ENVIRONMENTAL PRODUCT DECLARATION

as per ISO 14025

Owner of the Declaration	Eczacıbaşı, VitrA Tiles Co.
Programme holder	Institut Bauen und Umwelt (IBU)
Publisher	Institut Bauen und Umwelt (IBU)
Declaration number	EPD-ECZ-2013311-EN
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Valid to	25.04.2018

Porcelain Tiles

Eczacıbaşı VitrA Karo San. ve Tic. A. Ş.

Institut Bauen und Umwelt e.V.

www.bau-umwelt.com

VitrA

1 Summary

Eczacıbaşı, VitrA Tiles Co.	Porcelain Tiles
Programme holder IBU - Institut Bauen und Umwelt e.V. Rheinufer 108 D-53639 Königswinter	**Owner of the Declaration** Eczacıbaşı VitrA Karo San. ve Tic. A. Ş.Şifa Mah. Atatürk Cad. 34941 Tuzla, İstanbul, Turkey
Declaration number [to be supplemented by IBU]	**Declared product / Declared unit** Porcelain Tiles / 1 m^2
This Declaration is based on the Product Category Rules: Requirements on the EPD for Ceramic tiles and panels, June 2011 (PCR tested and approved by the independent expert committee)	**Scope:** Within this study a life cycle analysis according to ISO 14040/44 is performed for porcelain tiles manufactured by Eczacıbaşı Building Products Co. at the production plants located in Bozüyük and Tuzla. The life cycle analysis is based on the data declared by Eczacıbaşı VitrA Karo San. ve Tic. A. Ş. The EPD for porcelain tiles is an average EPD which represents production of all tiles produced at Eczacıbaşı VitrA Karo San. ve Tic. A. Ş. This analysis relies on transparent, plausible and documented basis data. All the model assumptions which influence the results are declared. The life cycle analysis is representative for the products introduced in the declaration for the given system boundaries.The life cycle analysis covers the manufacturing of the products from cradle to gate. The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.
Issue date 26.04.2013	**Verification** The CEN standard DIN EN 15804 serves as the core PCR.
Valid to 25.04.2018	Verification of the EPD by an independent third party as per ISO 14025 ☐ internally ☒ externally
Prof. Dr.-Ing. Horst J. Bossenmayer (President of Institut Bauen und Umwelt e.V.)	
Prof. Dr.-Ing. Hans-Wolf Reinhardt (Chairman of SVA)	Matthias Schulz, Independent tester appointed by SVA

2 Product

2.1 Product description

Porcelain tiles are composed of inorganic materials as clay, kaolin, quartz, calcite and feldspar in definite ratios. Porcelain tiles are fully vitrified ceramic tiles with a water absorption of 0,5 percent or less, which can either be unglazed or glazed.

This EPD covers the production of tiles in the plants Bozüyük and Tuzla. The average is calculated based on mass of tiles produced.

2.2 Application

Porcelain tiles are used for floor and wall covering.

2.3 Technical Data

Test regarding dimension and surface quality, as well as physical and chemical properties are performed prior to the product delivery. Relevant standards for testing are listed in section 2.4 of the EPD. All porcelain tiles in the delivery status have passed all relevant tests.

Water absorption:	≤ 0,5 % (w/w)
Breaking strength:	> 1300 N for thickness ≥ 7,5mm >700 N for thickness < 7,5mm
Modulus of rupture:	35 N/mm²
Deep abrasion:	175 mm3 (for unglazed tiles)
Surface abrasion	PEI I–V (for glazed tiles)
Coefficient of friction	R9 – R13 (DIN 51130) A, B, C (DIN 51097)
Staining Resistance	min. Class 3
Resistance to household chemicals, pool salts:	min. Class A

2.4 Placing on the market / Application rules

Porcelain Tiles comply with many standards.

