

Chemical and Material Library (CML)

Full system description

August 15, 2010



Summary

In support of the Pharos building product assessment tools, HBN has developed the Chemical and Material Library (CML) to provide health hazard and other environmental impact information from the life cycle of chemicals and other materials that may be used as content in products assessed by Pharos. The CML is the first-of-its-kind database that checks a library of almost 10,000 chemicals, polymers, wood species and other materials against 26 authoritative chemical hazard lists and 4 endangered species lists that have been developed by state, national and international governmental agencies and other reputable, science-based non-governmental organizations.

Information that previously could only be obtained with hours of research requiring specialized knowledge or expertise is now available to anyone in a matter of seconds. The CML provides an unsurpassed level of transparency about health hazards of a wide range of chemicals and threatened status of tree and other plant species and provides a critical metric of comparison for green building professionals and product manufacturers. The CML is integrated with the Pharos product selection system but may also be used on a standalone basis to evaluate chemicals, woods and other materials in products outside of the Pharos building product database.

The Library identifies the following issues:

- **Direct health hazards:** Pharos screens chemicals and other materials by CAS number against authoritative hazard lists to identify health hazards they may present to humans or ecosystems directly exposed to the material.
- **Life cycle health hazards:** The Pharos team researches key materials to identify additional chemicals used, created and emitted throughout the material's life cycle. These chemicals are then also screened to identify potential health hazards to the workers and local communities near where the raw materials are mined or grown and then manufactured into products. Pharos staff conducts a preliminary literature review of life cycle chemicals for each ingredient of a Pharos listed product and more in-depth research on select common ingredients
- **Endangered species:** Pharos screens forestry products and other biobased materials against authoritative lists that identify trees and other timber plant species that are directly endangered or are frequently harvested from threatened forest habitats.

Because the many hazard lists in the database evaluate a wide range of hazards by a variety of criteria, the CML uses a color coded flag system to rank levels of concern. These flags offer an at-a-glance differentiation, for example, between suspected asthmagens and known carcinogens, and provide transparency as to how they are scored in the Pharos product assessment system.

The CML is a work-in-progress. Many of the approximately 80,000 chemicals in commerce have not yet been thoroughly tested and evaluated for their direct health impacts and much more research is needed to fully understand the impact of many materials and our research on the life cycle associations for each material is evolving. Nonetheless, with health effect information from 26 national and international health hazard lists and 4 endangered species lists covering nearly 10,000 materials and growing, the Chemical and Materials Library provides the most powerful tool available to help specifiers avoid identified potential hazards in materials in use and in their life cycle. We welcome your data submissions and suggestions.

Contents

Chemical Hazard

Hazard identification and hazard action lists	3
Hazard lists status	5
Pharos flags & health hazard levels of concern	7
Compound groups	10
Life cycle health hazards	11
Hazards that do not apply to the use phase	13

Endangered Species

Endangered species identification and lists	14
Species list status	15
Pharos flags & species warning levels of concern	16

Chemical Hazard

Hazard identification and hazard action lists

Contrary to popular belief, there is no comprehensive governmental testing program to assure that chemicals are “safe” before they are allowed on the market. The vast majority of chemicals have not been tested for human health impacts, and the process of identifying unacceptable chemical risks and restricting or banning its use is so arduous as to have almost never succeeded. For this reason, the Congress and Obama Administration have begun the process of comprehensively rewriting the governing law, the Toxics Substances Control Act (TSCA).

Despite this lack of a comprehensive program, scientists have used modeling, epidemiology, and human and animal testing to identify associations between thousands of chemicals, metals and other substances and significant hazards for the environment and for the health of humans exposed to them. These lists provide important early warnings of danger to human health and the environment, and also important market signals to green building professionals and product manufacturers who want to get ahead of the curve before the next chemical scandal makes news. Attention to these lists, for example, would have signaled mounting concern and evidence about a range of chemicals used in building materials, including flame retardants, stain repellents and vinyl softeners, long before the US EPA ultimately announced in December of 2009 that they would subject certain “Chemicals of Concern” to new regulatory scrutiny.*

