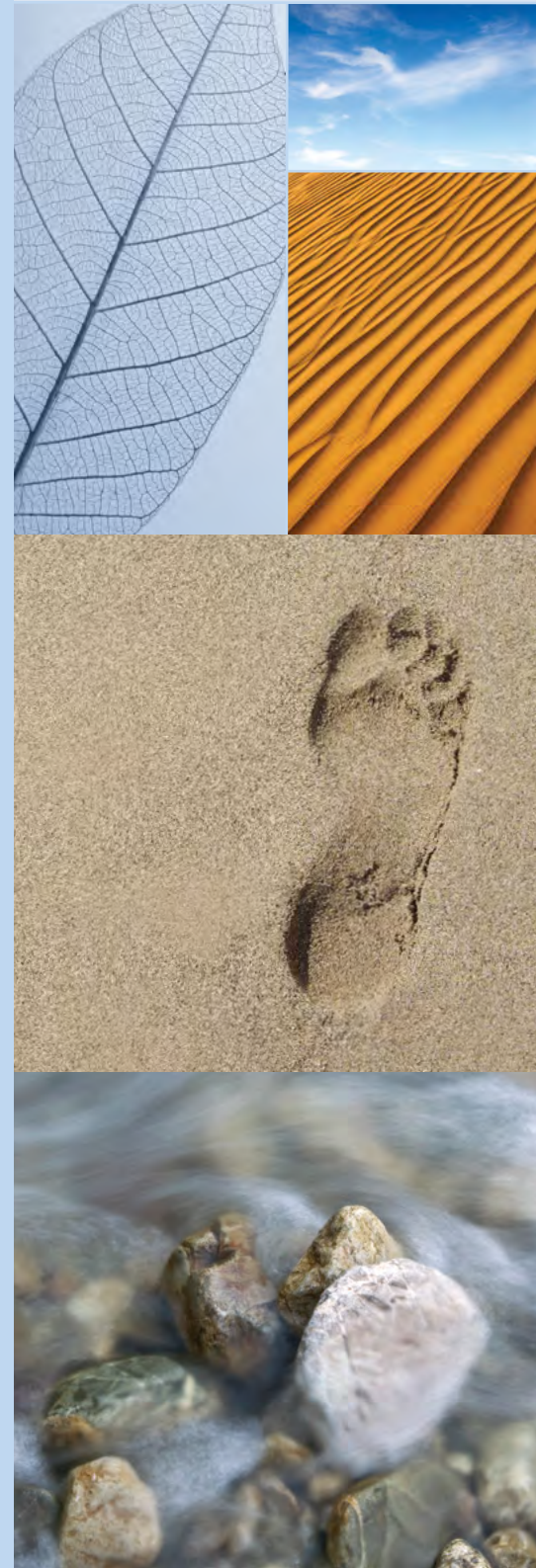




# Guide to EPDs for Ceramic Tile, Mortar, and Grout Made in North America

2019



# Total Transparency

The EPDs for North American-made Ceramic Tile, Mortar and Grout report the environmental footprints of North American-made ceramic tile, mortar and grout across all major impact categories within a 60-year building service life. Specify ceramic tile, mortar and grout covered by the EPDs to fulfill requirements of leading green building programs.



These EPDs are initiatives of the Tile Council of North America and participating members. Data analysis and modeling were performed by Thinkstep. Third-party certification by UL Environment ensures conformance to ISO standards for EPDs and LCAs.



Download EPDs at  
[www.TCNAtile.com](http://www.TCNAtile.com)

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# TOTAL TRANSPARENCY

## EPDs FOR NORTH AMERICAN-MADE CERAMIC TILE, MORTAR, AND GROUT

The environmental product declarations (EPDs) for North American-made ceramic tile, mortar, and grout provide a comprehensive overview of how these products impact the environment. The combination of the three provides environmental impact data, per square meter, of the main materials used to set tile.

The EPDs address the most important environmental considerations affecting the well-being of the planet and those who call it home—specifically, global warming, abiotic resource depletion, acidification, smog formation, eutrophication, and ozone depletion.

And, because EPDs and product environmental transparency are increasingly required in green construction standards and rating systems, specifying ceramic tiles, mortars, and grouts covered by the

EPDs can help achieve green building points and meet transparency requirements. In fact, as most green building standards, codes and rating systems provide incremental credit for the use of each product covered by an EPD, using tile in a project, with the accompanying mortar and grout, means that a single tile installation using materials covered by North American EPDs could potentially contribute “three times (3X).”

### The Credibility Process

When selecting construction materials, it's important to know decisions are supported by reliable, life cycle-based sustainability information. For the North American-made Ceramic Tile, Mortar, and Grout EPDs, the life-cycle assessments were independently performed by Thinkstep per the ISO standard 14040/44, *LCA*



*Principles, Framework, Requirements, and Guidelines.* Additionally, UL Environment, as Program Operator, verified the validity of the LCAs and certified the requirements of ISO 14025, *Principles and Procedures for EPDs*, were met. Conformance to these standards, plus certification of the EPDs by a globally recognized sustainability leader, ensures the EPDs are accurate, not unsubstantiated marketing claims or other attempts at “green washing.”

To produce the EPDs, the participating manufacturers provided extensive data on their materials and operations and participated in a cradle-to-grave evaluation of their products, from raw material sourcing/extraction, through manufacturing, delivery, installation, use, and end of life.

For each EPD, the specific environmental impacts measured, and the methodology for measuring those, are dictated by a Product Category Rule (PCR). For the tile EPD, the North American PCR for flooring EPDs was followed. Using product category rules developed for all flooring allows tile covered by the EPD to be compared to other flooring products evaluated under the same PCR.

For the mortar and grout EPDs, international PCRs for factory-made mortar were adapted for North American usage per an addendum published by UL Environment. This allowed the North American PCR to build on criteria that was previously used in the development of EPDs for other types of cementitious construction products. This provides valuable references when analyzing and interpreting EPDs in a global context.

The standardized reporting of tile, mortar and grout required by the PCRs additionally provides transparency and prevents green washing, as all parameters and



#### **DATA COLLECTION**

North American ceramic tile, mortar and grout manufacturers submit extensive data on their materials and operations, covering everything from raw material sourcing and extraction through end of life.



#### **DATA ANALYSIS AND LIFE-CYCLE ASSESSMENT (LCA)**

Sustainability leader Thinkstep analyzes the data to determine the environmental impacts and life cycle assessments of North American-made ceramic tile, mortar and grout.



#### **REVIEW OF DRAFT REPORT**

Sustainability leader UL Environment independently evaluates and certifies that PCRs were followed, as well as ISO 14025 and ISO 14040/44 standards for EPDs and LCAs.



#### **EXTERNAL VERIFICATION**

A panel of independent stakeholders verifies conformance to standards, applicability of the PCR, and that the information presented is accurate, not unsubstantiated marketing claims or other attempts at green washing.



#### **EPD CERTIFICATION AND REGISTRATION**

UL Environment certifies the EPDs and registers them in its online Sustainable Product Database, a publicly available resource for authentic and credible environmental product information.

# TOTAL TRANSPARENCY

## EPDs FOR NORTH AMERICAN-MADE CERAMIC TILE, MORTAR, AND GROUT

impacts in the PCR must be reported, not just those areas in which a product performs well.

### Products Covered by the EPDs

Because the EPDs are based on aggregated data from all participating manufacturers, they are “generic” or “non-proprietary” EPDs. As most major North American tile industry manufacturers participated, over 95% of North American-made products are covered: 2.5 billion square feet of tile and 2.25 billion kilograms of mortar and grout.

To find out if a specific product line is covered by a certified EPD, contact the participating manufacturers.

### Participating Tile Manufacturers

Arto  
Crossville  
Dal-Tile Corporation  
Florida Tile  
Florim USA  
Interceramic  
Ironrock  
Porcelanite Lamosa  
Quarry Tile Company  
StonePeak Ceramics  
Vitromex de Norteamérica

### Participating Grout and Mortar Manufacturers

Ardex  
Bexel  
Bostik  
Cemix/Texrite  
Crest  
Custom Building Products  
HB Fuller/Tec  
Interceramic  
Laticrete  
Mapei

The EPDs were initiated by Tile Council of North America (TCNA) and its participating members, with data analysis and modeling by Thinkstep and third-party, independent certification by UL Environment.



thinkstep



Environment



Download the EPDs at [TCNAtile.com](https://www.tcnatile.com)

*Just as nutrition labels inform the calorie conscious on food choices, an EPD informs with respect to sustainability. When using the North American-made Tile EPD alongside other flooring products' generic EPDs, one thing is clear: Ceramic tile has the lowest 60-year environmental impact per square foot (and per square meter) across all major impact categories. Similarly, the industry-wide EPDs for North American-made mortar and grout report very low 60-year environmental impacts per installed square meter.*

### Environmental Facts

Functional unit: 1 m<sup>2</sup> of Ceramic Tile Floor Covering  
Reference Service Life (RSL): 60 Years

60 YEAR IMPACT ASSESSMENT	Total
Primary Energy, Renewable (MJ)	10.4
Primary Energy, Non-Renewable (MJ)	225
Secondary Energy, Renewable (MJ)	0.15
Secondary Energy, Non-Renewable (MJ)	1.4
Global Warming Potential (kg CO <sub>2</sub> eq)	15
Acidification Potential (kg SO <sub>2</sub> eq)	0.0565
Ozone Depletion Potential (kg R11 eq)	8.11E-10
Smog Potential (kg Ethene eq)	0.0052
Eutrophication Potential (kg Phosphate eq)	0.00604
Abiotic Depletion Potential - Elemental (kg Sb eq)	1.22E-05
Abiotic Depletion Potential - Fossil (MJ)	219

### OTHER INFORMATION

Zero VOCs

Boundaries Cradle to Grave

Recycled Content Varies

Green Squared® Certification\* Some Tiles

Ceramic Tile Ingredients: Clay (70.3%), Quartz (4.8%), Feldspar (5.3%), Scrap (4.2%), Kaolin (3.2%), Granite (1.3%), Lime (1.1%), Glaze and Stain (5.4%), Other Minerals (4.0%)

Visit [www.TCNAtile.com](http://www.TCNAtile.com) for further information.

