



**Products, Carbon & Chemicals**

Martha Lewis, Head of Materials Henning Larsen

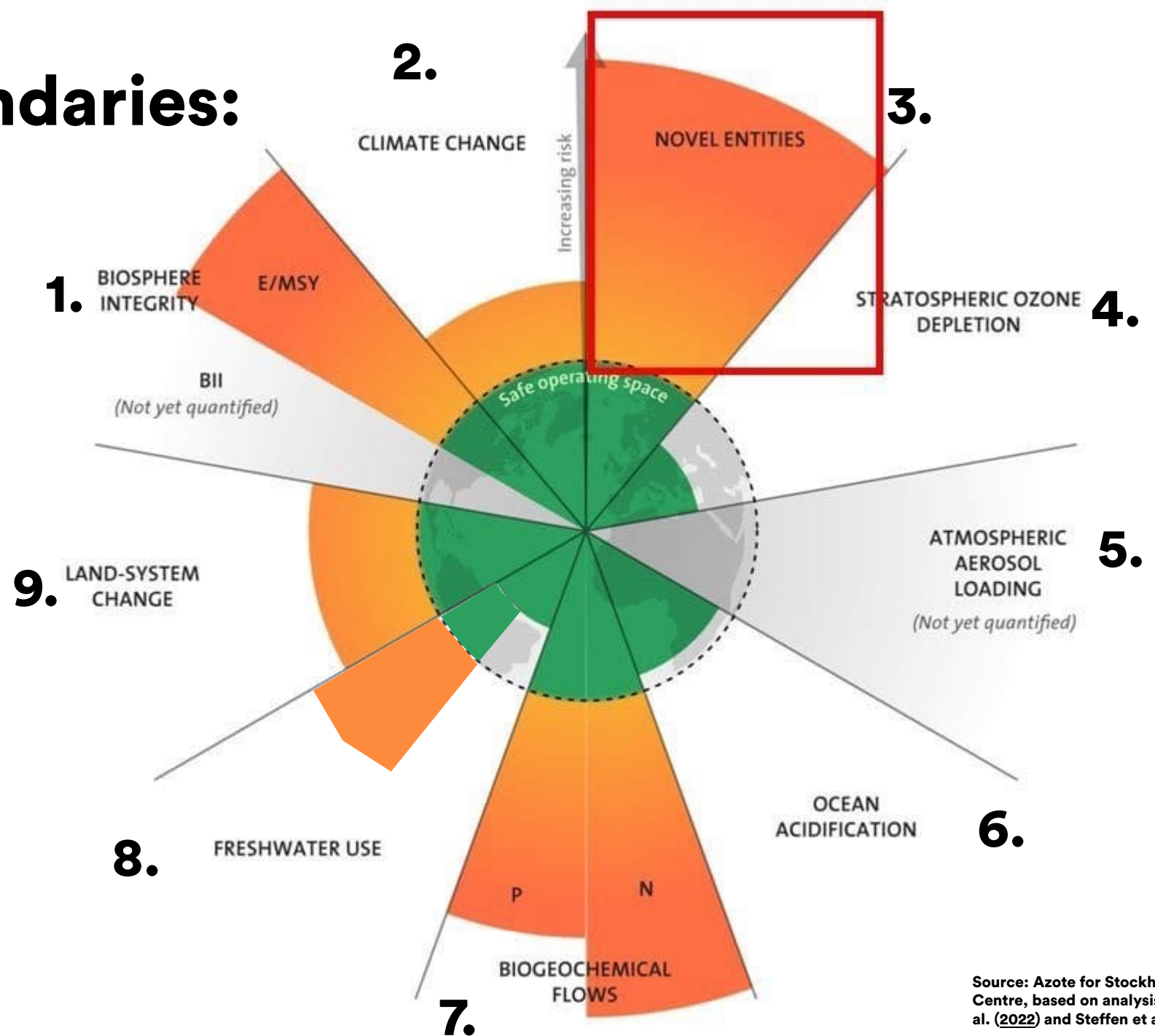
9 February 2023

**The Alliance for Sustainable Building Products  
Healthy Buildings Conference and Expo 2023**

**Triple planetary crisis**



# Planetary boundaries:



# Henning Larsen | Unboxing Carbon Material Catalog

## The Catalog

We collect all data developed inhouse and on the course in a catalog, hoping that it will be used across the industry to minimize our collective footprint.

[Read more and download the latest version available.](#)

[www.henninglarsen.com](http://www.henninglarsen.com)





**CARBON COMPARISONS 1 M2 OF INTERIOR CLADDING  
TYPES OF INTERIOR CLADDING**



25.6 kg CO<sub>2</sub>e  
**LESS yellow brick, Egernsund Wienerberger**  
 type: yellow-firing clay, biogas  
 thickness: 108mm  
 density: 1463 kg/m<sup>3</sup>  
 lifetime: 150 years  
 EPD no: MD-21029-EN

41.8 kg CO<sub>2</sub>e  
**Yellow Brick, Randers Tegl**  
 type: Yellow-firing clay, Vindø Brickyard  
 thickness: 108 mm  
 density: 1800 kg/m<sup>3</sup>  
 lifetime: 150 years  
 EPD no: MD-20030-EN

47.9 kg CO<sub>2</sub>e  
**Grey Bricks, Randers Tegl**  
 type: grey, yellow, and red firing clay  
 thickness: 108mm  
 density: 1825 kg/m<sup>3</sup>  
 lifetime: 150 years  
 EPD no: MD-17002-EN\_rev1

50.1 kg CO<sub>2</sub>e  
**Yellow Brick, Matzen Tegl**  
 type: Yellow-firing clay  
 thickness: 108 mm  
 density: 1600 kg/m<sup>3</sup>  
 lifetime: 150 years  
 EPD no: MD-20044-EN

59.7 kg CO<sub>2</sub>e  
**D-bricks, Petersen Tegl A/S**  
 type: yellow- and red-firing clay, German and British clay  
 thickness: 108 mm  
 density: 1825 kg/m<sup>3</sup>  
 lifetime: 150 years  
 EPD no: MD-19006-EN

