Certified
Environmental Product Declaration

Armstrong®

According to ISO 14025

Fine Fissured™ Ceiling Panels
Mineral Fiber

Fine Fissured Lay-In on Prelude XL Suspension System

Committed to Sustainability.

Armstrong is committed to delivering solutions that reduce the environmental impact of the buildings you create… from product design and raw material selection, to how our products are produced and delivered.

Now we provide Environmental Product Declarations (EPD's) to document the sustainability of our products. Inside this ICC-ES certified ISO compliant EPD you will find:

- Performance features like acoustics, light reflectance, and durability
- Product application and use
- Product ingredients and their sources
- Information on how a ceiling system is produced
- Life Cycle Assessment (LCA) results including global warming potential and primary energy usage
- Total impacts over the life cycle of the product

Fine Fissured delivers standard acoustical performance and HumiGuard Plus humidity resistance making it a good product for commercial applications.

Fine Fissured Ceiling Panels

Amount Per Serving – 1 sq ft of Acoustical Ceiling Panels

LCA IMPACT MEASURES	TOTAL
Primary Energy (MJ)	4.6
Global Warming Potential ($kgCO_2$ equivalent)	0.40
Ozone Depletion (kg CFC^- 11 equivalent)	4.33E-09
Acidification Potential (H^+ moles equivalent)	0.117
Eutrophication Potential (kg N^- equivalent)	3.36E-04
Smog Photochemical Oxidant Creation Potential (kg O_3-Equiv.)	0.045
PERFORMANCE ATTRIBUTES	
Acoustics NRC (Absorption)	0.55
Acoustics CAC (Blocking)	35
Light Reflectance	0.85
Sag/Mold Warranty	30 Years

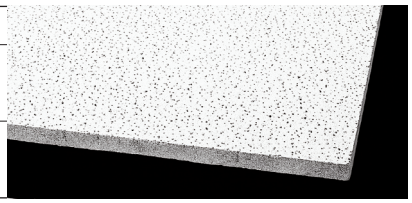
Ceiling Ingredients: Perlite, Newsprint, Mineral Wool, Starch, Recycled Ceilings, Coatings

Visit **armstrong.com/epd** for further information and to watch our video.

According to ISO 14025

This document is a Type III environmental product declaration by Armstrong World Industries that is certified by ICC-ES as conforming to the requirements of ISO 14025. ICC-ES has assessed that the Life Cycle Assessment (LCA) information fulfills the requirements of ISO 14040 in accordance with the instructions listed in the product category rules cited below. The intent of this document is to further the development of environmentally compatible and sustainable construction methods by providing comprehensive environmental information related to potential impacts in accordance with international standards.

Declaration Number:	EPD-0006
Program Operator:	ICC Evaluation Service, LLC www.icc-es.org
Declaration Holder:	Armstrong Commercial Ceiling Systems



Declared Product	Armstrong® Fine Fissured Ceiling Panels are wet-formed mineral fiber acoustical ceiling panels, featuring a medium-textured, non-directional visual.
Declaration Type	Cradle-to-Grave (with end of life information added). Intended for Business-to-Business (B-to-B) audiences.
Applicable Countries	U.S. and Canada, based upon the use of U.S.-specific standards, data, and declared impact measures. Otherwise, calculations are the same as the Institut Baven und Umwelt (IBU) Product Category Rules (PCR) "Mineralplatten fur adgehangteDeckensysteme," 2009-06.
Product Application	Provides outstanding acoustical performance for commercial spaces: • Back of house • Low end retail • Multi-purpose rooms • Corridors
Content of the Declaration	This declaration is complete and contains in its full form: • Product Definition • Material Content • Production of the Ceiling System • Installation of Ceiling Systems • Use Stage • Extraordinary Effects • End of Life Stage • Life Cycle Assessment • Additional Information, Evidence, Test Certificates • PCR Documentation and Verification • References
PCR Development	☐ New or Revised ☒ Existing
PCR Reference	PCR Ceiling Panels – Ceiling panels for suspended ceiling systems Version: October 2010 (U.S.) www.bau-umwelt.com

EPD Date of Issue: June 1, 2012 | **EPD Period of Validity:** June 1, 2015

Verification and Authorization of the Declaration

This declaration and the rules on which this EPD is based have been examined by an independent verifier in accordance with ISO 14025

X Rob Brooks		X	
Robert Brooks, Director of Environmental Programs, ICC-ES	Date **June 1, 2012**	Francois Charron-Doucet, Verifier **Scientific Coordinator - Quantis**	Date **June 1, 2012**

ICC-ES certification of an Environmental Product Declaration (EPD) is not the equivalent of an ICC-ES Evaluation Report, Verification of Attributes Report, or a listing for code compliance. ICC-ES certification of an EPD is limited to the requirements for Type III environmental declarations in accordance with ISO 14025 and does not apply to product performance attributes which demonstrate compliance to codes. ICC-ES certification of this EPD is not to be construed as representing aesthetics or any other attributes not specifically addressed, nor should it be construed as an ICC-ES endorsement of the subject of the EPD or a recommendation for its use. There is no warranty by ICC-ES, express or implied, as to any finding or other matter in the EPD, or as to any product covered by the EPD. The EPD holder is liable for the information and evidence on which the EPD is based.

According to ISO 14025

Summary LCA Results

Product Components Related to Life Cycle Assessment

Armstrong Ceiling Systems are comprised of two components – ceiling panels and a metal suspension system. Table 1 discloses the environmental impact measures for Fine Fissured ceiling panels. The ceiling system LCA results are detailed in Section 9.

Scope and Boundaries of the Life Cycle Assessment

The Life Cycle Assessment (LCA) was performed according to ISO 14040 and follows the PCR instructions. The cradle-to-grave LCA encompasses raw material production; transport of raw materials to production facility; manufacturing of ceiling panels; packaging; transportation to job site; use phase; and end of life including disposal or recycling. Detailed information regarding the LCA is found in Section 9.

