MODEL FOR DETERMINING ENVIRONMENTAL ASPECTS AND IMPACTS IN THE CERAMIC SECTOR

(Adaptation of the Leopold at al. matrix to the ceramic industry)

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1.- INTRODUCTION

The purpose of the present study was to identify the possible environmental aspects of the ceramic production process, as well as to assess the potentially associated environmental impacts.

According to ISO 14001 (Environmental Management Systems: Specifications and guidelines for their use), an **Environmental aspect** is any element of the activities, products or services of an organisation, which can interact with the environment. A significant environmental aspect is whatever has or can have a significant environmental impact.

In turn, the standard defines **Environmental impact** as being any change in the environment, whether adverse or beneficial, resulting wholly or partly from the activities, products or services of an organisation.

The scope of the study ranged from the extraction of the raw materials used in the process to transport of the final product for distribution and sales. It therefore includes the intermediate stages involving spray drying of the body composition, glaze, colour and frit production, together with the manufacturing of the ceramic products, as well as two auxiliary processes to ceramic tile manufacture - co-generation and process wastewater treatment. The process diagram presents the successive stages.

Five raw materials are basically used in the process: clays, glazes and colours, wrappings and packagings, natural gas and water. Of these, owing to their importance in the process, the study has specifically focussed on the extraction of the clays and minerals that yield glazes and colours.

The environmental impact of an industrial activity appears in three main ways:

- air pollution
- liquid emissions
- solid waste

In the case of the ceramic industry, the main impact is due to the industrial concentration.

In the field of the **liquid emissions**, many companies have decanting and wastewater treatment facilities, and in some cases reuse treated wastewater. Although the reuse of sludge and aqueous suspensions in spray drying is common practice, these systems are usually not sufficient to retain suspended particulates and are obviously no use in treating soluble pollutants in water (e.g. boron).

Gas cleaning is not very well developed and usually only suspended particulates are cleaned, not the polluting gases.

Before presenting the actual study, it is important to consider the following:

- Each plant has differentiating peculiarities from the rest, which need to be studied beforehand.
- The processes occurring in the whole plant need to be documented, drawing up a balance of the materials that produce air emissions, wastewater or solid waste and characterising these wastes.
- All the actions are focussed on maintaining and even improving product characteristics, optimising cleaning performance and minimum consumptions.

The present study represents a stage that leads up to the implementation of an environmental management system (ISO 14000), besides providing a tool for systematically identifying the environmental aspects in the ceramic sector in the province of Castellón.

2.- IDENTIFICATION OF GASEOUS EMISSIONS

2.1.- RAW MATERIALS PREPARATION

The gaseous emissions arising in this stage come from the exhaust systems located in the body preparation areas; these emissions can be treated by wet or dry systems.

The main characteristic of the raw materials preparation facilities is their volume. Furthermore, they generally lack systems that prevent dust from being spread.

In glaze and frit production, particulate emissions are usually minimal as pneumatic conveying systems are used.

2.2.- SPRAY DRYING

The hot gases used to dry the slip also draw away fine or less aggregated material. Part of this is recovered in the cyclones, but the finest fraction can be released into the air.

2.3.- PRESSING

Powders are generally involved with a moisture content of 5-6 %.

Suspended particulates are basically produced during raw materials transport to the presses, pressing (feeding of fillers, dies, etc.) and brushing.

2.4.- DRYING

Part of the water is removed from the tile by the rising temperature. During this process water vapour is released with minor particulate concentrations produced by tile breakage in the dryer or inappropriate brushing.

2.5.- GLAZING

Glazing emissions depend on the type of application:

- wet method: water and air
- dry method: greater air emissions

During glaze preparation and glazing, dust arises in:

- milling: the finest particulates tend to be scattered on charging the mills.
- fettling: of the body and unfired glazed at the tile sides.
- glaze application: by centrifugation in the case of discing, or spraying in airbrushing.
- dry glaze application: as granulars or powder. The finer the material, the more dust.

