

## ENVIRONMENTAL PRODUCT DECLARATION

# SUPERIOR ESSEX OPTICAL FIBER DATA CABLE

RISER RATED



*All Superior Essex riser optical fiber data cables including single mode and multimode fiber*



"Our environmental initiative is more than just a company objective; it is an ethical responsibility to our communities and to future generations. We have made the commitment to continuously improve the environmental sustainability of our operation and products and to lead by example."

Tim Waldner  
President,  
Superior Essex International LP

### The Plan

Superior Essex focuses on conservation, recycling, and minimizing any negative impact on the worldwide community. We aim to continuously reduce our environmental footprint to preserve and protect the natural environment.

### The Promise

We practice a high level of environmental sustainability in our manufacturing processes by conducting operations in a safe and environmentally responsible manner. By evaluating and measuring environmental performance, we continue to strive to meet worldwide environmental programs and initiatives.



# ENVIRONMENTAL PRODUCT DECLARATION


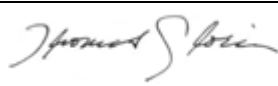


Simplex, Duplex Quad Interconnect; Microarray Data Center Interconnect; 3mm Microarray Breakout; 3mm Interlock Armored, Microarray Breakout; Breakout; Single Unit Distribution; Premises Fiber BrakeBox; Multi-Unit Distribution; Compact and Rugged Indoor MDU; Rugged Indoor/Outdoor MDU; Dry Block, Sunlight Resistant, Indoor/Outdoor; Hybrid Premises Fiber; Interlock Armor, Tight Buffer  
Premises Fiber Optic Riser Cable

According to ISO 14025

This declaration is an environmental product declaration (EPD) in accordance with ISO 14025 and ISO 21930. EPDs rely on Life Cycle Assessment (LCA) to provide information on a number of environmental impacts of products over their life cycle. 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, and the level of accuracy in estimation of effect differs for any particular product line and reported impact. Comparability: EPDs are not comparative assertions and are either not comparable or have limited comparability when they cover different life cycle stages, are based on different product category rules or are missing relevant environmental impacts. EPDs from different programs may not be comparable.



PROGRAM OPERATOR	UL Environment	
DECLARATION HOLDER	Superior Essex	
DECLARATION NUMBER	4786513765.102.1	
DECLARED PRODUCT	Riser Rated Optical Fiber Data Cable	
REFERENCE PCR	PCR for EPDs: Wire & Cable PCR 2013:1.0	
DATE OF ISSUE	December 11, 2014	
PERIOD OF VALIDITY	5 Years	
CONTENTS OF THE DECLARATION	Product definition and information about building physics Information about basic material and the material's origin Description of the product's manufacture Indication of product processing Information about the in-use conditions Life cycle assessment results Testing results and verifications	
The PCR review was conducted by:		Environment and Development Foundation
		PCR Addendum: UL Environment
This declaration was independently verified in accordance with ISO 14025 by Underwriters Laboratories <input type="checkbox"/> INTERNAL <input checked="" type="checkbox"/> EXTERNAL		 Wade Stout, UL Environment
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:		 Thomas Gloria, Life Cycle Services, LLC



## Product Definition and Information

### Company Description

Superior Essex is a global leader in the design, manufacture and supply of wire and cable products. This declaration is presented as we develop our product stewardship program to evaluate and reduce the impacts of products and processes throughout the corporation and business groups.

### Product Description

Thirteen premises fiber optic cable products are covered in this declaration. Riser cables are installed in non-plenum spaces of buildings and must meet associated fire safety test standards. All products listed below are UL Listed ONFR or OFCR. Most of these products are shipped on custom length reels.

#### **Simplex, Duplex, Quad Interconnect** Part Number: 33/A3/B3/C3

Simplex, Duplex and Quad Optical Fiber Interconnect Cables are typically used for patch cords and intrabuilding installations. Superior Essex designed these cables for environments where small size, flexible construction and flame resistance are required. These cables are available in both riser and plenum versions. Higher performance optical fibers are offered, including bend insensitive G.657.A1 single mode and 10G/300 OM3 and 10G/550 OM4 laser optimized 50 µm multimode.

#### **Microarray Data Center Interconnect** Part number: P3

The Microarray Data Center Interconnect Cables from Superior Essex are designed for high performance in a small package. The 12-fiber interconnect has an outside diameter of only 3.0 mm. The 24-fiber single unit employs two, 12-fiber microtubes that are ideal for 24-fiber MTP®/MPO array connectors. The 24-fiber duplex contains two, 12-fiber 3.0mm interconnect cables with an overjacket. The fibers can be fusion spliced, connectorized to high density MTP/MPO mechanical array connectors or attached to standard single ferrule mechanical connectors (LC, SC, ST, etc.) via a furcation kit. The loose fibers are surrounded by aramid yarns and a low smoke PVC (LSPVC) plenum or riser-rated jacket. Its small size allows for denser fiber routing than traditional tight buffered cables; its loose-tube construction gives it superior performance and installation ease compared to ribbon interconnect cable.

#### **3mm Microarray Breakout** Part number: P3

The Microarray Breakout cable from Superior Essex is designed for high performance in a small package. The design consists of 12-fiber 3 mm microarray interconnect cable subunits, each of which contain twelve 250 micron fibers. The aramid yarns inside the subunit allow the subunit to be crimped directly onto an MTP®/MPO connector. The 3 mm subunits are stranded around a central strength element that is both flexible and robust enough to pass backbone installation requirements. The stranded subunits are held to the strength element core by binder yarns and/or tapes ensuring excellent temperature performance. Finally, a RoHS-compliant flexible jacket protects the core from the rigors of installation while providing riser or plenum fire protection. The cable is available with TeraFlex® single mode, and laser-optimized 50/125 micron 10G/150 (OM2+), 10G/300 (OM3) and 10G/550 (OM4) multimode fiber types.

#### **3mm Interlock Armored, Microarray Breakout** Part number: L3

The Interlock Armored Microarray Breakout cable from Superior Essex is designed for high performance with robust mechanical protection. The design consists of 12-fiber 3 mm microarray interconnect cable subunits, each of which contain twelve 250 micron fibers. The aramid yarns inside the subunit allow the subunit to be crimped directly onto an MTP®/MPO connector. The 3 mm subunits are stranded around a central strength element that is both flexible and robust enough to pass backbone installation requirements. The stranded subunits are held to the strength element core by binder yarns and/or tapes ensuring excellent temperature performance. A RoHS-compliant flexible jacket protects the core while providing fire protection. Finally, the cable is interlock armored with either aluminum (standard) or steel and jacketed. The cable is available with TeraFlex® single mode or laseroptimized 50/125 micron 10G/150 (OM2+), 10G/300 (OM3) or 10G/550 (OM4) multimode fiber types.



**Breakout** Part number: T3

The optical fiber Breakout Cable from Superior Essex is designed with Central Office (CO) connectivity in mind. The cable consists of 2 mm interconnect cable subunits surrounding a central strength element. The subunits are surrounded by aramid yarns and a flame retardant PVC serrated jacket, and each is ideally suited to be attached to small form factor connectors. The cable is available in 6, 12 and 24-fiber count configurations.

