CLF Option 1 Amendment 1 Revision 2: Clarifications of Definitions and Compliance Pathway

This amendment is originally based on feedback received via email by Meghan Lewis on behalf of the Carbon Leadership Forum. Some options for AHJ to choose thresholds were modified. It includes the clarifications for Option 1 but not the update of the Covered Products Table so we can discuss separately.

*[Revision 2] Since the 7/21 SBCC work session, suggestions for revisions were compiled offline. These are incorporated in **blue** below (with comments in italics) to create Amendment 1 Revision 2 for discussion.*

OPTION 1

NEW SECTION

WAC 51-50-5400 Appendix S—Embodied Carbon ~~Green House Gas Emissions~~ Reporting and Reduction. *The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.*

***User Note*:**

About this appendix: *The purpose of Appendix S is to establish methods to measure and reduce the embodied carbon impact of building materials over the course of a building's life. Appendix S provides criteria for the production and submission of environmental product declarations, whole building life cycle assessment, and proof of building reuse for a building project.*

Section S101 General.

S101.1 Scope. The provisions of this appendix promote methods to measure and to reduce the ~~environmental impact of building materials over the course of a building's life~~ embodied carbon of buildings.

Section S102 Definitions.

Section S102.1 General. The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 of this code for general definitions.

Baseline building. The baseline shall be of the same size, geographic location, and thermal performance as the proposed building, and shall be functionally equivalent.

Roger Herringa proposal for 8/4 work session

Covered project. A project where the combination of new construction, additions, and alternations totals **[INSERT 50,000 OR 100,000]** gross

square feet or larger. Additions and alternations less than **[INSERT 50,000 OR 100,000]** gross square feet are not covered projects.

Language based on CLF comments discussed on 7/21 work session

Covered project. A project where the combination of new construction and additions to an existing building, and work area of alteration totals **[INSERT 50,000 OR 100,000]** gross square feet or larger. Additions less than **[INSERT 50,000 OR 100,000]** gross square feet and alterations are not covered projects.

Original language released for public comment

~~A new building or structure, or an addition to an existing building or structure, **[INSERT 50,000 OR 100,000]** gross square feet or larger; or an *alteration* that impacts a *work area* of **[INSERT 50,000 OR 100,000]** gross square feet or larger.~~

Embodied carbon. The sum of greenhouse gas emissions associated with extraction, ~~production~~, transport, ~~and~~ manufacturing, and waste management of a product or building through ~~the product's~~ its life.

Embodied Carbon Intensity (ECI). The total global warming potential (GWP) of a building per gross floor area and expressed in kgCO2e/m2 or lbsCO2e/ft2.

Environmental product declaration (EPD). A third-party verified report providing information about the environmental performance or impact of a covered specific product or material in alignment with ISO 21930.

Global warming potential (GWP). The metric for tracking *embodied carbon*, which is reported in kg CO_2~~e/unit~~. GWP normalizes different gases ~~associated with a product~~ to an equivalent mass of carbon dioxide over a period of 100 years.

~~**Industry-average EPD.** An *EPD* that reports the impacts of a product, which is an average of data provided by multiple manufacturers in a clearly defined sector and/or geographical area.~~

Product-specific EPD. An *EPD* that represents the impacts of a ~~single~~ specific product from a single manufacturer.

Proposed building. The building identified as the *covered project*.

Reused material. A building element that has been reclaimed through deconstruction so it can be installed in its original form for the same or similar purpose. Reused materials may only be minimally processed; recycled content does not count as reused.

Work area. That portion or portions of a building consisting of all reconfigured spaces as indicated on the construction documents. *Work area* excludes other portions of the building where incidental work entailed by the intended work must be performed and portions

of the building where work not initially intended by the owner is specifically required by this code.

Section S103 Embodied carbon.

S103.1 Embodied carbon. *Covered projects* shall document *embodied carbon* on *construction documents*, which shall be submitted to the *building official*. *Covered projects* shall comply with one of the following: S103.2 Product compliance pathway, S103.3 Whole building compliance pathway, or S103.4 Building reuse compliance pathway.

