Best Practices for Red List Free Affordable Housing

INTERNATIONAL LIVING FUTURE INSTITUTE℠

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COVER IMAGE: BLOCK PROJECT, SEATTLE, WA. IMAGE COURTESY OF FACING HOMELESSNESS.

Table of Contents

U-LEX PROJECT, SEATTLE, WA. IMAGE COURTESY OF SKL ARCHITECTS

31 TUFTS STREET, SOMERVILLE, MA. IMAGE COURTESY OF PLACETAILOR.

Introduction

The Best Practices Guide

The International Living Future Institute (ILFI or the Institute) envisions a future where all materials in the built environment have positive impacts on human, community, and ecosystem health. All ingredients within building products would be fully disclosed and free of toxicants and harmful chemicals. With this vision, ILFI created the Red List to identify the "worst -in-class" substances prevalent in the building industry that pose serious risks to human health and the environment. We have been working with affordable housing project teams and partners since 2011 to eliminate the use of Red List chemicals in affordable housing. Over the last three years, the Institute has created the Affordable Housing Materials List, which is a downloadable spreadsheet of products, by CSI division, that can be used, along with Declare, to help simplify the process of creating Red List Free specifications for affordable housing and other project types. Declare is an easy-to-read 'nutrition label' for products with online resources to promote, share, and find healthier building materials. The creation of the Affordable Housing Materials List and research by many teams have helped inform this guide.

It can be daunting to approach an overhaul of standard specifications or to design a Red List Free building, particularly for an affordable housing project team that more than likely has budget and time constraints, as well as a need to keep maintenance costs low. Material health information listing chemical names can be intimidating to engage with for a building professional who is, by training, not a toxicology expert and likely does not have advanced degrees in chemistry. It can be tempting to assume that there are regulations in place to protect from harmful chemicals in products; however, this is unfortunately not the case. There is no legal requirement for manufacturers of building materials to publish their ingredients

The outcome we ultimately strive for at ILFI is regenerative and healthy built environments for all people. We also strive to eliminate the effects of Red List chemicals on everyone who interacts with them, including factory workers, installers, occupants of buildings, those involved in end-of-life disposal, and surrounding communities.

and very limited regulation around chemicals in products[1]. It will take a collective effort by those in the affordable housing sector and in the healthy materials realm to ensure that materials for affordable housing are safe and affordable. This guide will help identify which Red List ingredients are common in each product category, the health implications of including Red List ingredients, and, most importantly, the alternatives and best categories to start with to move towards Red List Free affordable housing.

This guide is intended to provide information for architects, designers, consultants, contractors, owners, developers, maintenance and facility staff, and others seeking to make healthier material choices for their residents, workers, and communities. The outcome we ultimately strive for at ILFI is regenerative and healthy built environments for all people. We also strive to eliminate the effects of Red List chemicals on everyone who interacts with them, including factory workers, installers, occupants of buildings, those involved in end-of-life disposal, and surrounding communities. This is even more critical in Black, Indigenous, People of Color (BIPOC) and low-wealth communities, which have historically suffered and continue to suffer disproportionate exposure to environmental hazards (in the air, water, soil, and buildings) due to unjust and racist policies such as redlining that have resulted in worse health outcomes in these communities.

This guide is primarily focused on health-related attributes, as defined by the Red List. Note that this guidance is not intended as a pathway for achieving the Materials Petal in the Living Building Challenge (LBC) or Core Certifications and does not cover all requirements for these certifications, which are holistic and address a spectrum of issues in the built environment. ILFI has a multi-attribute approach to materials as explained in the sections below and has many other resources available on our website to reference for these attributes (such as embodied carbon[2]). We are creating this guide to invite more organizations in the affordable housing sector to join us on this mission by installing as many Red List Free materials as feasible in each project while simultaneously pushing and signaling to the market a demand for more Red List Free products that are affordable.

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[1] For more information around chemical regulations in the United States, refer to Krimsky S. The unsteady state and inertia of chemical regulation under the US Toxic Substances Control Act. Birnbaum LS, editor. PLoS Biol [Internet]. 2017 Dec 18 [cited 2018 Mar 2];15(12):e2002404. Available from: http://dx.plos.org/10.1371/journal.pbio.2002404

[2] Embodied carbon refers to the greenhouse gas emissions arising from the manufacturing, transportation, installation, maintenance, and disposal of building materials. In contrast, operational carbon refers to the greenhouse gas emissions due to building energy consumption.(https://carbonleadershipforum.org/embodied-carbon-101/). Embodied carbon has a significant contribution to climate change, which also disproportionately affects BIPOC and low-income communities, who typically experience more impacts of extreme heat and weather events.

The Red List

Since its inception in 2006, the Red List has been an intuitive tool for communicating the need to stop using chemicals that cause harm. The Red List represents the worst-in-class chemicals that are prevalent in the built environment; it does not include every possible hazardous chemical and it should also not be applied to consumer products or sectors where other types of chemicals are more common. As a binary screen to assess material health, the Red List brings simplicity to a complex topic. Once a project team has found product ingredient information, they can easily identify any Red List ingredients by cross checking the Chemical Abstract Service Registry Number (CASRN) identification numbers against the published spreadsheet of CASRN numbers on the Red List. The Red List is central to several of ILFI's programs, including the Materials Petal of the LBC, the Living Product Challenge (LPC), and the Declare Label. Red List compounds must be avoided at the level of 100 ppm, or 0.01% of a product, in LBC projects, Red List Free Declare Labels, and LPC products and process chemicals.

The Path to Optimized Product Health

The path to optimized product health includes the necessary steps a manufacturer must take toward improving the health profile of their products. This entails making sure the substances and materials within their products do not pose and health impacts to building occupants or those working in or living near the manufacturing plants. The following five steps have been identified by the industry:

1. **Know**
   Fully understand a material's ingredients and its production process
2. **Disclose**
   The act of sharing product content and/or its impacts publicy through approved certifications, labels, or standards
3. **Screen**
   Using known hazard lists to screen ingredients or processes for potential impacts
4. **Assess**
   A more rigorous investigation to determine the health and environmental impacts of each substance or material in the product
5. **Optimize**
   Removing or replacing chemicals with ones that have less impact on health or the environment

The chemical classes on the Red List range widely in structure, toxicity, and function. They include toxic legacy building materials like asbestos and polychlorinated biphenyls (PCBs) that are now illegal in most applications, but still found in many existing buildings; chemicals that are regulated, but not banned, like formaldehyde and other volatile organic compounds; and compounds of emerging concern that are pervasive in many products like ortho-phthalates, halogenated flame retardants, and per- and polyfluoroalkyl substances (PFAS). The Red List also includes chemical classes that have potential for harm during the extraction, processing, manufacture, or disposal stages of the product life cycle[3]. Red List compounds are found in many building products including drywall, insulation, adhesives, paint and other finishes, lighting fixtures, resilient flooring, waterproofing, textiles, windows, and more.

[3] This report from Energy Efficiency for All and Healthy Building Network explains the life cycle and environmental justice impacts of certain chemicals of concern.

Each product or ingredient screened for an LBC project or a Declare label creates opportunities for education, advocacy, and positive change.

Each product or ingredient screened for an LBC project or a Declare label creates opportunities for education, advocacy, and positive change. Thanks to the efforts of many in the building sector, the avoidance of Red List chemicals has sparked the innovation of new approaches that reduce the use of toxicants in buildings. For example, buildings can be designed with materials that do not require finishes, which often contain chemicals of concern, or without plenum spaces to maximize the use of low-smoke, halogen-free electrical cable. Declare and the broader transparency movement in the industry have pushed manufacturers to innovate and to eliminate Red List chemicals that have been standard in specific applications for many years. Among many others, Declare now includes composite wood products without formaldehyde, a tiling system that does not require mortar or adhesives, and an insulated panel without halogenated flame retardants.

The Red List is updated annually to stay current with science and policy. Early versions of the Red List flagged 13 chemical classes and ~300 individual compounds. As of 2023, the list comprises 19 chemical classes and over 11,000 individual compounds.

POSITIVE IMPACTS

The Institute's Red List and programs such as Declare, LBC, and the LPC have greatly raised awareness about the importance of material health within the regenerative building community. Diverse stakeholders reference or integrate the Red List in building standards, procurement policies, design strategies, and specifications. Thousands of manufacturers now voluntarily disclose ingredients and screen for the Red List. As our understanding of the health, environmental, and societal impacts of building materials increases in sophistication, the Red List and ILFI's material health programs will need to evolve as well. The material health community is aligning goals and strategies to work collectively toward making material optimization (the substitution of chemicals with health hazards across the product's life cycle) the norm rather than the exception.

Health Hazards

The descriptions below include the types of health and environmental hazards that are present in the chemical classes included on the Red List.

Acute aquatic toxicity:	Hazardous to aquatic environment and aquatic life.[4]
Acute or chronic organ or system toxicity:	Causing damage to organs or organ systems including the liver, kidneys, nervous system, hemoglobin function, and lung tissue.[5]
Antibiotic Resistance:	The ability of germs like bacteria or fungi to develop the ability to defeat the drugs designed to kill them, threatening the ability of medical advances to fight infections.
Asthmagen:	A substance that can induce or exacerbate symptoms of asthma (shortness of breath, wheezing, coughing, and chest tightness[6]). A 2013 report by Healthy Building Network named twenty of these asthmagens to be of thet highest priority, due to clear pathways for building occupants to be exposed to them after product installation and during normal use. Priority asthmagens identified include: acid aldehydes (two types); acrylates (four types); ammonium hydroxide; bisphenol A diglycidyl ether (BADGE); ethanolamines (three types); formaldehyde; isocyanates (six types); polyfunctional aziridine; and, styrene.[7]
Carcinogen:	Any substance or agent that is capable of causing cancer – the abnormal or uncontrolled growth of new cells in any part of the body in humans or animals. Most carcinogens are chronic toxins with long latency periods that can cause damage after repeated or long duration exposures and often do not have immediate apparent harmful effects.[8]
Developmental toxicant:	A substance that can cause harm to a developing child, including birth defects, low birth weight, and biological or behavioral problems that appear as the child grows.[9]
Endocrine disruptor:	A chemical compound that interferes with the normal functioning of the endocrine system (glands which secrete hormones into the blood) and the reproductive and other biological processes regulated by it.
Immunotoxicant:	A substance that causes adverse effects on the functioning of the immune system. Immunotoxicity leads to the increased incidence or severity of infectious diseases or cancer, since the immune system's ability to respond adequately to invading agents is suppressed.[10]