- EN 14411:2012 Ceramic tiles - Definitions, classification, characteristics and marking
- ANSI A137.1:2012 American National Standard Specifications for Ceramic Tile

- ISO 13006:2012 Ceramic tiles - Definitions, classification, characteristics and marking

- Test methods according to EN 14411:2012 and ISO 13006:2012:
- EN ISO 10545-1:1995, Ceramic tiles - Part 1: Sampling and basis for acceptance (ISO 10545-1)
- EN ISO 10545-2:1995, Ceramic tiles - Part 2: Determination of dimensions and surface quality (ISO 10545-2, including Technical Corrigendum 1)
- EN ISO 10545-3:1995, Ceramic tiles - Part 3: Determination of water absorption, apparent porosity, apparent relative density and bulk density (ISO 10545-3, including Technical Corrigendum 1)
- EN ISO 10545-4:2004, Ceramic tiles - Part 4: Determination of modulus of rupture and breaking strength (ISO 10545-4)
- EN ISO 10545-5:1996, Ceramic tiles - Part 5: Determination of impact resistance by measurement of coefficient of restitution (ISO 10545-5, including Technical Corrigendum 1)
- EN ISO 10545-6:2010, Ceramic tiles - Part 6: Determination of resistance to deep abrasion for unglazed tiles (ISO 10545-6)
- EN ISO 10545-7:1996, Ceramic tiles - Part 7: Determination of resistance to surface abrasion for glazed tiles (ISO 10545-7)
- EN ISO 10545-8:1994, Ceramic tiles - Part 8: Determination of linear thermal expansion (ISO 10545-8)
- EN ISO 10545-9:2004, Ceramic tiles - Part 9: Determination of resistance to thermal shock (ISO 10545-9)
- EN ISO 10545-10:1995, Ceramic tiles - Part 10: Determination of moisture expansion (ISO 10545-10)
- EN ISO 10545-11:1994, Ceramic tiles - Part 11: Determination of crazing resistance for glazed tiles (ISO 10545-11)
- EN ISO 10545-12:1995, Ceramic tiles - Part 12: Determination of frost resistance (ISO 10545-12, including Technical Corrigendum 1)
- EN ISO 10545-13:1995, Ceramic tiles - Part 13: Determination of chemical resistance (ISO 10545-13)
- EN ISO 10545-14:1995, Ceramic tiles - Part 14: Determination of resistance to stains (ISO 10545-14, including Technical Corrigendum 1)
- EN ISO 10545-15:1995, Ceramic tiles - Part 15: Determination of lead and cadmium given off by glazed tiles (ISO 10545-15)
- EN ISO 10545-16:2010, Ceramic tiles - Part 16: Determination of small colour differences (ISO 10545-16)

2.5 Delivery status

The dimensions of products in the delivery status vary between 1cmx1cm to 75cmx150cm accroding to customers demand. The thickness varies between 5mm and .14mm depending on the product properties.

2.6 Base materials / Ancillary materials

Main raw materials for porcelain tiles;

- Clay 50 - 60%
- Feldspar 35 - 45%
- Calcite 3 - 5%
- Kaolin 1 - 5%
- Other <1%

Auxiliary substances / additivies;

- Dispersant
- Pigment
- Binder
- Rheological additives

2.7 Manufacture

Manufacturing process of porcelain tiles is presented in Figure 1.

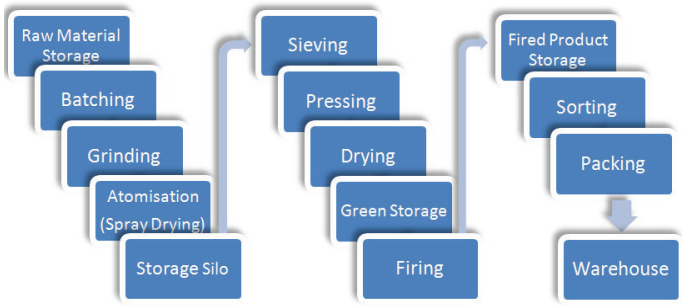

Figure 1. *Manufacturing process of porcelain tiles*

The raw materials used within the production step pass a quality control and are subsequently stocked in silos.