The particulates released in the glazing process are much more toxic than those exhausted in preceding process stages, owing to their complex chemical composition.

2.6.- FIRING

Emissions from floor and wall tile firing kilns and from frit melting kilns. Volatilising components from fuel combustion gases also arise owing to tile heating.

At glaze melting between 1400 and 1500°C, the gases contain a large quantity of volatiles and particulate matter.

Particulate sizes need to be taken into account in air emissions.

Fluorine is released as a gas, while lead is vented as a solid. The presence of other pollutants is also detected.

3.- WASTEWATER

The main wastewater characteristics are turbidity and the colour of the suspension owing to the suspension of clay and glaze particles. Wastewater mainly contains:

- suspended solids
- dissolved anions: sulphates, chlorides, etc.
- dissolved traces of heavy metals: Pb and Zn
- variable quantities of boron
- traces of organic matter: adhesives

4.- SOLID WASTE - INDUSTRIAL WASTE

This waste can be classified as follows:

4.1.- WASTE ASSIMILABLE TO URBAN WASTE (WAU)

This would include plastic, wood, paper, cardboard, organic refuse in general, etc.

4.2.- INERT WASTE (IW)

These are substances presenting total insolubility in water and any diluted acid (scrap metal, glass, ash, sand, fired scrap, etc.).

These types of waste are the most numerous and diverse; some types can be reused in the production process, while others are sent to controlled disposal sites.

4.3.- HAZARDOUS WASTES (HWS)

These exhibit some of the characteristics set out in law 10/1998, in RD. 833/88, RD. 952/97 or found as such in the European Catalogue of Wastes.

They do not all exhibit the same characteristics and management of each should therefore be studied separately.

Given the high cost of managing these wastes, all the actions that lead to reducing their production will be economically profitable.

Their characteristics make them more hazardous for the environment.

5.- IDENTIFICATION OF ENVIRONMENTAL ASPECTS AND IMPACTS THROUGHOUT THE CERAMIC PROCESS

To start with, to identify the aspects and impacts associated with the activity, the environmental impact identification matrix included in the annex (adapted from the Leopold Matrix) is used. Three intersections of activities with possible environmental impacts are marked on the matrix. This yields the following:

5.1. RAW MATERIALS EXTRACTION

As already mentioned, the study focuses on obtaining the clays and minerals that are subsequently to be converted to glazes and colours, as they are the two most important raw materials with regard to quantity and possible associated impact.

These materials are usually obtained by open pit mining. This type of mining presents the following environmental aspects and impacts.

5.1.A) Enviromental aspects

The enviromental aspects of this stage are:

- Starting and loading.
- Demolition.
- Dismantling.
- Drainage.
- Building construction.
- Installation of plumbing, pipes.
- Electrical installation.
- Maintenance.
- Movement of machinery.
- Earth movements.
- Drilling.
- Machinery traffic.
- Materials processing.
- Dumping of overburden.
- Blasting.

5.1.B) *Enviromental impacts*

The possible impacts of each of the foregoing aspects are as follows:

- Alteration of habitat for the fauna.
- Alteration of habitat for the vegetation.
- Change of use for the soil.
- Biological pollution of the water.
- Air pollution by gases.
- Air pollution by particulates
- Soil pollution.
- Physical pollution of the water.
- Chemical pollution of the water.
- Sliding.
- Erosion.
- Production of inert waste.
- Impact on the microclimate.
- Impact on the economy.
- Impact on the population.
- Impact on the infrastructures.
- Visual impact on the landscape.
- Flooding.
- Noise.
- Seismicity.

5.2. TRANSPORT

Transport operations are an important part of the production process, especially when the study area is not exclusively focussed on ceramic tile manufacture, but starts at raw materials mining and ends with transport of the final product for selling.

<u>Three transport moments</u> were detected during the process:

1. Raw materials transport after extraction for pre-processing.

2. Transport of these processed raw materials (spray-dried clay powder and glazes, colours and frits) to the ceramic manufacturing facilities.

