ENVIRONMENTAL PRODUCT DECLARATION

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

Owner of the Declaration	UAC Berhad
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-UAC-20240059-IBC3-EN
Issue date	05.06.2024
Valid to	04.06.2029

UAC Fiber Cement Board

UAC Berhad

www.ibu-epd.com | https://epd-online.com

1. General Information

UAC Berhad

Programme holder

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

Declaration number

EPD-UAC-20240059-IBC3-EN

This declaration is based on the product category rules:

Fibre cement / Fibre concrete, 01.08.2021
(PCR checked and approved by the SVR)

Issue date

05.06.2024

Valid to

04.06.2029

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

Florian Pronold
(Managing Director Institut Bauen und Umwelt e.V.)

UAC Fiber Cement Board

Owner of the declaration

UAC Berhad
Jalan Portland, Tasek Industrial Estate 36
31400 Ipoh, Perak
Malaysia

Declared product / declared unit

1 tonne of UAC Fibre Cement Board

Scope:

This EPD declaration is based on the average of one metric tonne UAC Fibre Cement Board manufactured by UAC Berhad. These products are produced in the manufacturing plant located in Ipoh, Perak (Malaysia) where the production data for 2022 was recorded. Life Cycle Assessment (LCA) was conducted based on the cradle-to-grave with option approach (Modules A1-A3, A5, C1-C4 & D). The Declaration holder is liable for the details and documentation upon which the evaluation is based.
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

Dr. Matthew Fishwick,
(Independent verifier)

2. Product

2.1 Product description/Product definition

This is an average EPD comprises the products listed below. These autoclaved composite materials are made from specially treated high-grade cellulose fibre, Portland cement, refined sand and water. The asbestos was analyzed with a third-party laboratory and was not found in the product.

The declared products include:

- UAC Superflex/Multipurpose/Every
- UAC Vistaboard/Flexaboard/Multiflex/Square Flex
- UAC Lattice (Square, Diamond)
- UAC Decoceil (Chemerah,Chemerah Plus, Tika, Angkasa, Forra, Forra Plus)
- UAC Plank (Sedartex Woodgrain, Smooth)
- UAC Plank Shiplap
- UAC Supertex Panel
- UAC Decowood (Woodlike, Smooth)
- UAC Fence
- UAC Skirting
- UAC Duravent

All the declared products are produced at the same process flow with the same raw material composition with difference of formulation and geometrical output. For the placing on the market in the Europian Union/Eueopean Free Trade Association (EU/EFTA) (with the exception of Switzerland) the *Regulation (EU) No. 305/2011 (CPR)* applies. The product needs a Declaration of Performance taking into consideration/ *EN 12467: 2012* Fibre cement flat sheets - product specification and test methods/ and the CE- marking.

2.2 Application

For the application and use the respective national provisions apply.

UAC Berhad manufactures a wide range of Fibre Cement Boards which are extensively used in residential, institutional, commercial and industrial buildings, as: -

- Internal Lining and Wall Partitioning
- Ceiling
- Soffit and Eave Lining
- Substrate for flooring
- Fire and insulation application
- Decorative application
- Roofing
- Others

2.3 Technical Data

The technical data given by the Declaration of Performance according to EN 12467 apply.

UAC Fibre Cement Boards conform and certify to (a) *MS1296:2010* for UAC Superflex and (b) *EN12467:2004* for 7.5mm UAC Sedartex Woodgrain Plank.

Product specification
UAC Fibre Cement Board (6mm thickness)
- Thermal conductivity (W/mK): 0.12
- Resistance of heat transmission, Ra (m^2K / W): 0.19
- Dry density (kg/m^3): 1400

Soundproof:
With a 6mm fibre cement sheet (1190mmx1190mm) installed in the opening between two adjacent but acoustically isolated reverberation rooms, 17-33dB sound transmission loss at frequency from 1255000Hz. Airborne noise insulation is determined as STC30 (tested in accordance with *ASTM E90-09*).