Porcelain tiles include several different products with different recipes. According to the recipe, both computer and automatic balancing aided systems are used for determining/measuring the amount of raw materials. The raw materials are loaded into the mills for wet grinding. After grinding, quality control tests are made.

The slip (raw material and water mud) passes through the spray-drying process in order to prepare a powder. The powder runs into a sieving process and is subsequently stored in the press-feeding silos. The powder is pressed into the tile form using hydraulic presses. After the pressing, tiles are dried in fast vertical-drying unit and following this step.

Subsequently the tiles are sent to a glazing unit or remain unglazed. Within the glazing unit printing and other surface design applications are performed. Now the tiles are sent to firing process. The fired tiles are sorted and packed using automatic sorting machines. Sorting criteria for the tiles are the desired color and size of the tiles. Name of the product, shade, and caliber number are written on to the package. Packed products are put on to pallets and then sent to the warehouse.

2.8 Environment and health during manufacturing

Occupational health and safety

Studies on health and safety of employees and safety of working conditions are conducted. Existing and potential risks are assessed and decreased to acceptable levels. All taken measures are included in a OHSAS 18001 Occupational Health and Safety Management System.

Environmental protection

Eczacıbaşı, VitrA Tiles Co.'s environmental policy is based on the principle "Being aware of our responsibilities towards the environment and society, our aim is to bequeath a viable and clean environment to future generations".

Adopting a green approach both to the production process and to products, protecting the environment and reducing the consumption of resources such as raw materials, energy and water are vital components of all processes.

Eczacıbaşı VitrA Tiles Co. re-uses residual glaze and mud in production, recovers the waste heat of the kilns and uses it for spray drying. The company treats domestic and biological wastewater and re-uses over 90% of the treated industrial water in production, and has built a pallet repair station and begun repairing old pallets by re-using them in packaging.

Activities being conducted include: Reducing noise levels in the processes from 90 dbA to 80 dbA through sound insulation, making the dust collection system a closed-cycle combining the forklift battery charging points in a single location and establishing a "battery charging station", eliminating back injury risks in the Quality Separation areas by employing a conveyor system an establishing a ventilation system to reduce ambient temperature.

Protection of environment, decreasing and legal withdrawal of wastes, effective usage of natural resources, decreasing of environmental risks is of primary importance. Activities relating to recycling of wastes and effective usage of resources, casting of environmental effects before plant and process design are conducted according to certified ISO 14001 Environmental Management System.

Continuous improvement works for effective usage of energy, energy effectiveness projects, assessment of present-potential opportunities, development and application of energy policy and reduction of greenhouse gas emissions done according to ISO 50001 Energy Management System.

The technology investments of energy for conscious usage and recycling to nature, responsibility of preserving natural resources started from production phase for all processes and recycling systems were developed to decrease wastes to minimum.

2.9 Product processing / Installation

Tiles are fixed to the floor and walls using tile cement subsequently the seams are filled with mortar. During the installation no emissions occur due to ceramic tiles. No health or environmental risks from the tiles.

2.10 Packaging

Products are packed in cardboard boxes, and stacked on wooden pallets. The amount of packaging material used depends on the tile size. Additionally small amounts of nylon and iron nails might be used for packaging.

2.11 Condition of use

Porcelain tiles are solid and chemically stable materials due to being fired at high temperatures.

2.12 Environment and health during use

During the use stage, porcelain tiles do not emit any pollutants or substances which are harmful to environment and health.

2.13 Reference service life

Type of EPD: cradle to gate

In the scope of this study the reference service lifeis not declared, according to EN15804:2012, since the use stage of the product is not assessed.

2.14 Extraordinary effects

Fire

Ceramic tiles do not contribute to fire and they may be classified as Class A1 according to EN 13501-1:2007+A1:2009.

Water

Porcelain tiles are insoluble products that do not react with water, do not dissolve or leak, and do not carry the risk of spill over.

Mechanical destruction

In case of mechanical damage, products may need to be replaced because of eventual sharp cutting edges.

2.15 Re-use phase

Porcelain tiles are not collected for the purposes of re-use or recycle.