~~**S103.2 Documentation of embodied carbon.** Documentation of *embodied carbon* for *covered projects* shall meet one of the following pathways:~~

~~1. Product compliance or whole building compliance pathway; for a new building or structure, or an *addition* to an existing building or structure, **[INSERT 50,000 OR 100,000]** gross square feet or larger.~~

~~2. Building reuse compliance pathway; for an *alteration* that impacts a *work area* of **[INSERT 50,000 OR 100,000]** gross square feet or larger.~~

~~3. Product compliance, whole building compliance, or building reuse compliance pathway; for an *addition* to a building or structure that also includes an *alteration*, where the *addition* and *work area* of the *alteration* have a combined area of **[INSERT 50,000 OR 100,000]** gross square feet or larger.~~

Vikram Sami suggests removing the 100% option from the product compliance pathway

S103.2~~3~~ Product compliance pathway. *Covered projects* shall ~~submit~~ include data from *product-specific EPDs* ~~Type III *environmental product declarations*~~, which cover the cradle-to-gate phase or life cycle modules A1 through A3, for all covered products per Table ~~Section~~ S103.2~~3~~.1. The ~~product compliance pathway~~ *construction documents* shall ~~calculate~~ include calculation of the

global warming potential (GWP) of the total mass or volume of the covered products by multiplying the mass or volume of each product by the GWP from that product's EPD, and summing the total across the project. The calculations shall demonstrate that the total GWP ~~an total~~ is ~~no more~~ less than **[INSERT 80~~,~~ OR 90~~, OR 100, 120, OR 175~~]** percent of the sum of the applicable *GWP* values from Table S103.2~~3~~.1, for the same total mass or volume of the covered products. The calculation shall include the following:

1. Project-specific product quantities and *GWP* data from *product-specific EPDs*;

2. Be summed ~~averaged~~ across the entire project based on mass or volume; and

3. Be submitted on a product pathway compliance form ~~(see example in this appendix)~~.

In lieu of product specific EPDs to demonstrate the GWP for a proposed product, the construction documents may demonstrate that the product specifications include a requirement for the product to be below a GWP limit.

A *product-specific EPD* is permitted to combine varying levels of manufacturing specificity and may be covered across multiple facility locations. Where a *product-specific EPD* is not available for a building product, the GWP values in Table S103.2.1 can be used in the compliance calculation ~~an *industry-average EPD* shall be permitted~~. Environmental impact data shall not be sourced from expired or retired data sources as determined on the permit vesting date.

S103.23.1 Covered products. Covered products shall include no less than 90 percent of the total combined mass or volume of all product(s) used in the building project that are included in Table S103.3.1.

~~(a) Structural concrete products, including ready mix, shotcrete, precast, and concrete masonry units.~~

~~(b) Reinforcing steel products, specifically rebar and post-tensioning tendons.~~

~~(c) Structural steel products, specifically hot rolled sections, hollow sections, metal deck, and plate; and~~

~~(d)Engineered wood products, such as cross-laminated timber, glulam beams, laminated veneer lumber, parallel strand lumber, dowel laminated timber, nail laminated timber, glulam laminated timber, prefabricated wood joists, wood structural panel, solid sawn lumber, structural composite lumber, and structural sawn lumber.~~

TABLE S1023.3.1
COVERED PRODUCT GWP VALUES[a]

COVERED PRODUCT		GLOBAL WARMING POTENTIAL	UNIT OF MEASUREMENT
Ready mix concrete products	Up to 2,499 psi	235	kg CO_2e/m^3
	2,500-3,999 psi	261	kg CO_2e/m^3
	4,000-4,999 psi	316	kg CO_2e/m^3
	5,000-5,999 psi	386	kg CO_2e/m^3
	6,000-7,999 psi	408	kg CO_2e/m^3
	8,000 psi and greater	487	kg CO_2e/m^3
	Lightweight, up to 3,999 psi	518	kg CO_2e/m^3
	Lightweight, 4,000-4,999 psi	575	kg CO_2e/m^3
	Lightweight, 5,000 psi and greater	632	kg CO_2e/m^3
Concrete masonry unit products	Normal weight, up to 3,249 psi	208	kg CO_2e/m^3
	Normal weight, 3,250-4,499 psi	232	kg CO_2e/m^3
	Normal weight, 4,500 psi and greater	241	kg CO_2e/m^3
	Medium weight, up to 3,249 psi	360	kg CO_2e/m^3