The difference between the sound absorption of the room with and without the 6mm fibre cement
sheet is determined to obtain the total sound loss by using the reverberation time values. Noise reduction coefficient is determined as NRC0.10 (*ASTM E423-90a*). Sound transmission loss (UAC Vistabord): Estimated 25dB (6mm), 28dB (9mm).

Constructional data

Name	Value	Unit
Gross density	1400	kg/m^3
Standard panel thickness	6	mm
Thermal conductivity	0.12	W/(mK)
Average Modulus of Rupture (saturated)	>10	N/mm^2
Average Modulus of Elasticity (Saturated)	4000 – 7000	N/mm^2
Moisture movement	0.06 to 0.08%	
Durability Classification	EN12467:2012	Category A
Strength classification	EN12467:2012	Class 2

.

2.4 Delivery status

UAC Fibre Cement Boards are manufactured in a range of thicknesses from 3.2mm to 25mm. The boards can be up to 3660mm in length and up to 1220mm wide.

2.5 Base materials/Ancillary materials

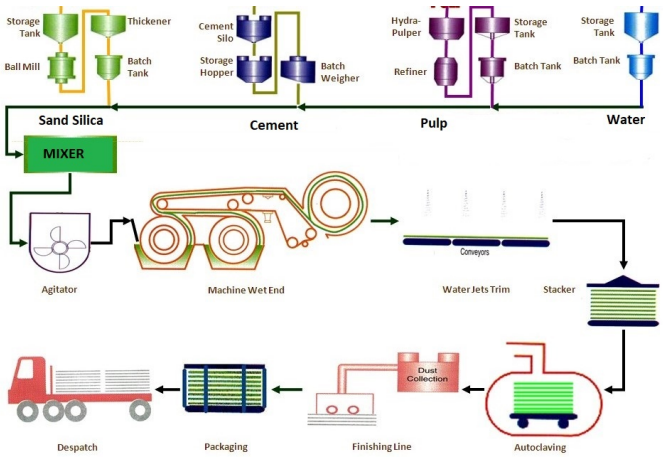
The base materials, auxiliary substances and additives for UAC Fibre Cement Boards are:

Name	Value	Unit
Base Material: Cement	30 – 40	% of dry mass
Base Material: Silica	50 – 60	% of dry mass
Base Material: Pulp / cellulose fibre	6 – 9	% of dry mass
Auxiliary Substances / Additives: Alumina / Alumina Tri-hydrate	0 – 5	% of dry mass
Auxiliary Substances / Additives: Silica Fume	0 – 5	% of dry mass
Auxiliary Substances / Additives: Red Pigment	0 – 1	% of dry mass

Products do not contain any substances that can be included in 'Candidate List of Substances of Very High Concern for Authorization' and raw materials used are not part of the EU REACH regulation.

2.6 Manufacture

Process flow of UAC Fibre Cement Board production:



UAC Fibre Cement Boards are produced with the Hatschek process or wet process: The raw materials are mixed homogeneously and pumped to the tubs at a controlled rate so that tubs are filled and overflow. A uniform film is formed onto the sieves and the film will be picked up by felt which will then be transferred to a size roller to be rolled in layers for the manufacturing of a `green sheet` (intermediate product formed during the production and yet to send to autoclave) according to the desired thicknesses. The speed of the felt is controlled in order to achieve consistent sheet thickness at a specified production rate.

Individual size roller determines the length of sheet being produced. If a patterned sheet is to be produced, a patterned sleeve will be placed on the size roller to create the desired patterns.

Once the desired thickness is achieved, it will then be separated and taken off from the size roller by a cut-off wire.

The green sheet will then be trimmed into size by a high-pressure water jet while the remaining scraps will return to the scrap agitator which will then be transferred back to the feed agitator for reuse in order to minimize generated waste.

The trimmed green sheets are stacked in tiers on steel base pallets.

The stacked green sheets will then be air-cured for a minimum 6-8 hours before curing in the autoclave for a total process duration of 10-12 hours.

