Egyptian Environmental Affairs Agency (EEAA)

Egyptian Pollution Abatement Project (EPAP)

Inspection Manual

Ceramic Industry

June 2002

Ceramic Industry
Inspection Handbook

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1. Introduction

The Egyptian Pollution Abatement Project (EPAP) sponsored by FINIDA has assigned Finish and Egyptian consultants for the task of developing sector-specific inspection and monitoring guidelines..

A General Inspection Manual, GIM, has been developed covering inspection aspects common to all sectors. The manual :

- Discusses the strategy, objectives and tasks of the inspectorate management
- Identifies the team leader responsibilities and tasks
- Presents a methodology for performing all types of inspection. Tasks during the various phases of planning, performing field inspection, report preparation and follow-up are discussed. Several checklists are included

Sector specific inspection manuals have been developed for the following industries

- Textile industry
- Pulp and paper industry
- Food industry
  - Grain milling industry
  - Dairy industry
  - Carbonated beverages industry
  - Confectionery industry
  - Fruits and vegetables industry
- Metallurgical industry
- Fabricated metal industry
- Motor vehicle assembly

The developed manuals were tested through a number of training programs that targeted RBOs and EMUs. The inspectors involved in the training used these manuals to inspect a number of industrial facilities. Feedback from the concerned parties led to the improvement of these manuals and their continuous update.

1.1 Preface

As a continuation of the previous effort, the following manuals are developed

- Paint industry
- Detergent oil and soap industries
- Cement and ceramic industry
- Fertilizer industry

1.1.1 Project objectives

The project aims at the development of sector-specific guidelines for inspection to be used by inspectors. These manuals are meant to be simplified but without abstention of any information necessary to the targeted users. Flowcharts, tables and highlighted notes are used for easy representation of information.

1.1.2 Organization of the inspection manual

The inspection manual for the ceramic industry includes ten chapters. The first chapter represents an introduction to the whole project and to the specific sub-sector of the industry. Chapters two to five deal with the ceramic industry and its environmental impacts.

The description of the industry in chapter 2 includes the inputs and outputs, a description of the different production lines with their specific inputs and outputs, a brief description of the service and auxiliary units that could be present at the industrial establishment with their potential sources of pollution and the various emissions, effluents and solid wastes generated from the different processes.

Chapter three describes the environmental and health impacts of the various pollutants whereas chapter four gives a summary of the regulation articles in the Egyptian environmental laws relevant to the ceramic industry. Chapter five gives examples of pollution abatement techniques and measures applicable to the ceramic industry.

The inspection procedures are described in chapters 6 to 10 starting with a brief description of the inspection process in chapter 6 then the planning aspects that should be considered at the inspectorate level are explained in chapter 7. The different tasks at the inspectors level specific to the ceramic industry, will be described in chapters 8 to 10. The tasks before field inspection are presented in chapter 8 whereas the inspection tasks for actually performing the field visit are defined in chapter 9. Chapter 10 is concerned with the conclusion of the field visit including inspection report writing, supporting the enforcement case and following-up the compliance status of the facility.

1.2 Introduction to the ceramic industry

The traditional ceramic industries are sometimes referred to as the clay products or silicate industries. In recent years new products have been developed as a result of the demand for materials that withstand higher temperatures, resist greater pressure, have superior mechanical properties, possess special electrical characteristics, or can protect against corrosive chemicals.
Figure 1. shows the production value distribution in Egyptian industrial sector. It can be noticed that the ceramic and anti-melting materials industries represents one of seven major industries in the Egyptian market. It represents 7% of the production value in Egyptian Industrial sectors

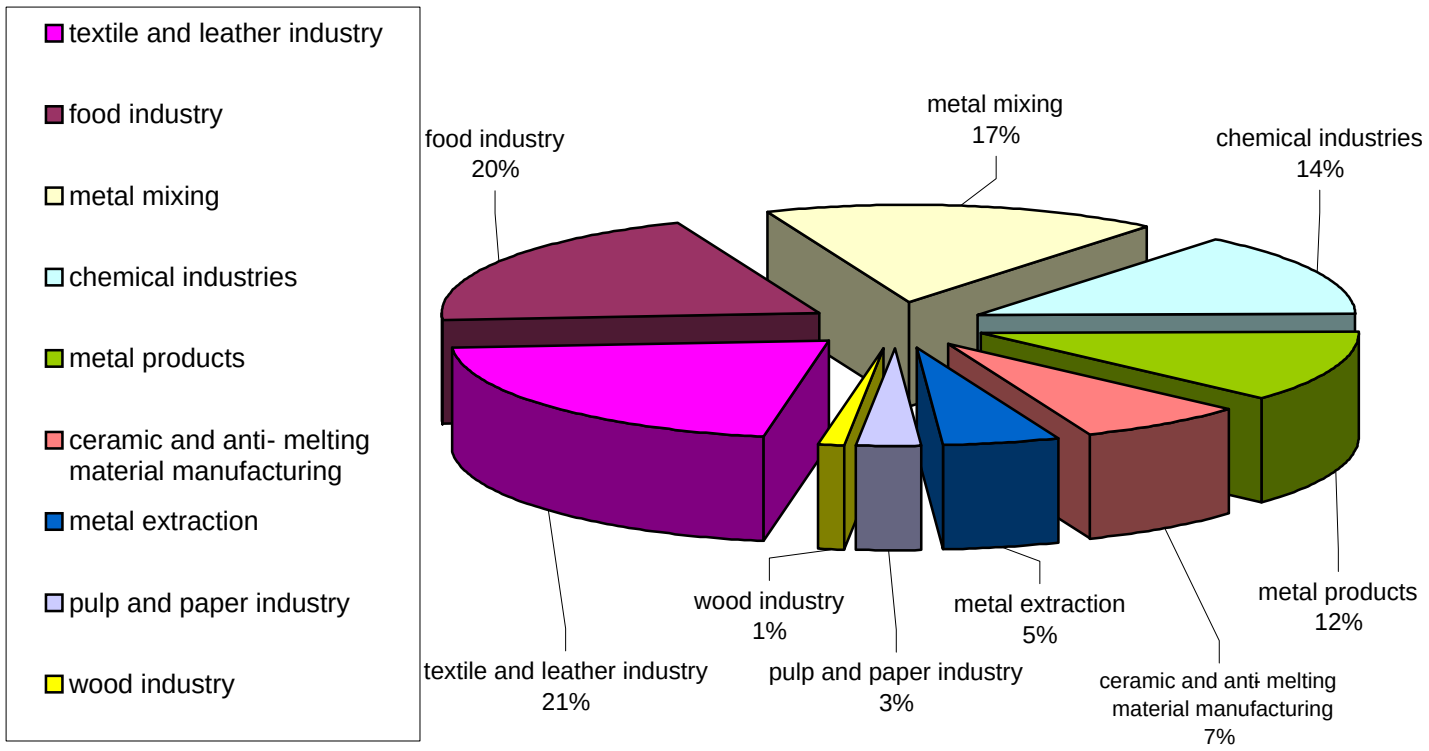


Figure (1) Production Value Distibution in Egyptian Industrial Sectors

2. Description of the industry

Ceramic industry is one of the important industries in Egypt. There are different types of products produced:

1. White ware : China, earthenware, pottery, porcelain, stoneware and vitreous ware
2. Structural clay products: Building brick, face brick, sewer pipe and drain tile
3. Refractories: Firebricks; silica, chromite, magnesite, magnesite-chromite brick, silicon carbide and zirconia refractories, aluminium silicate and alumina products
4. Specialty ceramic products

Service and ancillary units provide water and energy requirements as well as maintenance, storage, packaging, testing and analysis needs.

2.1 Raw materials, products and utilities.

The principal raw materials are sand, feldspar, ball clay, china clay , kaolin, talc and other materials that are used during the manufacturing process, such as soda ash, sodium silicate, calcium carbonate, plasticizers and lubricants. Glaze materials are used to modify the surfaces of the products. Glaze is prepared from sand, feldspar ($6Na_2O.SiO_2.Al_2O_3$), soda ash, binder, dolomite, water.
Chemicals are also used in the lab for quality control and analysis. Natural gas and mazot (fuel oil) may be used in the kiln as fuel.
Table (1) lists types of ceramic products in this industry

Table (1) Types of ceramic products in ceramic industry

White ware	Refer to ceramic ware that is white, ivory, or light gray in color after firing. White ware may further classified as earthenware, chinaware, porcelain, and technical ceramics.
Earthenware	Earthenware is defined as glazed or unglazed nonvitreous (porous) clay-based ceramic ware. Application of earthenware include art ware, kitchenware, ovenware, tableware, and tiles.
Stoneware	Stoneware is vitreous or semivitreous ceramic ware of fine texture, made primarily from nonrefractory fire clay or some combination of clays, fluxes, and silica that, when fired, has properties similar to stoneware made from fire clay. Applications of stoneware include art ware, chemical ware, cookware, drainpipe, kitchenware, tableware, and tiles and bricks.
Chinaware	Chinaware is vitreous ceramic ware of zero or low absorption after firing that is used or nontechnical applications. Applications of chinaware include art ware, ovenware, sanitary

	ware, and tableware.
Porcelain	Porcelain is defined as glazed or unglazed vitreous ceramic ware used primarily for technical purposes. Applications of porcelain include art ware, ball mill, chemically durable ware, electrical insulators, and table ware.
Technical ceramics	Technical ceramics include vitreous ceramics used for electrical insulation, ceramic filters and catalysts and for chemical, mechanical, structural applications.

Note: Defining the inputs and outputs helps predict the expected pollutants.

2.2 Production lines

This section describes the major industrial processes in Egypt within the Ceramic Products. Industry, including the materials used and the processes employed. The section is designed for those interested in gaining a general understanding of the industry, and for those interested in the inter-relationship between the industrial process and the topics described in subsequent sections of pollutant outputs, pollution prevention opportunities, and regulations. This section specifically contains a description of commonly used production processes, associated raw materials, the byproducts produced or released, and the materials either recycled or transferred off-site. This discussion, coupled with schematic drawings of the identified processes, provide a concise description of where wastes may be produced in the process.
Table 2 presents the various production lines that could be present in ceramic industry

Note: Knowledge of the operations involved in each production line and units allows the prediction of pollution sources and expected violations and helps determining possibilities for implementing cleaner technology.

Table 2. Production lines and service units in ceramic industry

Production Lines	Service Units
Sanitary ware production line. Table ware production line. Tiled floor production line Refractories production line Glaze production line	Laboratory Mechanical & electrical workshops Garage Storage facilities Wastewater Treatment Plant Restaurant and Housing complex

The manufacturing processes in ceramic industry may include the following operations:

- Preparation of body mixture
- Pulverizing
- Screening
- Mixing

- Forming (shaping by pressing, solid drain casting, Jiggering or extrusion)
- Preparation of moulds
- Drying
- Firing
- Glazing and Decoration
- Testing and inspection
- Sorting

2.2.1 Sanitary ware production line

Figure 2 presents the main units in this process, the inputs to the units and the pollution sources. These units are:

Preparation of Body Mixture (Slip)

- Sand and feldspar are ground with water in huge grinders to obtain a mixture of fine particles. Fine particles means a large surface area that facilitates chemical reaction. The mixture is fed to a storage tank provided with mixers to prevent precipitation.
- Ball clay is mixed with water in the presence of deffloculants (sodium silicate and sodium carbonate). Mixers with high velocity are used to mix different volumes of raw materials. The emulsified mixture is screened to remove insoluble particles then passed over a magnet to remove metals. Metal iron is converted during firing to brown iron oxide which leads to the presence of spots on the surface of the product, The mixture is then stored for 24 hr.
- The sand and feldspar mixture is mixed with the ball clay, china clay and broken pieces from pouring stage. The mixture is passed through screens and magnets to remove metals. The final mixture formed (slip) is left for curing and aging.

