Nudura® Insulated Concrete Form System

ISO 14020; ISO 14025; ISO 14040; ISO 14044; EN 15804; EN 16908; ISO 21930:
Edition 1; Revision 2: Nov. 2022

1. PROGRAM INFORMATION

Program Operator	The International EPD® System EPD International AB Box 210 60 SE-100 31 Stockholm Sweden www.environdec.com info@environdec.com
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EPD Registration number	*S-P-07658*
Publication Date	*10/11/2022*
Version Date	*10/11/2022*
Valid Until	*09/11/2027*

Product group classification: UN CPC 38703
Product category rules (PCR): *CEN Standard EN 15804:2012+A2:2019*
PCR review was conducted by: The Technical Committee of the International EPD System.
Chair:
Massimo Marino. Contact via *info@environdec.com*
Independent third-party verification of the declaration and data, according to ISO 14025:2006:
☐ EPD process certification ☒ EPD verification
Third party verifier: Dr Hüdai Kara PhD
Approved by: The International EPD® System
Procedure for follow-up of data during EPD validity involves third party verifier:
☐ Yes ☒ No

The EPD owner has the sole ownership, liability, and responsibility for the EPD. EPDs within the same product category but from different programmes may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804.

EPDs within the same product category but registered in different EPD programmes, or not compliant with EN 15804, may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully-aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterisation factors); have equivalent content declarations; and be valid at the time of comparison. For further information about comparability, see EN 15804 and ISO 14025.

2. COMPANY INFORMATION

Tremco Canada, Division of RPM Canada (hereinafter referred to as Tremco) is a leading manufacturer and distributor of insulated concrete forms (ICFs) in North America. This cradle-to gate with end-of-life environmental product declaration is for 1 panel of ICF system, with a mass of 6.91 kg, from the location fully owned and operated by Tremco, as follows:

Nudura Plant
855 boul. Industriel, Granby, QC J2J 1A6

Tremco is the study commissioner and EPD owner.

6” standard form ICF is one of Nudura’s standard ICF systems. Further information is publicly available on https://www.nudura.com/products/nudura-icf-series/icf-products/

3. PRODUCT INFORMATION

This EPD provides information concerning 6” standard form ICF produced by Tremco in Canada as detailed in Table 1.

Insulated concrete form is a system of formwork for reinforced concrete made with rigid thermal insulation that stays in place as a permanent interior and exterior substrate for walls, floors, and roofs. Insulated concrete form products are dry stacked and filled with concrete for the building of walls.

Nudura ICFs provide design professionals, architects, homeowners and contractors the freedom and versatility to design and build a structure the way it was envisioned.
The Nudura wall-building system empowers you to build more energy-efficient, sustainable, and comfortable homes or structures than those built with more traditional materials like wood.

3.1 TECHNICAL SPECIFICATION OF PRODUCT

Aspect	Details
Usage	Nudura Integrated Building Technology ICFs are used as a stay-in-place permanent formwork for structural concrete, load-bearing and non-load bearing, below-grade and above-grade walls. The forms are used in construction of plain and reinforced concrete beams, lintels, exterior and interior walls, and foundation and retaining walls. The forms remain in place after placement and curing of concrete which is required by all Codes to be protected by approved interior and exterior finish material.
Identification	Nudura Insulated Concrete Forms consist of two uniform thickness panels of EPS foam plastic insulation material that are cross-linked in parallel with a combination of injection moulded polystyrene fastening strips fitted with polypropylene plastic insert webs and integrally moulded foldable polypropylene hinged web/fastening strips.
Technical and Functional Characteristics	As given by: ACI 318 - Building Code Requirements for Structural Concrete ASTM C578 -Standard Spec. for Rigid, Cellular Polystyrene Thermal Insulation ASTM D1761 -Mech. Fasteners in Wood ASTM E84 -Surface Burning Characteristics of Building Materials ASTM E-119 -Fire Testing of Building Construction and Materials NFPA 259 -Standard Test Method for Potential Heat of Building Materials NFPA 268 -Ignitibility of Exterior Wall Assemblies via Radiant Heat Energy Source NFPA 285 -Flammability Characteristics of Exterior Wall Assemblies Containing Components Using the Intermediate Scale Multi-Story Test Apparatus NFPA 286 -Evaluating Room Fire Growth Contribution of Wall and Ceiling Int. Finish,

Table 1: Technical specification and usage

3.2 CONTENT DECLARATION

Material	Contribution (%)
Expanded polystyrene (EPS)	43.9%
Recycled polypropylene	53.4%
Steel wire	2.7%
Colorant	0.05%

Table 2: 6" standard form ICF composition

The product composition for the products is provided in **Table 2**. The ICF system does not meet the criteria for PBT (Persistent, Bio-accumulative and Toxic) or vPvB (very Persistent and very Bio-accumulative) in accordance with Annex XIII of Regulation (EC) No. 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH). Furthermore, the ICF system is an article, and it is exempted from REACH registration.

