Environmental Product Declaration	AEP Span, based on BOF Steel

Declaration Owner

AEP Span
2141 Milwaukee Way, Tacoma, Washington 98421
2110 Enterprise Boulevard, West Sacramento, California 95691
800.733.4955 | info@aepspan.com |www.aepspan.com

Product:

AEP Span (gauges 26 to 18) made from roll formed Steel, painted, and protected with ZINCALUME® coating (an aluminum-zinc coating), ZINCALUME® Plus coating (an aluminum-zinc with resin coating) or TruZinc® coating (hot-dipped galvanized coating).

Declared Unit

The declared unit is 100 m^2 of AEP Span product, based on Basic Oxygen Furnace (BOF) Steel.

EPD Number and Period of Validity

SCS-EPD-07578
EPD Valid January 13, 2022 through January 12, 2027

Product Category Rule

PCR Guidance for Building-Related Products and Services Part A: Life Cycle Assessment Calculation Rules and Report Requirements. UL 10010 Version 3.2. December 2018

PCR Guidance for Building-Related Products and Services: Part B: Insulated Metal Panels, Metal Composite Panels, and Meta Cladding l:Roof and Wall Panels UL 10010-5 v2.0, Oct. 23, 2018

Program Operator

SCS Global Services
2000 Powell Street, Ste. 600, Emeryville, CA 94608
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Declaration owner:	AEP Span
Address:	2141 Milwaukee Way, Tacoma, Washington 98421 2110 Enterprise Boulevard, West Sacramento, California 95691
Declaration Number:	SCS-EPD-07578
Declaration Validity Period:	EPD Valid January 13, 2022 through January 12, 2027
Program Operator:	SCS Global Services
Declaration URL Link:	https://www.scsglobalservices.com/certified-green-products-guide
LCA Practitioner:	Tess Garvey, Ph.D., SCS Global Services
LCA Software and LCI database:	OpenLCA 1.10 software and the Ecoinvent v3.7.1 database
Product's Intended Application:	Use in construction applications as metal roofing and wall panel systems
Product RSL:	n/a
Markets of Applicability:	Global
EPD Type:	Product-Specific
EPD Scope:	Cradle-to-Gate
LCIA Method and Version:	CML-IA and TRACI 2.1
Independent critical review of the LCA and data, according to ISO 14044 and ISO 14071	☐ internal ☒ external
LCA Reviewer:	Thomas Gloria, Ph.D., Industrial Ecology Consultants
Part A Product Category Rule:	PCR Guidance for Building-Related Products and Services Part A: Life Cycle Assessment Calculation Rules and Report Requirements. UL 10010 Version 3.2. December 2018
Part A PCR Review conducted by:	Lindita Bushi, PhD (Chair); Hugues Imbeault-Tétreault, ing., M.Sc.A.; Jack Geibig
Part B Product Category Rule:	PCR Guidance for Building-Related Products and Services: Part B: Insulated Metal Panels, Metal Composite Panels, and Meta Cladding l:Roof and Wall Panels UL 10010-5 v2.0, Oct. 23, 2018
Part B PCR Review conducted by:	Thomas Gloria, PhD; Brandie Sebastian, James Littlefield
Independent verification of the declaration and data, according to ISO 14025 and the PCR	☐ internal ☒ external
EPD Verifier:	Thomas Gloria, Ph.D., Industrial Ecology Consultants
Declaration Contents:	

Disclaimers: *This EPD conforms to ISO 14025, 14040, 14044, and ISO 21930.*

Scope of Results Reported: *The PCR requirements limit the scope of the LCA metrics such that the results exclude environmental and social performance benchmarks and thresholds, and exclude impacts from the depletion of natural resources, land use ecological impacts, ocean impacts related to greenhouse gas emissions, risks from hazardous wastes and impacts linked to hazardous chemical emissions.*

Accuracy of Results: *Due to PCR constraints, this EPD provides estimations of potential impacts that are inherently limited in terms of accuracy.*

Comparability: *The PCR this EPD was based on was not written to support comparative assertions. EPDs based on different PCRs, or different calculation models, may not be comparable. When attempting to compare EPDs or life cycle impacts of products from different companies, the user should be aware of the uncertainty in the final results, due to and not limited to, the practitioner's assumptions, the source of the data used in the study, and the specifics of the product modeled.*

In accordance with ISO 21930:2017, EPDs are comparable only if they comply with the core PCR, use the same sub-category PCR where applicable, include all relevant information modules and are based on equivalent scenarios with respect to the context of construction works.

1. AEP Span

AEP Span is a leading manufacturer of premier metal roof and siding products and a trusted partner for over 50 years, offering architects an unrivaled commitment to their success in achieving innovative building designs. AEP Span's portfolio of quality products has been engineered to deliver long-lasting performance and design flexibility and has been tested by an accredited third-party, exceeding industry testing standards. Moreover, structural performance data for AEP Span's products are available in a building code compliance report.

AEP Span has a team of responsive, knowledgeable, and trustworthy professionals committed to a true partnership in helping architects bring their vision to life for their clients. Moreover, as an environmental steward, AEP Span is passionate and proud to be leading the way to healthier, green built living spaces for all.

2. Products

2.1 PRODUCT DESCRIPTION

AEP Span products are available in varied gauges, widths, and made from steel with different coating weights and paint options. The results reported for AEP Span products are based on the production-weighted average across two production facilities in the U.S.