Mold preparation

Slip is poured in molds made from gypsum. These molds are made by mixing a special type of gypsum with water then poured in molds made from fiberglass. The molds are left to dry.

Pouring

The final shape of the product is obtained by pouring slip in gypsum molds. The surplus slip is recycled to the preparation stage. Bodies formed in molds are left to dry, and then removed from molds.

Tests and inspections are performed on the pieces of products to ensure that there are no defect. The defaulted pieces are recycled to the preparation step.

Drying The pieces are dried at 90° C by hot air to obtain a pieces with desired humidity required for glazing.

Glazing Glazing is a process by which the surfaces of the pieces are covered with a glassy layer. This layer provides the products with a smooth colored surfaces.
Glazing is applied either by spraying or dipping.
Sanitary ware is glazed by spraying guns using compressed air.

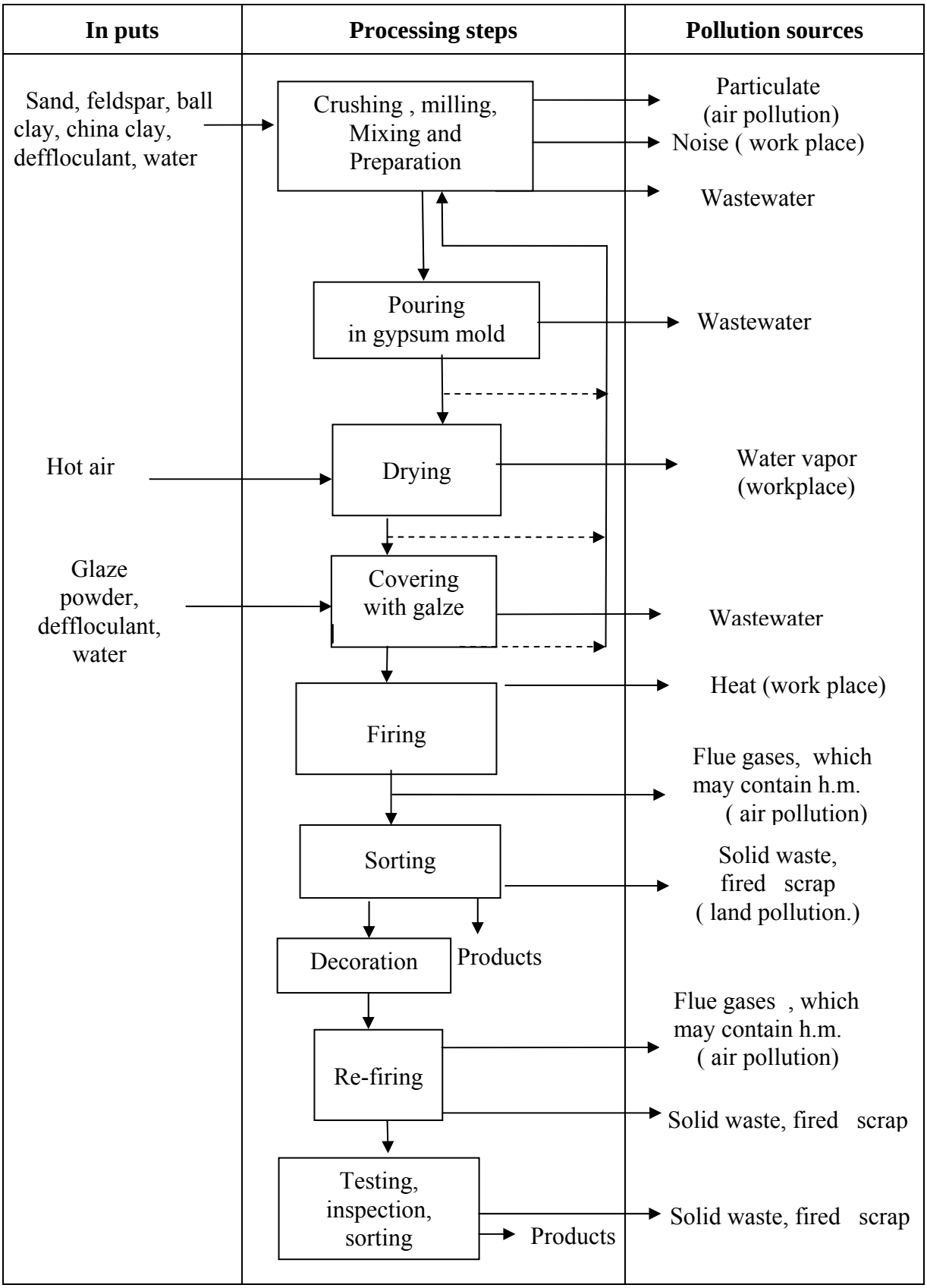
Firing The products are fired in kilns where, petroleum products and natural gas are used as fuels. The temperature inside the kiln is increased gradually through the length of the kiln. Pieces are passed first in a pre-heating stage, followed by a stage of higher temperature, then to the firing stage. At the firing stage the pieces are reached the maximum temperature 1200-1215° C. At the maximum temperature glaze is totally soluble and the reaction takesplace between glaze and the pieces to obtain a solidified structure. Pieces are cooled gradually, to reach the outlet temperature of about 100°C.

Sorting At the sorting stage the products are classified according to the quality. Small defects in the pieces are treated by special paste and refired at lower temperature.

Note: Find out:

- Check kiln stack emissions

Figure (2) The sanitary ware production line and Related Pollution sources



----► Solid waste to be recycled, h.m.= heavy metals

2.2.2 Refractories production unit

Refractories, are classified as, acid, basic and neutral and also super refractories. The main characteristics of these materials is to withstand the effect of thermal, chemical and physical effects. Refracories are sold in the form of firebrick; silica, magnesite, chromite and magnesite-chromite bricks; silicon carbide and zirconia refractories; aluminium silicate and alumina products.
Figure (3) presents the manufacturing steps for refractory production and its potential pollution sources. The operations involved in this production unit are:

Crushing and Milling One of the most important factors that affects the characteristics of the final product is the size of the particles in the batch. It is known that a mixture in which the proportion of coarse and fine particles is about 55:45, with only few intermediate particles, is the densest mixture.

Mixing The real function of mixing is the distribution of the plastic material so as to coat thoroughly the nonplastic constituents. This serves the purpose of providing a lubricant during the molding operation and permits the bonding of the mass with a minimum number of voids.

Molding The great demand for refractory bricks of greater density, strength, volume, and uniformity has resulted in the adoption of the dry-press method of molding with mechanically operated presses. The dry press method is particularly suited for batches that consist primarily of nonplastic materials. In order to apply high pressure forming, it is necessary to remove air from the bricks during pressing to avoid laminations and cracks when the pressure is released.

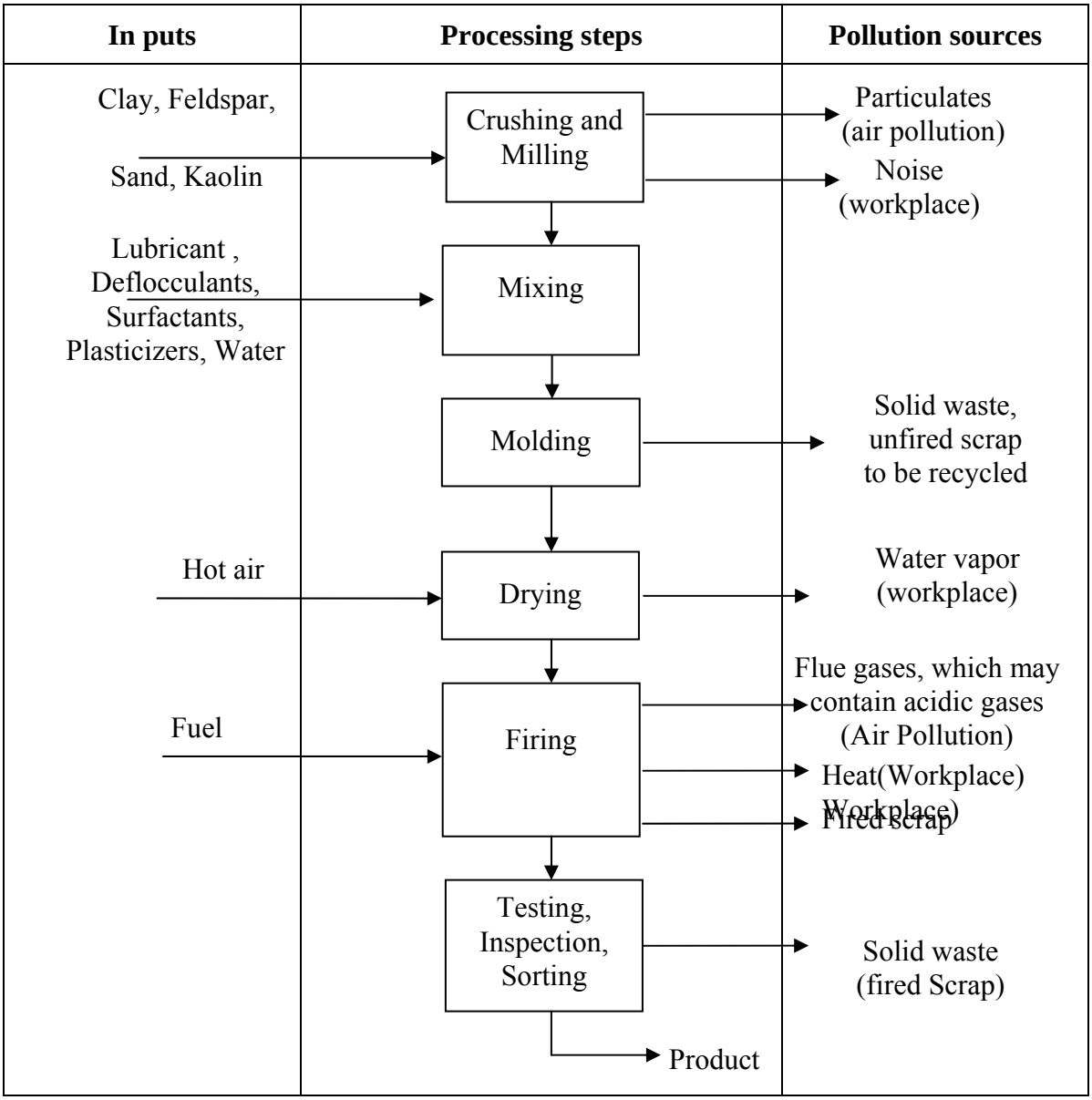
Drying Drying is performed by hot air. Drying is used to remove the moisture added to develop plasticity before molding. The elimination of water leaves voids and causes high shrinkage and internal strains.

Firing

Firing may be carried out in typical round, downdraft kilns or continuous tunnel kilns. Two important things take place during firing. The development of a permanent bond by partial vitrification of the mix, and the development of stable mineral forms for future service. The changes that take place are the removal of water of hydration, followed by calcination of carbonates and oxidation of ferrous iron.

During these changes the volume may shrink as much as 30% and sever strains are set up in the refractory. This shrinkage may be eliminated by pre-stabilization of the used materials.

Figure (3) A refractory production line and Related Pollution sources.