Life Cycle Assessment Summary

Declared Unit: 1 ft^2 of ceiling panels[1] for use over 50 years, impacts based on U.S. EPA TRACI 2.0 Impact Factors

Table 1: Life Cycle Assessment of Fine Fissured Ceiling Panels

IMPACT MEASURE[3]	TOTAL[1]	PRODUCTION	USE PHASE	END OF LIFE	REDUCTION[2]
Primary Energy (MJ)	4.6	3.5	0.3	0.8	-8%
Global Warming Potential (kg CO_2 equivalent)	0.40	0.19	0.03	0.18	-6%
Ozone Depletion (kg CFC-11 equivalent)	4.33E-09	4.33E-09	1.87E-15	1.37E-14	-25%
Acidification Potential (H^+ moles equivalent)	0.117	0.091	0.008	0.018	-6%
Eutrophication Potential (kg PO_4 equivalent)	3.36E-04	1.68E-04	2.88E-05	1.38E-04	-6%
Smog – Photochemical Oxidant Creation Potential (kg 0_3-Equiv.)	0.045	0.031	0.004	0.010	1%

[1] For declaration of impacts due to the inclusion of the suspension system, see page 13.
[2] Percent change (of Total) based on LCA comparison between 2007 and 2011 (negative indicates improvement over time), see Figure 11 on page 15.
[3] Additional impact measures are included in Section 10.

Additional Information

This declaration contains additional information, as listed below, that is outside the scope of the LCA. This additional information, provided by Armstrong, has not been evaluated by ICC-ES, but is considered useful for the purpose of comparing this EPD to other EPDs developed from the same PCR. Guidance is recommended in comparing performance data and LCA information for products that perform the same in the areas of Acoustics, Fire and Sag Resistance, Light Reflectance, Seismic Performance, and End of Life Recyclability. Please refer to page 4 for a summary of performance attributes by item number and note the website references listed below for additional information.

- Ceiling panel acoustical performance: armstrong.com/acoustics
- Ceiling panel fire resistance: armstrong.com/fireresistance
- Ceiling panel sag resistance: armstrong.com/nosag
- Ceiling panel light reflectance: armstrong.com/lightreflectance
- Suspension system seismic performance (verified by ICC-ES ESR-1308): armstrong.com/seismic
- Health, safety, and installation information

Detailed LCA Results

1.0 Product Definition

1.1 Product Definition and Performance

Armstrong® Fine Fissured Ceiling Panels are wet-formed mineral fiber acoustical ceiling panels, featuring a fine-textured, non-directional DuraBrite® surface for increased durability and superior light reflectance. Fine Fissured ceiling panels are manufactured by Armstrong World Industries in Marietta, Pennsylvania (17547), Pensacola, Florida (32505), Macon, Georgia (31206), and St. Helens, Oregon (97051).

2.0 Product Application

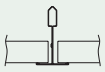
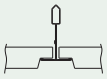
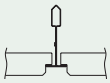
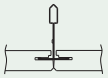
Commercial Interior Finish. Acoustical, Suspended Ceiling System. The ceiling system must be installed in accordance with Armstrong installation guidelines. Our ceiling system installation brochure, "Installing Suspended Ceilings," is a general application overview, covering essential steps of a basic suspended ceiling installation. You can reference this document at http://www.armstrong.com/common/c2002/content/files/15994.pdf.

3.0 Performance Attributes

There are different levels of performance associated with mineral fiber ceiling panels. Performance information is included in this EPD to provide a total understanding of this product and its performance attributes.

3.1 Performance Selection

Table 2: Performance of Fine Fissured Ceiling Panels

ITEMS INCLUDED IN THIS EPD	ATTRIBUTES
Fine Fissured Square Lay-in Panels for 15/16" Suspension System  1728, 1729, 1736, 1737, 1738	NRC 0.55 CAC 35, Item 1728 CAC 33 Fire Rating: Class A Light Reflectance 0.85 Sag-resistant (HumiGuard® Plus) (excludes item 1738) Anti-Microbial (BioBlock® Plus) Recyclable
Fine Fissured Angled Tegular Panels for 15/16" Suspension System  1732, 1733	
Fine Fissured Beveled Tegular Panels for 9/16" Suspension System  1734	
Fine Fissured Concealed Panels for 15/16" Suspension System  746	
Fine Fissured Tongue and Groove (adhesive, staple up)  741	

3.2 Key Selection Attributes

- Economical product for commercial applications
- Non-directional visual reduces installation time and scrap
- 30-Year Limited System Warranty against visible sag, mold/mildew, and bacterial growth (excludes item 1738)
- Available in colors (items 1728, 1729)
  Color Selection (Due to differences in printing and computer monitor settings, shade may vary from actual product.)

White (WH) Cream (CR) Haze (HA) Camel (CM) Platinum (PL) Adobe (AD) Tech Black (BL)

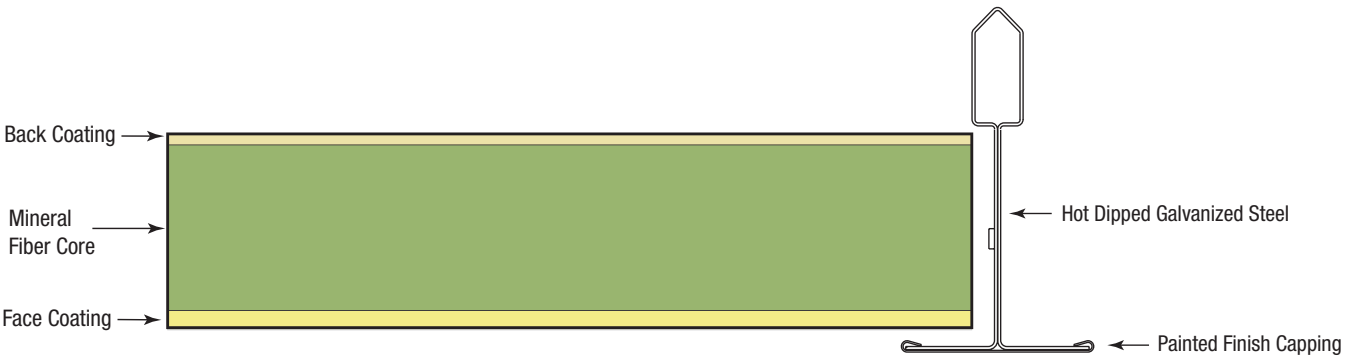
4.0 Material Content

4.1 Definitions

- **Back Coating** – A coating applied to the back of the product
- **Mineral Fiber Core** – Consists of fibers, perlite, recycled newspaper, and corn starch
- **Face Coating** – Durable, highly light-reflectant finish paint coating applied to the face
- **Hot Dipped Galvanized Steel** – Steel with zinc corrosion protection
- **Painted Finish** – Painted steel capping