	Medium weight, 3,250 psi and greater	244	kg CO_2e/m^3
	Lightweight, up to 3,249 psi	395	kg CO_2e/m^3
	Lightweight, 3,250 psi and greater	286	kg CO_2e/m^3
Reinforcing steel products	Rebar - unfabricated	753	kg CO_2e/metric ton
	Rebar - fabricated	854	kg CO_2e/metric ton
Structural steel products	Hot-rolled sections - unfabricated	1,000	kg CO_2e/metric ton
	Hot-rolled sections - fabricated	1,220	kg CO_2e/metric ton
	Hollow structural sections - unfabricated	1,710	kg CO_2e/metric ton
	Hollow structural sections - fabricated	1,990	kg CO_2e/metric ton
	Decking	2,320	kg CO_2e/metric ton
	Plate - unfabricated	1,480	kg CO_2e/metric ton
	Plate - fabricated	1,730	kg CO_2e/metric ton
COVERED PRODUCT		**GLOBAL WARMING POTENTIAL**	**UNIT OF MEASUREMENT**
Structural wood products	Laminated veneer lumber	361	kg CO_2e/m^3
	Laminated strand lumber	275	kg CO_2e/m^3
	Glue laminated timber	137	kg CO_2e/m^3
	Wood framing	63	kg CO_2e/m^3
	Softwood plywood	219	kg CO_2e/m^3
	Oriented Strand Board (OSB)	242	kg CO_2e/m^3
Insulation products	Expanded polystyrene (EPS)	2.67	1 m^2 @ RSI-1
	Polyiso - wall	4.19	1 m^2 @ RSI-1
	Polyiso - roof - GRF facer	2.20	1 m^2 @ RSI-1
	Polyiso - roof - CFG facer	3.04	1 m^2 @ RSI-1
	Extruded polystyrene (XPS)	41	1 m^2 @ RSI-1
	Heavy density mineral wool board	8.35	1 m^2 @ RSI-1

Mineral wool blanket	3.33	1 m^2 @ RSI-1
Closed-cell spray polyurethane foam - medium density	12.1	1 m^2 @ RSI-1
Closed-cell spray polyurethane foam - roofing	15.5	1 m^2 @ RSI-1
Closed-cell spray polyurethane foam - 2K-LP	19.7	1 m^2 @ RSI-1
Open-cell spray polyurethane foam	1.6	1 m^2 @ RSI-1
Loose-fill cellulose	0.49	1 m^2 @ RSI-1
Loose-fill mineral wool	1.56	1 m^2 @ RSI-1
a. The GWP values in the table represent industry-average values based on the 2023 Carbon Leadership Forum (CLF) North American Material Baselines Report.		

Roger Herringa suggests adding 70% as an option for the Whole Building Compliance

S103.43 Whole building compliance pathway. *Covered projects* shall submit a whole building life cycle assessment, developed in accordance with Section S103.4.1, and comply with one of the following:

1. **Absolute reduction requirement.** The *embodied carbon intensity* ~~*global warming potential*~~ of the proposed building shall be ~~no more~~ less than **[INSERT 100, 90, ~~OR~~ 80, OR 70]** percent of 102 $lbCO_2e$/square feet (500 $kgCO_2e/m^2$).
2. **Relative reduction requirement.** The *embodied carbon intensity* ~~*global warming potential (GWP)*~~ of the proposed building shall be less ~~no more~~ than **[INSERT 100, 90, ~~or~~ 80, OR 70]** percent of the *embodied carbon intensity* ~~*GWP*~~ of a functionally equivalent baseline ~~reference~~ building. The baseline ~~reference~~ building shall be of the same size, geographic location, and thermal performance as the proposed building, and shall be functionally equivalent ~~per ASTM E2921-22~~. The products and product quantities in the *proposed building* and the *baseline* ~~reference~~ *building* are permitted to vary. The same LCA tool(s) or software shall be used to complete the whole building life cycle assessment for both the baseline building ~~reference~~ and proposed building designs.