3.3 MANUFACTURING PROCESS

The main steps in the ICF manufacturing process are as follows:

- Raw material reception and preparation
- Raw material expansion
- Moulding
- Insertion of plastic inserts

Raw material supply, storage, and preparation

Raw materials are supplied, received, and stored in dedicated storage facilities.

Raw material expansion

A boiler (natural gas) is used to produce steam to pre-expand the EPS parts from a bead charged with pentane (blowing agent).

These pre-expanded beads are placed in silos to release more pentane before last step of moulding.

Moulding

A boiler (natural gas) is used to produce steam to push the pre-expanded beads into the final form.

Plastic inserts production

Recycled plastic beads are melted and injected into a mould to produce the form needed.

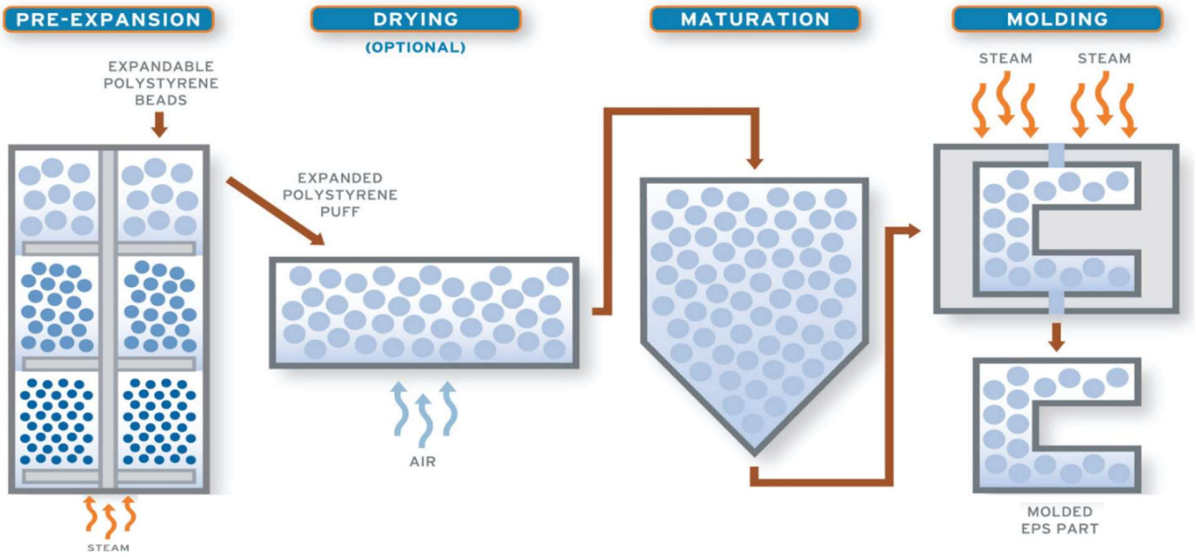

Figure 1: Process flow diagram

4. LCA INFORMATION

4.1 GOAL OF STUDY

The goal of this study was to generate an environmental profile of 6" standard form ICF produced and delivered from the locations fully owned and operated by Tremco, to better understand the associated lifecycle environmental impacts and to allow a Type III environmental declaration (this EPD) to be generated and made public via the International EPD System.

4.2 DECLARED UNIT

The **declared unit** for the study is defined as:

- 1 panel of ICF system, 6.91 kg

4.3 SYSTEM BOUNDARY

System boundaries determine the unit processes to be included in the LCA study and which data as "input" and/or "output" to/from the system can be omitted.

This EPD covers the cradle to gate stage (A1 to A3) plus end-of-life (C1-C4) and benefits and loads beyond the system boundary (D), because other life cycle stages are dependent on scenarios and are better developed for specific building or construction works.

System boundaries are according to the modular approach and the cradle to gate stage is divided into the upstream (A1), core (A2 and A3) and end-of-life phases, as outlined in Figure 2. Life cycle stage that are not covered by the EPD are indicated as MND (Module Not declared).