Figure 1. Composition of an Fine Fissured Ceiling Panel

Figure 2. Composition of Prelude XL Suspension Systems



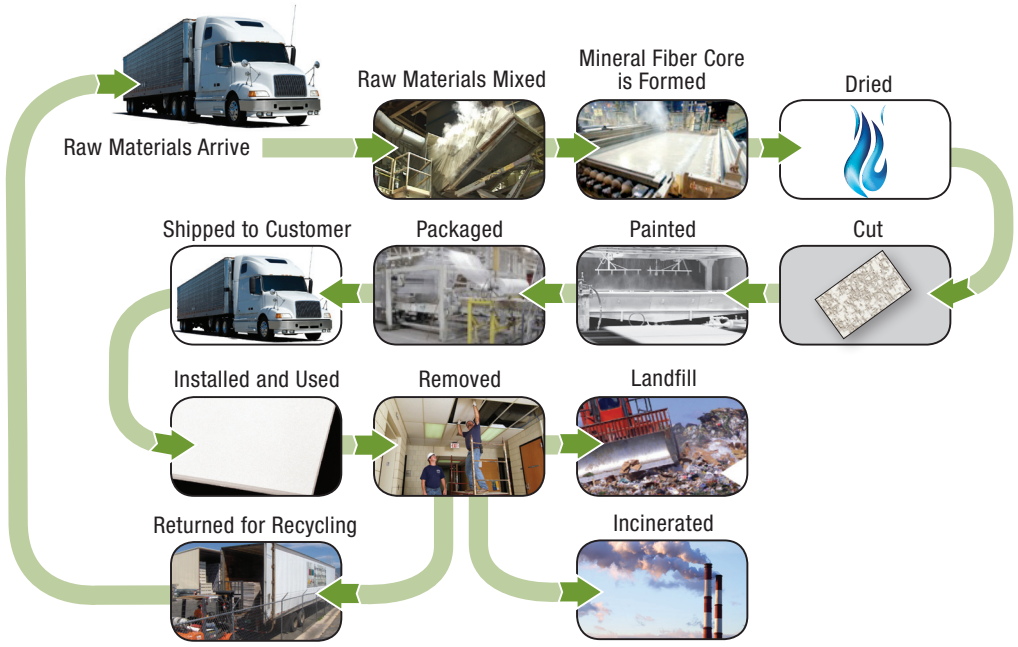
4.0 Material Content (continued)

Table 3: Material Content of Fine Fissured Ceiling Panels

MINERAL FIBER CORE	FUNCTION	QUANTITY (PERCENT BY WEIGHT)	RECYCLED MINERAL RESOURCE	MINERAL RESOURCE	NON-RENEW-ABLE	RENEW-ABLE	ABUNDANT	RECYCLED MATERIAL	ORIGIN	TRANS-PORTATION MODE	TRANS-PORTATION MILES
Fibers	Acoustics	10-25%	■	■	■		■	■	Global	Truck/Rail	750-1400
Perlite	Filler	50-75%		■	■		■		Global	Truck/Ship	8000-9000
Starch	Binder	1-10%				■	■		U.S.	Truck	1200-1300
Recycled Ceiling Panels	Filler	1-10%						■	U.S.	Truck	500-700
Recycled Paper	Filler	20-30%				■	■	■	U.S.	Truck	100-200
Coating	Finish	5-15%		■	■				U.S.	Truck/Rail	400-4000

4.2 Production of Ceiling Panel

Figure 3: Process for Manufacturing Fine Fissured Ceiling Panels



Fine Fissured mineral fiber ceiling panels are manufactured using a wet-formed process. After arriving at the Armstrong facility, the raw materials are mixed, water is added, and the mixture is formed into panels which are then dried. The panels are finished by application of back and prime coats, punching, final painting, cutting to size, and addition of edge detail. After packaging, the material is shipped and installed. At the end of its useful life, the ceiling panel can then be recycled, sent to a landfill, or incinerated. Recycled ceilings can be returned to Armstrong as part of our closed loop recycling process as a raw material for new ceiling panels.

4.0 Material Content (continued)

Table 4: Material Content of Suspension Systems

COMPONENTS	FUNCTION	QUANTITY (PERCENT BY WEIGHT)	RECYCLED MINERAL RESOURCE	MINERAL RESOURCE	NON-RENEW-ABLE	RENEW-ABLE	ABUNDANT	RECYCLED MATERIAL	ORIGIN	TRANS-PORTATION MODE	TRANS-PORTATION MILES
Hot Dipped Galvanized Steel	Suspension	>98%	■	■	■		■	■	Global	Truck	500-600
Paint	Finish	<2%		■	■				U.S.	Truck/Rail	200-500

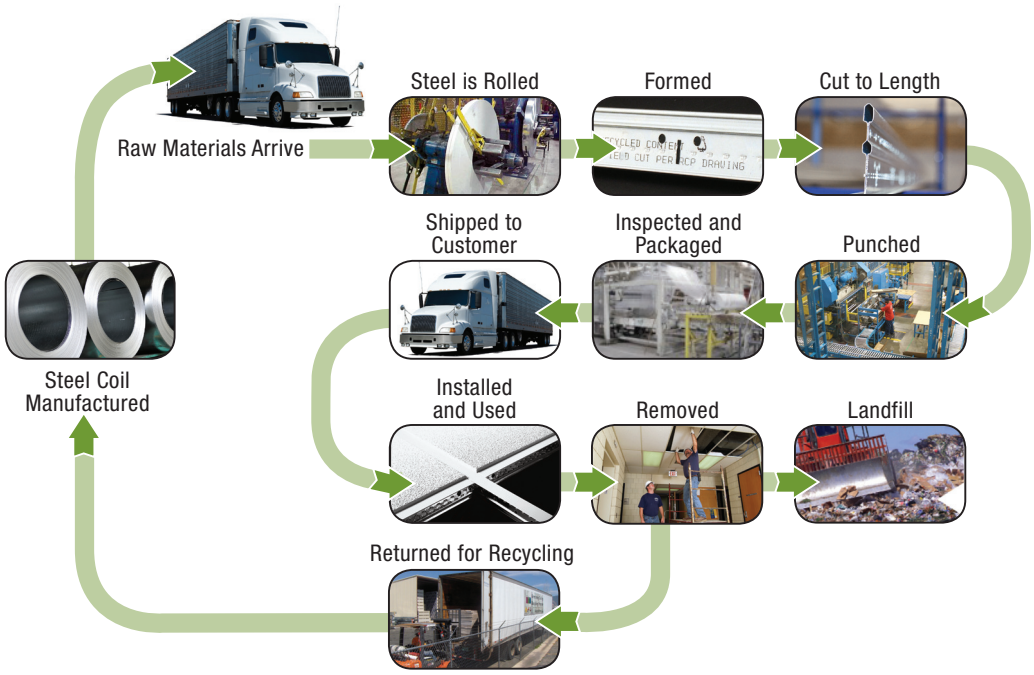
Table 5: Representative Suspension System for which Life Cycle Assessment Data was Compiled