3. Transport of finished products for selling.

5.2.A) *Enviromental aspects*

The following environmental aspects were identified in transport:

- Use of fuel.
- Production of solid urban waste (SUW).
- Production of hazardous wastes (HWs).
- Vehicular traffic.
- Communication arteries.
- Accidents.

5.2.B) *Enviromental impacts*

These above aspects associated with transport present the following environmental impacts:

- Depletion of resources.
- Alteration of habitat for the fauna.
- Alteration of habitat for the vegetation.
- Aquifer pollution
- Surface water pollution
- Air pollution by gases.
- Air pollution by particulates.
- Soil pollution.
- Physical pollution of the water.
- Chemical pollution of the water.
- Creation of barriers.
- Erosion.
- Impact on economy (+)
- Impact on health and safety of persons.
- Impact on infrastructures (+)
- Impact on services (+)
- Visual impact on the landscape.
- Acid rain.
- Noise.

5.3. SPRAY-DRIED POWDER

The clays that are mined need to undergo pre-processing to condition them for use in the manufacture of ceramic products. This is done by spray drying, which consists of several stages with different environmental aspects and impacts.

5.3. A) Enviromental aspects

The following aspects are to be considered:

- Water consumption.
- Energy consumption.
- Emission cleaning.
- Raw materials handling.
- In-course materials handling.
- Product handling.
- Heavy vehicular traffic.

5.3.B) Enviromental impacts

The following impacts are associated with each environmental aspect of this stage:

- Depletion of resources.
- Alteration of habitat for the fauna.
- Air pollution by gases.
- Air pollution by particulates.
- Physical pollution of the water.
- Greenhouse effect.
- Production of inert waste.
- Acid rain.
- Noise.
- Vibrations

5.4. GLAZE, COLOUR AND FRIT PRODUCTION

In this stage the mineral raw materials are processed and transformed into products that in turn become the raw materials of the main ceramic tile manufacturing stage.

5.4.A) Enviromental aspects

The following impacts are associated with each environmental aspect of this stage, in which different phases can be distinguished:

- Water consumption.
- Energy consumption.
- Consumption of natural resources.
- Emission cleaning.
- Raw materials handling.
- Product handling.
- Heavy vehicular traffic.

5.4.B) Enviromental impacts

- Depletion of resources.
- Alteration of habitat for the fauna.
- Air pollution by gases.
- Air pollution by particulates.
- Physical pollution of the water.
- Chemical pollution of the water.
- Greenhouse effect.
- Heat emission.
- Production of wrapping and packaging waste.
- Production of inert waste.
- Production of hazardous waste.
- Acid rain.
- Noise.

5.5. CERAMIC MANUFACTURING PROCESS

This stage forms the core of the present study, as it constitutes the main activity around which the other stages or auxiliary activities take place.

For the study of the environmental aspects and impacts the process has been divided into eight successive stages. Issues are also dealt with relating to Maintenance and General Services, and other general Aspects.

5.5.A) Enviromental aspects

- Social and economic aspects.
- Water consumption.
- Energy consumption.
- Consumption of natural resources.
- Scrap production.
- Infrastructures.
- Raw materials handling.
- Handling and process.
- Accidental losses of raw materials.
- Storage process.
- Sorting process.
- Firing process.
- Glazing process.
- Drying process.
- Reuse - recycling.
- Heavy vehicular traffic.
- Location of facilities.