**Single Unit Distribution** Part number: 43

These Superior Essex premises distribution optical fiber cables are constructed using a single unit – single jacket RoHS-compliant design with fiber counts from 6 through 24. The design consists of flexible 900 µm tight buffered industry standard 250 µm fibers (900/250/125 µm) and is suitable for use with standard connectors, like the SC, ST, and FC, and small-form-factor connectors like the LC. Dielectric aramid yarns are applied for strength while maintaining flexibility. The 18 and 24-fiber cable designs have a flexible glass reinforced central strength element for added durability and performance. A durable, flame resistant outer jacket is applied over the cable core using appropriate OFNR or OFNP rated materials.

**Premises Fiber Brakebox** Part number: 33/43

Superior Essex offers premises fiber cable products packaged in a BrakeBox® design, which includes the innovative QuickCount® footage marking and a variable resistance system that virtually eliminates reel over-spin and tangling. The BrakeBox packaging is a true advantage for installers who are pulling fiber cable in multiple locations. It not only stacks and travels better, it also protects the fiber cable better than an open reel. The box features two resistance mechanisms on both sides of the reel, each of which has three resistance settings. The variable brakes control back-tension preventing over-spin and tangling.

**Multi-Unit Distribution** Part number: 43

Premises Multi-unit Distribution Optical Fiber Cables are constructed using 6 or 12-fiber subunits stranded around a central strength member in a RoHS-compliant design for fiber counts from 18 through 144. Standard fibers for these cables include Reduced Water Peak (RWP) single mode, TeraGain® 220/600 62.5 µm multimode and TeraGain 10G/150 – laser optimized 50 µm multimode fiber. All fibers exceed industry requirements.

**Compact and Rugged Indoor MDU** Part number: D3

Both the Compact MDU 3 mm simplex cable and the Rugged Indoor MDU 5 mm simplex cable meet ICEA-730 Draft specification for MDU cables. The 3 mm is ideal for low-stress installations where space is a premium. The 5 mm is more robust and can handle installation tensions as high as 100 pounds. Both cables are available with G.657.B3 compliant bend resistant single mode fiber, preventing light loss even under tight bends.

**Rugged Indoor/Outdoor MDU** Part number: D5

The Rugged Indoor/Outdoor MDU is a 5 mm simplex cable that meets ICEA-730 Draft specification for MDU cables. The cable is robust and can handle installation tensions as high as 100 pounds. The black jacket is UL Listed Sunlight Resistant and the cable design employs dry block technology to prevent water penetration without the use of gels. This cable is available with G.657.B3 compliant bend resistant single mode fiber, preventing light loss even under tight bends.

**Dry Block, Sunlight Resistant, Indoor/Outdoor** Part number: W3

The Dry Block, Sunlight Resistant Indoor/Outdoor Tight Buffer Riser Rated Cable line offers the system designer the ultimate in premises optical fiber cable utility. These cables can be installed in open spaces, trays, conduits, inner-ducts, trenches, steam tunnels and building riser locations. These cables incorporate the latest in dry water-blocking technology. This system of water blocking eliminates the need to clean off the traditional gel-based water-blocking compounds found in loose tube cables. In addition, breakout kits and or other special termination equipment associated with loose tube Outside Plant (OSP) cables are not required. The outer jacket is comprised of a rugged UL Listed, sunlight resistant, black polymer that allows for the cable to be exposed to longterm direct sunlight without the concern of material degradation. All fiber types are available, including 50/125 µm, 62.5/125 µm and single mode.

**Hybrid Premises Fiber** Part number: 43/W3

Superior Essex offers a broad line of products including multimode and single mode fibers within the same optical





fiber cable. The use of hybrid fiber designs have proven useful to network systems designers because they offer the flexibility to run diverse applications upgrades without the need to install new cables. Superior Essex hybrid optical fiber cables are available in stranded tight buffer premises distribution cables, as well as all other loose tube cable product designs. Hybrid cables are used for standard campus networking applications and can be manufactured with a wide variety of fiber type combinations. They will save the designer and the customer significant costs over the lifetime of the physical cable plant.

#### **Interlock Armor, Tight Buffer** Part number: L3

Interlock Armored Optical Fiber Cables provide for an extremely well protected cable package ideally suited for harsh environments. The armor is available in aluminum or steel and comes with either an OFCR (riser) or OFCP (plenum) rating. This design offers the system designer a product that can be installed in high traffic areas where added mechanical protection and security are required. The flexible interlock armored cable design is also popular for retrofit applications and eliminates the need to install rigid conduit while still meeting building code guidelines.

#### **Manufacturing Locations**

These riser fiber optic cables are manufactured in Brownwood, Texas. This facility provided the primary data for the life cycle assessment. This declaration represents the average performance of each of the riser fiber optic cables.

#### **Applications and Uses**

The products listed are used in the non-plenum spaces of buildings. Applications for the riser products include 10BASE-T through 100GBASE-T Ethernet.

#### **Material Inputs**

The raw material inputs for the riser fiber optic cables are listed in Table 1. Table 2 details the average packaging associated with with each product.

Pounds per 100 feet (lb/100ft)	Optical Fiber	Tight buffer	Dielectric Aramid Strength Member	Central Strength Member	Rip Cord	Binder Yarn	Binder Tape	Outer Jacket	Interlock Armor	Polyester Tape	Water Blocking Tape	Total Weight per Length
Simplex, Duplex, Quad Interconnect	0.018	0.198	0.116	-	-	-	-	1.092	-	-	-	1.423
Microarray Data Center Interconnect	0.110	0.948	0.115	-	0.011	-	-	0.771	-	-	-	1.955
3mm Microarray Breakout	0.442	1.327	0.529	0.009	0.012	-	-	8.672	-	0.090	-	11.080
3 mm Interlock Armored, Microarray Breakout	0.442	1.327	0.529	0.004	0.012	-	-	-	11.783	-	-	14.096
Breakout	0.110	-	0.517	-	-	-	-	9.304	-	-	-	9.932
Single Unit Distribution	0.110	1.188	0.463	0.006	0.058	-	-	8.448	-	-	-	10.273
Premises Fiber BrakeBox	0.055	7.178	1.555	0.002	0.153	0.163	-	23.596	-	0.194	-	32.897
Multi-Unit Distribution	0.662	7.178	1.555	0.002	0.153	0.163	-	23.596	-	0.194	-	33.504
Compact and Rugged Indoor MDU	0.005	0.049	0.116	-	-	-	-	1.072	-		-	1.241
Rugged Indoor/Outdoor MDU	0.005	0.049	0.120	-	-	-	-	1.072	-		-	1.245
Dry Block, Sunlight Resistant, Indoor/Outdoor	0.662	7.180	1.556	0.002	0.162	-	0.190	13.509	-		0.541	23.801
Hybrid Premises Fiber	0.331	4.777	1.038	0.013	0.087	-	-	11.147	-	0.173	-	17.566
Interlock Armor, Tight Buffer	0.662	7.178	1.555	0.002	0.153	0.163	-	23.596	11.783	0.173	-	45.265