FAMILY	ITEMS	MANUFACTURING LOCATIONS
Prelude XL*		
Main Beam	7300 / 7301	Aberdeen, MD; Benton Harbor, MI; and Las Vegas, NV
Cross Tee 4'	XL7348 / XL7343 / XL7341	
Cross Tee 2'	XL7328 / XL8320	
Molding	7800	
Hanger Wire	7891	

* Prelude XL LCA data is representative of Suprafine XL, Silhouette XL, and Interlude XL Suspension Systems

4.3 Production of Suspension System

Figure 4: Process for Manufacturing Steel Suspension Systems



Armstrong suspension systems use hot dipped galvanized steel which is formed into coils. A large component of the steel is recycled material. The coils are split and painted, and then sent to Armstrong. At the Armstrong plant, the steel is pressed, roll formed, punched, and packaged. The material is then shipped and installed. When the system is disassembled, the majority of the steel is recycled.

4.4 Health, Safety, and Environmental Aspects During Production

Armstrong has a comprehensive environmental, health, and safety management program. Risk reduction begins in the product design process. All products go through a safety, health, and environmental review prior to sale. Armstrong also has a long standing commitment to the safety and health of all our employees. The company's safety management program is considered to be World Class. Our OSHA recordable incident rate is below 1.0, meaning that there is less than one injury per 100 employees per year. All employees view safety as a key responsibility of their jobs. In 2010, Armstrong was named one of "America's Safest Companies" by EHS Today.

Armstrong is equally committed to reducing our environmental impact. As with safety goals, each manufacturing facility has annual environmental plans, tailored to meet goals on energy, water, and waste reduction. Armstrong is a registered member with The Climate Registry. This means the company gets third-party verification of our global greenhouse gas (GHG) inventories, which are then made publicly available. As part of this effort, the cumulative energy usage by our facilities is reported in the Armstrong Climate Registry certification.

5.0 Installation of Ceiling Systems

5.1 Installation and In-use Condition Recommendations

The ceiling system must be installed in accordance with Armstrong installation guidelines. Our ceiling system installation brochure, "Installing Suspended Ceilings," is a general application overview, covering essential steps of a basic suspended ceiling installation. You can reference this document at http://www.armstrong.com/common/c2002/content/files/15994.pdf.

Fine Fissured ceiling panels are HumiGuard® Plus – offering superior resistance to sagging in high humidity conditions up to, but not including, standing water and outdoor applications (excludes item 1738).

5.2 Health, Safety, and Environmental Aspects During Installation

There are no recognized systemic hazards associated with installing ceiling panels. Armstrong recommends that installers handle materials in a manner to minimize airborne dust. Installers should wear appropriate personal protective equipment, such as gloves and safety glasses, to minimize exposure to dust and the potential for skin irritation.

5.3 Waste

Installation waste is minimized by the modular aspect of the ceiling panel system. A conservative 7% waste factor was assumed on-site during construction. This value is based on historic internal studies which have documented the quantity of scrap that is generated at the job site due to needed border cuts, penetrations, or installer mistakes. While this material can be and is recycled from some jobs, in this case, it is assumed that all of the on-site scrap material will be sent to a landfill located within 50 miles of the job site.

Only 0.5% of a suspension system including hanger wire is scrapped or wasted at the job site during installation.

5.4 Packaging

Armstrong ceiling panels are well packaged in a variety of recyclable corrugated sleeves and box styles. Wooden pallets are used to protect unit loads during shipping.

6.0 Use Stage

The system is warranted for 30 years of use; however, ceiling panels can last as long as the building's useful life if properly installed and maintained. The useful life indicated in the PCR for ceiling panels is 50 years. Warranty details can be found at http://www.armstrong.com/commceilingsna/article22553.html.

6.1 Cleaning and Maintenance

Cleaning instructions for Fine Fissured ceilings can be found at http://www.armstrong.com/commceilingsna/article21339.html.

6.2 Health Aspects During Usage

Fine Fissured meets the California Department of Health Services Standard Practice for the testing of VOC Emissions.

7.0 Extraordinary Effects

7.1 Fire Performance

ASTM E84 and CAN/ULC S102 surface burning characteristics. Flame Spread Index 25 or less. Smoke Developed Index 50 or less. (UL labeled)

7.2 Sag Resistance

HumiGuard® Plus offers superior resistance to sagging in high humidity conditions up to, but not including, standing water and outdoor applications and carries a 30-year limited system warranty (excludes item 1738)

7.3 Insulation Value

ASTM C518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Flow Meter Apparatus

R Factor – 1.5 (BTU units)

R Factor – 0.26 (Watts units)

Items 741, 746

R Factor – 1.6 (BTU units)

R Factor – 0.28 (Watts units)

7.4 Seismic Performance

Seismic Categories C, D, E, and F

ICC-ES ESR 1308 – see www.armstrong.com/seismicRX

7.5 Acoustical Panel Classification

ASTM E1264 - Standard Classification for Acoustical Ceiling Products

Type III, Form 2, Pattern C E, Fire Class A

8.0 End of Life Stage

8.1 Recycling or Reuse

The preferred method for a ceiling panel is to be recycled through the Armstrong Ceiling Recycling Program. Contact our Recycling Center at 1 877 276 7876 (press option 1, then 8), or visit www.armstrong.com/ceilingrecycling. Armstrong started reclaiming and recycling ceiling panels in 1997. Through 2011, Armstrong has recycled 116,128,000 square feet of ceiling panels into new ceiling panels.

8.2 Disposal

Disposal in municipal landfill or commercial incineration facilities is permissible and should be done in accordance with local, state, and federal regulations.

9.0 Life Cycle Assessment

This study provides life cycle inventory and environmental impacts relevant to Armstrong suspended ceiling systems. This LCA was conducted to 1) better understand the environmental impacts of the life cycle of suspended ceiling systems; 2) learn how the impacts of raw material selection, product formulation, and manufacturing process influence the life cycle impacts of suspended ceiling systems, and 3) use innovation to drive reduction in the product platform.

