safety to be applied in the factory and to establish procedures ensuring the highest levels of exposure to emissions of dust and free silica below national standards should Furthermore, a program of routine medical visits is thus undertaken a training program (and / or periodic awareness) continues covering both the health and safety issues within the plant that means on environmental protection.

14. If the cement is intended for the destruction of hazardous waste, specific procedures for handling materials on site and emergency interventions are required. Aspects of operationalization in connection with hazardous waste should be supervised and carried out by specially trained staff. Agents responsible for the regulation and safety of the public should ensure careful monitoring of the transport and storage of materials from the recognized practices in material handling, notification and emergency measures (see lines guidelines on the management of industrial risks).

15. Standards for emissions and effluents is applied to the plant should be based on national regulations where they exist or be established from the standards recommended by the Bank. Government agencies responsible for performing monitoring of pollution control equipment, enforce

standards and supervise all activities related to hazardous waste destruction are likely to require specialized training; they should also receive the necessary equipment and be vested with power. The assessment of impacts on the environment should take into account an estimate of local capacity on these issues and recommend ways to contribute to the project.

Monitoring

16. Of specific monitoring programs are essential both for the plant and for its location. However, follow-up operations in a cement companies should include the following aspects:

(i) Monitoring the opacity of the flue gases ;

(ii) (Periodic measurement of particle stacks to verify and calibrate the opacity meters ;

(iii) monitoring furnace dust , flue gas and cement in order to detect hazardous materials burned, and the pH (continuous) , the content of total dissolved salts, suspended solids , alkalinity and the content of potassium sulfate and liquid effluent ;

(iv) monitoring of work areas on the loudness and the presence of fugitive dust uncombined silica monitoring receiving waters by measuring pH and suspended solids;

(v) monitoring the quality of air in relation to suspended particles , the piles of material stored can result in runoff and leachate;

(vi) Verification of compliance with safety and pollution control.