2.2.3 Table ware production line

This type of products is produced by preparing the raw material in the form of slurry. The slurry is shaped by injection and dried. After drying it is first fired then covered with glaze and secondly fired. Decoration is applied and finally the third firing is done. Figure 4 presents the manufacturing steps for table ware.

2.2.4 Tile ware production line

Raw material handling

- The raw materials are weighted and transported by conveyors to the grinders.

Particulate emissions are generated from the weighing operation and during handling and conveying of raw materials

Slip preparation

- Sand and feldspar are ground with water in huge grinders to obtain a mixture of fine particles. Fine particles means a large surface area that facilitates chemical reaction. The mixture is fed to a storage tank provided with mixers to prevent precipitation.
- Ball clay is mixed with water in the presence of deffloculants (sodium silicate and sodium carbonate). Mixers with high velocity are used to mix different volumes of raw materials. The emulsified mixture is screened to remove insoluble particles then passed over a magnet to remove metals. Metal iron is converted during firing to brown iron oxide which leads to the presence of spots on the surface of the product. The mixture is then stored for 24 hr.
- The sand and feldspar mixture is mixed with the ball clay, china clay and broken pieces from pouring stage. The mixture is passed through screens and magnets to remove metals. The final mixture formed (slip) is left for curing and aging. This step generates solid waste on the screens.
- Aswan clay is added to the mixture to obtain red tiles.

Spray Drying

After slip preparation, the mixture is passed through spray dryer to dry the mixture and obtain a dried fine particles. In the dryer, the mixture flows in a counter current pattern to hot air. The effluent air carries dust particles that are separated by cyclones.

Forming

After drying, the mixture is pressed in a mechanical press.

Firing and glazing

To obtain the final products, there are three methods:-

- The tiles are fired (first fire or biscuit fire) then covered with glaze and refired.
- The tiles are covered with glaze and then fired (mono porosa).
- The fired tiles (by one of the above mentioned methods) are decorated and fired again to obtain the final products.

Figure 5 presents the manufacturing steps for tile ware.

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Note:
Porcelain tiles are manufactured by the same operating steps but do not require glazing

2.2.5 Glazing production line:

Glazes are considered as one of the important materials in the ceramic industry. They are glasses specially designed to have thermal expansion to match the ceramic substrate. It provides the product better durability, wide applications. Glazed products are easy to clean and resist corrosion.
The special enamel or glass-lined equipment so extensively used in chemical plants is tested by high frequency electrical testers.

All glazes are fired on the surfaces of the ceramic ware to melt them into a smooth, continuous glassy layer. The requirements for successful firing process are :

- Proper firing temperature, 750 to 1200°C
- Uniform heating and cooling of the ware
- An atmosphere free from dust

Figure (4) Table Ware Production line and Related Pollution Sources

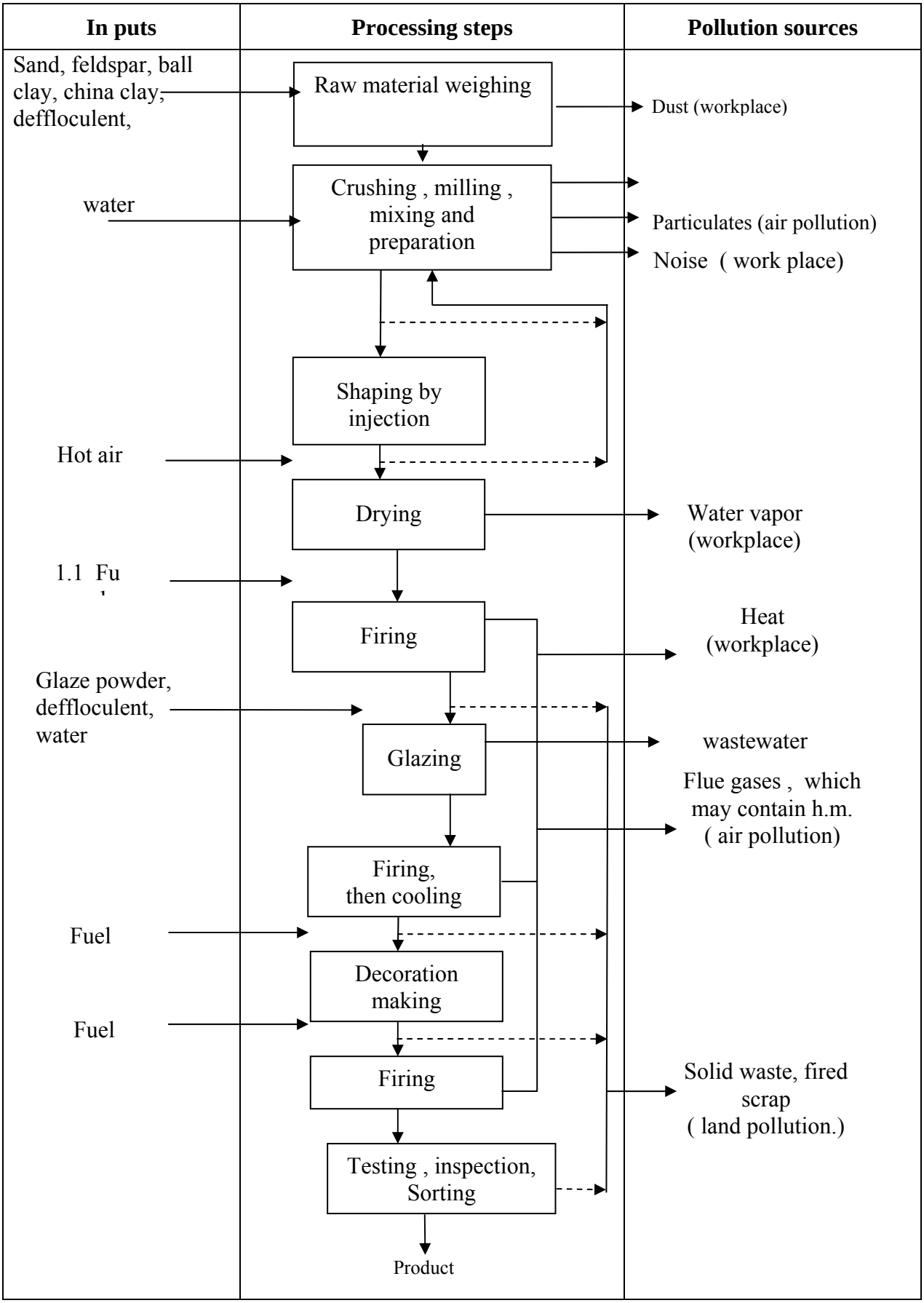
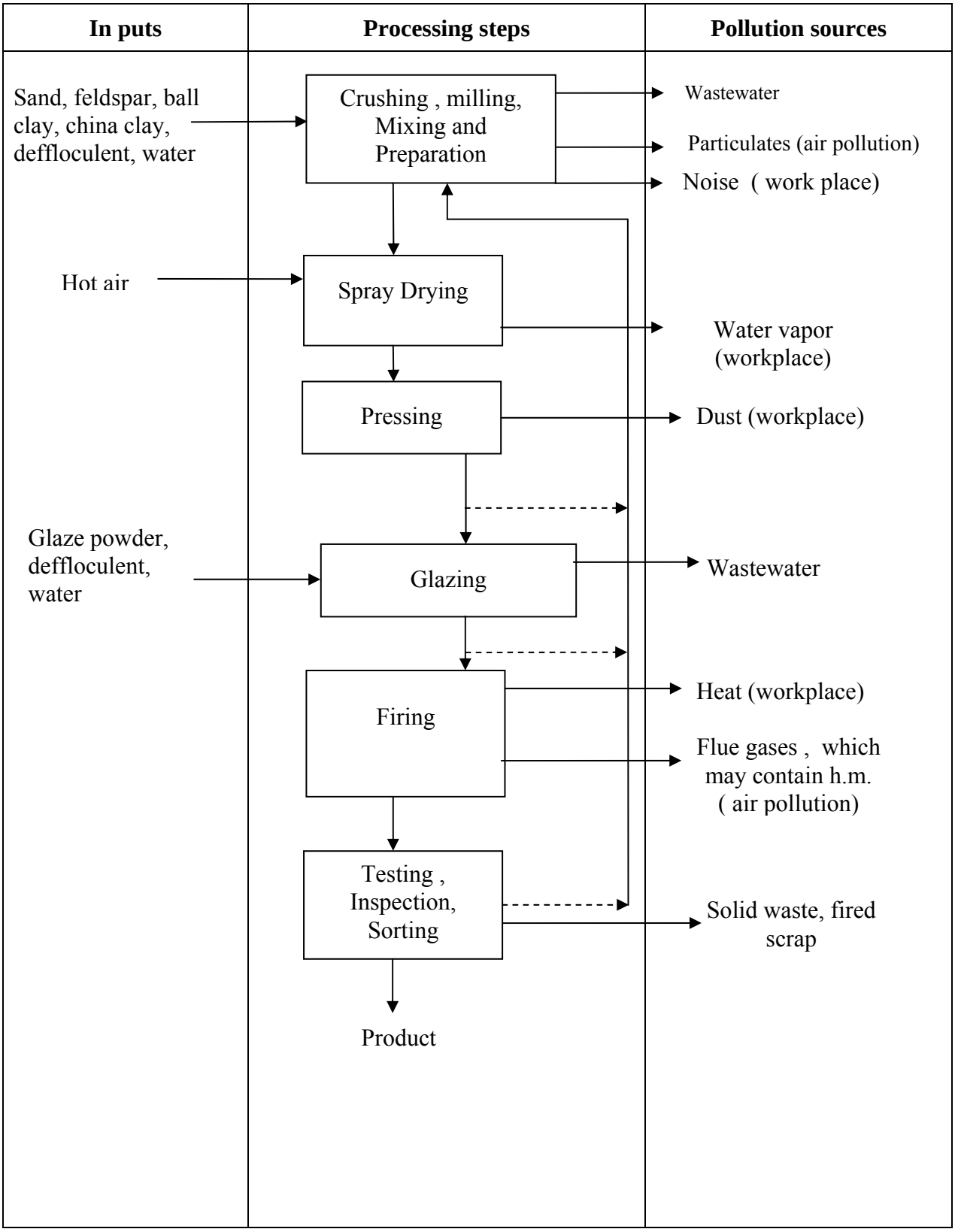


Figure (5) Tile ware production line and Related Pollution sources



----► Solid waste to be recycled, h.m.= heavy metals

2.3 Service units: description and potential pollution sources

Medium and large size plants will have some/all of the following services and auxiliary units. These units can be pollution sources and therefore should be inspected and monitored. Figure 6. shows the various units with their corresponding raw materials and their potential pollution sources.

2.3.1 Air Compressors

Air compressors are used in Ceramic industry for raw material pneumatic transporting. Compressors consume a considerable quantities of lube oils for lubricating and cooling purposes, in addition to electricity. The major environmental impacts are noise affecting workers and spent oils.

2.3.2 Laboratories

Laboratories have an important role in the ceramic industry, as they are responsible for:

- Testing raw materials, chemicals and wastewater
- Quality control of the products and comparing the findings with the standard specifications for raw materials and final products
- Chemicals used for testing could be hazardous. Proper handling and storage are required for compliance with environmental law.

2.3.3 Workshops and Garage

Large facilities have electrical and mechanical workshops for maintenance and repair purposes. Environmental violations could be due to:

- Noise
- Rinse water contaminated with lube oil

Pollution in the garage area will depend upon the services offered. The presence of a gasoline or diesel station implies fuel storage in underground or over the ground tanks that require leak and spill control .
Replacing lube oil implies selling it to petroleum company for recycling.