Mutagenic :	Anything that causes a mutation (a change in the DNA of a cell). DNA changes caused by mutagens may harm cells and cause certain diseases, such as cancer.
Neurotoxin:	A substance that alters the normal activity of the nervous system. This can eventually disrupt or even kill neurons (nerve cells) which are important for transmitting and processing signals in the brain and other parts of the nervous system[11], causing symptoms such as numbness.
Ozone depleting:	Chemicals that degrade ozone layer, the atmospheric shield that protects from high doses of UV radiation, which causes increased incidences of skin cancer and damages plants and marine ecosystems[12]. International action to ban CFCs in the 1980s has resulted in a notable recovery in the ozone layer[13].
Heavy metals:	Cadmium, mercury, lead and other metals that cause health problems including cancer, developmental issues, lung and kidney damage, bone loss, hypertension, breathing problems, anemia, ulcers, and allergic reactions.[14]
Particularly hazardous due to persistence:	The trait of chemicals, such as those that fall under the PFAS chemical class, to be extremely resistant to environmental and metabolic degradation, and sometimes, but not always resulting in higher concentrations over time and difficulties in removing contamination[15]. These are often referred to as “forever chemicals.”
Persistent Organic Pollutant (POP)/Persistent Bioaccumulative Toxic (PBT):	A set of toxic chemicals that are persistent in the environment and able to last for several years before breaking down. POPs circulate globally and chemicals released in one part of the world can be deposited at far distances from their original source through a repeated process of evaporation and deposition. POPs are lipophilic, which means that they accumulate in the fatty tissue of living animals and human beings. In fatty tissue, the concentrations can become magnified by up to 70,000 times higher than the background levels. As you move up the food chain, concentrations of POPs tend to increase so that animals at the top of the food chain such as fish, predatory birds, mammals, and humans tend to have the greatest concentrations of these chemicals, and therefore are also at the highest risk from acute and chronic toxic effects.[16]

Reproductive Toxicant:

A substance or agent that can cause adverse effects on the reproductive system. The toxic effects may include alterations to the reproductive organs and/or to the endocrine system (which includes the thyroid and adrenal glands). These effects can occur in both men and women.[17]

Very persistent, very bioaccumulative (vPvB):

Substances of very high concern due to their persistence, accumulation in living organisms, ability to travel long distances, and high toxicity.[18]

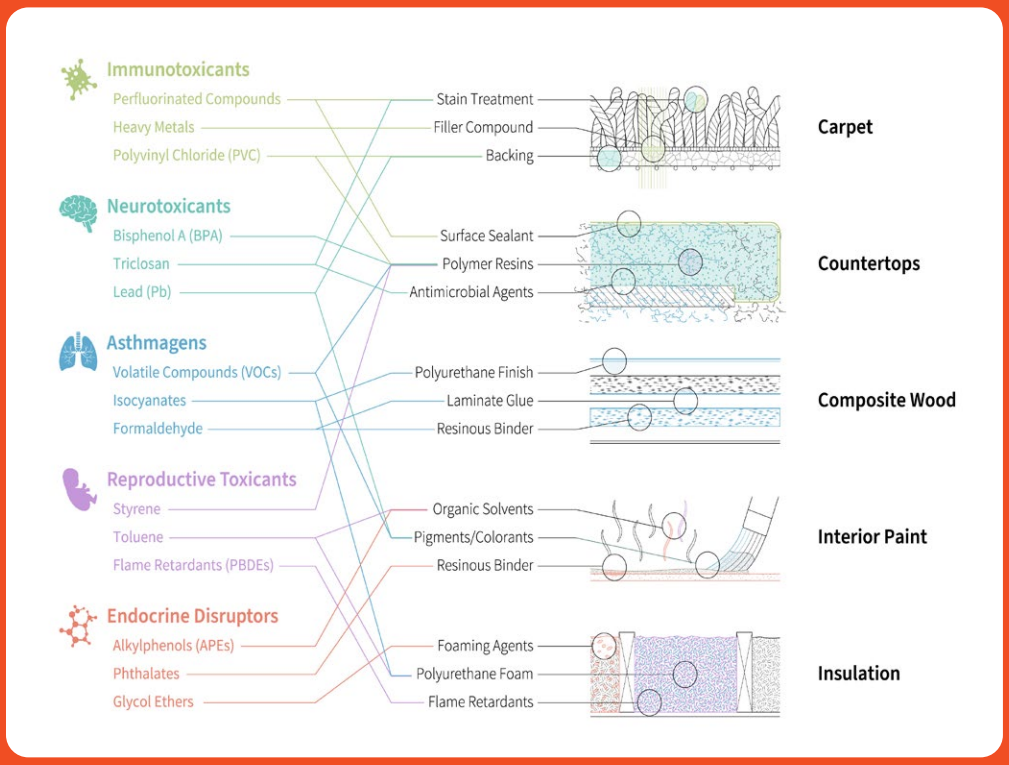
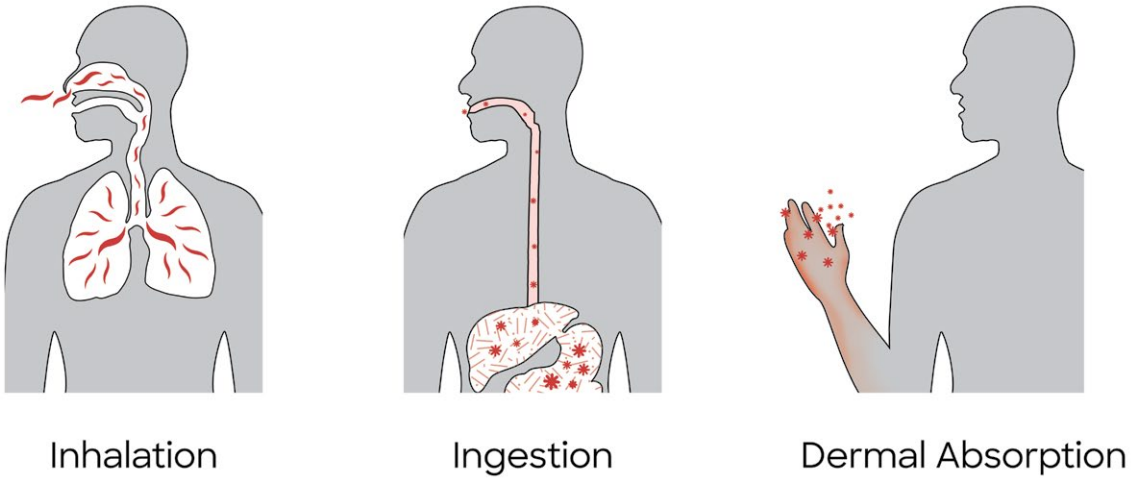


FIGURE 1: AN EXAMPLE OF THE TYPES OF CHEMICALS FOUND ON THE RED LIST AND WHERE THEY CAN BE FOUND IN THE BUILT ENVIRONMENT.

4 https://www.kemi.se/prioguiden/english/start/prio-criteria-for-phase-out-substances-and-priority-risk-reduction-substances
5 https://enhs.uark.edu/_resources/documents/sops/Specific_Target_Organ_Toxicants_12.19.pdf
6 https://enhs.uark.edu/_resources/documents/sops/Specific_Target_Organ_Toxicants_12.19.pdf
https://www.hse.gov.uk/foi/internalops/og/og-00016.htm
7 https://enhs.uark.edu/_resources/documents/sops/Specific_Target_Organ_Toxicants_12.19.pdf
https://healthybuilding.net/uploads/files/gb2014-asthmagen-paper.pdf
8 https://ehs.cornell.edu/research-safety/chemical-safety/laboratory-safety-manual/chapter-9-particularly-hazardous-6
9 https://homefree.healthybuilding.net/glossary
10 https://www.sciencedirect.com/topics/chemistry/immunotoxicity
11 https://www.ninds.nih.gov/health-information/disorders/neurotoxicity#
12 https://www.nationalgeographic.com/environment/article/ozone-depletion
13 https://www.wbur.org/onpoint/2023/01/30/how-the-world-came-together-to-save-the-ozone-layer
14 https://living-future.org/red-list/
15 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7784706/
16 https://www.unep.org/cep/persistent-organic-pollutants-pops-and-pesticides
17 https://ehs.cornell.edu/research-safety/chemical-safety/laboratory-safety-manual
18 https://risctox.istas.net/en/index.asp?idpagina=613

HOW CHEMICALS FROM BUILDING MATERIALS ENTER OUR BODIES



CHEMICALS FROM BUILDING MATERIALS CAN GET INTO OUR BODIES IN THREE DIFFERENT WAYS.
IMAGE COURTESY OF HEALTHY MATERIALS LAB AT PARSONS SCHOOL OF DESIGN.

Ingestion: Direct ingestion of water or dust that has been contaminated by chemicals migrating from building materials.

Inhalation: Breathing air that has been contaminated by chemicals migrating from building materials.

Dermal contact: Skin contact with chemicals that are present in air, dust, water, contaminated surfaces, and direct product contact. Chemicals may be absorbed by the skin and enter the bloodstream.

International Living Future Institute's Approach to Materials

ILFI's programs promote a positive and holistic vision of what good looks like for materials, emphasizing green chemistry approaches to product development, regenerative rather than extractive feedstocks, innovative approaches to carbon sequestration and waste remediation, and attention to equity in supply chains and other lifecycle stages. ILFI has several programs addressing the multiple attributes related to building materials.

TRANSPARENCY

The first step towards understanding if a product is healthy or not is transparency. In the materials health sphere, the concept of "transparency" or "disclosure" is the notion that manufacturers should be transparent with consumers about the ingredients and chemistry of their products. This is often not a simple request for manufacturers. Building products can have complicated supply chains and manufacturers are often not aware themselves of the chemicals that are included in the product or the risks that they may pose. There is also not an industry-wide agreement about the level of disclosure that is needed to fully identify any hazards; either the level of disclosure (parts per million or billion, e.g.) and the overall percentage of ingredients that should be disclosed. The Declare program was created to provide guidance on both of these questions and provide a credible and easy-to-read source for building practitioners to find material health information.

ADVOCACY

Hand-in-hand with transparency is the role of the project team to "advocate" for healthier materials. This means reaching out to manufacturers to request disclosure of ingredients as well as letting them know that you are specifying (or not specifying) their product based on its material health properties. Even if you are unable to find a Red List Free product for a specific application, actions like this taken by many different project teams signals a demand to manufacturers for healthier products.

