ENVIRONMENTAL PRODUCT DECLARATION

POLYISOCYANURATE SHEATHING

AP BREATHING SHEATHING ● CI MAX® FOAM SHEATHING ● AP FOIL-FACED FOAM SHEATHING

Think JM.

Johns Manville
A Berkshire Hathaway Company

Johns Manville (JM) is a global manufacturer of premium-quality building products for insulation, roofing, fibers and nonwovens for commercial, industrial and residential applications.

We ensure that each of our products not only performs, but also contributes to the health, safety, and sustainability of the environments where they are used.

We strive to ensure that our products meet the rigorous demands of their applications while focusing on finding new ways to reduce our environmental footprint, and we want to provide you with reliable materials that will allow you to do the same.

The use of JM's products improves energy efficiency in homes and buildings as the quickest and most cost-effective way to reduce energy use and lower greenhouse gas emissions.

People ● Passion ● Perform ● Protect

UL CERTIFIED ENVIRONMENTAL PRODUCT DECLARATION UL.COM/EPD

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AP™ BREATHING SHEATHING – CI MAX® FOAM SHEATHING – AP™ FOIL-FACED FOAM SHEATHING
BUILDING ENVELOPE INSULATION

According to ISO 14025, EN 15804, and ISO21930:2017

EPD PROGRAM AND PROGRAM OPERATOR NAME, ADDRESS, LOGO, AND WEBSITE	UL Environment 333 Pfingsten Road Northbrook, IL 60611 WWW.UL.COM www.spot.ul.com
GENERAL PROGRAM INSTRUCTIONS AND VERSION NUMBER	Program Operator Rules v2.7 2022
MANUFACTURER NAME AND ADDRESS	Johns Manville 717 17th St, Denver, CO 80202
DECLARATION NUMBER	4790545973.105.1
DECLARED PRODUCT & FUNCTIONAL UNIT OR DECLARED UNIT	1 m^2 of polyisocyanurate sheathing insulation with a thickness that gives an average thermal resistance RSI = 1m^2 K/W.
REFERENCE PCR AND VERSION NUMBER	Part A: Product Category Rules for Building-Related Products and Services, UL 10010, v3.2 Part B: Building Envelope Thermal Insulation EPD Requirements, UL 10010-1
DESCRIPTION OF PRODUCT APPLICATION/USE	Building Envelope Insulation
PRODUCT RSL DESCRIPTION (IF APPL.)	N/A
MARKETS OF APPLICABILITY	North America
DATE OF ISSUE	September 28, 2022
PERIOD OF VALIDITY	5 Years
EPD TYPE	Company specific
RANGE OF DATASET VARIABILITY	N/A
EPD SCOPE	Cradle to gate with end-of-life options (C1-C4)
YEAR(S) OF REPORTED PRIMARY DATA	September 2020 to August 2021
LCA SOFTWARE & VERSION NUMBER	GaBi 10.5
LCI DATABASE(S) & VERSION NUMBER	GaBi 2021 (CUP 2021.2)
LCIA METHODOLOGY & VERSION NUMBER	TRACI 2.1 and CML v4.2

The PCR review was conducted by:	UL Environment PCR Review Panel epd@ul.com
This declaration was independently verified in accordance with ISO 14025: 2006. ☐ INTERNAL ☒ EXTERNAL	Cooper McCollum, UL Environment
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	James Mellentine, Thrive ESG

LIMITATIONS

Exclusions: EPDs do not indicate that any environmental or social performance benchmarks are met, and there may be impacts that they do not encompass. LCAs do not typically address the site-specific environmental impacts of raw material extraction, nor are they meant to assess human health toxicity. EPDs can complement but cannot replace tools and certifications that are designed to address these impacts and/or set performance thresholds – e.g. Type 1 certifications, health assessments and declarations, environmental impact assessments, etc.

Accuracy of Results: EPDs regularly rely on estimations of impacts; the level of accuracy in estimation of effect differs for any particular product line and reported impact.