5.5.B) *Enviromental aspects*

- Depletion of natural resources.
- Alteration of habitat for the fauna.
- Biological contamination of water
- Air pollution by gases.
- Air pollution by particulates.
- Soil pollution.
- Physical pollution of the water.
- Chemical pollution of the water.
- Creation of barriers.
- Greenhouse effect.
- Heat emission.
- Production of wrapping and packaging waste.
- Production of inert waste.
- Production of hazardous waste.
- Production of solid urban waste
- Impact on employment.
- Impact on the economy.
- Impact on health and safety.
- Impact on infrastructures (+)
- Impact on services.
- Impact on monuments.
- Visual impact on the landscape.
- Acid rain.
- Proximity to gullies or riverbeds.
- Proximity to watercourses.
- Proximity to historical-artistic objects
- Proximity to reservoirs.
- Proximity to singular non-protected natural areas.
- Proximity to protected natural areas.
- Reuse and/or recycling of wrappings and wrapping waste
- Noise.
- Vibrations.

5.6. CO-GENERATION

Co-generation involves the joint production, in a sequential process, of electric energy and useful thermal energy.

5.6.A) *Enviromental aspects*

Three environmental aspects were identified in this process:

- Consumption of natural resources (natural gas or fuel oil).
- Process.
- Maintenance.

5.6.B) *Enviromental impacts*

The impacts relating to each of these aspects are as follows:

- Depletion of resources.
- Air pollution by gases.
- Greenhouse effect.
- Heat emission.
- Production of hazardous waste.
- Impact on the economy.
- Impact on infrastructures
- Acid rain.
- Noise.

5.7.- PROCESS WASTEWATER TREATMENT

From an environmental standpoint, the treatment of process wastewater is a highly important operation.

Large quantities of these waters are produced during the manufacturing process. The greatest amount of waste in this industry is wastewater, with the aggravating factor that inappropriate wastewater management can entail a high cost for the use of natural resources.

To identify aspects and impacts, the inputs, i.e. required consumption for the operation, will first be dealt with. The outputs or arising emissions will then be analysed, distinguishing whether the treated wastewater and sludges are recovered in the manufacturing process or discharged.

5.7.A) Enviromental impacts

5.7.A.1.- Inputs:

- Energy consumption.
- Reagent consumption.

5.7.A.2.- Outputs:

a) a) With water recovery

- Heavy vehicular traffic.

b) Without recovery

- Water emission to the public water system
- Water emission to the sewage system.
- Uncontrolled emission
- Delivery to an authorised administrator
- Wrappings and wrapping wastes.
- Heavy vehicular traffic.

5.7.B) Enviromental impacts

5.7.B.1.- Inputs:

- Depletion of resources..
- Impact on health and safety.
- Soil pollution
- Production of hazardous waste.

5.7.B.2.- Outputs:

a) With water recovery:

- Air pollution by gases.
- Air pollution by particulates.
- Acid rain.
- Greenhouse effect.
- Noise
- Alteration of habitat for the fauna.

b) Without recovery:

- Alteration of habitat for the fauna.
- Alteration of habitat for the vegetation.
- Aquifer pollution.
- Surface water pollution.
- Air pollution by gases.
- Air pollution by particulates.
- Soil pollution.
- Physical pollution of the water.
- Chemical pollution of the water.
- Greenhouse effect.
- Production of wrapping and packaging waste.
- Production of inert waste.
- Production of hazardous waste.
- Impact on health and safety.
- Impact on services (+).
- Visual impact on the landscape.
- Acid rain.
- Noise.

6. INTRODUCTION TO THE METHOD OF IMPACT EVALUATION

It does not suffice to list the environmental aspects and impacts of the ceramic process. To have a complete view it is necessary to evaluate them one by one to determine their importance and seriousness, to enable priorities to be established for corrective actions.

The proposed method is not the only possible one. Other valid methods can also be found in the literature.

However, our proposal - besides evaluating the impact by its characteristics - includes a consideration of other factors that we believe are relevant for the ceramic sector in the province of Castellón.

Firstly, compliance or non-compliance with current **legislation** is an indicator highlighting a greater or lesser seriousness of the impacts on the environment.

The second factor considered is the **type of industrial process** involved, as the ceramic sector is made up of a variety of activities with discernible differences concerning their interactions with the environment.

Finally the impact assessment includes the **geographic factor**, taking into consideration the biological, geological and water characteristics of the area known as La Plana de Castellón, in which the ceramic activity at issue takes place.