LIVING BUILDING CHALLENGE

While the Red List is a central element of the Living Building Challenge (LBC), it addresses materials holistically, including the transparency of materials information (through Declare labels), material health (with the Red List), local sourcing, indoor air quality, environmentally responsible sourcing (especially in regards to FSC wood), embodied carbon, waste, end-of-life options, and using salvaged materials.

DECLARE

ILFI's Declare label is a "nutrition label" for building products and is the easiest way to quickly find Red List Free products. All active Declare labels are accessible on a free and searchable database. Declare labels disclose all intentionally-added ingredients and residuals at or above 100 ppm (0.01%) present in the final product by weight. Each ingredient must be reported with a chemical name, Chemical Abstract Service Registry Number (CASRN), and percentage or percentage range that is included in the product. These labels report all product ingredients and use a simple color code system to flag chemicals of concern that are on the Red List (in red) or on the Watch List (in orange), which means they may be added to the Red List pending further research. Additional information is provided on the product's final assembly locations, life expectancy, end-of-life options, and overall compliance with relevant requirements of the Living Building Challenge. The Declare database also has filters that can identify products to help project teams achieve points under Enterprise Green Communities and LEED v4.1 and 4.2.

LIVING PRODUCT CHALLENGE

The Living Product Challenge (LPC) is a science-based certification for products that help restore our planet and improve the quality of human life. LPC goes beyond the Red List; not only does it require full disclosure and Red List screen of all ingredients and process chemicals, it also requires full chemical hazard assessment for all ingredients and optimization by removing all ingredients classified as carcinogenic, mutagenic, and/or reprotoxic (CMR), or persistent, bioaccumulative, and toxic (PBT). It encourages the creation of products that give more than they take and assess the entire life cycle impacts in every aspect of the product and its manufacturing process, from fair labor practices in supply chains to material health optimization, energy consumption, water use, impact on communities, and more. LPC products exemplify the long-term vision of products that have a positive impact on climate, health, and equity.

RED LIST FREE products disclose 100% of ingredients present at or above 100 ppm (0.01%) in the final product and do not contain any Red List chemicals.

RED LIST APPROVED products disclose a minimum of 99% of ingredients present in the final product and meet the LBC Red List Imperative requirements through one or more approved exceptions.

DECLARED products disclose 100% of ingredients present in the final product, but contain one or more Red List chemicals that are not covered by an approved exception.

Red List Vetting

This chapter provides an overview of the key steps a project team can use to identify whether a product includes Red List chemicals. The steps below walk through the process for vetting a product for Red List chemicals. There are two basic pathways. The first pathway, Path One, is to use products that have Declare labels products. This pathway is by far the easiest because all products with Declare labels and a Red List Free or Red List Approved Status have already shown they meet the requirements. No additional resaeaching or vetting is required. The second pathway, Path Two, requires research and analysis to determine if a product includes Red List ingredients and, if so, whether it is eligible for an exception within the Living Buidling Challenge. These steps are only comprehensive of the Red List process itself. Additional information and steps will be required for LBC project teams pursuing the full Materials Petal (see the Building Product Selection Guidance on our website for information on holistic materials selection).

Before beginning the vetting process using Path One or Path Two, it is helpful to establish a clear process that everyone on the team understands and commits to. You can use the Pre-Vetting Checklist on the following page to set up this process.

Path One

SELECT

Use products on Declare or on the Affordable Housing Materials List!

If the product has a Declare label, Red List ingredient information is quickly confirmed on the label as:

- **Red List Free:** No Red List chemicals!
- **Red List Approved:** May contain Red List chemicals that are considered unavoidable in the application at this time or may not have fully disclosed all ingredients (though it is confirmed that any withheld are Red List Free). While teams should prioritize Red List Free products, Red List Approved products may be the best in class in certain applications and will help avoid most, even if not all, Red List ingredients.
- **Declared:** Labels that indicate a status of “Declared” contain Red List ingredients. Red List Free or Approved products should be prioritized; however, manufacturers that have taken the first step of transparency should also be commended and these products should be selected over products with no transparent ingredient information.

DO

- **Inform the Manufacturer** with the Declare labeled product that that you chose the product for this reason - this helps the manufacturer to understand continued demand and a return on their investment.
- **Specify the Product.** List the specific Red List Free product in the specifications or performance requirements (such as “Red List Free or Approved”) in relevant sections of the project specifications.

Path Two

RESEARCH + REQUEST

If a product has no Declare label, search and/or request ingredient disclosures

- Some manufacturers include information about their product composition on their website. Look for documentation called Health Product Declarations or LBC or LEED letters. You can also use labeled building material repositories, like MindfulMaterials, Ecomedes, UL Spot, and the Health Product Declaration Collaborative to speed your work. Safety Data Sheets (SDS) may list ingredients, but they typically aren't sufficient because they don't require manufacturers to list all ingredients. Manufacturers who have labeled products listed in Declare or other repositories that provide complete health information shouldn't be asked for the information on those labels because they've already done the work. Be respectful of their time.
- If no information is readily available, reach out to the manufacturer. You can download sample "ask" letters from ILFI's Affordable Housing Website.

CONFIRM COMPLIANCE

Confirm Red List Compliance

- Does the product contain Red List ingredients? Cross check all CASRNs against the CASRNs on the Red List and Watch List CASRN Guide. Don't forget to review component ingredients such as a coating used on a product that might not be included in simple material breakdowns (and may be likely to contain Red List ingredients). Note that chemicals on the Watch List are being considered for addition to the Red List, but are not yet included, and those designated as "Priority" are intended to be added to a future version.
- Note that the LBC requires disclosures at 100 ppm (which is more granular than 1,000 or 10,000 ppm). Project teams are encouraged to prioritize products with disclosures at this level, but should choose to use a product disclosed at a lower threshold over a product with no transparency.
- If a product does include Red List ingredients, check if it is covered by an Exception listed in the Living Building Challenge Materials Petal Handbook, as certain chemical classes are unavoidable in particular application (at this time). However, Exceptions are rare and will never apply to cases where there are plenty of Red List Free options (such as resilient flooring).

Confirm VOC Content Compliance – this is part of the Red List scope!

- Is the product an adhesive, coating, or sealant that is wet-applied on site?
- VOCs must be compliant with the limit for that category set by SCAQMD Rule 1168 or CARB 2007 SCM for Architectural Coatings.

If product is Red List Free or Approved

- **Inform the Manufacturer.** Be sure to let a manufacturer with a Red List Free product know that you chose the product for this reason - this helps the manufacturer to understand continued demand and a return on their investment. Suggest they get a Declare Label for this product to make it easier for other project teams to find and specify their product.
- **Specify the Product.** List the specific Red List Free product in the specifications or performance requirements (such as "Red List Free or Approved") in relevant sections.

If product is NOT Red List Free or Approved

- **Begin the process again** on an alternative product and advocate to the manufacturer to provide transparent product information and/or reformulate the product to be Red List Free. Let them know your team is prioritizing healthy materials in your product specifications.

Pre-Vetting Checklist

Before beginning the material vetting process, ensure that you have set up a clear process:

- ☐ **Start early in design**, when you have the flexibility to change or eliminate material selections based on your goals and desired outcomes.
- ☐ **Set a goal.** Even if your project is not pursuing Living Building Challenge certification, having a clear goal in mind for materials (see Chapter 4 for examples of goals) as part of the Owner's Project Requirements (OPR) and Basis of Design (BOD) will provide accountability. Include verified Red List Free products in the BOD specifications to formalize the intent to include them in the final specifications.
- ☐ **Have a clear process for considering material attributes.** Who will lead the effort? What parties are responsible for what building material choices? What tracking and reporting tools will you use to catalog your work and share it among team members? As part of your materials research toolkit, have introductory emails or presentations (for meetings with contractors and other team members), forms that manufacturers can fill out if they don't have a label, and advocacy templates ready to send that ask the manufacturer to address any shortcomings. You can download sample resources from the Institute's Affordable Housing Website and LBC Resources page.
- ☐ **Always keep the "Why?" in mind!** Have a pitch (whether verbal or in writing) ready for project partners (such as manufacturer's representatives and consultants) that includes the information they'll need to be effective partners in the materials research. You can review information about health risks associated with the Red List on our website (or send them an excerpt from this guidebook!). Articles from Trim Tab, such as "Let's Get Down To Business: The Economic Case For Declare And The Living Product Challenge" or "Closing The Transparency Loop: How Building Material Manufacturers Are Transforming The Industry Through Cross-Sector Collaboration,"and even other manufacturer's sites, can help explain how leading manufacturers are embracing transparency and materials health.

Non-profit and mission-driven affordable housing organizations may want to remember that the production and transport of Red List materials (such as PVC-based products) often release toxic emissions into the air and water[19], which most impacts low-income frontline communities, often the same communities that affordable housing developers are trying to serve.

Trade workers may be suprised to hear that one benefit of vetting for Red List Chemicals is to eliminate chemicals that can harm them during the installation process because these are not adequately regulated in building materials.