There are two main types of lists in the CML: *hazard identification lists* and *hazard action lists*. A variety of state, national and international governmental bodies and non governmental organizations (NGOs) maintain *hazard identification lists*. These are lists of substances for which an authoritative body has reviewed the body of scientific evidence and categorized the substances as having an association with a specific health or environmental hazard. There are lists specific to persistent bioaccumulative toxicants (PBTs), carcinogens, mutagens, reproductive toxicants, and chemicals associated with other specific human health endpoints. This category of lists also includes lists specific to aquatic toxicants, ozone depletors, global warming gases and chemicals associated with other specific environmental impacts. Sometimes the lists will also categorize the strength of scientific evidence and certainty of the hazard.

In addition to lists that simply identify and categorize hazards based upon a specific health endpoint or environmental impact, there are also *hazard action lists* which are primarily policy tools for governments, non profits or companies. These generally take into account a range of endpoints and may be based upon a number of different hazard listings and other precautionary assessments of the scientific literature. An example of a governmental action list is the US EPA’s list of Chemicals of Concern referenced above for which they are developing action plans for voluntary and mandatory regulatory steps to reduce human exposures. An example of a non profit action list is the Red List of chemicals that must be excluded from Living Building Challenge projects.†

The CML makes this disparate information available in a user friendly format by:

- Compiling into one searchable database the most significant published hazard lists and
- Providing guidance for product screening to avoid the most hazardous substances based upon a prioritization of these lists.

The CML draws first from governmental hazard lists such as the US EPA’s lists of PBTs and the World Health Organization’s Cancer Monographs. It also draws from non governmental

* See Signal Blog “EPA’s “[Chemicals of Concern](#)” In Green Building Products” and CML [Chemicals of Concern](#) list for more on the EPA announcement.

† View the [Living Building Challenge Red List](#) in the Pharos CML for a full description of the list and how it is applied.

organizations' work such as Association of Occupational and Environmental Clinics list of asthmagens. As of the date of this publication, the CML scans 26 different lists. See the "Hazard lists status" section below for the complete list.

The CML provides information describing each of the included hazard lists, how it is categorized for level of concern within the Pharos scoring system, when the list was last updated and also provides links directly to the website of the issuer of the list.

The list will continue to grow as the Pharos team evaluates new lists for acceptance in to the Library. Currently under consideration are more lists of endocrine disruptors, plus lists of potential cardiovascular or blood toxicants, gastrointestinal/liver toxicants, immunotoxicants, skin or sense organ toxicants, corrosion or sensitization, acute human toxicants, acute and chronic aquatic and other ecotoxicants, immune system, eye and other organ toxicants.

The CML can be searched by name, synonyms or CAS number.^{*} A search for any material in the CML database will return a Chemical Profile, containing both direct and life cycle warnings. The Direct Hazard Warnings section of the Chemical Profile page indicates the name of each hazard list that identifies this material, any specific hazard warnings that the list uses to categorize the hazard and an associated Pharos hazard warning flag. See the section below on "Pharos flags & health hazard levels of concern" for explanation of the flag system.

Use in the Pharos product assessment system: Each product in the Pharos database has a Product Profile listing all of the known material contents for the product. For each material content, the Product Profile will include a flag in the materials column indicating the highest level of concern of all the hazard warnings associated with that material.

Absence of a hazard listing does *not* assure the safety of a material. Many of the approximately 80,000 chemicals in commerce have not yet been thoroughly tested and evaluated for their direct health impacts and much more research is needed to fully understand the impact of many materials.

Nonetheless, with health effect information from 26 state, national and international hazard lists covering over 9,000 materials and growing, the Chemical and Materials Library provides a powerful public tool to help specifiers avoid identified potential hazards in materials in use and in their life cycle.

^{*} CAS number – a unique identifier assigned by the Chemical Abstract Service of the American Chemical Society to uniquely identify chemical elements, compounds, polymers, and other materials and mixtures. Frequently used in Material Data Safety Data Sheets (MSDSes).

