**International Finance Corporation**

# Environmental, Health and Safety Guidelines for Ceramic Tile Manufacturing

## Liquid Effluents

Process wastewater, domestic sewage and contaminated stormwater should be treated to meet the following specified limits before being discharged to surface waters:

| *Parameter/Pollutant* | *Maximum Value* |
|---|---|
| pH | 6 to 9 |
| $BOD_5$ | 50 mg/L |
| Oil and Grease | 10 mg/L |
| Total Suspended Solids | 50 mg/L |
| Heavy Metals, Total | 10 mg/L |
| Cadmium | 0.1 mg/L |
| Chromium (total) | 0.5 mg/L |
| Lead | 0.2 mg/L |

Liquid effluent discharges to a public or private central wastewater treatment system may be subject to pre-treatment requirements. Sponsors should provide information from the local authority or private central wastewater treatment company, to confirm that the treatment system has the capacity to adequately treat the project's liquid effluents.

It is recommended that cooling water be recycled whenever feasible.

## Stack Emissions

Concentrations of contaminants emitted from process stacks should not exceed the following limits:

| *Parameter/Pollutant* | *Maximum Value* |
|---|---|
| Particulate Matter | |
| • Dryer | 50 mg/Nm$^3$ |
| • Kiln | 50 mg/Nm$^3$ |
| Nitrogen Oxides, as $NO_2$ | |
| • Kiln Operations | 600 mg/Nm$^3$ (at 10% Excess $O_2$) |
| Sulfur Dioxide | |
| • Kiln Operations | 400 mg/Nm$^3$ (at 10% Excess $O_2$) |

Concentrations of contaminants emitted from other stacks including boilers and electrical generating equipment should not exceed the following limits:

| *Parameter/Pollutant* | *Maximum Value* |
|---|---|
| Particulate Matter ($PM_{10}$) | |
| ≥50 MWe | 50 mg/Nm$^3$ |
| <50 MWe | 100 mg/Nm$^3$ |
| Nitrogen Oxides, as $NO_2$ | |
| Coal fired | 750 mg/Nm$^3$ |
| Oil fired | 460 mg/Nm$^3$ |
| Gas fired | 320 mg/Nm$^3$ |
| Sulfur Dioxide | 2,000 mg/Nm$^3$ |

## Dust Control Measures

a) The plant should be provided with air pollution control systems to control the dust emitted throughout the different stages of the process.

b) Equipment related to material handling and storage (such as conveyor systems, silos and all

transfer points) should be covered and equipped with dust collectors.

## Ambient Noise

Noise abatement measures should achieve either the following levels or a maximum increase in background levels of 3 dB(A). Measurements are to be taken at noise receptors located outside the project property boundary.

**Ambient Noise**

| | Maximum Allowable $L_{eq}$ (hourly), in dB(A) | |
|---|---|---|
| Receptor | Daytime 07:00 - 22:00 | Nighttime 22:00 - 07:00 |
| Residential; institutional; educational | 55 | 45 |
| Industrial; commercial | 70 | 70 |

## Solid And Liquid Wastes

a) Project sponsors should recycle or reclaim materials where possible.

b) If recycling or reclaim is not practical, wastes must be disposed of in an environmentally acceptable manner and in compliance with local laws and regulations.

c) All hazardous materials, process residues, solvents, oils, and sludges from raw water, process wastewater and domestic sewage treatment systems must be disposed of in a manner to prevent the contamination of soil, groundwater and surface waters.

## Other General Environmental Requirements

a) Formulations containing chromates should be avoided in water treatment processes.

b) Transformers or equipment containing polychlorinated biphenyls (PCBs) or PCB-contaminated oil should not be installed, and existing equipment involving PCBs or PCB-contaminated oil should be phased out and disposed of in a manner consistent with the requirements of the host country.

c) Processes, equipment and central cooling systems involving the use or potential release to the environment of chlorofluorocarbons (CFCs), including halon, should not be installed, and their use in existing processes and systems should be phased-out and disposed of in a manner consistent with the requirements of the host country.

d) Storage and liquid impoundment areas for fuels, raw and in-process materials, solvents, wastes and finished products should be designed with secondary containment (e.g. dikes, berms) to prevent spills and the contamination of soil, groundwater and surface waters.