[19] https://toxicfreefuture.org/research/pvc-poison-plastic/
Senathirajah K, Kemp A, Saaristo M, Ishizuka S, Palanisami T. Polymer prioritization framework: A novel multi-criteria framework for source mapping and characterizing the environmental risk of plastic polymers. J Hazard Mater [Internet]. 2022;429(December 2021):128330. Available from: https://doi.org/10.1016/j.jhazmat.2022.128330

"GILA RIVER INDIAN COMMUNITY SUSTAINABLE HOUSING, SACATON, AZ. IMAGE COURTESY OF WANDA DALLA COSTA, ARIZONA STATE UNIVERSITY

Product Guidance

Armed with some background knowledge, it will now be possible to start to select better products. There are six categories listed below ranking products based on their ingredient content:

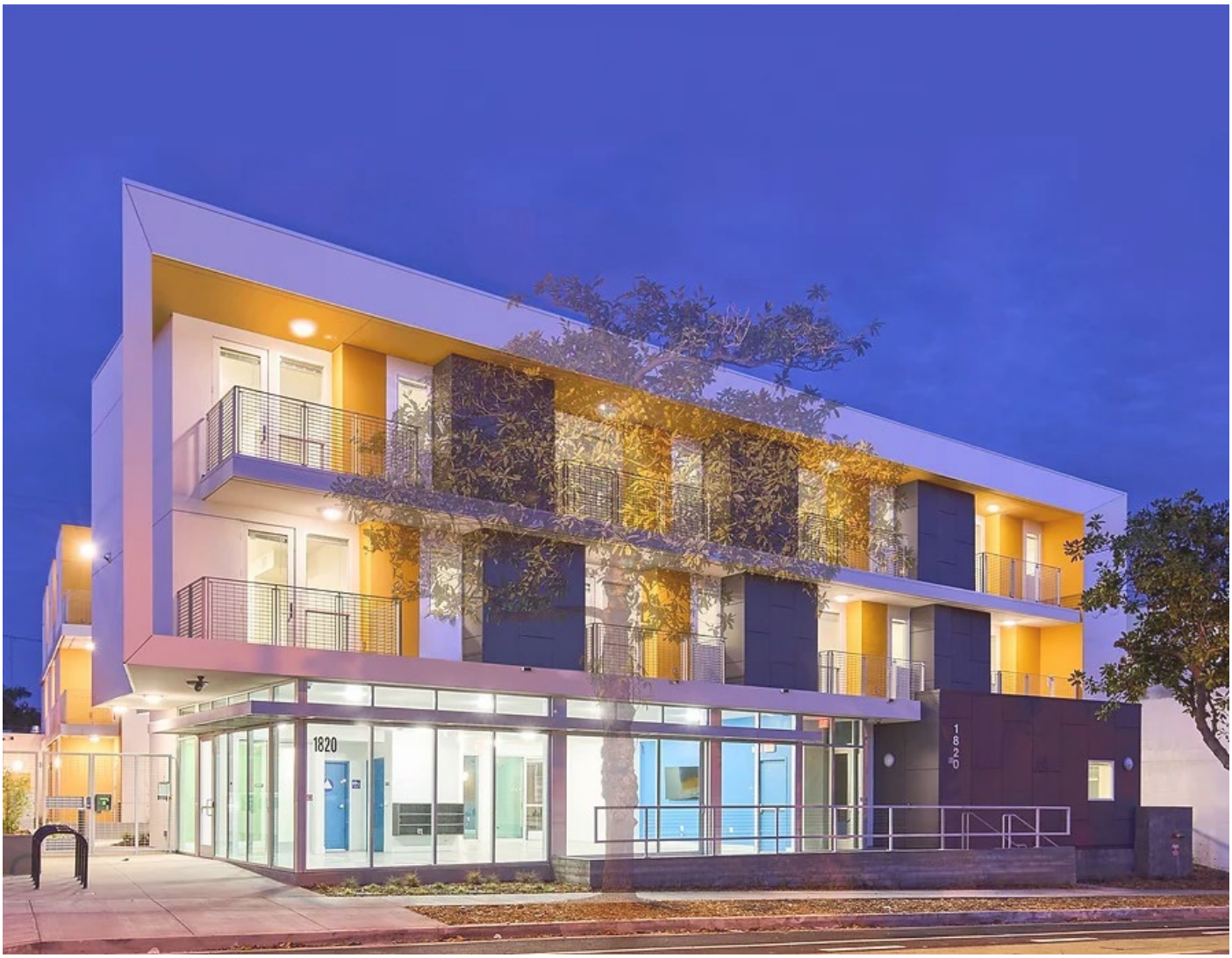
1. **Typically Red List Free**
2. **Easy to Spec Red List Free**
3. **Red List free with some cost implication**
4. **Limited options with cost implication**
5. **Few options/request transparency**
6. **Eliminate**

These levels have been informed by ILFI's Affordable Housing Materials List, which is a spreadsheet of products, organized by CSI division, of Red List Free and Approved products found in the Declare and other databases and/or researched by ILFI and our affordable housing project teams. For each level below, project teams may refer to the Affordable Housing Materials List to find specific products.

The guidance included here includes the most common product types that are used by affordable housing project teams and researched by ILFI.. Though not exhaustive it should be comprehensive of the primary types of products for most projects. This guide includes products in CSI Divisions 03 -10, 12, 14, 22, and 26.

Any products not included here or in the Affordable Housing Materials List should be assumed to contain Red List chemicals and should be researched via the Declare database, direct outreach to the manufacturer of the product, and/or through one of the resources included in

the Appendix and in Chapter II. Note that some of the products included in this guide may not have Red List chemicals, but may have high embodied carbon, or may not be sourced ethically, or in an environmentally responsible manner. For example, Grace Farms Foundation classifies brick products as a high-risk product for forced labor[1]. It is important to look at product selection holistically and consider multiple attributes in concert[2].



GREENWAY MEADOWS, SANTA MONICA, CA. IMAGE COURTESY OF WELDON BREWSTER.

1 Refer to Grace Farms Design for Freedom Toolkit for information on sourcing masonry and other materials to avoid ethical concerns in the supply chain

2 Refer to ILFI's Building Product Selection Guidance for a comprehensive guide to selecting materials based on multiple environmental and social attributes.

1. Typically Red List Free

Most of the products included in this section are made of few components. If additional sealers, adhesives, paints, or coatings are added to the material then Red List chemicals may be introduced.

This level includes products under CSI Divisions 03 - 07 and 09.

DIVISION 03 00 00 CONCRETE

Concrete should not contain any Red List ingredients and can be a good option for flooring or other applications.. The Living Homes at Mill Creek project team used concrete countertops to save on costs and to avoid the Red List ingredients that can be common in several types of countertops. However, sealers, densifiers, and coatings may contain per- and polyfluoroalkyl substances (PFAS), a chemical class on the Red List that has been linked to weakened immune systems, cancer, liver damage, and other health impacts.[3] There are several Red List Free concrete coating products available in Declare. Concrete and cementitious products can contribute significantly to the embodied carbon of a project; project teams are encouraged to select low embodied carbon concrete mixes.[4]

DIVISION 04 00 00 MASONRY

Masonry will also not generally contain any Red List chemicals, but project teams will need to avoid using epoxy grouts, which will often contain bisphenol A (BPA)[5], an endocrine disruptor that can affect neurological function and development[6]). Red List Free mortar and grout can be found in Declare.

3 https://living-future.org/red-list/

4 https://carbonleadershipforum.org/low-carbon-concrete-implementation-strategy/

5 https://informed.healthybuilding.net/explore#

6 https://living-future.org/red-list/

DIVISION 05 00 00 METALS

05 10 00 STRUCTURAL STEEL
05 30 00 METAL DECKING
05 40 00 METAL FRAMING
05 51 00 METAL STAIRS
05 52 00 METAL RAILING
05 59 13 METAL BALCONIES

Also relevant to metals in these sections:

07 60 00 FLASHING + SHEET METAL
10 71 00 EXTERIOR SUN CONTROL DEVICES

Uncoated metals do not generally pose a Red List concern and can be a good option to avoid Red List chemicals. Metal doors for example may be a better option for avoiding Red List chemicals than composite wood doors, which are likely to include formaldehyde. However, some metal coatings and sealers may contain multiple Red List ingredients, such as PFAS or phthalates, they can also be made with or contain hexavalent chromium (a toxic heavy metal that is linked to breathing problems and cancers in factory workers[7]). Many coating products contain Polyvinylidene fluoride (PVDF), which is classified as a PFAS compound. There are Red List Free metal coatings and primers with Declare labels available. Many manufacturers can provide a Galvalume finish, which can be made Red List Free, and should not cost more than other coatings. Steel will also contribute significantly to the embodied carbon of a project.

DIVISION 06 00 00 WOOD, PLASTICS, AND COMPOSITES

SOLID WOOD MEMBERS

06 10 00 ROUGH CARPENTRY
06 11 00 WOOD FRAMING
06 30 00 EXTERIOR CARPENTRY
06 41 00 ARCHITECTURAL WOOD CASEWORK

Also relevant to these sections:

09 64 00 WOOD FLOORING, INCLUDING CORK AND BAMBOO
12 30 00 CASEWORK
12 36 00 COUNTERTOPS

Untreated solid wood members used in millwork, wood framing, and wood siding will not contain Red List chemicals. Select solid wood components over composite wood to avoid Red List ingredients (especially formaldehyde, a known carcinogen and asthmagen.) Leave products unfinished and/or select any paints, sealers, coatings, or adhesives without Red List chemicals. Note that there are several Red List Free wood stain and varnish products available in Declare. Utilizing wood products from sustainably managed forests can be a way to decrease

7 https://living-future.org/red-list/

the embodied carbon of the project by avoiding concrete or steel in structural members. Wood products (such as wood flooring or siding or base boards) can also be a substitute for plastic products that contain Red List ingredients and pose risks for environmental and human health. Project teams pursuing LBC certification have additional sustainable sourcing requirements for wood products; other project teams are encouraged to prioritize sourcing FSC certified or salvaged wood products in order to avoid detrimental environmental effects associated with deforestation. Wood can be used as a means of bringing biophilic design and a connection to the natural environment into a building, particularly in urban contexts.

DIVISION 07 00 00 THERMAL AND MOISTURE PROTECTION

07 21 00 HEMPCRETE INSULATION

07 21 00 STRAWBALE INSULATION

07 21 06 BLOWN-IN CELLULOSE INSULATION

07 21 3 EXPANDED CORK BOARD INSULATION

07 21 23 SHEEP'S WOOL LOOSE FILL INSULATION

07 21 23 WOOD FIBER LOOSE FILL INSULATION

Natural insulating materials, such as strawbale insulation, can be an effective way to eliminate Red List chemicals and decrease the carbon impacts of the building. In appropriate contexts, strawbale or hempcrete can provide sufficient R-value and can be an affordable alternative to conventional insulation[8]. Hemplime insulation has been approved for use as an insulation in the new International Residential Code.

DIVISION 09 00 00 FINISHES

09 25 23 LIME-BASED PLASTER, INCLUDING ADOBE FLOOR

Natural finishes can be an impactful way to eliminate some of the most likely sources of Red List chemicals. Though more labor intensive, some projects in the Southwest have found adobe flooring to be a material that can provide a biophilic connection to the earth and to the context of the surrounding ecosystem. The Living Homes at Mill Creek installed both adobe floors,and as well as traditional plaster, which also avoids Red List chemicals that can be found in some gypsum wallboard products.

8 https://healthymaterialslab.org/projects/pa-hemp-home

2. Easy to Spec Red List Free

This level includes CSI sections that, unlike the previous level, are likely to include many products that contain Red List chemicals. However, the product types listed below can also be easily found Red List Free, with a small amount of research time, design effort, and minimal or no added costs. For ease of healthier product selection, standard specification should be updated to prioritize Red List Free options.

This level includes products under CSI Divisions 07 and 09.