Comparability: EPDs from different programs may not be comparable. Full conformance with a PCR allows EPD comparability only when all stages of a life cycle have been considered. However, variations and deviations are possible". Example of variations: Different LCA software and background LCI datasets may lead to differences results for upstream or downstream of the life cycle stages declared.

Product Definition and Information

Description of Company/Organization

For more than 160 years, Johns Manville (JM) has been dedicated to providing products that create stronger buildings, improve energy efficiency, and contribute to the health and comfort of building occupants.

JM manufactures premium-quality building and mechanical insulation, commercial roofing, glass fibers and nonwoven materials for commercial, industrial, and residential applications. JM products are used in a wide variety of industries including building products, aerospace, automotive and transportation, filtration, commercial interiors, waterproofing and wind energy.

JM employs 7,000 people globally and provides products to more than 85 countries. JM operates 44 manufacturing facilities in North America, Europe, and China. Since 1988, JM's global headquarters has been located in downtown Denver, Colorado.

Product Description

Product Identification

This environmental product declaration covers the following polyisocyanurate sheathing products from Johns Manville:

- AP™ Breathing Sheathing

AP™ Breathing Sheathing Polyiso Continuous Insulation board is a breathable continuous polyiso insulation, which is designed to be semi vapor permeable. AP Breathing Sheathing consists of a uniform closed-cell polyisocyanurate foam core bonded to a coated glass facer on both sides of the board.

- AP™ Foil-faced Foam Sheathing

AP™ Foil-Faced Polyiso Continuous Insulation board consists of a uniform closed-cell polyisocyanurate foam core bonded on each side to a foil facer. One side has a reflective foil facer and the other side has a white non-reflective foil facer to suit your building needs. It functions as a water-resistive barrier, vapor barrier and air barrier, eliminating the need to install additional components.

- CI Max ® Foam Sheathing

CI Max® is a high efficiency rigid foam sheathing designed for exposed interior applications. It is composed of a uniform closed-cell polyisocyanurate foam core with a glass-mat reinforced 1.5 mil embossed aluminum facer that is meant to be left exposed. CI Max foam sheathing is approved for use without a thermal barrier and provides an attractive and durable interior finish.

Figure 1: CI Max® Foam Sheathing

Product Specification

There are a variety of different polyisocyanurate products with unique performance characteristics to accommodate varied applications – from high-compressive strength to 25/50 flame/smoke requirements.

Product Average

This EPD is intended to represent company-specific polyisocyanurate sheathing products. The production data used to develop this EPD consider all manufacturing activities at the Johns Manville sites in Jacksonville (FL), Fernley (NV), Bremen (IN) in the United States, and Cornwall (ON) Canada. Results are weighted according to production totals at the facilities. Use of this EPD is limited to Johns Manville.

Application

Polyisocyanurate foam insulation is suitable for applications that require low flammability insulation. Polyiso products provide a continuous layer of insulation to reduce thermal bridging and improve energy efficiency. These insulation solutions are designed for both residential and commercial construction such as masonry, framed walls or ceilings.

Declaration of Methodological Framework

This EPD is declared under a “cradle-to-installation with end-of-life” system boundary. As such, it includes life cycle stages A1-A5 and C1-C4. It should be noted here that, C1 and C3 are to be reported as zero as they are assumed to fall below the cut-off criteria defined by ISO 21930. C2 is assumed as 20 km by truck.

Per the PCR (UL Environment, 2018), the assessment was conducted using a building service life of 75 years.

Technical Requirements

The technical specifications apply to products considered in this EPD:

- ASTM C1289 – Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
- ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation (Trymer only)

Additionally, the the following fire-related standards and test methods apply:

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

Properties of Declared Product as Delivered

Polyisocyanurate foam is delivered to the site of installation as packaged.

Material Composition

Table 1 provides the average material content of polyisocyanurate sheathing.