**Table 1: Material Inputs for Riser Fiber Optic Cables**

Material (lb per 100 ft)	Simplex, Duplex, Quad Interconnect	Microarray Data Center Interconnect	3mm Microarray Breakout	3mm Interlock Armored, Microarray Breakout	Breakout	Single Unit Distribution	Premises Fiber BrakeBox	Multi-Unit Distribution	Compact and Rugged Indoor MDU	Rugged Indoor/ Outdoor MDU	Dry Block, Sunlight Resistant, Indoor/ Outdoor	Hybrid Premises Fiber	Interlock Armor, Tight Buffer
Plywood	9.2E-02	1.3E-01	7.2E-01	9.1E-01	6.4E-01	6.6E-01	2.1E+00	2.2E+00	8.0E-02	8.0E-02	1.5E+00	1.1E+00	2.9E+00
Cardboard	1.5E-05	2.1E-05	1.2E-04	1.5E-04	1.1E-04	1.1E-04	3.5E-04	3.6E-04	1.3E-05	1.3E-05	2.5E-04	1.9E-04	4.8E-04
Polystyrene	1.3E-05	1.8E-05	1.0E-04	1.3E-04	9.2E-05	9.5E-05	3.1E-04	3.1E-04	1.2E-05	1.2E-05	2.2E-04	1.6E-04	4.2E-04
Polypropylene	7.6E-06	1.0E-05	5.9E-05	7.5E-05	5.3E-05	5.5E-05	1.7E-04	1.8E-04	6.6E-06	6.6E-06	1.3E-04	9.3E-05	2.4E-04
Total	9.2E-02	1.3E-01	7.2E-01	9.1E-01	6.4E-01	6.6E-01	2.1E+00	2.2E+00	8.0E-02	8.1E-02	1.5E+00	1.1E+00	2.9E+00
Non-Renewable Materials	9.2E-02	1.3E-01	7.2E-01	9.1E-01	6.4E-01	6.6E-01	2.1E+00	2.2E+00	8.0E-02	8.1E-02	1.5E+00	1.1E+00	2.9E+00
Renewable Materials	1.5E-05	2.1E-05	1.2E-04	1.5E-04	1.1E-04	1.1E-04	3.5E-04	3.6E-04	1.3E-05	1.3E-05	2.5E-04	1.9E-04	4.8E-04

Table 2: Average Packaging Material Inputs

### Manufacturing Process

The first step in the process is the inspection and testing of optical fibers as Superior Essex does not manufacture its own optical fibers. The clear glass fibers are then either colored via UV inking or, for tight buffered cable products, a colored PVC coating is applied by passing the raw glass fiber through the heated buffer and into a water cooling trough. The buffered cable leaves the cooling trough and passes through an air wipe to remove excess moisture as it is wound onto another coil. All types of fiber then require some form of sheathing process. At this step, fibers are automatically fed through an extruder. The sheathed fiber is then passed through a water cooling trough that slowly cools and hardens the tube and is rolled onto another reel. In tight buffered sheathing processes, cables are fed into an extruder along with special strength yarns. A fire retardant plastic material is extruded to form the protective tube around the fibers and is then cooled in a water trough. Depending on the number of fibers required, multiple tubes of fiber may be combined through fiber stranding. Cable spools, along with strength members, tape, yarns, and armoring materials (if applicable based on the intended use of the cable) are then fed into an electric stranding machine where the internal contents of the cable are assembled together. The cable spools are then fed into a jacketing machine, where jacket material is extruded onto the stranded cable, followed immediately by a printer than prints length and other information onto the jacketed cable, followed by another cooling trough, and onto a spool for packaging. Final product is generally shipped via plywood reels that are cut to custom lengths per customer order.

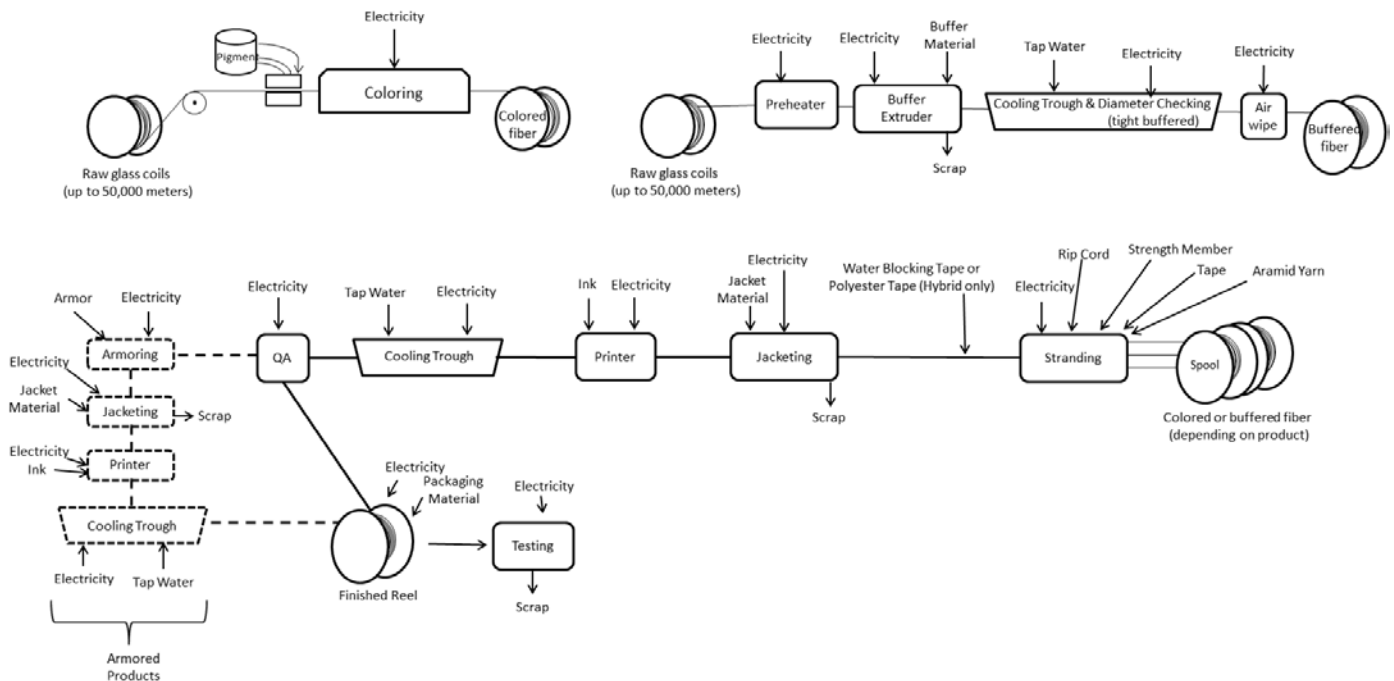


Figure 1: Manufacturing Process Flow of Premises Fiber Optic Cable



Figure 2: Photographs of Manufacturing Process

## Life Cycle Assessment Description

### Functional Unit

Environmental impacts are reported per functional unit of a product and the functional unit is the basis for comparison in an LCA. For the premises fiber optic cable, the functional unit is 100ft of cable.