2.16 Disposal

According to the European Waste Catalogue and The Waste Code List of the Turkish Ministry of Environment and Urban Planning, porcelain tiles waste belongs to the group of „construction and demolition wastes - tiles and ceramics" (code: 17 01 03).

2.17 Further information

Additional information about Eczacibasi VitrA Tiles Co. design, production and management philosophy Bluelife® can be found at:

http:\\www.vitrabluelife.com

Also a wide range of VitrA porcelain tiles are awarded with **EU ECOLABEL** certificate.

3 LCA: Calculation rules

3.1 Declared unit

The declaration refers to the declared unit of 1 m^2. The thickness considered for the EPD is 9 mm, which is the most common thickness for porcelain tiles. The impacts for other thicknesses may be calculated with help of the specific weights provided in Table 1 using the following formula:

$$I_{sp.} = I_{EPD} * \frac{d_{sp.}}{9mm}$$ [1]

Table 1. Average weight of the porcelain tiles

Thickness (mm)	Weight (kg/m^2)
5	10,5
6	12,6
7	14,7
8	16,8
9	18,9
10	21,0
12	25,2
14	29,4

This EPD covers the production of tiles in the plants Bozüyük and Tuzla. The average is calculated based on mass of tiles produced.

3.2 System boundary

The LCA considers the in this EPD product stage (cradle to gate). It includes the raw material production (A1), inbound logistics (A2), and manufacturing (A3) according to EN 15804, including the production of all raw materials. Secondary materials, apart from internally recycled scraps are not used.

3.3 Estimates and assumptions

All estimations and assumptions regarding the cutoff criteria and the allocation are declared within therelated parts of this section 3 “LCA: Calculationrules”. There are no other additional estimationsand/or assumptions in the scope of this study.

3.4 Cut-off criteria

No explicit cut-off criteria have been applied. The in- and output flows iron and nylon are neglected, their total share in mass is far below 1% of all inputs.

3.5 Background data

Background data for the Life Cycle Modelling has, where possible, been taken form the GaBi5 professional databases provided by PE INTERNATIONAL. Other sources for background data used with in the this study are ELCD/FEFCO and ELCD/CEWEP

3.6 Data quality

The data quality applied for the background data is good with regards to the technological and temporal scope. For some of the raw materials only German boundary conditions for the production of these materials have been available. Since the environmental impacts are largely driven by the firing process, the impact in the overall results should be insigficant. The datasets of the GaBi professional datasets applied are not older than 2008 for energy carriers and 2010 for all other datasets. Datasets from ELCD/FEFCO and ELCD/CEWEP are from 2002 and 2006.

3.7 Period under review

The primary data collected within in the study is from the production year 2011

3.8 Allocation

This study covers the product stage A1-A3 according to EN15804.

The data applied is from two production sites of Virtra karo. Energy and material supplies have been allocated to the product based on annually produced mass of tiles.

No further allocations have been applied within the foreground system.

3.9 Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to EN 15804:2012 and the building context, respectively the product-specific characteristics of performance, are taken into account.

1 $I_{sp.}$ – Indicator for the considered tile
I_{EPD} – Indicator as stated in the EPD
$d_{sp.}$ – Thickness of the considered tile

4 LCA: Scenarios and additional technical information

No additional LCA scenarios are declared for this EPD.

5 LCA: Results

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)																
PRODUCT STAGE			CONSTRUC-TION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARYS
Raw material supply	Transport	Manufacturing	Transport	Construction-installation process	Use	Maintenance	Repair	Replacement[1)]	Refurbishment[1)]	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

1) The modules Replacement (B4) and Refurbishment (B5) are normally not relevant on the product. For clarity reasons, those two moduless have been deleted in the following tables. If one or both modules are declarared respective columns can be inserted.

