

Applying Transparent and Verifiable Standards in the Water and Sewer Pipe Industry

Life Cycle Assessment (LCA) is a tool to quantify the environmental impacts of a product over the product’s entire lifespan. An LCA accomplishes the following:

- ▶ Identifies and quantifies the materials and the energy used throughout the product’s life
- ▶ Identifies the wastes and emissions released throughout the product’s life
- ▶ Assesses the environmental impact of those inputs and outputs

LCA is a critical component of transparent disclosure of environmental impact and is used to standardize industry comparisons.

This document details the validity, accuracy, and transparency of the PVC pipe LCA that results from the standards that the Uni-Bell PVC Pipe Association has utilized to disclose product environmental attributes, including:

- ▶ ISO 14040, which describes the principles and framework for life cycle assessment
- ▶ ISO 14044, which specifies the requirements and provides guidelines for life cycle assessment
- ▶ ISO 14025, which establishes the principles and specifies the procedures for developing Type III environmental product declarations

No other pipe material has disclosed environmental impact to as transparent and regulated a degree as the PVC pipe industry.

FIGURE 1 : THE PVC PIPE LIFE CYCLE ASSESSMENT DISCLOSES THE “CRADLE-TO-GRAVE” IMPACTS OF PIPE FOR STAGES A1 THROUGH C4

PVC PIPE LIFE CYCLE SYSTEM BOUNDARIES					
A1 - A3 PRODUCT Stage		B1 - B7 USE Stage		C1 - C4 END OF LIFE Stage	
A1	Raw Material Supply	B1	Use	C1	De-constructon/Demolition
A2	Transport	B2	Maintenance	C2	Transport
A3	Manufacturing	B3	Repair	C3	Waste Processing
A4 - A5 CONSTRUCITON PROCESS Stage		B4	Replacement	C4	Disposal
A4	Transport	B5	Refurbishment		
A5	Construction - Installation Process	B6	Operational Energy Use		
		B7	Operational Water Use		

The PVC pipe Life Cycle Assessment discloses the environmental impacts of PVC pipe according to internationally recognized standards. The LCA includes seven PVC pipe products in three market segments:

- ▶ Potable water pressure pipe
- ▶ Sanitary sewer gravity pipe
- ▶ Storm drainage gravity pipe

The PVC pipe LCA reports environmental impact data from cradle-to-grave, resulting in the first industry-wide study in the North American pipe industry to provide an Environmental Product Declaration (EPD) that is compliant with ISO 14025. The PVC pipe LCA meets more qualifications for transparency and accuracy than any other piping material.

The North American PVC pipe LCA study was conducted according to the life cycle inventory (LCI) and life cycle impact assessment (LCIA) standards established by the International Standards Organization (ISO). In particular, these standards require that:

- ▶ Environmental data must be specific and recent.
- ▶ Both primary data and secondary data must be disclosed.
- ▶ The final document must be critically reviewed to ensure accuracy.

The subsequent EPD was published in accordance with ISO 14025, which specifies the principles and the procedures for developing Type III Environmental Product Declarations and establishes the use of ISO 14040 for their development.

The International Standards Organization (ISO) is the most recognized and authoritative source for industry standards relating to LCAs, EPDs, and Product Category Rules (PCRs). The globally established experts at ISO (including professionals from applicable industries, consumer associations, academia, NGOs, and government) have published over 20,000 international standards. For more information on ISO and these standards, [click here](#).

CRITICAL REVIEW

The LCA was critically reviewed by a panel of independent experts in the field of sustainability, ensuring the accuracy of the LCA data, approach, and methodologies. The reviewers were:

- ▶ Rita Schenck (Institute for Environmental Research and Education)
- ▶ Nigel Howard (Clarity Environment)
- ▶ Charlie He (Carollo Engineers)

VERIFICATION BY NSF INTERNATIONAL

The results of the LCA study have been published in an ISO 14025-compliant Environmental Product Declaration (EPD). The EPD was independently verified by NSF International according to the requirements set forth by the Product Category Rule for Piping Systems for Use for Sewage and Storm Water (Under Gravity) addendum for North America, which includes potable water piping systems per version 2 of the addendum. The EPD meets the requirements for comparability with products evaluated in accordance to the guiding PCR document.

LCA BOUNDARIES

The assumptions used in this assessment were required by the Product Category Rule or assumed based on engineering expertise, in order to ensure the accuracy and transparency of the data. The comments below refer to these requirements and their importance:

- ▶ Life Cycle Assessments conducted in alignment with the above standards require that results are presented in alignment with the function, or purpose, of the product.
- ▶ A 100-year service life was used to evaluate piping materials as this is the most accurate standard for piping systems. By evaluating against this service life, the environmental impacts of piping materials over an entire life cycle can best be analyzed.

