An Environmental Product Declaration

According to ISO 14025:2006 and ISO 21930:2017

A company-specific cradle-to-gate EPD for
Reliable® Sprinkler Model P22 ESFR Sprinklers

ASTM International Certified Environmental Product Declaration

This document is a Type III environmental product declaration (EPD) for Reliable® Sprinkler Model P22 ESFR Sprinklers, as manufactured at its Liberty, SC facility for the reference year 2019.

This declaration has been prepared in accordance with ISO 14025 (1), ISO 21930 (2), ISO 14040/44 (3), (4), and ASTM's General Program Instructions for Type III EPD (5).

The intent of this document is to further the development of environmentally compatible and more sustainable construction methods by providing comprehensive environmental information related to potential impacts of Reliable fire sprinklers in accordance with international standards.

Environmental Product Declaration Summary

General Information	
Owner of the EPD	**The Reliable Sprinkler Automatic Sprinkler Co. Inc.** 103 Fairview Park Dr Elmsford, NY 10523 United States Link (URL) https://www.reliablesprinkler.com/ Established in 1920, Reliable Automatic Sprinkler Co., Inc. is a global manufacturer and distributor of fire protection products. Reliable corporate headquarters is located in Elmsford, NY; with a manufacturing plant in Liberty, SC, and regional sales and distribution centers throughout the US and across the world. *The owner of the declaration is liable for the underlying information and evidence.*
Manufacturing Site	Fire Sprinklers 1470 Smith Grove Rd, Liberty, SC 29657, United States
Product Group	Fire Sprinklers
Product Name	Reliable Sprinkler P22 ESFR fire sprinklers
Product Definition	The Reliable Model P22 is an ESFR fire sprinkler with a nominal K-factor of 22.4 (320 metric). The sprinkler uses a levered fusible alloy solder link in either a 165°F (74°C) or a 212°F (100°C) temperature rating.
Product Category Rule (PCR)	ISO 21930:2017 serves as the core PCR (2).
Certification Period	01/01/2023 – 5-year validity
Declared Unit	1-piece P22 ESFR fire sprinkler
ASTM Declaration Number	EPD – 376

EPD Information	
Program Operator	ASTM International 100 Barr Harbor Drive, PO Box C700 West Conshohocken, PA 19428-2959, USA https://www.astm.org/products-services/certification/environmental-product-declarations/epd-pcr.html

Declaration Type

This company specific "cradle-to-gate" production stage EPD applies to Reliable Sprinkler P22 ESFR fire sprinklers. Production activities covered include *the extraction and upstream production, transport to factory and manufacturing* (modules A1 to A3). The declaration is intended for Business-to-Business (B-to-B) communication.

Applicable Countries

United States and Canada

Product Applicability

The Reliable Model P22 is an ESFR fire sprinkler with a nominal K-factor of 22.4 (320 metric). The sprinkler uses a levered fusible alloy solder link in either a 165°F (74°C) or a 212°F (100°C) temperature rating. These sprinklers are designed to respond quickly to growing fires and will deliver a heavy water discharge to suppress a fire. Suppression is considered a higher level of control characterized by a sharp reduction in heat release rate along with preventing regrowth of the fire. For systems designed in accordance with NFPA 13 standards, the Model P22 is considered an ESFR fire sprinkler.

This EPD was independently verified by ASTM in accordance with ISO 14025 and the ISO 21930:	
Internal	**External**
	X

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EPD Project Report Information	
EPD Project Report	A Cradle-to-Gate Life Cycle Assessment of Eight Reliable Sprinklers, September 2022.
Prepared by Athena Sustainable Materials Institute	Lindita Bushi PhD, Grant Finlayson, and Jennifer O'Connor. Athena Sustainable Materials Institute 280 Albert St, Suite 404 Ottawa, Ontario, K1P 5G8, Canada info@athenasmi.org www.athenasmi.org
This EPD project report was independently verified by and in accordance with ISO 14025, ISO 14040/44, and ISO 21930:	Thomas P. Gloria, Ph.D. Industrial Ecology Consultants 35 Bracebridge Rd. Newton, MA 02459-1728
EPD explanatory material	For any explanatory material, regarding this EPD, please contact the program operator. ASTM International Environmental Product Declarations 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, http://www.astm.org

1 PRODUCT IDENTIFICATION

1.1 PRODUCT DEFINITION

A sprinkler system is defined as a fire control device that is intended to protect a building against fire by causing an automatic discharge of water, usually from pipes near the ceiling. This EPD focuses on Reliable Sprinkler P22 ESFR fire sprinklers as fabricated at Reliable's Liberty, SC facility.