AEP Span metal panels, trims and flashings, and flat sheets are produced using metallic coated (ZINCALUME®/Galvalume® or hot-dipped galvanized) steel, which offers outstanding corrosion protection and contributes to the lifespan of the products and building. Moreover, AEP Span metal products are coated in cool-formulated, premium paint systems which deliver solar reflectance and thermal emittance characteristics that contribute to helping keep a building cooler. AEP Span metal products are manufactured on a "cut-to-size" basis at the plant, eliminating waste at the job site and, at the end of its life use, is 100% recyclable.

The AEP Span in this study is used in construction applications and falls under the following CSI classifications:

07 41 00 Roof Panels
07 41 13 Metal Roof Panels
07 42 00 Wall Panels
07 42 13 Metal Wall Panels
07 61 00 Sheet Metal Roofing
07 61 13 Standing Seam Sheet Metal Roofing
07 61 16 Batten Seam Sheet Metal Roof
07 62 00 Sheet Metal Flashing and Trim
07 64 00 Sheet Metal Wall Cladding
07 64 13 Standing Seam Sheet Metal Wall Cladding
07 64 16 Batten Seam Sheet Metal Wall Cladding

Table 1. *Specification of AEP Span products included in the study, by facility*.

Product Type	Tacoma, WA	West Sacramento, CA
37.5" Flat Sheet	22-24 Ga	--
41.125" Flat Sheet	--	18-26 Ga
42.750" Flat Sheet	--	22-26 Ga
46" Flat Sheet	20-24 Ga	18-26 Ga
48 3/8" Flat Sheet	20-24 Ga	24 Ga
Box Rib™/ Reverse Box Rib	--	18-26 Ga
Design Span® 12"	22-24 Ga	--
Design Span® 16"	22-24	--
Design Span® 18"	20-24	--
Design Span® hp 17"	22-24	--
Flex Series	20-24 Ga	--
Flush Panel	22-24 Ga	--
Form Deck 7/8"	--	18-26 Ga
Form Deck 1 3/8"/CP-32	18-26 Ga	--
HR-36®/ Reverse HR-36	--	18-26 Ga
IronOx Corrugated	18-26 Ga	--
Mini-V-Beam™	--	18-26 Ga
Nu-Wave® Corrugated	--	18-26 Ga
PBR	--	22-26 Ga
Perception Collection®	18-24 Ga	--
Prestige Series®	18-24 Ga	--
Select Seam® Narrow Batten	22-24 Ga	--
Select Seam® Narrow Batten 12"	22-24 Ga	--
Snap on Narrow Batten	22-24 Ga	--
Snap on Wide Batten	22-24 Ga	--
Span-Lok™ /Span Lok hp	22-24	--
SpanSeam™	22-24	--
Trims, Flashings and Gutters	All gauges	All gauges
U-Panel	--	22-26 Ga

AEP Span produces products with an average density of 7,850 kg/m^2.

2.2 PRODUCT FLOW DIAGRAM

A flow diagram illustrating the production processes and life cycle phases included in the scope of the EPD is provided below.