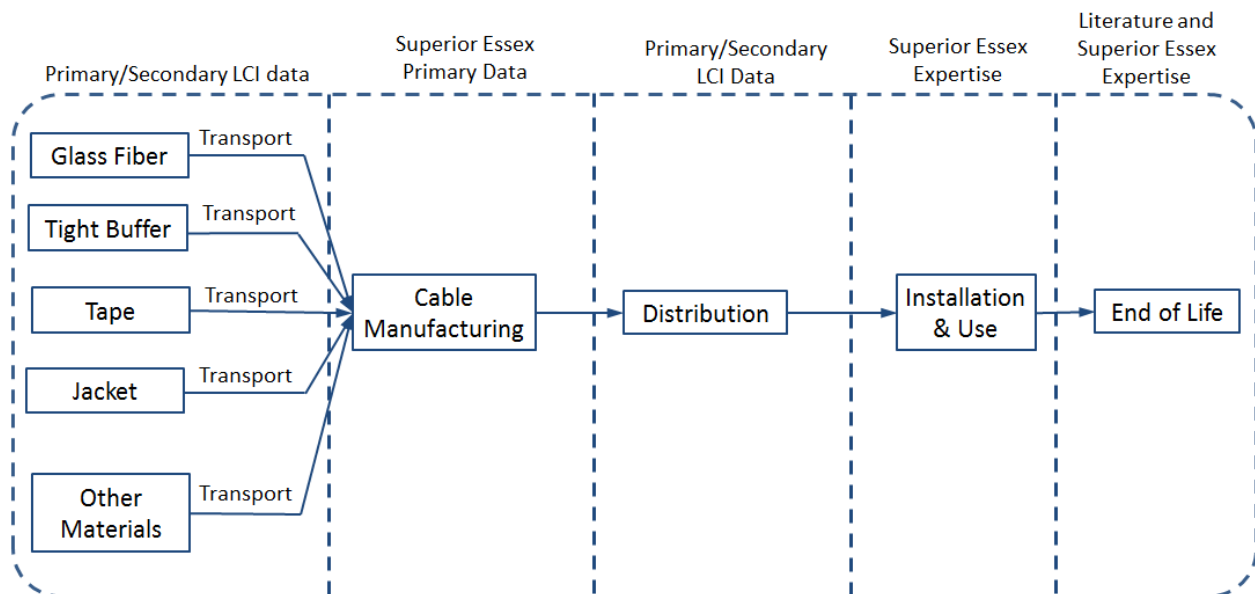
## Life Cycle Stages Assessed

Life Cycle Boundary	EPD Life Cycle Stage
Superior Essex Riser Cable Business-to-Business	Raw Material Acquisition
	Manufacturing
	Packaging/Storage
Superior Essex Riser Cable Business-to-Consumer	Marketing and Distribution
	Installation
	Use
	Waste Disposal

**Table 3: Life Cycle Stages Assessed**

## System Boundary

This project considers the life cycle activities from resource extraction through installation and end-of-life effects. The boundary covers raw material acquisition, manufacturing, marketing, use and waste disposal as seen in Figure 3.



**Figure 3: System Boundary**

## Allocation

Allocation for manufacturing energy was conducted based on production mass and then multiplied by the product weight per hundred feet. Water and waste items were allocated per length of production.

## Cut-off Criteria

For any impact category, if the sum of various impacts from a specific process/activity is less than 1% of the impact equivalent in that category, such a process/activity may be neglected during the inventory analysis. Nonetheless, the accumulated impact of neglected process/activity may not exceed 5%. Components and materials omitted from the LCA shall be documented.

This EPD is in compliance with the cut-off criteria. Components and materials omitted from the LCA shall be documented. Capital items for the production processes (machines, buildings, etc.) were not taken into consideration.



### Period under Consideration

---

The data used refer to the production processes of the fiber optic cable production facility from calendar year 2013.

### Software and Background Data

---

For life cycle modeling the SimaPro v8.02 Software System for Life Cycle Engineering, an internationally recognized LCA modeling software program, was used. All background data sets relevant for production and disposal were available in this software. Background and secondary datasets were modeled using the US LCI database, developed by the National Renewable Energy Laboratory, as well as the ecoinvent v3 database, which is developed by the Swiss Centre for Life Cycle Inventories.

### Marketing and Distribution

---

The finished products were modeled as being shipped 1000 miles by truck.

### Transportation

---

The manufacturing plant provided resource transportation mode and distance data to support the calculation of raw material transportation flows. The transportation LCI data from the US LCI database (kg-km basis) were used to develop the resource transportation LCI profile. Final products were modelled as being shipped 1000 miles by truck.

### Installation and Use Stage

---

The premises fiber optic riser cable products are distributed globally, but primarily throughout the United States and Canada. An average installation scrap rate of 5% was assumed in this study, as determined by interviews with installers and the expertise of Superior Essex. Installers routinely use battery-powered signal testing devices (a popular brand name is Fluke) during installation to ensure cable has been installed properly. The electricity consumed (based on calculations from the specifications of a late model Fluke device) is negligible compared to the rest of the installation or life cycle impacts and therefore was excluded from the study as allowed by the cut-off criteria.

The lifetime of the product is widely variable and is most often replaced not due to performance or degradation, but due to improvements in technology over time, for which corresponding increases in bandwidth and data speeds are demanded. Since the product is usually installed in a well-protected and undisturbed part of a building, the cable can continue to function throughout the life of the building. Fiber optic cable is a passive product after installation and during the use stage. The product consumes no energy and requires no maintenance. Therefore, no use stage impacts were measured, and thus none are presented in these results.

