EPS Insulation Advancements
& Technology Innovations

TECHNICAL BRIEF

Polystyrene Foam Insulation Environmental Footprint

EPS Outperforms XPS in Several Key Environmental Impact Categories

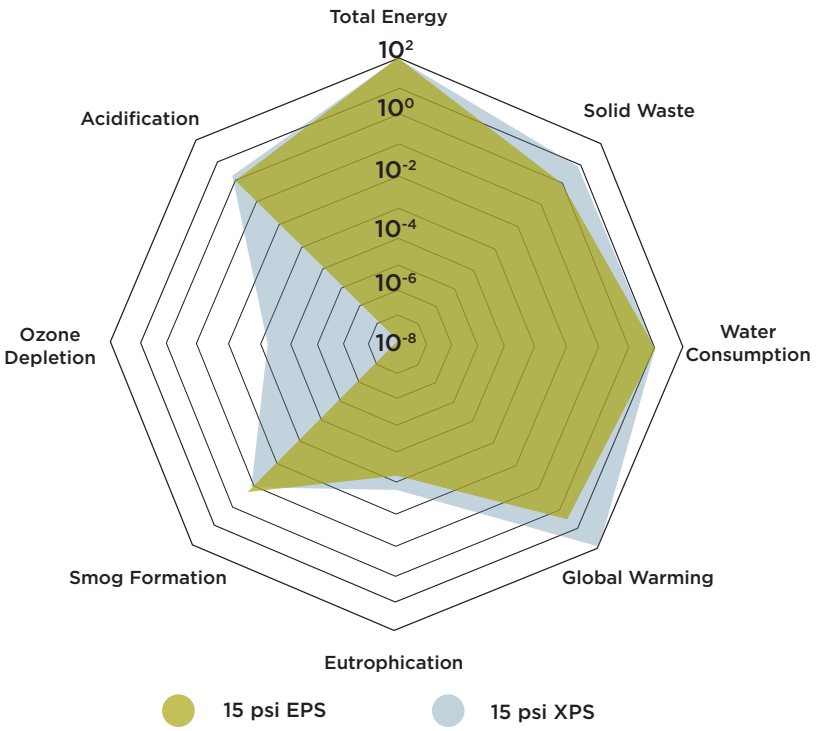
Environmental Product Declarations (EPDs) are based upon a Life Cycle Assessment (LCA) of the environmental impacts of a product over its life cycle. EPDs for insulation products were conducted according to the Product Category Rule (PCR) "Building Envelope Thermal Insulation".[1] EPDs based on the same PCR can be used to make informed comparisons as noted in Section 4 of ISO 14025.[2] The insulation PCR identifies eight environmental impact categories to be considered in an EPD.

The EPS Industry Alliance (EPS-IA) conducted a comparison of its expanded polystyrene (EPS) insulation EPD[3] with the average EPD results for Dow[4] (now Dupont) and Owens Corning[5] extruded polystyrene (XPS) insulation.

The most widely used green building certification program, LEED (Leadership in Energy and Environmental Design), recognizes buildings that contain products with favorable environmental impacts as determined through EPDs. Recognition as a preferred product requires that the product demonstrate an environmental impact less than the industry average in at least three of the following categories: global warming, ozone depletion, acidification, eutrophication, smog formation and total energy.[6] For polystyrene foam insulation, EPS is less than the industry average in four of the categories, thus meeting the optimization requirement. From a LEED perspective, EPS is a preferred product in the polystyrene foam insulation category.

EPS insulation significantly outperforms XPS insulation in several environmental impact categories: Ozone Depletion Potential, Global Warming Potential and Eutrophication.

Figure 1: Comparison of LCA Impact Categories



EPS Industry Alliance 1298 Cronson Blvd. Suite 201 Crofton, MD 21114 800-607-3772 www.epsindustry.org

*Table 1: Environmental Impacts for RCPS Insulation**

IMPACT CATEGORY[1]	Units of Measure	EPS 15 psi	XPS 15 psi	Relative Ratio XPS/EPS
Ozone Depletion	(kg CFC-11 eq)	2.2×10^{-8}	4.8×10^{-4}	22,000
Global Warming	(kg CO_2 eq)	3.77	71.3	19
Smog Formation	(kg O_3 eq)	0.27	0.18	0.67
Eutrophication	(kg N eq)	4.9×10^{-4}	1.7×10^{-3}	3.6
Acidification	(mol H+eq)	0.62	1.19	1.9
Water Consumption	(L)	13.4	17.5	1.3
Total Energy	(MJ)	96.4	75.8	0.79
Solid Waste	(kg)	1.01	0.733	0.73

*Based on RSI=1 (R-value=5.68) and 15 psi compressive strength.