Life cycle stages	Information modules	Type of EPD			
		a) Cradle to gate with module C1-C4 and module D [1)]	b) Cradle to gate with module C1-C4, module D and optional modules [2)]	c) Cradle to grave and module D	f) Construction service EPD: Cradle to gate with modules A1-A5 and optional modules
A1-A3 Product stage	A1) Raw material supply	Mandatory	Mandatory	Mandatory	Mandatory
	A2) Transport				
	A3) Manufacturing				
A4-A5 Construction process stage	A4) Transport	—	Optional for goods Mandatory for services (see alternative f)	Mandatory	Mandatory
	A5) Construction installation		*Recommended if a default scenario can be defined*		
B Use stage	B1) Use	—	Optional	Mandatory	Optional
	B2) Maintenance				
	B3) Repair				
	B4) Replacement				
	B5) Refurbishment				
	B6) Operational energy use				
	B7) Operational water use				
C End of life stage	C1) Deconstruction, demolition	Mandatory	Mandatory	Mandatory	Optional
	C2) Transport				
	C3) Waste processing				
	C4) Disposal				
D Benefits and loads beyond the system boundary	D) Reuse, recovery, recycling, potential	Mandatory	Mandatory	Mandatory	—
Declared or functional unit		Declared unit	Declared unit	Functional unit	Declared unit
Inclusion of reference service life (RSL)		Optional	Mandatory if any module in B is included	Mandatory	—

Figure 2: Modules included in the ICF system LCA

4.4 DATA SCORES AND QUALITY

The geographical system boundary of the LCA is North American. All processes are valid for the production sites in Canada. The fifteen concrete plants account for 100% of total ICF system produced by Tremco in Canada.

All material flows of the processes are based on company and site-specific data gathered for one year of operation, for the period 1st January 2021 – 31st December 2021.

Modelling of the life cycle of Nudura ICF system was performed using SimaPro v.9.1 LCA software from PRé.

All relevant background datasets are taken from the EcoInvent database v3.8 (cut-off) released in 2021.

The foreground data has been collected on site and validated based on mass balances. The background data is based on reviewed data from life cycle inventories. As all datasets are validated, the data quality for the entire study can be judged as very good.

4.5 ALLOCATION

All allocation is performed according to the basic rules from EN15804:2012+A2:2019. As no co-products are produced, the flow of materials and energy, and the associated release of substances into the environment is therefore related exclusively to the ICF product produced.

4.6 CUT-OFF CRITERIA AND ASSUMPTIONS

In the process of building a life cycle inventory (LCI) it is typical to exclude items considered to have a negligible (aka relatively inconsequential or immaterial) contribution to results. To do this in a consistent and robust manner there must be confidence that the exclusion is fair and reasonable. To this end, cut-off criteria were defined in this study, which allow items to be neglected if they meet the criteria. In accordance with EN15804, exclusions could be made if they were expected to be within the below criteria and the total neglected input flows per module did not exceed 5% of energy usage and mass:

- **Mass**: when using mass as a cut-off criterion, it is appropriate to require the inclusion in the study of all inputs that cumulatively contribute more than a defined percentage to the mass input of the product system being modelled.

- **Energy**: similarly, an appropriate decision, when using energy as a criterion, is to require the inclusion in the study of those inputs that cumulatively contribute more than a defined percentage of the product system's energy inputs.

- **Environmental significance**: decisions on cut-off criteria should be made to include inputs that contribute more than an additional defined amount of the estimated quantity of individual data of the product system that are specially selected because of environmental relevance.

Specific exclusions for this study:

- The adhesive used for the paper label is excluded from the study as per the cut-off criteria (estimated to be <1% of mass, energy, and environmental significance).

In addition to exclusions based on cut-off criteria, the following general exclusions from the scope of the study were made as permissible by the PCR:

- Capital goods and infrastructure flows;
- Human activity and personnel-related activity such as travel furniture, office supplies, etc.; and
- Environmental impacts associated with support functions (e.g., R&D, marketing, finance, management etc.)

4.7 COMPARABILITY

EPDs within the same product category but from different programmes may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804.