2.3.4 Storage Facilities

The specifications for the storage facilities depend on the stored material.

- Chemicals are used as additives for the process, for treatment processes.
- These chemicals require special handling, storage and management procedure as required by law.
- Fuel is used in the fuel combustion system, for the cars and delivery trucks. It is stored in underground or over ground tanks. The types of fuel usually used are fuel oil (Mazot), gas oil (solar), natural gas and gasoline.

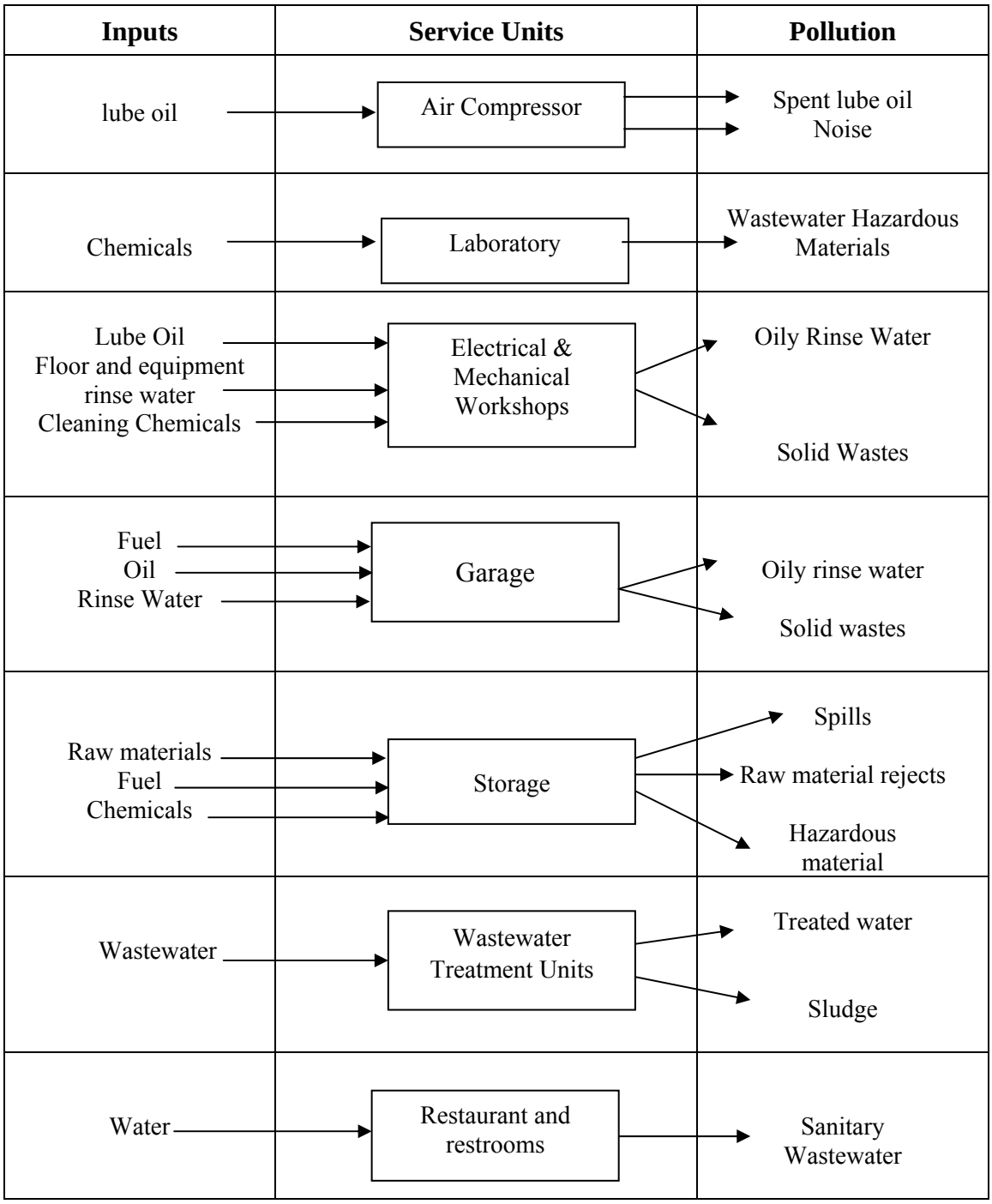
2.3.5 Wastewater Treatment Plants (WWTP)

Although a WWTP is a pollution abatement measure, it has to be inspected and monitored for potential pollution. Pollution may be due to malfunctioning or improper management. A ceramic facility discharges wastewater characterized by high total suspended solid (TSS).

2.3.6 Restaurants, Washrooms and Housing Complex

These facilities will generate domestic wastewater as well as domestic solid waste.

Figure (6) Service Units and Their Related Pollution Sources



2.4 Emissions, effluents and solid wastes:

Tables (3,4,5) summarize the major polluting processes,their outputs and the violating parameters.

2.4.1 Air emissions

- Stack flue gases from fuel burning (mazot and solar) for drying and firing oven. The flue gases contain sulfur oxides, nirogen oxides and carbon mono oxide, carbon dioxide and unburned hydrocarbon.
- A major source of particulate matter (or dust) at most ceramic plants are at the crushing zone, mills, pressing zone, handling and transportation of raw materials and gypsum loading zone.
- Usually the average concentration of dust is 30-40 mg/m^3, which exceeds the permissible limits set by the law (10 mg/m^3).
- Inhalable dust, the main sources of the inhalable dust are the crushing zone, mills, handling and transportation of raw materials. The inhalable dust could reach 5-6 mg/m^3 which exceed the permissible limit 5 mg/m^3.
- Dust is produced from tile ware production line during slip drying by hot air.

2.4.2 Effluents

- Highest levels of water pollution is generated from washing of molds and final products to remove any suspended impurities on the pieces. Impurities are removed after the pouring stage and before the drying stage.
- Spent lube oil from garage and workshops if discharged to sewer will give oily wastewater.
- Tile polishing generates a large quantity of wastewater high in suspended solids and settable solid. It is usually collected in settling tanks to separate the sludge before further treatment.
- Domestic wastewater

Typical effluent characteristics of the Egyptian ceramic industry are shown in table (6).

Table (6) Typical effluent characteristics of the Egyptian ceramic industry

Parameter	Average analysis (mg/lit)
pH	7.5
Total suspended solid	700
Total dissolved solid	220
Biological oxygen demand	30
Chemical oxygen demand	400
Oil and grease	25

2.4.3 Solid waste

Solid waste are generated from the manufacturing process :

- Surplus slip which remains in the molds after pouring
- The defected products before firing (tiles floor, sanitary ware and table ware)
- Defected products after firing (tiles floor, sanitary ware and table ware)
- Sludge generated from the wastewater of the polishing operation
- The other solid waste are cardboard, sacks, wood, plastic,…etc

2.4.4 Workplace

Noise is generated near milling and pressing units

2.4.5 Hazardous waste

The empty containers of pigments and chemicals are considered hazardous wastes. As well as the sludge produced from wastewater treatment.

2.5 Characteristics specific to the Ceramic industry

Pollution aspects related to the ceramic industry are mainly due to dust emission both in workplace and in ambient air. Other air pollution sources are from fuel combustion in kilns and dryers. The pollutants in the stack emissions will depend on the type of fuel used.
Effluents are characterized by higher concentration of suspended solids.

Table (3) Pollutants in different operations in sanitary ware

Operation	Inputs	Outputs	Pollution			
			Air	Water	Land	Workplace
Crushing, Milling, Mixing, Preparation	Sand, feldspar, clay	Body mixture (slip)	Particulates	Suspended solids	Solid waste and dust	Particulate emissions, noise
Shaping	Body mixture (slip)	Shaped parts	_____	Suspended solids	_____	Wastewater
Gypsum mold preparation	Gypsum, water	Gypsum molds	_____	_____	_____	_____
Drying	Shaped parts contain humidity	Dried parts	Water vapor	_____	_____	Heat stress
Glazing	Dried parts, Glaze powder, water	Glazed parts	_____	Suspended solids	Defected parts to be recycled	Wastewater
Firing	Glazed parts	Final product	Flue gases (Acidic)	_____	Fired Scrap	Heat stress Gaseous emissions

Table (4) Pollutants in different operations in table ware

Operation	Inputs	Outputs	Pollution			
			Air	Water	Land	Workplace
Crushing, Milling, Mixing, Preparation	Sand, feldspar, clay	Body mixture (slip)	Particulates	Suspended solids	Solid waste and dust	Particulate emissions, noise
Shaping by injection	Body mixture (slip)	Shaped parts	_____	Suspended solids	_____	Wastewater
Drying	Shaped parts contains humidity	Dried shaped parts	Water vapor	_____	_____	Humidity
Glazing	Dried parts , Glaze powder, water	Glazed parts	_____	Suspended solids	Defected parts to be recycled	Wastewater
Firing	Glazed parts	Final product	Flue gases (Acidic)	_____	Fired Scrap	Heat stress Gaseous emissions

Table(5) Pollutants in different operations in tiled floor

Operation	Inputs	outputs	Pollution			
			Air	Water	Land	Workplace
Crushing, Milling, Mixing, Preparation	Sand, feldspar, clay	Raw material mixture (slip)	Particulates	Suspended solids	Solid waste and dust	Particulate emissions noise
Drying	Raw materials mixture contains humidity	Dried raw materials	Water vapor	_____	_____	_____
Pressing	Dried raw materials	Shaped tiled floor	_____	_____	_____	Particulate emissions Noise
Glazing	Glaze powder, water	Glazed parts	_____	Suspended solids	Defected parts to be recycled	Particulate emissions noise
Firing	Glazed parts	Final product	Flue gases (Acidic)	_____	Off-specification	Heat stress Gaseous emissions

3. Environmental and health impacts of pollutants.

3.1 Impact of air emissions

Particulate matters Recent epidemiological evidence suggests that much of the health damage caused by exposure to particulates is associated with particulate matters smaller than 10μm (PM_{10}). These particles penetrate most deeply into the lungs, causing a large spectrum of illnesses (e.g. asthma attack, cough, and bronchitis). Emissions of particulates include ash, soot and carbon compounds, which are often the result of incomplete combustion.

Sulfur Oxides Air pollution by sulfur oxides is a major environmental problem. This compound is harmful to plant and animal life, as well as many building materials. Another problem of great concern is acid rain, which is caused by the dissolution of sulfur oxides in atmospheric water droplets to form acidic solutions that can be very damaging when distributed in the form of rain. Acid rain is corrosive to metals, limestone, and other materials.

Nitrogen Oxides Nitrogen oxides also dissolve in atmospheric water droplets to form acid rain.

Carbon dioxide Combustion of fossil fuels to produce electricity and heat contribute to the green house effect caused by the formation of carbon dioxide. The greenhouse phenomenon occurs when heat radiation from earth is absorbed by the gases causing a surface temperature increase.

Dust Occupational exposure to dust, presents health problems due to upper respiratory tract irritation and eczema.

Silicon dioxide There is sufficient evidence for the carcinogenicity of inhaled crystalline silica in the form of quartz. The action of crystalline silica on the lungs results in the production of a diffuse fibrosis in which the parenchyma and the lymphatic system are involved. This fibrosis is, to a certain extent progressive, and may continue to increase for several years after exposure is terminated.. The most common physical sign of silicosis is a limitation of expansion of the chest. There may be a dry cough.

Kaolin Clay Occupationally inhaled kaolin produced chronic pulmonary fibrosis sites of action: lung parenchyma, lymph nodes and hilus.