The methods for conducting the life cycle assessments used for this project were consistent with ISO 14040 and 14044. This report is intended to fulfill the reporting requirements in Section 5 of ISO 14044 and Part 2 of the Product Category Rules for Ceiling Panels for Suspended Ceiling Systems.

9.1 Information on the Product System Definition and Modeling of the Life Cycle

The declared unit for this EPD is 1 ft^2 of Fine Fissured ceiling panel for use over 50 years.

Ceiling System View: In order to understand the complete view of a ceiling system, life cycle information is included for the total ceiling system based on the coverage of a 1,000 square foot (ft^2) area of building space and then broken down into a 1 square foot (ft^2) view. This includes both the ceiling panels and the suspension system (Table 6). Table 5 details the representative suspension system for which the LCA data was compiled.

9.0 Life Cycle Assessment (continued)

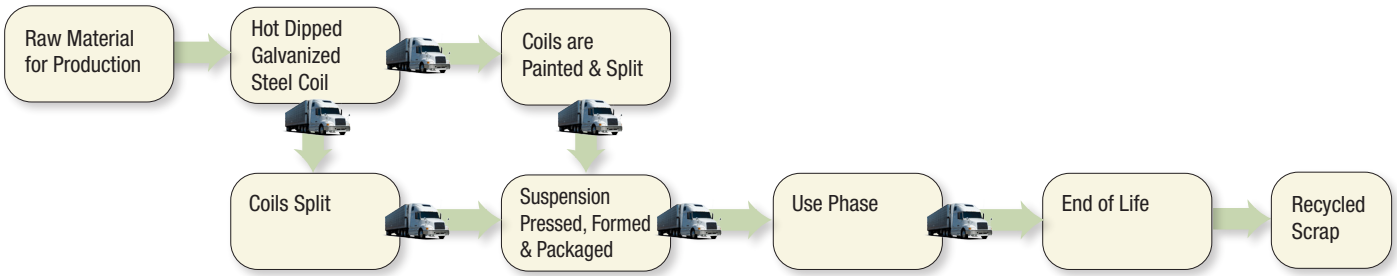
System Boundaries:

The system boundaries studied as part of this life cycle assessment include extraction of primary materials, raw materials manufacture, ceiling panel production, installation, and end of life.

The phases below outline a "cradle-to-grave" life cycle assessment for ceiling panels (Figure 5), and suspension systems (Figure 6).

Figure 5. Life cycle phases included for the mineral fiber ceiling panels in study:

Figure 6. Life cycle phases included for the steel suspension system in study:



As Shown in Figures 5 and 6, the Cradle-to-Grave Assessment Includes:

- Raw materials production including substrate, coating, and packaging materials for ceiling panels and hot dipped galvanized steel master coil production, forming, and packaging for suspension systems
- Transportation of raw materials to Armstrong manufacturing facility
- Manufacturing of the ceiling panels and suspension system at an Armstrong manufacturing facility
- Packaging of finished products including energy to operate packaging equipment
- Transportation from manufacturing facility to distribution centers, retailers, and job site (assumed to be 500 miles by truck)
- Use phase covers a useful life of 50 years as suggested in the PCR and includes the transportation and installation of the system
- End of life includes landfill disposal of ceiling panels with assumed 50 miles truck transport from job site to landfill

The Cradle-to-Grave Assessment Excludes:

- Overhead energy usage (heating, lighting) of manufacturing facilities
- Maintenance and operation of support equipment

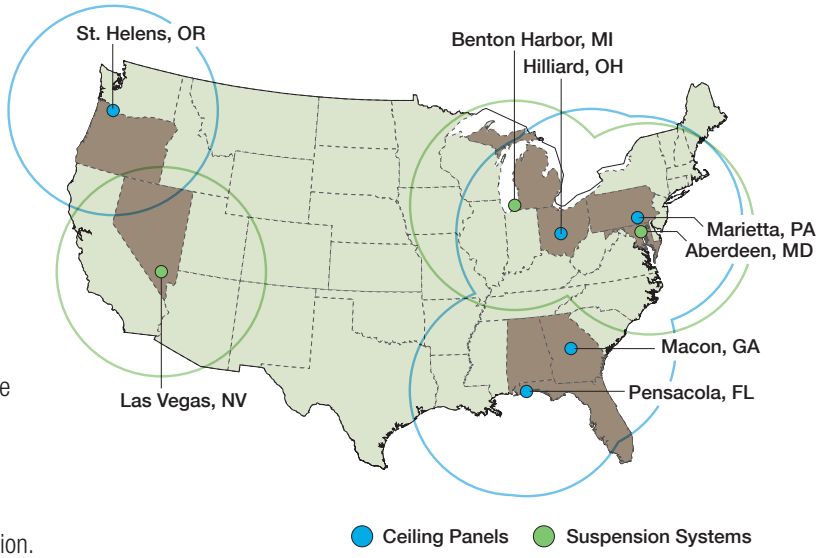
9.0 Life Cycle Assessment (continued)

Assumptions:

Armstrong World Industries began conducting life cycle assessments in 2006 and completed a baseline LCA of key products in 2007. Once the product life cycle impacts were understood, Armstrong began making changes to reduce life cycle impacts, such as global warming potential and primary energy demand. The reductions are outlined in Section 9.3.

All data is reported as a North American weighted average across our ceiling and suspension system plant locations. The majority of Armstrong ceiling products are distributed within 500 miles of the respective manufacturing plants. The same distribution trucks that take material to distribution centers backhaul post-consumer recycled ceiling panels to the manufacturing plants as part of our closed loop reclamation program. If product is not recycled, disposal transportation at end of life is assumed to be 50 miles.

This map shows the location of Armstrong manufacturing facilities with a circle denoting a 500-mile radius from each location.



Transportation emissions and fuels throughout the life cycle phases are included. All transportation associated with raw materials reflects the actual modes of transportation and mileage with the exception of recycled ceilings which assumes a transportation distance of 500 miles by truck.

Cutoff Criteria:

The cutoff criteria for the study are as follows:

- Mass – If a flow is less than 1% of the cumulative mass of the model, it is excluded, providing its environmental relevance is not a concern.
- Energy – If a flow is less than 1% of the cumulative energy of the model, it is excluded, providing its environmental relevance is not a concern.
- Environmental relevance – If a flow meets the above criteria for exclusion, yet is believed to potentially have a significant environmental impact, it is included.