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1m2 porcelain tiles

Parameter	Unit	A1-A3
Global warming potential	[kg CO_2-Eq.]	1,63E+01
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	1,89E-08
Acidification potential of land and water	[kg SO_2-Eq.]	7,40E-02
Eutrophication potential	[kg PO_4^{3-} - Eq.]	6,56E-03
Formation potential of tropospheric ozone photochemical oxidants	[kg Ethen Eq.]	3,14E-03
Abiotic depletion potential for non fossil resources	[kg Sb Eq.]	3,70E-05
Abiotic depletion potential for fossil resources	[MJ]	2,21E+02

RESULTS OF THE LCA - RESOURCE USE: 1m2 porcelain tiles

Parameter	Unit	A1-A3
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	[MJ]	1,29E+01
Use of renewable primary energy resources used as raw materials	[MJ]	0,00E+00
Total use of renewable primary energy resources	[MJ]	1,29E+01
Use of non renewable primary energy excluding non renewable primary energy resources used as raw materials	[MJ]	2,26E+02
Use of non renewable primary energy resources used as raw materials	[MJ]	0,00E+00
Total use of non renewable primary energy resources	[MJ]	2,26E+02
Use of secondary material	[kg]	0,00E+00
Use of renewable secondary fuels	[MJ]	0,00E+00
Use of non renewable secondary fuels	[MJ]	0,00E+00
Use of net fresh water*	[m^3]	-

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1m2 porcelain tiles

Parameter	Unit	A1-A3
Hazardous waste disposed*	[kg]	-
Non hazardous waste disposed*	[kg]	-
Radioactive waste disposed	[kg]	2,07E-03
Components for re-use	[kg]	0
Materials for recycling	[kg]	0
Materials for energy recovery	[kg]	0
Exported energy per energy carrier (Steam)	[MJ]	0
Exported energy per energy carrier (Electricity)	[MJ]	0

** Not declared according to the interim agreement approved by the advisory board on 4.12.2012*

6 LCA: Interpretation

Most of the renewable and non renewable primary energy is used in the manufacturing stage A3. The renewable share of the primary energy use is mainly due to the electricity consumption on site and the wooden pallets which are used for packaging. In A1 (pre-products) the renewable primary energy demand mainly results from the fluorspar production. Non renewable primary energy demand is mainly due to thermal energy as natural gas used to run the kilns and electricity needed in the tile production.

The production of raw materials A1 only contributes to a minor share to overall results of most of the discussed environmental impacts. A1 has a contribution of roughly 30% to 35% to POCP, ODP as well as GWP, and between 10% and 20% to ADP fossil and EP. Only for ADPE the mining of the raw materials used for the tile production largely dominates the results.

ADPF is as mentioned above mainly driven by product stage A3, i.e. the main contribution results from the use of thermal energy and electricity.

GWP shows results analogous to the APDF. Also here the manufacturing stage A3 is most relevant. 95% of the GWP is due to CO_2 which is emitted when fossil fuels are incinerated. The missing 5% of GWP are due to methane emissions, which also result from thermal energy and electricity production.

Emissions contributing to ODP are emitted from very few processes upstream the energy production chain. The values are generally very low. Its distribution matches the one of GWP.

EP is mainly driven by the emission of nitrogen oxides from electricity and thermal energy provision. For A1 the EP is also mainly due to NO_x emissions. These are emitted to smaller share form nearly all input materials.

Nitrogen Oxides also play a major role for the AP. Overall NO_x emissions are contribute to 33% to AP, the rest is mostly due to sulfur dioxide. For AP the life cycle stage A3 is also most relevant (80% of the impact). Within this step electricity consumption and thermal energy are the relevant drivers for AP.

7 Requisite evidence

No evidence is provided along with the EPD for the porcelain tiles product group, since there is no requirement regarding evidence is stated in the PCR Part B – Requirements on the EPD for ceramic tiles and panels.

