

The Red List and Insulated Metal Panels

With the effects of climate change weighing on the minds of many designers, the building construction industry has introduced new ways of minimizing the ecological impact of development: optimizing heating and cooling systems, repurposing materials from old projects, specifying locally-sourced products. Furthermore, designers are becoming increasingly conscious of the impact building materials can have on the health of their occupants.

The term “Red List” can sound a little alarming – chemicals that are red listed have been found to be harmful to the human body and/or our ecosystems – but if a project specification requires products that are free of red list materials, how do we know what chemicals to avoid? There are numerous lists of hazardous chemicals, from company-specific lists like the [Perkins+Will Transparency](#) initiative, to non-profit sustainability programs like [Cradle To Cradle’s Banned Lists of Chemicals](#), to government initiatives like the state of California’s [Prop. 65](#) list.

Most of these lists overlap with each other, but the most commonly referenced list is the [Declare Red List](#). The Declare program was developed by the International Living Future Institute (ILFI) as the material transparency petal of the Living Building Challenge, which is widely regarded as one of the most rigorous sustainability rating programs for buildings. In addition to using healthy materials, the Living Building Challenge requires buildings to be both net positive energy and net positive water, or in other words, they must generate *more* resources than they consume.

The full Declare Red List contains over 800 unique chemicals, distinguished by CAS#, but they can be grouped into the following categories:

- Antimicrobials (marketed with a health claim)
- Alkylphenols and related compounds
- Asbestos compounds
- Bisphenol A (BPA) and structural analogues
- California-banned solvents
- Chlorinated polymers, including:
 - Chlorinated polyethylene (CPE)
 - Chlorinated polyvinyl chloride (CPVC)
 - Chloroprene (neoprene monomer)
 - Chlorosulfonated polyethylene (CSPE)
 - Polyvinylidene chloride (PVDC)
 - Polyvinyl chloride (PVC)
- Chlorobenzenes
- Chlorofluorocarbons (CFC) and hydrochlorofluorocarbons (HCFC)
- Formaldehyde (added)
- Monomeric, polymeric and organophosphate halogenated flame retardants (HFRs)
- Organotin Compounds
- Perfluorinated compounds (PFCs)

- Phthalates (orthophthalates)
- Polychlorinated biphenyls (PCBs)
- Polycyclic aromatic hydrocarbons (PAHs)
- Short-chain and medium-chain chlorinated paraffins
- Toxic heavy metals
 - Arsenic
 - Cadmium
 - Chromium
 - Lead (added)
 - Mercury
- Volatile organic compounds (VOC) (wet-applied products)
- Wood treatments containing creosote or pentachlorophenol

We will cover some of the substances commonly encountered in the metal panel industry: alkylphenols, halogenated flame retardants (HFRs), heavy metals, phthalates, and volatile organic compounds (VOCs).

Alkylphenols

Many of the chemicals found on the Red List are not exclusive to the buildings industry. Alkylphenols, for example, are added to architectural coatings and sealants, but they can also be found in cosmetics, plastics, and pesticides. Most alkylphenols are used as a surfactant to lower the surface tension of a liquid. This makes the liquid slipperier, and so alkylphenols are well suited for laundry detergent, dish soap, and other cleaning products, as well as oils and lubricants.

However, medical research shows that alkylphenols can be endocrine disruptors, meaning they interfere with the biological systems that rely on hormones like testosterone and estrogen. Alkylphenols' ability to imitate hormones can lead to issues with [fertility](#) and reproduction as well as [breast cancer](#).

Long-chain alkylphenols are especially harmful because they are classified as Persistent Bioaccumulative Toxicants (PBTs). PBTs are carcinogens, mutagens, and other toxic chemicals that are not easily broken down in the environment or in the body. Therefore, PBTs can travel up the food chain, building up to high concentrations once they reach the level of human consumption.

Halogenated Flame Retardants (HFRs)

In the periodic table of elements, the halogen gases include the elements fluorine, chlorine, bromine, iodine, and astatine, though Halogenated Flame Retardants (HFRs) are most commonly chlorinated or brominated compounds. HFRs are additives used for fire resistance in many urethane-based foams, like building insulation or upholstered furniture or mattress padding, as well as plastics and electronics, like computer casings and circuit boards.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
H																	He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba	La-Lu	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Fr	Ra	Ac-No															

Figure 1. Halogens Group in the Periodic Table (source: www.chem.ucla.edu)

Medical studies have shown that exposure to HFRs may negatively affect [neurological development](#), [thyroid hormone production](#), [the reproductive system](#), and [the immune system](#). Studies have also suggested possible [liver toxicity and carcinogenicity](#).

HFRs, like alkylphenols and other Red List chemicals, are also PBTs. For example, Polybrominated Diphenyl Ethers (PBDEs), widely used in computer plastics since the 1970s, have [been shown to linger in human tissue even after being banned in the U.S. in 2004](#).

Heavy Metals

The deleterious effects of heavy metals such as lead and mercury are well known, but the Red List adds two more metals: cadmium and chromium VI.

[Cadmium pigments](#) are commonly added to dyes and paints to produce vivid yellows, reds, and oranges – some of the world’s most famous artists have used cadmium in their works, including Claude Monet, Vincent van Gogh, and Edvard Munch, who used cadmium to produce *The Scream*.

For many people, the most common source of exposure is cigarettes. Long-term inhalation of cadmium, whether from tobacco smoke, fossil fuel emissions, or metal particulates from manufacturing processes, can cause significant lung damage. [Cadmium can lead to increased risks of cancer](#), and it can also contribute to bone fragility as well as kidney and liver damage.