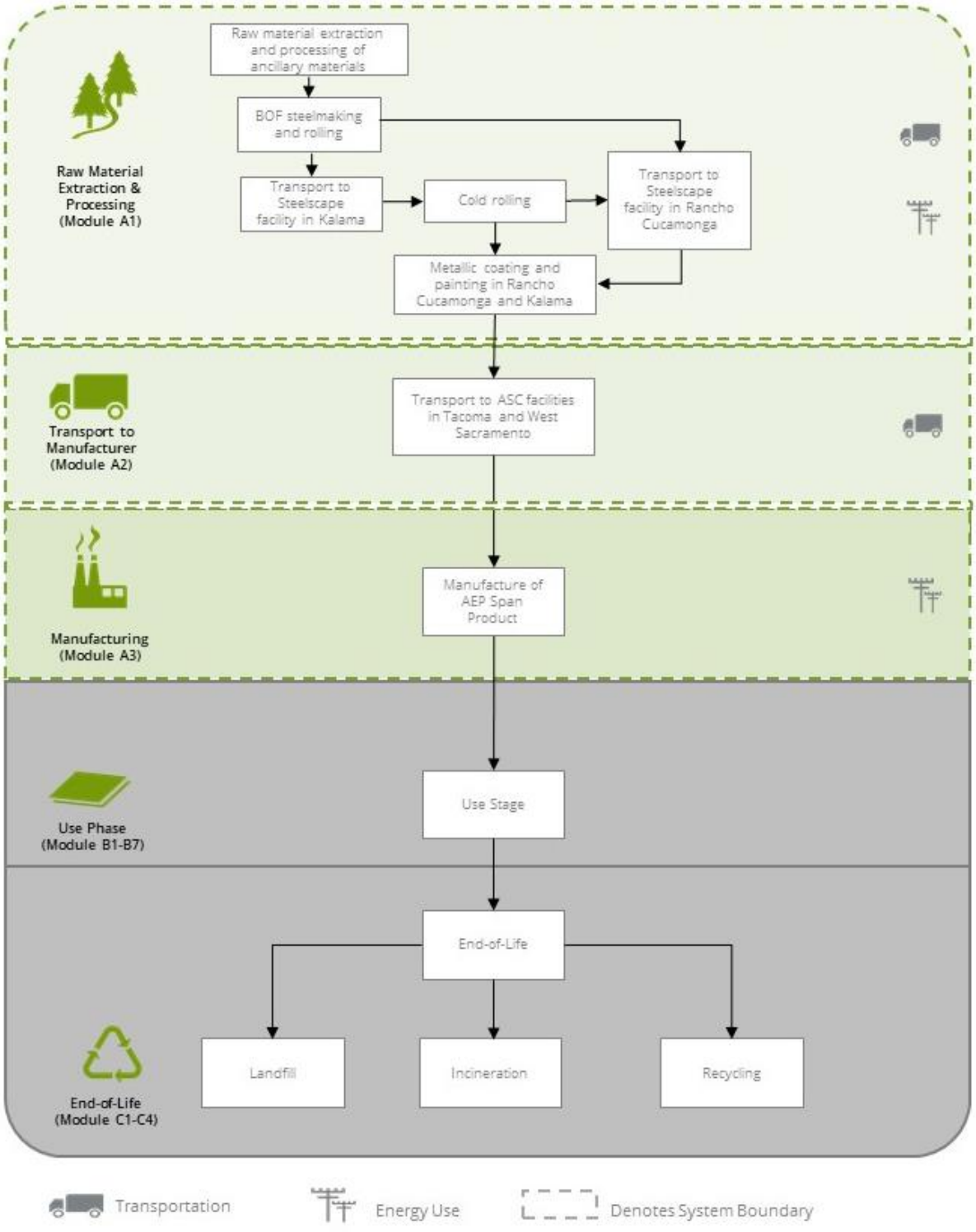

Figure 1. *Flow Diagram for the life cycle of AEP Span.*

2.4 DECLARATION OF METHODOLOGICAL FRAMEWORK

The scope of the EPD is cradle-to-gate, including raw material extraction and processing, transportation, steel manufacture and roll forming. The life cycle phases included in the product system boundary are shown below.

Table 2. *Life cycle phases included in the AEP Span product system boundary.*

Product			Construction Process		Use							End-of-life				Benefits and loads beyond the system boundary
A1	A2	A3	A4	A5	B1	B1	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Raw material extraction and processing	Transport to manufacturer	Manufacturing	Transport	Construction - installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction demolition	Transport	Waste processing	Disposal	Reuse, recovery and/or recycling potential
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

X = Module Included | MND = Module Not Declared

Cut-off and allocation procedures are described below and conform to the PCR and ISO standards.

2.5 TECHNICAL DATA

Technical specifications for AEP Span products in this EPD include ASTM A929/A929M-17- Standard Specification for Steel Sheet, Metallic-Coated by the Hot-Dip Process for Corrugated Steel Pipe.

2.6 INTENDED APPLICATION

The intended application of AEP Span products is for use in construction applications, including new construction and re-roofing applications, as metal roofing and wall panel systems.

2.7 MATERIAL COMPOSITION

The AEP Span products modeled in this study uses coated steel as the main input. AEP Span products were modeled for the declared unit of 100 m^2 of span product. Table 3 presents the percentage composition of AEP Span products and includes the product composition for all gauges considered in Table 1.

Table 3. *Material composition of the AEP Span products*

Material	% of Total Weight
Base metal (Hot rolled coil)	93-97%
Metallic Coating (TruZinc® and ZINCALUME Plus®)*	3-7%
Primer (optional)	NA
Paint	<0.005%

AEP Span products under normal conditions do not present inhalation, ingestion, or contact health hazards. These products are used primarily on the exterior of a building envelope, but can be used in interior applications, and do not include materials or substances which have potential route of exposure to humans or flora/fauna in the environment.

2.8 PROPERTIES OF DECLARED PRODUCT AS DELIVERED

The AEP Span products are produced on a cut-to-size basis. The gauges of AEP Span products under this EPD are provided in Table 1.

2.9 MANUFACTURING

The AEP Span products in this study are manufactured at the Tacoma, WA and West Sacramento, CA facilities. Cold rolling and coating occurs at Steelscape facilities. Upstream steel production, hot rolling and cold rolling occurs at the Nippon Steel mill in Japan and BlueScope Steel mill in Australia.

2.10 TRANSPORTATION

Transportation for the LCA model is based on data for 1st tier suppliers (coated steel and painted steel) and 2nd tier suppliers (hot and cold rolled coil supplier and other chemical input suppliers) to the two roll forming facilities operated by ASC Profiles (West Sacramento, and Tacoma). For each ASC Profiles roll forming facility, a mass-weighted average distance from the major suppliers of each type of steel is used for upstream transportation as summarized in Table 4.

Table 4. *Transport distances for AEP Span products.*

Facility Receiving	Material	Supplier Company	Supplier Location	Transportation Distance (miles)		
				By Truck	By Rail	By Ocean Freight
West Sacramento, CA	Coated and painted steel steel	Steelscape, LLC	Kalama, WA	617		
			Rancho Cucamonga, CA	420		
Tacoma, WA	Coated steel Painted steel	Steelscape, LLC	Kalama, WA	88		
			Rancho Cucamonga, CA	1,140		
Rancho Cucamonga, CA	BOF Steel	BlueScope Steel	Port Kembla, NSW, Australia	94		6,500
Rancho Cucamonga, CA	Rolled Steel	Steelscape LLC	Kalama, WA	1,040		
Kalama, WA	BOF Steel	Nippon Steel	Kashima, Oita, Japan	120		4,270

2.11 PACKAGING

The packaging materials for AEP Span products include lumber packaging, steel strapping, and plastics including plastic film and poly strapping.

