

Impacts of Housing Materials

And opportunities to address the impacts

Housing production is a top priority issue in Oregon. To address housing needs Executive Order 23-04 sets an annual housing production target of 36,000 homes over the next ten years, totaling 360,000 new homes. The Legislature responded by allocating over \$1 Billion in funding to prevent homelessness, reduce unsheltered homelessness, and build and preserve more affordable housing.¹ These actions provide an important opportunity to address essential housing needs in Oregon.

In meeting the housing goals, it is also important to meaningfully address climate, health, equity, and environmental justice which are significantly affected by the built environment and the materials we use to build it.

In this document, three major impact areas are identified across a number of common building materials that are frequently used in housing projects. Opportunities to address these impacts through codes, standards, programs, and more are identified in each section.



MAJOR IMPACT AREAS

Embodied Carbon. Embodied carbon of building materials is a significant contributor to Oregon's greenhouse gas (GHG) emissions. These emissions are important to include and align with state emissions reduction goals.







Exposure to toxicants. Toxicants and chemicals of concern are found in many building materials and used in the production process. Eliminating these from our building materials is an important part of addressing health impacts from the built environment.

Forced Labor. Building material supply chains pose significant risk of forced labor. Materials known to be produced with the use of forced labor must be avoided in Oregon's built environment.

Embodied carbon

Building materials account for about **8 percent** of Oregon's Consumption-Based Emissions.² Approximately 40 percent of which is due to residential construction. To continue to make progress on climate goals while also meeting housing needs, it is essential to reduce Oregon's embodied carbon emissions associated with housing production.

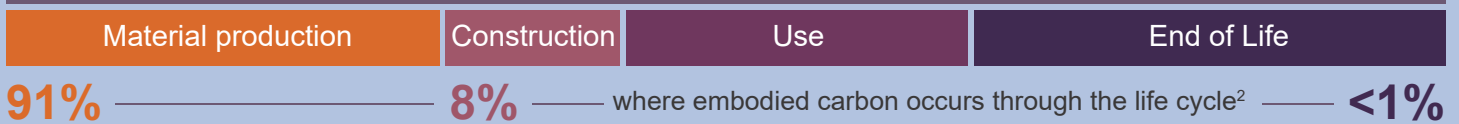
HOUSING MATERIALS WITH GREATEST EMBODIED CARBON EMISSIONS

-  Concrete
-  Wood
-  Insulation
-  Glass
-  Finishes
-  Furniture, fixtures, and equipment (FF&E)



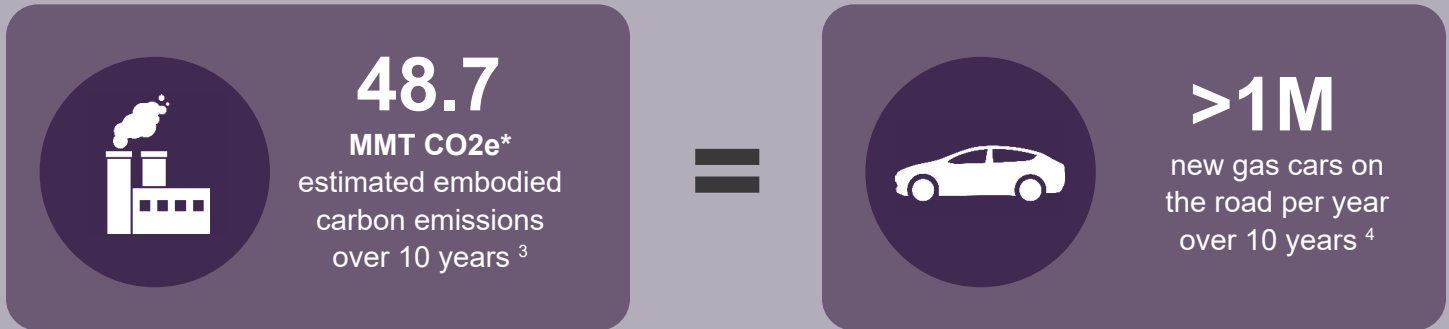
Embodied carbon is the greenhouse gas (GHG) emissions from resource extraction, manufacture, transport, installation, maintenance, disposal and recovery of construction materials.

LIFE CYCLE OF BUILDING MATERIALS



Embodied carbon (continued)

If the 360,000 homes are newly constructed according to current standards and industry practices, the GHG emissions from the building materials used to build these homes over the next 10 years are substantial.



*MMT CO₂e = Million metric tons of carbon dioxide equivalent

OPPORTUNITIES TO REDUCE EMBODIED CARBON EMISSIONS

Reuse existing buildings

Incentivize and support the conversion of vacant office space to residential.