The autoclaved sheets will undergo further cutting or trimming into the final dimension at sheet finishing with either a guillotine knife or a rotating saw. Sanding, edge recessing and slotting are also being done at sheet finishing.

Quality Management Systems in accordance to *ISO 9001:2015* for design and manufacture of fibre cement products are complied with.

2.7 Environment and health during manufacturing

The UAC Berhad operation is in compliance with ISO 45001:2018 (Occupational health and safety management system).

Water: Water contamination was not reported during the production of UAC Fibre Cement Boards. All the waste water is treated at a designated waste water treatment plant before discharging into the public sewerage, in accordance to the *Environmental Quality Act 1974 Act 127*.

Noise: Sound protection analyses and close monitoring on exposure limits have been established in accordance to the Factory and Machineries Act (*Noise Exposure*) *Regulations 1989 Act 139*.

Waste:
All scraps and rejected UAC Fibre Cement Boards are classified as solid waste under the *Malaysia Department of Environment (DOE) Regulations* and will be treated in landfill *Act 672*.

2.8 Product processing/Installation

UAC Fibre Cement Boards are cut using a guillotine knife or circular saw with tungsten carbide, and a diamond saw blade. Dust generated from the processes is collected through the effective dust collecting system and filtered before release to the air in accordance to the *Factories and Machinery Act (Mineral Dust) Regulations 1989 Act 139*. Dust emission is below the Permissible Level under Regulation 25 of the *Malaysia Environmental Quality (Clean Air) Regulations 1978 Act 127*.

2.9 Packaging

UAC Fibre Cement Boards are packed horizontally on wooden pallets and packaged with polyethylene stretch film, PET strap and cardboard edge protector. The wooden pallets are reused internally.

2.10 Condition of use

UAC Fibre Cement Boards have passed organic emissions tests under the *TUV Singapore* emission standards for formaldehyde, phenyl cyclohexene, phthalate, and total particles. Due to the stable crystalline calcium silicate hydrate phase after the autoclave process, the emission of volatile organic compound (VOC) detected are low and negligible for normal use in line with the designated purpose of the respective products.

2.11 Environment and health during use

Environmental aspects: Hazards to water, soil and air cannot arise from fibre cement flat sheets based on current knowledge.

2.12 Reference service life

The reference service life is not relevant for consideration of the LCA. As construction products with many different applications, a reference service life for Fibre Cement Boards is not declared here.
Description of the influences on the ageing of the product when applied in accordance with the rules of technology.

2.13 Extraordinary effects

Fire
For UAC Superflex, UAC Vistabord, UAC Decoceil, and UAC Supertex Woodgrain panel:

- **Fire Propagation Index:** range from 0,0-3,3, according to *BS 476-6:1989*.

- **Surface spread of flame test:** Class 1 surface spread of fame (actual result 0mm at 1.5m), according to *BS 476-7:1997*.

Fire protection

Name	Value
Building material class	A2
Burning droplets	d0
Smoke gas development	s1

Water

No substances are washed out from UAC fibre cement board products which could be hazardous to water.

Mechanical destruction
Irrelevant

2.14 Re-use phase
Products are not designed for re-use, recycling, and recovery (energy or otherwise), as they may impact the quality and render unfit for their intended use.

2.15 Disposal
According to *Malaysia Solid Waste* and *Public Cleansing Management Act 2007 Act 672*, remains of UAC fibre cement board waste products from construction sites or from demolition can be disposed of as solid waste. Waste code '17 01 01 (Concrete)' in line with the *European Waste Catalogue EWC*.

2.16 Further information
Further information on the products can be obtained from our website www.uac.com.my

3. LCA: Calculation rules

3.1 Declared Unit

All products show similar recipes with some differences in the dosage of pre-products for certain products. Declared unit to the UAC Fibre Cement Boards which are manufactured with the mixing of cement, silica sand, pulp, alumina, silica fume and red oxide and dried under pressure and temperature in the autoclave machine.
Construction materials' purpose, fixing and installation guides are being observed and no health impairment is known due to the basic materials employed and their behaviour according to current knowledge.
Further information on the products can be referred to the 'Product Specifications' from www.uac.com.my
The average metric tonne of fibre cement products is calculated based on the annual production data. The declared unit of this study is 1 metric tonne of UAC Fibre Cement Boards with an average bulk density of 1400 kg/m³.
Foreground data describing the on-site production are integrated into the LCA FE Software model in the study. The LCI is assessed based on annual production data. Background data are taken from the LCA FE Database.