60.1 kg CO<sub>2</sub>e  
**Yellow Brick, Randers Tegl**  
 type: yellow-firing clay, Hammershøj Brickyard  
 thickness: 108 mm  
 density: 1825 kg/m<sup>3</sup>  
 lifetime: 150 years  
 EPD no: MD-18015-EN

**Novel Entities**





# Global chemical production increased 50-fold since 1950

and is projected to triple again by 2050 compared to 2010

Source:  
UN Global Chemical Outlook I, 2019  
Outlook II, 2019



**Construction sector consumes 28%  
of global chemical production.**

**Source:**  
**UN Global Chemical Outlook II, 2019**  
Photo by Dorsa Masghati on Unsplash



**The construction sector consumes  
19.7% of the plastic used in the EU**





Source:  
Plastic Paints the Environment, Paruta et al., EAEnvironmental Action 2022

**58% of microplastic leaked to the oceans is from paint**



**Hazardous Chemical Usage**



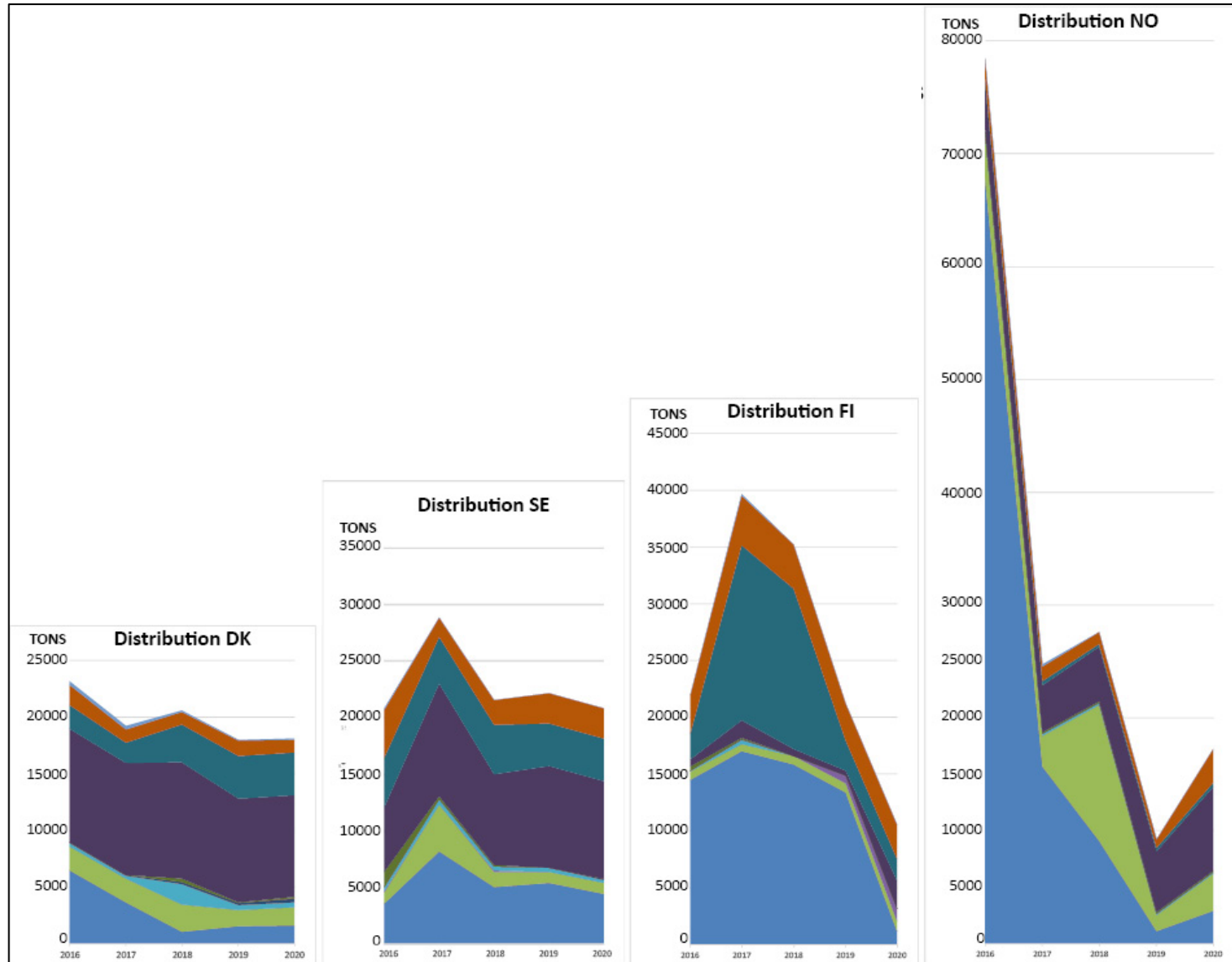
# Tons per year of SVHC & LOUS Substances

(EU REACH)

(DENMARK)

Declared in Construction Products

- Surface treatment
- Paints, lacquers and varnished
- Solvents
- Non-agricultural pesticides and preservatives
- Fillers
- Construction materials
- Adhesives, binding agents