### End-of-Life

---

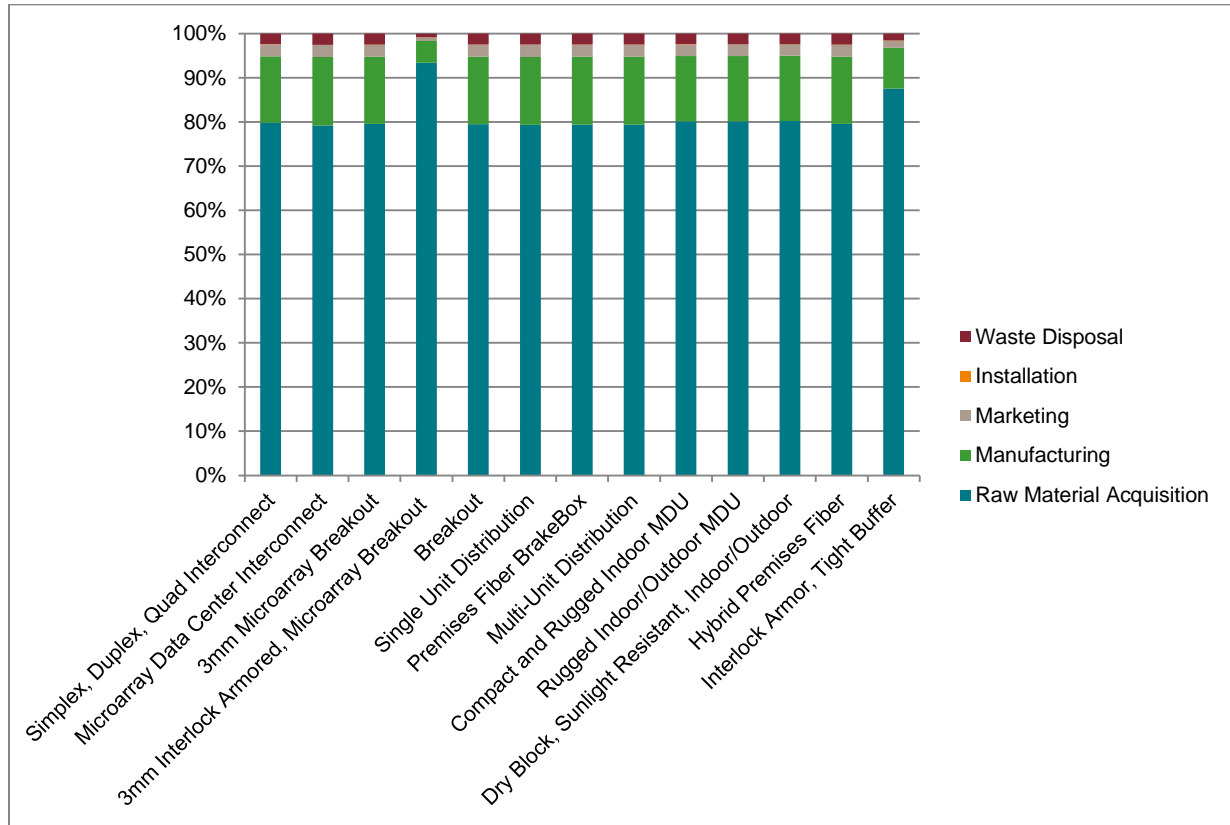
The study assumes that fiber optic cables are not recycled at the end of life with 100% of materials being disposed as the average US municipal solid waste disposition. The average US disposition includes 82% landfill and 18% incineration.

## Life Cycle Inventory

### Energy Use

Life Cycle Stage	Simplex, Duplex, Quad Interconnect	Microarray Data Center Interconnect	3mm Microarray Breakout	3mm Interlock Armored, Microarray Breakout	Breakout	Single Unit Distribution	Premises Fiber BrakeBox	Multi-Unit Distribution	Compact and Rugged Indoor MDU	Rugged Indoor/Outdoor MDU	Dry Block, Sunlight Resistant, Indoor/Outdoor	Hybrid Premises Fiber	Interlock Armor, Tight Buffer
Raw Material Acquisition	4.1E+01	5.5E+01	3.2E+02	1.5E+03	2.8E+02	2.9E+02	9.3E+02	9.5E+02	3.7E+01	3.7E+01	7.1E+02	5.0E+02	2.3E+03
Manufacturing	7.8E+00	1.1E+01	6.1E+01	7.7E+01	5.4E+01	5.6E+01	1.8E+02	1.8E+02	6.8E+00	6.8E+00	1.3E+02	9.6E+01	2.5E+02
Marketing	1.4E+00	1.9E+00	1.1E+01	1.4E+01	9.6E+00	1.0E+01	3.2E+01	3.2E+01	1.2E+00	1.2E+00	2.3E+01	1.7E+01	4.4E+01
Installation	1.9E-02	2.6E-02	1.5E-01	1.9E-01	1.3E-01	1.4E-01	4.4E-01	4.5E-01	1.7E-02	1.7E-02	3.2E-01	2.3E-01	6.0E-01
Waste Disposal	1.3E+00	1.7E+00	9.9E+00	1.3E+01	8.9E+00	9.2E+00	2.9E+01	3.0E+01	1.1E+00	1.1E+00	2.1E+01	1.6E+01	4.0E+01
Total Cradle-to-Grave	5.2E+01	6.9E+01	4.0E+02	1.6E+03	3.6E+02	3.6E+02	1.2E+03	1.2E+03	4.6E+01	4.6E+01	8.8E+02	6.3E+02	2.7E+03