### Environmental Facts

Functional Unit: 1 m<sup>2</sup> of Installed Grout  
(Application Rate, 0.212 kg/m<sup>2</sup>)

Reference Service Life (RSL): 60 Years

60 YEAR IMPACT ASSESSMENT	Total
Primary Energy, Renewable (MJ)	0.221
Primary Energy, Non-Renewable (MJ)	2.2
Global Warming Potential (kg CO <sub>2</sub> eq)	0.203
Acidification Potential (kg SO <sub>2</sub> eq)	0.000766
Ozone Depletion Potential (kg R11 eq)	2.94E-10
Smog Potential (kg Ethene eq)	6.11E-05
Eutrophication Potential (kg Phosphate eq)	9.46E-05
Abiotic Depletion Potential-Elemental (kg Sb eq)	2.34E-07
Abiotic Depletion Potential-Fossil (MJ)	2.1

### OTHER INFORMATION

VOC Emissions-CDPH Section 01350 Meets

Recycled Content Varies

Green Squared® Certification Some Grout

ANSI A118.6, ANSI A118.7 Meets

Tile Grout Ingredients: Sand, White Cement, Limestone, Grey Cement, Calcium Aluminate, Calcium Formate, Other Additives

Visit [www.TCNAtile.com](http://www.TCNAtile.com) for further information.

### Environmental Facts

Functional Unit: 1 m<sup>2</sup> of Installed Tile Mortar  
(Application Rate, 4.07 kg/m<sup>2</sup>)

Reference Service Life (RSL): 60 Years

60 YEAR IMPACT ASSESSMENT	Total
Primary Energy, Renewable (MJ)	2.1
Primary Energy, Non-Renewable (MJ)	32.3
Global Warming Potential (kg CO <sub>2</sub> eq)	2.88
Acidification Potential (kg SO <sub>2</sub> eq)	0.0115
Ozone Depletion Potential (kg R11 eq)	4.43E-09
Smog Potential (kg Ethene eq)	0.000951
Eutrophication Potential (kg Phosphate eq)	0.00121
Abiotic Depletion Potential-Elemental (kg Sb eq)	3.51E-06
Abiotic Depletion Potential-Fossil (MJ)	30.9

### OTHER INFORMATION

VOC Emissions-CDPH Section 01350 Meets

Recycled Content Varies

Green Squared® Certification Some Mortar

ANSI A118.1, ANSI A118.4, ANSI A118.11, ANSI A118.15, ISO 13007 Meets

Tile Mortar Ingredients: Sand, Calcium Carbonate, Grey Cement, White Cement, Ethylene Vinyl Acetate, Admixture, Cellulose Ether, Other Additives

Visit [www.TCNAtile.com](http://www.TCNAtile.com) for further information.

# CREDITS AND COMPLIANCE

## NORTH AMERICAN-MADE CERAMIC TILE, MORTAR, AND GROUT

### LEED v4

Under the credit category Building Product Disclosure and Optimization–Environmental Product Declarations, up to 2 points toward LEED certification can be earned by using products with EPDs, such as North American-made ceramic tile, mortar and grout.

#### Option 1 (1 Point) Environmental Product Declaration

AND/OR

#### Option 2 (1 Point) Multi-Attribute Optimization

One point can be earned for using at least 20 different permanently installed “products,” which are construction materials that meet one of the specified disclosure criteria and are therefore eligible for the valuation associated with that disclosure criteria. Valuations for such materials are awarded on a per-material basis, and this LEED point is earned by using enough materials that their combined valuations total at least 20 “products.”

Disclosure Criteria	Valuation
Proprietary LCA	¼ product
Generic EPD	½ product
Proprietary EPD	1 product

Materials that meet multiple criteria are eligible only for the highest valuation available; the valuations cannot be combined. Also, materials must be sourced from at least five different manufacturers.

**EPD** Products covered by the North American-made Ceramic Tile, Mortar, and Grout EPDs can each contribute at least ½ product toward the 20-product requirement. For example, for a project with 8 different tiles installed with the same mortar but different grouts (all covered by EPDs), the 17 tiles and related installation materials would contribute 8.5 “products” toward the 20-product requirement (Example A). In the same scenario, if the mortar, grout, and 1 of the 8 tiles also have a proprietary EPD, the same 17 tiles and related materials would contribute 13.5 “products” (Example B).

#### Example A

$$(8 \text{ tiles} + 1 \text{ mortar} + 8 \text{ grouts}) \times .5 \text{ products} = 8.5$$

#### Example B

$$(1 \text{ tile} \times 1 \text{ product}) + (1 \text{ mortar} \times 1 \text{ product}) + (8 \text{ grout} \times 1 \text{ product}) + (7 \text{ tiles} \times .5 \text{ products}) = 13.5$$

One point can be earned by using products with below-industry-average impacts, when those products comprise at least 50% of the total value of permanently installed products in the project and their environmental impacts are lower in at least 3 of the applicable impact categories: global warming potential, ozone depletion potential, acidification potential, eutrophication potential, photochemical oxidant creation potential, and fossil abiotic depletion potential.

**EPD** For this LEED point, only tiles, mortars, or grouts included in generic EPDs that also have one or more proprietary EPDs showing below-industry-average impacts can contribute to meeting the 50% value threshold.

Sample calculation for a project with \$1,000,000 in permanently installed products, including \$100,000 of ceramic tiles, mortar or grout that has lower-than-industry-average environmental impacts in at least 3 categories.

$$\frac{\$100\text{K (tile, mortar, grout value)}}{\$1\text{M (all materials value)}} = 10\%$$

In the example above, the contribution of the tile and related installation materials toward the 50% minimum would be 10% points (20% of the requirement).



## Green Globes

Under the provisions of Section 3.5.1.2, *Path B: Prescriptive Path for Building Core and Shell* and Section 3.5.2.2, *Path B: Prescriptive Path for Interior Fit-Outs*, using North American-made ceramic tiles, mortars, and/or grouts can contribute toward the 30 available points for using products with EPDs. Points are awarded for using products with:

EPDs:  
Generic or Proprietary      AND/OR      Third-Party Verified  
Proprietary Life-Cycle Assessment      AND/OR      Third-Party Certification  
to Multiple Attribute  
Standards

Points are awarded based on the percentage of product used (based on cost) and on where it is used. Products with EPDs are valued the same, regardless of whether their EPDs are generic or proprietary; both contribute equally toward the value percentage.

	Percentage of Products	Points
Section 3.5.1.2: Core and Shell	≥ 40%	20
	25% – 39%	15
	10% – 24%	10
Section 3.5.2.2: Interior Fit-Outs	≥ 40%	10
	25% – 39%	7
	10% – 24%	5



Without limit, using North American-made ceramic tiles, mortars, and grouts covered by EPDs will contribute to this requirement, in direct proportion to the products' value. Products that are also Green Squared Certified will earn double points for also meeting the requirement for products with third-party certifications based on multiple attribute standards.

Sample calculation for a project with \$1,000,000 in interior fit-out materials including \$150,000 in tiles, mortars, and/or grouts covered by the EPD:

$$\frac{\$150\text{K (tile, mortar, grout value, EPD)}}{\$1\text{M (value, all interior fit-out materials)}} = 15\% \quad (5 \text{ points})$$

Sample calculation for the same project, but with tile, mortar and grout that is covered by the EPD and Green Squared Certified:

$$\begin{aligned} &\$150\text{K (tile, mortar, grout value, EPD)} \\ &+ \$150\text{K (tile, mortar, grout value, Green Squared Certified)} \\ &\hline &\$300\text{K} \end{aligned}$$

$$\frac{\$300\text{K (tile, mortar, grout value)}}{\$1\text{M (value, all interior fit-out materials)}} = 30\% \quad (7 \text{ points})$$

# CREDITS AND COMPLIANCE

## NORTH AMERICAN-MADE CERAMIC TILE, MORTAR, AND GROUT

### NAHB National Green Building Standard

NAHB National Green Building Standard is commonly referred to as ICC 700. North American-made ceramic tile can help achieve points under Section 611.4, Product Declarations, in this ANSI-approved standard and rating system for residential construction. In this section of the standard, 5 points are awarded if EPDs are submitted for 10 different products installed in the building project. Each building material with an industry-wide EPD contributes a full ‘product’ toward the 10-product goal. Each building material with a product-specific EPD contributes two ‘products’ toward the 10-product goal.