Hazard lists status

As of this publication, hazard warnings from the referenced authoritative lists are catalogued for all materials listed by the issuer with a CAS number or that Pharos staff has been able to associate with a CAS number. Some of the lists also include general compound groups, such as lead based compounds, in addition to specific chemicals by CAS number. HBN staff is in the process of populating compound groups to associate more of these related chemicals with these warnings. This is an ongoing process. See the section below on compound groups for more information.

As of 8/15/2010, there were over 9,000 chemical, polymer and other material substances in the library with health hazard warnings on over 4,000 of them. The following 26 lists are currently scanned:

1. **AOEC Asthmagens** - Association of Occupational and Environmental Clinics
2. **CAL-EPA Prop 65** (carcinogens, mutagens & reproductive toxicants)- State of California Environmental Protection Agency, Office of Environmental Health Hazard Assessment (OEHHA)
3. **Cascadia Living Building Red List** - Cascadia Region Green Building Council and International Living Building Institute
4. **ECHA REACH SVHC** (Substances of Very High Concern for authorization)- European Union - European Chemicals Agency
5. **European Commission Directive 76/769** CMR (Carcinogens, Mutagens, and Reproductive Toxicants) - European Commission, Enterprise and Industry DG
6. **European Commission Endocrine Disrupters Strategy** - European Commission, Council of the European Union DG ENV
7. **European Commission ESIS-PBT** (Persistent Bioaccumulative Toxicants) - European Commission - Joint Research Centre - Institute for Health & Consumer Protection
8. **European Commission Risk Phrases** - European Commission, Joint Research Centre, Institute for Health and Consumer Protection, Consumer Products Safety & Quality Unit
9. **European Commission EC Ozone depletion substances** - European Commission, Council of the European Union DG ENV
10. **IARC Cancer Monographs** - International Agency for Research on Cancer, World Health Organization
11. **Lancet Grandjean & Landrigan Neurotoxic Chemicals** - Lancet: authors Philippe Grandjean & Phil Landrigan
12. **OR DEQ Priority Persistent Pollutants** - State of Oregon Department of Environmental Quality - Water Quality Division
13. **OSPAR Priority PBTs & EDs** (Endocrine Disrupters)- OSPAR Commission
14. **UNEP Stockholm Convention POPs** (Persistent Organic Pollutants) - United Nations Environment Programme, Stockholm Convention Secretariat
15. **US EPA NCEA IRIS Carcinogens** - US Environmental Protection Agency, National Center for Environmental Assessment
16. **US EPA NWMP Priority Chemicals (PBTs)** - US Environmental Protection Agency, National Waste Minimization Program
17. **US EPA Ozone Program Ozone Depleting Substances** - US Environmental Protection Agency, Ozone Layer Depletion Program
18. **US EPA Ozone Program Global Warming Potentials** - US Environmental Protection Agency, Ozone Layer Depletion Program
19. **US EPA PPT Chemicals of Concern** - US Environmental Protection Agency, Pollution Prevention & Toxics, Existing Chemicals Program
20. **US EPA PPT Priority PBTs** (Persistent Bioaccumulative Toxicants) - US Environmental Protection Agency, Pollution Prevention & Toxics, Persistent Bioaccumulative and Toxic Chemical Program
21. **US EPA TRI PBTs** (Persistent Bioaccumulative Toxicants) - US Environmental Protection Agency, Toxics Release Inventory Program

22. **US EPA TTN HAPs** (Hazardous Air Pollutants) - US Environmental Protection Agency, Technology Transfer Network
23. **US NIH NTP Reproductive & Developmental Monographs** - US Dept of Health & Human Services, National Institutes of Health, National Institute of Environmental Health Sciences, National Toxicology Program (NTP), Center for the Evaluation of Risks to Human Reproduction
24. **US NIH NTP RoC** (Report on Carcinogens) - US Dept of Health & Human Services, National Institutes of Health, National Institute of Environmental Health Sciences, National Toxicology Program
25. **US OSHA Carcinogens** - US EPA & US Department of Labor, Occupational Safety and Health Administration
26. **Washington State PBTs** - State of Washington, Department of Ecology

Information describing each list, contact information for the issuer and its update status is available at <http://www.pharosproject.net/hazard>