2.12 FURTHER INFORMATION

Further information on the product can be found on the manufacturers' website at https://www.aepspan.com

3. LCA: Calculation Rules

3.1 DECLARED UNIT

The declared unit is defined as the coverage of 100 m^2 of AEP Span product, used in various metal roofing and wall panel systems, in accordance with the PCR. The coverage area refers to the project flat area covered by the AEP Span products, and does not account for losses due to overlap.

Table 5. *Declared unit of AEP Span*

Parameter	Value	Unit
Declared unit	100	m^2 of coverage
Mass	589	kg

Table 6. *The modules and unit processes included in the scope for AEP Span*

Module	Module Description	Unit Processes Included in Scope
A1	Extraction and processing of raw materials; any reuse of products or materials from previous product systems; processing of secondary materials; generation of electricity from primary energy resources; energy, or other, recovery processes from secondary fuels	Steelmaking at Nippon Steel and BlueScope Steel, transportation of hot rolled coil to Steelscape facility in Kalama, pickling and cold rolling processes at Kalama facility, coating of steel and painting of steel at Steelscape facilities in Kalama and Rancho Cucamonga.
A2	Transport (to the manufacturer)	Transportation of coated and painted steel to roll forming facilities in Tacoma and West Sacramento
A3	Manufacturing, including ancillary material production	Manufacture of AEP Span products in the Tacoma and West Sacramento facilities.
A4	Transport (to the building site)	Module Not Declared
A5	Construction-installation process	Module Not Declared
B1	Product use	Module Not Declared
B2	Product maintenance	Module Not Declared
B3	Product repair	Module Not Declared
B4	Product replacement	Module Not Declared
B5	Product refurbishment	Module Not Declared
B6	Operational energy use by technical building systems	Module Not Declared
B7	Operational water uses by technical building systems	Module Not Declared
C1	Deconstruction, demolition	Module Not Declared
C2	Transport (to waste processing)	Module Not Declared
C3	Waste processing for reuse, recovery and/or recycling	Module Not Declared
C4	Disposal	Module Not Declared
D	Reuse-recovery-recycling potential	Module Not Declared

3.2 UNITS

All data and results are presented using SI units.

3.3 ESTIMATES AND ASSUMPTIONS

- Primary data on energy and resource use was collected for operations occurring in the Kalama and Rancho Cucamonga facilities. A production weighted average was calculated for all results across manufacturing facilities.

- The product uses cold rolled steel from BlueScope Steel mill in Australia and hot rolled steel from Nippon Steel mill in Japan. BlueScope Steel mill and Nippon Steel mill provided LCI and LCIA results.
- Primary data was also sought for intermediate processes such as pickling, cold rolling, coating and painting from Steelscape facilities in Kalama and Rancho Cucamonga, using Data Request Forms.
- Specific data were not available on resins used during the metallic coating process of steel. Based on the SDSs of these chemicals, secondary datasets for acrylic binders and dispersions from Ecoinvent database were used to represent these chemicals in the LCA model.
- The Kalama and Tacoma facilities are located in the NWPP eGRID NERC subregion. The West Sacramento facility is located in the CAMX eGRID NERC subregion. Ecoinvent inventory datasets were modified to reflect the eGRID electricity supply mix for the NWPP and CAMX subregions to estimate resource use and emissions from electricity use at the facilities.
- Electricity and natural gas use at the Kalama and Rancho Cucamonga facilities were adjusted to remove the amount used by a large administration building on-site using the square footage of the administration building and average fuel consumption for office buildings from the CBECS dataset [9]. This assumption did not have a significant impact on either the electricity or natural gas at Kalama.
- Representative inventory data for raw materials and ancillary materials were modeled with unit process data taken from Ecoinvent.
- Disposal of manufacturing waste is modeled based for solid and hazardous waste generation and disposal in the United States, as specified in the PCR. Specifically, 80% of non-hazardous wastes are disposed in landfill and 20% incinerated. Transportation for end-of-life scenarios was modeled using the EPA WARM model assumption of 20 miles (~32 km), from the point of product use to a landfill, material recovery center, or waste incinerator. Ecoinvent datasets are used to model the impacts associated with incineration and landfilling, which does not include energy recovery from landfill gas.

The PCR requires the results for several inventory flows related to construction products to be reported including energy and resource use and waste and outflows. These are aggregated inventory flows, and do not characterize any potential impact; results should be interpreted considering this limitation.

3.4 CUT-OFF RULES

According to the PCR, processes contributing greater than 1% of the total environmental impact indicator for each impact are included in the inventory. No data gaps were allowed which were expected to significantly affect the outcome of the indicator results. No known flows are deliberately excluded from this EPD.

3.5 DATA SOURCES

Primary data were provided by AEP Span for their manufacturing facility and LCI and LCIA results were provided by BlueScope Steel and Nippon Steel for their BOF steel mill. The sources of secondary LCI data are the Ecoinvent database.