Table 1: Polyisocyanurate sheathing material content

COMPONENT	CONTENT [% WEIGHT]
MDI	67.6%
Polyester polyol	15.6%
Polyether polyol	3.1%
Epoxy resin	2.8%
Flame retardant	1.9%
Cyclopentane-Isopentane	5.6%
Gel catalyst	0.3%
Amine catalyst	0.2%

A-Side surfactant	0.6%
B-Side surfactant	0.9%
Polyglycol	1.2%

Manufacturing

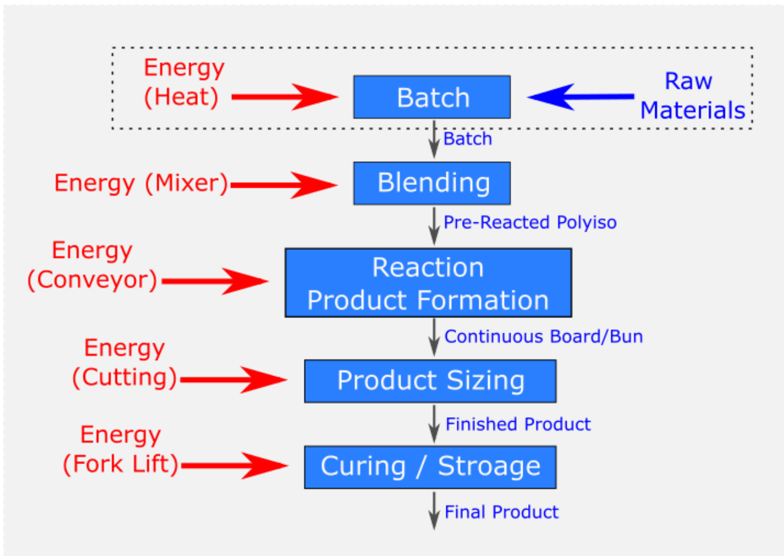


Figure 2: Flow diagram for the manufacturing of polyisocyanurate sheathing products

Polyisocyanurate (Polyiso) rigid foam insulation is composed of closed-cell rigid polyiso foam produced through the chemical reaction of an “A” side (MDI) and a “B” side (polyester polyol with various additives such as catalysts, surfactants, and flame retardant) plus a blowing agent. For polyiso sheathing, the foam is laid onto a foil-faced paper facer, where it is then sent through a laminator that is designed to cure the foam. The material is then cut to size, stacked, and packaged for shipment. The JM manufacturing process for polyiso insulation at a typical manufacturing facility is illustrated in Figure 2 above.

Packaging

Packaging for shipment comprises shrink film and polyester bags.

Transportation

Primary data included transportation distances via truck or rail for the transport of the raw materials to the production facilities. Transport of the finished product to the construction site is also accounted for, along with the transportation of construction wastes and the deconstructed product at end-of-life to disposal facilities. Distribution of the finished product is assumed to be volume-limited rather than mass-limited, with a utilization rate of 28% of mass capacity.

Product Installation

Johns Manville polyiso sheathing products are lightweight and can be easily cut with a utility knife or saw. Use maximum board lengths to minimize the number of joints. Vertical joints should be staggered. Butt joints should be centered over framing. To create a water-resistive barrier or an air barrier, treat seams and penetrations as instructed in the installation guide and in accordance with manufacturer's guidelines. Once installed, AP foil-faced polyiso continuous insulation may be left exposed for up to 60 days. Consult your local building department for code requirements. Specific installations instructions can be found on JM.com for AP foil-faced products use with wall systems, wall bracing, below grade applications, exterior wall, sheathing boards, and vaulted ceiling.

Use

Polyiso foam insulation is assumed to have a reference service life of 75 years, equal to that of the building. Once installed, insulation does not directly consume energy, but instead contributes to a reduction in the amount of energy required to heat and cool the building. The insulation requires no maintenance, and there are no parts to repair or refurbish. Any reduction in building operational energy consumption associated with insulation use needs to be considered on the level of the individual building and is considered outside the scope of this LCA.

Reference Service Life and Estimated Building Service Life

The use phase is considered to be burden-free for insulation products as they require no maintenance and have a 75-year reference service life equal to that of the entire building.