Methodology

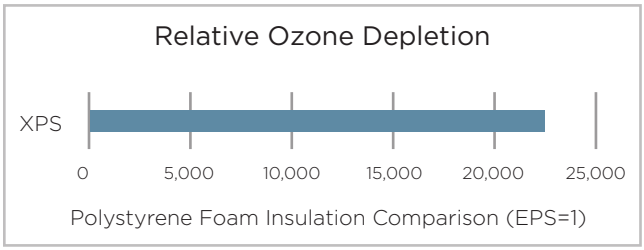
As defined in the insulation PCR, the functional unit for analysis in each of the EPDs was 1 m^2 (10.765 ft^2) of insulation at a thickness to yield a thermal resistance RSI = 1 $m^2 \cdot K/W$ (R-value 5.68 $ft^2 \cdot hr \cdot °F/BTU$) with a 60-year building service life.

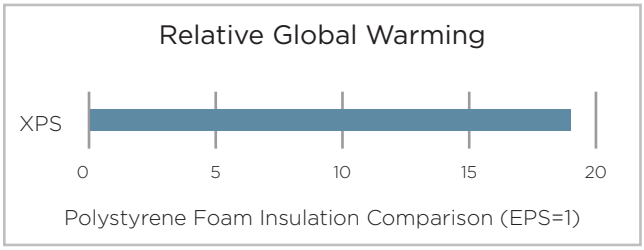
Compressive resistance is commonly used to specify polystyrene foam insulation for building applications based on the material specification ASTM C578 in the U.S. and CAN/ULC S701.1 in Canada. ASTM C578 EPS Type II insulation (which is essentially equivalent to CAN/ULC S701.1 EPS Type 2) with a minimum compressive resistance of 15 psi (104 kPa) was compared to C578 XPS Type X insulation with an equivalent compressive resistance.

The results of the EPD comparison are shown in Table 1 and graphically in Figures 1 and 2. Note that the scale for Figure 1 is logarithmic.

The EPD comparison highlights XPS insulation's use of an ozone-depleting cell gas that impacts its results in two categories: Global Warming and Ozone Depletion. In contrast, EPS contains only air as its cell gas dissipates shortly after manufacturing.

Figure 2: Comparison of Most Significant Impacts (linear scale)





While there are many factors to consider in the specification of polystyrene foam insulation, this EPD comparison shows that EPS insulation has a lower environmental impact than XPS insulation across several categories. In fact, EPS insulation offers the designer the possibility of achieving LEED recognition by incorporating it as the polystyrene foam insulation of choice in the building envelope.

[1] *UL Environment, Product Category Rule for preparing an EPD for Building Envelope Thermal Insulation, 2013, https://legacy-uploads.ul.com/wp-content/uploads/sites/2/2014/09/UL_Environment_PCR_for_Building_Envelope_Thermal_Insulation_v1.2.pdf.*

[2] *ISO 14025, Environmental labels and declarations – Type III environmental declarations – Principles and procedures, 2006, http://www.cscses.com/uploads/2016328/20160328110527052705.pdf.*

[3] *EPS Industry Alliance, Environmental Product Declaration for EPS Insulation, No. 4787238561.101.1, 2017.*

[4] *DOW Building Solutions, Environmental Product Declaration for STYROFOAM™ Insulation, No. 4786548101.101.1, 2014.*

[5] *Owens Corning, Environmental Product Declaration for FOAMULAR® XPS Insulation, No. 4786077032.101.1, 2013.*

[6] *U.S. Green Building Council, LEED BD+C: New Construction (v4): Building product disclosure and optimization – environmental product declarations, https://www.usgbc.org/credits/new-construction-core-and-shell-schools-new-construction-retail-new-construction-healthca-22.*