ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A2*

Owner of the Declaration	Letbek A/S
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-LET-20240417-CBI1-EN
Issue date	20.12.2024
Valid to	19.12.2029

Extruded recycled polyethylene products for the construction industry

Letbek A/S

Institut Bauen und Umwelt e.V.

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General Information

Letbek A/S

Programme holder

IBU – Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

Declaration number

EPD-LET-20240417-CBI1-EN

This declaration is based on the product category rules:

Boards and panels made of plastic (interior and exterior applications), 01.06.2023
(PCR checked and approved by the SVR)

Issue date

20.12.2024

Valid to

19.12.2029

Dipl.-Ing. Hans Peters
(Chairman of Institut Bauen und Umwelt e.V.)

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Extruded recycled polyethylene products for the construction industry

Owner of the declaration

Letbek A/S
Hornevej 18
6862 Tistrup
Denmark

Declared product / declared unit

1 kg of extruded recycled polyethylene products for the construction industry

Scope:

This Environmental Product Declaration described is a model EPD of extruded plastic products manufactured at Letbek A/S facility in Tistrup, Denmark.
It includes the following products:

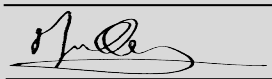
- Ground protection plates
- Cable covers
- Cylindric pole (DanPæl^{TM})

All of the above-mentioned products are made from recycled polyethylene (rPE) and colour additive, are produced by Letbek following the same production processes and follow similar end-of-life treatment. All products fall under the requirements of EPDs of boards and panels made of plastic for exterior applications and are therefore covered by the same c-PCR. The data used was collected at the production site or delivered by suppliers.
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.

The EPD was created according to the specifications of EN 15804+A2. In the following, the standard will be simplified as *EN 15804*.

Verification

The standard EN 15804 serves as the core PCR
Independent verification of the declaration and data according to ISO 14025:2011
☐ internally ☒ externally



Mr Olivier Muller,
(Independent verifier)

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Product

Product description/Product definition

This Environmental Product Declaration covers several products for the construction industry made primarily from recycled polyethylene (rPE) and a small amount of colour additive made from virgin PE. The product group covers 11 products, including:

- 10000: Ground protection plates 300x115 cm w/pattern and 4 handles
- 10001: Ground protection plates 200x115 cm w/pattern and 2 handles
- 10330: Ground protection plates 200x115 cm w/pattern and 2 handles
- 11574: Ground protection plates 300x100 cm w/pattern w/o handles
- 11239: Ground protection plates 300x115 cm w/pattern w/o handles
- 10086: Cable covers red 100x2 mm in rolls of 50 m
- 10104: Cable covers red 400x3,0 mm in rolls of 25 m
- 10314: Cable covers orange 150x2 mm in rolls of 50 m
- 10116: Cable covers yellow 170x2,0 mm in rolls of 50 mtr.
- 10390: Cable covers violet 100x1,5 mm in rolls of 50 m
- 12305: DanPæl to be used in construction industry

Some of the cable covers and DanPæl contain additional flat film and stickers, respectively.

For the use and application of the product the respective national provisions at the place of use apply, in Germany for example the building codes of the federal states and the corresponding national specifications.

Application

The products covered by this Environmental Product Declaration have different applications.

- Ground protection plates: used as drivable and walkable surfaces on building and construction or on festival grounds.
- Cable covers: Used to protect against digging through with hand tools on cables.
- DanPæl™: Used for traffic safety in construction sites.

Technical Data

No technical specifications are available as the recycled raw materials that the product consists of varies from batch to batch. Certain tests cannot be performed because the material cannot be converted into tensile test specimens.

Constructional data

Available constructional data for ground protection plates.

Name	Value	Unit
1% secant modulus	220-250	MPa
Tensile strength	17-22	MPa

For the remaining products (cable covers and DanPæl) there is no constructional data available.

Performance data of the product with respect to its characteristics in accordance with the relevant technical provision (no CE-marking).