Reuse, Recycling, and Energy Recovery

Polyisocyanurate insulation foams are typically not reused or recycled following its removal from a building. Although recycling is feasible, there are minimal recycling programs and infrastructure; therefore, current practice is to send the waste to a landfill. Thus, reuse, recycling, and energy recovery are not applicable for this product.

Disposal

At end-of-life, insulation is removed from the deconstructed building. Wastes are then disposed in a landfill. While insulation can theoretically be reused or recycled, doing so is not common practice in the industry. Therefore, the analysis assumes that after removal, the insulation is transported to the disposal site and landfilled.

Life Cycle Assessment Background Information

Functional Unit

Per the product category rules, the functional unit for this analysis is:

1 m^2 of insulation material with a thickness that gives an average thermal resistance R_{SI} = 1m^2 K/W.

Table 2: Functional unit (with product technical details)

	Area [m^2]	R_{SI} [m^2K/W]	R_{US} [BTU/(h°F ft^2)]	RSL [years]	Thickness [in]	Density [kg/m^3]	Mass [kg]
Functional Unit	1	1	5.68	75	0.89	27.5	0.62

System Boundary

Table 3 represents the system boundary and scope.

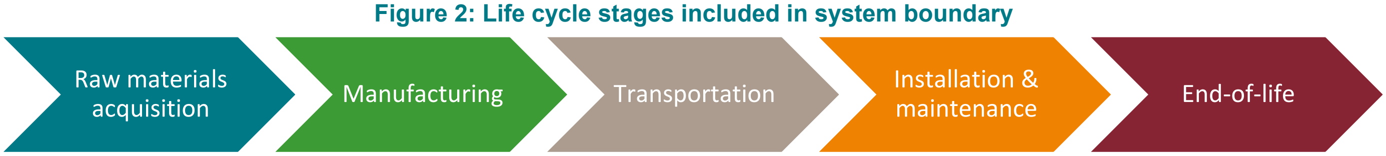
Table 3: Description of the system boundary modules

	PRODUCT STAGE			CONSTRUCT-ION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY
	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
	Raw material supply	Transport	Manufacturing	Transport from gate to site	Assembly/Install	Use	Maintenance	Repair	Replacement	Refurbishment	Building Operational Energy Use During Product Use	Building Operational Water Use During Product Use	Deconstruction	Transport	Waste processing	Disposal	Reuse, Recovery, Recycling Potential
EPD Type	X	X	X	X	X	MND	MND	MND	MND	MND	MND	MND	X	X	X	X	MND

This study covers the life cycle of the products from cradle to gate (installation) with end of life options. Within these boundaries, the following stages were included as per Figure 2 below:

- **Raw materials acquisition:** Raw material supply (including virgin and recycled materials), inbound transport
- **Manufacturing:** Production of insulation, product packaging, manufacturing waste, releases to environment
- **Transportation:** Distribution of the insulation product from the manufacturer to a distributor (if applicable) and from there, to the building site
- **Installation and Maintenance:** Installation process, installation wastes and releases to the environment, maintenance under normal conditions
- **End-of-Life:** Dismantling/demolition, transport to final disposal site, final disposition

Figure 2: Life cycle stages included in system boundary



Building operational energy and water use are considered outside of this study's scope: any beneficial impact that the use of insulation may have on a building's energy consumption is not calculated or incorporated into the analysis.

Estimates and Assumptions

The analysis uses the following assumptions:

- Insulation is assumed to have a 75-year reference service life, equal to that of the building.
- Installation is done by hand and assumed to have a negligible scrap rate.
- If inbound transportation distances were not provided for materials used in manufacturing, an assumption of 250 miles transport via truck was applied in the model.

Since primary data were not available to describe end-of-life treatment, the default values specified by the PCR Part A (UL Environment, 2018) were applied (Table 4).