6.1. ENVIRONMENTAL IMPACT EVALUATION

Having identified the general environmental aspects and associated impacts in the general matrix, each impact needs to be separately evaluated.

To do this the **Matrix of Importance** is first applied, in which on the basis of impact characteristics (intensity, extension, persistence, reversibility, etc.) an Importance value is found for the impact.

Secondly, the final evaluation of the impact is the result of modulating the foregoing value by applying several **Correcting Factors.** These factors consider criteria such as level of compliance with applicable legislation and regulations, type of industrial process involved, as well as the location of the facilities.

Thus, the **final evaluation** of each impact will be the result of the sum of the Importance Value and the three Correcting Factors:

VF = I + B1 + B2 + B3

where:

I is the Importance Value,
B1 evaluates the Degree of Compliance with applicable legislation and regulations
B2 evaluates the Type of Industrial Process, and
B3 evaluates the Location of the facilities.

6.2.- MATRIX OF IMPORTANCE

ELEMENTS OF THE MATRIX

±	i
EX	PR
PE	SI
I	

where:

(±) Sign
The sign of the impact indicates whether it is beneficial or harmful.

(i) Intensity
This refers to the level of effect of the action on the factor. The value ranges from 1 to 12, in which 12 indicates total destruction of the impacted environmental factor and 1 a minimum effect

(EX) Extent
This refers to the area of theoretical influence of the impact with regard to the activity's environment. The value is 1 (inside the facilities), 2 (affecting surroundings), 4 (going beyond surroundings), and 10 (total).

(PE) Persistency
This refers to the time that the effect is expected to last from the moment it appears until the impacted factor recovers its original state, either naturally or by applying some corrective action. We thus have: 1 (fleeting), 4 (temporary) and 8 (permanent).

(SI) Synergy
This refers to the reinforcement of two or more single effects when the total component of the sum is larger than each single effect..

We have: 1 (without synergy - single), 4 (synergic) and 8 (highly synergic)

(PR) Periodicity

This refers to the regularity with which the impact occurs, which may be either cyclical or recurrent (periodic effect), unpredictable (irregular) or constant in time (continuous). 1 (irregular), 3 (periodic) and 6 (continuous).

(I) Importance of the impact

This is the result:

$I = \pm [4i + 3EX + PE + SI + PR]$

The importance of the impact ranges from 10 to 100.

Values above 60 indicate significant impacts for the company.

Values above 70 imply that the significant impacts mentioned require a specific plan for correction/abatement of the arising impact.

6.3.- CORRECTING FACTORS.

Standard ISO 14001 requires the identification of significant aspects and impacts. The correcting factors thus serve to either penalise or soften the value of each impact, as they reflect three criteria that largely determine the actual impacts.

6.3.B.1) Degree of compliance with applicable legal requirements and regulations.

This factor is applied to the impacts directly or indirectly regulated by applicable legal requirements or regulations, whether at the State, regional or local level.

The non-complying environmental impacts (for example a discharge that exceeds permitted maximum levels) is penalised by a correcting factor of B1 = 5. Emissions within permitted levels are assigned factor B1 = 0.

6.3.B.2) Type of industrial process.

Given the extensive scope of the study, various industrial processes are included with similar characteristics, but there are also important differences. They also have impacts of different seriousness, as set out in the part on the various processes.

Therefore, a certain factor will be applied, depending on the type of process:

- ·) Raw materials extraction: B2 = 2.
- ·) Spray drying: B2 = 4.
- ·) Glaze, colour and frit production: B2 = 8.
- ·) Ceramic tile manufacture: B2 = 1.

6.3.B.3) Location of the facilities.

This aspect is very important, since, depending on the specific situation of an industry and external environmental factors, the seriousness of an impact can be modulated.

The following sets out the various factors that condition the importance of this aspect, for which we consider:

B3 = P + AC

where:

P is the variable that reflects the proximity to sensitive areas, and
AC is the variable that reflects the location of the facilities on aquifers.