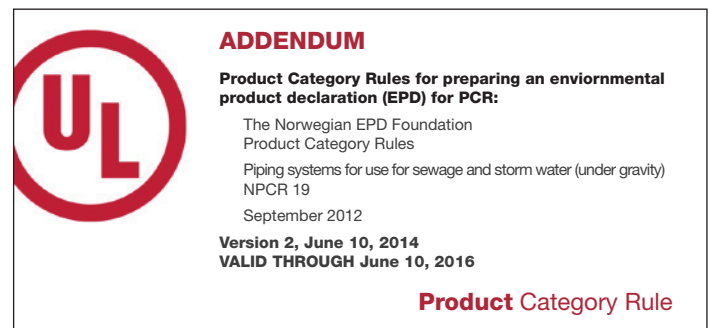
- ▶ Material specificity is critical to ensure that information is accurately communicated. This LCA is applicable for PVC pipe products in North America. Without material specificity, there is a danger of misinformation among alternative piping products.
- ▶ The LCA used updated industry-wide PVC resin production studies to provide up-to-date and accurate information.
- ▶ Both the installation phase and use phase were included, as the environmental impacts that occur during these phases for all piping materials are significant. Transparent, comparable information on environmental impacts were included, such as greenhouse gas generation, global warming potential, and total embodied energy.
- ▶ The LCA was developed in alignment with the Institute for Sustainable Infrastructure (ISI) Envision™ standard. Many credits in the standard consider life cycle impacts, such as the reduction of net embodied energy and greenhouse gas emissions throughout a product's life cycle. LCA methodology, as described above, is critical in evaluating these impacts and in complying with the standard.

CONSIDERING ALTERNATIVES

Decision-makers should have expectations for reporting criteria as outlined above. One instance of certification which may not meet the above requirements is The Institute for Market Transformation to Sustainability's (MTS) SMaRT Certification rating systems. Below are areas which highlight the differences to the above criteria:

- ▶ The SMaRT program does not enable comparability.
- ▶ The SMaRT Product Category Rule (PCR) does not represent a specific product, category or product function as required by ISO 14025.
- ▶ The SMaRT program excludes certain material types.

FIGURE 2 : "PIPING SYSTEMS FOR USE FOR SEWAGE AND STORM WATER (UNDER GRAVITY)" THE PCR USED BY UNI-BELL TO DEVELOP THEIR EPD



CONCLUSION: ASSESS COMPETING CLAIMS TECHNICALLY AND ANALYTICALLY

Many other environmental certifications do not require accuracy and transparency of data to the extent that ISO standards do. For this reason, it is imperative for decision-makers to assess competing claims technically and analytically. When evaluating claims made by product manufacturers, it is important to consider the following:

- ▶ Is this document written to internationally recognized standards?
- ▶ Is this document certified for adherence to those standards?
- ▶ Has this document been critically reviewed by experts?
- ▶ Is this document clear and specific as to the material types, locations, and material disclosure?
- ▶ Does this document disclose the methodology used for evaluating impacts?
- ▶ Does this document evaluate the individual life cycle phases of the product?
- ▶ Does this document disclose the limitations of the product?

The standards referenced above have been developed, and were specifically selected by Uni-Bell, due to their stringent, specific, and un-biased nature. All external associates that partnered with Sustainable Solutions Corporation to perform these analyses conducted their studies in accordance to these standards. It will be critical to evaluate LCAs using the questions above, as SSC has encountered studies conducted using non-standardized or undisclosed methodology, which may not be considered transparent, comparable, and may cloud environmental impact data.

In order to select the materials that best align with sustainability goals and initiatives, we encourage decision-makers to consider the sources and accuracy of data when evaluating environmental impact documentation among piping materials, in order to select the materials that best align with sustainability goals and initiatives.

REFERENCES

Clickable links.

- ▶ [International Organization for Standardization, ISO 14025:2006, "Environmental Labels and Declarations – Type III Environmental Declarations – Principles and Procedures" \(2015\)](#)
- ▶ [International Organization for Standardization, ISO 14040:2006, "Environmental Management – Life Cycle Assessment – Principles and Framework" \(2016\)](#)
- ▶ [International Organization for Standardization, ISO 14044:2006, "Environmental Management – Life Cycle Assessment – Requirements and Guidelines" \(2016\)](#)
- ▶ [NSF International, "The NSF Mark" \(2017\)](#)
- ▶ [Sustainable Solutions Corporation, "Life Cycle Assessment of PVC Water and Sewer Pipe and Comparative Sustainability Analysis of Pipe Materials" \(2017\)](#)
- ▶ [Uni-Bell PVC Pipe Association, "Environmental Product Declaration for PVC Pressure Pipe: Potable Water, Reclaimed Water, Sewer Force Main; PVC Non-Pressure Pipe: Sanitary Sewer and Storm Sewer Pipe Systems" \(2015\)](#)



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