The Reliable Model P22 is an ESFR fire sprinkler with a nominal K-factor of 22.4 (320 metric). The sprinkler uses a levered fusible alloy solder link in either a 165°F (74°C) or a 212°F (100°C) temperature rating. These sprinklers are designed to respond quickly to growing fires and will deliver a heavy water discharge to suppress a fire. Suppression is considered a higher level of control characterized by a sharp reduction in heat release rate along with preventing regrowth of the fire. For systems designed in accordance with NFPA 13 standards, the Model P22 is considered an ESFR fire sprinkler. (6) . FM Approvals classifies the Model P22 as a quick-response storage and non-storage sprinkler when used in accordance with FM Global Property Loss Prevention Data Sheets (7).

Figure 1 shows the Model P22 ESFR specifications. Further product properties and characteristics for this fire sprinkler type can be found on the Reliable website (8).

Figure 1 Model P22 ESFR specifications

P22 ESFR Pendent Sprinkler
Technical Specifications
Style: Pendent
Connection: 1" NPT or ISO7-1R1 (BSPT) thread
Nominal K-Factor: 22.4 (320 metric)
Max. Working Pressure: 175 psi (12 bar)
Temperature Ratings
Ordinary: 165°F (74°C)
Intermediate: 212°F (100°C)

1.2 FIRE SPRINKLERS LISTINGS AND APPROVALS

The Reliable Sprinkler P22 ESFR fire sprinklers meet the following approvals:

- FM Approvals

The Reliable Sprinkler P22 ESFR fire sprinklers, follow the NFPA 13 Standard for the Installation of Sprinkler Systems (6). The industry benchmark for design and installation of automatic fire sprinkler systems, NFPA 13 addresses sprinkler system design approaches, system installation, and component options to prevent fire deaths and property loss.

2 DECLARED UNIT

Table 1 shows the declared unit for P22 ESFR fire sprinkler as manufactured at its facility in Liberty, SC.

Table 1. Declared Unit – 1-piece P22 ESFR Sprinkler

Sprinkler	P22 ESFR Sprinkler
Declared unit	1 piece
Mass (kg/piece)	0.1982

3 MATERIAL COMPOSITION and COMPONENT CONTENT

The material composition by input material (in %) and component content (in %) for 1-piece P22 ESFR Sprinkler are provided in Tables 2 and 3.

Table 2. Material composition – 1-piece P22 ESFR Sprinkler

Material composition -1 piece	P22 ESFR Sprinkler
Brass	84.7%
Bronze	8.7%
Other	6.6%
Finished Product	100.0%

Table 3. Component contribution- 1-piece P22 ESFR Sprinkler

Component content -1 piece	P22 ESFR Sprinkler
Thermal Sensor	0.5%
Sprinkler Frame	84.7%
Button (Cap)	3.7%
Sealing Assembly	1.4%
Load Screw	0.9%
Deflector	6.9%
Lever	1.4%
Ejection Spring	0.2%
Strut	0.5%
Finished Product	100.0%