Bentonite Clay The powder may contain large amounts of free silica which can produce pneumoconiosis with chronic inhalation.
Chronic inhalation exposure to similar clays, such as fuller's earth, has been shown to cause pneumoconiosis without pathological changes of silicosis. Symptoms usually appear after many years of exposure.
Direct eye exposure resulted in severe anterior segment uveitis and retrocorneal abscess in a dental assistant.

Soda ash Dusts or vapors of sodium carbonate may cause irritation of mucous membranes with subsequent coughing and shortness of breath

3.2 Impact of Effluents

Spent lube oils from garage and workshops could be a cause for concern if discharged into the sewer system, because they tend to coat surfaces causing maintenance problems. Also, if they discharged to surface waters, they can interfere with the aquatic life in these surface waters and create unsightly floating matter and films.

3.3 Environmental Impact of Solid Wastes

The type of solid wastes varies from suspended matter, sludges, chemicals, paints, glazes, fired defaulted products, to damaged equipment. If these wastes manifest hazardous characteristics they considered as hazardous wastes, and should be safely disposed.
The disposal of sludge and fired defaulted products of ceramic industries is proving to be a an important issue because of there volume.

3.4 Environmental Impact on Workplace

Constant noise causes an increase in blood pressure, and may affect the nervous system. Moreover, it can reduce a person's attention and concentration, and cause hearing loss as a result of long periods of exposure.

4. Egyptian Laws and Regulations

There are a number of laws and regulations that address the different environmental violations. The following are the laws applicable to the Ceramic industry.

4.1 Concerning Air Emissions

Article 40 of Law 4/1994, article 42 of the executive regulations and annex 6 deal with gaseous emissions from combustion of fuel. The statutes relevant to the fuel combustion are:

- The use of fuel oil (mazot) and other heavy oil products, as well crude oil shall be prohibited in dwelling zones.
- The sulfur percentage in fuel used in urban zones and near the dwelling zones shall not exceed 1.5%.
- The design of the burner and fire-house shall allow for complete mixing of fuel with the required amount of air, and for the uniform temperature distribution that ensure complete combustion and minimize gas emissions caused by incomplete combustion..
- Gases containing carbon dioxide shall be emitted through chimneys rising sufficiently high in order that these gases become lighter before reaching the ground surface, or using fuel that contains high proportions of sulfur in power generating stations, as well as in industry and other regions lying away from inhabited urban areas, providing that atmospheric factors and adequate distances to prevent these gases from reaching the dwelling and agricultural zones and regions, as well as the water courses shall be observed.
- Chimneys from which a total emission of wastes reaches 7000 – 15000 kg/hr, shall have heights ranging between 18 – 36 meters.
- Chimneys from which a total emission of gaseous wastes reaches more than 15000 kg/hour, shall have heights exceeding at least two and a half times the height of surrounding buildings, including the building served by the chimney.
- The permissible limits of emissions from sources of fuel combustion are given in table (7).

Table (7) Maximum limits of emissions from sources of fuel combustion

Pollution	Maximum limit, mg/m^3 of exhaust	
	Existing	New
Sulfur Dioxide.	4000	2500
Carbon Monoxide.	4000	2500
Ashes in urban regions.	250	250
Ashes in remote regions.	500	500
Smoke.	250	250

4.2 Concerning Effluents

Limits for pollutants in wastewater vary depending on the type of receiving water body. The parameters that should be monitored and/or inspected are BOD, COD, pH, temperature, TSS, TDS, Oil and Grease.
Table (8) presents the permissible limits for discharges to the different recipients (sea, Nile, canals, agricultural drains, public sewer) according to the different relevant laws.
Spent lube oil has a negative impact on water and soil and therefore its disposal should be monitored/inspected..

4.3 Concerning Solid Waste

A number of laws address solid waste management. The following laws apply to scrap and sludge from the WWTP:

- Law 38/1967 which addresses public cleanliness, regulates the collection and disposal of solid wastes from houses, public places, commercial and industrial establishments.
- Ministry of Housing, Utilities and Urban Communities (MHUUC) decree No. 134 of 1968, which provides guidelines from domestic and industrial sources, including specifications for collection, transportation, composting, incineration and land disposal.
- Law 31/1976, which amended law 38/1967
- Law 43/1979, the Law of Local administration, which provided that city councils are responsible for "physical and social infrastructure", effectively delegating responsibility for infrastructure functions.
- Law 4/1994 regulates incineration of solid waste

4.4 Concerning Work Environment

Violations of work environment could be encountered:

- Wherever heating is performed: temperature and humidity are regulated by article 44 of Law 4/1994, article 46 of the executive regulations and annex 9.
- Near heavy machinery: noise is regulated by article 42 of Law 4/1994, article 44 of the executive regulations and table 1, annex 7.
- Ventilation is regulated by article 45 of Law 4/1994 and article 47 of the executive regulations.
- Smoking is regulated by article 46 of Law 4/1994 and article 48 of the executive regulations, and Law 52/1981.
- Work environment conditions are addressed in Law 137/1981 for Labor, Minister of Housing Decree 380/1983, Minister of Industry Decree 380/1982

Table (8) Egyptian Environmental Legal Requirements for Industrial Wastewater

Parameter (mg/1 unless otherwise noted)	**Law 4/94: Discharge Coastal Environment**	**Law 93/62 Discharge to Sewer System (as modified by Decree 44/2000)**	**Law 48/82: Discharge into :**			
			Underground Reservoir & Nile Branches/Canals	**Nile (Main Stream)**	**Drains**	
BOD (5day,20 deg.)	60	<600	20	30	Municipal	Industrial
COD	100	<1100	30	40	60	60
pH (Grease)	6-9	6-9.5	6-9	6-9	80	100
Oil & Grease	15	<100	5	5	6-9	6-9
Temperature (deg.)	10C > avg. temp of receiving body	<43	35	35	10	10
Total Suspended Solids	60	<800	30	30	35	35
Settable Solids	__	<10	__	20	50	50
Total Dissolved Solids	2000	__	800	1200	__	__

The limits for the relevant pollutants are presented in Table 9:
Table (10) presents the permissible limits for dust in workplace.

Table (9) Permissible limits as time average and for short periods

Material	Limits			
	Time average		Exposure limits for short periods	
	ppm	mg/m^3	ppm	mg/m^3
Carbon dioxide	5000	9000	15000	27000
Carbon monoxide	50	55	400	440
Sulfur dioxide	2	5	5	10

Table (10) Limits for nuisance causing dusts

Limits for total dusts	10 mg/m^3
Limits for inhalable dusts	5 mg/m^3

4.5 Concerning hazardous material and waste

Law 4/1994 introduced the rules and instruction to store and handle hazardous materials and wastes. The hazardous chemicals used in the lab and the fuel for the fuel combustion system, fall under the provisions of Law 4/1994. Articles 29 and 33 of the law makes it mandatory for those who produce or handle hazardous materials in gaseous, liquid or solid form, to take precautions to ensure that no environmental damage shall occur. Articles 25, 31 and 32 of the executive regulations (decree 338/1995) specify the necessary precautions for handling hazardous materials. Storing of fuel for the boilers is covered by the Law 4/1994 as hazardous material There is no explicit articles in Law 4/1994 or in decree 338/1995 (executive regulations), regarding holding a register for the hazardous materials; article 33 is concerned with hazardous wastes. However, keeping the register for the hazardous materials is implicit in article 25 of the executive regulations regarding the application for a license.

4.6 The Environmental Register.

Article 22 of Law 4/1994 states that the owner of the establishment shall keep a register showing the impact of the establishment activity on the environment. Article 17 and Annex 3 of the executive regulations specify the type of data recorded in the register.

The emergency response plan and the hazardous materials register will also be part of the environmental register as stated in part 4.5.

5. Pollution Abatement Measures

This section deals with pollution abatement in the three media air, water and soil. Three types of interventions will be considered:

- In-plant modifications, which are changes that are performed in the plant to reduce pollutant concentrations in streams through recovery of materials, segregation and/or integration of streams, reducing the flow rate of the wastewater streams that need further treatment to reduce the hold-up of the required WWTP.
- In-Process modifications, which are changes performed on the process such as the introduction of newer technology, substitution of a hazardous raw material, performing process optimization and control.
- End-of-pipe (EoP) measures, which involve treatment of the pollutant or its separation for further disposal. Whereas in-plant and in-process modifications usually have an economic return on investment, end-of-pipe measures will be performed for the sole purpose of compliance with the laws without economic

Egyptian Environmental Laws do not require water and energy conservation measures. These measures have been considered in this manual since resource depletion and hence conservation is a worldwide-recognized environmental issue that could be implemented in Egypt in the near future. Water conservation measures can lead to higher concentrations of pollutants in the effluent streams. Both energy and water conservation measures will provide both financial and economic benefits.

The term Cleaner Production (CP) refers to the same concepts of pollution reduction through in-process, in-plant and resource conservation, in contradistinction to end-of-pipe treatment. In many cases, the adoption of CP can eliminate the need for (EoP) treatment.

The following CP and EoP measures have been identified for the ceramic industry.

5.1 Air Pollution

Flue gases

Particulate matter in flue (exhaust) gases are due the ash and heavy metal content of the fuel, therefore low combustion temperature, low excess air level, controlling flow rate of flue gases may affect the emission. Sulfur dioxide is due to the sulfur content of the fuel. Nitrogen oxides are formed when maximum combustion temperature and high excess air. Carbon monoxide is formed when incomplete combustion occurs at low air to fuel ratio.

The following measures can be adopted to minimize air pollution from flue (exhaust) gases:

- Replace Mazot by solar or natural gas. Mazot is high in sulfur content.
- Regulate the fuel to air ratio for an optimum excess air that ensures complete combustion of carbon monoxide to dioxide.
- Keep the combustion temperature at a moderate value to minimize particulate matter and nitrogen oxides.
- Implement a particulate emission control equipment (filters, electrostatic precipitators,..etc)

Dust

a) The plant should be provided with air pollution control systems to control the dust emitted throughout the different stages of the process (cyclones, electrostatic precipitators,..etc)
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.
c) Cyclones are installed for dust elimination from stack emissions.

5.2 Water Pollution Abatement Measures

In-plant modifications

- Integration and segregation of sewer lines to minimize treatment needs and ensure compliance with the environmental laws, can be an option for many factories. In some cases where there are several discharge points from the factory, mixing of the streams could lead to compliance. In other cases where treatment is imperative some streams could be segregated and discharged without violation. The remaining streams will require a small capacity treatment unit.

In-process modifications

- Modernize the equipment

Table 11 shows the low cost solutions to increase efficiency and reduce waste in ceramic and porcelain production

Table (11) Low-cost solutions to increase efficiency and reduce waste in ceramics and porcelain production

Avoid or reduce the use of heavy metals in mixes and glazes	Glazes that do not contain lead or other heavy metals are commonly available. Metals in ceramic mixes are used for their engineering properties. Process engineers should search for non-toxic ingredients.
Dry clean up	Vacuums and damp brooms can be used to clean up dust from mixes and grinding, reducing the amount of waste that goes into the wastewater from final clean up.
Water recirculation	Wastewater can be stored so the suspended particles settle to the bottom, then the water can be reused for cleaning. Sludge can be collected, dried and made into inexpensive bricks rather than disposing it.
Improve product drying before firing	Extended drying time reduces fuel requirements. Even drying throughout product stacks reduces defective firing.
Improve air flow control	Stopping all air leaks and controlling the kiln opening size allows better control of air flow speed and direction. This in-turn improve combustion.
Switch to natural gas fuel	If available and competitively priced, these fuels have significantly less emissions and can improve product quality.
New kiln design	Vertical shaft brick kilns allow increased production rates and significantly decreased emissions through improved combustion air flow efficiency. Several other kiln designs have also proven to be relatively low-cost and much more efficient than traditional ovens or kilns.