Table 7. *Data sources for the AEP Span*

Flow	Dataset	Data Source	Publication Date
Raw Materials			
BOF Steel	LCI and LCIA Results obtained from Nippon Steel and BlueScope Steel	Nippon Steel BlueScope Steel	2020
Paints	alkyd paint production, white, solvent-based, product in 60% solution state | alkyd paint, white, without solvent, in 60% solution state | Cutoff, U - RoW	Ecoinvent 3.7.1	2020
Bonderite	market for chromium oxide, flakes | chromium oxide, flakes | Cutoff, U – GLO market for nitric acid, without water, in 50% solution state | nitric acid, without water, in 50% solution state | Cutoff, U – RoW diammonium phosphate production | diammonium phosphate | Cutoff, U – RoW market for phosphoric acid, industrial grade, without water, in 85% solution state | phosphoric acid, industrial grade, without water, in 85% solution state | Cutoff, U - GLO	Ecoinvent 3.7.1	2020
HCl	market for hydrochloric acid, without water, in 30% solution state | Cutoff, U - RoW	Ecoinvent 3.7.1	2020
Inhibitor	market for hydrochloric acid, without water, in 30% solution state | hydrochloric acid, without water, in 30% solution state | Cutoff, U – RoW market for non-ionic surfactant | non-ionic surfactant | Cutoff, U - GLO	Ecoinvent 3.7.1	2020
Rolling Oil	lubricating oil production | lubricating oil | Cutoff, U - RoW	Ecoinvent 3.7.1	2020
Zinc ingots	market for zinc | zinc | Cutoff, U - GLO	Ecoinvent 3.7.1	2020
Aluminum ingots	aluminium, ingot, primary, import from Asia (excluding China) | aluminium, primary, ingot | Cutoff, U - IAI Area, North America	Ecoinvent 3.7.1	2020
PC Resin	polycarbonate production | polycarbonate | Cutoff, U - RoW	Ecoinvent 3.7.1	2020
Plastic shrink wrap	packaging film production, low density polyethylene | packaging film, low density polyethylene | Cutoff, U - RoW	Ecoinvent 3.7.1	2020
Wood skids	EUR-flat pallet production | EUR-flat pallet | Cutoff, U - RoW	Ecoinvent 3.7.1	2020
Solvents	market for solvent for paint | solvent for paint | Cutoff, U - GLO	Ecoinvent 3.7.1	2020
Chemicals	market for chemicals, inorganic | chemical, inorganic | Cutoff, U - GLO	Ecoinvent 3.7.1	2020
Cleaning chemicals	market for cleaning consumables, without water, in 13.6% solution state | cleaning consumables, without water, in 13.6% solution state | Cutoff, U - GLO	Ecoinvent 3.7.1	2020
Electricity/Heat			
Electricity	electricity voltage transformation from high to medium voltage | electricity, medium voltage | Cutoff, U - US-WECC adapted for eGRID 2019 for CAMX and NWPP	Ecoinvent 3.7.1 EGRID 2019	2020 2021
Natural gas	market for natural gas, high pressure | natural gas, high pressure | Cutoff, U – US heat and power co-generation, natural gas, conventional power plant, 100MW electrical | heat, district or industrial, natural gas | Cutoff, U - US-WECC	Ecoinvent 3.7.1	2020
Light fuel oil	light fuel oil production, petroleum refinery operation | light fuel oil | Cutoff, U - RoW	Ecoinvent 3.7.1	2020
Transportation			
Truck	transport, freight, lorry 16-32 metric ton, EURO4 | transport, freight, lorry 16-32 metric ton, EURO4 | Cutoff, U - RoW	Ecoinvent 3.7.1	2020
Rail	transport, freight train, diesel | transport, freight train | Cutoff, U - US	Ecoinvent 3.7.1	2020

3.5 DATA QUALITY

The data quality assessment addressed the following parameters: time-related coverage, geographical coverage, technological coverage, precision, completeness, representativeness, consistency, reproducibility, sources of data, and uncertainty.