-40-75%

Embodied carbon emission reduction potential per building through reuse of the structure of an existing building.⁵

Aligns with
House Bill 2984, 2023

Build smaller

Reduce size of housing by incentivizing smaller units, multifamily, more units per lot.



20-40%

embodied carbon emissions reduction potential.⁶

Aligns with
House Bill 2001, 2019

Optimize building materials

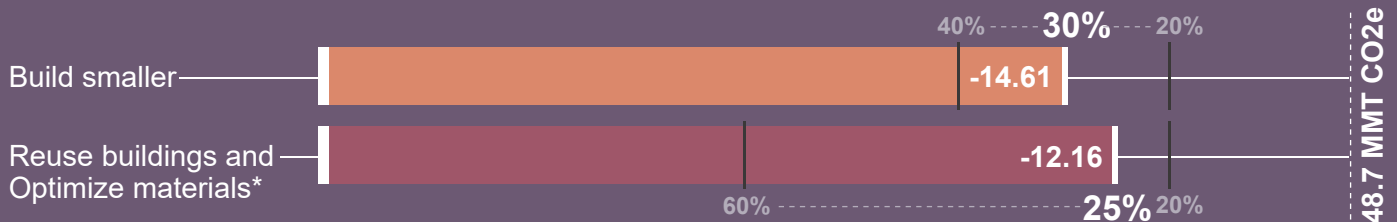
Set embodied carbon limits for materials and buildings; incentivize manufacturers to reduce embodied carbon.

-20-60%

Recommendations by Resilient Efficient Building Task Force.⁷

Aligns with
House Bill 3409, 2023

Estimated embodied carbon emissions reductions



*In alignment with Resilient Efficient Building Task Force, the potential reductions from these strategies have been combined.



Exposure to toxicants

Building materials can contain chemicals of concern. Toxicants that pose risk to human and environmental health may be present in the manufacturing process. Green Science Policy Institute takes a Six Classes⁸ approach to reducing chemical exposure and harm. Understanding which materials contain chemicals and sourcing safer alternatives is important for **reducing health**

HOUSING MATERIALS WITH GREATEST HEALTH CONCERNS

- Adhesives and sealants
- Laminated and particleboard materials
- Insulation
- Vinyl in flooring, windows, and pipes
- Paints and coatings
- Furnishings, textiles, and carpet



SIX CLASSES OF CHEMICALS OF CONCERN⁸

PFAS. PFAS are linked to cancers, elevated cholesterol, decreased fertility, and thyroid problems, and decreased immune response.

Antimicrobials. Antimicrobials are associated with development and reproductive issues, asthma, allergen sensitivity, skin irritation, and adverse respiratory, nervous system, immunological, reproductive and developmental effects.

Flame retardants. Flame retardants are associated with developmental issues and hyperactivity, cancer, hormone disruption, and decreased fertility.

Bisphenols (BPA) and phthalates. BPA is linked to asthma, neurodevelopmental issues, obesity, diabetes, heart diseases, decreased fertility, and cancer. Phthalates are linked with asthma, allergies, and cognitive and behavioral issues.

Some solvents. Solvent vapors may lead to temporary nervous system symptoms. Long term occupational exposure to some solvents may increase cancer risk.