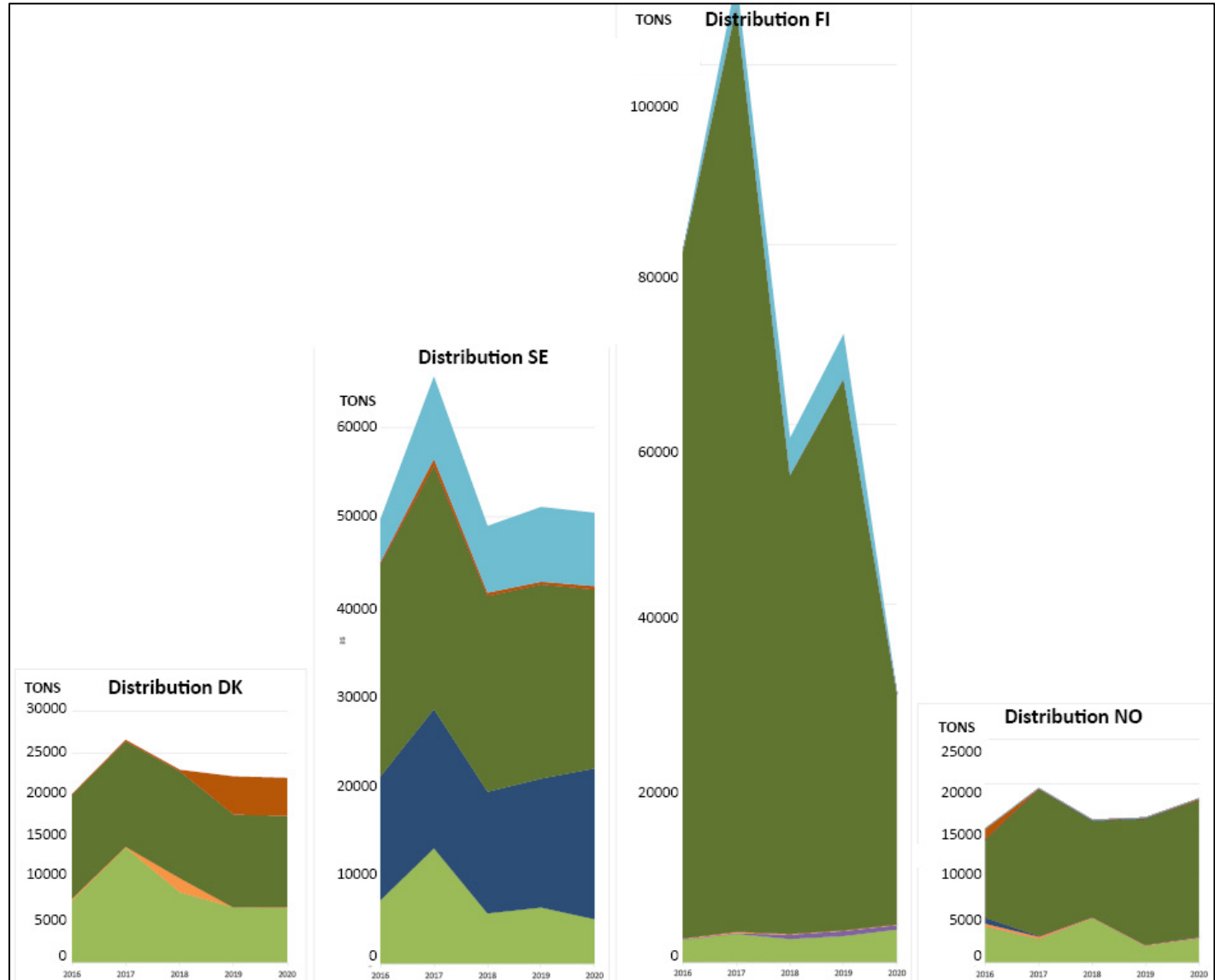




# Tons per year of LBC Red List Substances

Declared in Construction Products

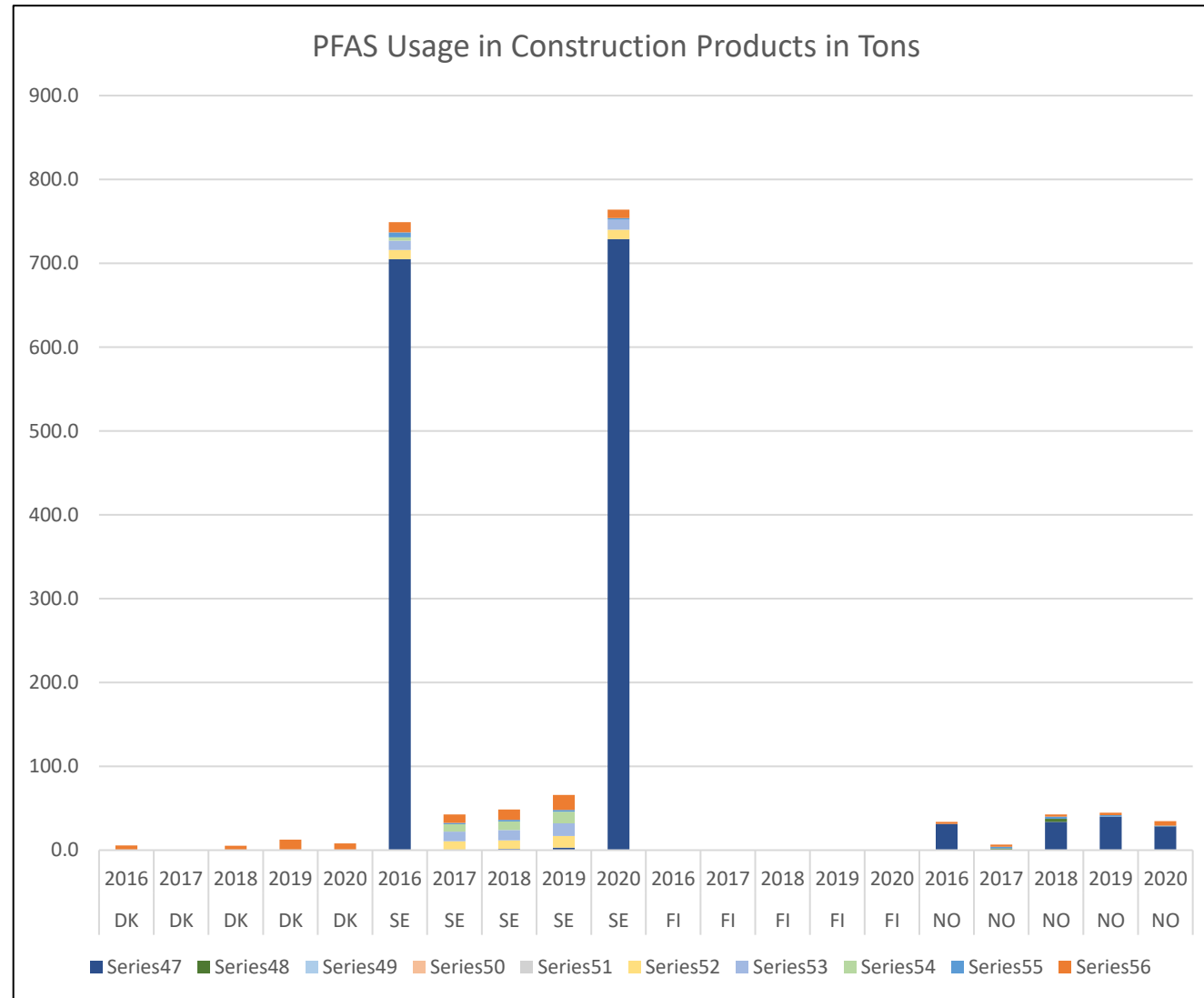
- Wood treatments containing creosote or pentachlorophen
- Chlorinated Polymers - Polyvinyl Chloride (PVC)
- Phthalates (Orthophthalates)
- Formaldehyde (added)
- Chlorinated Polymers - Chlorinated Polyethylene and Chlorosulfonated Polyethylene
- Bisphenol A (BPA) and structural analogues