Lists under consideration for addition to the database, include


- **CEPA Domestic Substances** - Environment Canada & Health Canada
- **CHE Toxicant and Disease Database** - Collaborative on Health and the Environment (CHE)
- **NIOSH Carcinogen** - US Centers for Disease Control, National Institute of Occupational Safety and Health, (US CDC-NIOSH)
- **Scorecard** – Green Media Toolshed

Pharos flags & health hazard levels of concern

As noted above, most hazard lists simply associate a chemical or class of chemicals with a specific endpoint. A small subset of governmental and private lists consider multiple endpoints and constitute a hazard action list – targeting the chemicals for priority substitution or regulation and in some cases, phase-out. Most of these are significantly limited by the scope, capacity and political realities of the agency. There is currently no single, comprehensive governmental list or database that categorizes the relative significance of all chemical hazards.

The Pharos CML categorizes the relative significance of all chemical identified in the hazard lists on a five level scale and identifies each substance in a hazard list with a Pharos hazard flag indicating this level of hazard. The flags are differentiated by a color scheme based upon HBN's categorization of significance of the hazard and the scientific confidence of the concern and HBN's recommendation of how that should inform substitution efforts. As the name implies, the Pharos hazard flag categorization is based on a hazard assessment. The Pharos hazard flag does not represent a characterization of level of exposure or a risk assessment. Rather this categorization reflects current trends in chemical *hazard* management policy work and specifically is informed by collaborative work that HBN has engaged in with Clean Production Action (CPA), members of Health Care Without Harm and the Business–NGO Working Group on chemical hazard analysis.


The colored flag system indicates the level of concern due to potential health or other environmental effects that have been associated with the substance and the level of confidence in the science studying those associations.

-  **Black - Urgent concern** – Material of urgent concern due to known persistence, bioaccumulation and toxicity (PBT) or extremely high global warming or ozone depletion potential. Avoid immediately.

PBT substances in this category do not break down rapidly in the environment to more benign substances therefore accumulate and concentrate as they work up the food chain. These chemicals are those classified as known to be one of the following:

- Persistent, Bioaccumulative and Toxic (PBT) or any two of the criteria in combination:
- very Persistent and very Bioaccumulative (vPvB)
- very Persistent and Toxic (vPT, or
- very Bioaccumulative and Toxic (vBT))

Global warming and ozone depletion gases in this category are of the highest potency - GWP greater than 10,000 or ODP greater than 0.2.

-  **Red - Very high concern** - Material of very high concern due to likelihood of priority health effects or very high global warming or ozone depletion potential. High priority to eliminate.

Substances in this category for their direct effect on human health have been classified as known or likely to lead to any of the following **priority health effects**:

- **Cancer** (carcinogens)
- **Genetic mutation** (mutagens)
- **Reproductive or developmental harm** (harms the reproductive system, interferes with reproduction or development of the fetus or young developing child – the above group of effects is sometimes referred to as “CMRs”) and

* See CPA's Green Screen for Safer Chemicals [www.cleanproduction.org/Greenscreen.php] and HBN and CPA's Chemicals of High Concern Red List of Lists [www.busngoworkgroup.org]

- **Endocrine disruption** (interferes with hormones and other endocrine functioning)


“Known or likely potential” of the effects are typically characterized on a hazard list with any of the following terms:

- “Known” (as in “Known carcinogen”)
- “Known to be” (as in “Known to be carcinogenic”)
- “Is”
- “Probable”
- “Likely”
- “Presumed”
- “Reasonably anticipated”
- “Strong” (strength of evidence in CHE list)

Substances are also placed in the red very high concern category if

- they have been identified through modeling activities, such as QSAR,^{*} or screening level testing, as likely PBTs but not yet confirmed by controlled testing, or
- have been identified as having significant PBT characteristics in scientific studies, but have not yet been listed by a governmental hazard listing organization.

Global warming and ozone depletion gases in this category are of very high potency - GWP greater than 1,000 and ozone depletion gases with ODP less than 0.2

-  **Orange - High concern** – Possible association with priority health effects or known potential for asthma or other respiratory problems or high ecotoxicity or high global warming potential. Next priority for substitution.