Table 8. *Data quality assessment for the AEP Span system.*

Data Quality Parameter	Data Quality Discussion
Time-Related Coverage: Age of data and the minimum length of time over which data is collected	The most recent available data are used, based on other considerations such as data quality and similarity to the actual operations. Typically, these data are less than 10 years old (typically 2015 or more recent). All of the data used represented an average of at least one year's worth of data collection. For AEP Span manufacture, facility data is based on September-November 2020, due to recent changes in operations, and was considered sufficient. Using a full-year's coverage for AEP manufacturing could improve the time-related data quality.
Geographical Coverage: Geographical area from which data for unit processes is collected to satisfy the goal of the study	The data used in the analysis provide the best possible representation available with current data. Actual processes for upstream operations are primarily North American. Surrogate data used in the assessment are representative of North American operations. Data representative of European operations are considered sufficiently like actual processes. Data representing product disposal are based on regional statistics.
Technology Coverage: Specific technology or technology mix	For the most part, data are representative of the actual technologies used for processing, transportation, and manufacturing operations.
Precision: Measure of the variability of the data values for each data expressed	Precision of results are not quantified due to a lack of data. Data collected for operations were typically averaged for one or more years and over multiple operations, which is expected to reduce the variability of results.
Completeness: Percentage of flow that is measured or estimated	The LCA model included all known mass and energy flows for production of AEP Span. In some instances, surrogate data used to represent upstream and downstream operations may be missing some data which is propagated in the model. No known processes or activities contributing to more than 1% of the total environmental impact for each indicator are excluded.
Representativeness: Qualitative assessment of the degree to which the data set reflects the true population of interest	Data used in the assessment represent typical or average processes as currently reported from multiple data sources and are therefore generally representative of the range of actual processes and technologies for production of these materials. Considerable deviation may exist among actual processes on a site-specific basis; however, such a determination would require detailed data collection throughout the supply chain back to resource extraction.
Consistency: Qualitative assessment of whether the study methodology is applied uniformly to the various components of the analysis	The consistency of the assessment is considered to be high. Data sources of similar quality and age are used with a bias towards Ecoinvent v3.7.1 data where available. Different portions of the product life cycle are equally considered; however, it must be noted that final disposition of the product is based on assumptions of current average practices in Europe and the United States.
Reproducibility: Qualitative assessment of the extent to which information about the methodology and data values would allow an independent practitioner to reproduce the results reported in the study	Based on the description of data and assumptions used, this assessment would be reproducible by other practitioners. All assumptions, models, and data sources are documented.
Sources of the Data: Description of all primary and secondary data sources	Data representing energy use at the manufacturing facilities represent an annual average and are considered of high quality due to the length of time over which these data are collected, as compared to a snapshot that may not accurately reflect fluctuations in production. The Ecoinvent database is used for secondary LCI datasets.
Uncertainty of the Information: Uncertainty related to data, models, and assumptions	Uncertainty related to materials is low. Actual supplier data for upstream operations was not available for all suppliers and the study relied upon the use of existing representative datasets. These datasets contained relatively recent data (<10 years) but lacked geographical representativeness. Uncertainty related to the impact assessment methods used in the study are high. The impact assessment method required by the PCRs includes impact potentials, which lack characterization of providing and receiving environments or tipping points.

3.6 PERIOD UNDER REVIEW

The period of review for the Tacoma, WA and West Sacramento, CA facilities is September 1, 2020 through November 31, 2020.

3.7 ALLOCATION

With respect to the steel scrap, the 100-0 recycled content approach is used in which the recycled material bears only the burden of any processing from waste material.

Mass allocation was deemed the most accurate and reproducible way of calculating the energy and material requirements for the manufacture of steel and co-products. Primary data for resource use (e.g., electricity, natural gas, water), waste/co-products, and emissions released, are allocated on a mass-basis as a fraction of total annual production of steel and the co-products.

The transportation from primary producer of material components (e.g., alloys, fluxes) to steel mill and the Kalama and Rancho Cucamonga facilities are based on primary data provided by AEP Span, including modes, distances, and amount of steel transported from each supplier to the respective facility. Transportation was allocated on the basis of the mass and distance the material was transported.

3.8 COMPARABILITY

The PCR this EPD was based on was not written to support comparative assertions. EPDs based on different PCRs, or different calculation models, may not be comparable. When attempting to compare EPDs or life cycle impacts of products from different companies, the user should be aware of the uncertainty in the final results, due to and not limited to, the practitioner's assumptions, the source of the data used in the study, and the specifics of the product modeled.

4. LCA: Scenarios and Additional Technical Information

Manufacturing

Basic Oxygen Furnace (BOF) steelmaking and hot rolling occurs at the Nippon Steel mill in Japan. BOF steelmarking and cold rolling occurs at BlueScope Steel mill in Australia. Cold reduction and metallic coating processes occur at Steelscape Kalama and Rancho Cucamonga facilities. The manufacturing of AEP Span at the Tacoma and West Sacramento facilities involves process steps including: de-coiling; coil slitting (optional: in-line slitting or cut-to-length slitting); roll forming; cutting (shearing); and packaging and loading.

Coated coil is received at the roll forming facility, loaded onto a coil handler and decoiled. Coils are often wider than the desired feed width for the roll formed product, and multiple product feeds can be slit from one mother coil. The inline slitter slits the coil at various widths across the width of the coil based on the desired slit coil length. Prior to being slit, a protective film (to avoid scratching of the surface during transportation and field installation) can be applied. Coil is cut to length (typically between 10-20 ft) on the Cut-to-Length line. Protective film and sealants can also be pre-applied to the Cut-to-Length process. The steel is then fed to the roll forming machines. The roll formed product is sheared to lengths, based on customer specifications. Finished goods are stacked prior to being wrapped, crated or banded depending on the product.

Electricity is modeled using ecoinvent v3.7.1 and modified to meet the grid mix for the Kalama and Tacoma facilities, which are located in the NWPP eGRID2019 subregion, and the West Sacramento and Rancho Cucamonga facilities, which are located in the WECC eGRID2019 subregion.

Transportation of waste materials at manufacturing assumes a 20 mile (~32 km) average distance to disposal, consistent with assumptions used in the US EPA WARM model. Assumed disposal rates for nonhazardous wastes are based on US EPA SMM rates of 20% incineration and 80% landfilled. Hazardous wastes are disposed by landfilling.

5. LCA: Results

Results of the Life Cycle Assessment are presented below. It is noted that LCA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

The following environmental impact category indicators are reported using characterization factors based on the U.S. EPA's Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts – TRACI 2.1 and CML-IA.