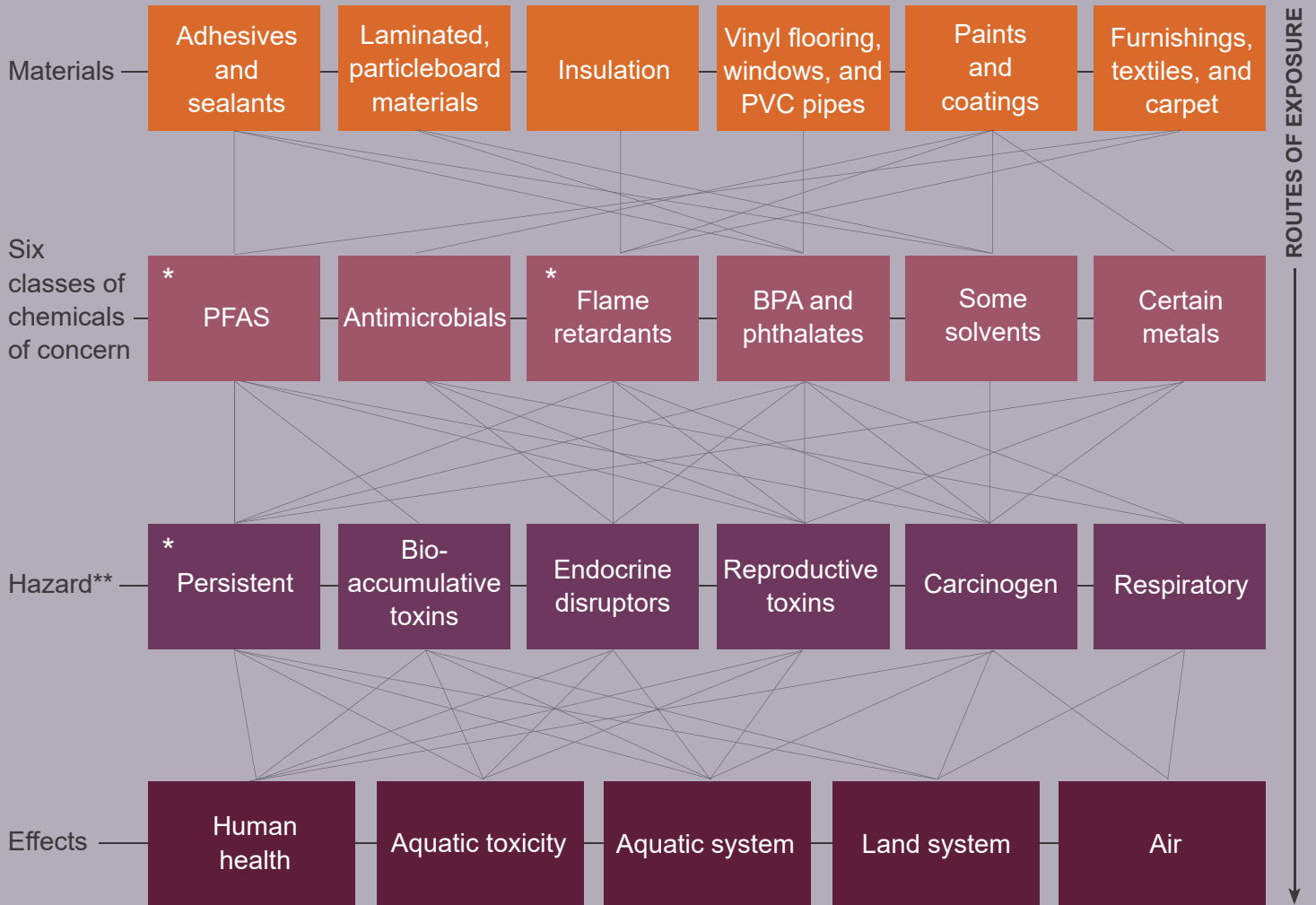
Certain metals. Mercury, arsenic, cadmium, and lead can harm brain development and lead to increased cancer risk.



Exposure to toxicants (continued)

ROUTES OF TOXICANT EXPOSURE IN BUILDING MATERIALS

Note: connection lines are for illustration only to show interrelations between materials and routes of exposure



*Represents potential initial priorities for action.

**Definitions for the hazards can be found in the Appendix

OPPORTUNITIES TO ADDRESS TOXICANTS EXPOSURE IN BUILDING MATERIALS

Cooperation. Create a legislative mandate that connects and adequately resources existing efforts on chemical use, management, and outcomes that remain isolated by jurisdictional boundaries.













Class-based approach. Shift legislation to a class-based approach for chemical management instead of individual chemicals and products for greater impact.



Forced labor

The building materials we source for projects in Oregon come from all over the U.S. and the world. The supply chains of these materials can be complex and lack transparency. One of the major issues that needs addressed is forced labor. According to the International Labor Organization, **construction** is the global industrial sector at the **highest risk of forced labor**.⁹

BUILDING MATERIALS AT HIGHEST RISK OF FORCED LABOR IN THE SUPPLY CHAIN¹⁰

-  Polysilicon (solar panel component)
-  Limestone (cement)
-  Timber (structural and finishes)
-  Stone (finishes, roof, concrete, etc.)
-  Rubber (mortar, gaskets, flooring)
-  Textiles
-  Bricks
-  Copper (wiring, equipment, finishes)
-  Steel and iron (finishes, structural, equipment)
-  Glass
-  Soda ash (glass manufacturing)
-  Minerals (mica, gypsum, silica)



Forced labor is defined as all work or service that is exacted from any person under the menace of any penalty and for which the said person has not offered themselves voluntarily.