Declared unit

Name	Value	Unit
Declared unit	1	t
Gross density	1400	kg/m^3
Conversion factor to 1 kg	0.000714286	-

For IBU core EPDs (where clause 3.6 is part of the EPD): for average EPDs, an estimate of the robustness of the LCA values must be made, e.g. concerning the variability of the production process, geographical representativeness and the influence of background data and preliminary products compared to the environmental impacts caused by the actual production.

3.2 System boundary
Type of EPD: Cradle to gate with options.

The following life cycle stages were included: A1-A3, A5, C1, C2, C3, C4 and D.

Manufacture of preliminary products (cement, sand, pulp, alumina, silica fume and red pigment) and transportation of raw materials and preliminary products to the plant have been considered. Manufacturing process in the plan including energy, manufacture of auxiliaries, disposal of residual materials incurred and consideration of any emissions incurred. Manufacture of packaging materials has also been considered.

3.3 Estimates and assumptions
No other estimations or assumptions were made regarding the specifications outlined in this section (Chapter 3).

3.4 Cut-off criteria
All operating data, i.e. all of the starting materials used, internal fuel consumption and electricity consumption, all direct production waste as well as all emission measurements available were taken into consideration in the analysis. Accordingly, material flows with a share of less than 1 % were also considered in this study. It can be assumed that the total of all neglected processes does not exceed 5 % in the effective categories. Machinery, plants and infrastructure required in the manufacturing process are not taken into consideration.

3.5 Background data
Secondary data from the *LCA FE Database* (Formerly GaBi) were used to model the background system in the LCA model. The consistent data items contained in the *LCA FE database* are documented in the online *Sphera* documentation centre. The basic data in the *LCA FE database* was applied for energy, transportation, and consumables. The LCA was primarily developed based on the Malaysia database. Average data from the other regions were incorporated where the Malaysia database is not available.

3.6 Data quality
All background data records related to the UAC operation were provided by UAC Berhad as well as the *LCA FE* database. Technological: All primary and secondary data are modelled to be specific to the technologies or technology mixes under study. Where technology-specific data are unavailable, proxy data are used. The overall technological representativeness is considered to be good.

Geographical: All primary and secondary data are collected specific to the country / region under study. Where country/region-specific data are unavailable, proxy data are used. The overall geographical representativeness is considered to be good.

Temporal: All primary data are collected for a representative year. All secondary data come from the Sphera LCA FE Databases and are representative of the years 2020-2025. As the study for the product systems is based on the reference year 2022, temporal representativeness is good.

3.7 Period under review
The LCA study was developed based on the operation activities from January to December of 2022.

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

3.9 Allocation

No allocation was applied in the life cycle assessment for the foreground data of the examined products.

3.10 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. The main LCA database used in the study is the *Sphera MLC* and *Sphera LCA FE CUP 2023.2*.

4. 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, and it shall be separately declared for the product and for any accompanying packaging.

Information on describing the biogenic carbon content at factory gate

Name	Value	Unit
Biogenic carbon content in product	29.49	kg C
Biogenic carbon content in accompanying packaging	0.17	kg C

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

Installation into the building (A5)

The installation (Screws, adhesives etc. along with electricity consumption) phase could not be modelled due to data unavailability. In module A5 the incineration of the packaging materials has been considered. The thermal and energy credit with Malaysian dataset has been considered.

Name	Value	Unit

In case a **reference service life** according to applicable ISO standards is declared then the assumptions and in-use conditions underlying the determined RSL shall be declared. In addition, it shall be stated that the RSL applies to the reference conditions only.