5. ENVIRONMENTAL PERFORMANCE

Parameter	Unit	A1	A2	A3	C1	C2	C3	C4	D
Parameters describing environmental impacts for 1 panel ICF system									
GWP-total: Global Warming Potential total[1]	kg CO_2 eq.	14.2	2.31E-02	3.12	2.38E-02	3.37E-02	0.00	8.72E-03	-12.4
GWP – Fossil: Global Warming Potential fossil fuels	kg CO_2 eq.	14.0	2.31E-02	3.06	2.38E-02	3.36E-02	0.00	8.72E-03	-12.3
GWP-biogenic: Global Warming Potential biogenic	kg CO_2 eq.	0.190	6.10E-06	8.91E-03	6.78E-06	5.77E-05	0.00	4.5E-06	-0.127
GWP-luluc: Global Warming Potential land use and land use change[2]	kg CO_2 eq.	4.24E-03	2.96E-07	5.71E-02	5.87E-07	3.56E-06	0.00	2.97E-07	-1.09E-03
ODP: Depletion potential of the stratospheric ozone layer	kg CFC 11 eq.	2.90E-07	5.24E-09	3.15E-07	5.33E-09	7.7E-09	0.00	1.81E-09	-1.2E-07
AP: Acidification potential	mol H^+ eq.	4.96E-02	7.93E-05	6.41E-03	2.56E-04	1.40E-04	0.00	8.98E-05	-4.43E-02
EP-freshwater: Eutrophication potential, fraction of nutrients reaching freshwater end compartment (EP-freshwater)	kg P eq	2.96E-04	5.36E-08	1.00E-04	1.67E-08	1.69E-07	0.00	3.1E-08	-2.19E-04
EP-marine: Eutrophication potential, fraction of nutrients reaching marine end compartment	kg N eq.	8.28E-03	2.46E-05	3.06E-03	1.15E-04	4.75E-05	0.00	3.90E-05	-6.67E-03
EP-terrestrial: Eutrophication potential, Accumulated Exceedance	mol N eq.	8.82E-02	2.71E-04	1.58E-02	1.26E-03	5.23E-04	0.00	4.28E-04	-7.19E-02
POCP: Formation potential of tropospheric ozone	kg NMVOC eq.	4.31E-02	7.39E-05	0.151	3.45E-04	1.41E-04	0.00	1.19E-04	-3.85E-02
ADP – minerals & metals: Abiotic depletion potential for non-fossil resources [3] [4]	kg Sb eq.	9.46E-06	1.89E-09	3.57E-07	1.23E-09	1.47E-09	0.00	4.2E-10	-4.7E-07

[1] The total global warming potential (GWP-total) is the sum of
— GWP-fossil
— GWP-biogenic
— GWP-luluc

[2] It is permitted to omit GWP-luluc as separate information if its contribution is < 5 % of GWP-total over the declared modules excluding module D.

[3] The abiotic depletion potential is calculated and declared in two different indicators:
— ADP-minerals & metals include all non-renewable, abiotic material resources (i.e., excepting fossil resources);
— ADP-fossil include all fossil resources and includes uranium.

[4] ultimate reserve model of the ADP-minerals & metals model

Parameter	Unit	A1	A2	A3	C1	C2	C3	C4	D
ADP-fossil: Abiotic depletion for fossil resources potential [3]	MJ, net calorific value	280	0.319	56.6	0.329	0.486	0.00	0.116	-284
WDP: Water (user) deprivation potential, deprivation-weighted water consumption	m^3 world eq. deprived	9.76	1.25E-04	-1.12	8.48E-05	2.48E-04	0.00	4.69E-05	-9.55
Parameters describing use of resources for 1 panel ICF system									
PERE: Renewable primary energy used as energy carrier (fuel)	MJ	3.07	4.13E-04	20.3	5.33E-04	5.90E-03	0.00	4.87E-04	-1.34
PERM: Renewable primary resources with energy content used as material	MJ	0.114	7.84E-05	0.933	9.12E-05	6.70E-04	0.00	1.90E-04	9.69E-03
PERT: Total renewable primary resources	MJ	3.19	4.91E-04	21.2	6.24E-04	6.57E-03	0.00	6.76E-04	-1.33
PENRE: Non-renewable primary resources used as an energy carrier (fuel)	MJ	286	0.308	58.3	0.314	0.468	0.00	0.114	-283
PENRM: Non-renewable primary resources with energy content used as material	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PENRT: Total non-renewable primary resources	MJ	286	0.308	58.3	0.314	0.468	0.00	0.114	-283
SM: Secondary materials	kg	3.68	0.00	0.00	0.00	0.00	0.00	0.00	3.68
RSF: Renewable secondary fuels	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NRSF: Non-renewable secondary fuels	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FW: Use of net fresh water resources	m^3	0.226	5.88E-06	-6.45E-02	4.52E-06	2.37E-05	0.00	1.53E-06	-0.222
Parameters describing waste production for 1 panel ICF system									
HWD: Hazardous waste disposed	kg	1.78E-04	3.08E-06	9.56E-05	3.22E-06	4.69E-06	0.00	1.09E-06	1.13E-05
NHWD: Non-hazardous waste disposed	kg	0.345	9.11E-05	4.41E-02	2.45E-05	7.05E-05	0.00	3.45	3.08E-03
RWD: Radioactive waste disposal	kg	8.19E-05	2.23E-06	3.37E-05	2.36E-06	3.48E-06	0.00	8.01E-07	6.78E-06
Parameters describing outputs flows for 1 panel ICF system									
CRU: Components for reuse	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Parameter	Unit	A1	A2	A3	C1	C2	C3	C4	D
MR: Material for recycling	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MER: Materials for energy recovery	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EEE: Exported energy, electrical	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EET: Exported energy, thermal	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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