**Table 4: Cradle-to-Grave Cumulative Energy Demand (MJ) per 100 feet of Cable**



**Figure 4: Cradle-to-Grave Cumulative Energy Demand**

### Use of Resources

Impact Category	Simplex, Duplex, Quad Interconnect						Microarray Data Center Interconnect						3mm Microarray Breakout					
	Raw Material	Manufacturing	Marketing	Installation	Waste Disposal	Cradle to Grave	Raw Material	Manufacturing	Marketing	Installation	Waste Disposal	Cradle to Grave	Raw Material	Manufacturing	Marketing	Installation	Waste Disposal	Cradle to Grave
Non renewable energy (MJ)	4.1E+01	7.8E+00	1.4E+00	1.9E-02	1.2E+00	5.1E+01	5.4E+01	1.1E+01	1.9E+00	2.6E-02	1.7E+00	6.8E+01	3.1E+02	6.0E+01	1.1E+01	1.5E-01	9.6E+00	4.0E+02
Renewable energy (MJ)	3.4E-01	2.9E-02	0.0E+00	1.2E-04	4.0E-02	4.1E-01	5.1E-01	3.9E-02	0.0E+00	1.6E-04	5.5E-02	6.0E-01	2.6E+00	2.2E-01	0.0E+00	9.3E-04	3.1E-01	3.1E+00
Net Water Use (m3)	1.3E+00	1.2E-01	0.0E+00	7.0E-04	2.5E-01	1.6E+00	1.7E+00	1.7E-01	0.0E+00	9.7E-04	3.4E-01	2.3E+00	8.9E+00	9.5E-01	0.0E+00	5.5E-03	1.9E+00	1.2E+01
Impact Category	3mm Interlock Armored, Microarray Breakout						Breakout						Single Unit Distribution					
	Raw Material	Manufacturing	Marketing	Installation	Waste Disposal	Cradle to Grave	Raw Material	Manufacturing	Marketing	Installation	Waste Disposal	Cradle to Grave	Raw Material	Manufacturing	Marketing	Installation	Waste Disposal	Cradle to Grave
Non renewable energy (MJ)	1.3E+03	7.7E+01	1.4E+01	1.9E-01	1.2E+01	1.4E+03	2.8E+02	5.4E+01	9.6E+00	1.3E-01	8.6E+00	3.5E+02	2.9E+02	5.6E+01	1.0E+01	1.4E-01	8.9E+00	3.6E+02
Renewable energy (MJ)	1.4E+02	2.8E-01	0.0E+00	1.2E-03	3.9E-01	1.4E+02	2.1E+00	2.0E-01	0.0E+00	8.3E-04	2.8E-01	2.6E+00	2.3E+00	2.1E-01	0.0E+00	8.6E-04	2.9E-01	2.8E+00
Net Water Use (m3)	1.3E+03	1.2E+00	0.0E+00	7.0E-03	2.5E+00	1.3E+03	7.1E+00	8.5E-01	0.0E+00	4.9E-03	1.7E+00	9.7E+00	7.1E+00	8.8E-01	0.0E+00	5.1E-03	1.8E+00	9.8E+00
Impact Category	Premises Fiber BrakeBox						Multi-Unit Distribution						Compact and Rugged Indoor MDU					
	Raw Material	Manufacturing	Marketing	Installation	Waste Disposal	Cradle to Grave	Raw Material	Manufacturing	Marketing	Installation	Waste Disposal	Cradle to Grave	Raw Material	Manufacturing	Marketing	Installation	Waste Disposal	Cradle to Grave
Non renewable energy (MJ)	9.2E+02	1.8E+02	3.2E+01	4.4E-01	2.8E+01	1.2E+03	9.4E+02	1.8E+02	3.2E+01	4.4E-01	2.9E+01	1.2E+03	3.6E+01	6.8E+00	1.2E+00	1.6E-02	1.1E+00	4.5E+01
Renewable energy (MJ)	7.6E+00	6.6E-01	0.0E+00	2.8E-03	9.2E-01	9.2E+00	7.9E+00	6.7E-01	0.0E+00	2.8E-03	9.3E-01	9.5E+00	3.0E-01	2.5E-02	0.0E+00	1.0E-04	3.5E-02	3.6E-01
Net Water Use (m3)	2.5E+01	2.8E+00	0.0E+00	1.6E-02	5.8E+00	3.4E+01	2.6E+01	2.9E+00	0.0E+00	1.7E-02	5.9E+00	3.5E+01	1.1E+00	1.1E-01	0.0E+00	6.1E-04	2.2E-01	1.5E+00
Impact Category	Rugged Indoor/Outdoor MDU						Dry Block, Sunlight Resistant, Indoor/Outdoor						Hybrid Premises Fiber					
	Raw Material	Manufacturing	Marketing	Installation	Waste Disposal	Cradle to Grave	Raw Material	Manufacturing	Marketing	Installation	Waste Disposal	Cradle to Grave	Raw Material	Manufacturing	Marketing	Installation	Waste Disposal	Cradle to Grave
Non renewable energy (MJ)	3.7E+01	6.8E+00	1.2E+00	1.7E-02	1.1E+00	4.6E+01	7.0E+02	1.3E+02	2.3E+01	3.2E-01	2.1E+01	8.8E+02	5.0E+02	9.6E+01	1.7E+01	2.3E-01	1.5E+01	6.3E+02
Renewable energy (MJ)	3.0E-01	2.5E-02	0.0E+00	1.0E-04	3.5E-02	3.6E-01	6.6E+00	4.8E-01	0.0E+00	2.0E-03	6.6E-01	7.7E+00	4.4E+00	3.5E-01	0.0E+00	1.5E-03	4.9E-01	5.2E+00
Net Water Use (m3)	1.2E+00	1.1E-01	0.0E+00	6.2E-04	2.2E-01	1.5E+00	2.4E+01	2.0E+00	0.0E+00	1.2E-02	4.2E+00	3.0E+01	1.5E+01	1.5E+00	0.0E+00	8.7E-03	3.1E+00	2.0E+01
Impact Category	Interlock Armor, Tight Buffer																	
	Raw Material	Manufacturing	Marketing	Installation	Waste Disposal	Cradle to Grave												
Non renewable energy (MJ)	2.2E+03	2.5E+02	4.4E+01	6.0E-01	3.9E+01	2.5E+03												
Renewable energy (MJ)	1.5E+02	9.1E-01	0.0E+00	3.8E-03	1.3E+00	1.5E+02												
Net Water Use (m3)	1.3E+03	3.9E+00	0.0E+00	2.2E-02	8.0E+00	1.3E+03												

Table 5: Cradle-to-Grave non-renewable energy, renewable energy, and water use per 100ft of Cable

## Waste Management

Life Cycle Stage	Simplex, Duplex, Quad Interconnect	Microarray Data Center Interconnect	3mm Microarray Breakout	3mm Interlock Armored, Microarray Breakout	Breakout	Single Unit Distribution	Premises Fiber BrakeBox	Multi-Unit Distribution	Compact and Rugged Indoor MDU	Rugged Indoor/Outdoor MDU	Dry Block, Sunlight Resistant, Indoor/Outdoor	Hybrid Premises Fiber	Interlock Armor, Tight Buffer
Incineration (with and without energy recovery)	2.9E-01	4.0E-01	2.3E+00	2.7E+00	2.0E+00	2.1E+00	6.8E+00	6.9E+00	2.5E-01	2.5E-01	4.9E+00	3.6E+00	9.2E+00
Landfill (nonhazardous waste)	2.5E+00	3.4E+00	1.9E+01	1.4E+02	1.6E+01	1.7E+01	5.5E+01	5.6E+01	2.2E+00	2.2E+00	4.3E+01	3.0E+01	1.9E+02
Hazardous Waste	1.9E-03	1.5E-03	1.5E-02	5.2E-02	1.6E-02	1.5E-02	4.2E-02	4.2E-02	1.9E-03	1.9E-03	2.5E-02	2.0E-02	9.3E-02
Landfill Avoidance (recycling)	8.8E-03	1.1E-02	6.2E-02	7.9E-02	5.6E-02	5.8E-02	1.8E-01	1.9E-01	7.0E-03	7.0E-03	1.3E-01	9.8E-02	2.5E-01