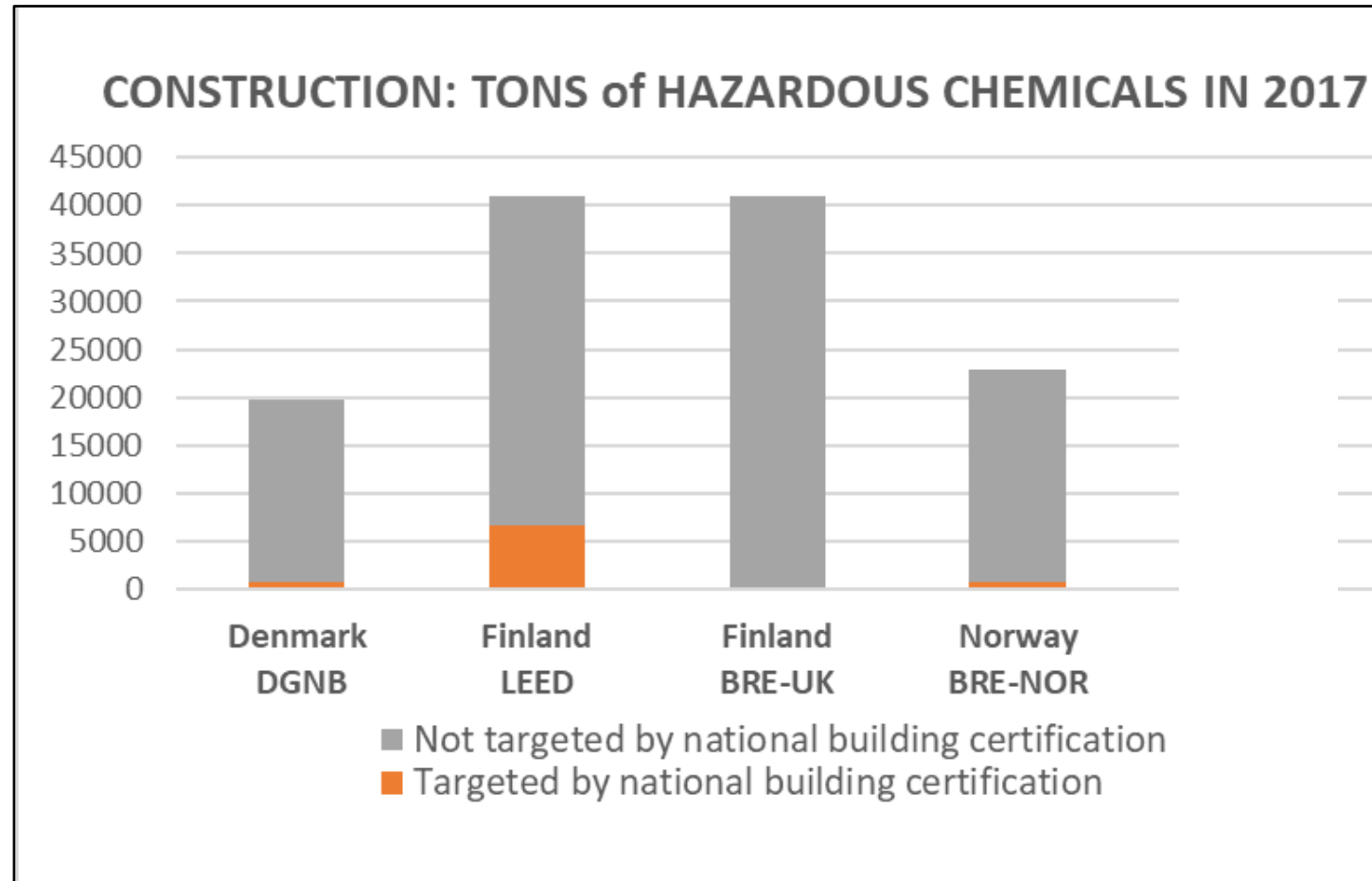
# Use of PFAS in construction products

Used in paints, adhesives, flame retardants

- Increased risk of kidney or testicular cancer
- Increased cholesterol levels
- Decreased vaccine response in children
- Changes in liver enzymes
- Increased risk of high blood pressure or pre-eclampsia in pregnant women
- Small decreases in infant birth weights