Table 4. Default end-of-life assumptions from the PCR

COMPONENT	RECYCLED	LANDFILLED	INCINERATED
Product	0%	100%	0%
Paper packaging	75%	20%	5%
Plastic packaging	15%	68%	17%

Cut-off Criteria

Cut-off criteria were applied to capital equipment production and maintenance under the assumption that the impacts associated with these aspects were sufficiently small enough to fall below cut-off when scaled down to the functional unit. Otherwise, all energy and material flow data available were included in the model.

Data Sources

The LCA model was created using the GaBi 10.5 Software system for life cycle engineering, developed by Sphera Inc. (Sphera, 2021). Background life cycle inventory data for raw materials and processes were obtained from the GaBi CUP 2021.2 database. Primary manufacturing data were provided by Johns Manville.

Data Quality

A variety of tests and checks were performed throughout the project to ensure high quality of the completed LCA. Checks included a review of project specific LCA models as well as the background data used.

Geographical Coverage

In order to satisfy cut-off criteria, proxy datasets were used as needed for raw material inputs to address lack of data for a specific material or for a specific geographical region. These proxy datasets were chosen for their representativeness of the actual product. Additionally, European data or global data were used when North American data (for raw materials sourced in the US) were not available.

Temporal Coverage

Foreground data for each manufacturer represent a continuous 12-months over September 2020 to August 2021 calendar year. The majority of background datasets are based on data from the last 10 years (since 2017).

Technological Coverage

The primary data represent production of the products under evaluation. Secondary data were chosen to be specific to the technologies in question (or appropriate proxy data used where necessary).

Completeness

Foreground processes were checked for mass balance and completeness of the emissions inventory. No data were knowingly omitted.

Period under Review

Primary data collected represent production during the September 2020 to August 2021. This analysis is intended to represent production from September 2020 to August 2021.

Allocation

No multi-output (i.e., co-product) allocation was performed in the foreground system of this study. No known flows are deliberately excluded from this EPD.

Allocation of background data (energy and materials) taken from the GaBi 2021 databases is documented online at https://sphera.com/wp-content/uploads/2020/04/Modeling-Principles-GaBi-Databases-2021.pdf.

Allocation of manufacturing material and energy inputs was done on a mass basis. Allocation of transportation was based on mass while considering the utilization rate.

For recycled content and disposal at end-of-life, system boundaries were drawn consistent with the cut-off allocation approach. Likewise, the system boundary was drawn to include landfilling of fiberglass at end-of-life (following the polluter-pays principle) but exclude any avoided burdens from material or energy recovery.

Data collection was performed by Johns Manville reaching out directly to plant facility managers. Specific data were collected for raw material use; however, energy use posed a considerable challenge to attribute to the products. The only exception was natural gas, where process-level boiler and furnace energy use was available. For electricity and other facility fuel use, only site-level and multi-process data were available. These data were normalized by the mass of product manufactured at the facility over the temporal scope. Air emissions were also unavailable at the process-level; therefore, a facility air emission report was leveraged to attribute the emissions to per declared unit of product.

Comparability

No comparisons or benchmarking is included in this EPD.

Life Cycle Assessment Scenarios

Polyisocyanurate sheathing insulation requires no maintenance, and there are no parts to repair or refurbish. The reference service life for the polyiso sheathing insulation product is 75 years. Installation is done by hand with only packaging waste generated during that step.

Table 5. Transport to the building site (A4)

NAME	VALUE	UNIT
Fuel type	Diesel	
Liters of fuel	0.0011	L/100 km
Vehicle type	Heavy Duty Truck	
Transport distance	402	km
Capacity utilization (including empty runs, mass based	67	%
Gross density of products transported	27.5	kg/m³

Table 6. Installation into the building (A5)

NAME	VALUE	UNIT
Ancillary materials (plastic packaging)	0.00683	kg

Table 7. End of life (C1-C4)