DIVISION 07 00 00 THERMAL AND MOISTURE PROTECTION

Products in Division 7 are located inside of the waterproofing system with a significant impact on the indoor air quality and health of occupants. Many products in this section will also commonly contain Red List ingredients. Declare and the Affordable Housing Materials List includes many products in Division 7.

INSULATION

07 21 00 BATT INSULATION

07 21 00 RIGID BOARD INSULATION

07 21 00 ACOUSTIC INSULATION

07 21 00 BLOWN-IN INSULATION

Many insulation products commonly contain several Red List chemicals such as halogenated flame retardants (HFR), formaldehyde, and phthalates.[9] HFRs are persistent bioaccumulative toxins that have been accumulating exponentially in humans in recent years. Formaldehyde is classified as a carcinogen and asthmagen. Phthalates are endocrine disruptors and cause harm to childhood development, reproductive system, and increase the incidence of cancer.[10] There are many Red List Free affordable product options available in Declare that are proven and durable products that are familiar to many affordable housing developers and architects. Affordable housing project teams have successfully specified Red List Free insulation products in many projects by manufacturers with Declare labels. There are nearly 50 insulation products with a Declare label as of March 2023.

9 https://assets.ctfassets.net/ntcn17ss1ow9/6lpUnRB2ABFvoBHtlhA7aY/fe4ccd5a4634c703495e33b811a411a1/NRDC-3094_Specifying_Healhier_Materials_report_05.pdf

10 https://living-future.org/red-list/

Note that spray polyurethane foam products are not included on the Affordable Housing Materials List because spray foam will almost always contain Red List chemicals, such as halogenated flame retardants.[11] Batt, rigid board, acoustic, and blown-in insulations can generally be specified Red List Free using products with Declare labels (see the Affordable Housing Materials List for a list of dozens of products).

VAPOR BARRIERS

07 26 00 VAPOR BARRIERS

Vapor barriers are often made of high-density polyethylene, which should typically not contain Red List chemicals. There are several sheet-applied and fluid-applied products available with Declare labels. Affordable housing project teams have indicated that Declare-labeled vapor barrier products are widely available and economical. Note that vapor barriers may sometimes be made of PVC or extruded polystyrene boards, which typically contain HFRs.[12] PVC is on the Red List because its monomer, vinyl chloride is carcinogenic; it is also a Persistent Organic Pollutant Source Materials that often contains lead, phthalates, and cadmium (a very toxic heavy metal), and can result in the production of dioxins, some of the most potent toxins to humans with no safe limit for exposure.[13] The train derailment in East Palestine, Ohio in February 2023, posed a high likelihood to experts to have released dioxins into the surrounding community when vinyl chloride (the monomer for PVC) was burned.[14]

DIVISION 09 00 00 FINISHES

Similar to products in Division 7, finishes in Division 9 have a significant impact on the indoor air quality and health of occupants due to their location on the interior of the building and their large surface area.

GYPSUM BOARD

09 29 00 GYPSUM BOARD

Gypsum board is a relatively easy product type to specify Red List Free, as there are many compliant gypsum board products in Declare that should be cost-neutral products with proven performance and durability records. Wallboard products without Declare labels may contain traces of heavy metals, particularly synthetic gypsum, as byproducts of coal production.[15] Additionally, some gypsum products, especially those marked 'mold-resistant,' may contain

11 https://assets.ctfassets.net/ntcn17ss1ow9/6IpUnRB2ABFvoBHtlhA7aY/fe4ccd5a4634c703495e33b811a411a1/NRDC-3094_Specifying_Healhier_Materials_report_05.pdf

12 https://healthybuilding.net/products/7-insulation

13 https://living-future.org/red-list/

14 https://www.statnews.com/2023/02/21/east-palestine-train-chemicals/

15 https://informed.healthybuilding.net/explore

antimicrobials[16] which are on the Red List due to their potential effects on hormones, learning, and muscle function. [17]

CERAMIC TILE

09 30 00 TILE

There are many Red List Free tile products in Declare that are expected to be cost-neutral to other tiles products. Some affordable housing developers (such as Foundation Communities in Austin, Texas) have found that tile is a cost effective flooring option that requires little maintenance or replacement over time and also avoids the health and environmental issues associated with vinyl flooring. Tile products without Declare labels (or other forms of disclosure) may contain lead in the glaze or in added recycled content,[18] underlining why it is important to utilize products with transparency. Note also, as stated under Division 12 36 00 countertops, sealers and grout may contain per- and polyfluorinated alkyl substances (PFAS) and should be vetted against the Red List. However, it is possible to find Red List Free grout and sealers and, one manufacturer, Drytile has even made a Declare-labeled product that eliminates the need for grout.

ACOUSTIC CEILING TILE AND ACOUSTIC TREATMENT

09 51 00 ACOUSTIC CEILING TILE 09 80 00 ACOUSTIC TREATMENT

As of the publication of this document, there are dozens of acoustic ceiling tile products and suspension systems available in Declare from established manufacturers such as Armstrong World Industries and United States Gypsum. Project teams should be able to easily find Red List Free products with a Declare label. Acoustic ceiling tiles without Declare labels or product disclosure information may contain formaldehyde as binders or antimicrobials as coatings.

CARPET

09 68 00 CARPET 09 68 61 SHEET CARPETING 09 68 13 TILE CARPETING

There are many Red List Free affordable carpet options available with a Declare label. Standard carpet products will commonly include Red List ingredients, such as PVC, PFAS, antimicrobials, and HFRs.[19] Products marketed with stain repellant treatments are likely to contain PFAS. The existence of a Declare label makes the differentiation easier. To maintain healthy indoor environments, project teams should consider minimizing carpeted areas, which tend to harbor dust and allergens much more than other flooring options.

16 https://informed.healthybuilding.net/explore

17 https://living-future.org/red-list/#red-list-and-watch-list-casrn-guide

18 https://informed.healthybuilding.net/explore#

19 https://healthybuilding.net/products/1-flooring

PAINTS AND COATINGS

09 90 00 PAINT

09 61 00 FLOORING TREATMENT (CONCRETE FLOORS)

09 93 00 STAINING AND TRANSPARENT FINISHING

Interior wet-applied products, such as paint, are a critical product from a health impact standpoint. Paints and other coatings often contain high levels of volatile organic compounds (VOC), which will affect indoor air quality, and/or alkylphenol ethoxylates (APEs), which are endocrine disruptors. There are many Red List Free exterior and interior paint and coating products available on the market that should have minimal or no cost implications. Mineral paints are an option that are likely to avoid Red List Chemicals and the potential for microplastic pollution associated with acrylic latex paints.[20] Project teams should avoid epoxy coatings, as they usually contain bisphenol A (BPA), a reproductive and neurological toxin.

20 https://architizer.com/blog/practice/materials/microplastic-plastic-paint-alternatives/

3. Some Cost Implications

This level includes product types that do have some Red List Free and affordable options, including options with Declare labels. Many project teams will already be using Red List Free options for several of these product types and, even teams not pursuing the Living Building Challenge, may be able to integrate Red List Free options for many, if not all of the others.

However, the products listed in this level may have some moderate cost premiums, and/or there may be fewer Red List Free products available than in the previous level. In some cases, such as resilient flooring, there are actually many Red List Free options available with Declare labels, from several different manufacturers. Many of these flooring options are reasonably priced and are often included in affordable housing project budgets. However, if a baseline of vinyl flooring is assumed, then any other options can tend to be somewhat more expensive. Note that product types like vinyl flooring externalize the negative impacts of their products. They often cause environmental degradation or otherwise negatively impact surrounding communities, letting them appear cheaper than if they bore the full responsibility for their impact. Vinyl flooring also has toxic maintenance protocols that can add to the long term costs of the product.

This level includes products in CSI Divisions 06 - 09, 12, and 22.

DIVISION 06 00 00 WOOD, PLASTICS, AND COMPOSITES

COMPOSITE WOOD

06 12 00 STRUCTURAL PANELS

06 15 00 WOOD DECKING

06 16 00 SHEATHING (NOT GWB)

06 17 00 SHOP FABRICATED STRUCTURAL WOOD (LVL, CLT)

06 20 00 FINISH CARPENTRY, MILLWORK, INTERIOR ARCHITECTURAL WOODWORK

06 70 00 STRUCTURAL COMPOSITES

Composite wood will often contain high amounts of formaldehyde and it is often better to use solid wood wherever possible to avoid Red List chemicals. Some manufacturers such as Columbia Forest Products, have successfully avoided added formaldehyde by producing plywood made with soy-based resins. Several formaldehyde-free products have Declare labels and have been included in affordable housing project team budgets for items such as casework. If Red List Free options cannot be found, particularly for casework or

countertops, the Institute has issued a temporary Exception for the use of a very small amount of formaldehyde in composite wood based on the lack of available products on the market in the USA. The guidance, which can be found in the Petal Handbook, provides a pathway to mitigate the amount of formaldehyde used, while not avoiding its use entirely in this specific instance. Exceptions such as this are very limited in scope and considered temporary until the market evolves to remove Red List ingredients in these applications. Note also that, according to the Healthy Building Network, plywood has the least amount of formaldehyde-containing binder, by weight, (3.5%) and should be prioritized over MDF or particleboard, which have more than double this amount.[21] Per ILFI's exception, in LBC projects, plywood used for structural applications, such as sheathing, may contain added formaldehyde; plywood used for finished applications, it is imperative to prioritize FSC certified products in order to avoid contributing to deforestation.

DIVISION 07 00 00 THERMAL AND MOISTURE PROTECTION

DAMPPROOFING/WATERPROOFING

07 10 00 DAMPPROOFING + WATERPROOFING

Waterproofing membranes are often made of PVC. However, there are TPO, EPDM, and other sheet membrane products available in Declare. There are also multiple Red List Free fluid-applied products available with Declare labels and/or Health Product Declarations. Many of these options are likely to have minimal cost implications, but some may be more expensive than conventional PVC options.