Table 6: Cradle-to-Grave Waste (kg) per 100ft of Cable

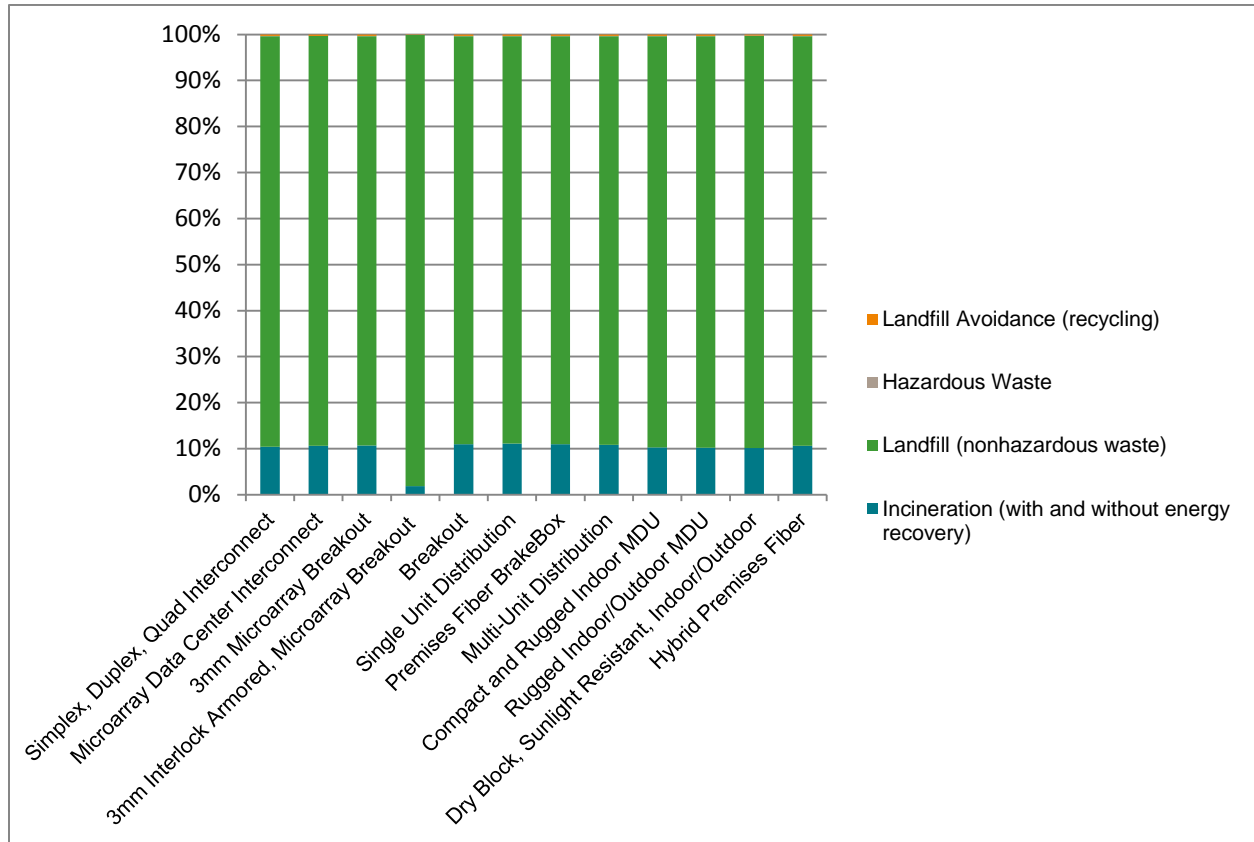


Figure 5: Cradle-to-Grave Waste

## Life Cycle Impact Assessment

The environmental impacts listed below were assessed throughout the life cycle of the riser fiber optic cable products as defined above, per 100 feet of cable. The environmental impacts were analyzed using TRACI 2.1 methodology.

Impact Category	Simplex, Duplex, Quad Interconnect						Microarray Data Center Interconnect						3mm Microarray Breakout					
	Raw Material	Manufacturing	Marketing	Installation	Waste Disposal	Cradle to Grave	Raw Material	Manufacturing	Marketing	Installation	Waste Disposal	Cradle to Grave	Raw Material	Manufacturing	Marketing	Installation	Waste Disposal	Cradle to Grave
Global Warming (kg CO <sub>2</sub> eq)	2.0E+00	4.7E-01	1.0E-01	2.7E-03	3.0E-01	2.8E+00	2.7E+00	6.5E-01	1.4E-01	3.7E-03	4.2E-01	3.9E+00	1.5E+01	3.7E+00	7.9E-01	2.1E-02	2.4E+00	2.2E+01
Acidification (kg SO <sub>2</sub> eq)	2.2E-02	4.1E-03	6.0E-04	5.7E-06	5.3E-04	2.7E-02	3.0E-02	5.7E-03	8.3E-04	7.9E-06	7.3E-04	3.7E-02	1.7E-01	3.2E-02	4.7E-03	4.5E-05	4.1E-03	2.1E-01
Eutrophication (kg N eq)	2.0E-02	1.9E-04	3.4E-05	2.7E-04	3.6E-04	2.0E-02	2.8E-02	2.6E-04	4.6E-05	3.7E-04	5.0E-04	2.9E-02	1.5E-01	1.5E-03	2.6E-04	2.1E-03	2.8E-03	1.6E-01
Smog (kg O <sub>3</sub> eq)	1.3E-01	2.3E-02	1.7E-02	1.5E-04	6.7E-03	1.8E-01	1.7E-01	3.1E-02	2.3E-02	2.0E-04	9.2E-03	2.4E-01	9.6E-01	1.8E-01	1.3E-01	1.1E-03	5.2E-02	1.3E+00
Ozone Depletion (kg CFC-11 eq)	1.5E-07	1.8E-09	3.9E-12	2.5E-10	6.6E-09	1.6E-07	2.1E-07	2.4E-09	5.3E-12	3.4E-10	9.1E-09	2.2E-07	1.1E-06	1.4E-08	3.0E-11	1.9E-09	5.2E-08	1.2E-06
Impact Category	3mm Interlock Armored, Microarray Breakout						Breakout						Single Unit Distribution					
	Raw Material	Manufacturing	Marketing	Installation	Waste Disposal	Cradle to Grave	Raw Material	Manufacturing	Marketing	Installation	Waste Disposal	Cradle to Grave	Raw Material	Manufacturing	Marketing	Installation	Waste Disposal	Cradle to Grave
Global Warming (kg CO <sub>2</sub> eq)	9.2E+01	4.7E+00	1.0E+00	2.7E-02	3.0E+00	1.0E+02	1.3E+01	3.3E+00	7.1E-01	1.9E-02	2.1E+00	1.9E+01	1.3E+01	3.4E+00	7.3E-01	2.0E-02	2.2E+00	2.0E+01
Acidification (kg SO <sub>2</sub> eq)	4.6E-01	4.1E-02	6.0E-03	5.7E-05	5.2E-03	5.1E-01	1.5E-01	2.9E-02	4.2E-03	4.0E-05	3.7E-03	1.9E-01	1.6E-01	3.0E-02	4.4E-03	4.1E-05	3.8E-03	2.0E-01
Eutrophication (kg N eq)	2.7E-01	1.9E-03	3.3E-04	2.7E-03	3.6E-03	2.8E-01	1.3E-01	1.3E-03	2.3E-04	1.9E-03	2.5E-03	1.4E-01	1.4E-01	1.4E-03	2.4E-04	2.0E-03	2.6E-03	1.5E-01
Smog (kg O <sub>3</sub> eq)	6.1E+00	2.3E-01	1.6E-01	1.5E-03	6.6E-02	6.6E+00	8.4E-01	1.6E-01	1.2E-01	1.0E-03	4.7E-02	1.2E+00	8.5E-01	1.7E-01	1.2E-01	1.1E-03	4.8E-02	1.2E+00
Ozone Depletion (kg CFC-11 eq)	1.1E-05	1.7E-08	3.8E-11	2.4E-09	6.6E-08	1.1E-05	9.3E-07	1.2E-08	2.7E-11	1.7E-09	4.6E-08	9.9E-07	9.6E-07	1.3E-08	2.8E-11	1.8E-09	4.8E-08	1.0E-06
Impact Category	Premises Fiber BrakeBox						Multi-Unit Distribution						Compact and Rugged Indoor MDU					
	Raw Material	Manufacturing	Marketing	Installation	Waste Disposal	Cradle to Grave	Raw Material	Manufacturing	Marketing	Installation	Waste Disposal	Cradle to Grave	Raw Material	Manufacturing	Marketing	Installation	Waste Disposal	Cradle to Grave
Global Warming (kg CO <sub>2</sub> eq)	4.4E+01	1.1E+01	2.3E+00	6.2E-02	7.0E+00	6.4E+01	4.5E+01	1.1E+01	2.4E+00	6.4E-02	7.1E+00	6.5E+01	1.7E+00	4.1E-01	8.8E-02	2.4E-03	2.6E-01	2.5E+00
Acidification (kg SO <sub>2</sub> eq)	5.0E-01	9.6E-02	1.4E-02	1.3E-04	1.2E-02	6.3E-01	5.1E-01	9.7E-02	1.4E-02	1.3E-04	1.2E-02	6.4E-01	1.9E-02	3.6E-03	5.3E-04	5.0E-06	4.6E-04	2.4E-02
Eutrophication (kg N eq)	4.7E-01	4.4E-03	7.8E-04	6.2E-03	8.4E-03	4.9E-01	4.7E-01	4.5E-03	7.9E-04	6.4E-03	8.5E-03	4.9E-01	1.7E-02	1.7E-04	2.9E-05	2.4E-04	3.2E-04	1.7E-02
Smog (kg O <sub>3</sub> eq)	2.8E+00	5.3E-01	3.8E-01	3.4E-03	1.5E-01	3.9E+00	2.9E+00	5.4E-01	3.9E-01	3.5E-03	1.6E-01	4.0E+00	1.2E-01	2.0E-02	1.4E-02	1.3E-04	5.8E-03	1.6E-01
Ozone Depletion (kg CFC-11 eq)	3.3E-06	4.1E-08	8.9E-11	5.7E-09	1.5E-07	3.5E-06	3.3E-06	4.1E-08	9.1E-11	5.8E-09	1.6E-07	3.5E-06	1.4E-07	1.5E-09	3.4E-12	2.2E-10	5.8E-09	1.4E-07