NAME		VALUE	UNIT
Assumptions for scenario development (description of deconstruction, collection, recovery, disposal method and transportation)		landfill	100%
Collection process (specified by type)	Collected separately	-	kg
	Collected with mixed construction waste	0.627	kg
Recovery (specified by type)	Reuse	-	kg
	Recycling		kg
	Landfill	0.627	kg
	Incineration	-	kg
	Incineration with energy recovery	-	kg
	Energy conversion efficiency rate	-	
Disposal (specified by type)	Product or material for final deposition	0.627	kg
Removals of biogenic carbon (excluding packaging)		-	kg CO_2

Life Cycle Assessment Results

The following results are based on a functional unit of 1 m^2 of polyisocyanurate sheathing insulation. The following results exclude biogenic carbon as there are no relevant biogenic carbon removals or emissions in the life cycle. There is no calcination, carbonation and combustion of waste from non-renewable sources.

Impact assessment and other results are shown for a cradle-to-installation with end-of-life options (C1-C4). Modules C1 and C3 are not associated with any impact and are therefore declared as zero.

Life Cycle Impact Assessment Results

Table 8. North American Impact Assessment Results for 1 m^2 of polyisocyanurate insulation (R_{SI} = 1 m^2K/W)

TRACI v2.1	UNITS	A1- A3 PRODUCT STAGE	A4 PRODUCT DELIVERY	A5 CONSTRUCTION STAGE	C2 TRANSPORT TO END OF LIFE	C4 DISPOSAL AT END OF LIFE
Global warming potential	kg CO2 eq.	2.88E+00	2.03E-02	3.06E-03	1.62E-03	2.73E-02
Depletion potential of stratospheric ozone	kg CFC 11 eq.	4.80E-10	3.98E-18	8.60E-19	3.18E-19	9.11E-17
Acidification potential	kg SO2 eq.	4.66E-03	9.31E-05	1.73E-06	4.54E-06	1.16E-04
Eutrophication potential	kg N eq.	3.75E-04	8.87E-06	1.25E-06	5.23E-07	6.47E-06
Smog formation potential	kg O3 eq.	9.55E-02	2.15E-03	2.16E-05	1.03E-04	2.06E-03
Abiotic depletion potential for fossil resources	MJ	7.81E+00	3.73E-02	5.46E-04	2.99E-03	5.31E-02

Table 9. EU Impact Assessment Results for 1 m² of polyisocyanurate insulation (R_{SI} = 1 m²K/W)

CML v4.2	Units	A1- A3 Product Stage	A4 Product delivery	A5 Construction Stage	C2 Transport to End of Life	C4 Disposal at End of Life
Global warming potential	kg CO2 eq.	2.80E+00	2.01E-02	3.05E-03	1.60E-03	2.68E-02
Depletion potential of stratospheric ozone	kg R11 eq.	4.80E-10	3.98E-18	8.60E-19	3.18E-19	9.11E-17
Acidification potential	kg SO2 eq	3.97E-03	6.77E-05	1.51E-06	3.35E-06	1.07E-04
Eutrophication potential	kg P eq.	8.71E-04	1.98E-05	1.32E-06	1.04E-06	1.44E-05
Photochemical oxidant creation potential	kg Eth eq.	6.46E-04	-2.46E-05	3.16E-08	-1.13E-06	1.02E-06
Abiotic depletion potential, fossil resources	MJ	5.78E+01	2.80E-01	4.44E-03	2.24E-02	4.08E-01
Abiotic depletion potential, elements	kg Sb eq.	1.07E-05	6.26E-09	1.25E-10	5.01E-10	1.18E-08

Life Cycle Inventory Results

Table 10. Resource Use for 1 m² of polyisocyanurate insulation for 1 m² of polyisocyanurate insulation (R_{SI} = 1 m²K/W)