## Workplace Air Quality

a) Periodic monitoring of workplace air quality should be conducted for air contaminants relevant to employee tasks and the plant's operations.

b) Ventilation, air contaminant control equipment, protective respiratory equipment and air quality monitoring equipment should be well maintained.

c) Protective respiratory equipment must be used by employees when the exposure levels for welding fumes, solvents and other materials present in the workplace exceed local or internationally accepted standards, or the following threshold limit values (TLVs):

| *Parameter/Pollutant* | *Maximum Value* |
|---|---|
| Particulate (inert or nuisance dusts) | 10 $mg/m^3$ |
| Portland Cement | 10 $mg/m^3$ |
| Silica/Crystalline Quartz | 0.1 $mg/m^3$ |

## Workplace Noise

a) Feasible administrative and engineering controls, including sound-insulated equipment and control rooms should be employed to reduce the average noise level in normal work areas.

b) Plant equipment should be well maintained to minimize noise levels.

c) Personnel must use hearing protection when exposed to noise levels above 85 dBA.

## Work In Confined Spaces

a) Prior to entry and occupancy, all confined spaces (e.g., tanks, sumps, vessels, sewers, excavations) must be tested for the presence of toxic, flammable and explosive gases or vapors, and for the lack of oxygen.

b) Adequate ventilation must be provided before entry and during occupancy of these spaces.

c) Personnel must use air-supplied respirators when working in confined spaces which may become contaminated or deficient in oxygen during the period of occupancy.

d) Observers/assistants must be stationed outside of confined spaces to provide emergency assistance, if necessary, to personnel working inside these areas.

## Hazardous Material Handling and Storage

a) All hazardous (reactive, flammable, radioactive, corrosive and toxic) materials must be stored in clearly labeled containers or vessels.

b) Storage and handling of hazardous materials must be in accordance with local regulations, and appropriate to their hazard characteristics.

c) Fire prevention systems and secondary containment should be provided for storage facilities, where necessary or required by regulation, to prevent fires or the release of hazardous materials to the environment.

## Health - General

a) Sanitary facilities should be well equipped with supplies (e.g., protective creams) and employees should be encouraged to wash frequently, particularly those exposed to dust, chemicals or pathogens.

b) Ventilation systems should be provided to control work area temperatures and humidity.

c) Personnel required to work in areas of high temperature and/or high humidity should be allowed to take frequent breaks away from these areas.

d) Pre-employment and periodic medical examinations should be conducted for all personnel, and specific surveillance programs instituted for personnel potentially exposed to toxic or radioactive substances.

## Safety - General

a) Shield guards or guard railings should be installed at all belts, pulleys, gears and other moving parts.

b) Elevated platforms and walkways, and stairways and ramps should be equipped with handrails, toeboards and non-slip surfaces.

c) Electrical equipment should be grounded, well insulated and conform with applicable codes.

d) Personnel should use special footwear, masks and clothing for work in areas with high dust levels or contaminated with hazardous materials.

e) For work near molten or high temperature materials, employees should be provided with non-slip footwear, gloves, safety glasses, helmets, face protection, leggings and other necessary protective equipment.

f) Eye protection should be worn by personnel when in areas where there is a risk of flying chips or sparks, or where intense light is generated.

g) Personnel should wear protective clothing and goggles when in areas where corrosive materials are stored or processed.

h) Emergency eyewash and showers should be installed in areas containing corrosive materials.

i) A safety program should be established for construction and maintenance work.

j) A fire prevention and fire safety program should be implemented and include regular drills.

## Training

a) Employees should be trained on the hazards, precautions and procedures for the safe storage, handling and use of all potentially harmful materials relevant to each employee's task and work area.

b) Training should incorporate information from the Material Safety Data Sheets (MSDSs) for potentially harmful materials.

c) Personnel should be trained in environmental, health and safety matters including accident prevention, safe lifting practices, the use of MSDSs, safe chemical handling practices, and proper control and maintenance of equipment and facilities.

d) Training also should include emergency response, including the location and proper use of emergency equipment, use of personal protective equipment, procedures for raising the alarm and notifying emergency response teams, and proper response actions for each foreseeable emergency situation.

## Record Keeping and Reporting

a) The sponsor should maintain records of significant environmental matters, including monitoring data, accidents and occupational illnesses, and spills, fires and other emergencies.

b) This information should be reviewed and evaluated to improve the effectiveness of the environmental, health and safety program.

c) An annual summary of the above information should be provided to IFC.