The same holds for a service life declared by the manufacturer. Corresponding information related to in-use conditions needs not be provided if a service life taken from the list of service life by *BNB* is declared.

End of life (C1-C4)

Name	Value	Unit
Collected separately waste type waste type	1000	kg
Landfilling	1000	kg

100% landfill has been considered in the end-of-life of the product.

5. LCA: Results

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	X	MND	MND	MNR	MNR	MNR	MND	MND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1 tonne UAC Fiber Cement Boards with Average Bulk density 1400 kg/cum

Parameter	Unit	A1-A3	A5	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq	6.44E+02	1.98E+00	4.63E-01	3.88E+00	0	1.14E+02	-1.22E+00
GWP-fossil	kg CO_2 eq	7.43E+02	1.41E+00	4.63E-01	3.3E+00	0	1.48E+01	-1.22E+00
GWP-biogenic	kg CO_2 eq	-1E+02	5.77E-01	1.3E-04	5.35E-01	0	9.92E+01	-2.26E-04
GWP-luluc	kg CO_2 eq	3.73E-01	4.79E-06	1.21E-04	5.07E-02	0	4.67E-02	-2.16E-04
ODP	kg CFC11 eq	5.23E-10	1.52E-13	3.46E-13	8.73E-14	0	3.82E-11	-6.05E-13
AP	mol H^+ eq	2.95E+00	2.96E-04	2.1E-03	4.56E-03	0	1.07E-01	-4.17E-03
EP-freshwater	kg P eq	1.53E-03	4.12E-08	1.82E-07	3.2E-06	0	3.03E-05	-3.2E-07
EP-marine	kg N eq	1.11E+00	9.02E-05	6.41E-04	1.49E-03	0	2.75E-02	-1.36E-03
EP-terrestrial	mol N eq	1.2E+01	1.37E-03	7.01E-03	1.84E-02	0	3.03E-01	-1.49E-02
POCP	kg NMVOC eq	3.07E+00	2.47E-04	1.74E-03	3.89E-03	0	8.31E-02	-3.73E-03
ADPE	kg Sb eq	1.99E-05	1.41E-09	7.37E-09	8.43E-07	0	6.94E-07	-1.29E-08
ADPF	MJ	7.34E+03	3.87E-01	5.21E+00	5.1E+01	0	2E+02	-1.57E+01
WDP	m^3 world eq deprived	1.03E+01	2.04E-01	3.48E-03	1.35E-02	0	1.65E+00	-6.25E-03

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 tonne UAC Fiber Cement Boards with Average Bulk density 1400 kg/cum

Parameter	Unit	A1-A3	A5	C1	C2	C3	C4	D
PERE	MJ	1.48E+03	7.48E+00	5.78E-01	3.27E+00	0	1.24E+03	-1.01E+00
PERM	MJ	1.21E+03	-7.38E+00	0	0	0	-1.21E+03	0
PERT	MJ	2.69E+03	9.64E-02	5.78E-01	3.27E+00	0	3.26E+01	-1.01E+00
PENRE	MJ	7.32E+03	2.37E+01	5.21E+00	5.1E+01	0	2E+02	-1.58E+01
PENRM	MJ	2.33E+01	-2.33E+01	0	0	0	0	0
PENRT	MJ	7.34E+03	3.88E-01	5.21E+00	5.1E+01	0	2E+02	-1.58E+01
SM	kg	0	0	0	0	0	0	0
RSF	MJ	0	0	0	0	0	0	0
NRSF	MJ	0	0	0	0	0	0	0
FW	m^3	4.72E+00	4.8E-03	1.22E-03	5.56E-03	0	5.05E-02	-2.13E-03

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 tonne UAC Fiber Cement Boards with Average Bulk density 1400 kg/cum