Additionally, up to 10 points can be awarded under Section 610, Life Cycle Analysis, for using products with lower environmental impacts, compared to products intended for the same use. To garner points under Section 610, the selected product must improve upon multiple environmental impacts by an average of 15%, with the number of points awarded tied to the number of impact categories in which the selected product performs better.

Number of Impact Categories	Points
4	2
5	3

#### Applicable Impact Categories:

- Fossil fuel consumption
- Global warming potential
- Acidification potential
- Eutrophication potential
- Ozone depletion potential

The standard requires that the LCA tool used to determine the environmental impacts must be based on a reference service life of 60 years. It allows comparisons to be made between different types of products with the same use. It also allows comparison of individual product impacts to the industry averages for the same product type.

Each tiling product covered by the North American-made tile, mortar and/or grout EPDs contributes a full product toward the 10-product threshold specified by



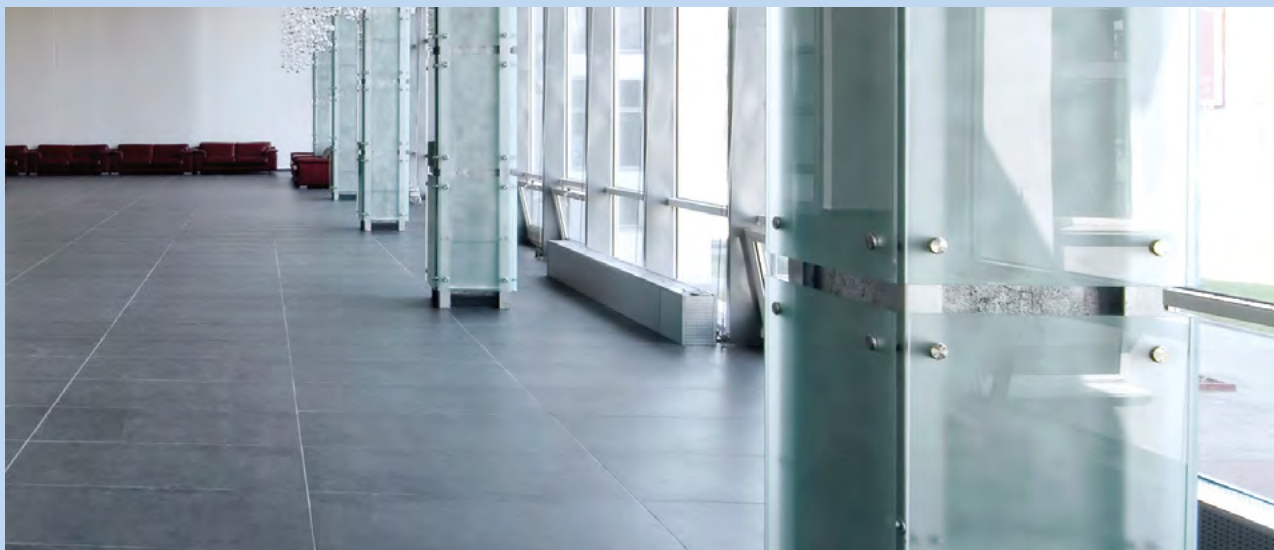
Section 611.4 of this standard. Those which have product-specific EPDs count double, expanding opportunities for garnering the previously discussed 5 points and creating the possibility of satisfying the 10-product requirement solely with tile installations alone!

**EPD** Furthermore, the North American-made Ceramic Tile, Mortar, and Grout EPDs report environmental impacts over 60 years, as analyzed by GaBi LCA software, according to the requirements of the standard.

When choosing between tile and an alternate flooring material, using ceramic tile covered by the EPD is advantageous when building to this standard, because the EPD shows very low environmental impacts in all categories. In fact, tile covered by the EPD has the lowest impact in all six impact categories, as compared to the impacts reported for other common flooring options in their publicly available, generic EPDs. Refer to the 60-year impact analysis graphs included in this guide for details.

When choosing between specific tiles, mortars, and/or grouts, products covered by generic EPDs will additionally contribute when such products also have proprietary EPDs showing impacts that are on average 15% lower, as compared to the industry average reported in the generic EPD, in at least 4 categories.

Additionally, products that are Green Squared Certified® can also contribute points as detailed elsewhere in the NABH Green Building Standard. Refer to the Tile and Green Building chart in *Tile: The Natural Choice* for details.



## International Green Construction Code (IgCC) Powered by ASHRAE Standard 189.1

About IgCC: An initiative of the International Code Council (ICC). IgCC was developed as model code language for states and municipalities to establish baseline sustainability requirements for new and existing commercial buildings.

About ASHRAE 189.1: An ANSI-approved standard, ASHRAE 189.1 was designed to be incorporated into governing jurisdictions' codes and ordinances for commercial buildings and enforced by building officials and inspectors.

**IgCC and ASHRAE Standard 189.1 are now integrated into a single model code and standard for high-performance buildings.**

In IgCC Section 901.4.1.4 (ASHRAE 189.1 Section 9.4.1.4.2), *Multiple-Attribute Product Declaration or Certification*, at least 10 different products installed in the building by the time occupancy is allowed shall have a generic EPD, have a proprietary EPD, conform to a third-party multi-attribute certification, or have a third-party reviewed life cycle assessment (LCA).



Each tiling product used, if covered by one or more of the North American made Ceramic Tile, Mortar, and/or Grout EPDs, counts as one product toward the ten-product threshold.

# CREDITS AND COMPLIANCE

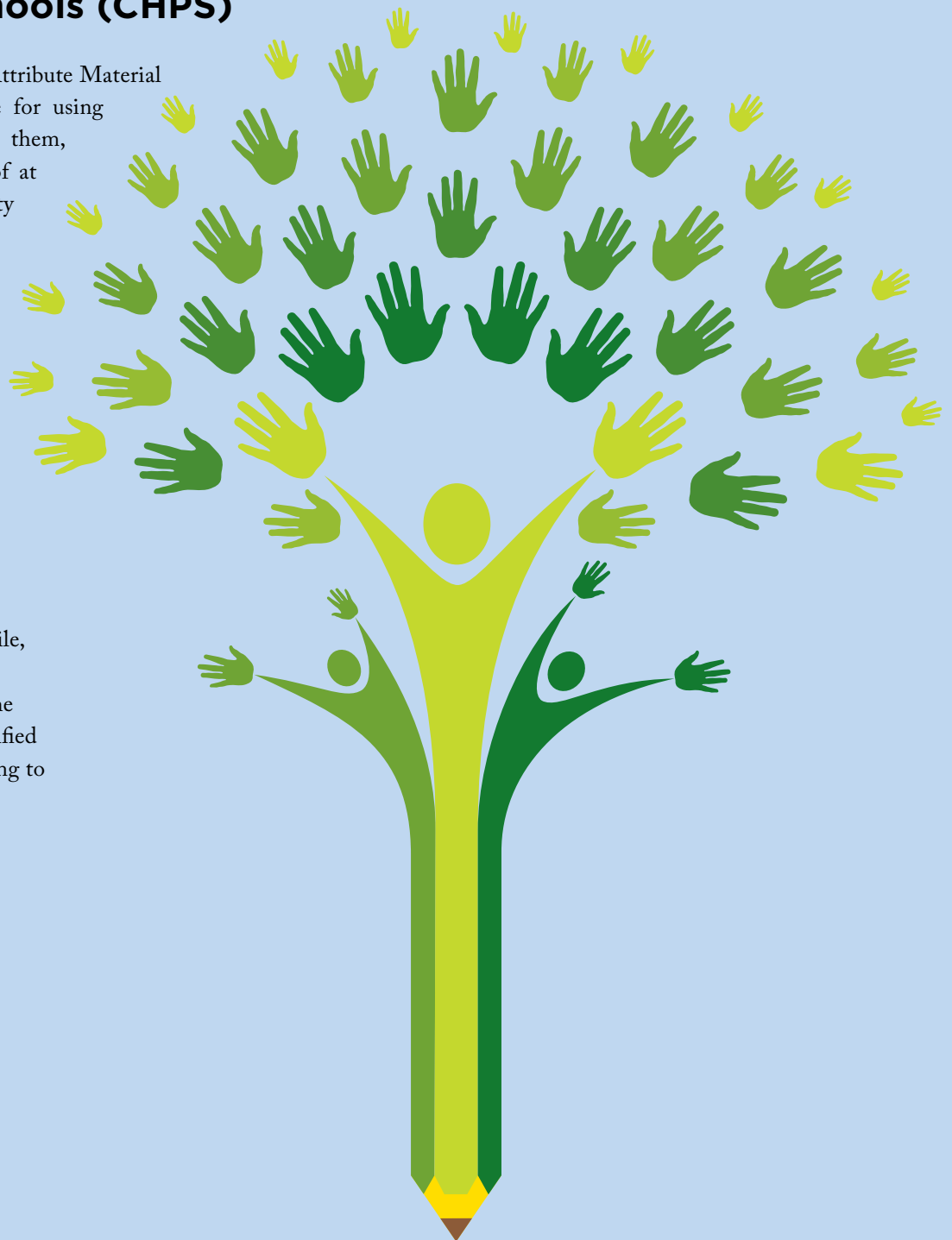
## NORTH AMERICAN-MADE CERAMIC TILE, MORTAR, AND GROUT

### Collaborative for High Performance Schools (CHPS)

Under Section MW 7.1, Multi-Attribute Material Selection, 3 points are available for using products with EPDs. To earn them, the standard requires selection of at least 10 products with third party certified EPDs conforming to ISO 14025 and/or ISO 21930. Products are valued the same, whether their EPDs are generic or proprietary.