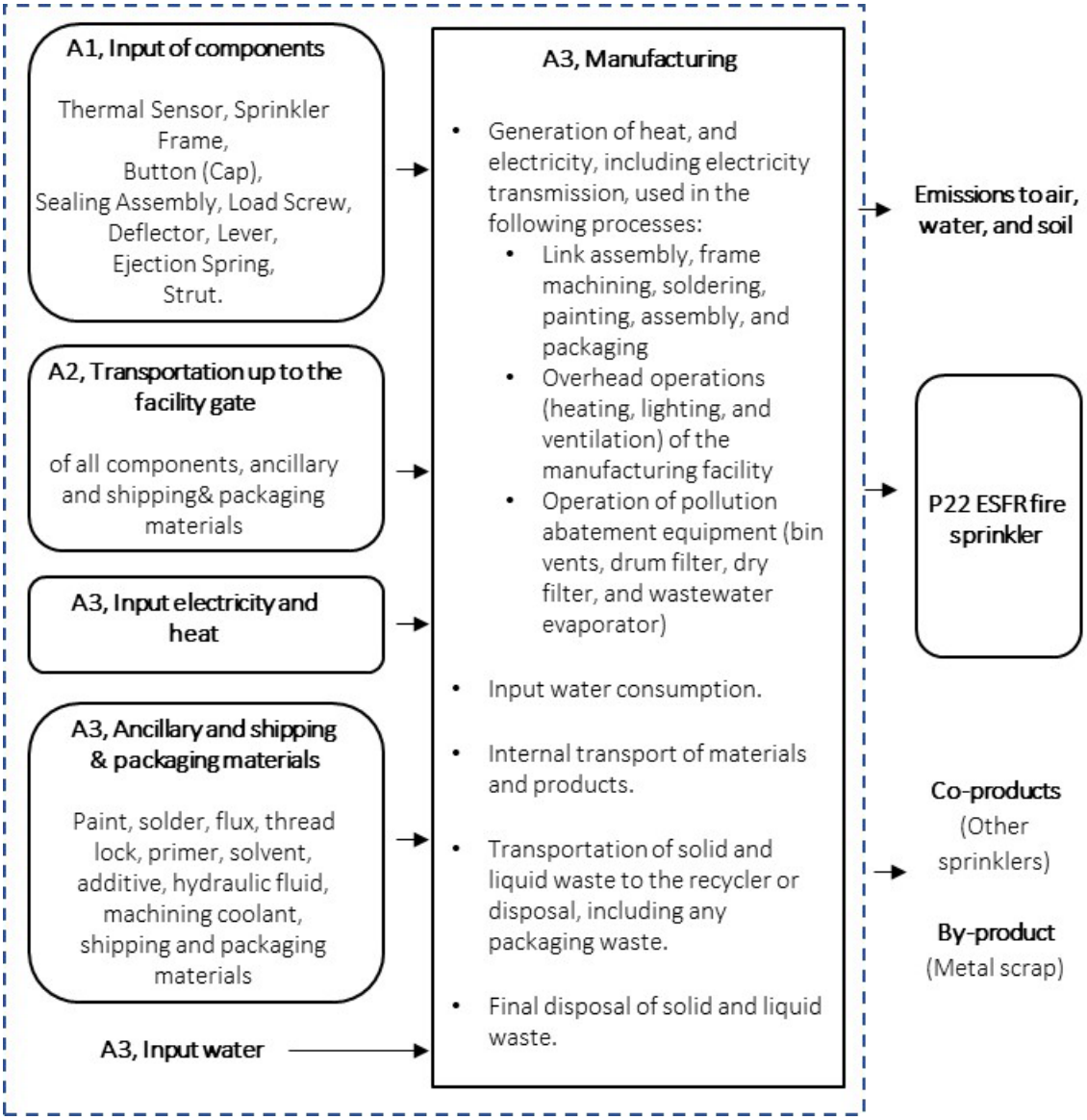
4 LIFE CYCLE STAGES

Figure 2 shows the life cycle stages and information modules that are included within the cradle-to-gate LCA system boundary of this EPD. The boundary is “cradle-to-gate”, which includes the *Production stage* (A1 to A3 modules). *Construction, Use, and End-of-Life stages* - are excluded from the system boundary. The *Production stage* system boundary is shown in Figure 3. Per ISO 21930, 7.1.7.2.1 (2), *the system boundary with nature (natural environment) includes those technical processes that provide the material and energy inputs into the system and the subsequent manufacturing and transport processes up to the to the factory gate, as well as the processing of any waste arising from those processes.*

Figure 2 Life Cycle Stages and Modules

Production stage			**Construction stage**		**Use stage**							**End-of-life stage**			
Extraction and upstream production	Transport to factory	Manufacturing	Transport to site	Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational Energy Use	Operational Water Use	De-Construction/ Demolition	Transport to waste processing or disposal	Waste processing	Disposal of waste
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
X			MND												
X- module is included in system boundary; MND- module is not declared (excluded from system boundary)															

Figure 3 Production stage (module A1 to A3) system boundary of Reliable fire sprinklers manufacturing



5 LIFE CYCLE INVENTORY

5.1 DATA COLLECTION, SOURCES, AND CALCULATIONS

LCI data collection was based on one customized LCI survey. The LCI survey covered the primary data for the Liberty, SC facility for the 2019 reference year (12 consecutive months).