Base materials/Ancillary materials

Name	Value	Unit
Recycled PE (rPE)	90-98	%
Virgin PE	2-10	%

The main constituents of the product is recycled PE and colour additive made from virgin PE. However, some of the cable covers and DanPæl™ include flat film and stickers, respectively, which are also made from virgin PE.

Manufacture

The products are manufactured by extrusion at Letbek's facility. The rPE and virgin PE are added to the extruder, where the products are moulded and cut to size. The waste material generated during production is re-granulated and re-enters to the production loop.

Environment and health during manufacturing

No further environmental protection measures beyond those which are legally prescribed as necessary.

Product processing/installation

The products are manually installed.

Packaging

Products are delivered in pallets, wrapped in PE film and PP strips. Pallets can be recycled. PE film and PP strips can also be recycled, although they are generally incinerated.

Conditions of use

The products are designed to withstand various weather conditions. They require low maintenance, reducing the need for frequent replacements.

Reference service life

As the products are passive in the use phase, the use phase is not included, and therefore the reference service life is not informed.

LCA: Calculation rules

Declared Unit

The declared unit of this study is one kg of extruded recycled polyethylene products for the construction industry.

Declared unit and mass reference

Name	Value	Unit
Gross density +/- 17.5	927.5	kg/m^3
Declared unit	1	kg
Conversion factor to 1 kg	1	-
Grammage for ground protection plates +/- 0.5	8.79	kg/m^2

The products are made from the same raw materials, are produced following the same production processes, and produced at the same facility. All products are made from the rPE and virgin PE (colour additive), however, there is a variability of the amount of rPE and virgin PE per kg, and an addition of flat film on the cable covers and stickers on the DanPæl™. Note that as a consequence of the cut-off boundary, the recycled content comes into the system burden free for which reason it has no impact on the environmental performance of the products.

System boundary

This is a cradle-to-gate EPD with modules A1-A3, C1-C4 and D.

Product stage - Modules A1-A3
The production stage includes:

- A1, processing of secondary material from previous product systems.
- A2, transport to factory gate.
- A3, manufacturing of products and packaging, as well as processing up to the end-of-waste state.

All the above-mentioned is included in this study. Waste and losses during manufacturing are included in the processes in which they occur, according to the "polluter-pays" principle. Machinery and construction of the manufacturing facility is not included in this study.

End-of-Life stage - Scenarios
According to Danish statistics, plastic waste is most often recycled (88%) but can also be incinerated (11%) or landfilled (1%) (Eurostat, 2023). Therefore, three different waste scenarios have been modeled, so the user of the EPD can choose which EoL scenario is most likely in their situation. C3, C4 and D relates to the 100% recycling scenario, C3/1, C4/1 and D/1 relates to the 100% incineration scenario, and C3/2, C4/2 and D/2 relates to the 100% landfilling scenario.

End-of-life stage - Modules C1-C4
The end-of-life stage includes:

- C1, deconstruction and demolition.
- C2, transport to waste processing.
- C3, waste processing for reuse, recovery and/or recycling.
- C4, disposal.

The deconstruction of the products is assumed to be done manually. As a result, no processes have been assigned to module C1. A transport distance of 50 km is assumed from the site to the waste processing facilities. End-of-life treatment of packaging material is not included, as module A5 is not declared.

Benefits and loads beyond the system boundaries - Module D
Within the 100% recycling EoL scenario, the system is credited for substituting virgin PE. Within the 100% incineration EoL scenario, the system is credited for producing heat and electricity. Within the 100% landfilling EoL scenario, no benefits and loads arise, as the waste material is assumed to be disposed of in a landfill in module C4.

Estimates and assumptions
The transport of raw materials and waste materials was assumed to occur using the same type of vehicle. In addition, a distance of 50 km was assumed to a waste disposal site in module C2.