Parameter	Unit	A1-A3	A5	C1	C2	C3	C4	D
HWD	kg	1.64E-05	1.02E-11	1.61E-10	1.05E-10	0	4.36E-09	-7.14E-10
NHWD	kg	2.3E+02	2.4E-02	1.28E-03	2.01E-03	0	1E+03	-3.28E-03
RWD	kg	4.3E-02	2.21E-05	6.62E-07	4.84E-06	0	2.28E-03	-1.49E-06
CRU	kg	0	0	0	0	0	0	0
MFR	kg	0	0	0	0	0	0	0
MER	kg	0	9.65E-01	0	0	0	0	0
EEE	MJ	0	3.47E+00	0	0	0	0	0

EET	MJ	0	6.22E+00	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 tonne UAC Fiber Cement Boards with Average Bulk density 1400 kg/cum

Parameter	Unit	A1-A3	A5	C1	C2	C3	C4	D
PM	Disease incidence	4.77E-05	1.65E-09	1.73E-08	3.08E-08	0	1.31E-06	-3.43E-08
IR	kBq U235 eq	7.16E+00	3.55E-03	8.36E-05	4.76E-04	0	2.64E-01	-2.06E-04
ETP-fw	CTUe	4.56E+03	1.54E-01	4.21E-01	9.7E+00	0	1.08E+02	-8.12E-01
HTP-c	CTUh	1.36E-07	1.39E-11	5.49E-11	2.01E-10	0	1.68E-08	-1.85E-10
HTP-nc	CTUh	6.34E-06	2.33E-10	7.25E-10	6.13E-09	0	1.77E-06	-1.44E-09
SQP	SQP	1.51E+04	1.18E-01	3.83E-01	3.97E+01	0	4.86E+01	-6.71E-01

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.

6. LCA: Interpretation

In terms of environmental impacts, due to the energy- and resources-intensity of the raw material production processes, the cement production was recorded to be the major contributor to the environmental indicators for the production of 1 tonne UAC Fibre Cement Board.

This study revealed that the manufacturing activities within the UAC Plant had an equivalent environmental impact profile as compared to the raw material production process.

In overall, the production (Module A1-A3) of 1 tonne of UAC Fibre Cement Board contributed 743.41 kg CO_2eq of GWP (Global warming potential, fossil) in which the Module A1 contributes 55.69% and Module A3 (36.48%) followed by Module A2 (7.83%).

The total cradle to gate (Module A1-A3) AP is 2.95 kg H^+eq. in which major contribution is coming from Module A3 (40.33%) followed by Module A2 (30.57%) and Module A1 (29.10%).

The total cradle to gate (Module A1-A3) ADPE-element is 1.99 E-05 kg Sb-eq in which major contribution is coming from Module A1 (76.49%) followed by Module A3 (16.73%).

The total cradle to gate (Module A1-A3) ADPE-fossil is 7340.17 MJ in which the significant contribution is coming from Module A1 (45.91%) and Module A3 (44.14%) followed by Module A2 (9.95%).

7. Requisite evidence

7.1 Radioactivity
Measurement of the nuclide content in Bq/kg for Ra-226, Th-232, K-40. In Germany, there are currently no statutory limit values specified for assessing the radioactivity of building materials. Assessment can be performed on the basis of:

- EU Commission "Radiation Protection 112" document
- OENORM 5200-Nordic Countries' Recommendation 2000.

Testing on the toxicity characteristic leaching procedure (TCLP) using SW 846 6010 and 7473 methods were conducted for UAC Fibre Cement Board (represented by Flexabord and Superflex) where the results are demonstrated in the table below.

Leaching Test

Name	Value	Unit
Arsenic (As)	< 0.018	mg/L
Barium (Ba)	≤ 0.16	mg/L
Cadmium (Cd)	≤ 0.0013	mg/L
Chromium (Cr)	≤ 0.017	mg/L
Mercury (Hg)	≤ 0.002	mg/L
Plumbum (Pb)	≤ 0.02	mg/L
Selenium (Se)	≤ 0.02	mg/L
Silver (Ag)	< 0.01	mg/L

The '*ASTM D5116-06: Standard Guide for small smallscale environmental chamber determinations of organic emissions from indoor materials/products'* testing conducted by TUV Singapore certified that UAC Fibre Cement Board is:

VOC emissions

Name	Value	Unit
Total VOC emission rate	0.17	mg/cum/hour
Formaldehyde emission	<0.02	per cum/hour
Phenyl cyclohexene emission rate	Not dectected*	per cum/hour
Phthalate emission	0.003	per m^3
Total particle emission	<0.02	per m^3

* Detection level: 0.002 mg per m^3

8. References

Act 127
Laws of Malaysia Act 127 – Environmental Quality Act 1974 – Environmental Quality (Clean Air) Regulations, 1978

Act 139
Laws of Malaysia Act 139 – Factories and Machinery Act 1967 – Factories and Machinery (Mineral Dust) Regulations 1989

Laws of Malaysia Act 139 – Factories and Machinery Act 1967 – Factories and Machinery (Noise Exposure) Regulations 1989

Act 672
Laws of Malaysia Act 672 – Solid Waste and Public Cleansing Management Act 2007

ASTM D5116-06
Standard Guide for small small-scale environmental chamber determinations of organic emissions from indoor materials/products

ASTM E90-09
Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

ASTM E 423: Standard test method for normal spectral

BS 476 Part 6.
Fire propagation. Source:
http://www.colorcoatonline.com/en/technical/regulations/fire_performance/bs_476/

BS 476 Part 7.
Surface spread of flame. Source:
http://www.colorcoatonline.com/en/technical/regulations/fire_performan

BS EN 12467:2004
Fibre-cement flat sheets. Product specification and test methods

EN 15804
EN 15804:2012+A2:2019+AC: 2021, Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

European Waste Catalogue (EWC)
Chapter 17: Construction and demolition wastes (including excavated soil from contaminated sites)

IBU 2016
IBU (2016): General Programme Instructions for the Preparation of EPDs at the Institut Bauen und Umwelt e.V., Version 1.1 Institut Bauen und Umwelt e.V., Berlin.

ISO 9001
ISO 9001: 2015 -Quality management systems requirements

ISO 14025
DIN EN ISO 14025:2011-10 Environmental labels and declarations — Type III environmental declarations — Principles and procedures

ISO 14040
ISO 14040:2006: Environmental management – Lifecycle assessment – Principles and framework.

ISO 14044
ISO 14044:2006: Environmental management – Lifecycle assessment – Requirements and guidelines

LCA FE (Formerly GaBi): Software and database for life cycle engineering. LBP, University of Stuttgart and thinkstep AG, Leinfelden-Echterdingen, 2023

LCA FE (Formerly GaBi): Documentation of GaBi 10.6-Datasets for life cycle engineering. LBP University of Stuttgart and thinkstep AG, 2023.

https://sphera.com/product-sustainability-gabi-data-search/

Method 6010 -
Inductively Coupled Plasma-Atomic Emission Spectrometry

Method 7473 -
Mercury in Solids and Solutions by Thermal Decomposition, Amalgamation, and Atomic Absorption Spectrophotometry

MS1296
Malaysia Standard MS 1296: 2010 Fibre-Cement Flat Sheets

PCR 2021, Part A & B
Institut Bauen and Umwelt e,V, Berlin (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 version 1.3, 2021, Part B: Requirement on the EPD by fibre cement/ fibre concrete, version 1.6, 01.08.2021, www.bau-mwelt.de

SW 846
Test Methods for Evaluating Solid Waste, Physical / Chemical Methods

Publisher

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

+49 (0)30 3087748- 0
info@ibu-epd.com
www.ibu-epd.com

Programme holder

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

+49 (0)30 3087748- 0
info@ibu-epd.com
www.ibu-epd.com

Author of the Life Cycle Assessment

thinkstep Sustainability Solutions Pvt. Ltd., a Sphera company
Meadows, Sahar Plaza 707
400059 Mumbai
India

+91 99671 06584
ragrawal@sphera.com
www.sphera.com

Owner of the Declaration

UAC Berhad
Jalan Portland, Tasek Industrial Estate 36
31400 Ipoh, Perak
Malaysia

+605 – 291 2033
chen_lin_shiung@uac.com.my
www.uac.com.my