#### EPD

North American-made ceramic tile, mortar and grout can contribute toward earning these points, as the EPDs have been third-party certified by UL Environment as conforming to ISO standards for EPDs.





## CALGreen

This standard is part of the California Building Standards Code and is commonly adopted as model language by developers of green building standards and rating systems in other parts of the country.

Section A5.409.3 for Non-Residential Construction requires at least 50% use of materials or assemblies based on life-cycle assessment (LCA) of their global warming potential (climate change/greenhouse gases) and two more environmental impacts from the list below:

- Fossil fuel depletion
- Stratospheric ozone depletion
- Acidification of land and water resources
- Eutrophication
- Photochemical oxidants (smog)



Tiling products covered by the North American-made Ceramic Tile, Mortar and/or Grout EPDs are eligible for consideration under this section of CALGreen, as the EPDs provides LCA data and address the referenced environmental impacts.

## GSA P-100 Facilities Standards

This standard incorporates sustainability criteria into design standards for the construction of government-funded buildings. Section 3.4 (Interior Performance) sets forth several provisions for ceramic tile:

The “Baseline” and Tier 1 High Performance provisions specify that tiles conform to ANSI A137.1, the ANSI standard for ceramic tile, and be Green Squared Certified.®

The Tier 2 High Performance and Tier 3 High Performance provisions specify that tiles conform to ANSI A137.1, the ANSI standard for ceramic tile, be Green Squared Certified,® and have a publicly-available EPD.



Tiles covered by the North American-made Ceramic Tile EPD are eligible for use on Tier 2 and Tier 3 federal building projects, provided they are also Green Squared Certified® and meet the tile performance standards given in ANSI A137.1.

\*Note: At the time of this publication, there are no GSA P-100 provisions for tile mortar or tile grout.





# ENVIRONMENTAL FOOTPRINT: TILE, MORTAR AND GROUT A 60-YEAR IMPACT ANALYSIS

Today, North American construction products are increasingly being evaluated based on their 60-year environmental footprint, a time frame chosen for the average service life of a building. Accordingly, the EPDs for North American-made Ceramic Tile, Mortar, and Grout provide long-term environmental impact data. In fact, the flooring Product Category Rule (PCR) requires EPDs to provide a life-cycle assessment (LCA) with a 60-year impact analysis. This appropriately includes the environmental impacts associated with acquiring a product's raw materials, manufacturing the product, and then delivering, installing, maintaining, and disposing of it, multiplied by the theoretical number of times the product would wear out and would have to be reinstalled (i.e. 60 years divided by the product's service life, in years).

In all six of the major environmental impact assessment categories, as included in the EPD for North American-made Ceramic Tile, Mortar, and Grout, the environmental benefits resulting from tile's inherent durability, long life, and low maintenance are clearly realized.

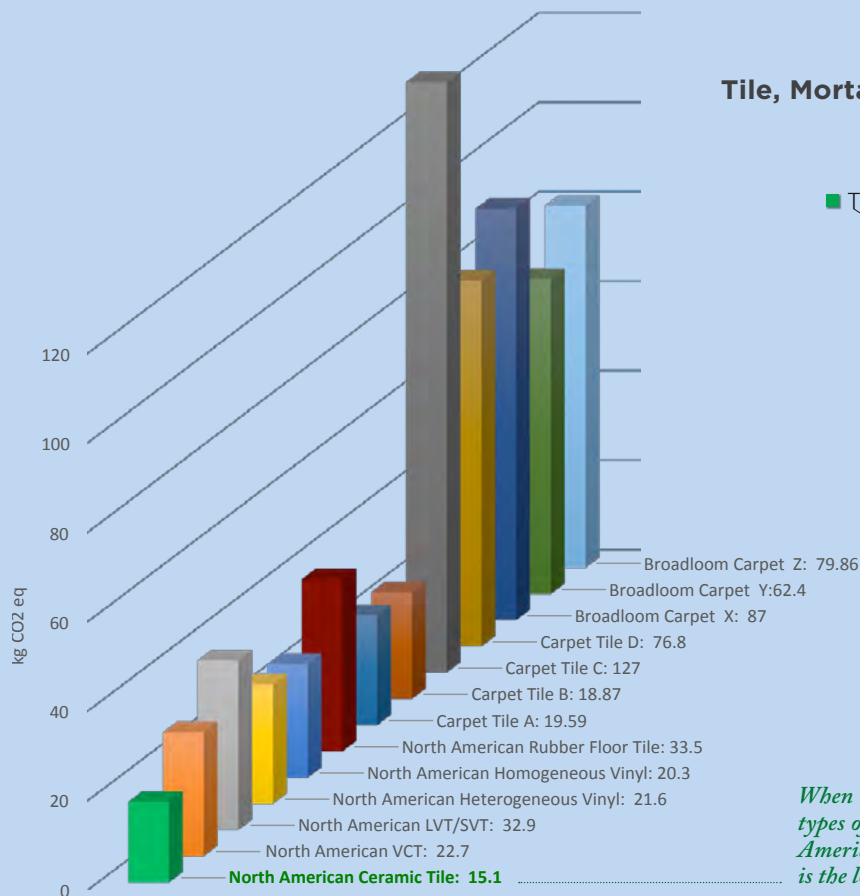
**The EPDs for North American-made tiles, mortars, and grouts all report very low 60-year environmental impacts per installed square meter. In fact, when the EPD for North American-made Tile is compared to the generic EPDs for other types of flooring, developed under the same PCR and using the same building service life, North American-made ceramic tile has the lowest impact across all major categories.**

## Global Warming Potential (GWP)

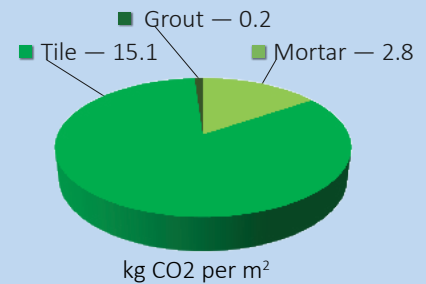
GWP, commonly referred to as “carbon footprint,” is measured by emissions of carbon-equivalent gases and relates to climate change.

The North American-made Ceramic Tile, Mortar and Grout EPDs report a 60-year GWP of 15.1 kg CO<sub>2</sub> equivalent (eq.) per square meter for tile, 2.8 kg per m<sup>2</sup> for mortar, and 0.2 kg per m<sup>2</sup> for grout.

### GWP: Tile vs Other Types of Flooring



### Tile, Mortar, and Grout: Combined GWP



*When compared to the EPDs for other types of flooring developed under the North American Flooring PCR, tile's GWP value is the lowest.*



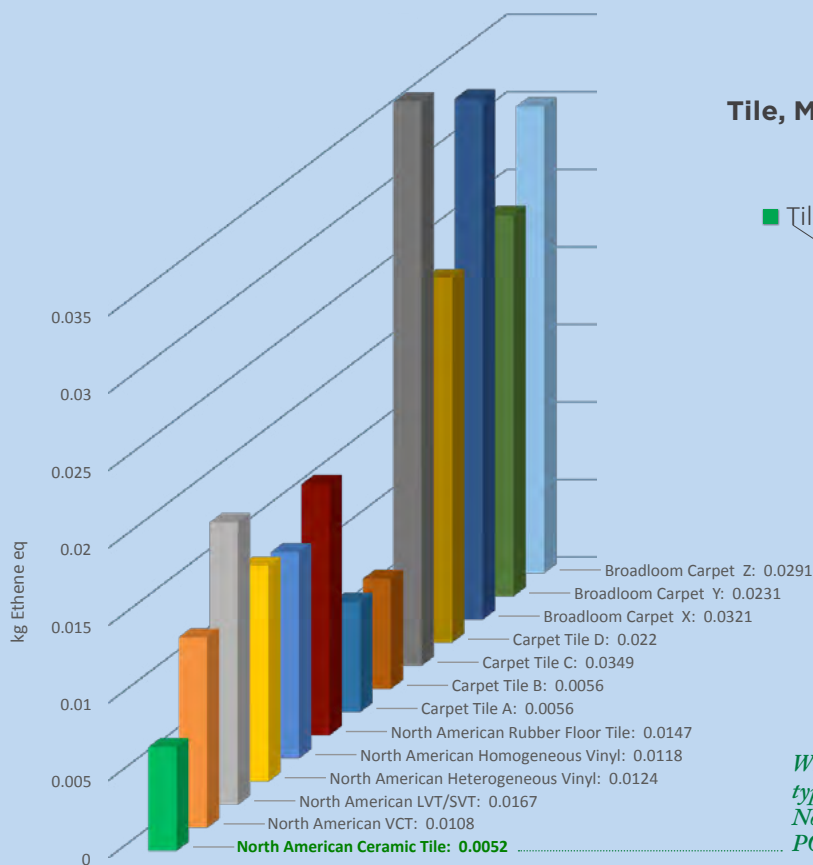
# ENVIRONMENTAL FOOTPRINT: TILE, MORTAR AND GROUT A 60-YEAR IMPACT ANALYSIS

## Photochemical Oxidant Creation Potential (POCP)

POCP is directly linked to smog formation. Smog is harmful to humans and animals, most notably for aggravating bronchial-related diseases; it also inhibits plant growth due to decreased UV radiation, and can discolor ground-level materials like building exteriors.