8 References

Institut Bauen und Umwelt 2011

Institut Bauen und Umwelt e.V., Königswinter (pub.): Generation of Environmental Product Declarations (EPDs); General principles for the EPD range of Institut Bauen und Umwelt e.V. (IBU), 2011-06

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PCR 2012, Part A

Institut Bauen und Umwelt e.V., Königswinter (pub.): Product Category Rules for Construction Products from the range of Environmental Product Declarations of Institut Bauen und Umwelt (IBU), Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Background Report. July 2011

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PCR 2011, Part B

Institut Bauen und Umwelt e.V., Königswinter (pub.): PCR Guidance-Texts for Building-Related Products and Services from the range of Environmental Product Declarations of Institute Construction and Environment e.V. (IBU), Part B: Requirements on the EPD for Ceramic tiles and panels, June 2011

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ISO 14025

DIN EN ISO 14025:2009-11: Environmental labels and declarations — Type III environmental declarations — Principles and procedures

EN 15804

EN 15804:2012: Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

EN 14411

EN 14411:2012: Ceramic tiles. Definitions, classification, characteristics, evalua tion of conformity and marking

ANSI A137.1

ANSI A137.1:2012: Specifications For Ceramic Tile

ISO 13006

ISO 13006:2012: Ceramic tiles -- Definitions, classification, characteristics and marking

EN ISO 10545-1

EN ISO 10545-1:1995: Ceramic tiles -- Part 1: Sampling and basis for acceptance

EN ISO 10545-2

ISO 10545-2:1995: Ceramic tiles -- Part 2: Determination of dimensions and surface quality

EN ISO 10545-3

EN ISO 10545-3:1995: Ceramic tiles -- Part 3: Determination of water absorption, apparent porosity, apparent relative density and bulk density

EN ISO 10545-4

EN ISO 10545-4: 2004: Ceramic tiles -- Part 4: Determination of modulus of rupture and breaking strength

EN ISO 10545-5

EN ISO 10545-5:1996: Ceramic tiles -- Part 5: Determination of impact resistance by measurement of coefficient of restitution

EN ISO 10545-6

EN ISO 10545-6:2010: Ceramic tiles -- Part 6: Determination of resistance to deep abrasion for unglazed tiles

EN ISO 10545-7

EN ISO 10545-7:1996: Ceramic tiles -- Part 7: Determination of resistance to surface abrasion for glazed tiles

EN ISO 10545-8

EN ISO 10545-8:1994: Ceramic tiles -- Part 8: Determination of linear thermal expansion

EN ISO 10545-9

EN ISO 10545-9:2004: Ceramic tiles -- Part 9: Determination of resistance to thermal shock

EN ISO 10545-10

EN ISO 10545-10:1995: Ceramic tiles -- Part 10: Determination of moisture expansion

EN ISO 10545-11

EN ISO 10545-11:1994: Ceramic tiles -- Part 11: Determination of crazing resistance for glazed tiles

EN ISO 10545-12

EN ISO 10545-12:1995: Ceramic tiles -- Part 12: Determination of frost resistance

EN ISO 10545-13

EN ISO 10545-13:1995: Ceramic tiles -- Part 13: Determination of chemical resistance

EN ISO 10545-14

EN ISO 10545-14: Ceramic tiles -- Part 14: Determination of resistance to stains

EN ISO 10545-15

EN ISO 10545-15:1995: Ceramic tiles -- Part 15: Determination of lead and cadmium given off by glazed tiles

EN ISO 10545-16

EN ISO 10545-16:2010: Ceramic tiles -- Part 16: Determination of small colour differences

EN 13501-1

EN 13501-1:2007+A1:2009: Fire classification of construction products and building elements. Classification using test data from reaction to fire tests

BS OHSAS 18001

BS OHAS 18001:2007, Occupational health and safety management systems. Requirements

ISO 14001

ISO 14001 Environmental management systems - Requirements with guidance for use (ISO 14001:2004 + Cor. 1:2009); German and English version EN ISO 14001:2004 + AC:2009

2000/532/EGEntsch

Commission Decision of 3 May 2000 replacing Decision 94/3/EC establishing a list of wastes pursuant to Article 1(a) of Council Directive 75/442/EEC on waste and Council Decision 94/904/EC establishing a list of hazardous waste pursuant to Article 1(4) of Council Directive 91/689/EEC on hazardous waste

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