“Suspected association” with the priority health effects can be characterized on a hazard list with any of the following terms:

- “Possible”
- “Suggestive”
- “Suspected”
- “May cause”
- “Limited evidence”
- “Danger of”
- “Good ” (strength of evidence in CHE list)

Substances are also placed in the orange category if they are known or likely to lead to other chronic toxicity effects. Other chronic toxicity effects currently cataloged in the Library are:[†]

- **Asthma trigger** or other respiratory sensitization
- **Neurotoxicity**

Substances are placed in the orange category for

- highly acute toxicity or
- high ecotoxicity effects

This is characterized by:

- Risk phrases that start with “very toxic”

Substances are placed in the orange high concern category if:


- they have been identified through modeling activities, such as QSAR, or screening level testing, as likely associated with a priority health concern but not yet confirmed by controlled testing, or

^{*} QSAR which identify structural similarity between the targeted substance and other known toxicants

[†] This category will likely be expanded upon assessment of the Scorecard database and the Toxicant and Disease Database developed by the Collaborative on Health and the Environment (CHE)

- have been identified as having likely associations with a priority health concern in some scientific studies, but have not yet been listed by a governmental hazard listing organization.

Global warming gases in this category are of high potency - Global warming gases with GWP greater than 100.

-  **Yellow - Moderate concern** - Known acute health effects, known ecotoxicity, suspected other chronic (non priority) health effects, moderate global warming or ozone depletion or very preliminary data of possible association with priority health effects. Avoid when possible.

Substances are placed in the yellow moderate concern category if they are known to lead to acute health effects, are of known ecotoxicity or are suspected of association with other (non priority) chronic effects.

- Risk phrases that start with “toxic”

This category also includes substances about which sufficient concern about a potential priority health effect has been raised for them to be considered by at least one of the governmental hazard listing organizations, but the organization has not yet found adequate data to characterize the hazard. Substances in this category can be characterized on a hazard list with any of the following terms:


- “Unknown”
- “Not classifiable”

Substances are also categorized in the yellow moderate concern category if they have been listed by a governmental hazard listing organization for a priority health effect, but subsequently delisted due to a determination that evidence does not reach the threshold for listing, but which have not been clearly established to *not* be associated with the health effect.

If there are preliminary indications of concern for priority health endpoints but only from a small number of tests with too little data to confidently determine higher concern, such as substances on lists derived from a literature searches (like CHE) that characterize the data as:

- “Weak” or “Limited”

Global warming gases in this category are of moderate potency - global warming gases with GWP greater than 10.

-  **Green – Low concern** - Material studied and found not to cause the listed health impact. Not a guarantee for other health impacts. Watch for other flags.

This category identifies that the issuer of the hazard list has reviewed testing of the substance and determined that there is sufficient evidence that the substance does not cause the health impact listed. This judgment is limited to the health effect listed on the hazard list and does not in any way imply that the substance is ‘green’ or safe in regard to other health effects. There may be other health impacts associated with this material. For example a chemical may get a green flag on cancer, but a red flag on reproductive toxicity.

The Pharos flags characterize a relative hazard concern level based upon the manner in which the substance is listed on each hazard list. Presence is sufficient for flagging. Exposure pathways and risk assessment are not a factor. The flags imply no warranty of the overall safety of the substance.

Compound groups

Many materials are identified on hazard lists individually and referenced by their specific CAS Registry Number (often called just CAS number). An explanation of CAS numbers is located at www.pharosproject.net/wiki/index.php?title=CAS_number. Currently the CML provides complete listings of all chemicals listed directly by CAS number in the hazard list. In other cases, however a hazard list will identify a group of structurally similar compounds (such as lead compounds) as all having the same hazard. The Pharos staff is in the process of establishing compound groups of these similar compounds and associating warnings from the hazard lists and warning flags with them as well. Building these groups will be an ongoing process.

The Compound Group section of the Chemical Profile page indicates the name of any compound group that this material is a member of and any hazard warnings associated with that group

A set of double flags on the Product Profile page line for a material content indicates that the material is flagged with the hazard warning flag because of its membership in a flagged compound group.