The North American-made Ceramic Tile, Mortar, and Grout EPDs report a 60-year POCP of 0.0052 kg Ethene equivalent (eq.) per square meter for tile, 0.00095 kg per m<sup>2</sup> for mortar, and 0.000061 kg per m<sup>2</sup> for grout.

**POCP: Tile vs Other Types of Flooring**



**Tile, Mortar, and Grout: Combined POCP**



*When compared to the EPDs for other types of flooring developed under the North American Flooring PCR, tile's POCP value is the lowest.*



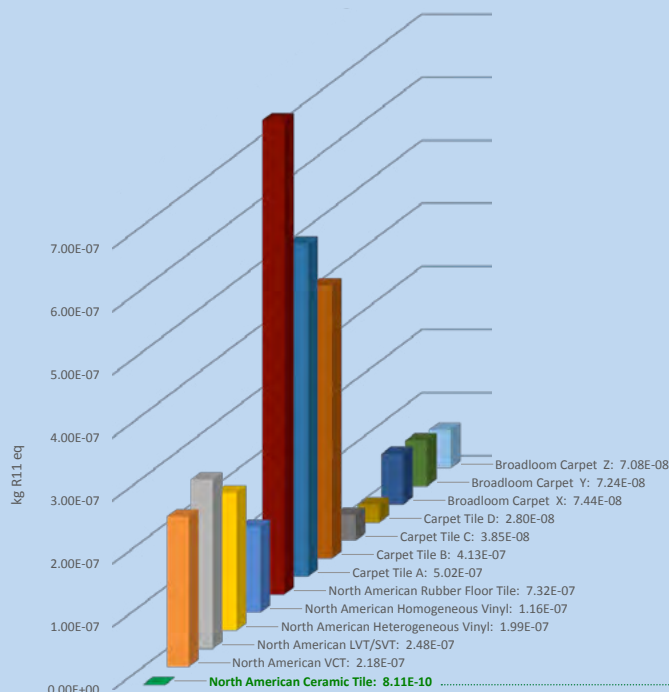
## Ozone Depletion Potential (ODP)

Ozone depletion occurs when chlorofluorocarbons (CFCs) and hydrofluorocarbons (HCFCs) reach the stratosphere, react with the sun, and break down the ozone layer. Decreased ozone can lead to an increase in the amount of UV-B radiation that reaches Earth's surface, having harmful effects on human health, animal health, terrestrial and aquatic ecosystems, biochemical cycles, and materials.

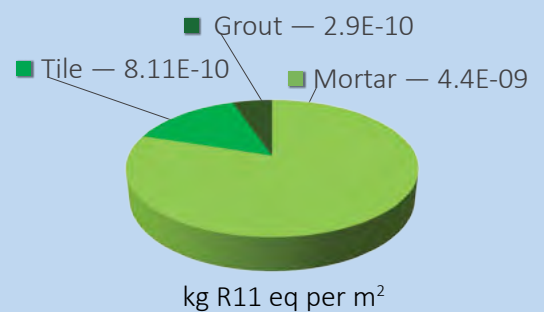
The North American-made Ceramic Tile, Mortar, and Grout EPDs report a 60-year ODP of 0.00000000811 kg R11 equivalent (eq.) per square meter for tile, 0.0000000044 kg per m<sup>2</sup> for mortar, and 0.0000000029 kg per m<sup>2</sup> for grout.



### ODP: Tile vs Other Types of Flooring



### Tile, Mortar, and Grout: Combined ODP



*When compared to EPDs for other types of flooring products developed under the North American Flooring PCR, tile's ODP value is the lowest.*

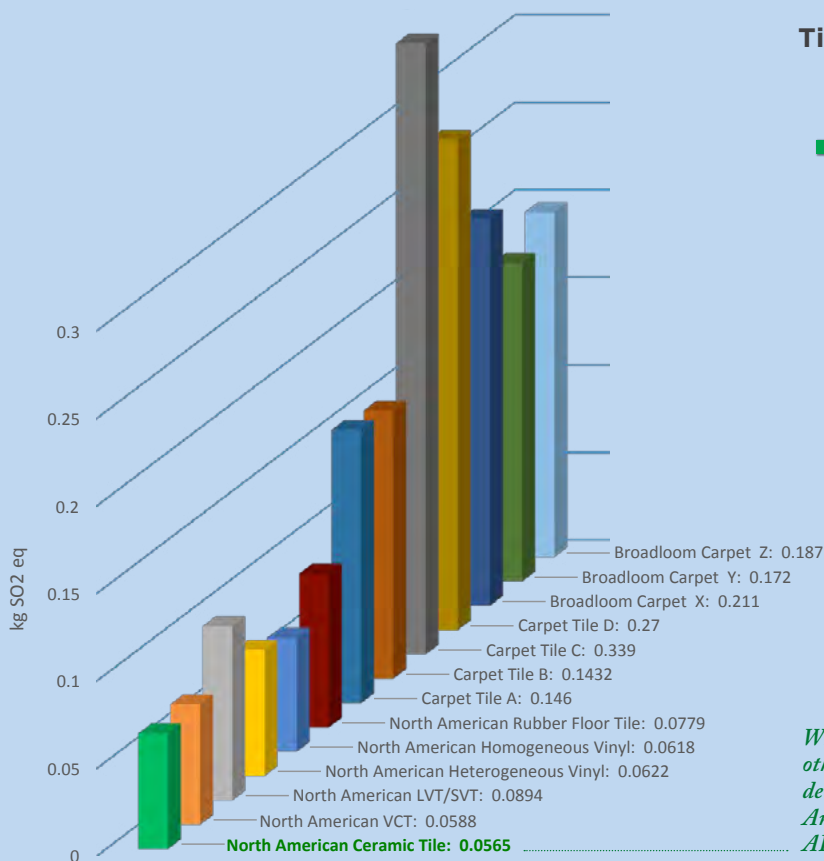
# ENVIRONMENTAL FOOTPRINT: TILE, MORTAR AND GROUT A 60-YEAR IMPACT ANALYSIS

## Acidification Potential (AP)

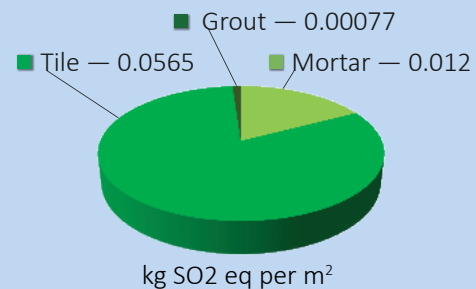
Acidification occurs when soil, groundwater, surface water and atmospheric moisture pH levels are lowered. This can have a harmful impact on organisms, ecosystems, and man-made materials, including buildings.

The North American-made Ceramic Tile, Mortar and Grout EPDs report a 60-year AP of 0.0565 kg SO<sub>2</sub> equivalent (eq.) per square meter for tile, 0.012 kg per m<sup>2</sup> for mortar, and 0.00077 kg per m<sup>2</sup> for grout.

AP: Tile vs Other Types of Flooring



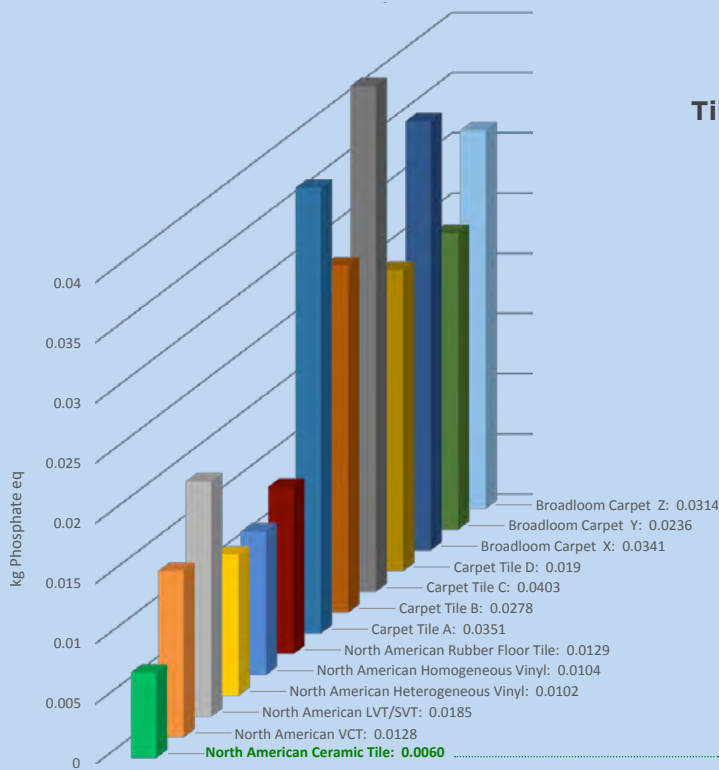
Tile, Mortar, and Grout: Combined AP



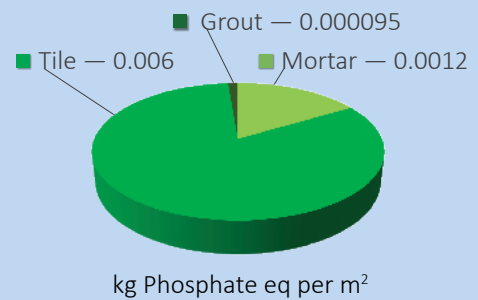
*When compared to EPDs for other types of flooring products developed under the North American Flooring PCR, tile's AP value is the lowest.*