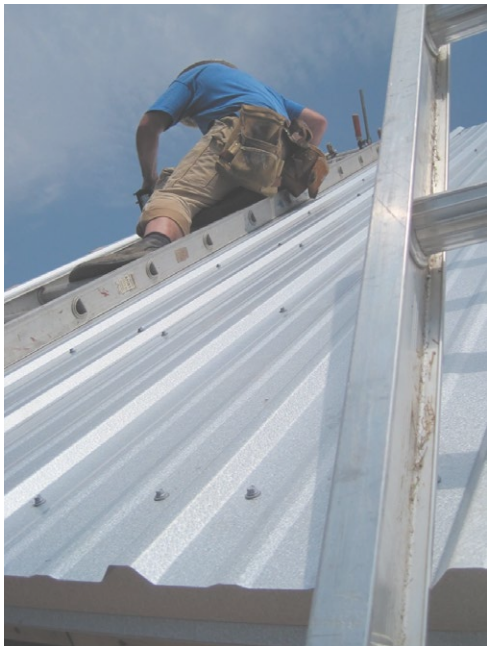
ROOFING AND SIDING

07 41 00 METAL ROOF PANELS

07 42 00 WALL PANELS AND RAINSCREENS

07 46 00 SIDING

07 50 00 MEMBRANE ROOFING



Roofing and siding products are considered, for the purposes of this guide, to be moderately difficult because a baseline of PVC-based products is still used by some affordable housing developers, which will likely be cheaper than Red List Free options. However, there are many Red List Free options and many affordable housing developers have specified these products, even in very low-budget projects Several Red List Free TPO and EPDM roofing

21 https://informed.healthybuilding.net/explore

membranes are available in Declare, including a Red List Free TPO roofing system from GAF. Red List Free TPO roofing is a commonly used building product that has been specified by many affordable housing project teams; however, single-ply PVC roofing membranes are still used and TPO is likely to cost more than these options (though TPO roofing is becoming more cost competitive to PVC and is more energy-efficient, recyclable at end of life, and durable). Note also that EPDM membranes may contain halogenated flame retardants;[22] project teams not pursuing the Living Building Challenge should consider requesting product ingredient disclosure from the manufacturer if you are using a product without a Declare label. Wood, metal, and cementitious siding products can also be found Red List Free and are generally good options to avoid Red List chemicals, particularly in vinyl siding, though there is less product disclosure available for many cementitious siding products (however, the Affordable Housing Materials List currently lists Red List Free products from Cembrit). Ensure that wood, metal, or cementitious siding products utilize Red List Free coatings or paint, or use a wood material that does not require a sealer and embrace the aesthetic of natural weathering. Cementitious products will also have a higher embodied carbon footprint so this should be carefully considered as well.

FIREPROOFING

07 81 00 APPLIED FIREPROOFING
07 81 23 INTUMESCENT FIREPROOFING
07 82 00 BOARD FIREPROOFING
07 84 13 PENETRATION FIRESTOPPING
07 84 46 FIRE-RESISTIVE JOINT SYSTEMS

Fireproofing products will often contain multiple Red List ingredients, including halogenated flame retardants, formaldehyde, and BPA. Interior Sprayed Fire-Resistive Material (SFRM), spray applied plaster coating, gypsum, cementitious, and intumescent coating products can all be found Red List Free and several products are available in Declare from multiple manufacturers.

DIVISION 08 00 00 OPENINGS

STOREFRONT

08 41 13 STOREFRONT

Aluminum storefront systems will often contain PVC connectors. Red List Free options can be found on the market and in Declare, but these may pose a moderate cost increase over other options.

22 https://healthybuilding.net/products/13-roofing

DIVISION 09 00 00 FINISHES

RESILIENT FLOORING

09 65 00 RESILIENT FLOORING 09 65 13 RESILIENT BASE + ACCESSORIES

In lieu of vinyl flooring, project teams should consider linoleum or other bio-based flooring in applications where vinyl is typically specified. Linoleum can usually meet the performance requirements of a project and often proves more durable than vinyl flooring. There are many of these types of resilient flooring products with Declare labels. Although these have historically not been as affordable as vinyl-based flooring, this is starting to change, with some project teams reporting that PVC-free resilient flooring can be cost-neutral. Additionally, note that vinyl flooring contains PVC, phthalates, and other Red List ingredients, and the manufacturing of petroleum-derived products, such as PVC, causes detrimental impacts on neighboring communities, which are most often low-income and/or BIPOC communities.[23] Some affordable housing project teams have found polished concrete flooring to be an affordable and low-maintenance option for flooring in some areas (but remember to choose Red List Free sealers to avoid PFAS). In addition, vinyl wall base also contains PVC and project teams should consider specifying rubber, tile, or wood base products.

DIVISION 12 00 00 FURNISHINGS

WINDOW TREATMENTS

12 20 00 WINDOW TREATMENT

Window treatments, particularly blinds, are often made of PVC and may also contain phthalates. Red List Free roller shade and aluminum blind options are available, several of which have Declare labels. However, they are likely to be somewhat more expensive, if the baseline product is PVC blinds. Project teams may also consider using smart glass options (at least one of which has a Declare label) that can help avoid using blinds.

CASEWORK

12 30 00 CASEWORK (SOMETIMES ALSO LISTED UNDER DIVISION 06 00 00 WOOD, PLASTICS, AND COMPOSITES)

Select solid wood components for casework wherever possible to avoid Red List ingredients associated with composite wood materials (especially formaldehyde, a known carcinogen and asthmagen). To avoid Red List ingredients, leave wood products unfinished or carefully vet any paints, sealers, or coatings; there are several Red List Free options on the Affordable Housing Materials List and in Declare. Project teams should also prioritize sourcing FSC certified wood

23 https://informed.healthybuilding.net/explore

products in order to avoid detrimental environmental effects associated with deforestation. Note that FSC certified casework products may be harder to source and/or may cost more, but this varies widely regionally. In some areas, FSC certified casework products have a minimal or no cost premium, but FSC framing products can be much more expensive than conventional alternatives and in some regions, the inverse is true (and in some regions, there is a minimal or no cost increase for either type of FSC wood).

COUNTERTOPS

12 36 00 COUNTERTOPS

Several Red List Free or Approved quartz and solid surface countertops are available in Declare, many of which are options that can be integrated into affordable housing budgets. Mineral or stone-based countertops do not need to be sealed after installation and avoid Red List ingredients that may be present in sealers. However, these may be somewhat more expensive than laminate countertop options, which are likely to contain PVC or formaldehyde. As mentioned, one project team installed concrete countertops as a creative way to avoid Red List chemicals. Note that sealers for concrete (and for countertops) often contain Red List ingredients, but you can find Red List Free options in Declare.

DIVISION 22 00 00 PLUMBING

PLUMBING FIXTURES

22 40 00 PLUMBING FIXTURES

There are many Red List Free plumbing fixtures listed in the Declare database, including water closets, urinals, lavatories, kitchen sinks, and faucets. Fixtures with Declare labels are typically high-performance and should help reduce water use in the building as well. Bathroom accessories such as towel and grab bars can also be found in Declare. Note that plumbing fixtures, especially those with a chrome finish, may contain hexavalent chromium (Chromium VI), a toxic heavy metal on the Red List due to its link to breathing problems and certain cancers.[24] Project teams should request product disclosures for all products or use products with Declare labels to avoid this. Additionally, note that, as of the date of this publication, Chromium VI will most likely not be avoidable in the plating on flush levers and commercial flush valves due to a lack of alternative materials available for this application (LBC project teams will follow the relevant Exception regarding this application in the Living Building Challenge Materials Petal Handbook). All project teams should also ensure that all plumbing fixtures meet the federal definition of “lead free,”as defined in S. 3874 (111th): Reduction of Lead in Drinking Water Act, effective January 1, 2014; however, most reputable manufacturers will

24 https://living-future.org/red-list/

meet this standard.

Affordable housing project teams have encountered difficulty finding bath and shower surrounds with an appropriate level of disclosure to determine whether they contain Red List ingredients. At this time it is not clear if acrylic or other bath and shower surrounds typically used in affordable housing buildings would contain Red List chemicals. Several project teams have used tile to avoid this issue; as mentioned above, there are many compliant ceramic tiles products.

PIPING

22 10 00 PLUMBING PIPING AND PUMPS

Some types of plumbing piping (such as sprinkler piping and sometimes domestic water systems) are commonly made with PVC or CPVC (which is in the same chemical class as PVC). Copper, PEX (crosslinked polyethylene), HPDE, steel, polypropylene, and cast iron are also common options, all of which will most likely not contain Red List chemicals; however, note that copper piping joined with solder may contain lead and should be avoided. There are several cast iron pipes with Declare labels. Several manufacturers have Declare labels for cast iron pipe products; however, cast iron pipes are likely to be more expensive than PVC piping.

4. Limited Options with Cost Implications

The Institute has consistently received feedback that the product types listed below tend to be challenging for affordable housing project teams. This does not mean that there are no options and it does not mean that affordable housing project teams cannot specify Red List Free products in the sections below. There are several options for all of these categories within Declare and listed on the Affordable Housing Materials List. However, some of these product types will typically be more expensive and sometimes significantly more expensive than baseline options. Some product types are not necessarily more expensive, but may have limited Red List Free options. The products in this level are prime for collective research and advocacy; by more teams participating in the effort to specify Red List Free products, more manufacturers will be pushed to create Red List Free products as well as provide transparency and pursue Declare labels.

It is helpful to ensure that the entire project team is a part of all sustainability goals, including healthy materials, from the beginning. Contractors could be recruited to help find acceptable products for this section, since many of them are likely to be more familiar with the performance and installation properties. They also may be invested in finding products that are also safer for them and their teams, since they are in direct contact with the products on a daily basis. Project teams can also creatively balance the budget to include Red List Free options that do have a cost increase. Teams in the past have reduced parking (that was not needed) and been selective about adding balconies only on sides of the building where they were likely to be utilized and not on units facing busy streets.

This level includes products in CSI Divisions 07 and 08.

DIVISION 07 00 00 THERMAL AND MOISTURE PROTECTION

ADHESIVES AND SEALANTS

07 90 00 ADHESIVES AND SEALANTS 09 30 13 MORTAR + GROUT

There are adhesives and sealants with Declare labels. Products without Declare labels are likely to include Red List chemicals (including phthalates and VOCs). As wet-applied products, these off-gas (release chemicals into the air) upon installation and impact the health of installers and residents. Project teams should prioritize using adhesives and sealants with Declare labels and try to minimize the use of these products overall throughout the building by relying on mechanical installation methods or products that do not require adhesives. For example, one manufacturer has a Red List Free tile product that requires no adhesives for installation.

Healthy Building Network's Informed tool provides guidance on which product types, including

sealants, are likely to be healthier options; in general, products ranked yellow and green are likely to be Red List Free products while products ranked red are likely to contain Red List ingredients. In addition, product types ranked yellow and green minimize the use of hazardous chemicals throughout the product's life cycle (manufacturing, installation, maintenance, and end of life), which disproportionately impact people of color, low-wealth populations, and children. Project teams can use this guidance to direct their research efforts toward products that are most likely to be Red List Free.