Life cycle health hazards

The hazards from substances involve much more than the direct health hazards of exposure to the substance. Different chemicals are used, created and emitted at different stages of extraction, harvesting and manufacturing of a material. Some substances will degrade over time, emitting different chemicals and a host of new chemicals may be formed if the product burns accidentally in use or in an incinerator or landfill at the end of life. These chemicals may pose occupational safety hazards to those who work in the mines, agricultural fields and factories, incinerators or landfills along the life cycle or in the nearby communities.

HBN has begun to compile information on the chemicals involved in the life cycle of key materials used in products in the Pharos database. For each ingredient of a Pharos listed product, Pharos staff conducts a preliminary literature review of life cycle hazard associations to establish a representative assessment of the entire life cycle of the material. More in-depth research is conducted on select common ingredients.


Primary resources for this research are:

- the National Library of Medicine's Hazardous Substances Databank at: <http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB> and
- the NREL US Life-Cycle Inventory Database at <http://www.nrel.gov/lci/database/default.asp>

and a variety of other governmental and non governmental information sources. Each chemical record is a work-in-progress and does not necessarily represent all chemicals that may be used, created or emitted in the life cycle of a material. We welcome submissions and suggestions to improve our life cycle hazard data.

The life cycle information listed here is for generic versions of the material. In cases where there are multiple chemical synthesis pathways for manufacturing the material, the record may include information on multiple pathways and will indicate which chemicals are integral and hence used all the time and which ones represent options and will only be used in some instances. Manufacturers will have the option to improve scoring of a product by providing product specific life cycle information when they can document that their supply chain does not use certain chemicals of concern.

The CML expresses this information in the Life Cycle section of the Chemical Profile. Substances are identified for hazard by hazard lists as in the Direct Health Hazards, with the same Pharos health hazard prioritization and warning flags.

A colored circle on the Product Profile page line in the life cycle column  indicates the highest warning for the chemicals in the life cycle of the material

Chemical involvement in the life cycle is categorized broadly by:

- o Use in manufacture
- o Exposure in use
- o Exposure in degradation
- o Exposure in combustion

- o **Use in manufacture:** Manufacture can include any step from cradle to gate – that is from the initial extraction of the feedstock from the earth at a mine or well or from growing plants (cradle) through to the end of manufacture of the final material (factory gate). Chemicals are categorized as:
 - o **Feedstock:** Bulk raw materials constituting the principal input for an industrial process.
 - o **Monomer:** Molecules that bond chemically with other molecules to form a polymer, such as vinyl chloride monomers that are lined to form polyvinyl chloride

or glucose monomers that are linked to form such polymers as starch and cellulose.

- **Catalyst:** Substances, usually used in small amounts relative to the reactants, that modify and increase the rate of a reaction without being consumed.
- **Additive:** Chemicals that are added to provide specific characteristics to the final compounds, such as phthalate plasticizers or paraffin flame retardants.
- **Intermediate:** Chemicals that are formed from a preceding process that are further reacted in subsequent processes.
- **Byproduct:** Substances generated from production that are not useful to production of the target material and that are used in other processes or managed as waste or released into the work environment or released to the outdoor environment.
- **Contaminant:** Unintentional and unwanted substances mixed with the target material. They may originate from contaminants to the original feedstock or as byproducts of the chemical processes that are used to create the material.
- **Not in manufacturing**
- **Unknown**

They are also characterized as to whether there are known **emissions** of the chemical from any step of the manufacturing process from cradle to gate. Emissions include any release to air, water or land and any transfer from a facility, including to waste facilities.

All of these chemicals create potential exposure issues for the workers and to neighboring communities (if emitted). The feedstocks, intermediates and byproducts generally do not end up in products so are not an exposure concern for users. Monomers, catalysts and pollutants sometimes end up in products, usually in trace amounts. Additives of course are intended to end up in products in amounts that range from trace to very large percentages.