End-of-pipe treatment

The effluent is mainly contaminated with clay and other mineral based raw materials. A majority of them are insoluble and will be present in the effluent stream as dispersed or suspended particles. Therefore effluent wastewater is characterized by turbidity, color and high suspended solids levels.

Proposed treatment system

The proposed system to treat the effluent for reuse or discharge into the receiving body needs the following units: screens, equalization tank, feed pump, flow regulator, mixing tank, flocculation tank and clarifier.

5.3 Abatement Measures for Solid Waste Pollution

Solid waste

- Solid waste generated during the manufacturing steps (except after firing) whether a mixed raw materials or product could be recycled to the preparation step.
- The rejected products after firing can be classified into two types : - First type can be repaired by using special pastes andrefired to obtain a final product

- Second type can not be repaired, therefore, it is reused as raw material for floor tiles manufacture

Sludge

Effluent treatment processes generate solids. It should be dried and dumped in waste disposal sites.

5.4 Abatement measure for workplace

Abatement measures for noise can be achieved by:

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

5.5 Water conservation

Water and sewer service costs have been rising, and these increases can cut into profits. Using water more efficiently can help counter these increases.

Water Conservation

- Install water meters and monitor water use
- Use automatic shut-off nozzles and mark hand-operated valves so that open, close and directed-flow positions are easily identified.
- Minimize spills on the floor minimizes floor washing.
- Repair leaks.
- Handle solid waste dry.

6. Industrial Inspection

The inspection of the Ceramic industry will follow the procedures described in the Inspection Guidelines. This chapter presents a summary of the inspection process regarding the purpose and scope of various types of inspection, and the proposed inspection procedure for the Ceramic Industry.
The overall purpose of inspections is to enforce environmental laws. Table 12 lists the various types of inspections and the objectives that have to be fulfilled for each type.

Table 12: The different types of inspections and their objectives

Inspection type	**Objectives**
Site Inspection	
1. Comprehensive	Evaluate compliance status regarding all aspects of Law 4
2. Specific	Evaluate compliance status regarding some aspects of Law 4 Review special conditions set by EEAA in EIA studies. Investigate complaints
3. Follow-up	Check environmental register and implementation of compliance measures
Inspection campaign	
1. Geographic	Check pollution sources to specific receiving media
2. Sector specific	Check aspects relevant to specific sector

As evident from the above table, comprehensive inspection deals with all aspects of environmental laws and therefore is considered in this manual. Other inspection types can be tailored accordingly.
Developing an inspection strategy and quarterly and/or monthly plans are the responsibility of the inspectorate management. Developing site-specific inspection plans for carrying out the scope of work that fulfills inspection objectives is the responsibility of the inspection team. Planning for inspections is presented in more detail in the General Inspection Manual, GIM (EPAP-2002).

7. Inspection planning at the inspectorate level

The responsibilities of the inspectorate management regarding the specific inspection are to state clearly, in writing, the type of inspection and related objectives as well as the time schedule necessary to carry out inspection. The inspectorate management is also responsible for providing preliminary information about the facility, inspection tools, and logistics.

7.1 Activities characteristic to the Ceramic Industry

Taking the comprehensive inspection as an example, the objectives stated in Table 12 dictate the activities required for covering all aspects of compliance with environmental laws and regulations. The required personnel, equipment and logistics are determined accordingly.
The inspectorate management should have a clear idea about how to proceed with inspection of this type of facilities. The main problem in this industry are:

- The solid waste produced from processing lines (screening, molding,…etc)
- The defected parts and products produced from drying, firing steps
- Wastewater generated from washing operation

Large facilities are expected to have most production lines and most service units.

7.2 Providing information about the facility

Chapters (2-7) present the technical aspects regarding the ceramic industry, its pollution sources and relevant environmental laws. Information regarding compliance history related to other inspecting parties (irrigation inspectors, occupational health inspectors, etc.) can be helpful in anticipating potential violations and preparing necessary equipment.

7.3 Providing resources

The required personnel, tools and equipment depend on the size of the facility to be inspected. The inspection team leaders, in coordination with the inspectorate management, are responsible for assessing the inspection needs. The number of inspectors required depends on the size of the facility and the planned activities.
Usually the team members are split and assigned different tasks during the field visit to allow the required activities to be performed in parallel. Each task is rotated among the inspectors to diversify their experience.

8. Preparation for field inspection (inspection team)

As presented in the General Inspection Manual, GIM (EPAP-2002), tasks necessary for preparation for field inspection, are:

- Gathering information about the specific facility to be inspected
- Preparing of the inspection plan
- Preparing the checklists

This manual presents the case of a comprehensive multi-media site-inspection of a large ceramic facility since it represents the highest level of inspection complexity. Tasks for carrying out less complicated inspections can be easily deduced.

8.1 Gathering and reviewing information

The inspection team should review the general information prepared for the ceramic industry (chapters 2-5) and then check - if possible - what production lines and service units are present at the targeted facility. In addition to the required information listed in Annex (a) of the General Inspection Manual, GIM (EPAP-2002), it is important at this stage to determine the following:

- The type of receiving body for the industrial wastewater and review relevant Egyptian laws (Chapter 4).
- The scope of inspection and related activities based on the type and objectives of inspection required by the inspectorate management.
- The potential pollution hazards as addressed in section 2.4, and accordingly, define measurement and analyses needs.

Note to inspector:

- *Some facilities dilute its polluted wastewater with water before discharging to sewer. Degree 44/2000 explicitly prohibits this behavior.*

8.2 Preparation of the inspection plan

An example of an inspection plan is included in Annex (b) of the General Inspection Manual GIM (EPAP-2002). The plan should take into account the following:

- For large ceramic facilities, the inspection team could be divided into smaller groups. Each group will be responsible for inspecting a number of production lines and service units.
- At the beginning of the field visit, the inspection team should check the environmental register for completeness using the checklist provided in Annex (g) of the General Inspection Manual, GIM (EPAP-2001).
- The results of the analyses included in the environmental register should be checked at the end of the field visit (if suspicion arises about them) and copies of these results should be obtained.

Notes to inspector:

- *When the final effluent is expected to be in violation of environmental laws, sampling should be planned.*
- *Because of possible shock loads a grab sample at the time of discharge should be performed. If grab samples are taken when no shock load is discharged the results will not reflect the actual pollutants loads.*
- *To prove that a shock load has been discharged, a composite sample over the shift duration should be analyzed. If the results show higher pollutant concentrations than those of the grab sample, then a shock load was discharged.*
- *Make sure that the polluting production lines are in operation since some factory management resort to halting the polluting lines during the inspection.*

8.3 Preparation of the required checklists

The checklist for the ceramic industry is presented in Annex 1 of this manual. The checklist has been prepared in such a way that it starts with general information about the facility and its operation. Separate checklists are then filled for each production line/service unit independently for relevant environmental aspects and media. The inspection team will compile the checklists relevant to existing production lines and service units in the targeted facility.

The development of the checklists goes through the following steps:

- Draw the block flow diagrams for the production lines with their pollution sources
- Identify the areas of possible non-compliance and the parameters that need checking. For example, noise should be checked near the compressors.
- Identify what to observe, ask and/or estimate that can convey information about pollutants. For example :
  - Oily effluents from production lines or oily cooling water indicates the contamination of the plant effluent with oil

Note to inspector:
Law 4 does not specify standards for effluent from production lines but only for final disposal points. However, effluent quality from production lines is an important indicator of the final discharge quality.

8.4 Legal aspects

As evident from chapter 2, a large ceramic facility is expected to be in violation of several environmental laws, specifically with respect to wastewater if no treatment is performed. The inspection team should be prepared for legally establishing such a violation.

Note to inspector:

It is the responsibility of the inspector to assess the seriousness of the violation upon which the enforcement action will be based. His information about the nature and cause of the violation must be well documented and the evidence sound. The case could be contested in court and the inspector will be asked to defend his technical judgement.

9. Performing the field inspection

9.1 Starting the field visit

The General Inspection Manual, GIM (EPAP, 2002) describes the procedures involved for entering an industrial facility. The inspector's attitude and behavior are very important from the start and will dictate the factory's personnel response to the inspection tasks.

Note to inspector:

- *It is better at this stage not to ask direct questions about the solid waste and defected parts and products. Interviewing the workers on-site in an indirect manner can give better results.*
- *Check the results of effluent analyses, time and place of sampling. If suspicious make your own analyses.*
- *Get a sketch of the factory layout with sewer lines and final disposal points.*

9.2 Proceeding with the field visit

Information gathered during the facility tour is dependent on interviews of facility personnel and visual observation. Annex (D) in the Guidelines for Inspection Team GIM(EPAP, 2002) presents some useful interviewing techniques.

Using the facility layout, start by checking the final disposal points and the various plants and/or service units connected to each point. This will determine where and how to take the effluent samples. Visual observations about the condition of the sewer manholes should be recorded. In some facilities the discharge to the receiving body is performed through a bayyara (cesspit), septic tanks or holding tanks. If the holding tank is not properly lined, contamination of the underground water could occur.

Note to inspectors:
Cesspits, septic tanks and holding tanks are a form of pre-treatment that generates settled sludge. Check:

- *The presence of accumulated sludge and related hygienic conditions*
- *The disposal of the sludge*

Inspection of the production lines should start with the feeding of raw materials and end with the product packaging and storage.

Production Lines

Sanitary ware production line	- What happens to the solid waste produced from pouring, drying and glazing stages ? - Check the humidity produced from water vapor emission at drying stage - What happens to the defected products produced from sorting ? - What is the quantity of wastewater produced from this unit ? - Does the facility treat wastewater before discharging ? - What is the final discharge point - What kind of fuel is used in the furnace ? - What is the surrounding area (when using fuel oil (mazot) in the furnace) ? - Check for heat stress from kiln - Check for suspended solids in air (workplace)
Tiles production line	- What happens to the solid waste produced from pressing, drying and glazing stages ? - Check the humidity produced from water vapor emission at drying stage - What happens to the defected products produced from sorting ? - What is the quantity of wastewater produced from this unit ? - What kind of fuel is used in the furnace ? - What is the surrounding area (when using fuel oil (mazot) in the furnace) ? - Check for heat sress from furnace - Check for suspended solids in air (workplace)
Table ware production line	- What is the amount of wastewater produced ? - What happens to the defected products produced - What kind of fuel is used for firing ? - Check heat stress from kiln - Check the suspended solids in air (workplace)

Service Units	
Garage, and Workshops	- Check for noise and take measurements if necessary. - Check solid waste handling and disposal practices. - Check for spent lube oil disposal method. Ask for receipt if resold.
Storage facilities	- Check storage of hazardous materials and fuel as described in Law 4/1994. - Check spill prevention and containment measures for storage of liquids.
WWTP	- What is the final discharge point - Check for sludge accumulation and disposal. - Analyze the treated wastewater.
Effluent analysis	
Receiving body	- The nature of the receiving body determines the applicable laws. - Check if effluent discharge is to public sewer, canals and Nile branches, agricultural drains, sea or main River Nile. - Accordingly, define applicable laws, relevant parameters and their limits.
Sampling	- A composite sample must be taken from each final disposal point over the duration of the shift or a grab sample at peak discharge. Each sample will be analyzed independently. - According to legal procedures in Egypt, the effluent sample is spilt and one of them is sealed and kept untouched.