DIVISION 08 00 00 OPENINGS

DOORS

08 11 00 METAL DOORS
08 14 00 WOOD DOORS
08 33 00 OVERHEAD + COILING DOORS
08 70 00 DOOR HARDWARE

It can be difficult to find Red List Free doors suitable for use on multi-family residential projects. Doors are often made of composite wood and contain high levels of formaldehyde. Red List Free wood doors are available that have been specified on affordable housing projects by prioritizing them in the budget, but may carry a cost premium. As an alternative, metal doors can be found Red List Free; several manufacturers have Declare labels and these will often not have Red List ingredients. Overhead coiling doors can also likely be found Red List Free. Door hardware can be found Red List Free and there are multiple options in Declare.

WINDOWS

08 50 00 WINDOWS

There are more Red List Free windows available in Declare than in the past; however, PVC or uPVC windows are, unfortunately, likely to be the cheapest option available and tend to be ubiquitous in affordable housing projects. Note that uPVC does not contain plasticizers, but still includes other Red List chemicals in the manufacturing process. Some wood windows may contain engineered wood components with formaldehyde and may not fit into the budget for affordable housing projects. There are fiberglass and aluminum windows with Declare labels, but these are also likely to have a price premium compared to vinyl windows. However, some affordable housing project teams have been able to fit fiberglass windows into the budget by prioritizing it. Affordable housing project teams, particularly non-profits, should also consider reaching out to manufacturers of Red List Free options to request discounts.

5. Few Options/Request Transparency

This level includes product types where there are likely to be few, if any, Red List Free options available. Most of the products under these CSI sections are complex equipment and it can be challenging to find complete disclosures that include all components of the product. If a team is limited on research time, the products in this level should be a lower priority; for Living Building Challenge project teams these product types often use a General Red List Exception and/or are part of the 10% that is excluded from the Red List scope. As for all products, asking manufacturers for transparency is a crucial first step to impact change in these product categories. Many of the products in this level will have significant impacts on energy efficiency and water use and these concerns may be a primary driver for product selection.

This level includes products in CSI Divisions 14, 22, 23, and 26.

DIVISION 14 00 00 CONVEYING EQUIPMENT

14 20 00 ELEVATORS

There are limited options for Red List Free options, although one manufacturer does have two elevator cabins with Declare labels. Refer to the section on electrical equipment below for the Institute's approach to vetting electrical equipment.

DIVISION 22 00 00 PLUMBING

22 30 00 PLUMBING EQUIPMENT

Domestic hot water heaters are complex equipment as well and it may be difficult to find Red List Free options, due to the number of components that need to be disclosed. Many affordable housing project teams have reported that domestic hot water systems are one of the top uses of energy in the project so specifying efficient fixtures to reduce operational energy should be a focus. Note also that natural gas hot water heaters can be common in affordable housing (though prohibited by all ILFI building certifications), depending on the region, and specifying electrical equipment should be a goal both to decarbonize the built environment and to eliminate health hazards associated with gas equipment. A study completed by one affordable housing pilot project team found that substituting a CO2 heat pump hot water system reduced energy use associated with domestic hot water by 70%.

DIVISION 23 00 00 HEATING, VENTILATION, AND AIR CONDITIONING

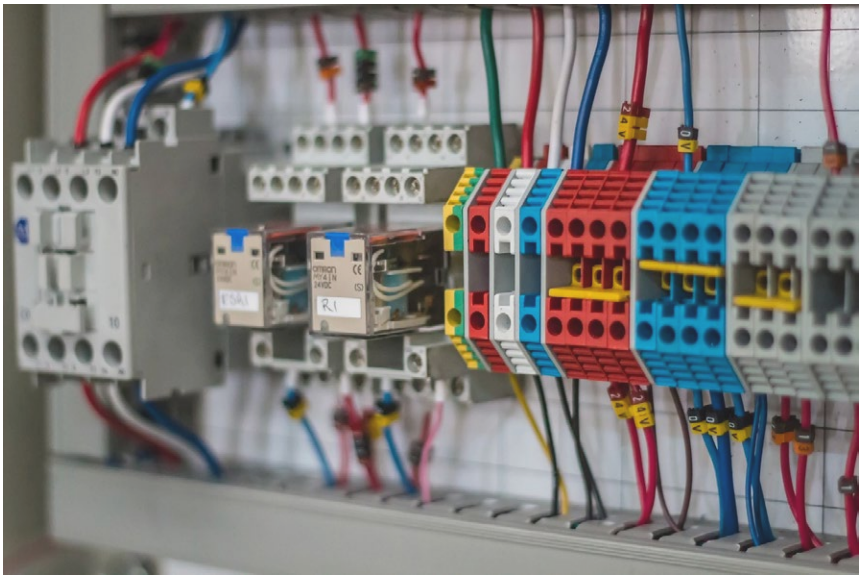
23 00 00 HEATING, VENTILATION, AND AIR CONDITIONING

Manufacturers of HVAC equipment often have difficulty providing transparency information due to the complex nature of their products and complicated supply chains. For Living Building Challenge projects teams, the Institute has an Exception that allows project teams to exclude small components that are less than 10%, by weight, of the product. This Exception was created to allow project teams to focus efforts and not become stymied by an inability to find documentation for every single minor component of each piece of equipment, which can be challenging. Project teams should request transparency for these products, but also balance the effort and time that is allotted to each individual product or CSI section.

DIVISION 26 00 00 ELECTRICAL

26 00 00 ELECTRICAL 26 50 00 LIGHTING FIXTURES 26 51 15 CEILING FANS

There are many Red List Free lighting fixtures available with Declare labels. Finding other Red List Free and Declare-labeled electrical fixtures and equipment can be challenging. For example, ILFI is not aware of any Red List Free ceiling fans, as of this publication. Living Building Challenge project teams will use an Exception for products with small electrical components. LBC teams look for products that comply with the regulations of the European Union's Restriction of the Use of Certain Hazardous Substances (RoHS) Directive 3, 2015, which establishes maximum concentration values for toxic chemicals tolerated by weight in homogeneous materials, as mapped out in the Materials Petal Handbook.



6. Eliminate

The products in the level below will always contain Red List chemicals because these chemicals are an integral part of the product, such as in the case of vinyl flooring. Eliminate these products from standard specifications and design them out of projects as much as possible. These products can be replaced with Red List Free products from categories 1-4.

This level includes products in CSI Divisions 07 and 09.

DIVISION 07 00 00 THERMAL AND MOISTURE PROTECTION

07 21 13 EXPANDED POLYSTYRENE (EPS) OR EXTRUDED POLYSTYRENE (XPS) INSULATION

07 21 19 FOAMED IN PLACE INSULATION

The products above will almost always contain halogenated flame retardants (HFRs), which are persistent bioaccumulative toxins that have multiple impacts on human health. The manufacturing of these product types, particularly foamed in place insulation, also tends to contribute to significant pollution over its life cycle.[25] The Living Building Challenge includes a limited Exception for LBC teams that allows for the use of HFRs in foam insulation, however, it is limited to very specific applications with limited space where no other product is acceptable. In most situations, project teams should strive to eliminate these products from their specifications and use an alternative insulation product (refer to the Affordable Housing Materials List for dozens of Red List Free insulation products!)

DIVISION 09 00 00 FINISHES

09 65 19 VINYL FLOORING

There are many better and Red List Free alternatives to vinyl flooring (including linoleum, which is unlikely to contain Red List chemicals). The Affordable Housing Materials List and Declare have dozens of options of Red List Free resilient flooring products. Though many affordable housing developers have stopped using vinyl flooring, it is still used widely.

ALL OTHER VINYL-BASED PRODUCTS

It is important to keep in mind that the production of vinyl chloride produces many negative environmental effects, which have been externalized by the industry, and are largely borne by disadvantaged frontline communities, as was witnessed in the February 2023 train derailment and chemical spill in East Palestine, Ohio. No vinyl is the best option.

25 https://healthybuilding.net/reports/24-chemical-and-environmental-justice-impacts-in-the-life-cycle-of-building-insulation

Getting Started: Setting Goals and General Guidance

A Path to Red List Free Materials for Affordable Housing

The market for Red List Free materials began to shift when project teams demanded that manufacturers provide transparency and also shift their product chemistry to exclude harmful chemicals. Declare now has grown to include thousands of products. With a concerted effort of manufacturers, project teams, and organizations like the International Living Future Institute, Healthy Building Network, Energy Efficiency for All, Toxic-Free Future, Green Science Policy Institute, Parsons Healthy Materials Lab, and others, industries have shifted in significant ways - for example, phthalates, which cause impacts on childhood and reproductive development, have mostly been eliminated in flooring products (though PVC, which contains several carcinogenic process chemicals, is still often present).

The previous chapter includes six levels of products: 1) Typically Red List Free, 2) Easy to Spec Red List Free, 3) Some Cost Implications, 4) Limited Options with Cost Implications, 5) Few Options/Request Transparency, and 6) Eliminate. To begin the journey to Red List Free affordable housing, ILFI suggests that each team set specific goals that includes most (if not all) products that can be easily integrated while pushing to research, implement, and advocate for at least a few products that are more of a reach. The six levels are not definitive and may change over time as both the Red List and the product market evolves. The delineations are not intended to dissuade project team members from attempting to find Red List Free products in the more challenging areas, but to have a realistic understanding of available options and to help funnel time and effort into products that are likely to have the most success and to encourage advocacy for the product types that have limited options.

Below are a few suggested goals that project teams could set to begin incorporating Red List Free products and creating healthier homes. Project teams should begin by taking inventory of where they are in the process of healthy materials. You can use the Affordable Housing Materials List to quickly review each CSI division and highlight products that are commonly specified. When you review the products in the standard specifications against this list, you may realize that you already use many Red List Free products, particularly from Levels 1 and 2. Project teams may be ready for different goals, depending on their starting point. Some project teams may want to begin with Step 1, while others may be ready for Step 5. Any of the goals below could be starting points; ILFI's Affordable Housing Project Teams in the past have chosen goals from each level (even completely Red List Free!) for their projects. Project teams should strive to build upon successes and pursue higher percentages of Red List Free materials with each project. Note, however, that the goals below do not have to necessarily be pursued in order. Project teams may find after pursuing Step 1 on an initial project that they can leapfrog to Step 4.

Pursuing one of the goals below will help project teams to start engaging with Red List Free products and view each project as an opportunity to eliminate as many Red List chemicals as possible, as well as a chance to advocate. The more teams that begin taking on specifying Red List Free products and asking manufacturers and other team members about them, the quicker the market will move and the easier it will be for everyone to build Red List Free Affordable Housing.