Reigning winds.

In the La Plana de Castellón area, the north-northeastern winds prevail, as well as the western winds.

This situation means that the most affected areas by industry air emissions are found in the extreme south, southwestern and southeastern La Plana area. This is precisely where the mountain range known as the Serra d'Espadà is located, which forms a natural boundary to the area and is currently a protected area because of its ecological value.

Proximity to sensitive areas(P).

This environmental factor is closely related to the previous one. The nearness of the industry to these areas increases the seriousness of the impacts, especially if the prevailing winds carry the gas and particulate emissions there.

The following were identified as sensitive areas:

·) Natural area (P1).
·) Urban centres (P2).
·) Reservoirs and watercourses (P3).

Así, P = P1 + P2 + P3

·) **Natural areas (P1)**.

In this case, only the Serra d'Espadà can be affected by the proximity of the industry.

The area known as the Paratge Natural del Desert de Les Palmes in the northernmost part of the La Plana area has most of the industry to its south and therefore does not receive the pollution carried on the prevailing winds (north-northeast).With regard to the western winds that could carry emissions from the ceramic sources in L'Alcora or Sant Joan de Moró, the Borriol mountain range cuts them off from the Desert de Les Palmes.

With regard to the Serra d'Espadà, we have already indicated that the prevailing winds bring this mountain range the emissions from the whole area. However, not all the facilities are equally close, and two areas can be distinguished, namely to the north and south of the Mijares river.

Thus the value of P1 is 2 if the facility lies north of the Mijares river, and 4 if it lies to the south..

•) **Urban centres(P2).**

This variable is 2 if the facility is located more than 2000 m away from an urban centre, and 4 when the distance is smaller.

•) **Reservoirs and water courses (P3).**

The criterion is the same as before: if the proximity is less than 2000 m, P3 = 4, whereas if it is over 2000 m, P3 = 2.

a) Underground aquifers (AC).

The province of Castellón is part of two large Hydro-geological Systems, the Javalambre - Maestrazgo System and the Espadán - Plana de Castellón System.

The area in which the ceramic industry is located - between the towns of Castellón de La Plana, Almassora, Vila-Real, Nules, Betxí, Onda, Ribesalbes, L´Alcora and Sant Juan de Moró - lies between both systems. The dividing line runs between Onda and Ribesalbes, along the southernmost part of the Sitjar and Mª Cristina reservoirs, and then turns towards Borriol and Benicássim

We consider that the location in one system or the other does not have the same possible consequences, as the aquifers of the Espadán - Plana de Castellón System, which could be affected, supply a much larger population and crops with water than the aquifers of the Javalambre - Maestrazgo System.

Thus this variable (AC) is 2 when the facility is located in the Javalambre - Maestrazgo System, and 4 in the Espadán - Plana de Castellón System.

7. GUIDE TO USING THE MATRIX

The matrix consists of two parts. The top part defines all the environmental aspects capable of producing an environmental impact; the left column gives the possible impacts that can appear.

First the detected aspects are identified at the top.

These aspects are subsequently crossed with the impacts that appear in the column on the left, marking the intersections.

The matrix should be prepared by a person acquainted with the process to be tested, or preferably by several persons, subsequently pooling the results.

Secondly Table 1 is prepared.

The top row indicates the tested processes, while all the detected aspects are entered in the column on the left.

ASPECTS	ACTIVITY						
	1	2	3	4	5	6	7

Table 1.

1: Process A
2: Process B
3: Process C
4: Process D
5: Process E
6: Process F...

In the third place Table 2 is prepared for each basic process, indicating in the "aspects" column all the detected aspects for each process, and in the impact column the detected impacts.

PROCESS:				
ASPECTS	IMPACTS			

Table 2.

7.1.- QUALITATIVE IMPACT EVALUATION

After identifying the aspects and environmental factors capable of being impacted by these aspects, the qualitative evaluation provides a reference as to the importance of the individual impacts.