Data Quality:

2007 – 2011 LCA data was used in the compilation of this EPD.

The LCA model was created using the GaBi 5 Software system for life cycle engineering, developed by PE INTERNATIONAL GmbH. The GaBi database provides the life cycle inventory data for several of the raw and process materials obtained from the background system. The data quality is considered to be good to high quality. With the exception of supplier specific data, all other relevant background data was taken from the GaBi database software. With the exception of perlite, no data set was over 10 years old.

All gate-to-gate, primary foreground data was collected for the ceiling panels manufacturing process. Background data was collected from suppliers or generic data was used. When generic data was used, it was verified and triangulated against several sources.

Allocation:

The environmental burden associated with recycled ceiling panels corresponds to the burden of producing the virgin material, which is required to offset the material "lost" to environmental degradation each time the product is recycled. This substitution allocation method applies to the use of recycled ceilings as a raw material because the inherent properties of the ceiling panels are maintained when recycled.

Steel scrap generated during the manufacture of suspension systems was considered a valuable co-product and was addressed with system expansion. To be consistent with the WorldSteel dataset, the scrap steel from the manufacturing process and the steel suspension system at the end of life was given a credit based on the "Value of Steel" model (Avery, 2009). Also, allocation occurred at the end of life phase for ceiling panels as they were partitioned based on 1% overall ceiling panel recycling rate. Credits for electricity and heat gained from thermal recycling of waste and packaging in a solid waste incinerator and/or landfill were not taken in this study.

9.0 Life Cycle Assessment (continued)

9.2 Results of the Life Cycle Assessment

The LCA results are documented separately for the following stages:

1. Production
2. Use
3. End of Life

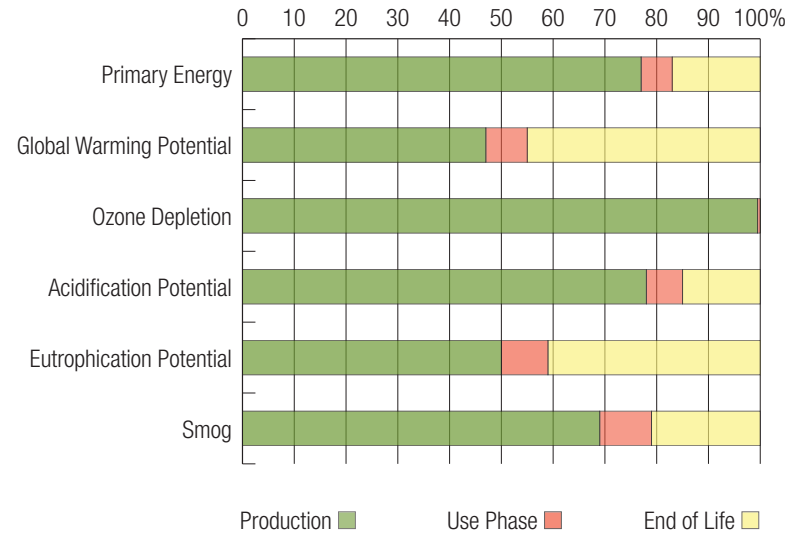
Table 6 shows the results for one declared unit of ceiling panel along with the potential impacts for the total ceiling system.

Table 6: LCA Detail by Life Cycle Stage for One Declared Unit of the Ceiling System Including 1 ft² of Fine Fissured Ceiling Panels and 1 ft² of Prelude XL Suspension System in a 2' x 2' Module, for Use over 50 years*

IMPACT MEASURE	PRODUCTION		USE PHASE		END OF LIFE		TOTAL FINE FISSURED CEILING PANEL ONLY	TOTAL PRELUDE XL SUSPENSION SYSTEM ONLY	TOTAL FINE FISSURED CEILING PANEL + PRELUDE XL SUSPENSION SYSTEM
	FINE FISSURED	PRELUDE XL	FINE FISSURED	PRELUDE XL	FINE FISSURED	PRELUDE XL			
Primary Energy (MJ)	3.5	2.8	0.3	0.2	0.8	-0.1	4.6	2.9	7.5
Global Warming Potential (kg CO_2 equivalent)	0.19	0.22	0.03	0.01	0.18	-0.01	0.40	0.22	0.62
Ozone Depletion (kg CFC-11 equivalent)	4.33E-09	2.56E-09	1.87E-15	4.10E-10	1.37E-14	2.48E-10	4.33E-09	3.22E-09	7.55E-09
Acidification Potential (H^+ moles equivalent)	0.091	0.040	0.008	0.000	0.018	0.000	0.117	0.040	0.157
Eutrophication Potential (kg PO_4 equivalent)	1.68E-04	3.30E-05	2.88E-05	6.53E-06	1.38E-04	2.83E-06	3.36E-04	4.23E-05	3.78E-04
Smog – Photochemical Oxidant Creation Potential (kg O_3-Equiv.)	0.031	0.009	0.004	0.001	0.010	0.000	0.045	0.010	0.055

Figure 7: Life Cycle Impact Assessment of Fine Fissured Ceiling Panels*

Figure 7 shows the relative importance in percentage terms for the Production, Use, and End of Life stages for the ceiling panel.



*Based on U.S. EPA TRACI 2.0 Impact Factors

9.0 Life Cycle Assessment (continued)

Figure 8 shows the sources of primary energy separated into non-renewable and renewable resources. Figures 9 and 10 show the contribution of different resources to renewable and non-renewable primary energy. All figures refer to energy sources used to manufacture Fine Fissured ceiling panels in 2011.