ESTIMATED BURDEN OF FORCED LABOR IN OREGON'S BUILDING MATERIAL SUPPLY CHAIN

	\$150B	13%	28M	89M	160M
Global*	modern slavery worldwide value	global GDP for construction industry	people held in forced labor servitude	people who have experienced modern slavery (past 5 years)	children subject to child labor
Oregon share ¹¹	\$75M	0.65%	14,000	44,500	80,000

*Global numbers from Design for Freedom report¹⁰



Forced labor (continued)

An important first step to addressing this issue is to conduct research to gain a better understanding of the actual forced labor risks in Oregon’s building

material supply chain, identifying the top materials of concern, and beginning to implement procurement policies, standards, and legislation to address these issues.

POTENTIAL HIGH RISK SUPPLY NETWORK OF BUILDING MATERIALS INTO OREGON¹²



	Bricks	Glass	Minerals	Poly-silicon	Limestone Soda Ash	Rubber	Steel and Iron	Stone	Textiles	Timber
Brazil	●	●			●		●	●		●
Paraguay	●	●			●		●	●		
Egypt	●	●			●		●	●		
Uganda	●						●	●		●
Madagascar			●					●		●
India	●		●				●	●		
North Korea							●		●	●
China	●	●	●	●	●		●		●	●
Vietnam						●			●	●
Cambodia	●					●			●	



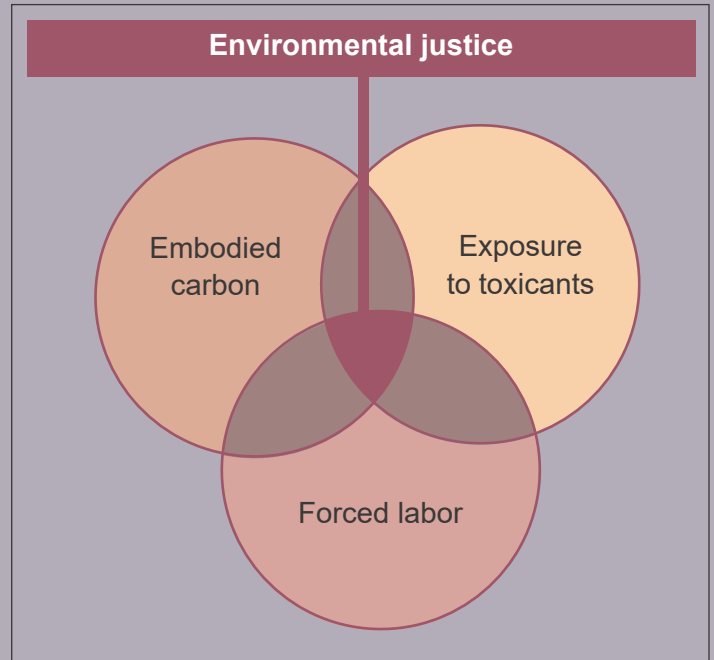
Environmental Justice

Environmental justice is a common thread across the three impact areas discussed in this document.

Embodied carbon. The burden of climate change impacts, including by building material production, is felt most by communities that have been disadvantaged through a legacy of injustices like redlining, particularly low income and communities of color.

Exposure to toxicants. Toxicants can have impacts throughout the life cycle of building materials. Along this life span workers, builders, and building occupants can have risk of exposure to toxicants in building materials. Higher risk jobs tend to have higher representation of low income and communities of color.

Forced labor. In the building material supply chain, people are subject to unfair labor practices including forced labor, unpaid labor or modern slavery, and child labor. Children, low income, and communities of color, often in other parts of the world, are at most risk.



OPPORTUNITIES TO ADDRESS ENVIRONMENTAL JUSTICE IN BUILDING MATERIALS

Environmental injustice in the built environment also extends beyond these highlighted issues. Historic and current practices like redlining and disinvestment lead to health, economic, and other compounding impacts such as increased temperature in formerly redlined neighborhoods, lack of essential infrastructure, and displacement and gentrification.

In 2022, the Oregon Legislature passed House Bill 4077. This bill established the Environmental Justice Council within the Governor's office and mandated certain agencies and other institutions to develop an Oregon-specific environmental justice mapping tool. To continue, and expand, environmental justice work, there are a number of things that could be done.

Set mandatory requirements for state agencies. Mandate environmental justice be integrated in government decision-making including legislation, rulemaking, permitting, codes, and programs.

Expand Funding. Allocated additional funding for community outreach and designate seats on all boards, councils, and other decision-making bodies for community members who represent environmental justice communities.

Accountability. Establish a system of accountability for state agencies to ensure actions conducted on the state's behalf positively impact people's lived experience and address deficiencies.



Appendix

DEFINITIONS

Bio-accumulative toxins. The propensity of certain chemicals to build up through the food chain.

Carcinogenic. Any substance having the potential to cause cancer.

Endocrine disruptors. Mimics, blocks, or interferes with the body's hormones in the endocrine system.