9.3 Ending the field visit

When violations are detected a legal report is prepared stating information pertaining to sampling location and time. Violations of work environment regulations should also state location and time of measurements. Other visual violations such as solid waste accumulation, hazardous material and waste handling and storage, and material spills should be photographed and documented. It is preferable that the facility management signs the field-inspection report but this is not a necessary procedure.
A closing meeting with the facility management can be held to discuss findings and observations.

Note to inspector:
- *The less certain the team leader is about a specific violation the more reason not to discuss it at the closing meeting.*

10. Conclusion of the field inspection

The activities performed during the site inspection are essential for preparation of the inspection report, for assessing the seriousness of the violations, for pursuing a criminal or civil suit against the facility, for presenting the legal case and making it stand in court without being contested, and for further follow-up of the compliance status of the facility.

10.1 Preparing the inspection report

An example of an inspection report is included in Annex (F) of the Guidelines for Inspection Team GIM(EPAP, 2002). The inspection report presents the findings, conclusions, recommendations and supporting information in an organized manner. It provides the inspectorate management with the basis for proposing enforcement measures and follow-up activities.

10.2 Supporting the enforcement case

Many issues may be raised and disputed in typical enforcement actions. Enforcement officials should always be prepared to:

- Prove that a violation has occurred. The inspector must provide information that can be used as evidence in a court of law.
- Establish that the procedures were fairly followed.
- Demonstrate the environmental and health effect of the violating parameter.

Note to inspectorate management:

- *Although the inspector is not required to suggest pollution abatement measures, the inspectorate management should be able to demonstrate that a remedy for the violation is available.*

10.3 Following-up compliance status of violating facility

After performing the comprehensive inspection and detecting the violations the inspectorate management should:

- Decide on the sanctions and send the legal report to the judicial authority.
- Plan routine follow-up inspections. This type of inspection focuses on the violating source and its related pollution abatement measure. Self-monitoring results are reviewed during the visit.
- Follow-up the enforcement case (legal department)

Annex (1)

Inspection Checklist for Ceramics Production Facility

Annex (1- A)

Basic Data Sheet

(To be fed to the database of the inspection units)

Ministry of State for Environmental Affairs
Egyptian Environmental Affairs Agency
Basic Data Sheet

Date of visit:……. Visit number:…….

Facility name:……

Commercial name:…….

Licensed Activity:……... Days off:……

Legal status:……

Address of facility

Area of facility:…… Governorate:…….

City:…… Zone:…….

Phone no. :…… Fax no.:…….

……... …….

Year of operation :…….. Postal code:……

The Facility Representative:……..

Environmental management representative:…….

Chairman/Owner:……

Address of Administration

e-mail:……..

Phone no. :…… Fax no.:…….

……... …….

The industrial sector:……

No. of male employees: …… No. of female employees:……

Do they work in production …….

Total no. of employees: …….

Number of shifts/day:…….……shifts/day

Duration of shift:……..…hrs/shift

Environmental register:…….. Hazardous waste register:…….

EIA:…….. Self monitoring:…….

Nature of Surrounding Environment

Industrial ❑	Coastal ❑	Coastal/ Residential ❑
Industrial/ Residential ❑	Residential ❑	Agricultural ❑
Agricultural/ Industrial ❑	Agricultural/ Residential ❑	Desert ❑

Ministry of State for Environmental Affairs
Egyptian Environmental Affairs Agency
Basic Data Sheet

Power Consumption

Electricity ❑ Fuel ❑

Electric power: ……...kWh/(day-month-year)

Type of fuel	Fuel consumption	
Mazot	…….	Ton/(day-month-year)
Solar	…….	Ton/(day-month-year)
Natural gas	…….	Ton/(day-month-year)
Butagas	…….	Ton/(day-month-year)
Other ….	…….	Ton/(day-month-year)

The GPS (Global Positioning System) reading for Gaseous Emissions

1- LAT(Latitude):..……. LONG(Longitude):…….
2- LAT(Latitude):…… LONG(Longitude):…….
3- LAT(Latitude):…… LONG(Longitude):…….

Production

Product	Quantity/ (day-month-year)
……	……
……	……
……	……
……	……
……	……
……	……
……	……
……	……
……	……
……	……
……	……

Water Supply

Artesian well ❑ Municipal water ❑ Treated water ❑ Nile water ❑

Canal water ❑ Other…….. ❑

Ministry of State for Environmental Affairs
Egyptian Environmental Affairs Agency
Basic Data Sheet

Water Consumption

Amount of water consumed in operation (day-month-year):

Process ……..m^3/ Boilers……..m^3/

Domestic usage……....m^3/ Cooling……....m^3/

Other…….. …….m^3 /

Total amount of water consumed (day-month-year)…… ……..m^3/

Type of waste water:
Industrial ❑ Domestic ❑ Mixed ❑

Wastewater Treatment:
Treated ❑ Untreated ❑

Type of Treatment:
Septic tanks ❑ pH adjustment ❑ Biological treatment ❑
Chemical treatment ❑ Tertiary treatment ❑

Amount of treated water/ (day-month-year)……..m^3 /
Amount of waste water/(day-month-year)…….m^3 /

Final wastewater receiving body:
Nile ❑ Lakes (fresh water) ❑ Drain ❑
Groundwater ❑ Public sewer system ❑ Canals❑
Agricultural Land ❑ Desert Land ❑ Other……❑

The Global Positioning System(GPS) reading for final disposal
1-LAT(Latitude):……. LONG(Longitude):…….
2-LAT(Latitude):……. LONG(Longitude):…….

Engineering Drawings for the Facility
Gaseous emissions map Yes ❑ No ❑

Sewer map: Domestic ❑
Industrial ❑
Mixed ❑
Factory Layout ❑
Production process flow diagram ❑

Ministry of Environmental Affairs-EEAA
30 Misr Helwan Agricultural road - Maadi- Cairo 11728
Tel. (02)5256452-(02)5256453 Ext.8849 Fax(02)5256490

Raw material consumption

No.	Trade name	Scientific name	CAS no.	UN no.	Physical state	Type of container	Amount	Classification	
								Hazardous	Non-Hazardous

Inspection Team Member:

Team member	Position

Date: Inspector signature:

Annex (1- B)

Inspection Checklist for Hazardous Materials and Wastes

Annex (F-2)
Inspection checklists for hazardous materials and wastes for a facility

1. Hazardous materials (to be filled in case the facility uses hazardous materials) [1]

Fill the following table according to the codes below

Hazardous material	Amount	Field of utilization	Storage method[2]	Method of disposal of the containers	Conformity of containers to specifications[3]	Presence of MSDS[4]

[1] To be filled from the list of used raw material and chemicals according to the hazardous material list issued by the Ministry of Industry, checking the presence of a valid license for handling

[2] According to law 4/1994, does the storage area have:
S_1: alarm, precaution and fire fighting system? S_2: first aid procedures?

[3] Check containers' compliance with law4/1994:
C_1: sealed and don't cause any threats while handling C_2: unaffected with along storing period
C_3: labeled with hazard and toxicity signs C_4: labeled in Arabic (production, origin, utilization instruction)
C_5: labeled with its content, the effective substance and its concentration

[4] Material safety data sheet

2. Hazardous wastes (to be filled in case the facility generates hazardous wastes)[1]

Fill the following table according to the codes below

Hazardous waste	Source	Amount generated/ year	Storing method			On-site treatment and disposal			Transportation method	Presence of documents indicating off-site disposal[6]
			Method of storage inside the facility	Compliance of containers' specifications and labels with law 4/1994[2]	Compliance of storage areas with law 4/1994[3]	Treatment[4]	Final disposal[5]	Compliance of treatment and disposal with law 4/1994		

[1] Hazardous wastes can be identified according to law 4/1994 and by using the hazardous wastes list of the Ministerial decree no.65 for 2002 as refrence

Is there a hazardous wastes register? Yes ❑ No ❑

[2]Does the facility take into consideration that the storage containers should be:
C_1: with sealed covers to protect the container from rain water and dust and to prevent any wastes leakage during storage and/or transportation
C_2: constructed or lined by impermeable material which doesn't react with the contained material
C_3: of suitable capacity C_4: labeled

[3] Specification of storage area: determining specified locations for storage of hazardous wastes where safety conditions are set up to prevent the occurrence of any harm to the public or to those persons exposed to the wastes

[4] Which of the following methods are used by the facility for the treatment of hazardous wastes?
N_1: biodegradation N_2: incineration N_3: physical or chemical treatment

[5] Which of the following methods are used by the facility for the hazardous wastes final disposal?
F_1: land filling in specially engineered landfill F_3: other (specify)…….

[6] Contracts with wastes' contractors and receipts.

Annex (1- C)

Inspection Checklist for Production Lines and Service Units

Checklist for Sanitary ware Production Line

1. General	
1.1 The housekeeping status Floor condition Piling of solid waste	 ---------- ----------
1.2 Make sure the all units of the production line are operated	----------
1.3 Type of operation	☐ Batch ☐ Continuous
1.4 Amount of raw material processed per day and per shift	---------- ---------- ----------
2. Status of the Work Environment	
2.1 Do you feel with heat stress from the firing stage?	☐ Yes ☐ No
2.2 Does the facility have heat stress and humidity measurements	☐ Yes ☐ No
2.3 Is there a ventilation system in place ? **<u>If Yes</u>** Is the ventilation system operating?	☐ Yes ☐ No ☐ Yes ☐ No
2.3 does the shaping step generate noise? **<u>If Yes</u>** Check the exposure time	☐ Yes ☐ No
Note : If suspicious, measure humidity and/or heat	
3. Status of Effluents (Wastewater)	
3.1 What is the amount of wastewater produced from this production line?	---------- ----------
3.2 Notice the characteristics of the wastewater?	----------
4. Status of Solid Waste	
4.1 What type of solid waste is produced	---------- ---------- ----------
4.2 What are the amount of each type ?	----------
4.3 What happen to solid waste generated from sorting ?	---------- ---------- ----------
4.4 What happen to solid waste generated from refiring?	---------- ---------- ----------

5. Status of Ambient Air	
5.1 Type of fuel used for kilns and dryers	☐ Mazot ☐ Solar
In case of using mazot Is it a dwelling zone	☐ Yes ☐ No
Note : The use of mazot as fuel in the dwelling zone is Prohibited by law.	
5.2 What is the height of the chimney for kilns and dryers	----------
Note : the height of the chimney must be 2.5 times the height of adjacent buildings.	
5.3 If mazot is used in non dwelling regions, or smoke is detected	Are there analyses of the flue gases for sulfur dioxide, carbon monoxide, and particulate matter ☐ Yes ☐ No <u>If Yes</u> Are they enclosed in the environmental register ☐ Yes ☐ No <u>If No</u> Ask for preparation of these records and their inclusion in the environmental register
Note : Perform analysis, if necessary	

Checklist for Refractory Production Line

1. General	
1.5 The housekeeping status Floor condition Piling of solid waste	 ---------- ----------
1.6 Make sure the all units of the production line are operated	----------
1.3 Type of operation	☐ Batch ☐ Continuous
1.4 Amount of raw material processed per day and per shift	---------- ---------- ----------
2. Status of the Work Environment	
2.1 Are there noise in the workplace	☐ Yes ☐ No
2.2 What are the source of noise	---------- ----------
2.3 How long does the employee exposed to noise ?	---------- ----------
2.4 Does the worker wear the hearing protection tools?	---------- ----------
2.5 Does the facility have noise measurements	---------- ----------
2.6 Do you feel with heat stress?	☐ Yes ☐ No
2.7 Does the facility have heat stress measurements	☐ Yes ☐ No
2.8 are there measurements for dust in the workplace?	
Note : If suspicious, measure noise and/or heat	
4. Solid Waste	
4.1 What type of solid waste is produced	---------- ---------- ----------
4.2 What are the amount of each type ?	---------- ---------- ----------
5. Status of Ambient Air	
5.1 Type of fuel used for kilns and dryers In case of using mazot Is it a dwelling zone	☐ Mazot ☐ Solar ☐ Yes ☐ No