Figure 8: Sources of Primary Energy

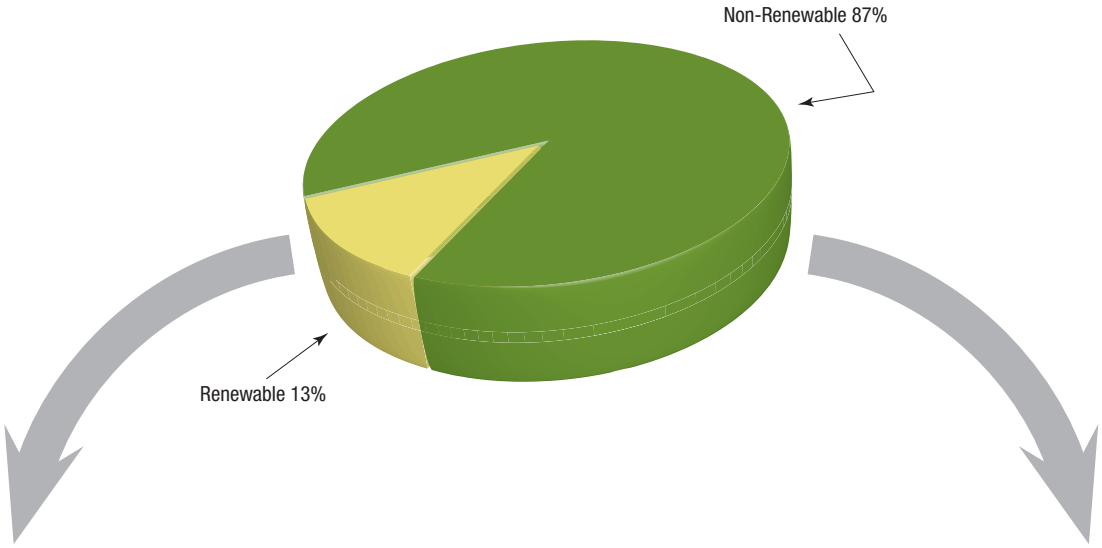


Figure 9: Renewable Energy by Source

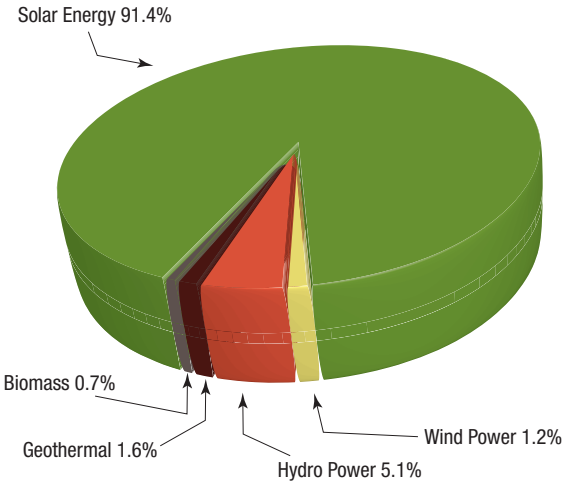
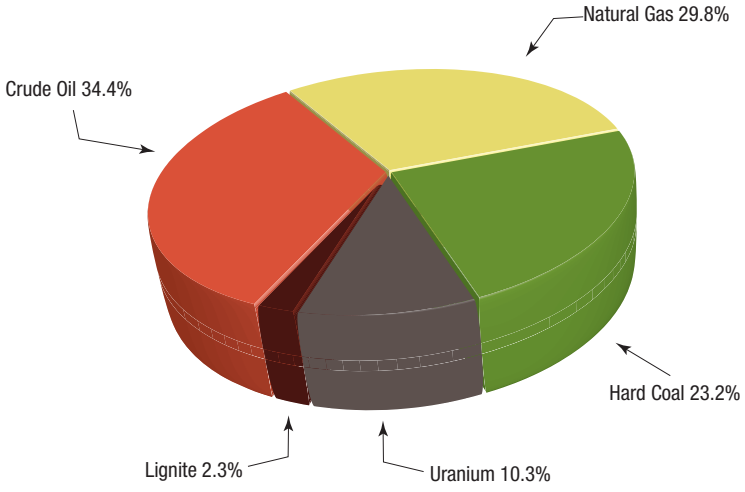


Figure 10: Non-Renewable Energy by Source



9.0 Life Cycle Assessment (continued)

Waste and Water Consumption

The waste shown in Table 7 accounts for the waste generated at Armstrong manufacturing facilities ("Production"). The "Use" phase waste accounts for the disposal of the packaging and scrap materials generated during installation; the quantity of ceiling tiles disposed of following removal from a building is shown in the "End of Life" phase. These waste values do not include the waste generated in the upstream processes. Other waste categories specified in the PCR were excluded due to data quality.

The life cycle of this product consumes water during production while producing non-hazardous wastes. The quantities are separated into contribution per life cycle stage as shown in Table 7 for 1 ft^2 of Fine Fissured Ceiling Panel.

Table 7: Waste and Water Consumption for Fine Fissured Ceiling Panels (1 ft^2)

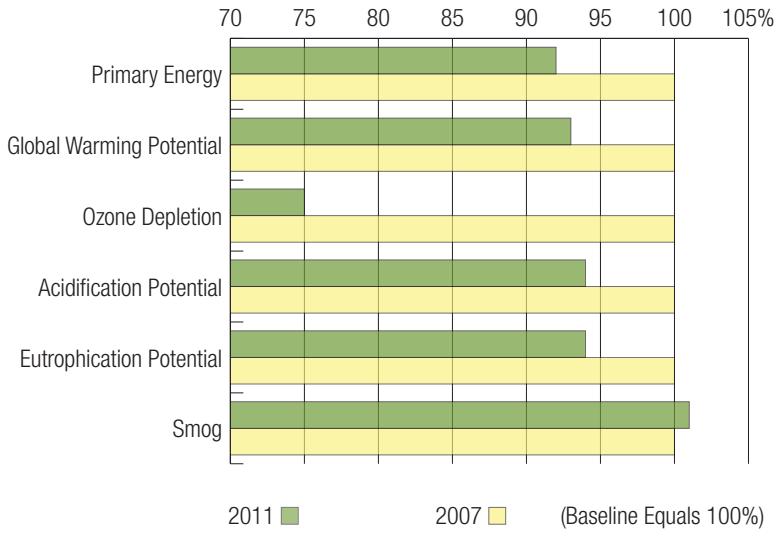
	PRODUCTION	USE	END OF LIFE	TOTAL
Non-hazardous Waste (lbs/ft^2)	0.07	0.08[1]	0.75	0.90
Water Consumption (gal/ft^2)[2]	0.12	0.01	0.03	0.16

[1] Use phase includes 7% installation scrap and all packaging
[2] Water consumption = water use (without rainwater) - water released back to the watershed

9.3 Life Cycle Impact Comparison

Figure 11 shows the comparison of LCA impacts in percent terms, based on 2007 production compared to 2011 for Fine Fissured:

Figure 11: Comparison of Fine Fissured from 2007 to 2011



9.0 Life Cycle Assessment (continued)

9.4 Interpretation of Life Cycle Assessment

From the results of the suspended ceiling system life cycle covered in this study, it was concluded that the ceiling panel manufacturing process and raw materials – specifically, mineral wool in the ceiling panel and steel in the suspension systems – have the greatest impact on Primary Energy Demand (PED) and "carbon footprint" (represented by Global Warming Potential [GWP]).