The frequency of role and of emissions is categorized for each of the chemicals:

Frequency role in manufacturing: a substance's use or creation in the manufacturing process is characterized by how common it is:

- **Integral:** A substance (such as a monomer) that is necessarily inherent to the manufacture of this material and without which it would be a different material or for which no alternatives have been demonstrated.
- **Frequent:** A substance that is commonly used - associated with at least one third of the manufacturing processes - but is a design option. Alternate production methods do not involve this substance.
- **Occasional/Rare:** A substance that is only infrequently used - less than one third of the manufacturing processes.
- **Unknown:** No known use in manufacturing or unclear.

Frequency of emission in manufacturing a substance's emission in the manufacturing process is characterized by how common it is:

- **Consistent:** A substance that shows up consistently in tests and emissions reporting and confirmed by at least two sources.
 - **Frequent:** A substance that shows up frequently but not consistently – e.g., in over one third of emissions tests and/or records if sequential annual data such as TRI reports are available. Confirmed by at least two sources/
 - **Occasional/Rare:** A substance that only infrequently appears in emissions test or reports - one third of the time or less in sequential annual reporting – or is reported only by a sole data source.
 - **Unknown:** No known evaluation of its emission or unclear.
- **Exposure in use:** The substance can be emitted from products with this material in their contents during use – hence is a potential exposure hazard for users. Options are:

- **Yes:** Testing finds consistently that such products do emit the substance
 - **Possible:** Testing finds that occasionally such products do emit or materials of similar structure (such as other members of a compound group) have been shown to emit this substance
 - **No:** Not found in any use testing to date and not known from similar products.
 - **Unknown:** No known evaluation of use exposure or unclear.
- **Exposure in degradation:** The substance is a degradation product of this material hence is a potential exposure hazard for users. *Protocols for this data point are still in development.* Options are
 - **Yes:** Testing finds consistently that the material does degrade into this substance
 - **Possible:** Testing finds that occasionally the material degrades into this substance or materials of similar structure have been shown to degrade into this substance.
 - **No:** Not found in any degradation testing to date and not known from similar materials.
 - **Unknown:** No known evaluation of use exposure or unclear.
 - **Exposure in combustion:** The substance is a combustion product of this material hence is a potential exposure hazard at end of life to workers in incinerators and landfills and communities near them. . *Protocols for this data point are still in development.* Options are:
 - **Yes:** Testing finds consistently that the material does release this substance during combustion.
 - **Possible:** Testing finds that occasionally the material release this substance during combustion or materials of similar structure have been shown to release this substance during combustion
 - **No:** Not found in any combustion testing to date and not known from similar materials.
 - **Unknown:** No known evaluation of exposure in combustion or unclear.

Note that carbon monoxide and carbon dioxide are ubiquitous combustion byproducts of any carbon containing material, and are not included in our combustion assessments.

Hazards that do not apply to the use phase

Pharos uses these warnings for scoring in the User Toxicity and Manufacturing Toxicity sections. See the online Framework descriptions in the Pharos tool for detail about how these hazards are scored.

Some hazard list warnings are not applicable to the health of building occupants and so are not included in the scoring for the User Toxicity category, only in the Manufacturing Toxicity category. These are:

- Aquatic toxicity
- Ozone depletion
- Global warming
- Occupational specific health hazards

Occupational specific hazards refers to health hazard assessments that are specific to a hazard from a particular form of the substance that generally only occurs in the conditions of the manufacture of the product. Sometimes the warning explicitly identifies this hazard as only associated with manufacture and not being applicable to the use phase of a product containing the substance. An example of this is the hazard warnings for airborne crystalline silica particles_of respirable size in the Prop 65 and IARC lists. These materials are likely only to be in this form (airborne and respirable size) during manufacture, not in use in final form in the building.

Endangered Species

Endangered species identification and lists

Use of biobased materials whether from agricultural plants or from trees is appealing due to their renewable nature. Overharvesting, plantation farming, chemical use and other problems, however, threaten many species of trees with extinction as well as threatening entire forest habitats and the animals and humans that depend upon them.

A variety of state, national and international governmental bodies and non governmental organizations (NGOs) maintain endangered species identification lists. These are lists of plant and animal species for which an authoritative body has reviewed assessments of the health and distribution of the species and pressures on their native environment to identify species that are threatened with extinction and then categorized the species to identify the level of threat.