S103.43.1 Whole building life cycle assessment. Whole building life cycle assessments shall comply with the following:

1. ISO 14040 and ISO 14044.
2. Software used to conduct a whole building life cycle assessment shall conform to ISO 21931—1 and/or EN 15978 and shall have a data set compliant with ISO 14044 and ISO 21930 and/or EN 15804. The software shall utilize calculation methodology that is

compliant with EN 15978, ISO 21931—1 and ISO 21929—1. Environmental impact data shall not be sourced from expired or retired data sources as determined on the permit vesting date.

3. The scope shall cover cradle-to-grave, including at minimum ~~all~~ life cycle stage modules ~~in life cycle stages~~ A1-A5, B4, and C2-C4. The scope shall ~~is permitted to~~ exclude modules B6 and B7, covering operating energy and water stages.

4. The assessment shall include all of the following building elements: foundations; *exterior wall envelope materials used for cladding, sheathing, insulation, and structure*; *primary structural frame*; *secondary structural members*; *roof covering*; *roof deck*; *fenestration*; *and load-bearing walls*~~; and insulation~~. The assessment is permitted to include *nonload bearing walls*; fireproofing; interior constructions and *interior finishes*. An assessment submitted for an *addition* or *alteration* is permitted to exclude existing and/or remaining building components.

5. The reference study period shall be 60 years.

6. **Reused materials.** For *reused materials*, it is permissible to assume the A1 – A4 stages carry no GWP impact in the *proposed building*. It is permissible for the *baseline building* to include the A1-A4 impacts of *reused materials* as if they were new.

7. **Structural and material optimization.** Structural and material use optimization shall be included or excluded at the discretion of the project team as long as the *baseline building* and the *proposed building* are functionally equivalent.

8. **Material improvement.** When the *construction documents* require materials to have a *global warming potential* no greater than a specified value, the *proposed building WBLCA* can include these improved values in the LCA.

9. **Biogenic carbon.** Biogenic carbon and carbon sequestration shall not be included in reductions to comply with this code, but may be reported separately from fossil GWP.

Roger Herringa suggests the following language in the Building Reuse Compliance Pathway

S103.4~~5~~ Building reuse compliance pathway. A covered project that includes an alteration that maintains 45% of an existing structure calculated per Section 103.5.1.

Language based on CLF comments discussed at 7/21 work session

S103.4~~5~~ Building reuse compliance pathway. ~~An *alteration* shall retain no less than a combined 45 percent, as calculated per Section S103.5.1, of the *existing building's primary* and *secondary structural frame* and *exterior wall envelope* as part of the *work area.*~~ An *addition* to a building or structure ~~that also includes an *alteration*, where the *addition* and *work area* of the *alteration*~~

~~have a combined area~~ of **[INSERT 50,000 OR 100,000]** gross square feet or larger, is permitted to use this compliance pathway.

S103.~~4~~5.1 Building reuse compliance calculation. The calculation shall include roof and floor areas, and façade area as measured in elevation, for the entire building. Façade areas are permitted to be considered retained even if the existing *exterior wall covering* is repaired, replaced, or modified to increase insulation or airtightness.

EXCEPTION: Buildings, or portions of building, that are deemed unsafe or *dangerous*, or that have *hazardous materials*, that are remediated as part of the project.

S103.~~4~~5.2 Construction documents for building reuse compliance pathway. *Construction documents* for the building reuse compliance pathway shall clearly distinguish the square footage for existing and new elements, and include the following information:

(a) Gross floor area of *existing building*(s) in square feet;

(b) Gross floor area of the aggregate addition(s) in square feet (if applicable);

~~(c) Gross floor area of the *alteration* in square feet;~~

(c~~d~~) Existing total floor area and retained total floor area of the *primary* and *secondary structural frame* of the *existing building*(s) in square feet; and

(d~~e~~) Existing total *exterior wall* and *fenestration* surface area and total retained *exterior wall* and *fenestration* surface area of the *existing building*(s) in square feet, as well as areas allowed to be excluded from the calculations.