## Eutrophication Potential (EP)

### EP: Tile vs Other Types of Flooring



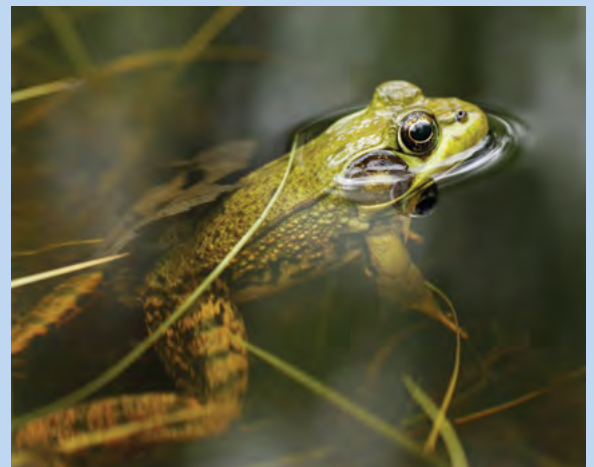
### Tile, Mortar, and Grout: Combined EP



*When compared to the EPDs for other types of flooring products developed under the North American Flooring PCR, tile's EP value is the lowest.*

Eutrophication is the enrichment of a body of water (or ecosystem) with nutrients needed for photosynthesis, such as carbon dioxide and nutrient compounds containing nitrogen and/or phosphorus, commonly from fertilizer runoff and sewage. It is a significant cause of oxygen depletion in bodies of water, resulting from excess plant and algal growth, causing hypoxic conditions in which marine life cannot be sustained.

The North American-made Ceramic Tile, Mortar, and Grout EPDs report a 60-year EP of 0.0060 kg Phosphate equivalent (eq.) per square meter for tile, 0.0012 kg per m2 for mortar, and 0.000095 kg per m2 for grout.



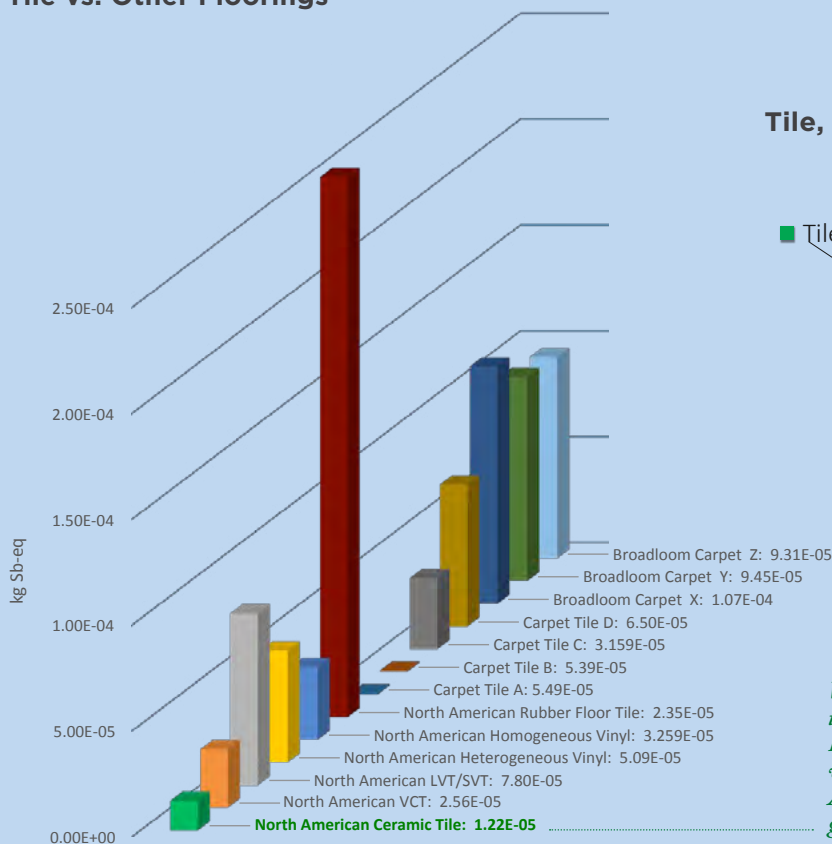
# ENVIRONMENTAL FOOTPRINT: TILE, MORTAR AND GROUT A 60-YEAR IMPACT ANALYSIS

## Abiotic Resource Depletion Potential (ADP)

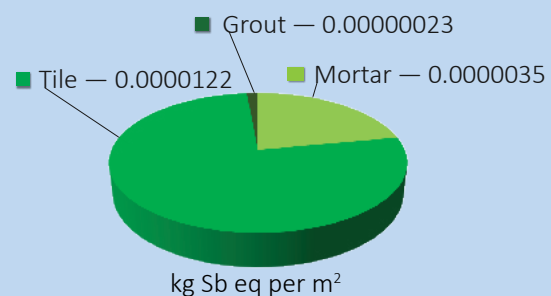
Abiotic resources are natural resources derived from non-living, non-organic materials. Since “non-living” can cover a wide variety of resources, ranging from renewable to non-renewable and finite to perpetual, there is debate about which types of resource depletion are worse, and whether or not all abiotic resources should be grouped together. Most commonly, LCAs take into account land, fossil fuels, and metals, and ADP can be considered elemental (ADP-e), or fossil (ADP-f).

The North American-made Ceramic Tile, Mortar and Grout EPDs report a 60-year elemental depletion of 0.0000122 kg Sb equivalent (eq.) per square meter for tile, 0.0000035 kg per m<sup>2</sup> for mortar, and 0.00000023 kg per m<sup>2</sup> for grout. and a 60-year fossil depletion of 219 MJ per square meter for tile, 31 MJ per m<sup>2</sup> for mortar, and 2 MJ per m<sup>2</sup> for grout

### Elemental Abiotic Resource Depletion Potential (ADP-e): Tile vs. Other Floorings

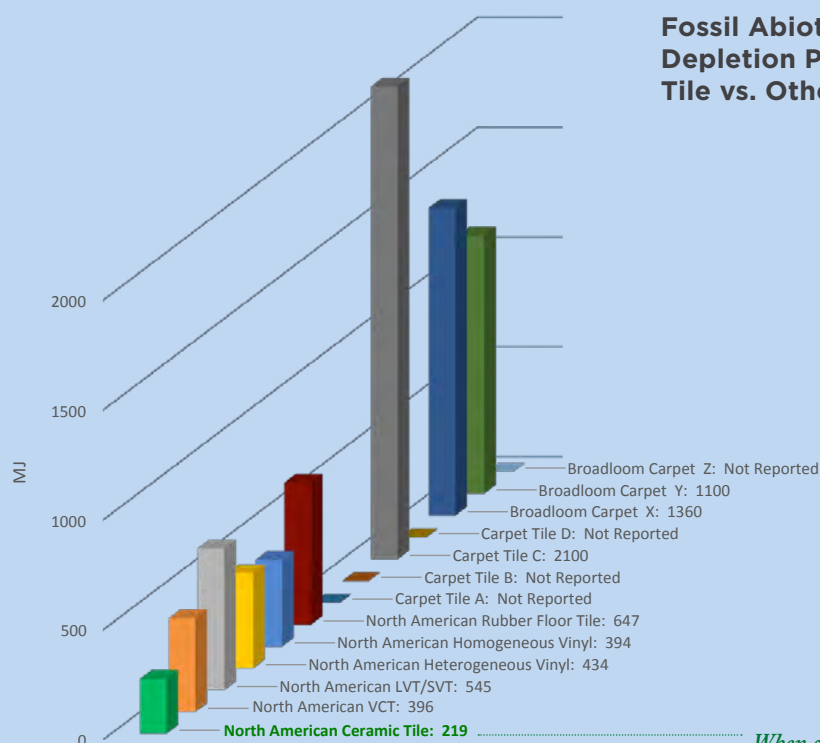


### Tile, Mortar, and Grout: Combined ADP-e



*When compared to EPDs for other flooring types developed under the North American Flooring PCR, tile has the lowest ADP-f value of those reported and the lowest ADP-e value among values reported in generic flooring EPDs.*