This evaluation is carried out according the foregoing impact evaluation method, using the following table to systematise the evaluation of the impacts..

IMPACT	±	i	E X	P E	S I	P R	I	F V

Tabla 3.

After applying the evaluation formula and evaluating the impacts unitarily and by processes, their respective importance becomes apparent in a single process, or by summing them up by processes, the evaluation shows what deserves most attention on being most "sensitive".

This evaluation serves to complete the section on the determination of the environmental aspects and impacts of our Environmental Management System, and to determine the environmental objectives and targets, or the definition of a specific management programme for correcting the highest scoring impacts.

PRACTICAL CASE:

A ceramic floor and wall tile manufacturing company located in the municipality of Borriol, close to the Mª Cristina reservoir serves as **an example of a practical case of the use of the matrix for determining aspects and impacts** in the ceramic sector in the province of Castellón.

To simplify the case, we shall only use the RAW MATERIALS RECEPTION process.

A schematic flow chart was first prepared, to provide a rough idea of the process that occurs at the company

FIRST STEP

Taking the matrix, the possible environmental aspects of the activity are identified with their associated impacts, indicating the intersections. This task is done by the plant Technical Director, Production Manager or outside consultant, subsequently compiling the data to prepare Table 1.

SECOND STEP

Table 1 is drawn up.

ASPECTS	PROCESSES				
	1	2	3	4	5
Accidental material losses					
Consumption of natural resources					
Reuse and / or recycling					
Energy consumption					
Expired products					
Factory location					
Heavy vehicular traffic					

1: RAW MATERIALS RECEPTION
2: PRESSING
3: DRYING
4: ETC

THIRD STEP

After identifying the aspects of the activity RAW MATERIALS RECEPTION, Table 2 is drawn up.

PROCESS: RAW MATERIALS RECEPTION

ASPECTS	IMPACTS			
Heavy vehicular traffic	Gas pollution	Particulate emission	Noise	
Accidental material losses	Particulate emission	Production of HWs	Soil pollution	
Consumption of natural resources	Depletion of resources			
Reuse and/or recycling	Reuse of wrappings			
Energy consumption	Depletion of resources			

The impact evaluation can then be performed as set out in the section on the Evaluation of Environmental Impacts.

IMPACT EVALUATION: RAW MATERIALS RECEPTION

IMPACT	±	i	EX	PE	SI	PR	I	FV
Gas pollution	-	5	4	2	4	4	**42**	**55**
Particulate emission	-	5	4	2	2	2	**38**	**51**
Noise	-	5	2	2	2	2	**32**	**45**
Production of HTWs	-	10	2	4	2	2	**54**	**67**
Soil pollution	-	12	1	4	4	4	**63**	**76**
Depletion of resources	-	2	1	4	2	4	**21**	**34**
Reuse of wrappings	+	1	1	2	1	1	**11**	**23**

$I = \pm [4i + 3EX + PE + SI + PR]$

Where:

$P = (P_1 + P_2 + P_3) = 10$

$P_1 = 2$ $P_2 = 4$ $P_3 = 4$

$AC = 2$

$B_1 = 0$ $B_2 = 1$ $B_3 = (P + AC) = 12$

$FV = I + B_1 + B_2 + B_3$

ALARMS:

Impacts with FV equal to or larger than 60 = Production of HWs

Impacts with FV equal to or larger than 70 = Accidental soil contamination

This exercise therefore shows that:

There is a significant impact at raw materials reception, namely the production of Hazardous Wastes (waste from wrappings that contained chemical products) at the raw materials reception of glazes and colours.

There is a significant impact produced by possible soil pollution caused by accidents in raw materials transport (glazes and colours) for which a specific management programme needs to be developed.

There are impacts close to the consideration threshold, which are to be considered potentially important.