(e) The sum of the total area of retained existing elements including floor, roof, and facade area divided by the sum of the total area of all existing elements including floor, roof and facade area.

Section S104 Verification and amended documentation of reduction of embodied carbon.

S104.1 ~~Registered design professional~~ Compliance on construction documents. A *registered design professional* shall prepare the *construction documents* and provide signature verifying compliance with the requirements of this appendix. Covered projects shall comply with one of the following at the time of permit: S103.2 Product Compliance Pathway, S103.3 Whole Building Compliance Pathway, or S103.4 Building reuse compliance pathway.

S104.2 Amended construction documents for embodied carbon (this section is optional at the discretion of the jurisdiction). ~~Covered products shall be installed in accordance with the approved *construction documents*. Where any change in products occur that are not in compliance with the approved *construction documents*, amended *construction documents*, based on data from procured products, shall be resubmitted for approval prior to the issuance of a certificate of occupancy.~~ Calculations for the selected

compliance option under S103.1 shall be updated on the construction documents before the certificate of occupancy is issued.

For compliance with section S103.2, updated calculations shall include GWP data from procured *covered products*. It is permissible to update product quantities to match procured quantities.

For compliance with section S103.3, WBLCA calculations shall be updated on the construction documents for the *proposed building* before the certificate of occupancy is issued. Updated WBLCA calculations shall include actual *GWP* data sourced from *product-specific EPD values* from procured products. The updated *proposed building* WBLCA must meet the *absolute reduction requirement* or the *relative reduction requirement* selected under Section S103.3.

For all pathways S103.2, S103.3, and S103.4, compliance can be achieved if the updated calculations are accompanied by a narrative describing why the pathway criteria were not met.

S105 Referenced standards.

S105.1 General. See Table S105.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, standard title, and the section or sections of this appendix that reference the standard.

TABLE S105.1 REFERENCED STANDARDS

Standard Acronym	Standard Name	Sections Herein Referenced
~~ASTM E2921—22~~	~~Standard Practice for Minimum Criteria for Comparing Whole Building Life Cycle Assessments for Use with Building Codes, Standards, and Rating Systems~~	~~S103.4.1.2.1~~
EN 15804—2022	Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products	~~S103.4.3~~ S103.3.1
EN 15978—2011	Sustainability of construction works - Assessment of environmental performance of buildings - Calculation method	~~S103.4.3~~ S103.3.1
ISO 14040—2006	Environmental management - Life cycle assessment - Principles and framework	~~S103.4, S103.4.1~~ S103.3.1
ISO 14044—2006	Environmental management - Life cycle assessment - Requirements and guidelines	~~S103.4, S103.4.1, S103.4.2~~ S103.3.1
ISO 21929-1—2011	Sustainability in building construction - Sustainability indicators - Part 1: Framework for the development of indicators and a core set of indicators for buildings	~~S103.4.3~~ S103.3.1

ISO 21930—2017	Sustainability in buildings and civil engineering works - Core rules for environmental product declarations of construction products and services	~~S103.4.3~~ S103.3.1
ISO 21931-1—2022	Sustainability in buildings and civil engineering works - Framework for methods of assessment of environmental, social and economic performance of construction works as a basis for sustainability assessment - Part 1: Buildings	~~S103.4.3~~ S103.3.1