Pharos screens forestry products and other biobased materials against these authoritative lists to identify trees and other timber plant species that are directly endangered or are frequently harvested from threatened forest habitats. Some warnings are for a specific species and others are for groups of species

Wood is often very ambiguously named. Scientific names (genus and species, where species are names for related plants within a larger species group) should provide a consistent way of identifying a specific type of plant, but botanists frequently do not agree on the scientific naming of a plant. Trade names can be even more ambiguous. The same common trade name may refer to many different related species of wood and sometimes even totally unrelated species from a different genus. The Pharos staff is working to identify the different synonyms and scientific names that may apply to commercially available woods and cross-indexing them in the CML tool.

The CML may be searched by common trade names and by scientific names (genus & species). Pharos then searches based upon the variations on the common name and different applicable genus and species combinations to provide a range of possible warnings that may apply to the named wood. These warnings are displayed with a Pharos hazard warning flag that indicates the relative level of concern of that warning. See the section below on "Pharos flags & species warning levels of concern" for explanation of the flag system.

Any wood species with an orange flag or higher should be avoided entirely unless its harvest was certified by a robust independent sustainable forestry certification system such as the FSC or better. Even yellow flagged species should be used with caution and avoided when possible due to possible threats to endangered species and destruction of critical forest habitats.

Absence of a warning listing does not assure that a species is free of threats.

Wood naming is ambiguous and subject to confusion. Synonyms are prolific for many species. Many species have not yet been adequately assessed and building of this database is an ongoing process. Nonetheless for those wood needs for which supplies of sustainably harvested timber certified by FSC or better, this Library is rapidly becoming the most comprehensive index of threat status for species of woods used in construction.

Species list status

As of 8/15/2010, there were almost 800 species of trees and other building related plants in the biobased portion of the Library with hazard warnings on the majority of them. The following 4 lists are scanned:

1. **UNEP WCMC CITES-listed Trees** - United Nations Environment Programme - World Conservation Monitoring Centre (WCMC)
2. **USDA Threatened & Endangered Trees Database** – US Department of Agriculture, Natural Resources Conservation Service
3. **WWF Tropical Wood Guide** - World Wildlife Federation
4. **Rainforest Relief Wood from Endangered Forests** - Rainforest Relief (Partially incorporated. Photographic Guide & Examples of Woods series of lists are included in their entirety. Tropical Woods to Avoid database is still in process)


Information describing each list, contact information for the issuer and its update status is available at <http://www.pharosproject.net/hazard>


Lists under development for addition to the database, include


- o **FOE Good Wood Guide** – Friends of the Earth
- o **IUCN Red List of Threatened Species** - International Union for Conservation of Nature and Natural Resources, Species Survival Commission


Pharos flags & species warning levels of concern

Species warnings are marked with flags that are color coded to indicate the Pharos system's prioritization of concern based upon the degree of the threat to the species. One of the most widely accepted criteria sets for rating the threat to endangered species is the IUCN Red List Categories and Criteria prepared by the Species Survival Commission of the IUCN (International Union for Conservation of Nature and Natural Resources).^{*} Pharos structures its prioritization of the relative significance of threats based upon the IUCN categories.

 Black – Extinct (EX) or Critically Endangered (CE) - species is extinct or facing an extremely high risk of extinction. Species that have been listed as extirpated in one or more US states (that is are locally extinct but may still be extant in other locations) are also included in this category.

 Red – Endangered (EN) - species is facing a facing a very high risk of extinction. Pharos also places most endangered species warnings from organizations that do not use the IUCN classification system into this category. This also includes species that are endangered in one of more states, even if they may be abundant in other locations.

 Orange – Vulnerable (VU) - species is facing a high risk of extinction. Frequently referred to as Threatened.

 Yellow – Near Threatened (NT) - species is not yet considered vulnerable or endangered, but is close to qualifying for or is likely to qualify for a threatened category in the near future. Species not yet evaluated (NE) are included here. Data deficient species (DD) are also included in this category where more information is required and the possibility that future research will show that threatened classification is appropriate

 Green – Least Concern (LC) – species is still widespread and abundant

^{*} <http://www.iucnredlist.org>