Persistent. The persistence of a substance refers to the potential for long-term exposure to toxins.

Reproductive toxins. Reduced fertility such as effects on gonads and spermatogenesis.

Respiratory. Chemical pollution that causes issues such as asthma, bronchitis, and pneumonia.

END NOTES AND REFERENCES

1. This figure includes \$155 million to support emergency response to Homelessness State of Emergency; \$316 million to rehouse additional households, prevent homelessness, maintain shelter operations, create new permanent supportive housing, and provide ongoing support; \$650 million in bonds to build and preserve affordable housing.

2. Oregon's Greenhouse Gas Emissions through 2015: An assessment of Oregon's sector-based and consumption-based greenhouse gas emissions. Department of Environmental Quality. <https://www.oregon.gov/deq/FilterDocs/OregonGHGreport.pdf>.

3. This figure is calculated by multiplying Census estimated number of residential building permits issued in 2015 (17,510, per the Oregon Office of Economic Analysis) by the average home size in 2015 (2,687 sqft, per the U.S. Department of Commerce) to get an estimated area of housing produced in 2015. Then, dividing annual consumption-based emissions from building materials for housing in 2015 (2.80 MMT CO₂e, per DEQ's Consumption-Based Emissions Inventory²) by the estimated area of housing produced in 2015 to get an average embodied carbon emissions per sq ft. Then, multiplying by 360,000 housing units and the average home size in 2021 (2,273 sqft, per the latest

data available from the U.S. Department of Commerce) to get the estimated embodied carbon emissions from new construction of 360,000 homes built to current standards and typical industry practices.

4. According to the U.S. EPA, a typical passenger vehicle emits about 4.6 metric tons of carbon dioxide per year. The total estimated embodied carbon emissions for new housing production was divided by this figure to translate the emissions into the equivalent of cars on the road over the 10 years. Then, divided by 10 to show as cars per year over the 10 years.

5. Studies find an array of values for embodied carbon reductions from reusing the structure of an existing building. DEQ's research for the Resilient Efficient Building Task Force found figures from 40-75 percent.

6. A 2010 study published by DEQ found that home size is among the most important determinants for reducing impacts. Reducing from a Medium Standard Home (2262 sqft) to an Extra-small home (1149 sqft), environmental impacts were reduced between 20-40 percent. Study: A Life Cycle Approach to Prioritizing Methods of Preventing Waste from the Residential Construction Sector in the State of Oregon. Department of Environmental Quality. September 29, 2010. <https://www.oregon.gov/deq/FilterDocs/ADU-ResBldgLCA-Report.pdf>.



Appendix (continued)

7. Senate Bill 1518, 2022, established the Resilient Efficient Buildings Task Force. The Task Force was directed to identify and evaluate policies related to building codes and building decarbonization for new and existing buildings that would enable the state to meet greenhouse gas emissions reduction goals. In their report, the Task Force preferred the option to reduce embodied carbon from construction by 60 percent by 2030 with a few preferring 20 percent. In studying these strategies for the Task Force, DEQ found that 25 percent is a conservative, achievable estimate within the next ten years, though the potential is even greater. Report: Joint Task Force on Resilient Efficient Buildings. December 13, 2022. <https://olis.oregonlegislature.gov/liz/202111/Downloads/CommitteeMeetingDocument/258395>.

8. The Six Classes Approach to Reducing Chemical Harm: Healthier Products, Healthier People. Green Science Policy Institute. <https://www.sixclasses.org/>.

9. Global Estimates of Modern Slavery, Forced Labour and Forced Marriage. International Labor Organization. Sept. 19, 2017. https://www.ilo.org/wcmsp5/groups/public/@dgreports/@dcomm/documents/publication/wcms_575479.pdf.

10. Design for Freedom. Grace Farms. October 2020. <https://www.designforfreedom.org/>.

11. Oregon's share of forced labor impacts in the global supply chain are estimated by multiplying the global impacts (per, Design for Freedom¹⁰) by Oregon's proportion of the global population (0.05 percent). Oregon's proportion of the global population was calculated by dividing Oregon's population (4.246M in 2021, per the U.S. Census Bureau) by the worldwide population (8 billion in November 2022 per the United Nations). Without direct data, this methodology was used to give a rough estimate of Oregon's share these impacts. Additional research into these impacts in Oregon's supply chain will provide more specific and reliable data.

12. Potential high risk supply networks of building materials into Oregon include those locations which were identified as associated with three or more building materials at risk for forced labor (per the Design for Freedom Report). Additional research into Oregon's supply chain will provide more specific and reliable data.

Translation or other formats

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