Sample Product Compliance Pathway Form

COVERED PRODUCT		INDUSTRY AVERAGE GWP	UNIT	PROJECTSPECIFIC VOLUME OR MASS	GWP PER PRODUCT-SPECIFIC EPD	REDUCTION, BY VOLUME OR MASS
Ready mix concrete products	Up to 2,499 psi	235	kg CO_2e/m^3			
	2,500-3,999 psi	261	kg CO_2e/m^3			
	4,000-4,999 psi	316	kg CO_2e/m^3			
	5,000-5,999 psi	386	kg CO_2e/m^3			
	6,000-7,999 psi	408	kg CO_2e/m^3			
	8,000 psi and greater	487	kg CO_2e/m^3			
	Lightweight, up to 3,999 psi	518	kg CO_2e/m^3			
	Lightweight, 4,000-4,999 psi	575	kg CO_2e/m^3			
	Lightweight, 5,000 psi and greater	632	kg CO_2e/m^3			
Concrete masonry unit products	Normal weight, up to 3,249 psi	208	kg CO_2e/m^3			
	Normal weight, 3,250-4,499 psi	232	kg CO_2e/m^3			
	Normal weight, 4,500 psi and greater	241	kg CO_2e/m^3			
	Medium weight, up to 3,249 psi	360	kg CO_2e/m^3			
	Medium weight, 3,250 psi and greater	244	kg CO_2e/m^3			
	Lightweight, up to 3,249 psi	395	kg CO_2e/m^3			
	Lightweight, 3,250 psi and greater	286	kg CO_2e/m^3			

Reinforcing steel products	Rebarunfabricated	753	kg CO_2e/ metric ton			
	Rebar fabricated	854	kg CO_2e/ metric ton			

COVERED PRODUCT		INDUSTRY AVERAGE GWP	UNIT	PROJECTSPECIFIC VOLUME OR MASS	GWP PER PRODUCT-SPECIFIC EPD	REDUCTION, BY VOLUME OR MASS
Structural steel products	Hot rolled sections – unfabricated	1,000	kg CO_2e/ metric ton			
	Hot rolled sections – fabricated	1,220	kg CO_2e/ metric ton			
	Hollow structural sections – unfabricated	1,710	kg CO_2e/ metric ton			
	Hollow structural sections – fabricated	1,990	kg CO_2e/ metric ton			
	Decking	2,320	kg CO_2e/ metric ton			
	Plate – unfabricated	1,480	kg CO_2e/ metric ton			
	Plate – fabricated	1,730	kg CO_2e/ metric ton			
Structural wood products	Laminated veneer lumber	361	kg CO_2e/m^3			
	Laminated strand lumber	2,745	kg CO_2e/m^3			
	Glue-laminated timber	137	kg CO_2e/m^3			
	Wood framing	63	kg CO_2e/m^3			
	Softwood plywood	219	kg CO_2e/m^3			
	Oriented Strand Board (OSB)	242	kg CO_2e/m^3			
COVERED PRODUCT		INDUSTRY AVERAGE GWP	UNIT	PROJECTSPECIFIC VOLUME OR MASS	GWP PER PRODUCT-SPECIFIC EPD	REDUCTION, BY VOLUME OR MASS

Insulation products	Expanded polystyrene (EPS)	2.67	1 m^2 @ RSI 1			
	Polyiso - wall	4.19	1 m^2 @ RSI 1			
	Polyiso - roof - GRF facer	2.20	1 m^2 @ RSI 1			
	Polyiso - roof - CFG facer	3.04	1 m^2 @ RSI 1			
	Extruded polystyrene (XPS)	41	1 m^2 @ RSI 1			
	Heavy density mineral wool board	8.35	1 m^2 @ RSI 1			
	Mineral wool blanket	3.33	1 m^2 @ RSI 1			
	Fiberglass blanket	N/A	1 m^2 @ RSI 1			
	Closed-cell spray polyurethane foam - medium density	12.1	1 m^2 @ RSI 1			
	Closed-cell spray polyurethane foam - roofing	15.5	1 m^2 @ RSI 1			
	Closed-cell spray polyurethane foam - 2K-LP	19.7	1 m^2 @ RSI 1			
	Open-cell spray polyurethane foam	1.6	1 m^2 @ RSI 1			
	Loose-fill cellulose	0.487	1 m^2 @ RSI 1			
	Loose-fill mineral wool	1.56	1 m^2 @ RSI 1			
	Loose-fill fiberglass	N/A	1 m^2 @ RSI 1			
Total						