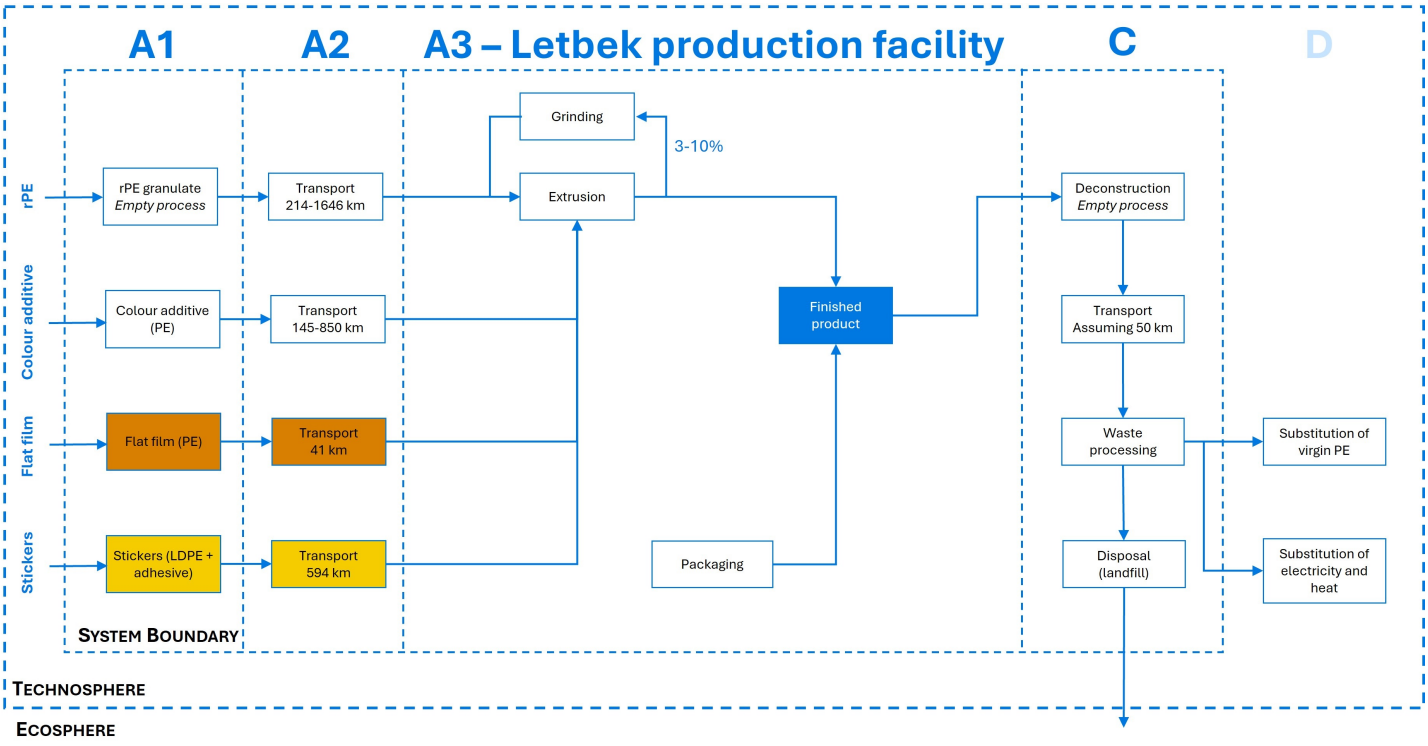
Cut-off criteria
Machinery, spare parts for machinery, as well as inputs needed for operation and maintenance are excluded from this study, as these are expected to be under the cut-off criteria, due to the long lifespan of the machinery.
Both the pigmentation in the colour additives and the glue on the sticker falls under the cut-off criteria. These are therefore excluded, and the colour additive and the sticker are therefore modelled as polyethylene.
The water used in the cooling towers in manufacturing (module A3) are recirculated. Smaller amounts evaporate; however, these fall under the cut-off criteria and is not included as neither emissions, nor as new input to replace the evaporated water as it is estimated to be negligible amounts.