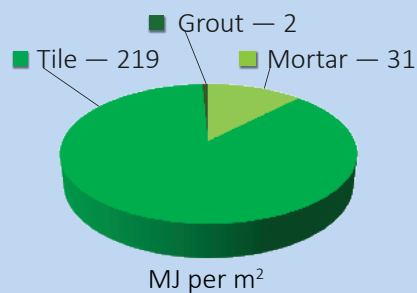




### Fossil Abiotic Resource Depletion Potential (ADP-f): Tile vs. Other Flooring

*When compared to EPDs for other flooring types developed under the North American Flooring PCR, tile has the lowest ADP-f value of those reported and the lowest ADP-e value among values reported in generic flooring EPDs.*

### Tile, Mortar, and Grout: Combined ADP-f



# EPD

## TRANSPARENCY SUMMARY: TILE

COMPANY NAME	Industry-Wide
PRODUCT TYPE	Porcelain, Pressed Floor, Mosaic, Quarry, Wall
PRODUCT NAME	Ceramic Tile: Made in North America
PRODUCT DEFINITION	Floor or wall covering which is inert, fire resistant, non-combustible, durable, easy to maintain and made of mineral-based natural materials. Manufacturers include: Arto, Crossville, Dal-Tile, Florida Tile, Florim USA, Interceramic, Ironrock, Porcelanite Lamosa, Quarry Tile Co, Stonepeak, and Vitromex.
PRODUCT CATEGORY RULE (PCR)	NSF PCR for Flooring (Carpet, Resilient, Laminate, Ceramic, and Wood)
CERTIFICATION PERIOD	October 24, 2014 to October 24, 2019
DECLARATION NUMBER	4786483078.101.1



### LIFECYCLE IMPACT CATEGORIES

The environmental impacts listed below were assessed throughout the product's lifecycle – including raw material extraction, transportation, manufacturing, packaging, use, and disposal at end of life.

ATMOSPHERE			WATER		EARTH	
<b>Global Warming Potential</b> refers to long-term changes in global weather patterns – including temperature and precipitation – that are caused by increased concentrations of greenhouse gases in the atmosphere.	<b>Ozone Depletion Potential</b> is the destruction of the stratospheric ozone layer, which shields the earth from ultraviolet radiation that's harmful to life, caused by human-made air pollution.	<b>Photochemical Ozone Creation Potential</b> happens when sunlight reacts with hydrocarbons, nitrogen oxides, and volatile organic compounds, to produce a type of air pollution known as smog.	<b>Acidification Potential</b> is the result of human-made emissions and refers to the decrease in pH and increase in acidity of oceans, lakes, rivers, and streams – a phenomenon that pollutes groundwater and harms aquatic life.	<b>Eutrophication Potential</b> occurs when excessive nutrients cause increased algae growth in lakes, blocking the underwater penetration of sunlight needed to produce oxygen and resulting in the loss of aquatic life.	<b>Depletion of Abiotic Resources (Elements)</b> refers to the reduction of available non-renewable resources, such as metals and gases, that are found on the periodic table of elements, due to human activity.	<b>Depletion of Abiotic Resources (Fossil Fuels)</b> refers to the decreasing availability of non-renewable carbon-based compounds, such as oil and coal, due to human activity.
TRACI						
CML	15.1 kg CO <sub>2</sub> -Equiv.	8.11E-010 kg R11-Equiv.	0.0052 kg Ethene-Equiv.	0.0565 kg SO <sub>2</sub> -Equiv.	0.00604 kg Phosphate-Equiv.	1.22E-005 kg SB-Equiv.
						219 MJ

**FUNCTIONAL UNIT** One square meter of ceramic tile. Life cycle impact results are expressed for 60 years of use.



Environment

## MATERIAL CONTENT

Material content measured to 1%.

COMPONENT	MATERIAL	AVAILABILITY	MASS%	ORIGIN
Body	Clay	Mineral perpetual	70.3%	US, Mexico, Europe
	Feldspar	Mineral perpetual	5.3%	US, Mexico, Europe
	Sand	Mineral perpetual	4.8%	US, Mexico, Europe
	Scrap	Pre-consumer Post-consumer	4.2%	US, Mexico, Europe
	Kaolin	Mineral perpetual	3.2%	US, Mexico, Europe
	Granite	Mineral perpetual	1.3%	US, Mexico, Europe
	Lime	Mineral perpetual	1.1%	US, Mexico, Europe
	Other Additives	Mineral perpetual	4.0%	US, Mexico, Europe
Surface	Glaze & Stain	Mineral perpetual	5.4%	US, Mexico, Europe

## ADDITIONAL ENVIRONMENTAL INFORMATION

PRE-CONSUMER RECYCLED CONTENT	<b>VARIES %</b>
POST-CONSUMER RECYCLED CONTENT	<b>VARIES %</b>
VOC EMISSIONS	<b>ZERO/INORGANIC</b>
WATER CONSUMPTION	

## RECYCLING OR REUSE

Ceramic tile can outlast multiple generations of building occupants and is commonly reused in an existing building or salvaged for use in a new building. Solid and inert, it can also be used in a variety of post-life applications such as clean fill, roadway paving, and raw materials used to manufacture new products. To represent a "worst case" scenario, this EPD reports environmental impacts based on 100% of all tile removal waste being disposed of in a landfill.

## ENERGY

RENEWABLE ENERGY	4.42 %	10.4 MJ
NON-RENEWABLE ENERGY	95.58 %	225 MJ

## MANUFACTURER CONTACT INFO

NAME	Tile Council of North America (TCNA)
PHONE	864-646-8453
EMAIL	
WEBSITE	www.TCNATile.com

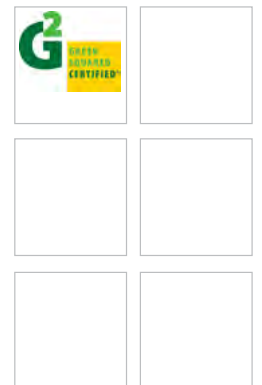
## STANDARDS

ANSI A137.1 American National Standard Specifications for Ceramic Tile

ISO 13006 International Organization for Standardization Specifications for Ceramic Tile

ANSI A138.1/Green Squared® American National Standard Specifications for Sustainable Ceramic Tiles, Glass Tiles, and Tile Installation Materials

## CERTIFICATIONS



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# EPD

## TRANSPARENCY SUMMARY: GROUT

COMPANY NAME	Industry-Wide
PRODUCT TYPE	ANSI A118.6, A118.7, and ISO 13007
PRODUCT NAME	Cement Grout for Tile Installation: Made in North America
PRODUCT DEFINITION	Factory-prepared mixture of cement, aggregate and other ingredients used to fill joints, or the spaces between tiles. Once cured, it is durable, fire-resistant, and moisture insensitive. Manufacturers include Ardex, Bexel, Bostik, Crest, Custom, HB Fuller/TEC, Interceramic, Laticrete, MAPEI, and Cemix/Textrite
PRODUCT CATEGORY RULE (PCR)	IBU Part A & B for Mineral Factory-made Mortar, 07.2014, with UL Addendum
CERTIFICATION PERIOD	September 30, 2016 to September 30, 2021
DECLARATION NUMBER	4787109018.101.1



### LIFECYCLE IMPACT CATEGORIES

The environmental impacts listed below were assessed throughout the product's lifecycle – including raw material extraction, transportation, manufacturing, packaging, use, and disposal at end of life.

ATMOSPHERE			WATER		EARTH	
<b>Global Warming Potential</b> refers to long-term changes in global weather patterns – including temperature and precipitation – that are caused by increased concentrations of greenhouse gases in the atmosphere.	<b>Ozone Depletion Potential</b> is the destruction of the stratospheric ozone layer, which shields the earth from ultraviolet radiation that's harmful to life, caused by human-made air pollution.	<b>Photochemical Ozone Creation Potential</b> happens when sunlight reacts with hydrocarbons, nitrogen oxides, and volatile organic compounds, to produce a type of air pollution known as smog.	<b>Acidification Potential</b> is the result of human-made emissions and refers to the decrease in pH and increase in acidity of oceans, lakes, rivers, and streams – a phenomenon that pollutes groundwater and harms aquatic life.	<b>Eutrophication Potential</b> occurs when excessive nutrients cause increased algae growth in lakes, blocking the underwater penetration of sunlight needed to produce oxygen and resulting in the loss of aquatic life.	<b>Depletion of Abiotic Resources (Elements)</b> refers to the reduction of available non-renewable resources, such as metals and gases, that are found on the periodic table of elements, due to human activity.	<b>Depletion of Abiotic Resources (Fossil Fuels)</b> refers to the decreasing availability of non-renewable carbon-based compounds, such as oil and coal, due to human activity.
TRACI 0.203 kg CO2-Equiv.	3.73E-10 kg CFC 11-Equiv.	0.0123 kg O3-Equiv.	8.13E-04 kg SO2-Equiv.	6.14E-05 kg N-Equiv.	N/A	N/A
CML 0.203 kg CO2-Equiv.	2.94E-10 kg CFC 11-Equiv.	6.21E-05 kg Ethene-Equiv.	7.89E-04 kg SO2-Equiv.	9.40E-05 kg Phosphate-Equiv.	2.34E-07 kg SB-Equiv.	2.07 MJ

**FUNCTIONAL UNIT** One square meter (1 sqm) of installed grout. Life cycle impact results are expressed for 60 years. Assumed application rate is 0.212 kilograms per square meter. Divide results by 0.212 to calculate impact per kilogram of grout.