# Certification systems are NOT screening for the hazardous chemicals in use in Nordic Countries



**How to navigate**





# Eliminate substances in products based on properties

## Phase-out properties as defined by the Swedish Chemicals Agency

Properties	Classification according to the CLP regulation for determination of the intrinsic properties	Maximum concentration in BREEAM-SE
Carcinogenic	(Carcinogenicity, Category 1A and 1B) <b>H350</b> : May cause cancer...*	0.1%
Mutagenic	(Germ cell mutagenicity, Category 1A and 1B) <b>H340</b> : May cause genetic defects...*	0.1%
Toxic to reproduction	(Reproductive toxicity, Category 1A and 1B) <b>H360</b> : May damage fertility or the unborn child...*	0.3%
Endocrine disrupter	Substances classified in categories 1 and 2 in the EDs database (List from the European commission available at <a href="http://ec.europa.eu/environment/archives/docum/pdf/bkh_annex_01.pdf">http://ec.europa.eu/environment/archives/docum/pdf/bkh_annex_01.pdf</a> )	0.1%
Particularly hazardous metals (Cd, Hg, Pb)	Mercury, cadmium, lead and compounds of these metals are all phase-out substances. Specific criteria are not because the presence of these metals is enough.	Cd 0.01% Hg 0.1% Pb 0.1%
PBT /vPvB – Persistent, Bioaccumulating, Toxic / very Persistent, very Bioaccumulating	Criteria available at <a href="http://www.kemi.se">www.kemi.se</a>	0.1%
Ozone-depleting substances (0,1%)	(Hazardous to the ozone layer) <b>EUH059</b> : Hazardous to the ozone layer <b>H420</b> : Harms public health and environment by destroying ozone in the upper atmosphere.	0.1%
Strongly allergenic	(Resp. Sens category 1) <b>H334</b> : may cause allergy or asthma symptoms or breathing difficulties if inhaled. (Skin Sens. category 1A) <b>H317</b> : May cause an allergic skin reaction.	
Particularly persistent substances (PFAS)	Per- and polyfluoroalkyl substances, PFAS, have due to their extreme persistence comparable hazardous properties to those of particularly hazardous substances defined in Sweden's environmental quality objectives A Non-Toxic Environment. PFAS should therefore from a precautionary perspective be treated similarly to other particularly hazardous substances and be phased out.	

## Risk-reduction properties defined by the Swedish Chemicals Agency

Properties	Classification according to the CLP regulation for determination of the intrinsic properties	Maximum concentration in BREEAM-SE
Very high acute toxicity	Acute toxicity, Category 1 and 2 <b>H330</b> : Fatal if inhaled <b>H310</b> : Fatal in contact with skin <b>H300</b> : Fatal if swallowed (Specific target organ toxicity after single exposure) <b>H370</b> : Cause damage to organs.	1%
Allergenic	Classification Skin sensitisation in Category 1 or 1B (Skin Sens. 1/1B) <b>H317</b> : May cause an allergic skin reaction.	1%
High chronic toxicity	(Specific target organ toxicity after repeated exposure) <b>H372</b> : Cause damage to organs through prolonged or repeated exposure.	1%
Mutagenic (1 %)	(Germ cell mutagenicity, Category 2) <b>H341</b> : Suspected of causing genetic defects	1%
Environmentally hazardous, long-term effects	(Hazardous to the aquatic environment, Chronic Category 1 and 4) <b>H410</b> : Very toxic to aquatic life with long lasting effects. <b>H413</b> : May cause long lasting harmful effects to aquatic life	H410: 2.5% H413: 25%
Potential PBT / vPvB	Criteria available at: <a href="http://www.kemi.se">www.kemi.se</a>	0.1%
Carcinogenic	Classification Carcinogenicity in Category 2 <b>H351</b> : Suspected of causing cancer.	
Toxic to reproduction	Classification Reproductive toxicity in Category 2 or additional Category for effects on or through breast-feeding: <b>H361</b> : Suspected of damaging fertility or the unborn child. <b>H362</b> : May cause harm to breast-fed children.	

# Product declarations are necessary

**USA**

Marmoleum Sheet with Topshield2 by Forbo Flooring Systems

Health Product Declaration 1.1

CLASSIFICATION: 09 65 00.00 Finishes: Resilient Flooring

PRODUCT DESCRIPTION: Marmoleum Sheet is a homogeneous covering made of natural resins, linseed oil, rosin binders, wood flour, limestone, and dry pigments with a natural jute backing. Marmoleum features Topshield2, which is a high performance, double UV cured factory applied finish that makes the product "occupancy ready" after installation. The double UV cured layer technology delivers color clarity and vibrancy, along with extraordinary wear performance by providing a surface that can be repaired after accidents or restored after years of intensive use. The thickness of Marmoleum Sheet varies by collection. The standard thickness is 2.5mm (1/10"). Marmoleum Composition Sheet (MCS) is available in 2.0mm (0.08"). Marmoleum sheet is packaged on a roll that is 79" (2 meters) wide with a maximum length of 105' (32 meters).

Section 1: Summary Basic Method / Product Threshold

CONTENT INVENTORY

Inventory Reporting Format

Nested Materials Method

Basic Method

Threshold Disclosed Per

Material

Product

Threshold level

100 ppm

1,000 ppm

Per GHS SDS

Per OSHA MSDS

Other

Residuals/Impurities

Considered

Partially Considered

Not Considered

Explanation(s) provided for Residuals/Impurities?

Yes

No

All Substances Above the Threshold Indicated Are:

Characterized  Yes Ex/SC  Yes  No

% weight and rate provided for all substances.

Screened  Yes Ex/SC  Yes  No

All substances screened using Priority Hazard Lists with results disclosed.

Identified  Yes Ex/SC  Yes  No

All substances disclosed by Name (Specific or Generic) and Identifier.

Number of GreenScreen BM-4/EM3 contents ... 0

Contents highest concern GreenScreen Benchmark or List transferor Score ... LT-1

Nanomaterial ... No

INVENTORY AND SCREENING NOTES:

(%) ranges for ingredients are used as a means of keeping the exact formulations proprietary.