Background data
Background data was used for modules A1, A2, C1-C4 and D. Data from ecoinvent 3.10, EN 15804 database was used as background data and is not more than 5 years old.

Data quality
The robustness of the LCA values is judged to be good. All products belong to the same group, are made from the same raw materials and go through the same manufacturing processes (extrusion and re-granulation of waste). Direct measurements of individual machines were taken. When different machinery is used, the worst-case values relating to electricity consumption are used.

The geographical representativeness is good, as all products are manufactured in Denmark.

Period under review
The production data related to primary data collection is from 2024.



Geographic Representativeness

Land or region, in which the declared product system is manufactured, used or handled at the end of the product´s lifespan: Europe

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* and the building context, respectively the product-specific characteristics of performance, are taken into account.

LCA: Scenarios and additional technical information

Characteristic product properties of biogenic carbon

The biogenic carbon content quantifies the amount of biogenic carbon in a construction product leaving the factory gate. Both the biogenic content of the product and the accompanying packaging is declared, separately.

Note: 1 kg of biogenic carbon is equivalent to 44/12 kg of CO_2.

Information on describing the biogenic carbon content at factory gate

The biogenic carbon given is the smallest amount, following the worst-case approach.

Name	Value	Unit
Biogenic carbon content in accompanying packaging	0.00555	kg C
Biogenic carbon content in product	-	kg C

Note: 1 kg of biogenic carbon is equivalent to 44/12 kg of CO_2.

The following technical scenario information covers the disposal of the accompanying packaging material, produced in module A3, on the construction site as module A5 is not declared in this EPD.

Installation into the building (A5)

The assumed waste scenario for the packaging waste leaving the system in A5 is shown in the table below. The packaging, consisting of wood pallets, plastic film, and plastic strips, is assumed to be recycled and incinerated.

Name	Value	Unit
Packaging waste for recycling, wood pallets	4.99E-02	kg
Packagin waste for incineration, plastic strips	4.23E-03	kg
Packaging waste for incineration, plastic film	8.33E-03	kg

The values shown here is the worst-case values, meaning that it is different for the three products.

End of life (C1-C4)

The end of life (EoL) has been modelled as three different scenarios, with 100% recycling, 100% incineration and 100% landfilling, respectively. It is estimated that the ground protection plates and the DanPæl™ are collected separately and the cable covers are collected as mixed construction waste for all scenarios. Thus the scenarios varies in C3, C4 and D. The values in the table below should be understood as representing each specific scenario. In the 100% recycling scenario, 1 kg is recycled, with 0 kg allocated to energy recovery or landfilling. For the 100% incineration scenario, 1 kg is sent for energy recovery, with 0 kg recycled or landfilled. Finally, in the 100% landfilling scenario, 1 kg is landfilled, and 0 kg is allocated to recycling or energy recovery.

Name	Value	Unit
Recycling PE	1	kg
Energy recovery PE	1	kg
Landfilling PE	1	kg

Reuse, recovery and/or recycling potentials (D), relevant scenario information

Only the small share of plastic in the product that is virgin plastic – the color additive, flat film, and stickers – can be

credited as substituting plastic. For the 100% recycling scenario, there will be benefits from substituting plastic, and for the 100% incineration scenario, there will be benefits from exported energy. For the 100% landfilling scenario, there will be no loads or benefits. The values in the table below are therefore applicable for the recycling and incineration scenarios, where it is implied that for the 100% recycling scenario, energy recovery parameters are zero; for the 100% incineration scenario, substitution of virgin PE is zero; and lastly, for the 100% landfilling scenario, both substitution of virgin PE and energy recovery parameters are zero.

Name	Value	Unit
Substitution of virgin PE	2.00E-02	kg
Energy recovery from incineration (electricity)	1.38E+00	kWh
Energy recovery from incineration (district heat)	9.62E+00	MJ

The values given are worst-case.