Environment



## MATERIAL CONTENT

Material content measured to 1%.

COMPONENT	MATERIAL	AVAILABILITY	MASS%	ORIGIN
Sand	Sand	Mineral perpetual	53	Locally sourced US, Canada, Mexico
Cement	White cement	Mineral manufactured	27	US, Canada, Mexico, Europe
Limestone	Limestone	Mineral perpetual	10	Locally sourced US, Canada, Mexico
Cement	Grey cement	Mineral manufactured	5	Locally sourced US, Canada, Mexico
Additive	Calcium aluminate	Mineral perpetual	2	Locally sourced US, Canada, Mexico
Additive	Calcium formate	Mineral perpetual	1	Locally sourced US, Canada, Mexico
Additive	Other additives	Various	2	US, Canada, Europe, Asia

## ADDITIONAL ENVIRONMENTAL INFORMATION

PRE-CONSUMER RECYCLED CONTENT	<b>VARIES %</b>
POST-CONSUMER RECYCLED CONTENT	<b>VARIES %</b>
VOC EMISSIONS	<b>CDPH 01350 COMPLIANT</b>
WATER CONSUMPTION	<b>0.51 L</b>

## ENERGY

RENEWABLE ENERGY	<b>9 %</b>	<b>0.21 MJ</b>
NON-RENEWABLE ENERGY	<b>91 %</b>	<b>2.3 MJ</b>

## MANUFACTURER CONTACT INFO

NAME	Tile Council of North America (TCNA)
PHONE	864-646-8453
EMAIL	
WEBSITE	www.TCNAtile.com

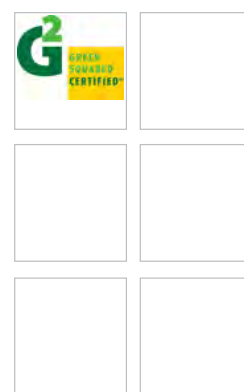
## RECYCLING OR REUSE

Tile installations with cement grout can last as long as buildings and are often reused for multiple generations of building occupants. Although tile and cement grout can be used in a variety of post-life applications (e.g., clean fill, roadway paving, aggregate for new products, etc.), this analysis adopts a conservative approach and assumes that 100% of tile and associated waste are disposed in a landfill.

## STANDARDS

ANSI A118.6 American National Standard Specifications, Standard Cement Grouts for Tile Installation  
ANSI A118.7 American National Standard Specifications, High Performance Cement Grouts for Tile Installation  
ISO 13007 Terms, Definitions and Specifications, Ceramic Tile Grouts and Adhesives  
ANSI A138.1/Green Squared® American National Standard Specifications, Sustainable Ceramic Tiles, Glass Tiles and Tiles, and Tile Installation Materials

## CERTIFICATIONS



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# EPD

## TRANSPARENCY SUMMARY: MORTAR

COMPANY NAME	Industry-Wide
PRODUCT TYPE	ANSI A118.1, A118.4/11, A118.15, and ISO 13007
PRODUCT NAME	Cement Mortar for Tile Installation: Made in North America
PRODUCT DEFINITION	Blend of cement, sand, water retention compounds and other additives used to adhere tile to a substrate. Once cured, it is durable, fire-resistant, moisture insensitive, and maintenance-free. Manufacturers include Ardex, Bexel, Bostik, Crest, Custom, HB Fuller/TEC, Interceramic, Laticrete, MAPEI, and Cemix/Texrite
PRODUCT CATEGORY RULE (PCR)	IBU Part A & B for Mineral Factory-made Mortar, 07.2014, with UL Addendum
CERTIFICATION PERIOD	September 30, 2016 to September 30, 2021
DECLARATION NUMBER	4787109018.102.1



### LIFECYCLE IMPACT CATEGORIES

The environmental impacts listed below were assessed throughout the product's lifecycle – including raw material extraction, transportation, manufacturing, packaging, use, and disposal at end of life.

ATMOSPHERE			WATER		EARTH	
<b>Global Warming Potential</b> refers to long-term changes in global weather patterns – including temperature and precipitation – that are caused by increased concentrations of greenhouse gases in the atmosphere.	<b>Ozone Depletion Potential</b> is the destruction of the stratospheric ozone layer, which shields the earth from ultraviolet radiation that's harmful to life, caused by human-made air pollution.	<b>Photochemical Ozone Creation Potential</b> happens when sunlight reacts with hydrocarbons, nitrogen oxides, and volatile organic compounds, to produce a type of air pollution known as smog.	<b>Acidification Potential</b> is the result of human-made emissions and refers to the decrease in pH and increase in acidity of oceans, lakes, rivers, and streams – a phenomenon that pollutes groundwater and harms aquatic life.	<b>Eutrophication Potential</b> occurs when excessive nutrients cause increased algae growth in lakes, blocking the underwater penetration of sunlight needed to produce oxygen and resulting in the loss of aquatic life.	<b>Depletion of Abiotic Resources (Elements)</b> refers to the reduction of available non-renewable resources, such as metals and gases, that are found on the periodic table of elements, due to human activity.	<b>Depletion of Abiotic Resources (Fossil Fuels)</b> refers to the decreasing availability of non-renewable carbon-based compounds, such as oil and coal, due to human activity.
TRACI 2.88 kg CO2-Equiv.	5.65E-09 kg CFC 11-Equiv.	0.200 kg O3-Equiv.	0.0122 kg SO2-Equiv.	5.62E-04 kg N-Equiv.	N/A	N/A
CML 2.89 kg CO2-Equiv.	4.43E-09 kg CFC 11-Equiv.	9.66E-04 kg Ethene-Equiv.	0.0118 kg SO2-Equiv.	1.21E-03 kg Phosphate-Equiv.	3.51E-06 kg SB-Equiv.	30.8 MJ

**FUNCTIONAL UNIT** One square meter (1 sqm) of installed mortar. Life cycle impact results are expressed for 60 years of use. Assumed application rate is 4.07 kilograms per square meter. Divide results by 4.07 to calculate impact per kilogram of mortar.



Environment

## MATERIAL CONTENT

Material content measured to 1%.

COMPONENT	MATERIAL	AVAILABILITY	MASS%	ORIGIN
Sand	Sand	Mineral perpetual	37	Locally sourced US, Canada, Mexico
Calcium carbonate	Calcium carbonate	Mineral perpetual	30	Locally sourced US, Canada, Mexico
Cement	Grey cement	Mineral manufactured	15	Locally sourced US, Canada, Mexico
Cement	White cement	Mineral manufactured	13	US, Canada, Mexico, Europe
Additive	E/VA	Polymer manufactured	1	US, Europe
Additive	Admixture	Mineral perpetual	1	US, Mexico, Europe
Additive	Cellulose ether	Organic rapidly renewable	1	US, Europe
Additive	Other additives	Various	1	US, Canada, Europe, Asia

## ADDITIONAL ENVIRONMENTAL INFORMATION

PRE-CONSUMER RECYCLED CONTENT	VARIES %
POST-CONSUMER RECYCLED CONTENT	VARIES %
VOC EMISSIONS	CDPH 01350 COMPLIANT
WATER CONSUMPTION	6.5 L

## ENERGY

RENEWABLE ENERGY	6 %	2.11 MJ
NON-RENEWABLE ENERGY	94 %	32.5 MJ

## MANUFACTURER CONTACT INFO

NAME	Tile Council of North America (TCNA)
PHONE	864-646-8453
EMAIL	
WEBSITE	www.TCNAtile.com

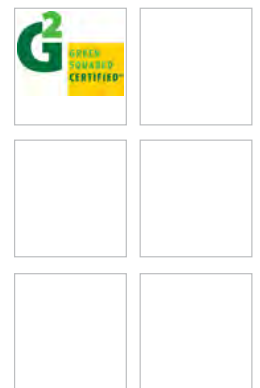
## RECYCLING OR REUSE

Tile installations with cement mortar can last as long as buildings and are often reused for multiple generations of building occupants. Although tile and cement mortar can be used in a variety of post-life applications (e.g., clean fill, roadway paving, aggregate for new products, etc.), this analysis adopts a conservative approach and assumes that 100% of tile and associated waste are disposed in a landfill.

## STANDARDS

ANSI A118.1 American National Standard Specifications, Dry-Set Cement Mortar  
ANSI A118.4/11 American National Standard Specifications, Modified Dry-Set Cement Mortar  
ANSI A118.15 American National Standard Specifications, Improved Modified Dry-Set Cement Mortar  
ISO 13007 Terms, Definitions and Specifications, Ceramic Tile Grouts and Adhesives  
ANSI A138.1/Green Squared® American National Standard Specifications, Sustainable Ceramic Tiles, Glass Tiles and Tiles, and Tile Installation Materials

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Release date: January 2019

Green building standards and rating systems are living documents, and the consensus regarding their use and interpretation is ever-evolving. Check for updates to *Tile: The Natural Choice* at [www.TCNAtile.com](http://www.TCNAtile.com).



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