CMLI-A Impact Category	Unit	TRACI 2.1 Impact Category	Unit
Global Warming Potential **(GWP)**	kg CO_2 eq	Global Warming Potential **(GWP)**	kg CO_2 eq
Depletion potential of the stratospheric ozone layer **(ODP)**	kg CFC 11 eq	Ozone Depletion Potential **(ODP)**	kg CFC 11 eq
Acidification Potential of soil and water **(AP)**	kg SO_2 eq	Acidification Potential **(AP)**	kg SO_2 eq
Eutrophication Potential **(EP)**	kg PO_4^{3-} eq	Eutrophication Potential **(EP)**	kg N eq
Photochemical Oxidant Creation Potential **(POCP)**	kg C_2H_4 eq	Smog Formation Potential **(SFP)**	kg O_3 eq
Abiotic depletion potential **(ADP-elements)** for non-fossil resources	kg Sb eq	Fossil Fuel Depletion Potential **(FFD)**	MJ Surplus, LHV
Abiotic depletion potential **(ADP-fossil fuels)** for fossil resources	MJ, LHV	-	-

These impact categories are globally deemed mature enough to be included in Type III environmental declarations. Other categories are being developed and defined and LCA should continue making advances in their development. However, the EPD users shall not use additional measures for comparative purposes.

The following inventory parameters, specified by the PCR, are also reported.

Resources	Unit	Waste and Outflows	Unit
RPR_E: Renewable primary resources used as energy carrier (fuel)	MJ, LHV	**HWD:** Hazardous waste disposed	kg
RPR_M: Renewable primary resources with energy content used as material	MJ, LHV	**NHWD:** Non-hazardous waste disposed	kg
$NRPR_E$: Non-renewable primary resources used as an energy carrier (fuel)	MJ, LHV	**HLRW:** High-level radioactive waste, conditioned, to final repository	kg
$NRPR_M$: Non-renewable primary resources with energy content used as material	MJ, LHV	**ILLRW:** Intermediate- and low-level radioactive waste, conditioned, to final repository	kg
SM: Secondary materials	MJ, LHV	**CRU:** Components for re-use	kg
RSF: Renewable secondary fuels	MJ, LHV	**MR:** Materials for recycling	kg
NRSF: Non-renewable secondary fuels	MJ, LHV	**MER:** Materials for energy recovery	kg
RE: Recovered energy	MJ, LHV	**EE:** Recovered energy exported from the product system	MJ, LHV
FW: Use of net freshwater resources	m^3	-	-

Table 9. *Life Cycle Impact Assessment (LCIA) results for AEP Span based on BOF Steel. Results reported in MJ are calculated using lower heating values. All values are rounded to three significant digits.*

Impact Category	Life cycle stage			
	A1	A2	A3	Total (A1-A3)
CML-IA				
GWP (kg CO_2 eq)	1,910	130	176	2,210
	86.2%	5.9%	7.9%	100.0%
AP (kg SO_2 eq)	8.69	0.501	0.605	9.79
	88.7%	5.1%	6.2%	100.0%
EP (kg $(PO_4)^{3-}$ eq)	1.60	0.118	0.337	2.06
	77.9%	5.7%	16.4%	100.0%
POCP (kg C_2H_4 eq)	1.48	0.0167	0.0570	1.56
	95.3%	1.1%	3.7%	100.0%
ODP (kg CFC-11 eq)	$3.39x10^{-5}$	$2.27x10^{-5}$	$9.32x10^{-6}$	$6.59x10^{-5}$
	51.5%	34.4%	14.1%	100.0%
ADPE (kg Sb eq)	$9.15x10^{-5}$	$1.14x10^{-6}$	$2.70x10^{-5}$	$1.20x10^{-4}$
	76.5%	1.0%	22.5%	100.0%
ADPF (MJ)	19,000	1,920	2,190	23,100
	82.2%	8.3%	9.5%	100%
TRACI 2.1				
GWP (kg CO_2 eq)	1,910	75.1	174	2,160
	88.5%	3.5%	8.1%	100.0%
AP (kg SO_2 eq)	7.84	0.343	0.635	8.81
	88.9%	3.9%	7.2%	100.0%
EP (kg N eq)	2.29	0.0828	0.708	3.08
	74.3%	2.7%	23.0%	100.0%
SFP (kg O_3 eq)	121	8.29	9.52	139
	87.2%	6.0%	6.8%	100.0%
ODP (kg CFC-11 eq)	$4.55x10^{-5}$	$1.83x10^{-5}$	$1.20x10^{-5}$	$7.57x10^{-5}$
	60.1%	24.2%	15.8%	100.0%
FFD (MJ eq)	877	165	214	1,260
	69.8%	13.2%	17.0%	100.0%

Comparisons cannot be made between product-specific or industry average EPDs at the design stage of a project, before a building has been specified. Comparisons may be made between product-specific or industry average EPDs at the time of product purchase when product performance and specifications have been established and serve as a functional unit for comparison. Environmental impact results shall be converted to a functional unit basis before any comparison is attempted.

Any comparison of EPDs shall be subject to the requirements of ISO 21930. EPDs are not comparative assertions and are either not comparable or have limited comparability when they have different system boundaries, are based on different product category rules or are missing relevant environmental impacts. Such comparison can be inaccurate and could lead to erroneous selection of materials or products which are higher-impact, at least in some impact categories.