LCA: Results

The following tables show the LCA results obtained in this study. For calculation of the results, characterization was used on a model created of individual inputs from different LCIA methods to comply with EN 15804+A2. The LCIA has been calculated in Excel using the following methods from ecoinvent 3.10:

- EF v.3.1 EN 15804
- EN 15804 inventory indicators according to ISO 21930

The additional indicators are retrieved by using ecoinvent cumulative LCIA results for the system model EN 15804, cut-off. It follows ISO 21930 for all the datasets; hence, the results include all the background processes as well as foreground processes.

C1 is declared as 0 since manual deconstruction is assumed.

The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins or risks.

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)

Product stage			Construction process stage		Use stage							End of life stage				Benefits and loads beyond the system boundaries
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	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	MNR	MNR	MNR	MND	MND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1 kg of extruded recycled polyethylene products for the construction industry

Parameter	Unit	A1-A3	C1	C2	C3	C3/1	C3/2	C4	C4/1	C4/2	D	D/1	D/2
GWP-total	kg CO_2 eq	8.96E-01	0	9.51E-03	2.53E-01	3.09E+00	0	0	0	1.19E-01	-2.45E-01	-3E-01	0
GWP-fossil	kg CO_2 eq	1.11E+00	0	9.5E-03	2.53E-01	3.09E+00	0	0	0	1.19E-01	-2.44E-01	-2.54E-01	0
GWP-biogenic	kg CO_2 eq	-7.17E-02	0	6.25E-06	7.9E-04	1.96E-04	0	0	0	1.04E-04	-1.01E-03	-4.62E-02	0
GWP-luluc	kg CO_2 eq	7.11E-04	0	3.16E-06	5.62E-05	4.06E-06	0	0	0	1.99E-06	-1.31E-04	-1.48E-04	0
ODP	kg CFC11 eq	2.59E-08	0	1.89E-10	4.04E-10	4.43E-10	0	0	0	3.35E-10	-1.1E-08	-5.07E-09	0
AP	mol H^+ eq	3.34E-03	0	1.98E-05	2.47E-04	3.75E-04	0	0	0	6.58E-05	-7.51E-04	-1.26E-03	0
EP-freshwater	kg P eq	2.85E-04	0	6.43E-07	1.1E-05	2.88E-06	0	0	0	6.84E-07	-4.66E-05	-9.88E-05	0
EP-marine	kg N eq	7.53E-04	0	4.75E-06	8.59E-05	1.87E-04	0	0	0	2.61E-04	-1.47E-04	-2.89E-04	0
EP-terrestrial	mol N eq	7.83E-03	0	5.13E-05	8.66E-04	1.98E-03	0	0	0	2.97E-04	-1.52E-03	-3.81E-03	0
POCP	kg NMVOC eq	4.28E-03	0	3.29E-05	2.5E-04	4.84E-04	0	0	0	1.43E-04	-1.33E-03	-9.15E-04	0
ADPE	kg Sb eq	4.71E-06	0	3.16E-08	6.5E-07	6.34E-08	0	0	0	2.25E-08	-2.16E-06	-6.98E-07	0
ADPF	MJ	2.05E+01	0	1.34E-01	4.6E-01	2.24E-01	0	0	0	2.34E-01	-7.66E+00	-2.97E+00	0
WDP	m^3 world eq deprived	2.2E-01	0	6.53E-04	4.23E-02	7.17E-02	0	0	0	1.52E-03	-6.51E-02	-2.66E-02	0

GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential)

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1 kg of extruded recycled polyethylene products for the construction industry