Impact Category	Rugged Indoor/Outdoor MDU						Dry Block, Sunlight Resistant, Indoor/Outdoor						Hybrid Premises Fiber					
	Raw Material	Manufacturing	Marketing	Installation	Waste Disposal	Cradle to Grave	Raw Material	Manufacturing	Marketing	Installation	Waste Disposal	Cradle to Grave	Raw Material	Manufacturing	Marketing	Installation	Waste Disposal	Cradle to Grave
Global Warming (kg CO <sub>2</sub> eq)	1.8E+00	4.1E-01	8.9E-02	2.4E-03	2.7E-01	2.5E+00	3.4E+01	7.9E+00	1.7E+00	4.5E-02	5.1E+00	4.9E+01	2.4E+01	5.8E+00	1.2E+00	3.3E-02	3.7E+00	3.5E+01
Acidification (kg SO <sub>2</sub> eq)	1.9E-02	3.6E-03	5.3E-04	5.0E-06	4.6E-04	2.4E-02	3.6E-01	6.9E-02	1.0E-02	9.6E-05	8.9E-03	4.5E-01	2.7E-01	5.1E-02	7.5E-03	7.1E-05	6.5E-03	3.3E-01
Eutrophication (kg N eq)	1.7E-02	1.7E-04	2.9E-05	2.4E-04	3.2E-04	1.7E-02	3.3E-01	3.2E-03	5.6E-04	4.5E-03	6.1E-03	3.4E-01	2.5E-01	2.4E-03	4.2E-04	3.3E-03	4.5E-03	2.6E-01
Smog (kg O <sub>3</sub> eq)	1.2E-01	2.0E-02	1.4E-02	1.3E-04	5.8E-03	1.6E-01	2.2E+00	3.8E-01	2.8E-01	2.5E-03	1.1E-01	3.0E+00	1.5E+00	2.8E-01	2.0E-01	1.8E-03	8.2E-02	2.1E+00
Ozone Depletion (kg CFC-11 eq)	1.4E-07	1.5E-09	3.4E-12	2.2E-10	5.8E-09	1.5E-07	2.8E-06	2.9E-08	6.5E-11	4.1E-09	1.1E-07	2.9E-06	1.9E-06	2.2E-08	4.8E-11	3.0E-09	8.2E-08	2.0E-06
Impact Category	Interlock Armor, Tight Buffer																	
	Raw Material	Manufacturing	Marketing	Use	Waste Disposal	Cradle to Grave												
Global Warming (kg CO <sub>2</sub> eq)	1.3E+02	1.5E+01	3.2E+00	8.6E-02	9.6E+00	1.6E+02												
Acidification (kg SO <sub>2</sub> eq)	9.3E-01	1.3E-01	1.9E-02	1.8E-04	1.7E-02	1.1E+00												
Eutrophication (kg N eq)	7.1E-01	6.1E-03	1.1E-03	8.6E-03	1.2E-02	7.3E-01												
Smog (kg O <sub>3</sub> eq)	8.7E+00	7.3E-01	5.3E-01	4.7E-03	2.1E-01	1.0E+01												
Ozone Depletion (kg CFC-11 eq)	1.4E-05	5.6E-08	1.2E-10	7.8E-09	2.1E-07	1.4E-05												

**Table 7: Cradle-to-Grave Life Cycle Impact Assessment Results per 100 ft of Cable**

## References

- ANSI/TIA-568-C. Optical Fiber Cabling Components Standard
- C22.2 NO. 214-08 (R2013) - Communications cables (Bi-national standard, with UL 444)
- EN 15804:2012 Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products
- EPA, Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI)
- EPA, Wire and Cable Insulation and Jacketing: Life-Cycle Assessments for Selected Applications, June 2008, EPA 744-R-08-001
- FTC Part 260, Green guides
- (ILCD, 2010) Joint Research Commission, 2010, ILCD Handbook: General Guide for Life Cycle Assessment
- Intergovernmental Panel on Climate Change (IPCC)
- ISO 14025:2006 *Environmental labels and declarations – Type III environmental declarations – Principles and procedures*



- ISO 14040:2006 *Environmental management - Life cycle assessment – Principles and framework*
- ISO 14044:2006 *Environmental management - Life cycle assessment – Requirements and guidelines*
- ISO 21930:2007 *Sustainability in building construction – Environmental declaration of building products*
- NFPA 262: Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces
- NFPA 70®: National Electrical Code
- UL 44 Standard Thermoset-Insulated Wires and Cables
- UL 1666 Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts
- USEPA Waste Reduction Model (WARM)

### LCA Development

---

This EPD and corresponding LCA were prepared by Sustainable Solutions Corporation of Royersford, Pennsylvania.



### Contact Superior Essex

---

For more information, please visit <http://ce.superioressex.com/>, or contact Technical Support at [Comm.TechSupport@spsx.com](mailto:Comm.TechSupport@spsx.com) or +1 (877) 263-2818.

Superior Essex is located at:

6120 Powers Ferry Road  
Suite 150  
Atlanta, GA 30339