CONTENT IN DESCENDING ORDER OF QUANTITY

Summary of product contents and results from screening individual chemical substances against HPD Priority Hazard Lists and the GreenScreen for Safer Chemicals®. The HPD does not assess whether using or handling this product will expose individuals to its chemical substances or any health risk. Refer to Section 2 for further details.

MATERIAL | SUBSTANCE | RESIDUAL OR IMPURITY

GREENSCREEN SCORE | HAZARD TYPE

MARMOLEUM SHEET WITH TOPSHIELD2 | CELLULOSE PULP | UNK

CELLULOSE PULP (SC: WOOD FLOUR) | UNSLEED OIL | NOGS

CELLULOSE PULP (SC: WOOD FLOUR) | UNSLEED OIL | LT-P1 | RES | MUL

LIMESTONE; CALCIUM CARBONATE | UNSLEED OIL | LT-P1 | RES | MUL

SK1 CELLULOSE; MICROCRYSTALLINE (CELLULOSE)

SK1 CELLULOSE; MICROCRYSTALLINE (CELLULOSE) | SK1

MICROCRYSTALLINE (SC: JUTE) | NOGS GUM ROSIN | LT-P1 | SK1

POLYURETHANE FOAMS | LT-UNK | IRON OXIDE | LT-UNK | CAN FERRIC OXIDE YELLOW | LT-UNK | FERRIC OXIDE | CAN | CAN TITANIUM DIOXIDE

ETHYL 2-PROPENOATE AND METHYL 2-METHYL-2-PROPENOATE | LT-UNK

VOLATILE ORGANIC COMPOUND (VOC) CONTENT

VOC Content data is not applicable for this product category.

CERTIFICATIONS AND COMPLIANCE See Section 2 for additional listings.

VOC emissions: CDPH Standard Method V1.1 (Section 01350/CHPS) - Classroom & Office suitable

LCA: Environmental Product Declaration (EPO) by UL - Industry Generic

CONSISTENCY WITH OTHER PROGRAMS

Pre-checked for LEED v4 Material Ingredients, Option 1

HPD v2.1.1 created via HPDC Builder Page 1 of 10

Marmoleum Sheet with Topshield2  
hpdrepository.hpd-collaborative.org

**SE**

407 Byggevaredeklaration

1. GRUNDDATA

Dokumentdata

Id: A-736562019789-21

Version: 4

Upprättad: 2019-03-19 14:15:36

Senast spard: 2019-03-19 14:16:46

Ändringen avser:  Nytt dokument

Tillägg artiklar:  Ja  Nej

407 Byggevaredeklaration Moelven Interiörpanel målad/betsad

Varunamn: 407 Byggevaredeklaration Moelven Interiörpanel målad/betsad

Artikel-nr/ID-begrepp

Artikelidentitet: GTIN

7040431893652, 7040431893653, 7040431893650, 7040431893706, 7040431894901, 7040431917228, 7040431917235, 7040431917242, 7040431917259, 7040431917260, 7040431917280, 7040431917287, 7040431917303, 7040431917368, 7040431918005, 7040431920051, 7040431923823, 7040431923830, 7040431923847, 7040431925421, 7040431925438, 7040431925445, 7040431926053, 7040435000209, 7040435000380

Varugrupp/Varugruppsindelning

Varugruppsystem	Varugruppsid
BK04	03503
BSAB00	HSD.17

Varubeskrivning: Med en interiörpanel i massivt trä från Moelven kan du skapa värme och trivsel i dina rum. Panel i massivt trä är tålig och kan användas både i tak och i väggar.

Prestandadeklarationer: Ja  Nej

Prestandadeklarationsnummer: 150CPR 151CPR

Övriga upplysningar:

Moelven Wood AB

Företagsnamn: Moelven Wood AB

Organisationsnummer: 566201-9785

Adress: Box 8006

Kontaktperson: Bengt Persson

Uppgiftslämnaren är ensam ansvarig för uppgifter om produkter som registrerats i databasen. Uppgiftslämnaren och Bygghandelsindustrierna reserveras sig för korrekt information som har blivit felaktigt reviderad i databasen.

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**Declare.**

Your Product Your Company

Final Assembly: City, State, Country

Life Expectancy: 000 Years

End of Life Options: Recyclable (42%), Landfill (58%)

Ingredients:

Your First Component: Sustainably Sourced Ingredient (Location), Your Second Component: Living Building Challenge Red List, Proprietary Ingredient (0.07%), REACH or SIN List; Your Third Component: Non-Toxic Ingredient, [XXX-000] Declare Supplier Ingredient, EPA Chemical of Concern, Bio-Based Ingredient, Red List and SIN List

\*LBC Temp Exception I10-E4 Proprietary Ingredients <1%

Living Building Challenge Criteria:

XXX-0000

VOC Content: 0 g/L

Declaration Status

EXP. 01 JAN 2020

VOC Emissions: Compliant

LBC Red List Free

LBC Compliant

Declared

MANUFACTURER RESPONSIBLE FOR LABEL ACCURACY

INTERNATIONAL LIVING FUTURE INSTITUTE™ [declareproducts.com](http://declareproducts.com)

SVHC Free

Product Certification

Health Product Declaration [HPD](#)

Byggevaredeklaration [BVD](#)