In some forms, chromium can be relatively harmless – in fact, chromium III (trivalent chromium) is a [beneficial nutrient](#) that helps with sugar and fat metabolism.

However, chromium VI, also called hexavalent chromium or “hex chrome”, is highly toxic and [a known human carcinogen](#). You may recognize chromium VI from the [groundwater contamination lawsuit](#)

against utility company Pacific Gas & Electric, which was famously made into the Julia Roberts movie *Erin Brockovich*.

Despite being heavily regulated – Europe is in the [midst of phasing out](#) chromium VI altogether – chromium VI continues to be employed in a wide variety of industries, from leather tanning and textile dyeing to anticorrosion and chrome plating.

Chromium is also the main element that gives stainless steel its corrosion resistance. While chromium VI is added during the production of stainless steel, it is not in a hazardous form in the final stainless steel alloy since it is bound to the other metals; therefore, stainless steel is not a Red List concern. However, care should still be taken to properly ventilate fumes or particulates generated from welding or cutting stainless steel.

Chromium VI can also be used as part of the pretreatment process of coil-coated paint finishes; however, many paint suppliers now offer chromium-free processes, such as Sherwin-Williams' Fluropon Pure PVDF finish.

Phthalates

Phthalates are plasticizers that are added to rigid plastics to make them more pliable. The most common source of exposure to phthalates in building materials is polyvinyl chloride (PVC) – another red listed substance – which can be used for pipes, conduits, vinyl flooring, and vinyl-backed carpet. Phthalates are also found in paints, sealants, and wood varnish, as well as consumer goods such as food packaging, baby products, cosmetics, and wire and cable coatings like on power cords and earbuds.

In the metal panel industry, phthalates are added to some coil-coated paint finishes to help limit cracking of the coating during the roll-forming and bending processes.

Since there is such widespread use of phthalates and the term describes such a diverse variety of chemicals, research to determine the exact health impacts of phthalates is [continuously evolving](#). So far, phthalates have been linked to [infertility](#) and [pregnancy loss](#), [hormone imbalance](#), and [respiratory problems](#) like asthma and rhinitis.

Volatile Organic Compounds (VOCs)

Volatile Organic Compounds (VOCs) will sound familiar to those who have experience with LEED or other sustainable building programs. Current and past versions of LEED have a credit that rewards projects for using low-emitting materials.

Volatility is defined as the ability of a substance to vaporize, and so volatile organic compounds are a class of materials that emit vapor, or “off-gas”, at room temperature and pressure. Many of the compounds listed in other categories of the Red List are also VOCs or semi-VOCs.

VOCs can be found in a wide variety of building materials, including furniture, insulation, carpet, flooring, paints, sealants, adhesives, and PVC, and their [health impacts](#) range from carcinogenic to respiratory. Even daily exposure can lead to headaches and irritation.

Paints are a common source of VOCs. Most sustainability programs, including LEED and the Red List, only regulate paints that are applied on the project jobsite. CENTRIA metal panels typically use coil-coated material where the paint is applied to a coil of metal and then run through an oven to cure. Therefore, any harmful VOCs are baked off during the curing process and do not reach the jobsite.

The most widely referenced standards for VOC limits are published by the South Coast Air Quality Management District (SCAQMD). Older versions of LEED directly specified that products comply with SCAQMD's content limits, such as Rule 1113 for interior architectural finishes or Rule 1168 for adhesives and sealants; however, LEED v4 provides another option for the low-emitting materials credit by recognizing products that are tested in accordance with California Department of Public Health (CDPH) Standard Method v1.1-2010, also known as "Section 01350".

The intention of CDPH Standard Method is to more accurately determine the daily in-use emissions of finished, assembled products. Whole product samples are sealed in an airtight chamber, and emission levels are recorded after 11, 12, and 14 days. This test is especially useful for products that consist of multiple components, such as insulated metal panels.

The LEED low-emitting materials credit is particularly concerned with products that are used within the weather-resisting system to promote a healthy environmental quality for the users of the building. However, VOCs can also contribute to outdoor pollution, [like smog](#), and so it is in the best interest of manufacturers of cladding and other exterior components to determine the VOC content of their products.

The Future of IMP

CENTRIA is committed to developing the healthiest possible products. In the fall of 2017, CENTRIA introduced Halogen-free foam with the Formawall Dimension Series product line, eliminating harmful HFRs from the insulation formula. Combined with Fluorofinish Pure, a chromium- and phthalate-free architectural finish system, Formawall Dimension Series is one of the most sustainable IMPs on the market.

Pertinent Acronyms and Definitions

CDPH	California Department of Public Health	Publishes the Standard Method for VOC emissions testing
ILFI	International Living Future Institute	Oversees the Living Building Challenge and the Declare Program
IMP	Insulated Metal Panel	Exterior building cladding consisting of two metal liner sheets and an internal foam core
LEED	Leadership in Energy & Environmental Design	A points-based rating system for the sustainability of buildings. The most commonly recognized sustainability program for buildings
HFR	Halogenated Flame Retardant	Fire-resistive ingredient in foam and plastic that contains halogens, most commonly chlorine or bromine
PBT	Persistent Bioaccumulative Toxicant	Compounds that are not easily broken down in the environment or in the body and can build up in the food chain
SCAQMD	South Coast Air Quality Management District	Manages VOC content limits for interior architectural products
VOC	Volatile Organic Compound	Substance that emits harmful vapor at room temperature and pressure