9.5 Ceiling Panel Impacts:

As shown in Table 6 on page 13, the majority of the environmental impacts for this product occur during the extraction and processing of raw materials detailed in the Production Stage. For most ceiling panels, the opportunity for reduction is in the manufacturing process as well as reductions associated with raw materials. Recycled ceiling panels used in the production process reduce raw material impacts by using less virgin raw materials.

9.6 Suspension System Impacts:

As shown in Table 6 on page 13, the majority of the environmental impacts for the ceiling suspension systems occur during the production of the steel. Heavy-duty suspension system components have greater impacts than intermediate-duty suspension system components, because they contain more steel.

9.7 Use Stage:

Although Armstrong provides a 30-year ceiling system warranty, the use stage is defined in the PCR at 50 years and this is what was used in the LCA. The assumption is that the ceiling system requires no cleaning or maintenance so the impact is very small.

9.8 End of Life Impacts:

End of Life Impacts associated with landfilling and/or incineration of Fine Fissured ceiling panels have the greatest impact on eutrophication and global warming potential as 41% of the eutrophication and 45% of the global warming potential occur during the end of life phase. These impacts are eliminated when ceiling panels are recycled.

10.0 Additional Information, Evidence, Test Certificates

10.1 Bio-Persistence of Mineral Wool Fibers

Slag wool fibers have been classified as "not classifiable as to its carcinogenicity to humans" (Group 3) by the International Agency for Research on Cancer (IARC). The MSDS for this product can be found at http://www.armstrong.com/pdbupimages/190700.pdf as referenced in volume 81.

10.2 VOC Emissions

Fine Fissured product meets the 2010 California Department of Health Services Standard Practice for the testing of VOC Emissions.

11.0 References

11.1 PCR

Product Category Rules for Environmental Product Declarations – ceiling panels for suspended ceiling systems. Confirmed by IBU Advisory Board October 2010

11.2 Standards

EN ISO 14025:2006, Environmental labels and declarations – Type III – environmental declarations - Principles and procedures

EN 14040 ISO 14040:2006, Environmental management – Life cycle assessment – Principles and framework

EN 14044 ISO 14044:2006 Environmental management – Life cycle assessment – Requirements and guidelines

ASTM E1264-08e1 Standard Classification for Acoustic Ceiling Products

ASTM E84-12 Standard Test Method for Surface Burning Characteristics of Building Materials

ASTM C518-10 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus

ASTM C636 / C636M-08 Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels

ASTM C423-09a Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

2010 Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers – Version 1.1 – California

ASTM E1414 / E1414M-11a Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum

12.0 Third Party Evaluations

- Certificate of Compliance for VOC Emissions: Berkeley Analytical
- UL Classified Acoustics
- ICC-ES recognizes Armstrong Seismic Rx® Suspension System as a code compliant solution (ESR-1308)
- Climate Registry certification of our greenhouse gas (GHG) inventories
- Flame Spread Rating (ASTM E84) – Class A

13.0 Quality Assurance

Armstrong has a robust internal Quality Assurance process that is based on industry-accepted best practices and is led by a team of quality professionals who have been certified by the American Society for Quality. The process involves several hundred different measures made throughout the manufacturing processes. In addition, our products are UL labeled for fire and acoustical performance, a process which involves strict oversight by Underwriters Laboratories. The Armstrong acoustical laboratory is ISO 17025 certified and is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP).

14.0 References

Table 8: Life Cycle Impact Assessment Categories, Indicators of Contribution to Environmental Issues, Units of Measure, and Brief Descriptions

IMPACT CATEGORY	INDICATOR	DESCRIPTION	UNIT	REFERENCE
Acidification	Acidification Potential (AP)	A measure of emissions that cause acidifying effects to the environment. The acidification potential is assigned by relating the existing S^-, N^-, and halogen atoms to the molecular weight.	mol H^+ equivalent	J. Bare, TRACI: The Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts 2.0, 2011.
Climate Change	Global Warming Potential (GWP)	A measure of greenhouse gas emissions, such as CO_2 and methane. These emissions are causing an increase in the absorption of radiation emitted by the earth, magnifying the natural greenhouse effect.	kg CO_2 equivalent	Intergovernmental Panel on Climate Change (IPCC). IPCC Guidelines for National Greenhouse Gas Inventories 2006.
Eutrophication	Eutrophication Potential (EP)	An indicator of the potential to cause an increase in biomass production. In water, this can lead to algal blooms resulting in oxygen depletion that affects higher species such as fish. Undesirable shifts in numbers of species can also occur, resulting in a threat to biodiversity.	kg Nitrogen equivalent	J. Bare, TRACI: The Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts 2.0, 2011.
Ozone Creation	Photochemical Oxidant Potential (POCP)/Smog Potential	A measure of emissions of precursors that contribute to low level smog, produced by the reaction of nitrogen oxides and VOC's under the influence of UV light.	kg NO_X equivalent	J. Bare, TRACI: The Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts 2.0, 2011.
	Primary Energy Demand	A measure of the total amount of primary energy extracted from the earth. PED is expressed in energy demand from non-renewable resources (e.g., petroleum, natural gas, etc.) and energy demand from renewable resources (e.g., hydropower, wind energy, solar, etc.). Efficiencies in energy conversion (e.g., power, heat, steam, etc.) are taken into account.	MJ	
	Water Consumed	Water consumption is the sum of all water inputs to the life cycle. Includes water required for production of raw materials, upstream datasets, and manufacturing processes. Does not capture the end of life of the water consumed.	gal/ft^2	
	Waste Disposed	Waste disposed is the sum of all waste outputs from the life cycle. This includes hazardous and non-hazardous wastes and does not capture end of life of the waste generated.	lbs/ft^2	

14.1 Definitions

GaBi 5.0 – LCA Modeling Software

TRACI 2.0 – (Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts) is an impact assessment tool developed by EPA for Sustainability Metrics, Life Cycle Assessment, Industrial Ecology, Process Design, and Pollution Prevention. The impact categories in TRACI include acidification, ecotoxicity, eutrophication, fossil fuel depletion, global warming, human health cancer, human health criteria, human health non-cancer, ozone depletion, and smog formation. The categories were selected based on their level of commonality with existing literature in this area, consistency with EPA regulations and policies, current state of development, and perceived societal value. TRACI was developed specifically for the U.S. using input parameters consistent with U.S. locations.