Data calculation procedures follow ISO 14044 (4), and ISO 21930 (2). The LCA model was developed using SimaPro v.9.3 2022 (9). SimaPro LCA software contains recognized databases (e.g., ecoinvent v3.8, 2021 database, Allocation, Cut-off by classification and U.S. LCI Database, 2015) that provide LCI datasets for upstream, core, and downstream material and processes. SimaPro 9.3 2022 also contains the U.S. EPA TRACI v2.1 2012 LCIA methodology, CML-baseline version 4.7 2016 LCIA methodology, and the Cumulative Energy Demand, LHV (NCV) version 1.0 November 2018 which are used for this LCA study. Per ISO 21930, 7.2.2 (2), when transforming the inputs and outputs of combustible material into inputs and outputs of energy, the net calorific value (lower heating value) of fuels is applied according to scientifically based and accepted values specific to the combustible material.

5.2 DATA QUALITY REQUIREMENTS AND ASSESSMENTS

A detailed description of collected data and the data quality assessment regarding the ISO 14044 (4) and ISO 21930 (2) is provided in the LCA project report (10). Data quality is assessed based on its representativeness (technology coverage, geographic coverage, time coverage), completeness, consistency, reproducibility, transparency, and uncertainty (Table 4).

Table 4. Data Quality Requirements and Assessments

Data Quality Requirements	Description
Technology Coverage	Data represents the prevailing technology at Reliable Sprinkler's manufacturing plant in Liberty, SC. Whenever available, North American typical or average industry LCI datasets were utilized for all upstream and core material and processes. *Technological representativeness is characterized as "high".*
Geographic Coverage	The geographic region considered is the U.S. Whenever available, for all upstream and core material and processes, geographic specific LCI datasets were utilized. *Geographical representativeness is characterized as "high".*
Time Coverage	Activity data are representative. - Sprinkler manufacturing process- primary data collected for reference year 2019 (12 months) - In-bound/ out-bound transportation data- primary data collected for reference year 2019 (12 months) - Generic data: the most appropriate LCI datasets were used as found in the ecoinvent v.3.8 database for US and global and US LCI Database, and modeled in SimaPro LCA software v.9.3, 2022 (9). *Temporal representativeness is characterized as "medium" to "high".*

Data Quality Requirements	Description
Completeness	All relevant, specific processes, including inputs (raw materials, energy, and ancillary materials) and outputs (emissions and production volume) were considered and modeled. The relevant background materials and processes were taken from the ecoinvent v 3.8 LCI database for US and global and US LCI Database and modeled in SimaPro LCA software v.9.3, 2022 (9). The completeness of the cradle-to-gate process chain in terms of process steps is rigorously assessed for all products and documented in the project report.
Consistency	To ensure consistency, the input/output LCI modeling of the fire sprinklers used the same LCI modeling structure, which consisted of input raw, secondary, ancillary, and packaging materials, intermediate products, energy flows, water resource inputs, product outputs, co-products, by-products, emissions to air, water and soil, and solid and liquid waste disposal. Crosschecks concerning the plausibility of mass and energy flows were continuously conducted. The LCA team conducted mass and energy balances at the facility level to maintain a high level of consistency.
Reproducibility	Internal reproducibility is possible since the data and the models are stored and available in *Athena Reliable LCI database* developed in SimaPro, 2022. A high level of transparency is provided throughout the reviewed LCA project report as the LCI profile is presented for each of the declared products. Key primary (manufacturer specific) and secondary (generic) LCI data sources are summarized in the supporting LCA project report.
Transparency	Activity and LCI datasets are transparently disclosed in the LCA project report, including data sources.
Uncertainty	A *sensitivity check* was conducted to assess the reliability of the EPD results and conclusions by determining how they are affected by uncertainties in the data or assumptions on calculation of LCIA and energy indicator results. The LCA background report includes the results of a *sensitivity analysis* and *Monte Carlo uncertainty analysis of background data sets.*

5.3 ALLOCATION RULES

The Liberty, SC manufacturing facility produces various fire sprinklers as well as a limited number of non-fire sprinkler products and as such allocation was necessary. “Mass” based, plant specific data for 1-piece of declared fire sprinkler were used to calculate the input raw, shipping and packaging materials consumed. “Mass” was used as the physical parameter for allocating flows between the products of interest and other co-products to calculate the input energy flows (electricity, and natural gas), ancillary materials used at the facility, total water consumption, process emissions to air and water and waste flows. No environmental burden or credit is allocated to the by-product (metal scrap) of the declared fire sprinklers. The LCI modeling accounts for the manufacturing yield of all upstream and on-site processes. In addition, allocation related to transport is based on the mass of transported inputs and outputs.