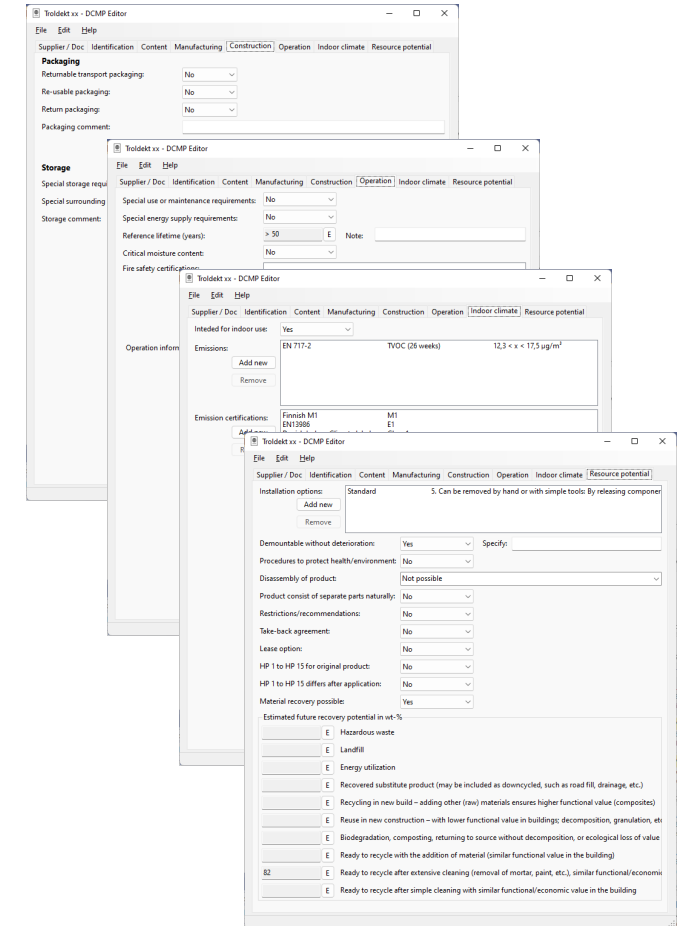
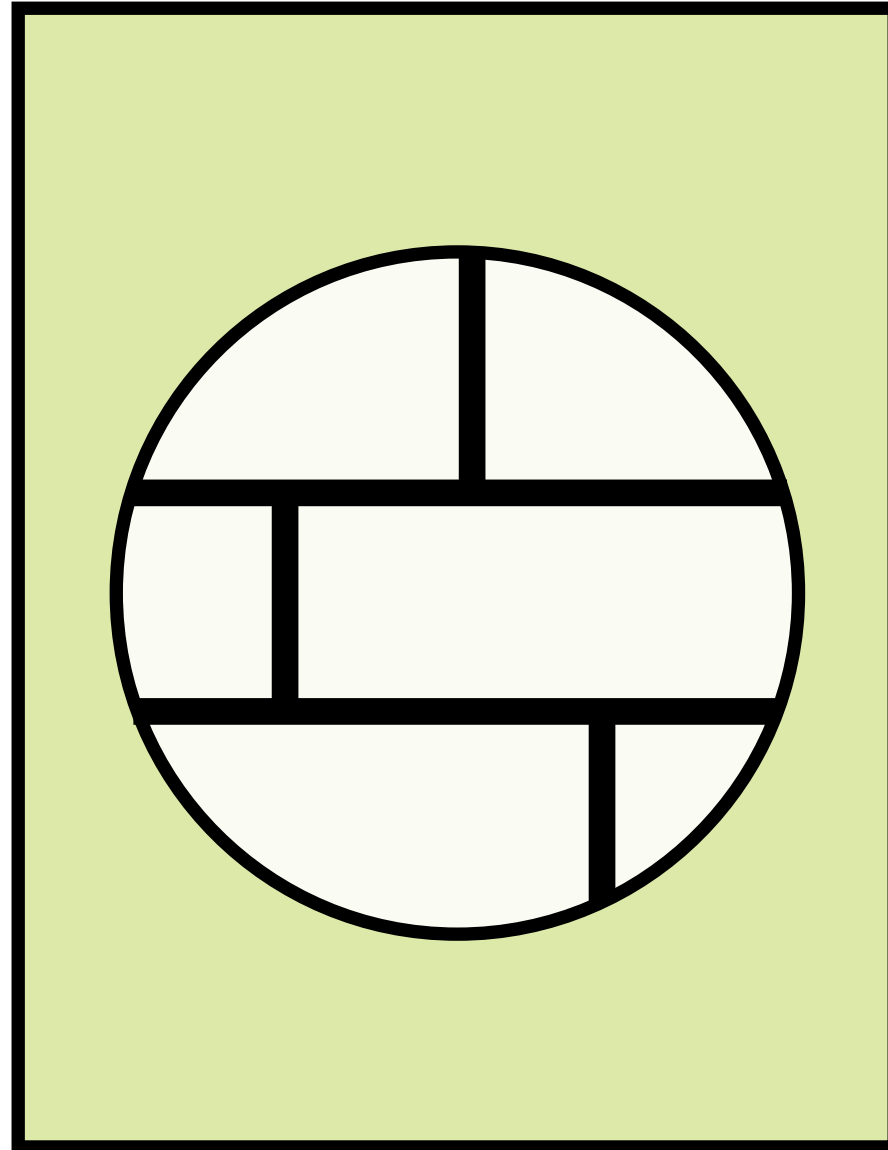
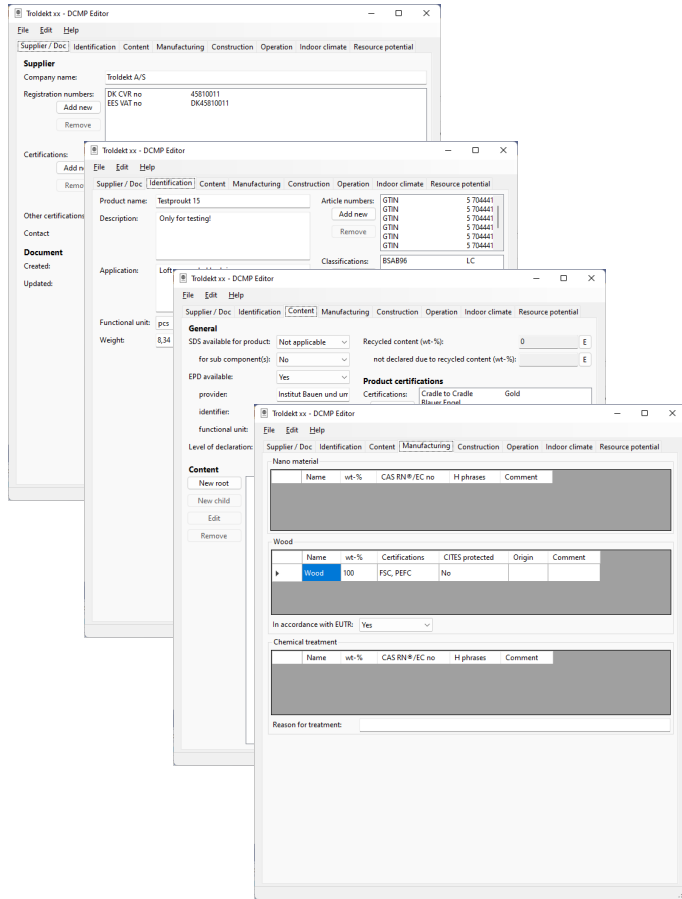
MANUFACTURER RESPONSIBLE FOR LABEL ACCURACY  
INTERNATIONAL LIVING FUTURE INSTITUTE™ [declareproducts.com](http://declareproducts.com)