	Units	A1- A3 Product Stage	A4 Product delivery	A5 Construction Stage	C2 Transport to End of Life	C4 Disposal at End of Life
Renewable primary energy as energy carrier	MJ	1.85E+00	1.16E-02	3.27E-04	9.29E-04	3.47E-02
Renewable primary energy resources as material utilization	MJ	-	-	-	-	-
Total use of renewable energy resources	MJ	1.85E+00	1.16E-02	3.27E-04	9.29E-04	3.47E-02
Non-renewable primary energy as energy carrier	MJ	4.31E+01	2.82E-01	4.57E-03	2.25E-02	4.17E-01
Non-renewable primary energy as material utilization	MJ	1.64E+01	-	-	-	-
Total use of non-renewable primary energy resources	MJ	5.95E+01	2.82E-01	4.57E-03	2.25E-02	4.17E-01
Use of secondary material	kg	-	-	-	-	-
Use of renewable secondary fuels	MJ	-	-	-	-	-
Use of non-renewable secondary fuels	MJ	-	-	-	-	-
Use of recovered energy	MJ	-	-	-	-	-
Use of net fresh water	m³	1.60E-02	4.96E-05	5.58E-06	3.97E-06	5.73E-05

Table 11. Output Flows and Waste Categories for 1 m² of polyisocyanurate insulation (R_{SI} = 1 m²K/W)

	Units	A1- A3 Product Stage	A4 Product delivery	A5 Construction Stage	C2 Transport to End of Life	C4 Disposal at End of Life
Hazardous waste disposed	kg	2.82E-06	2.36E-11	4.02E-13	1.88E-12	3.94E-11
Non-hazardous waste disposed	kg	2.27E-02	2.59E-05	4.88E-03	2.07E-06	6.21E-01
High level radioactive waste disposed	kg	7.62E-07	9.49E-10	5.91E-11	7.60E-11	4.02E-09
Intermediate and low-level radioactive waste disposed	kg	2.12E-05	2.61E-08	1.60E-09	2.09E-09	1.07E-07
Components for re-use	kg	-	-	-	-	-
Materials for recycling	kg	-	-	1.02E-03	-	-

Materials for energy recovery	kg	-	-	-	-	-
Exported energy	MJ	-	-	-	-	-

Facility-Specific GWP Results

Johns Manville's polyisocyanurate product is manufactured at five different facilities. The results presented below represent a production-weighted average of these facilities. To understand how the GWP may vary between sites, facility-specific GWP100 results are presented below.

Table 12. Facility-specific GWP results

IPCC AR5 GWP 100 (kg CO_2 eq)	A1- A3 Product Stage	A4 Product Delivery	A5 Construction Stage	C2 Transport to End of Life	C4 Disposal at End of Life
Jacksonville, Florida (US)	2.97E+00	2.03E-02	3.07E-03	1.62E-03	2.73E-02
Fernley, Nevada (US)	3.05E+00	2.03E-02	3.07E-03	1.62E-03	2.73E-02
Cornwall, Ontario (Canada)	3.02E+00	2.03E-02	3.07E-03	1.62E-03	2.73E-02
Bremen, Indiana (US)	2.88E+00	2.03E-02	3.06E-03	1.62E-03	2.73E-02

Scaling to Other R-values

Environmental performance results are presented per functional unit, defined as 1 m^2 of insulation product that can deliver R_{SI} = 1 m^2K/W. In the United States, insulation is typically purchased based on R-value stated in units of $ft^2 \cdot °F \cdot hr/Btu$. Environmental impacts per square meter of these alternative R-values can be calculated by multiplying the above results by scaling factors presented in Table 13.

Table 13. Scaling Factors to Other R-values

Customary US R-value	Thickness [in]	Scaling factor per 1 m^2 of R_{SI} = 1
R-11	3.2	2.20
R-13	3.8	2.64
R-19	5.6	3.52
R-22	6.5	4.40
R-30	8.8	5.72
R-38	11.2	7.48
R-49	14.4	9.68

$$\text{Polyiso impact per } m^2 \text{ (R-xx)} = \text{Impact scaling factor (R-xx)} \times \text{Polyiso impact per } m^2 \ (R_{SI} = 1)$$

LCA Interpretation

The manufacturing stage dominates the majority of impact categories due to the raw materials required for polyiso production such as MDI and polyester polyol. Outbound transport accounts for relevant contributions to the eutrophication potential and smog formation potential impact categories. For other impact categories, outbound transport is a minor contributor.