Table 10. *Resource use and waste flows for AEP Span based on BOF Steel. Results reported in MJ are calculated using lower heating values. All values are rounded to three significant digits.*

Parameter	Life cycle stage			
	A1	A2	A3	Total (A1-A3)
Resources				
RPR_E (MJ)	568	0.0317	59.4	627
	90.5%	0.0050%	9.5%	100%
RPR_M (MJ)	0.0	0.0	1.95	1.95
	0.0%	0.0%	100%	100%
$NRPR_E$ (MJ)	16,500	2.25	612	17,100
	0	0	0	0
$NRPR_M$ (MJ)	0.0599	0.0	0.0	0.0599
SM (MT)	100%	0.0%	0.0%	100%
	0.00	0.00	0.00	0.00
RSF/NRSF (MJ)	0.00	0.00	0.00	0.00
RE (MJ)	45.9	0.00148	0.851	46.7
FW (m^3)	98.2%	0.0032%	1.82%	100%
	568	0.0317	59.4	627
Wastes				
HWD (kg)	0.229	$6.24x10^{-6}$	$1.79x10^{-3}$	0.231
	99.2%	0.0027%	0.8%	100.0%
NHWD (kg)	37.3	0.115	27.9	65.3
	57.1%	0.18%	42.7%	100%
HLRW (kg)	0.0132	$1.82x10^{-7}$	$2.05x10^{-4}$	0.0134
	98.5%	0.001%	1.5%	100.0%
ILLRW (kg)	0.0107	$1.62x10^{-5}$	$2.11x10^{-3}$	0.0128
	83.3%	0.127%	16.5%	100%
CRU (kg)	0.00	0.00	0.00	0.00
MR (kg)	222	0.0	43.8	265
	83%	0.0%	17%	100%
MER (kg)	0.00	0.00	0.00	0.00
EE (MJ)	Neg.	Neg.	Neg.	Neg.

Neg = negligible

The PCR requires the calculation of carbon emissions and removals, all of which are negligible due to the fact that no biogenic carbon is included in the product and any packaging is negligible.

6. LCA: Interpretation

The contributions to total impact indicator results are dominated by the raw material extraction and processing stage (A1) followed by the product manufacturing stage (A3) for many indicators.

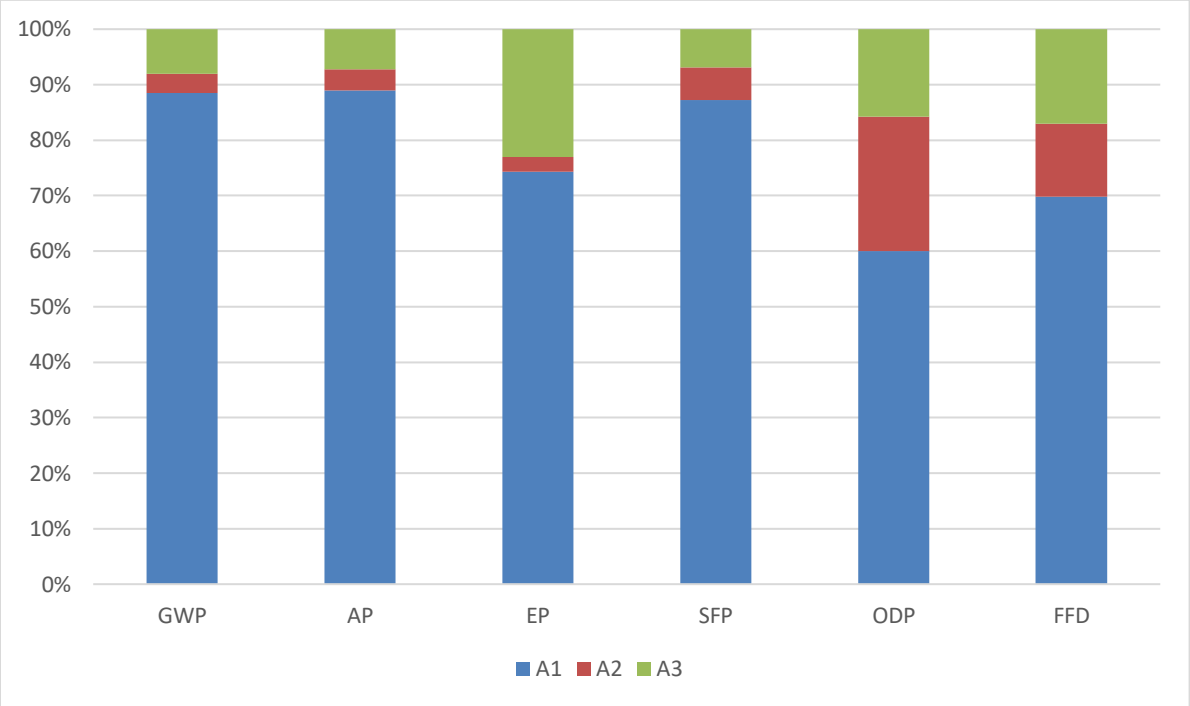

Figure 2. *Contribution analysis for the AEP Span, manufactured from BOF Steel, using TRACI 2.1.*

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