5.4 CUT OFF RULES

The cut-off criteria as per ISO 21930, 7.1.8 (2) were followed. All input/output data collected at the Liberty, SC facility were included in the LCI modelling developed using SimaPro v.9.3 2022 (9). None of the input/output data were excluded based on the cut-off criteria. Material Data Sheets (MDSs) were used for few ancillary materials e.g., thread lock, solvent, and additive. Any data gaps in the MDS are filled in with two (proxy) generic LCI datasets, as appropriate (conservative assumptions): Chemical, organic {GLO}| market for | Cut-off, U; Chemical, inorganic {GLO}| market for | Cut-off, U.

This EPD excludes the following processes:

- Capital goods and infrastructure, and
- Personnel related activity (travel, furniture, office operations and supplies).

6 LIFE CYCLE ASSESSMENT RESULTS

Table 5 presents the “cradle-to-gate” LCA results for 1-piece P22 ESFR fire sprinkler.

As per the US EPA Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI), version 2.1, 2012 (11) impact categories are used as they provide a North American context for the mandatory category indicators to be included in this EPD.

These are relative expressions only and do not predict category impact endpoints, the exceeding of thresholds, safety margins or risks (4). Per ISO 21930, 7.1.7.1 (2), “individual indicators for information modules A1, A2 and A3 may be aggregated to a total for each indicator in the production stage”.

Table 5. Production stage (A1-A3) EPD results for 1-piece P22 ESFR Sprinkler

Impact category and inventory indicators	Unit	P22 ESFR Sprinkler
Global warming potential, GWP 100[1)]	kg CO_2 eq	**1.79**
Ozone depletion potential, ODP[1)]	kg CFC-11 eq	**1.3E-07**
Smog formation potential, SFP[1)]	kg O_3 eq	**0.33**
Acidification potential, AP[1)]	kg SO_2 eq	**0.085**
Eutrophication potential, EP[1)]	kg N eq	**0.056**
Fossil fuel depletion, FFD[1)]	MJ surplus	**2.00**
Abiotic depletion potential, fossil ADPf[2)]	MJ	**20.7**
Renewable primary resources used as an energy carrier (fuel), RPR_E	MJ	**5.92**
Renewable primary resources with energy content used as material, RPR_M[3)]	MJ	**0**
Non-renewable primary resources used as an energy carrier (fuel), $NRPR_E$	MJ	**24.6**
Non-renewable primary resources with energy content used as material, $NRPR_M$[3)]	MJ	**0**
Secondary materials, SM[3)]	kg	**0**
Renewable secondary fuels, RSF[3)]	MJ	**0**
Non-renewable secondary fuels, NRSF[3)]	MJ	**0**
Recovered energy, RE[3)]	MJ	**0**
Consumption of freshwater, FW[3)]	m³	**0.055**
Hazardous waste disposed, HWD[3)]	kg	**2.5E-04**
Non-hazardous waste disposed, NHWD[3)]	kg	**8.5E-04**
High-level radioactive waste, conditioned, to final repository, HLRW[3) 4)]	m³	**4.8E-09**
Intermediate- and low-level radioactive waste, conditioned, to final repository, ILLRW[3)]	m³	**4.6E-08**
Components for re-use, CRU[3)]	kg	**0**
Materials for recycling, MR[3)]	kg	**0.048**
Materials for energy recovery, MER[3)]	kg	**0**
Recovered energy exported from the product system, EE[3)]	MJ	**0**

Notes:

[1)] Calculated as per U.S EPA TRACI 2.1, v1.06, SimaPro v 9.3 GWP-100, excludes biogenic CO_2 removals and emissions associated with any biobased products, including bio-based packaging. There is no biogenic content in the declared products. CO_2 emissions from calcination and carbonation are not applicable to the declared products; 100-year time horizon GWP factors are provided by the IPCC 2013 Fifth Assessment Report (AR5), TRACI 2.1, v1.05 (11). FFD is required in LEED v4.1 MR Credit: Building Product Disclosure and Optimization – Environmental Product Declarations (12).

[2)] Calculated as per CML-IA Baseline v3.05, SimaPro v 9.3. ADP_f is also required in LEED v4.1 MR2 Credit: Building Product Disclosure and Optimization – Environmental Product Declarations (12).

[3)] Calculated as per ACLCA ISO 21930 Guidance (13), respective sections 6.2 to 10.8.