Parameter	Unit	A1-A3	C1	C2	C3	C3/1	C3/2	C4	C4/1	C4/2	D	D/1	D/2
PERE	MJ	3.59E+00	0	2.29E-03	1.75E-01	7.56E-03	0	0	0	6.51E-03	-2.09E-01	-5.98E+00	0
PERM	MJ	3.95E+00	0	0	0	0	0	0	0	0	0	0	0
PERT	MJ	7.54E+00	0	2.29E-03	1.75E-01	7.56E-03	0	0	0	6.51E-03	-2.09E-01	-5.98E+00	0
PENRE	MJ	1.55E+01	0	1.34E-01	4.21E-01	2.24E-01	0	0	0	1.56E-01	-3.36E+00	-2.97E+00	0
PENRM	MJ	4.15E+01	0	0	-4.15E+01	-4.15E+01	0	0	0	0	0	0	0
PENRT	MJ	5.7E+01	0	1.34E-01	-4.11E+01	-4.13E+01	0	0	0	1.56E-01	-3.36E+00	-2.97E+00	0
SM	kg	8.99E-01	0	0	0	0	0	0	0	0	0	0	0
RSF	MJ	0	0	0	0	0	0	0	0	0	0	0	0
NRSF	MJ	0	0	0	0	0	0	0	0	0	0	0	0
FW	m^3	1.42E-02	0	1.8E-05	8.47E-04	5.7E-04	0	0	0	0	-1.7E-03	-6.66E-03	0

PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy

excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2:
1 kg of extruded recycled polyethylene products for the construction industry

Parameter	Unit	A1-A3	C1	C2	C3	C3/1	C3/2	C4	C4/1	C4/2	D	D/1	D/2
HWD	kg	7E-02	0	1.95E-04	9.06E-03	1.81E-02	0	0	0	3.5E-04	-8.97E-03	-2.74E-02	0
NHWD	kg	4.97E+00	0	4.12E-03	1.94E-01	1.1E+00	0	0	0	1E+00	-2.2E+00	-5.17E-01	0
RWD	kg	5.49E-06	0	1.07E-08	3.49E-07	2.83E-08	0	0	0	1.88E-08	-1.17E-06	-1.74E-07	0
CRU	kg	0	0	0	0	0	0	0	0	0	0	0	0
MFR	kg	0	0	0	1E+00	0	0	0	0	0	0	0	0
MER	kg	0	0	0	0	0	0	0	0	0	0	0	0
EEE	MJ	0	0	0	0	4.98E+00	0	0	0	0	0	0	0
EET	MJ	0	0	0	0	9.62E+00	0	0	0	0	0	0	0

HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional:
1 kg of extruded recycled polyethylene products for the construction industry

Parameter	Unit	A1-A3	C1	C2	C3	C3/1	C3/2	C4	C4/1	C4/2	D	D/1	D/2
PM	Disease incidence	4.24E-08	0	6.99E-10	4.46E-09	1.4E-09	0	0	0	1.62E-09	-5.93E-09	-1.04E-08	0
IR	kBq U235 eq	1.01E-01	0	1.73E-04	7.27E-03	4.77E-04	0	0	0	3.51E-04	-1.96E-02	-2.88E-03	0
ETP-fw	CTUe	3.92E+00	0	3.64E-02	1.05E+00	6.52E-01	0	0	0	6.49E-02	-8.75E-01	-7.84E-01	0
HTP-c	CTUh	5.38E-09	0	6.75E-11	1.52E-09	3E-10	0	0	0	6.08E-11	-9.66E-10	-9.86E-10	0
HTP-nc	CTUh	1.01E-08	0	8.65E-11	1.29E-09	2.9E-09	0	0	0	3.61E-10	-2.1E-09	-3.43E-09	0
SQP	SQP	4.12E+01	0	8.07E-02	9.49E-01	5.18E-02	0	0	0	5.7E-01	-6.86E-01	-1.01E+01	0

PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic); SQP = Potential soil quality index

Disclaimer 1 – for the indicator 'Potential Human exposure efficiency relative to U235'. This impact category deals mainly with the eventual impact of low-dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure or radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – for the indicators 'abiotic depletion potential for non-fossil resources', 'abiotic depletion potential for fossil resources', 'water (user) deprivation potential, deprivation-weighted water consumption', 'potential comparative toxic unit for ecosystems', 'potential comparative toxic unit for humans – cancerogenic', 'Potential comparative toxic unit for humans - not cancerogenic', 'potential soil quality index'. The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high as there is limited experience with the indicator.

References

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