Example Steps to Red List Free

1. **Incorporate Red List free materials for all Level 1 and 2 products into every project.**
   This should be an easy step for most teams.

2. **All level 1 and 2 products are Red List Free/Approved +**
   Choose 5 individual products from level 3 or 4 to research and reserve in budget.
   Advocate to manufacturers of Level 5 products.

3. **All Level 1 and 2 products are Red List Free/Approved +**
   Choose 10 individual products from level 3 or 4 to research and reserve in budget.
   Advocate to manufacturers of Level 5 products.

4. **All Level 1 and 2 products are Red List Free/Approved +**
   Choose 2 CSI sections from level 3 or 4 to research and reserve in budget.
   Advocate to manufacturers of Level 5 products.

5. **All Level 1 and 2 products are Red List Free/Approved +**
   Choose 4 CSI sections from level 3 or 4 to research and reserve in budget.
   Advocate to manufacturers of Level 5 products.

6. **All interior finish materials are Red List Free/Approved.**

7. **All Level 1-4 products are Red List Free/Approved.**
   Advocate to manufacturers of Level 5 products.
   Eliminate all Level 6 products.

8. **90% of products are Red List Free/Approved. Where it is not possible to find Red List Free/Approved products, advocate to the manufacturer.**
   Note that this step is in line with the Living Building Challenge Materials Petal requirements for the Red List. (Living Building Challenge projects are subject to additional requirements regarding materials in the Materials, Health + Happiness, and Energy Petals.)

COLISEUM PLACE, OAKLAND, CA. IMAGE COURTESY OF DAVID BAKER ARCHITECTS.

Strategies for Integrating Healthy Materials

As you strive toward LBC certification or one of the goals above, remember that you are not alone in the pursuit of Red List Free products! Many LBC project teams have embarked on this quest and have useful lessons and strategies to pass along. The tips below can help assist you in being successful.

USE UNFINISHED, UNCOATED PRODUCTS

Products such as adhesives, sealants, and sealers often have Red List chemicals. If you can embrace a raw aesthetic or use materials that do not require additional coatings, you can avoid many of these chemicals. Many products, such as wood and concrete, are Red List Free, but introduce Red List chemicals when they are coated or treated. Some products may naturally weather over time in a way that does not affect durability. It is worth challenging assumptions about aesthetics to prioritize the health of occupants and communities.

INTEGRATE NATURAL PRODUCTS

Some affordable housing project teams, most notably the Living Homes at Mill Creek, have utilized many natural products, such as adobe floors and straw bale insulation, which helped them avoid Red List chemicals and build in a contextual, climate-appropriate way. Natural materials were used successfully by indigenous communities for hundreds of years and many have excellent performance attributes without introducing Red List chemicals into the space or supply chain.

AVOID PLASTIC AS MUCH AS POSSIBLE

Plastic-containing products very often contain PVC, phthalates, or other Red List chemicals. Prioritizing using wood, linoleum, stone, or other non-plastic materials wherever feasible will help to eliminate this issue. Plastics are petroleum-derived products and frequently contain chemicals that are linked to chronic health issues, whether they directly pose a risk to occupants or to someone else in the supply chain.[1] For more information on how the ubiquity of plastic products is undermining our collective attempts at decarbonization and externalizing costs to BIPOC and low-income communities, read this article by the Healthy Building Network.

STREAMLINE THE MATERIALS PALETTE

This is a best practice to avoid unnecessary embodied carbon and Red List chemicals. A minimalist aesthetic focuses research time on the needed materials and saves cost. Aside from finishes, eliminating wet-applied products such as adhesives in favor of mechanical installation methods reduces likely sources of Red List chemicals.

STRATEGICALLY REDUCE THE AMOUNT OF MATERIALS

Utilizing standardized floor plans, right-sizing wall dimensions to reduce drywall, and other Lean construction practices can reduce waste and significantly reduce materials costs, which can allow room in the budget for Red List Free or Approved products that may have a cost premium.[2]

THINK ABOUT THE PROJECT AND BUDGET HOLISTICALLY

Can other elements in the building be reduced or eliminated to facilitate incorporation of healthy materials? Could parking be reduced? Are there other building elements that are unnecessary or unlikely to be utilized? Consider the project priorities carefully and be creative if value engineering is necessary.

1 Reference: Landrigan PJ, Raps H, Cropper M, Bald C, Brunner M, Canonizado EM, et al. The Minderoo-Monaco Commission on Plastics and Human Health. Ann Glob Heal [Internet]. 2023 Mar 21;89(1):1–215. Available from: https://annalsofglobalhealth.org/articles/10.5334/aogh.4056/

2 https://www.walshconstruction.com/2022/06/exploring-a-different-path-to-more-better-housing/

FOCUS RESEARCH TIME ON PRODUCT TYPES MOST LIKELY TO HAVE RED LIST FREE OPTIONS

The guidance in Chapter 3 provides information on which products currently have the most Red List Free options. Rather than taking on the most difficult products first, it is advisable to start accumulating wins on as many products as possible and, especially if research time is limited, direct efforts where you are most likely to succeed. LBC project teams may also find it useful to begin research on the easier products first.

RECRUIT CONTRACTORS AND CONSTRUCTION TEAMS TO HELP

Contractors will be critical to the success of a healthy materials goal. Include LBC or healthy materials goals in your Request for Proposals (RFP) to ensure that you find partners that share your commitment. Contractors have deep knowledge about installation properties of products, such as adhesives and, as day-to-day users of the product, are most likely to be affected by health impacts. Integrated design processes and delineating a clear role and process for each member of the team is critical to success.

WORK WITH MANUFACTURERS AND THINK CREATIVELY

Affordable housing projects are typically built by mission-driven and non-profit developers. It is worth asking manufacturers if they can donate or reduce costs of materials in order to help your team create a healthier building in communities where it is greatly needed. Manufacturers may be able to brainstorm creative solutions to decrease the costs. For example, one manufacturer suggested aligning the production of their material to the factory's slow periods, in order to allow them to offer it at a lower price to an affordable housing project team - a win for both parties.

HUNTER'S VIEW PHASE III, SAN FRANCISCO, CA. RENDERING COURTESY OF DAVID BAKER ARCHITECTS

Conclusion

The International Living Future Institute envisions a future where the built environment is free of chemicals that have the potential to cause harm to those manufacturing the product, installers and construction workers, building occupants, and those that may dispose of a product at the end of its life. We especially envision this future for the low-income and BIPOC communities that have borne the brunt of some of our country's worst policies and environmental disasters. They have often been the frontline communities that have had to breathe hazards in the air and live with substandard building materials in their homes. They have often been the first ones to begin to experience the impacts of climate change. The health of underserved communities must be prioritized in our collective action for healthier spaces and avoiding harmful chemicals. The affordable housing project teams that ILFI has worked with over the past decade have begun to show that it is possible to begin eliminating Red List Free chemicals in affordable housing. It is time for the sector to join together to prioritize the health of residents and communities and to chart a Path to Red List Free Materials for Affordable Housing together.

Appendix A: Resources

- **ILFI Affordable Housing and Materials Resources:**
  - Affordable Housing Materials List: A downloaded spreadsheet of Red List Free products, by CSI division.
  - "Ask" Templates: Sample letters to send manufacturers to request disclosure of product ingredients.
  - Materials Case Studies: Three case studies of affordable housing project teams pursuing the Living Building Challenge, including a list of Red List Free products that were specified.
  - Building Product Selection Guidance: This guide provides an overview of the materials requirements in the Living Building Challenge (LBC) 4.0 Materials Petal compliance, as well as key strategies and tips.
  - Sample specifications: Template specifications for project teams to reference when including Red List requirements in their Construction Documents.
- **Declare:** Declare is a nutrition label for building products. Declare labels disclose all intentionally-added ingredients and residuals at or above 100 ppm (0.01%) present in the final product by weight.
- **Living Building Challenge Petal Handbooks:** The Petal Handbooks are available for free to all active Living Future members. The Petal Handbooks provide additional guidance and pathways for all seven petals, including the Materials Petal.
- **Parsons Healthy Materials Lab:** The Lab offers educational resources including online courses, practice guidance, and tools to select healthier materials for affordable housing. They have also created materials collections of common building products and low embodied carbon materials. The collections include information for all products that have Declare labels, HPD's, EPD's and other Material Health and Embodied Carbon related certifications and note any products that have been used in affordable housing.
- **Healthy Building Network's Informed:** Informed is a new, simple materials modeling tool created by Healthy Building Network to help project teams select safer building products. Informed uses a straightforward color-based system to rank product types based on their chemical impacts over their life cycle. This approach gives project teams visual cues that make it easier to avoid the most hazardous products (ranked red and orange) and select safer options (ranked yellow and green). In addition, Informed provides key guidance to help project teams understand and communicate the rationale behind their product choices. By avoiding product types ranked red, and choosing product types that are ranked yellow and green, project teams will typically select products that are free of Red List Chemicals. In addition to avoiding Red List chemicals in the product, product types ranked yellow

and green minimize the use of hazardous chemicals throughout the product's life cycle (manufacturing, installation, maintenance, and end of life), which disproportionately impact people of color, low-wealth populations, and children. Leveraging a materials modeling tool like Informed can help project teams identify chemical "hot spots" in their buildings, create benchmarks, set goals, and illustrate and communicate findings to other stakeholders. Data can be used to calculate the weight or volume of hazardous chemicals avoided in a space, a room, or even a portfolio of projects.

- **Health Product Declaration Collaborative:** HPDC includes a repository of freely accessible health product declarations that report on product contents and health information, including identifying Red List chemicals.
- **Grace Farms Design for Freedom Toolkit:** A comprehensive resource for design and construction professionals to implement ethical, forced-labor free materials sourcing strategies into their practices. The Toolkit is organized into three areas of focus: Education, Commitment, and Implementation.
- **Energy Efficiency for All's Healthy Affordable Building Materials Initiative:** This initiative provides information on specifying healthier materials for multi-family energy efficiency upgrade and retrofit programs, particularly related to insulation and air sealing materials. Detailed reports can be downloaded from the website to assist in choosing the most preferable and healthy materials in these categories.
- **Toxic Free Future:** Toxic Free Future's website includes research and investigative reports to bring environmental health issues to light.
- **Mindful Materials Common Materials Framework:** A database aggregating 100 most common product certifications (include Declare and the Living Building Challenge) with 650 sustainability factors in 5 broad buckets of health and sustainability.