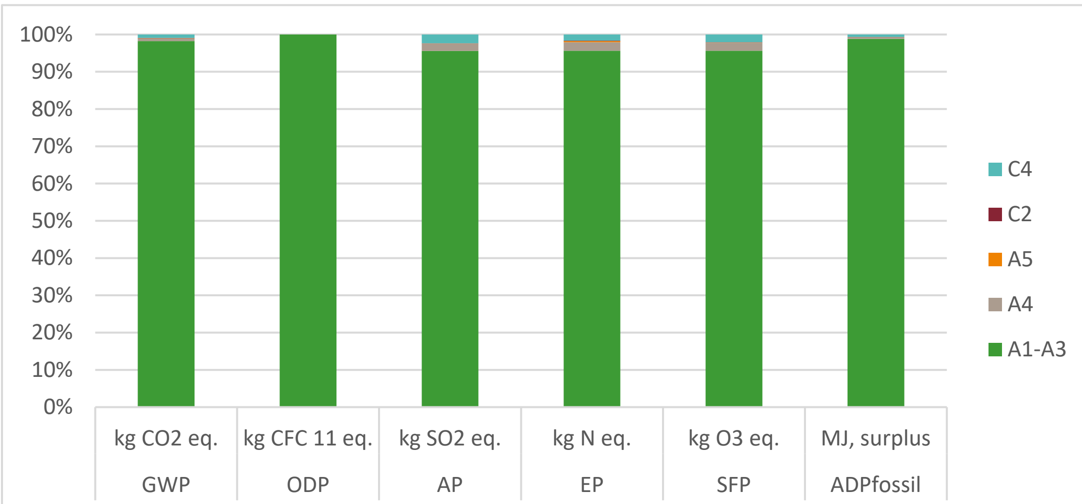


Figure 3. Results per life cycle stages

Installation accounts for a small fraction of overall life cycle impact given that minimal resources are required to install. There is no impact associated with the use stage. While insulation can influence building energy performance, this aspect is outside the scope of this study. Additionally, it is assumed that insulation does not require any maintenance to achieve its reference service life, which is modeled as being equal to that of the building (i.e., 75 years). No replacements are necessary; therefore, results represent the production of one (1) square meter of insulation at a thickness defined by the PCR functional unit.

The use of JM's products improve energy efficiency in homes and buildings as the quickest and most cost-effective way to reduce energy use and lower greenhouse gas emissions. At end-of-life, insulation is removed from the building and landfilled. Waste was dominated by the end-of-life disposal of the product. Non-hazardous waste also accounts for waste generated during manufacturing and installation.

Additional Environmental Information

Environment and Health During Manufacturing

Johns Manville insulation products are designed, manufactured and tested in our own facilities, which are certified and registered to the stringent ISO 9001 (ANSI/ASQC 90) and ISO 14001 quality and environmental standards. These certifications, along with regular, independent third-party auditing for compliance, is your assurance that JM products deliver consistent high quality.

Johns Manville polyiso sheathing is produced with an EPA-compliant hydrocarbon-based blowing agent that has zero Ozone Depletion Potential (ODP) and virtually no Global Warming Potential (GWP); it also meets both CFC- and HCFC-free specification requirements. Polyiso is one of North America's most widely used insulation products and has been cited by the EPA for its responsible impact on the environment.

Building Use Stage Benefits

Sustainable insulation requires no additional energy or maintenance in order to perform during the life of service. Polyisocyanurate insulation is effective in helping reduce heat flow, reduce unwanted noise, and control moisture.

Environment and Health During Installation

Safety glasses and gloves are recommended during installation of the product.

Extraordinary Effects

Fire

Polyisocyanurate sheathing insulation must be protected from open flame because it is combustible and shall only be used as specified by the local building code with respect to flame spread classification and to the use of a suitable thermal barrier when required.

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