[4)] It should be noted that the foreground system (Reliable fire sprinkler manufacturing process) does not generate any HLRW or ILLRW. High, intermediate, or low-level radioactive waste is generated by electricity production (spent fuel from reactors, routine facility maintenance and operations)" (ISO 21930:2017, clause 7.2.14). High-level radioactive waste, e.g., when generated by electricity production, consists mostly of spent fuel from reactors." (ISO 21930:2017, clause 7.2.14).

7 INTERPRETATION

The Reliable Sprinkler P22 ESFR fire sprinkler EPD results represent a “cradle-to-gate” environmental profile per 1-piece for each declared fire sprinkler as manufactured at its Liberty, SC plant for the reference year 2021.

Module A1 Extraction and upstream production contributes the largest share of the LCIA category indicator results, accounting for between 76% and 99% of the *Production stage* (A1 to A3) potential environmental burdens. *Module A3 Manufacturing* is the second largest contributor (<20%) to the overall potential environmental impacts of the fire sprinkler manufacture. Approximately 80% of the total primary energy is derived from *non-renewable primary energy resource* ($NRPR_E$). M*odule A2 transportation* contributed less than 6% to the overall potential impact of fire sprinkler production stage.

8 ADDITIONAL ENVIRONMENTAL INFORMATION

- Reliable's Liberty facility is ISO 9001 certified.
- The Liberty, SC facility uses bin vents, drum filter, dry filter, and wastewater evaporators as pollution abatement equipment.

9 DECLARATION TYPE

This “cradle-to-gate” EPD applies to Reliable Sprinkler P22 ESFR fire sprinklers. Production activities covered include *the extraction and upstream production, transport to factory, manufacturing* (modules A1 to A3). The declaration is intended for Business-to-Business (B-to-B) communication.

The P22 ESFR fire sprinklers fall under the description:
- *A product-specific EPD, from one (1) manufacturer’s plant*.

10 EPD COMPARABILITY LIMITATION STATEMENT

The following ISO 14025 and ISO 21930 statements indicate the EPD comparability limitations and intent to avoid any market distortions or misinterpretation of EPDs.

- *Environmental declarations from different programmes may not be comparable* (1).
- Only EPDs prepared from cradle-to-grave life cycle results and based on the same function, Reference Service Life, quantified by the same functional unit, and meeting all the conditions for comparability listed in ISO 14025:2006 and ISO 21930:2017 can be used to comparison between products

11 REFERENCES

1. ISO 14025: 2006 Environmental labeling and declarations - Type III environmental declarations - Principles and procedures.

2. ISO 21930:2017 Sustainability in buildings and civil engineering works - Core rules for environmental product declarations of construction products and services.

3. ISO 14040/Amd1:2020 Environmental Management – Life Cycle Assessment – Principles and Framework, International Organization for Standardization, 2006.

4. ISO 14044/Amd1:2017/Amd2:2020 Environmental Management – Life Cycle Assessment – Requirements and guidelines, International Organization for Standardization, 2006.

5. ASTM Program Operator for Product Category Rules (PCRs) and Environmental Product Declarations (EPDs), General Program Instructions, 04/29/20.

6. NFPA 13 2022, Standard for the Installation of Sprinkler Systems.

7. Reliable 2022, Model GL112 Series Sprinklers-Storage & Non-Storage Sprinklers, K11.2 (160 metric), Bulletin 132, January 2022, https://www.reliablesprinkler.com/product/gl-112.

8. Reliable Sprinklers 2022, https://www.reliablesprinkler.com/sprinklers/.

9. PRé 2022. SimaPro LCA Software v9.3, 2022., https://simapro.com/.

10. Athena Sustainable Materials Institute, A Cradle-to-Gate Life Cycle Assessment of Eight Reliable Fire Sprinklers, September 2022.

11. Bare, J., TRACI 2.0: The Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts 2.0. Clean Technologies and Environmental Policy 2011, 13, (5), https://link.springer.com/article/10.1007/s10098-010-0338-9#page-1.

12. LEED v4.1, MRc2: Building product disclosure and optimization, Environmental Product Declarations,. https://leeduser.buildinggreen.com/credit/NC-v4.1/MRc2#tab-credit-language .

13. ACLCA 2019, Guidance to Calculating Non-LCIA Inventory Metrics in Accordance with ISO 21930:2017. The American Centre for Life Cycle Assessment. May, 2019.