ANNEX

		A. AIR EMISSIONS					B. PHYSICAL EMISSIONS				C. WATER					D. SOILS						E. BIODIVERSITY									F. WASTE PRODUCTION				G. SOCIO-ECONOMIC ASPECTS																OTROS		EVALUATIONS
																						E1. FLORA			E2. FAUNA																												
		a Ozone	b Gas pollution	c Suspened particulates	d Acid rain	e Greenhouse effect	a Radiation	b Vibration	c Noise	d Heat	a Chemical pollution	b Physical pollution	d Biological pollution	e Aquifer pollution	f Surface water pollution	a Erosion	b Creation of barriers	c Soil pollution	d Flooding	e Seismicity	f Microclimate	a Species	b Protected species	c Alteration of habitat	a Birds	b Land animals	c Water animals	d Protected species	e Barriers	f Alteration of habitat	a Inert	b S.U.W.	c H.W.	d Production of wrappings	a Health and safety of persons	b Employment	c Creation of infrastructures	d Services	e Barriers to traffic	f Economy	g Landscape	h Monuments	i Proximity to reservoirs	j Proximity to watercourses	k Proximity to riverbeds	l Proximity to gullies	m Prox. historical/ artistic objects	n Prox. protected natural areas	o Prox. non-protected natural areas	p Prox to singular spaces	a Depletion of resources	b Accidents	
PROPOSED ACTIONS																																																					
1. RAW MATERIALS RECEPTION (CLAYS)	a Heavy vehicular traffic																																																				
	b Accidental losses																																																				
	c Preservation of natural resources																																																				
	d Reuse or recycling																																																				
	f Energy consumption																																																				
2. PRESSING	a Raw materials handling																																																				
	b Energy consumption																																																				
	c Process																																																				
3. DRYING	a Use of natural resources																																																				
	b Energy consumption																																																				
	c Process																																																				
4. RAW MATERIALS RECEPTION (PREP. GLAZES AND SCR.PR. PASTES)	a Heavy vehicular traffic																																																				
	b Accidental losses																																																				
	c Preservation of natural resources																																																				
	d Reuse or recycling																																																				
	f Energy consumption																																																				
5. PREP. GLAZES AND SCR.PR. PASTES	a Use of natural resources																																																				
	b Energy consumption																																																				
	c Process																																																				
6. RAW MATERIALS STORAGE	a Process																																																				
	b Heavy vehicular traffic																																																				
7. RAW MATERIALS RECEPTION (SCREEN PREP.)	a Heavy vehicular traffic																																																				
	b Accidental losses																																																				
	c Preservation of natural resources																																																				
	d Reuse or recycling																																																				
	f Energy consumption																																																				
8. SCREEN PREP.	a Use of natural resources																																																				
	b Energy consumption																																																				
	c Process																																																				
8. GLAZING	a Use of natural resources																																																				
	b Energy consumption																																																				
	c Process																																																				
9. KILN	a Energy consumption																																																				
	b Process																																																				
10. SORTING	a Energy consumption																																																				
	b Process																																																				
11. WRAPPINGS RECEPTION	a Heavy vehicular traffic																																																				
	b Accidental losses																																																				
	c Preservation of natural resources+B62																																																				
	d Reuse or recycling+B4																																																				
	f Energy consumption																																																				
12. FINISHED PROD. STORAGE	a Process																																																				
	b Heavy vehicular traffic																																																				
12. MAINTEN.	a Use of natural resources																																																				
	b Energy consumption																																																				
	c Scrap production																																																				
13. W.WATER	a Use of natural resources																																																				
	b Energy consumption																																																				
	c Process																																																				
14. DESIGN	a Use of natural resources																																																				
	b Energy consumption																																																			
	c Process																																																				
15. LABORAT.	a Use of natural resources																																																				
	b Energy consumption																																																				
	c Process																																																				
16. GENERAL ASPECTS	a Facility location																																																				
	b Infrastructure																																																				
	c Social and economic aspects																																																				
OTHERS	a																																																				
	b																																																				
EVALUATIONS																																																					

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