Note : The use of mazot as fuel in the dwelling zone is Prohibited by law.	
5.2 What is the height of the chimney for kilns and dryers	---------- -
Note : the height of the chimney must be 2.5 times the height of adjacent buildings.	
5.3 If mazot is used in non dwelling regions, or smoke is detected	Are there analyses of the flue gases for sulfur dioxide, carbon monoxide, and particulate matter ☐ Yes ☐ No <u>If Yes</u> Are they enclosed in the environmental register ☐ Yes ☐ No <u>If No</u> Ask for preparation of these records and their inclusion in the environmental register
Note : Perform analysis, if necessary	

Checklist for Table ware Production Line

1.General	
1.1 The housekeeping status Floor condition Piling of solid waste	 ---------- ----------
1.2 Make sure the all units of the production line are operated	----------
1.3 Type of operation	☐ Batch ☐ Continuous
1.4 Amount of raw material processed per day and per shift	---------- ---------- ----------
1.5 what is the type of fuel used for firing ?	
2. Status of the Work Environment	
2.1 Do you feel with heat stress from the firing stage?	☐ Yes ☐ No
2.2 Does the facility have heat stress and humidity measurements	☐ Yes ☐ No
2.3 Is there a ventilation system in place ? **<u>If Yes</u>** Is the ventilation system operating?	☐ Yes ☐ No ☐ Yes ☐ No
3. Status of Effluents (wastewater)	
3.1 What is the amount of wastewater produced from this production line?	---------- ----------
3.2 Notice the characteristics of the wastewater?	----------
4. Solid Waste	
4.1 What type of solid waste is produced	---------- ---------- ----------
4.2 What are the amount of each type ?	----------
4.3 What happen to solid waste generated from sorting ?	---------- ---------- ----------
5. Status of Ambient Air	
5.1 Type of fuel used for kilns and dryers In case of using mazot Is it a dwelling zone	☐ Mazot ☐ Solar ☐ Yes ☐ No
Note : The use of mazot as fuel in the dwelling zone is Prohibited by law.	

5.2 What is the height of the chimney for kilns and dryers	----------
Note : the height of the chimney must be 2.5 times the height of adjacent buildings.	
5.3 If mazot is used in non dwelling regions, or smoke is detected	Are there analyses of the flue gases for sulfur dioxide, carbon monoxide, and particulate matter ☐ Yes ☐ No <u>If Yes</u> Are they enclosed in the environmental register ☐ Yes ☐ No <u>If No</u> Ask for preparation of these records and their inclusion in the environmental register
Note : Perform analysis, if necessary	

Checklist for Tiled Floor Production Line

1.General	
1.1 The housekeeping status Floor condition Piling of solid waste	 ---------- ----------
1.2 Make sure the all units of the production line are operated 0	----------
1.3 Type of operation	☐ Batch ☐ Continuous
1.4 Amount of raw material processed per day and per shift	---------- ---------- ----------
1.5 what is the type of fuel used for firing ?	
2. Status of the Work Environment	
2.1 Do you feel with heat stress from the firing stage?	☐ Yes ☐ No
2.2 Does the facility have heat stress and humidity measurements	☐ Yes ☐ No
2.3 Is there a ventilation system in place ? **<u>If Yes</u>** Is the ventilation system operating?	☐ Yes ☐ No ☐ Yes ☐ No
3. Status of Effluents (wastewater)	
3.1 What is the amount of wastewater produced from this production line?	---------- ----------
3.2 Notice the characteristics of the wastewater?	----------
4. Solid Waste	
4.1 What type of solid waste is produced	---------- ---------- ----------
4.2 What are the amount of each type ?	----------
4.3 What happen to solid waste generated from sorting ?	---------- ---------- ----------
5. Status of Ambient Air	
5.1 Type of fuel used for kilns and dryers In case of using mazot Is it a dwelling zone	☐ Mazot ☐ Solar ☐ Yes ☐ No

Note : The use of mazot as fuel in the dwelling zone is Prohibited by law.	
5.2 What is the height of the chimney for kilns and dryers	----------
Note : the height of the chimney must be 2.5 times the height of adjacent buildings.	
5.3 If mazot is used in non dwelling regions, or smoke is detected	Are there analyses of the flue gases for sulfur dioxide, carbon monoxide, and particulate matter ☐ Yes ☐ No <u>If Yes</u> Are they enclosed in the environmental register ☐ Yes ☐ No <u>If No</u> Ask for preparation of these records and their inclusion in the environmental register
Note : Perform analysis, if necessary	

Checklist for Boilers and Water Treatment Units

1. General	
1.1 Number of boilers and capacity	---------- ----------
1.2 What is the method used for water treatment?	❑ Lime ❑ Ion exchange ❑ Reverse osmosis
2. Status of Air Pollution	
2.1 What is the height of the stack of each boiler	Boiler (--)---------- Boiler (--)---------- Boiler (--)----------
***Note**: the height of the stack must be 2.5 times the height of adjacent buildings.*	
2.2 Type of fuel used for boilers	❑ Mazout ❑ Solar ❑ Natural gas ❑ Other…….
2.3 In case of using mazot for boilers, is the surrounding area residential?	❑ Yes ❑ No
***Note**: The use of mazot as fuel in the residential area is Prohibited by law.*	
2.4 If mazot is used in non residential area, are there analysis of the flue gases for sulfur dioxide, carbon monoxide, and particulate matter	❑ Yes ❑ No
2.5 If Yes Check the compliance of the analysis readings in the register with your observations	---------- ---------- ----------
***Note** : Whatever the fuel used ,if you notice any smoke, take a sample for analysis*	
3. Status of Work Environment	
3.1 Check the heat stress next to the boilers	----------
3.2 Check the noise next to the boilers and duration of exposure	---------- ----------
3.3 Are they included in the environmental register?	❑ Yes ❑ No
***Note** : In case of suspicious perform your own measurements*	
4. Status of Effluent	
4.1 What is the blow down rate from the boilers?	---------- m^3/d
4.2 What are the blow down and back wash rates for the treatment units?	---------- m^3/d ---------- m^3/d
4.3 Steam condensate is	❑ Recycled to the boilers ❑ Discharged to sewer
5. Status of solid waste	
5.1 If lime method is used, sludge is generated, what is the amount of sludge produced per day?	---------- ----------
5.2 What is the sludge disposal method?	----------
6. Status of Hazardous Material	
6.1 Check the storage method of chemicals used in the treatment process. Is it in compliance with law 4?	---------- ---------- ❑ Yes ❑ No
6.2 Is there any fuel leaks from fuel tanks	❑ Yes ❑ No
6.3 Is there any fire extinguishing devices and fire fighting measures?	❑ Yes ❑ No
6.4 Is there a spill prevention plan?	❑ Yes ❑ No
6.5 Do you notice anything that can provoke a fire? Such as the presence of a pump underneath the fuel tank (the start-up of the engine can produce a spark)	❑ Yes ❑ No Comment ---------- ----------

Checklist for Cooling Towers

1.General	
1.1 Number and capacity of cooling towers	---------- ---------- ----------
1.2 Cooling tower make-up rate Note : Blow-down = 10-15% of make-up	Rate ---------- Blow-down ----------
2. Status of Effluent	
2.1 Cooling water for the compressors is performed in	❑ Open Cycle ❑ Closed Cycle
Note : • *Cooling towers are used in an open cycle for cooling the effluent stream to the tempreture limit regulated by law 4/1994* • *If performed in open cycle it will dilute the final effluent*	
2.2 Record the amount of open cycle cooling	----------

Checklist for Garage

1. General	
1.1 Are detergents or solvents used for washing equipment, trucks, floor,….etc?	❑ Yes ❑ No
1.2 What is the amount of oil and grease used per day?	---------- ----------
1.3 What is the amount of spent lube oil per day ?	----------
1.4 How does the facility dispose the spent oil ?	----------
2. Status of Effluent	
2.1 What is the amount of wastewater generated ?	----------
2.2 Do you observe any oil / foams / solid matter in the inspection manhole?	❑ Yes ❑ No

Checklist for Laboratories

1. General	
1.1 What is the amount of eflluents generated per day?	----------
1.2 Check the disposal method of eflluents	----------
1.3 List the chemicals used in the laboratories	----------
2. Status of Work Environment	
2.1 Are there any odor/ gases/ noise in the work environment? 2.2 Check the exposure time	❑ Yes ❑ No ----------
3. Status of Hazardous Material	
3.1 Check storage of hazardous material. Is it in compliance with the requirements of law 4/1994?	❑ Yes ❑ No
3.2 Are there any first aid measures in place?	❑ Yes ❑ No

Inspection Checklist for Wastewater Treatment Plant

1. General	
1.1 What is the capacity of WWTP?	----------
1.2 Specify the units included in WWTP : Pumping station Equalization tank Aeration tank Sedimentation tank Sludge thickening tank Sludge drying Others	 ❑ Found ❑ Not found ❑ Found ❑ Not found ❑ Found ❑ Not found ❑ Found ❑ Not found ❑ Found ❑ Not found ❑ Found ❑ Not found ----------
1.3 List any chemical and its quantity used for wastewater treatment (coagulants,…..)	---------- ----------
2. Status of Effluent	
2.1 Are there analysis readings for the effluent? If not make your own	❑ Yes ❑ No
2.2 Are the analysis readings included in the environmental register?	❑ Yes ❑ No
3. Status of Solid Wastes	
3.1 Determine the sludge disposal	----------
Note : *Sludge can be use in liquid or dry form in agricultural purposes,according to the Ministrial decree 214/97 issued by the Ministry of Housing*	
3.2 If a third party is involved in disposal, check the presence of contracts and receipts	❑ Found ❑ Not found Comment ---------- ----------

Inspection Checklist for Compressors

1. General	
1.1 Number of compressors	----------
1.2 Type of compressors (air, ammonia or gases)	----------
2. Status of Effluents	
2.1 Identify the type of the used lube oils.	----------
2.2 Check the disposal method of used lube oils	----------
2.3 Check the documents confirming selling of lube oils in the environmental register.	----------
2.4 What is the amount of spent cooling water discharged from the compressors?	----------
2.5 Identify the disposal point of this wastewater.	----------
3. Status of Work Environment	
3.1 Do you notice high noise levels beside the compressors?	----------
3.2 Are noise measurements in the environmental register consistent with observations? If suspicious perform your own measurements	❑ Yes ❑ No
3.3 Do you notice any ammonia leaks at the ammonia compressors?	❑ Yes ❑ No
3.4 Check the analysis results in the environmental register.	
Check the emergency procedures concerning the ammonia compressor.	

Checklist for Mechanical Workshops (Maintenance)

1. Status of Effluent	
1.1 What is the amount of wastewater generated?	----------
1.2 What is your visual observation for the inspection manhole of the workshop?	----------
2. Status of Solid Wastes	
2.1 What is the amount of solid waste generated and its type?	----------
2.2 How does the facility get rid of the solid wastes generated?	----------
3. Status of Work Environment	
3.1 Are there any noise in work place **If yes** 3.2 Are there any measurements for noise 3.3 Check the exposure time **If not** Perform measurements	❑ Yes ❑ No ❑ Yes ❑ No ----------