**To minimize adverse impacts on human health and the environment, material declarations are necessary**

# Digital Construction Material Passport -tool launched Jan. 2023





[www.materialpass.org](http://www.materialpass.org)



Henning  
Larsen —

# Education: PFAS in building products



## PFAS "Forever Chemicals" in:

Roofing

Coatings

Flooring

Sealants and Adhesives

Glass

Fabrics

Wires and Cables

Tape

Timber-Derived Products

Solar Panels

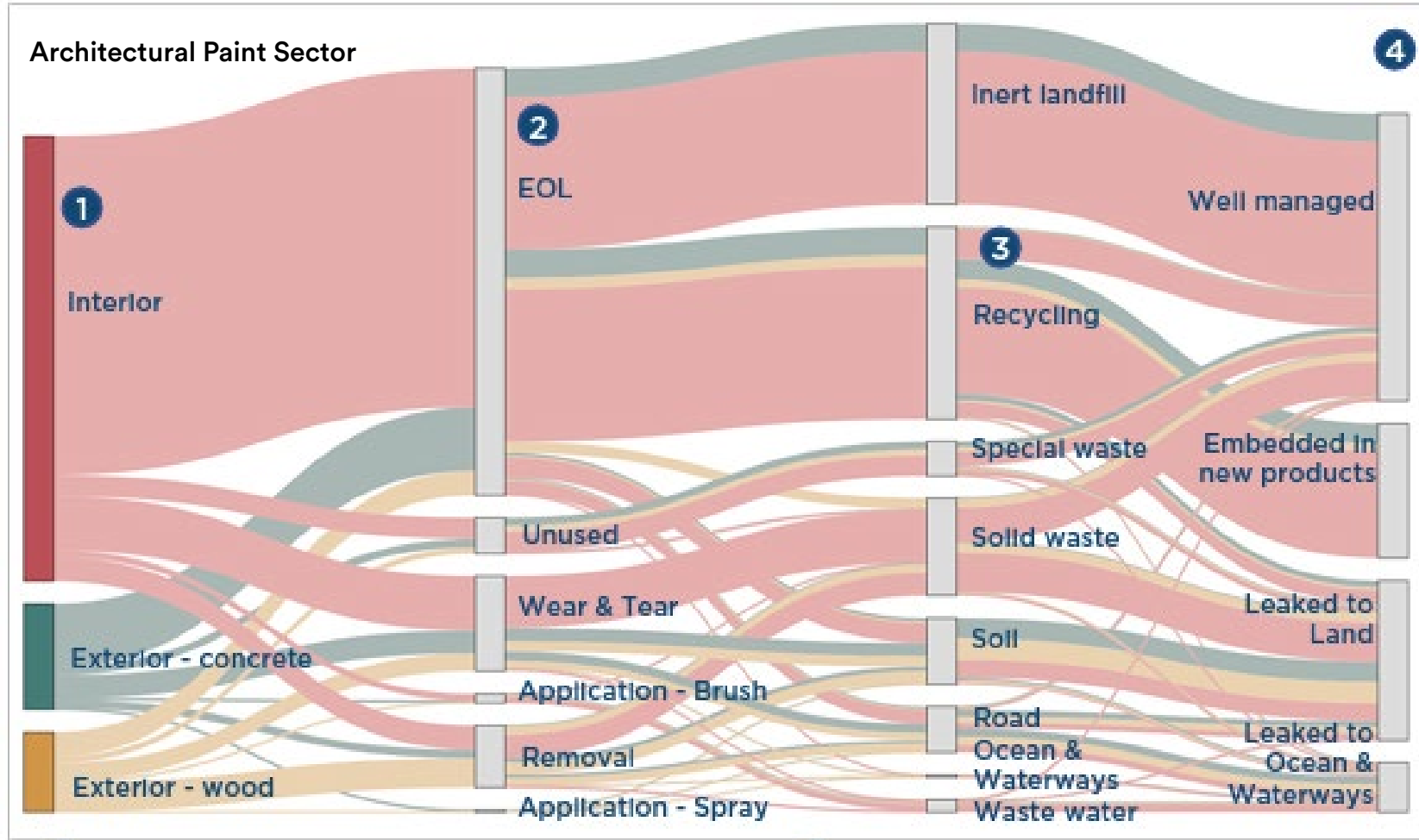
Artificial Turf

Seismic Damping Systems

Source:  
[Green Science Policy Institute, 2021](#)

# Education: Architectural paint - polymer based

Is 48% of global paint-related plastic pollution



3,573. kt leakage / year

Source:  
[Plastic Paints the Environment, Paruta et al., EAEnvironmental Action 2022](#)





# Reassess our material economy





# ... from mineral to biobased



Rammed earth photo credit: Dominique Gauzin-Müller <



Cork

Earth

Straw-bale

Reed

CLT

LTL Architects, Manual of Biogenic House Sections, 2022

Bamboo

Hemplime



# Reassess the triple bottom line:

