Identification and Analysis of Product/Chemicals Exchange Information within the Building Product Sector

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Executive Summary

This research is in reference to the current phase of CiP work for the undertaking of case studies on selected product sectors to provide a clear picture of the status of chemicals information exchange within each sector. In order for stakeholders to best manage risks from chemicals in products, there must first be clear knowledge of information availability and flows: who maintains what type of data? Which stakeholder communities need information based on that data? How is information shared? Does information get shared in a timely matter? This case study relates to answering such questions for a sector highly prioritized by SAICM stakeholders--building materials.

The 2009 survey of SAICM stakeholders to gauge interest for CiP product sector priorities identified construction and building materials as a highly ranked priority sector, with 37% of survey respondents ranking the category as a "top 4" priority.[i] Construction and building materials are an important priority sector for a number of reasons, including the fact that building materials are estimated to account for as much as 40% of global energy and materials use and 33% of carbon dioxide emissions.[ii] This volume of materials use, combined with the rapid expansion of the green building industry, argues for a critical need for availability of information about the potential life-cycle impacts of building materials.

Many regulatory and voluntary initiatives are driving greater information provision and exchange and are cited and discussed as part of this study. These include regulations such as the European Construction Products Directive (Council Directive 89/106/EEC) and the "REACH" Regulation on the Registration, Evaluation, Authorisation and Restriction of Chemicals (EC No. 1907/2006), voluntary, market-driven certification and standards programs such as the Building Research Establishment Environmental Assessment Method (BREEAM), the Leadership in Energy and Environmental Design (LEED) system, and the Comprehensive Assessment System for Building Energy Efficiency (CASBEE). In addition, public databases developed by government and environmental organizations, such as BASTA and Pharos, are helping to make information about chemicals in products more available. However, there are still information gaps and needs going unfilled.

This case study focuses on an assessment of how information on chemicals within the construction and building materials sector are presently provided, transferred, tracked and accessed by different stakeholders within the life-cycle supply chain. In addition, insights are provided about additional information requirements and gaps to be addressed to better meet the needs of stakeholders in both developed and developing countries.

Survey Findings

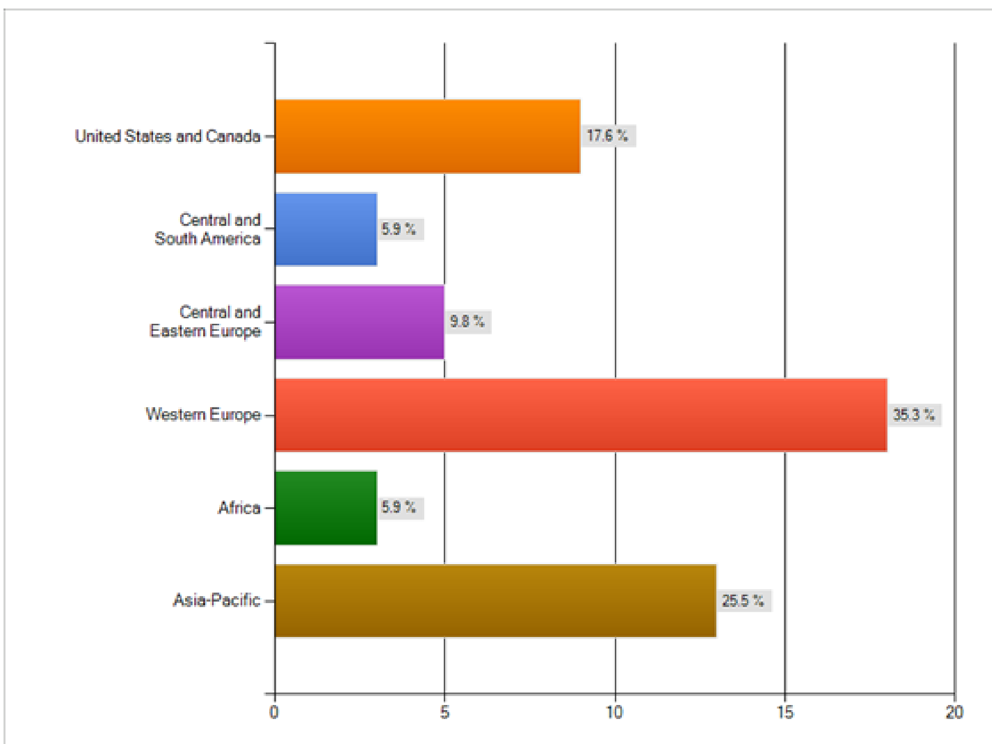
As a key research component, an electronic survey was developed and distributed in mid-November, 2010. The survey was distributed to SAICM stakeholders, building and construction industry representatives, architects, deconstruction and demolition industry representatives,

and applicable non-governmental organizations. In addition to the electronic survey, corresponding phone interviews were conducted with numerous stakeholders. The intended purpose of this process was to:

1) identify additional information systems being developed in regions and/or individual countries that may not have been identified through the literature search;
2) gain data and expert opinion on existing strengths, problems and gaps related to the flow of information related to building materials; and
3) identify obstacles encountered by different stakeholders throughout the production chain and product life-cycle in providing and accessing required information.

Fifty-two survey responses were received, with responses from all geographic regions (see Figure 1). Of those, thirty-five surveys were from developed countries and sixteen were from developing countries; there was one non-response.[iii]

Figure 1: Geographic Distribution of Survey Responses



Summary of responses:

- There was excellent distribution of responses across stakeholder sectors, representing manufacturing and production, architecture and design, building and construction, demolition and recycling, trade associations, government and regulatory, non-governmental and non-profit, and academia and education.

- Approximately 68% of respondents report seeking/using information about chemicals in building materials to identify materials meeting regulatory standards set for their region or industry sector.
- Products ranked highest in terms of priority for chemicals information include interior finishing (including paints), flooring, structural materials (including wood, metal and concrete), insulation, and material feedstocks/raw ingredients for material production.
- In rating the trustworthiness of information sources, 43% of respondents ranked government/regulatory data sources as most trustworthy and unbiased, and 49% ranked industry/trade sources as biased, but accurate.
- Respondents rank a "high" or "very high" priority for additional information about chemicals in building products, specifically related to "scientific data on the health impacts of materials and chemicals" and "chemical and material content of products."
- 38% of respondents report being able to find information about chemicals in specific building products when they need it. However, more than half of those respondents (54.5%) say that the information found is inadequate, and generally not specific enough.
- When asked for research priorities for chemical information across different life-stages of a building, the highest priorities are for use (occupation, performance), product/material manufacturing, and end-of-life (demolition, reuse, recycling).
- 77% of respondents do not feel that existing information systems provide balanced chemical information across the life-cycle stages of the product, largely because they feel that pertinent data does not exist.

Stakeholder Use of CiP Information: Needs and Constraints

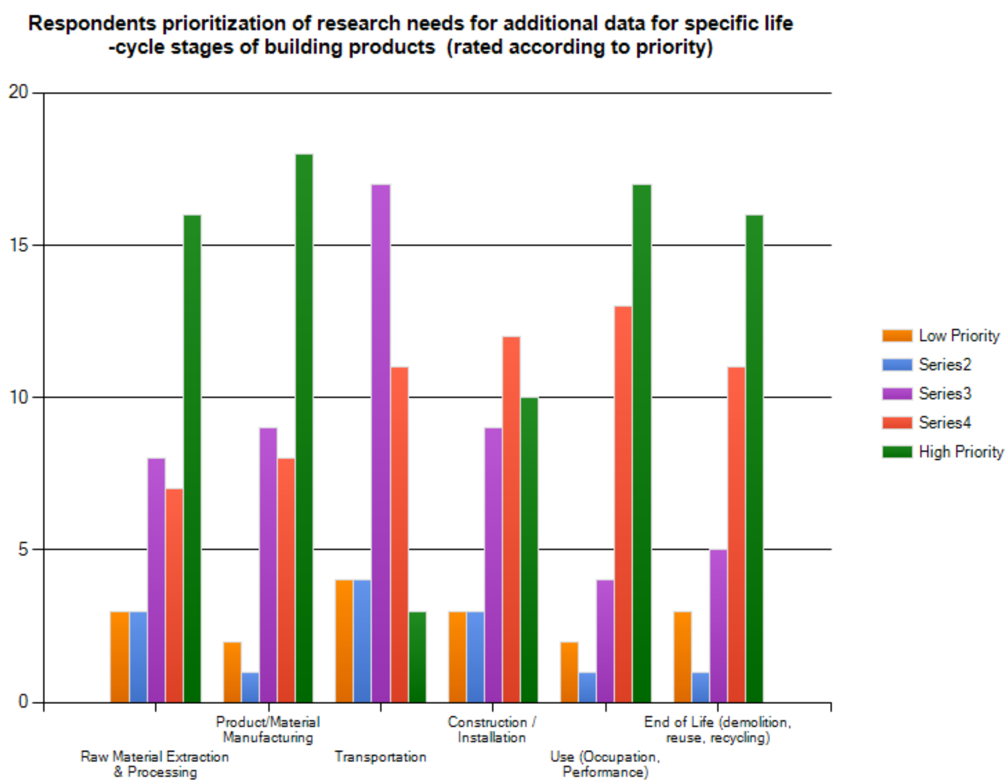
In survey results, 72% of survey respondents reported regularly seeking information about chemicals in building and construction materials, with another 24% of respondents saying that, while they do not currently seek such information, they plan to do so in the future. Key reasons for seeking such information across the survey group included risk reduction for the protection of workers, policy development, risk reduction for the protection of occupants, and public or consumer advocacy and protection.

In terms of the formats in which respondents commonly seek information, there were a few notable findings. While the most routinely sought sources of information were predictably from web-based systems (78.6%), this was closely followed by use of MSDSs (71.4%). The widespread use of MSDSs as a source of information, given their limitations, points to a need for better communication about what should be expected from such a report. In addition, information from manufacturers and trade associations (reports, product statements, marketing material, etc.) is often used as a key source of information (69%).

In responses related to seeking CiP information for specific products, 62% of survey respondents stated that they do not find information when they need it. Further, for those that do find pertinent information, more than half report that the information found is inadequate, largely because it is not specific enough.

Respondents were also queried about their needs for chemical information across the product life-cycle. When asked whether respondents felt existing information systems provided balanced data across the life-cycle of most building and construction products, 77% of respondents said they do not currently provide balanced data. However, 50% of those respondents felt it was because the data for such information does not yet exist. When asked which life-cycle stages should be prioritized for future research to yield chemical-related information about building products, the highest rated lifecycle stages were the use phase (occupation and performance), product and material manufacturing, and end-of-life (demolition, reuse and recycling) (see Figure 2).

Figure 2:



In addition, there were several common concerns that were echoed across respondents in multiple stakeholder categories. The most common concerns included:

- Limited global regulation of CiP or chemicals of concern: several survey respondents referenced hopes that the requirements of REACH will make chemical information more available, and that the resulting information will trickle down for those seeking product information anywhere in the world.

- MSDSs, which are broadly relied upon as a source of information, often include proprietary or trademarked names for substances. As MSDSs are one of the most routinely found and used sources of information, these potential gaps in information make reliance upon them problematic.
- For those who seek and need information about chemicals in building products, an oft-cited issue was that substantive information takes too long to gather. Information must often be gathered from multiple sources and lists, requiring an assessment of varying data quality. Respondents report that trying to identify solid data is time consuming and difficult.
- Several comments reflected a concern that existing data, often designed for markets in the North America and Europe, do not adequately reflect chemical and material issues for extremely humid or hot climates such as higher formaldehyde and VOC emissions that occur in hot climates.
- Data for the long-term reuse, recycling, and disposal implications for materials are often absent.

Potential ways to address the gaps and obstacles

Research results for this case study have identified significant background information on the types of existing CiP material available, as well as the use and perceived limitations of such information by those stakeholders seeking it. There are a variety of sources, of varying quality, that are commonly used, including eco-labels, reference lists of materials for green building certifications and standards, industry reporting initiatives, and so on. Existing resources such as BASTA in Sweden, NaturPlus, and the Pharos initiative were commonly cited as useful resources. However, in most cases, stakeholders find existing resources either inadequate for their needs or too time-consuming to use efficiently for their needs.

Many stakeholders stated a hope that pending regulatory systems or enhanced public databases would address some of these gaps. For example, many stakeholders referenced the intended information from REACH as a potential source which will reduce the time commitments for identifying pertinent chemical information about chemicals in building products. The recent ISO declaration, ISO 21930:2007, for “Sustainability in building construction – Environmental declaration of building products” establishes a methodology to ensure a transparent methodology for developing environmental product declarations for building products which will provide better consistency in EPDs. Similarly, stakeholders referenced the potential of information exchange from the European Construction Products Directive, as more harmonized product standards are developed.

In addition, numerous obstacles were cited in the exchange of chemical information in building products. Examples of reported obstacles, as discussed previously, include:

- Perceived lack of data and lack of data that is specific enough;
- Available information is more germane to European and North American countries;
- Time-consuming nature of finding CiP information, particularly amidst shifting regulatory requirements at local and regional levels;
- Time-consuming nature of cross-referencing performance data with CiP data;
- Potential gaps in data from existing chemical reporting mechanisms, such as MSDSs; and
- Poor CiP information for end-of-life disposition of materials.

As with many product categories, there was a perception that manufacturers of products are reticent to share chemical information. While this may sometimes be the case, especially with factors such as trademarked or proprietary substances, it was also noted by several manufacturers that sometimes they struggle to get adequate information on substances from their suppliers (this was especially a concern noted with recycled feedstocks). This admission indicates a potential willingness of manufacturers to provide more information to the market.

Stakeholders across all categories stated a belief that part of the problem with provision of chemicals information for building materials is that the information simply has not been collected or is not available.

Ultimately, the question of how to best facilitate the exchange of chemicals information in building products is quite germane. Stakeholders across all stakeholder categories reported limitations and perceptions of inadequate or non-existent information exchange. While existing systems are a laudable starting point, a number of opportunities and suggested collaborations have been identified for potential improvements.

Leverage the Role of Green Building Standards & Certification Programs

Given the growth in green building certifications and standards, as well as the growing network of regionally- and country-specific green building councils, an opportunity exists to leverage these as information exchange resources. Green building standards are continuously in the process of developing future versions with updated requirements, and can serve in a powerful supply-and-demand position. Many prominent green building standards have fairly open and transparent standard development processes; the managing organizations of such programs would likely be receptive to partnering to discuss enhanced CiP needs for the building product sector.

There are many types of needed CiP information identified through this case study that could be prioritized for inclusion in future versions of standards. An example includes requirements to maintain long-term CiP information for specific products within the reporting and maintenance requirements for building certification; this would mitigate EOL information needs when buildings are refurbished or materials are reused.

Another opportunity exists with the expansion of green building councils in various geographic regions; regionally-specific criteria can be defined that address unique materials and climate needs. Currently there are more than 70 national member councils under the World Green Building Council (WGBC); these councils are in various stages of membership. However, these organizations are an active and growing driver for green building information, including CiP information. In a recent survey conducted by the green building industry publication *Green Business Insider,* 47 WGBC councils were surveyed about the status and expectations for the green building industry in their countries; the survey shows expectations of 100 percent growth in council membership and at least a doubling of certified green buildings in the next five years.[iv]

Promote Standardized Reporting of Environmental Data

A common frustration amongst stakeholders was lack of knowledge about differing reporting requirements across various regulatory platforms. One option for future discussion is identifying opportunities to better standardize reporting of environmental data. An example of one such "success story" would be the expanding use of the Globally Harmonized System of Classification and Labeling of Chemicals, or GHS; the GHS is now being cited in developing standards for products such as paints and cleaning chemicals.

Further, there may be opportunities for better outreach to stakeholders about what type of information they should and should not expect from certain reports. It may be useful to develop a common resource, akin to a "frequently asked questions" reference for the broad community of stakeholders to access as they determine whether a resource such as an MSDS, product declaration, or life-cycle study serves their information needs.

Support development of additional life-cycle research

While much life-cycle research has been done, an obstacle noted in this case study is the real and perceived lack of balanced life-cycle data for many building products. This was cited by many survey respondents as a need behind their belief that much of the scientific data for CiP information for this sector "does not exist." An option for potential discussion might include identification of priority materials and building materials for which no life-cycle data has been developed. An important issue to consider for this recommendation would be the time and resource requirements of rigorous collection of life cycle data; this constraint would suggest a need to select key subsets of the building products sector for prioritization of data collection. Yet another opportunity may exist to commission a study of emerging or newer technologies, such as nanomaterials or antimicrobials, which are increasingly being used in multiple product sectors.

Another item for discussion would be to potentially provide a central funding mechanism to support broad reporting of information collected for other studies. In many circumstances, academics doing LCAs for specific projects have collected large quantities of data from the industry or market sector of interest for a particular project. Much of this data is not passed into publicly-available databases. This is often not due to confidentiality requirements, but rather is due to a lack of resources to organize the data into a publicly-useful format once the original project has been completed. A central funding mechanism could efficiently use relatively modest resources to provide grants to "mine" and refine these sources of valuable data.

Provide ways for architects, designers, and specifiers to cross-reference performance and application data with CiP information

When selecting a building material appropriate for specific applications, architects, designers, and specifiers must take into account myriad aspects of a material's physical, chemical, and aesthetic properties. Materials must be selected to serve specific functional and aesthetic requirements while meeting health and environmental standards. This selection process requires constant cross-referencing of different types of data. Existing information sources do not adequately address the needs of this design process in a central manner. For example, a designer might be searching for formaldehyde free insulation. While existing sources may provide a list of formaldehyde-free insulation materials, a designer will typically still need to explore each product to determine its specific performance qualities including r-value per unit thickness, type of facing used, whether it acts as a vapor barrier, air barrier, or moisture barrier. These specific performance qualities are not addressed through broad categories of organization (i.e. "insulation") often seen with CiP data sources.

Conclusions

This case study has established that useful information systems are on the increase for CiP information in building materials, yet there is a significant unfulfilled need for information. The need is global and spans stakeholder groups. But there are unique challenges faced by economies in transition and southern hemisphere countries, which are presently forced to rely on predominantly European and North American information resources, which often have limited applicability to both available products and regional climate pressures.

In addition to follow-up discussions about some of the recommended opportunities for bridging gaps in information sources and flows, there are also future research opportunities that may have value. While the analysis of broad product sectors is quite illuminating, a sector such as building materials is almost too large to identify a "one size fits all" solution to information provision. It would be useful to conduct a study of a focused subset of building materials with specific chemical information needs and outcomes, for example chemical information related to interior finishes, which can have significant indoor air quality implications. By conducting a study with a more constrained product scope, it might be possible to develop working relationships with key stakeholders in the product chain, and identify and test different methods for sharing information. Such a study would inform the creation of mechanisms for information sharing between stakeholders that could be modeled and replicated across products and product sectors.

Finally, the confluence of traditional drivers such as mandated regulatory reporting requirements and more recent voluntary certification and standards programs creates a timely opportunity for greater discussion and partnerships for provision of CiP information for building materials. In the past, the provision of CiP information in the building materials industry has been more of a struggle on the demand side, with government, NGOs and consumers desiring information and feeling the need to create it themselves. However, increasingly, manufacturers of building products want to provide more information to the market, in order to be a player in the growing green building industry. This suggests a brighter future for chemical disclosure if the market pressure of certifications and public policy can be efficiently harnessed.

Notes

[i] Becker, M. (2009). *Survey of SAICM Focal Points on the Need for Information on Chemicals in Products*, prepared for the UNEP Chemicals Branch. December.

[ii] U.S. Green Building Council. *Green Building Facts.* Retrieved from www.usgbc.org/ShowFile.aspx?DocumentID=5961.

[iii] Designations of "developed" and "developing" countries were based upon the United Nations Statistics Division's "Composition of macro geographical (continental) regions, geographical sub-regions, and selected economic and other groupings (revised 16 December 2010)." Retrieved from http://unstats.un.org/unsd/methods/m49/m49regin.htm.

[iv] Green Building Insider (2010). "GBI Survey: Councils Expect Huge Increases in Green Building Certifications." *Green Building Insider.* Accessed at http://www.greenbuildinginsider.com/articles/20101

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I. Introduction

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II. Methodology for the Study

This study was carried out across multiple research tasks. Tasks included:

- Defining the scope of the product sector.
- An extensive search of existing and planned information systems and resources related to building materials.
- A written survey and selected interviews of SAICM stakeholders, building and construction industry representatives, architects, deconstruction and demolition industry representatives, and applicable non-governmental organizations.
- Analysis of identified information systems, including an assessment of major information gaps that may exist, lapses or inadequacies in the provision or availability of information to stakeholders, and suggestions for possible solutions to identified gaps and obstacles.

A brief description of each research task follows.

2.1 Definition of "Building and Construction Materials"

An initial priority for this case study was the identification of an appropriate definition of the product sector. Building materials comprise a tremendously broad product sector, potentially encompassing almost all materials and chemicals imaginable. In order to efficiently accomplish the desired scope of work in a relatively brief time frame, we sought to clearly articulate what to include in the product sector definition. Our definition statement is as follows:

> A broad definition of building material includes any material from which a structure or building is made and encompasses any number of materials both building specific and improvised. This definition includes any number of materials ranging from industrial products such as glass and steel to natural materials as simple as straw to salvaged items such as cardboard and tin cans. The type of materials used in buildings varies widely based on regional and economic considerations.
>
> For the purpose of this study, building materials are considered as existing within the realm of consumer products, including but not limited to products manufactured or processed with the intended or common end use as a component of a building or structure. This study limits consideration to building components which can be reasonably considered as permanent components of buildings including fixed elements such as framing, sheathing, and decking and excluding non-fixed elements such as drapery and furnishings.
>
> In keeping with the intent of the "Survey of SAICM Focal Points on the Need for Information on Chemicals in Products" prepared for the UNEP Chemicals Branch by Monica Becker, paints, sealants, and adhesives sold as such are excluded from the study as they fall within the realm of the Globally Harmonized System of Classification and

Labeling of Chemicals (GHS). Paints, sealants, and adhesives used to manufacture building materials such as laminates and composite wood products are considered to be within the range of study.

It is beyond the scope of this study to consider building materials which are extracted and used locally in raw form and with minimal processing. For example, bamboo cut, dried and used in its raw form as gutters is not considered in this study while bamboo that is processed with adhesives and resins into flooring material is considered. Mud bricks made by the end user are also excluded, while mud bricks manufactured and sold as a commodity are considered even if the composition of both materials is essentially the same. Exception is made where known hazards are associated with such locally extracted and minimally processed materials exist in concert with an existing method or need for the dissemination of information regarding such hazards.

Materials are considered on a generic basis and by material class as defined by material composition and/or end use within a building. In cases where location of manufacture and raw material extraction play a role in determining potential material content, further categorical division is applied.

2.2 Background Literature Review

In order to gauge the availability of information resources for building materials and products, an extensive search was conducted, exploring both domestic and international information sources. Information from many of the following sources and websites, along with original research, was used to compile a building materials resource list. The most current versions of sources were used wherever possible, but as websites are constantly updated, the information may change over time. The resulting resource list includes 183 web-based resources representing 50 publishing countries and includes sources from government, academia, non-governmental organizations, trade/industry associations and label/standard developers. Identified sources are included as Appendix 1.

The search was intended to reflect domestic and global issues and special concerns regarding the building materials sector. Special focus was given to the following categories:

- Material use, including generic material or product information;
- Life-cycle impact of materials on the environment, including information gathered from third- party resources and/or manufacturers;
- Product design and composition;
- Evaluations of material properties, including availability and performance of alternative products;
- Evaluation of building products and systems; and
- Outcome documentation (including information from the interplay of building material properties and material use to construction or operation waste).

Data collection involved reviewing web sources based on a number of search terms; search terms were predominantly conducted in English. Web searches covered a number of broad categories of information on building products and chemicals in building products including: sourcing (local, international, recycled or renewable), human health (hazardous or concerning chemical substances, fire ratings, etc.), end of life (reuse, recyclability, salvage, domestic or international recycling programs available), life cycle assessments (life cycle inventories from extraction to use to demotion), and individual and specific product properties and available alternatives.

2.3 Overview of Survey and Interview Findings

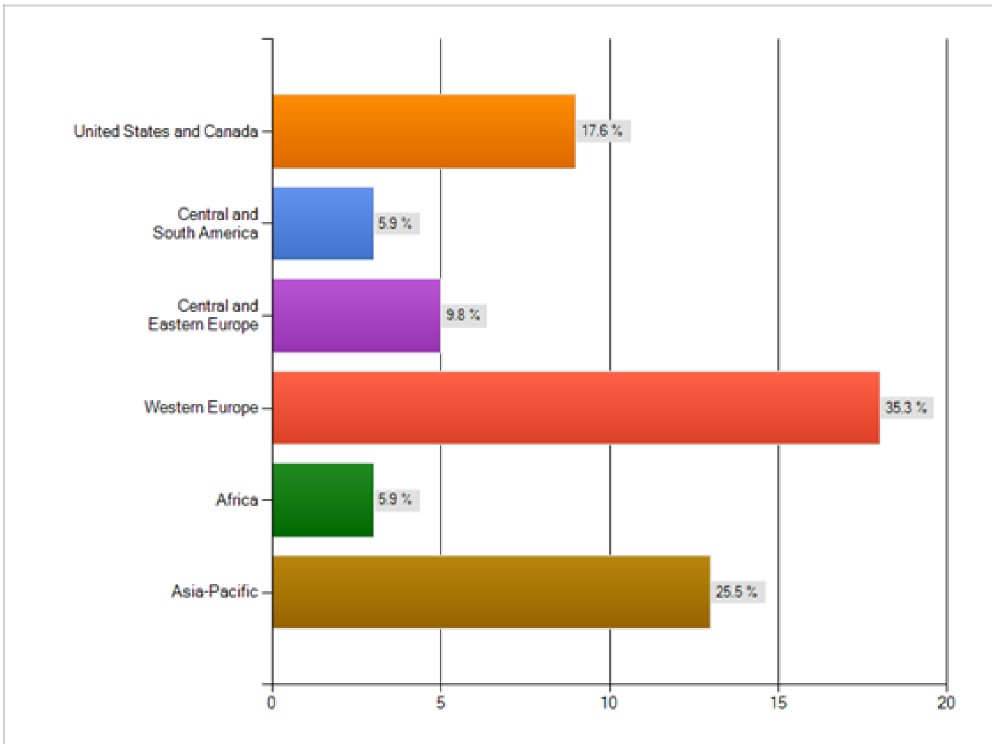
As a key research component, an electronic survey was developed and distributed in mid-November, 2010. The survey was distributed to SAICM stakeholders, building and construction industry representatives, architects, deconstruction and demolition industry representatives, and applicable non-governmental organizations. In addition to the electronic survey, corresponding phone interviews were conducted with numerous stakeholders. The intended purpose of this process was to:

1) identify additional information systems being developed in regions and/or individual countries that may not have been identified through the literature search;
2) gain data and expert opinion on existing strengths, problems and gaps related to the flow of information related to building materials; and
3) identify obstacles encountered by different stakeholders throughout the production chain and product life-cycle in providing and accessing required information.

A copy of the survey is provided as Appendix 2. Survey findings will be highlighted throughout the report, however a cursory summary of responses is included below.

Fifty-two survey responses were received, with responses from all geographic regions (see Figure 1). Of those, thirty-five surveys were from developed countries and sixteen were from developing countries; there was one non-response.[3]

Figure 1: Geographic Distribution of Survey Responses



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- Products ranked highest in terms of priority for chemicals information include interior finishing (including paints), flooring, structural materials (including wood, metal and concrete), insulation, and material feedstocks/raw ingredients for material production.
- In rating the trustworthiness of information sources, 43% of respondents ranked government/regulatory data sources as most trustworthy and unbiased, and 49% ranked industry/trade sources as biased, but accurate.
- Respondents rank a "high" or "very high" priority for additional information about chemicals in building products, specifically related to "scientific data on the health impacts of materials and chemicals" and "chemical and material content of products."
- 38% of respondents report being able to find information about chemicals in specific building products when they need it. However, more than half of those respondents (54.5%) say that the information found is inadequate, and generally not specific enough.

- When asked for research priorities for chemical information across different life-stages of a building, the highest priorities are for use (occupation, performance), product/material manufacturing, and end-of-life (demolition, reuse, recycling).
- 77% of respondents do not feel that existing information systems provide balanced chemical information across the life-cycle stages of the product, largely because they feel that pertinent data does not exist.

III. Sector Overview

3.1 Life cycle of products in the sector

The building materials industry is incredibly large and varied with a wide range of materials serving myriad functions. The global building materials market was projected to exceed US$391 billion by the close of 2010; Asia-Pacific is the largest market for building materials, accounting for approximately 35% of the global market in 2007.[4] The sector overview below describes key chemical and material flows for major material classes within the building industry. Existing data is not sufficient to address the extent to which chemicals used during production of material feedstocks and throughout the production process remain present in final products. For this reason, a precautionary approach is taken for the material classes detailed below; all chemicals involved in or produced throughout the lifecycle of material production are included.

Solid and Composite Wood and Agricultural Products

Building materials considered in this category include treated and untreated solid wood products along with a variety of composite wood and agricultural products including plywood, oriented strand board (OSB), and particle board. Materials in this category are used in structural applications in the form of solid or composite framing and sheathing elements, and as finishing elements such as flooring, cabinetry, and casework. VOC's and other chemicals added during manufacture of wood and agricultural products may be emitted from treated and composite wood and agricultural products at varying levels throughout a product's life.

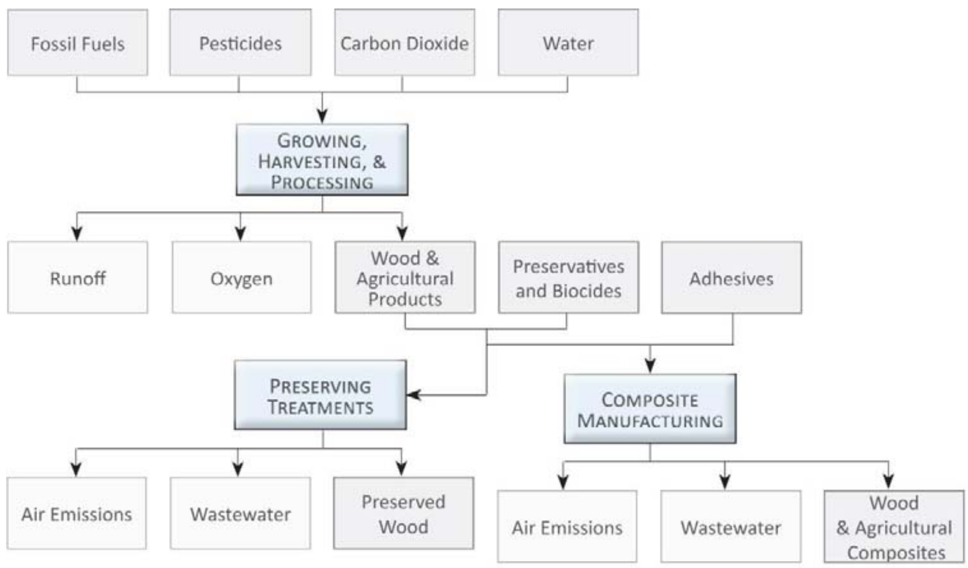
According to the report by the Food and Agricultural Organization of the United Nations (FAO), "Global Forest Resources Assessment 2005", the world's largest forest plantation areas are found in Asia with approximately 65 million hectares of productive forest, followed by Europe with approximately 25 million hectares, and North and Central America with approximately 15 million hectares.[5] Regulation of these forest plantations varies widely and depends largely on the institutional frameworks present locally and the strength of policies associated with them.

Chemical entry into the lifecycle of wood products occurs primarily during raw material extraction and processing, and during product manufacturing. However, chemicals used to produce wood and agricultural products may be transferred to workers, consumers, and the environment during all stages of a product's lifecycle, from raw material extraction and processing to end-of-life disposal.[6] VOCs from formaldehyde-based adhesives and other chemicals added during the manufacture of composite wood and agricultural products may be emitted at varying levels throughout a product's life. Chemicals used to preserve wood may also be released to the environment, and pesticides and fertilizers used to grow raw materials for these products may affect workers and the environment during the manufacture and use of the chemicals. The extent to which these chemicals remain in final products is unclear.

Forest and farm management practices are a significant factor in the use of chemicals in forest and agricultural products. Clear-cutting forests and the resultant monoculture plantation forests along with conventional agricultural practices may require greater pesticide use than their sustainably managed counterparts.[7] Chemical residues from pesticides used during growing may or may not be present in finished materials, but enter the environment in the form of run-off from badly managed forests and fields and may impact farm and forest workers who come into direct contact with these pesticides.

The ability to determine chemicals used to grow forest and agricultural products largely depends on the level of transparency in the supply chain of these products. The origin of forestry and wood products, and in turn, the methods by which they are produced is often difficult to determine in the absence of third party certifications, and even these are only as useful as the transparency of their respective metrics. Forestry management in the absence of third party certification is subject to strength of policy and institutional frameworks present in the place of origin, which may be difficult to determine even when the origin of a product is known.

Figure 2: Typical Forest Products Materials Flow



In addition to raw wood and agricultural products, a variety of other chemicals and raw materials are used to produce treated lumber and composite wood products. Chemical releases to the environment result from both the mining of minerals used to preserve wood, including arsenic, copper, and chromium, and from the extraction and processing of oil and natural gas used to produce adhesives, including phenol-formaldehyde and urea-formaldehyde.[8]

Manufacturing preservative-treated and composite wood and agricultural products involves the addition of various chemical preservatives and adhesives. Chemicals are released to the environment during wood treatment processes and during manufacturing of composite wood products in the form of run-off, air emissions, and soil contamination and may pose health risks to workers in manufacturing plants. Some of these chemicals remain present in final products where they may be introduced to construction workers, consumers, and the environment through skin absorption, inhalation of dust, off-gassing, and leaching.[9]

Common chemical preservatives currently in use include chromate copper arsenate (CCA). Though banned from consumer products in the United States, CCA is still used in many applications such as permanent wood foundations, lumber used in commercial construction, plywood used in residential and commercial buildings, marine applications, and exterior applications such as utility poles and farm fencing. [10] Chemicals from wood preserving facilities may enter the environment as water soluble chemicals such as arsenic salts, and may remain present in soils around preserving facilities. [11]

Ammonium copper quaternary (ACQ), copper azole, and micronized copper are copper-based wood treatments that have largely replaced CCA in consumer applications. Copper is toxic to many aquatic organisms and may leach from treated wood over time. Although micronized copper treatments minimize leaching from treated wood to the surrounding environment, the mining of copper remains a lifecycle consideration due to chemical releases to workers and the environment during raw material extraction. Agricultural pesticides may also be used to preserve wood as both a surface treatment and pressure-treatment.[12]

Common chemical adhesives currently in use include phenol-formaldehyde and urea-formaldehyde. Phenol-formaldehyde is widely used as an adhesive in interior and exterior plywood, OSB, and glue-laminated lumber. Urea-formaldehyde is more often used in interior grade medium-density fiberboard (MDF) and particle board. In addition to upstream impacts associated with the production of formaldehyde binders, formaldehyde in composite wood products is released to environment through the process of off-gassing. Another adhesive, polymeric diphenyl methylene diisocyanate (PMDI or MDI) is starting to being substituted for formaldehyde-based adhesives in particleboard.[13]

Chemicals in preservative treated and composite wood products may be released to the environment at the end of the material's useful life. From a reuse perspective, it is typically impossible to identify the original sources and chemical profile of many construction products, including wood products. Aged, treated lumber may not be easily distinguishable from untreated lumber and may be disposed of improperly. Onsite burning of construction scrap releases toxins to the air, and preservative-treated wood may be recycled erroneously by facilities that convert wood scrap into mulch.[14]

Steel

Steel is a widely used in structural applications for many building types as structural steel members or as reinforcing in concrete construction. Galvanized steel, which involves coating steel with a layer of zinc, is used as sheet steel and fasteners. Stainless steel is made by dissolving significant quantities of chromium and other metals into iron during production and is used in fasteners, cladding, fixtures and hardware, and in certain structural applications. In 2009, the top three regions producing crude steel were China, the European Union, and Japan, which together accounted for approximately 67% of global production. The top three consumers of steel were China, the European Union, and the United States.[15]

Table 1: Steel Production and Consumption, 2009 (thousand metric tons)

Country	**Production**	**Apparent Consumption**
China	500,312 **(37.6%)**	452,850 **(34.8%)**
European Union	197,999 **(14.9%)**	197,908 **(15.2%)**
Japan	118,739 **(8.9%)**	83,200 (6.4%)
United States	91,350 (6.9%)	102,438 **(7.9%)**
World	1,329,123	1,300,722

Source: World Steel Association, *Steel Statistical Yearbook 2009*

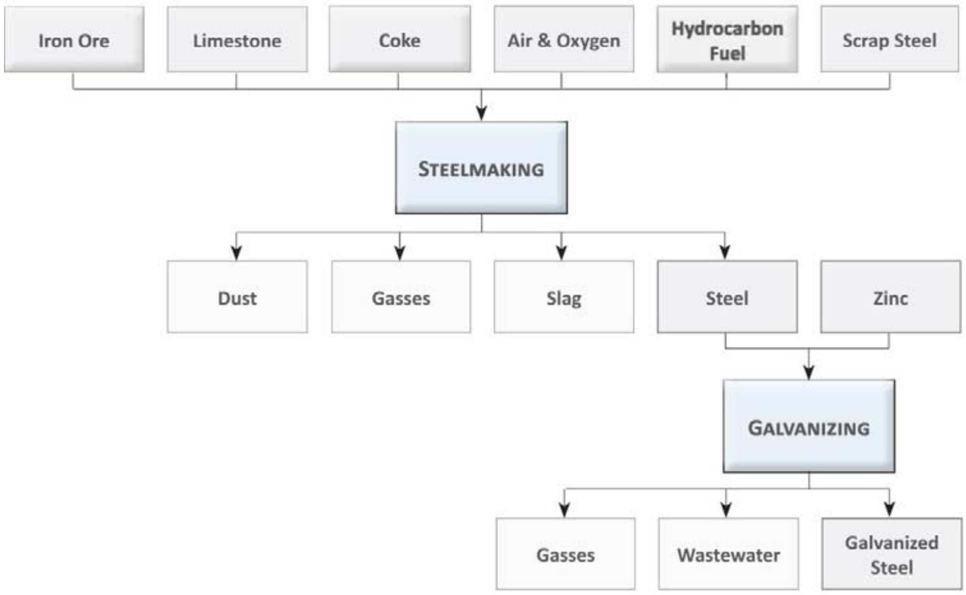
Chemical use in steel production occurs primarily during raw material extraction and processing, and manufacturing. While steel itself is generally considered inert and, as a finished product, is not known to release significant quantities of chemicals into the environment, chemicals employed during steel manufacturing and finishing may affect workers and the environment.[16]

Mining of raw materials for steel including iron ore, coal, and limestone may introduce chemicals to workers and the environment in the form of run-off and air emissions from fuel combustion. Coke, produced from bituminous coal, plays a significant role in steel production. Emissions from coke ovens include polycyclic aromatic hydrocarbons, benzene, B-naphthylamine, cadmium, arsenic, beryllium and chromium. Water used in the cooling process may contain potential carcinogens and is considered hazardous waste.[17]

Another point of entry of chemicals into steel production occurs during the galvanization process which uses zinc to form a protective coating. Chemicals may be introduced to workers and the environment during zinc ore mining in the form of run-off. Heavy metal contaminants including lead, cadmium, chromium, copper, silver, and selenium may be released during the zinc smelting process. Cooling and rinsing water used in the galvanization process may also introduce chemicals into the environment.[18] Over time, zinc coatings on galvanized metal wear away and enter the environment.

As with forestry products, determination of the chemicals involved in steel production and their potential impacts to human health and the environment depend on the strength of policy and institutional frameworks present where raw materials are mined and processed into steel. Determining the level of impact depends both on the level of transparency in the steel supply chain and the transparency of policy and enforcement surrounding its production.

Figure 3: Steel and Galvanized Steel Materials Flow



Despite the chemical hazards associated with its raw production, steel is a highly recyclable material. Steel used in construction can and often does contain high percentages of recycled steel. Steel with high recycled-content has proportionally smaller amounts of embodied chemical use, therefore knowing how much recycled steel a product contains is necessary to assess its contribution to chemical use. Data on steel's recycled content is becoming more commonly available on a plant by plant basis in developed countries; however, in the absence of certification or transparency of origin, recycled content is not easily determined.[19]

Insulation

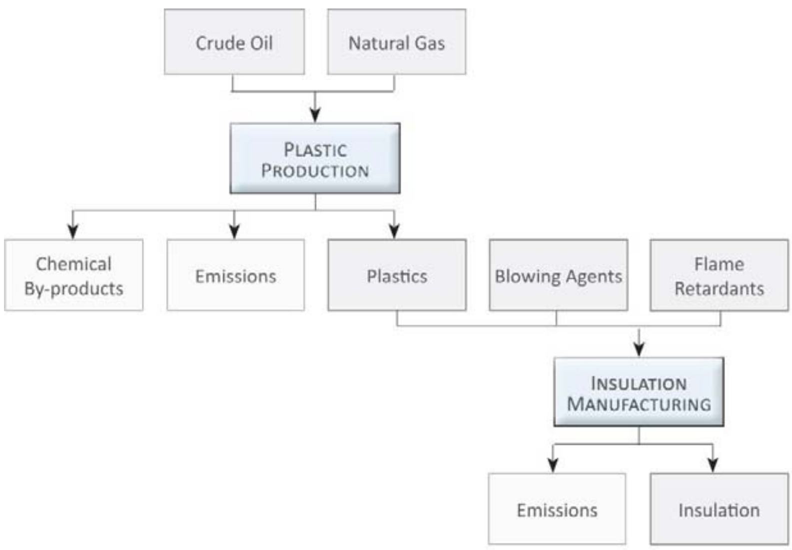
Materials used as insulation vary widely and each type of insulation has unique manufacturing processes and chemical composition. Common types of insulation include fiberglass, rigid foams, spray-in-place foams, mineral wool and cellulose. Chemicals may be introduced to workers and the environment during mining of raw materials, manufacture of insulation and its components, and installation.[20] Chemicals may be released to workers, consumers, and the environment during all life-cycle stages including useful life, and end of life.

Rigid and spray-in-place foam insulation
There are three major types of rigid and semi-rigid insulation: Extruded polystyrene (XPS), Expanded polystyrene (EPS), and Polyisocyanurate (Polyiso). XPS and EPS are manufactured using crude oil and natural gas to produce benzene and ethylene, respectively, which are then converted to styrene monomer. Various blowing agents are then used to create polystyrene foam. XPS uses HCFC-142b (hydrochlorofluorocarbon) as a foaming agent during manufacture. HCFC-142b replaced the more harmful greenhouse gas CFC-12 (Chlorofluorocarbon), but is still an ozone-depleting greenhouse gas. HCFCs are now being phased out due to their ozone depleting potential and are already banned in some countries including the European Union, though others, including Canada, Mexico, and the Unites States still allow for their use.[21] EPS uses pentane as a blowing agent. Air and water emissions from the production of polystyrene and its intermediate chemicals include benzene, chlorinate organic compounds, hydrocarbons, and metals.[22]

Over time, blowing agents entrained within the cells of foam insulation may escape to the environment at varying levels. Virtually all polystyrene insulations, including XPS and EPS, are treated with HBCD (Hexabromocyclododecane), a brominated flame retardant.[23] HBCD is a persistent bioaccumulative toxin which can be found worldwide in humans, wildlife, and the environment. The degree to which insulation products contribute to these levels throughout their lifecycle remains unclear.

While polystyrene packaging materials can be recycled into XPS, only EPS which was previously building insulation can be recycled as such.[24] CFCs contained within older foams in existing buildings may enter the atmosphere at end of life if improperly disposed of, and chemicals may enter the environment in case of building and landfill fires or other burning of foam insulation.

Figure 4: Rigid, Semi-rigid, and Spray Foam Insulation Materials Flow



Polyiso insulation, along with polyurethane insulation (addressed below) is made from polymeric methylene diisocyanate (PMDI), a polyol that reacts with the PMDI, and a blowing agent. The polyol component is variable and sometimes includes recycled plastics such as polyethylene terephthalate (PET). Polyiso insulation is also treated with flame retardants and primarily uses pentane as a blowing agent in its production replacing HCFCs and HFCs.[25]

As with other foam insulations, spray polyurethane foam (SPF) once used CFCs as blowing agents. CFCs were replaced by HFCFs which are now being phased out.[26] Products are now being produced using alternative blowing agents including HFCs, pentane, and a mixture of carbon dioxide and water.[27] These spray-in-place foams introduce another point of exposure to chemical content during installation of foam. The installation process generally combines two chemical components which react to create foam which must cure in place. Although the foam is considered inert upon curing, chemicals may be introduced to workers and consumers during the spraying and curing process if not properly protected.

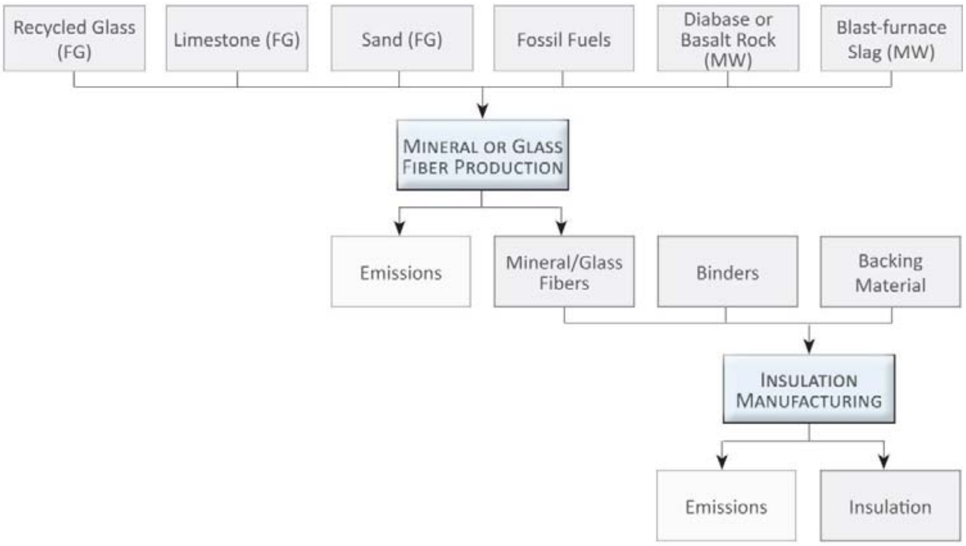
Fiberglass and Mineral Wool Insulation

Fiberglass insulation is made from sand, dolomitic limestone, and borax, which are mined and used to manufacture glass. Post-industrial glass cullet from plate glass manufacturing, and post-consumer glass bottles may also be used as a glass source. Molten glass is then spun into thin strands which are immediately coated with a binder. The glass fibers are then shaped and cured into batts or blankets which may be backed with foil or craft paper or used as loose-fill.[28]

Mineral wool insulation may be made from diabase and basalt rock or from slag from iron-ore blast furnaces (slag wool). As with fiberglass insulation, molten minerals are spun into thin fibers and coated with a binder. The binder used in most fiberglass and mineral wool insulation is often phenol-formaldehyde; the production of which produces toxic intermediate chemicals as described in the section above describing wood products.[29] Formaldehyde free binders are also available.

Chemicals may be introduced to the environment as emissions from mining operations and glass melting furnaces.[30] Production of phenol-formaldehyde binders involves toxic intermediate chemicals which may be introduced to the environment or workers. In addition, formaldehyde may off-gas from insulation materials once they are installed in buildings affecting both workers and occupants.[31]

Figure 5: Fiberglass and Mineral Wool Insulation Materials Flow



Asbestos and Other Insulation Materials
Vermiculite is sometimes used as insulation and may contain asbestos depending on where it is mined. Additionally, asbestos, discussed below was once a common ingredient in certain types of insulations and may continue to pose threats during demolition and disposal of construction waste. Urea formaldehyde foam insulation (UFFI) is no longer in use due to indoor air quality concerns associated with the off-gassing of formaldehyde.[32]

Concrete
Chemicals enter concrete's lifecycle during raw material production, mixing, and curing. Cement, aggregates, water, and various admixtures are the primary ingredients in concrete. [33] Each component carries its own unique lifecycle impacts. Concrete itself is generally considered inert with the possible exception of off-gassing of chemical admixtures and some aggregates. During the curing process, concrete releases significant amounts of carbon dioxide.[34]

In 2008 China accounted for 54% percent of the 2,857 million tons of cement produced globally. India and the United States are a far second and third, respectively, in production. According to the same report, 94% of cement produced is consumed domestically. Of the 6% traded, China is the largest exporter, followed by Japan and Thailand, and the United States is the largest importer, followed by Russia and Nigeria.[35]

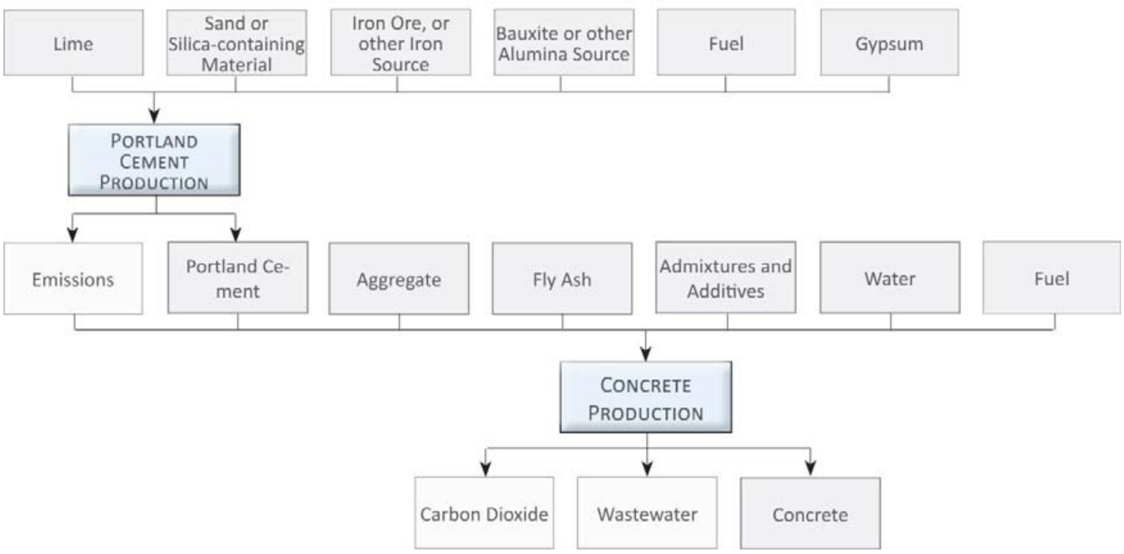
Cement is the most energy intensive ingredient in concrete. Its production begins with the mining of raw materials including the following: a source of calcium such as limestone; a source of silica, including shale and clay; calcium sulfite, such as gypsum; and iron and alumina from bauxite and iron ores or certain waste materials. These materials are heated to extremely high temperatures. Chemical emissions from cement kilns vary according to environmental controls employed at each plant and the type of fuel used. Common fuel types include coal and coke, and natural gas. Additionally, many cement plants incorporate various forms of waste as fuel sources including tires, waste oil, and other potentially hazardous materials. Emissions from cement kilns may include other hazardous substances such as chromium, arsenic, and mercury.[36]

Fly ash from coal-fired power plants may be used as a substitute for cement in concrete mixtures.   Emissions from coal-fired power plants often contain heavy metals which may also be present in fly ash. Chemical composition of fly ash is directly related to the type of coal burned and may contain varying levels of mercury and other heavy metals such as arsenic, cadmium, chromium, and selenium. [37]

Aggregates used in concrete vary and often include a combination of crushed stone and sand. Depending upon source, some aggregates in concrete may contribute radon in concrete.[38] Other chemicals resulting from aggregate production may include air emissions from fuel combustion and run-off from quarrying operations. Certain recycled materials may also be used as aggregate (such as scrap tires and demolition waste). Determination of the chemical properties of aggregates depends upon origin and policies governing the place of origin.

Admixtures are chemicals which are added to concrete mixtures to control qualities such as curing time, workability, freeze resistance, and resistance to cracking. Chemicals such as sulfonated melamine-formaldehyde, sulphonated naphthalene formaldehyde condensates, alkyl benzene sulphonates and methyl-ester-derived cocamide diethanolamine, along with various nano-particles and biocides may be added to concrete. Chemicals used in admixtures vary widely and are not easily identified through current labeling practices.[39]

Figure 6: Typical Concrete Materials Flow



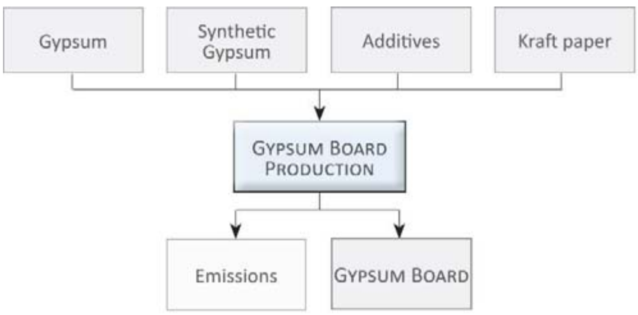
Wall Board
Gypsum board is the most commonly used type of wallboard. It is generally composed of mined gypsum or synthetic gypsum, and paper facing. According to the USGS's 2008 Minerals Yearbook, China was the leading producer of raw gypsum, followed by the United States and Iran. Of the gypsum produced worldwide, it is estimated that close to 20% is traded internationally.[40]

Chemicals may enter the environment as air and water emissions from gypsum mining operations and paper production. Calcined gypsum is produced by heating raw gypsum which may result in air emissions including sulfur oxides, nitrogen oxides, and VOCs.[41] Synthetic gypsum, or flue-gas-desulfurization (FGD) gypsum is a byproduct of chemical scrubbers in coal-fired power plants. Sulfur dioxide emissions contained in flue-gas are exposed to calcium carbonate. A chemical reaction creates calcium sulfite which is converted to gypsum by oxidizing it with water.[42]

There is some controversy about potential heavy metal content in synthetic gypsum, but no definitive research has been performed. [43] Chemical contaminants may be found in drywall where materials other than gypsum are added as fillers or flame retardants. Older drywall may contain asbestos and poses a risk during demolition or repair.[44] In early 2008, some drywall produced in China was found to emit sulfide gasses.[45]

As with other building materials, the ability to assess chemical content of drywall is largely dependent on transparency in sourcing. Some third-party certifications address synthetic gypsum content in gypsum board where it is considered as post-industrial recycled content.

Figure 7: Gypsum Board Materials Flow



Resilient Flooring
Vinyl flooring is one of the most widely used resilient flooring products on the market. It is composed primarily of polyvinyl chloride (PVC) resin and additives including stabilizers, plasticizers, pigments, and various fillers.[46] Chemical pathways for release into the environment occur at all lifecycle stages from raw material extraction to end of life.

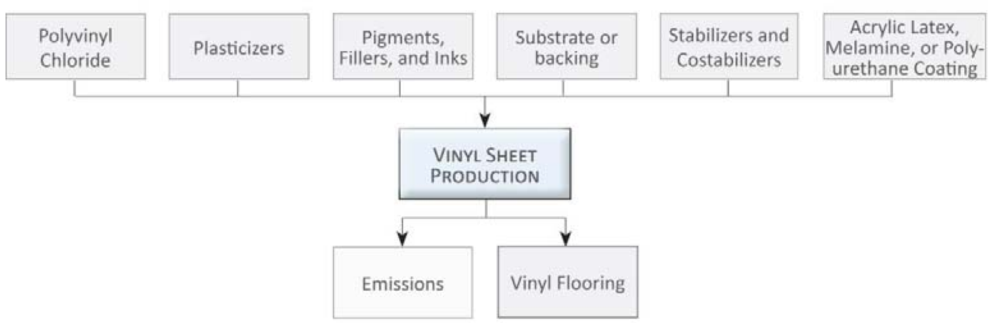
Petrochemicals are a major ingredient in vinyl flooring. Ethylene, a derivative of natural gas or petroleum, is reacted with chlorine, a derivative of sodium chloride, to produce diochloroethane (ECD). ECD is converted to vinyl chloride monomer and hydrochloric acid through a cracking process. Vinyl chloride monomer is then polymerized into PVC using a variety of methods.[47]

Exposure to vinyl chloride monomer is linked with a form of liver cancer. While vinyl chloride monomer residues can be found in very small amounts in finished PVC products, exposure is more likely to occur in manufacturing and processing facilities. In North America and Western Europe, the introduction of closed-loop polymerization processes have been widely adopted by industry, significantly limiting worker exposure to vinyl chloride monomer. However, older production technologies persist in some low- and medium-resource countries.[48] Exposure levels are tightly controlled in the United States and other OECD countries.[49] However, as with other product sectors, health and environmental impacts associated with the production of vinyl flooring and its feedstocks depend on the location of manufacture and the strength of policies and regulations in place in each location.

Additives used in the production of vinyl flooring are another point of entry for chemicals. Phthalates, including di-2-ethylhexyl phthalate, may be used as plasticizers along with flame retardants, smoke suppressants, and biocides. Heavy metals including lead and cadmium may be used as stabilizers;[50] however the use of cadmium in vinyl floor production is declining and was phased out in European Union in 2001. The precise composition of vinyl flooring varies by manufacturer and production location.

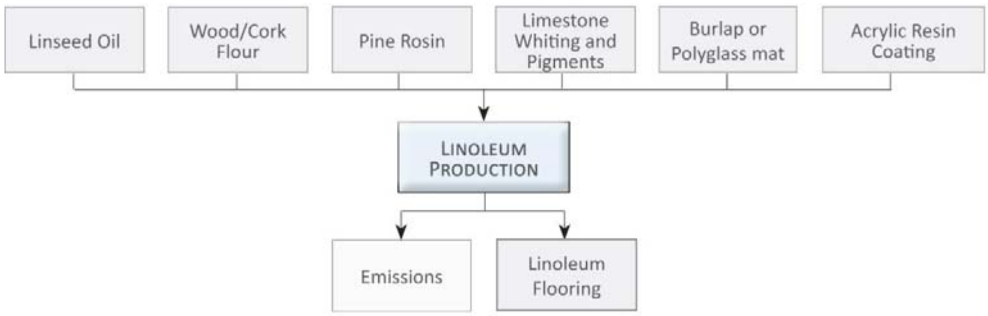
During use phase, vinyl flooring has been found to off-gas chemicals including aromatic hydrocarbons, aliphatic hydrocarbons, and halogenated hydrocarbons. At the end of life, recycling of vinyl flooring is minimal, though a few flooring manufacturers do recycle it. Concentrations of legacy chemicals such as cadmium which exceed current regulations may limit recycling potential.[51] Older vinyl flooring may contain asbestos posing risks to occupants and construction and demolition professionals.

Figure 8: Vinyl Flooring Materials Flow



Linoleum is primarily made from linseed oil from flax seed, rosin binders, wood and cork flour, fillers, and drying agents which are combined with pigments and synthetic or natural backing fiber to create flooring. Primary chemicals involved with the production of linoleum are associated with the agricultural and forest products as describe previously as well as through drying agents and additives. Additionally, VOCs are released during the oxidation of linseed oil. [52]

Figure 9: Linoleum Flooring Materials Flow



Siding and Exterior Cladding

Siding and cladding is another major category of building materials which includes many of the materials mentioned in previous categories and includes diverse materials such as PVC, wood, fiber cement, various metals including steel and aluminum, masonry, and ceramics. Vinyl siding is one of the most common siding materials due to primarily to its low cost, availability, and perceived maintenance reduction. Vinyl siding, along with flooring and piping, is one of the largest uses of PVC and is the most common residential siding material in the US and Canada.[53] Like other PVC products, vinyl siding may contain a variety of additives including phthalates and flame retardants which pose risks humans and the environment. Chemicals associated with PVC and its production are detailed in the section above on resilient flooring, and in section 3.2 in the section on chlorinated plastics.

3.2 Specific Substances of Concern in the building products sector

In addition to chemicals referenced in the life-cycle of the general classes of building products mentioned above, there are also specific substances and classes of chemicals commonly referenced as concerns within the building products category. The amount of time that most people spend indoors makes exposure to certain chemicals and classes of chemicals of paramount concern. However, the depth of research and accessible information on chemicals of concern within different building materials varies wildly. For example, there is substantial literature in the area of health and environmental impacts attributed to formaldehyde, particularly related to indoor air. But continuous improvements in material and product technologies for building materials also spawn new issues that may warrant a precautionary approach, such as increased use of nanomaterials and anti-microbials.

Chemicals of concern in the building products sector include those implicated in the lifecycle emissions from the extraction, production, and the use and disposal of the materials. The chemicals added to or used to make building products serve important performance, aesthetic, and functional demands[54]. For instance, volatile organic compounds (VOCs) are used as feedstocks for some plastics and used in binders and other resins for products such as composite wood or insulation, in paints, coatings and adhesives, and treatments to provide water resistance or to enhance stain repellence. The environmental and health hazards of many building materials are globally or locally distributed and can include the formation and release of toxic substances and the consumption of energy and resources in all stages. An overview of the more commonly used chemicals for building products follows.

Formaldehyde

Formaldehyde is produced naturally in the environment at low levels through the oxidation of hydrocarbons. It is also manufactured by the chemical industry and is incorporated in a wide range of building products, such as composite wood products and insulation. Formaldehyde is classified as a Group 2B carcinogen (probable human carcinogen) by the International Agency for Research on Cancer (IARC).

Wood-based building materials that involve the use of formaldehyde in their production and emit formaldehyde during their use are major contributors to formaldehyde emissions in the construction process. Wood-based products, such as medium-density fiberboard (used in drawer fronts and cabinetry), particleboard and hardwood plywood paneling (used in sub-flooring and cabinetry), and softwood plywood (used in exterior construction) are among the most likely building materials responsible for formaldehyde emissions. Certain insulation materials also contain formaldehyde.

Exposure to formaldehyde can potentially occur at the production, site application and use stages of a product.[55] The rate at which products like composite wood or textiles release formaldehyde varies over time and will generally decrease as products age. Initially following installation, high indoor temperatures or humidity can cause increased release of formaldehyde from these products.[56] The primary routes of exposure of formaldehyde that can result in acute health effects are inhalation and absorption through the skin.

Wood Preservatives

Wood preservatives contain active ingredients and solvents and can result in adverse health effects if exposed to excessive amounts. There are two major types of wood preservatives: oil-based and water-based.

> ***Creosote and pentachlorophenol*** (PCP) are two oil-based treatments commonly used to treat construction materials such as railroad ties and utility poles.

Chromated copper arsenate (CCA), ***ammonium copper quaternary*** (ACQ), copper azole and micronized copper are water-based treatments. CCA contains arsenic, a chemical shown to cause skin and lung cancer after prolonged exposure. ACQ has more recently been used heavily in industry and is less considerably less toxic.

Wood preservatives are poisonous to pests and insects, and protect wood products from environmental deterioration. They may also be hazardous to humans and the environment. Wood preservatives may be spray-applied, resulting in minute droplets of the product which may remain suspended in the air after application posing an inhalation risk to workers. Certain types of preservative products use volatile petroleum-based solvents as vehicles for the preservative compound, which evaporate from the treated wood as the product dries. Exposure to high concentrations of petroleum-based solvents can cause narcotic effects and loss of consciousness.

Chromated copper arsenate (CCA) was used in pressure-treated wood products for sixty years and has largely been withdrawn from North American consumer markets. Government and public attention to the issue of health hazards from CCA-treated wood, both national and international, has been growing steadily over the past few years. In March 2003, EPA finalized a voluntary agreement with preservative manufacturers to ban the production of CCA-treated wood for most residential uses.[57] However, the ban does not prohibit the sale of CCA-treated wood produced prior to the ban, nor does the measure address existing structures, and CCA-treated wood is still used in certain commercial and industrial applications In the United States, a warning label must be displayed in locations where CCA-treated wood is sold. The EPA has also removed CCA from its list of approved chemical pesticides.

Non-arsenic based alternatives to CCA include alkaline copper quaternary (ACQ), copper azole, which replace the arsenic in CCA with a high level of copper and organic co-biocides.[58] Though considered less hazardous by composition, major health and environmental concerns are associated with copper extraction and processing, and disposal. Leaching of copper from treated wood can harmful environmental effects, specifically to aquatic organisms.[59]

Micronized copper quaternary (MCQ), is a relatively new preservative treatment marketed as an environmentally preferable alternative to soluble copper treatments. MCQ is a variation on copper-based organic formulations.[60] The MCQ treatment process uses micronized copper particles which are injected into wood. This method reduces leaching, is non-volatile, and eliminates surface residue.[61] [62]

Chlorinated Plastics

Chlorinated plastics, including PVC, are of special concern due to their global distribution and use and the hazards associated with them.[63] PVC is the most widely used chlorinated plastic polymer in the United States, with 12.8 billion pounds produced in the U.S. alone in 2010, [64] and 47.5 billion ton global production capacity.[65] The building industry is responsible for more than 75% of that PVC use.[66] PVC is the only major building material that is an organochlorine, a class of chemicals that breaks down slowly and can remain in the environment long after disposal. Controversy exists regarding environmental and health concerns related to PVC's production and the exposure of users to phthalates, VOCs and other additives. As such, governments and organizations in Europe and North America have explored restrictions and PVC avoidance programs.

Chemical releases associated with vinyl production may occur in all stages of PVC's life cycle. Environmental and health impacts of the manufacturing stage include ethylene and chlorine gas production, feedstock production, polymerization, formulation and molding. During use phase, chemicals used during the manufacture of PVC products may be released into the indoor or outdoor environment. At the end of useful life, PVC is typically incinerated or placed in landfills, where unintended by-products may leach into surrounding terrestrial or aquatic environments. While initiatives aimed at promoting PVC recycling have increased recycling rates, recycling of post-consumer PVC remains limited and is considered difficult due to the range of additives in products.[67]

Health concerns of PVC and other chlorinated plastics include the release dioxins, a family of chemicals containing known human carcinogens. Dioxins are created during the production and manufacturing processes and when chlorinated plastics are burned, either accidentally or intentionally, during disposal.[68] For example, in the UK municipal incinerators account for 20% of dioxin releases, with accidental fires accounting for 19%[69]. Proper incineration can control exposure to dioxins, using temperatures over 850˚ Celsius and using proper air control technologies,[70] however standards for incineration vary. Controversy exists regarding the extent to which the chlorine present in PVC correlates to dioxin formation and release.

Asbestos

Asbestos is a fibrous mineral that occurs naturally in many parts of the world. It has a number of mechanical characteristics, which have made it desirable for use in building materials. It is extremely strong, is resistant to fire and chemical destruction, does not conduct heat or electricity, and is lightweight. The health concerns associated with asbestos are numerous.[71] When asbestos fibers are inhaled, they remain in the lungs for an extended period of time, causing inflammation, irritation, and diseases including lung cancer, mesothelioma asbestosis, and other potentially life threatening diseases, which may not show up until well after exposure.[72]

Exposure to asbestos may occur during mining, manufacturing, construction, and during removal of asbestos during renovation and demolition. Asbestos was used extensively in building materials until health concerns became widespread in the 1970's and asbestos-containing materials can still be found in many older buildings today. Materials that were made with asbestos included pipe and furnace insulation materials, asbestos shingles, millboard, textured paints, floor tiles and backing, and various insulation and fireproofing materials.

While the production and use of many forms of asbestos has been banned, either entirely or partially, in over 50 countries around the world[73], asbestos is still used and mined in many places including Canada, India, and China. Even in some countries that have banned asbestos, including the United States, exemptions are still permitted for minor use.[74] The main regions of commercial asbestos production are in Canada, the former Soviet Union and Southern Africa. According to an IBAS report, 90 percent of the countries with the sharpest increases in asbestos use are in Asia, and the populations most at risk for exposure to asbestos live and work in Asia.[75] Asian countries account for 70 percent of the world's asbestos production and nearly 50 percent of the world's consumption of asbestos products.[76] At the beginning of 2011, India's Supreme Court refused to ban asbestos in the country, illustrating the wide lag that can exist in legislative action following discovery of adverse health effects of certain chemicals in products.

VOCs

Volatile organic carbons (VOCs) are compounds that readily volatize into the air under typical conditions of use. Volatile organic compounds (VOCs) include a large number of chemicals which volatilize out of products into the surrounding environment. This volatilization results in elevated concentrations of VOCs in the indoor environment. Building materials known to emit VOSs include certain composite wood products, insulations, carpets and flooring, and many paints, coatings, and adhesives. VOCs in building materials include chemicals which are known or suspected human carcinogens, contribute to liver, kidney, and central nervous system damage, and cause a number of other adverse health effects.[77] Common VOC compounds released from building materials include formaldehyde, acetaldehyde, toluene, isocyanates, xylene, and benzene. In addition to affecting indoor air quality, certain VOCs are regulated due to their contribution to photochemical smog.

PBTs

Another prominent class of chemicals of concern includes persistent bioaccumulative toxicants (PBTs). PBTs are compounds that both persist and bioaccumulate in the environment and are considered toxic. PBTs are associated with a range of known or highly probable serious human health effects, including cancer, endocrine disruption, immune system disorders, impaired brain development, and birth defects. A variety of PBTs are used in building materials or are a byproduct of the material life cycle. Common types of PBTs present in building materials include heavy metals (such as lead, mercury, etc.), halogenated flame retardants (HFRs), perfluorochemicals (PFCs), and dioxins.

Polychlorinated biphenyls (PCBs) are another PBT of concern in building materials. PCBs were widely used in caulking paints, coatings, and sealants from the 1950s until the 1970s. Several investigations in Germany, Sweden, and Finland have demonstrated relationships between PCBs in sealants and levels in indoor air and settled dust, as well as in soil around the foundations of buildings containing these materials.[78] Though widely banned from use in most dissipative applications in the late 1970s in the United States, Canada, western Europe and Japan, there is increasing awareness of PCB legacy issues in older structures.

Radioactivity of Building Products
The concentration of natural radionuclides (naturally occurring radioactivity) in building materials vary significantly from one country to another and from one place to another in the same country. Radiation exposure of the population increases with the use of building materials containing above-normal levels of natural radioactivity. Naturally occurring radionuclides are present in significant amounts in building materials, such as gypsum, red clay bricks, marble, sand and cement products, and in recycled industrial waste products.[79] Exposure to internal radiation during the use stage of building products via radon off-gas and its decay products can pose adverse human health affects, affecting the respiratory tract.[80]

IV. Existing CiP Information Systems

There are many existing channels for information provision and use related to CiP in building products, which provide a great deal of data. However, as will be discussed in Section 5 on "Needs and Constraints," there is still much improvement to be made. Before an in-depth discussion of the information source types, there are some interesting trends in the provision and use of data that should be noted. These trends were noted consistently across the literature review, surveys and interviews conducted for this case study. They include:

- Information has been driven by government chemicals policy and various green building certification systems and standards.
- There are wide differences in the quality and quantity of information across types of materials.
- There is a lack of CiP information available specifically for countries outside of North America and Europe.
- Despite the growth of public databases and manufacturer declarations on building products, a majority of stakeholders depend upon MSDSs as a primary information source.
- Stakeholders referenced the potential of enhanced information exchange from the European Construction Products Directive and the REACH Directive.
- The proliferation of green building standards and certifications is providing a strong market incentive for manufacturers to offer more transparent information about their products.
- Growing numbers of green building councils in countries around the world have the potential to provide a platform for the dissemination of better CiP information.

4.1 Information Source Types

In general, stakeholders report using the following information source types for chemical information about building products: materials safety data sheets, public databases (which often include “red” or restricted materials listings), information clearinghouses, standards and certifications, reporting initiatives, and trade association information. All these categories are further discussed below.

The case studies following were selected from the literature review of international sources related to the building and construction industry and from sources identified by survey respondents. They are intended to give a broad view of the types of information sources currently addressing CiP information while also identifying information sources with potential to do so. For this reason, certain representative sources that currently collect and distribute information related to the building industry but do not currently address CiP-specific information were also included. Selections were made based on the applicability of information sources to CiP-specific information while attempting to remain representative of international efforts. Additional information sources are included in the reference findings of the literature review in Appendix 1. For the purpose of this study, sources of CiP information about building materials were organized into the following categories:

Material Safety and Data Sheets

Material safety data sheets (MSDS’s) are reports that characterize the physical and chemical properties of a material. The intent behind a MSDS is to provide workers and emergency personnel with data about potential health and safety risks of a material. Though hazardous chemical ingredients are listed, MSDSs are not a comprehensive source of information regarding chemicals in products. Hazardous chemicals present in low concentrations are often omitted from MSDS ingredient lists, and many chemical compounds are characterized as proprietary and are not disclosed to consumers. ISO, ANSI, and OSHA all publish guidelines for the generation of MSDSs, however reporting standards for MSDSs vary based on local regulations. In both the ISO and ANSI MSDS standards, carcinogenic chemicals below 0.1% concentration, and all other hazardous chemicals at concentrations below 1%, are exempt from reporting. In both standards, definitions of ‘carcinogen’ and ‘hazardous’ are loosely defined.

The EU REACH Regulation has established more stringent reporting requirements for safety data sheets. Annex II of REACH (EU Regulation EC No. 1907/2006), as further amended by Commission Regulation No. 453/2010, mandates what information should be included in safety data sheets. Notably, safety data sheets will be required to list substances or mixtures classified as hazardous, persistent, bioaccumulative and toxic (PBT), or very persistent and very bioaccumulative (vPvB), and substances of very high concern (SVHC).[81] Table 2 provides general information on the types of information that are required for MSDSs under these various schemes.

Table 2: Requirements for Substance Inclusion on an MSDS*

ISO	REACH	ANSI	OSHA
• Chemical identity • Common name, synonyms, etc. • CAS number(s), EC number, etc. • Impurities and stabilizing additives which are themselves classified and which contribute to the classification of the substance.	• Registration Number, EINECS or ELINCs number is required (when available) • Substance classification in accordance with the Dangerous Substances Directive and the Regulation on Classification, Labeling and Packaging of Substances and Mixtures • Substance or a mixture classified as hazardous, or PBT/vPvB or SVHC • A mixture not classified as dangerous, but containing a substance posing human health or environmental hazards with a concentration of >1% by weight for non-gaseous mixtures or 0.2% by volume for gas.	• Common chemical name(s) • Generic name(s) • Synonyms • CAS number(s) • Components or impurities contributing to the hazard (name, concentration)	• Chemical and common name of ingredients contributing to known hazards • For untested mixtures, the chemical & common name of ingredients at 1% or greater that present a health hazard and those that present a physical hazard in the mixture • Ingredients at 0.1% or greater, if carcinogens.

*Please note that this table is not meant to provide an exhaustive listing of requirements for various MSDSs; it is for example purposes only.

Public Databases

This source category includes two general types of database. The first type includes searchable databases, either subscription-based or free, which store information about specific building materials. The case studies chosen for this category collect information on the chemical and material composition of building products and compare the contents to third-party published lists of chemical hazards and concerns. Information about material contents and any associated hazards or concerns associated with a specific product are subsequently made available to the public. In both cases, the databases rely on manufacturers to provide information about a product or material.

A second type of database includes published lists of information regarding chemicals in general. This includes any regulatory lists of hazardous or concerning chemicals often referenced by product-specific databases. These lists are produced by government agencies as well as non-governmental organizations and non-profits and are made publicly available, or in some cases, become the basis for legislative action. The lists may or may not contain information about what products are likely to contain a given chemical or material.

Standards and Certifications

This category includes published guidelines that address materials in one of two ways. The first certifies buildings through an assessment of various aspects of a building's sustainability. These types of building standards generally address CiP-specific information through a prescriptive approach in which certain chemical contents in materials are restricted or discouraged. These standards serve primarily as a platform for raising issues associated with a few specific chemicals of concern in certain product classes. These types of standards do not provide CiP information about specific products and materials.

A second type of standard or certification looks at individual building products to determine properties based on a predetermined set of metrics. Individual products are then certified accordingly. Companies may then use the certification status as a way to validate claims about a product, and certifying organizations often provide a publicly available listing of all certified products. These types of certifications do not generally publish specific information about a product's contents, but limit reported information to a pass/fail approach. Usefulness of this type of standard in communicating CiP information is largely dependent upon the transparency of metrics employed by the certifying body.

There are several long-standing green building programs that have led the growth in this category of information sources. Oft-modeled programs include the Building Research Establishment Environmental Assessment Method (BREEAM), the Green Globes system, the Leadership in Energy and Environmental Design (LEED) system, and the Comprehensive Assessment System for Building Energy Efficiency (CASBEE). The literature review database includes more than forty such programs (found in Appendix A).

Information Clearinghouses

For the purpose of this report, information clearinghouses are differentiated from databases based on the nature of information provided. While databases are considered to have primarily product-specific CiP information, clearinghouses have a much broader focus. As illustrated by the chosen case study below, these source types act as central servers for academic and technical reports on a wide range of issues related to the construction industry and beyond.

Reporting Initiatives

Reporting initiatives are of two general types. The first includes guidelines that are published to standardize the way in which information about an organization or product is conveyed. While other information source categories, such as standards and certifications, may produce documents for this purpose for internal use, this category addresses reporting initiatives whose sole purpose is to standardize the collection of information for a variety of potential end uses.

The second type of reporting initiative includes steps taken voluntarily by product manufacturers to disclose CiP information about their products. This can take form as an internally generated product data sheet or sustainability report. This information is most often made publicly available through a specific manufacture's website, and is limited to the level of information a company chooses to disclose.

Trade and Industry Associations

These associations are membership-based groups of industry stakeholders. They represent the interests of their constituencies and often represent groups in legislative and regulatory matters. Trade organizations often function as a news and information outlet for the industry they represent. Therefore, major issues regarding chemical regulations are often reported on through these outlets. Though some information about the composition of products represented by the association may be available, they do not generally publish product-specific CiP information.

4.2 Selected Case Studies of Representative Information Sources

Pharos
Source: Health Building Network (HBN)
http://www.healthybuilding.net/
Publishing Country: United States
Source Type: Public Database

HBN is a non-governmental organization that developed, in partnership with the Cascadia Green Building Council and the University of Tennessee Center for Clean Products, the Pharos Project (www.pharosproject.net), a building materials rating tool, which considers product impacts to human health and the environment as well as social and economic impacts. In addition to administering the Pharos Project, HBN serves as a news outlet for health and regulatory information related to building products, and regularly publishes reports related to human health impacts of building materials.

Pharos is a web-based tool which seeks to provide transparent information and access to health and environmental data about the manufacture, use, and end of life of building materials.

While the targeted users of Pharos are building professionals involved in the specification and procurement of building materials, Pharos can be used by anyone who registers as a member of the system. The cost of registration is $75 annually and gives users access to detailed information on all products in the Pharos system. Currently, there are around 300 building products in seven material categories with a stated goal to add 125 additional products quarterly.

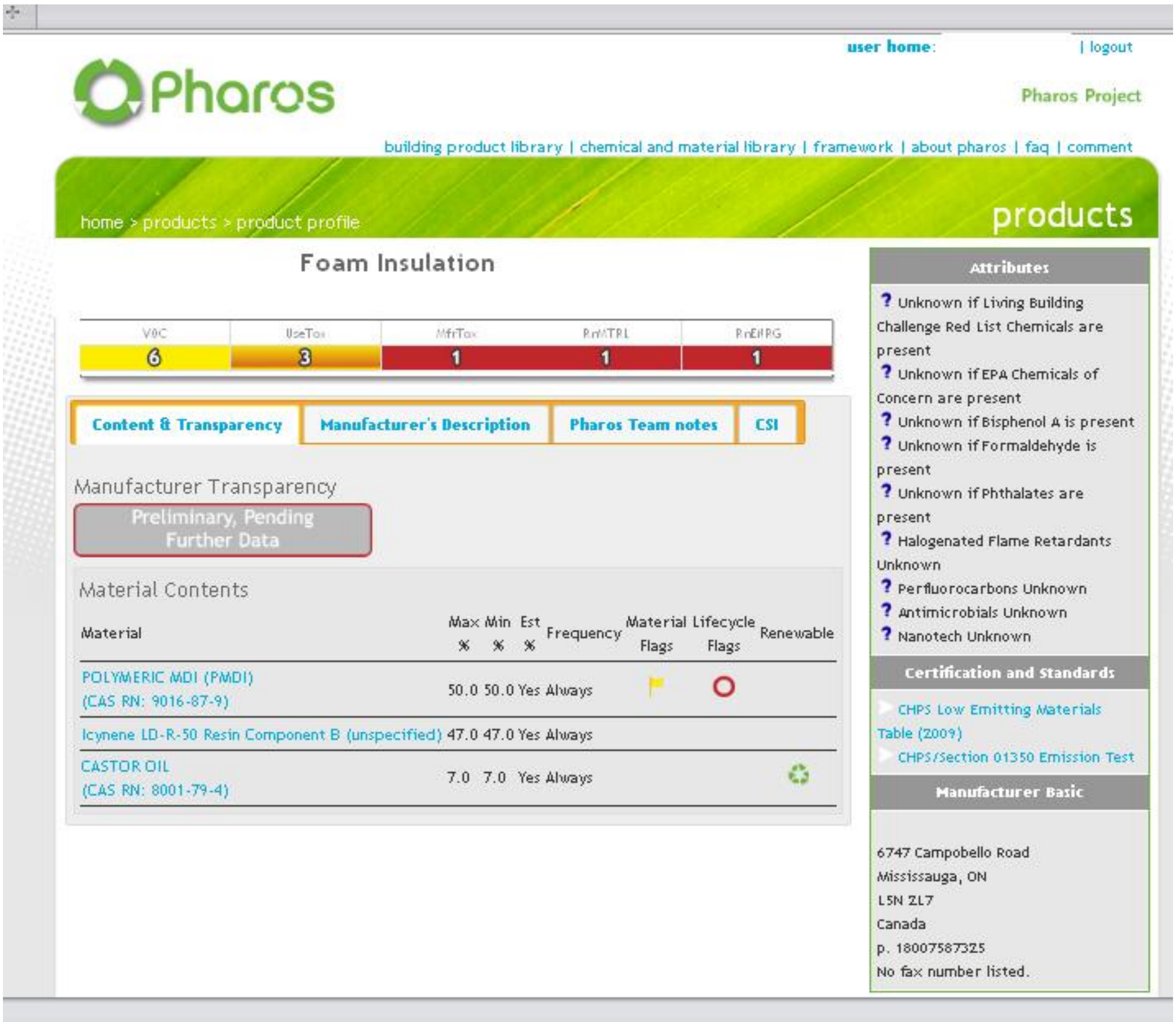
Pharos provides a multi-attribute analysis of impacts through numerical, color-coded scores across three main impact areas; Health and Pollution, Environment and Resources, and Social and Community. These categories are subdivided into 17 categories in varying stages of development. The Health and Pollution impact area currently address the chemical contents of products as they relate to the following categories: User Toxics, Manufacturing & Community Toxics, End of Life Toxics, and Volatile Organic Compounds.

Products listed in Pharos are scored on a ten-point achievement scale within each impact category. Level ten represents the ideal product in a given category and level one the worst. Each level in between represents a benchmark of achievement on the path to a defined ideal. Pharos does not combine individual category scores into a single numerical score for the product as a whole and does not encourage users to do this. Scores reflect relative benchmarks on the path to each category's ideal rather than absolute assessments that are comparable across categories. Pharos provides the data and the methodology behind the summary scores, allowing users to make their own conclusions about what is important about a product and which categories are most relevant to an individual user's purpose.

Pharos addresses CiP information by asking manufactures to fully disclose ingredients in their products. All product ingredients are then compare to the 'Chemical and Material Library' - an internal database which compiles health and safety information on over 9,000 chemicals and materials. Scores in various categories are then based on this information. Pharos users may also search the library for information on individual chemicals.

The level of participation and disclosure each manufacturer provides is reflected in the rating tool. Unverified and untested data is displayed as such to Pharos users, allowing them to make objective decisions based on available information. If manufacturers explicitly decline to participate, this decision is also made public to users. The lack of manufacturer participation and full disclosure is a limit to the Pharos system; however, Pharos addresses this problem by taking a precautionary approach when assigning ratings to products with incomplete and unverified data. Third-party documentation is not a requirement of Pharos, however, the level of documentation of data is accounted for in scoring protocols and is clearly conveyed. In general, manufacturers already marketing their products to the green building industry are generally more prepared to respond to demands for information.

Sample Screenshot of Typical Pharos Materials Description for a Product



The Chemical and Material Library accounts for direct health hazards by screening materials against 28 authoritative hazard listings to identify potential health hazards including persistent bioaccumulative toxicants (PBTs), and materials that cause cancer, genetic mutation, reproductive or developmental harm and endocrine disruption. Additionally, life cycle health hazards are addressed through identification of additional chemicals used, created and emitted throughout a material or chemical's life cycle.

Hazard Lists accounted for in the Pharos Chemical and Materials Library include:

- AOEC Asthmagens;
- CAL-EPA Prop 65;
- Cascadia Living Building Red List;
- ECHA REACH SVHC;
- European Commission Directive 76/769 CMR;

- European Commission Endocrine Disrupters Strategy;
- European Commission ESIS-PBT;
- European Commission Risk Phrases;
- European Commission EC Ozone depletion substances;
- IARC Cancer Monographs;
- *Lancet* Grandjean & Landrigan Neurotoxic Chemicals;
- OR DEQ Priority Persistent Pollutants;
- OSPAR Priority PBTs & EDs & equivalent concern;
- UNEP Stockholm Convention POPs;
- US EPA NCEA IRIS Carcinogens;
- US EPA NWMP Priority Chemicals (PBTs);
- US EPA Ozone Depleting Substances;
- US EPA Ozone Global Warming Potentials;
- US EPA PPT Priority PBTs;
- US EPA PPT Chemicals of Concern;
- US EPA TRI PBTs;
- US EPA TTN HAPs;
- US NIH NTP RoC;
- US NIH NTP CERHR Reproductive & Developmental Monographs;
- US OSHA Carcinogens;
- USEPA OPP FIFRA Registered Pesticides;
- USGBC LEED Pilot Credit 11; and
- Washington State PBTs.

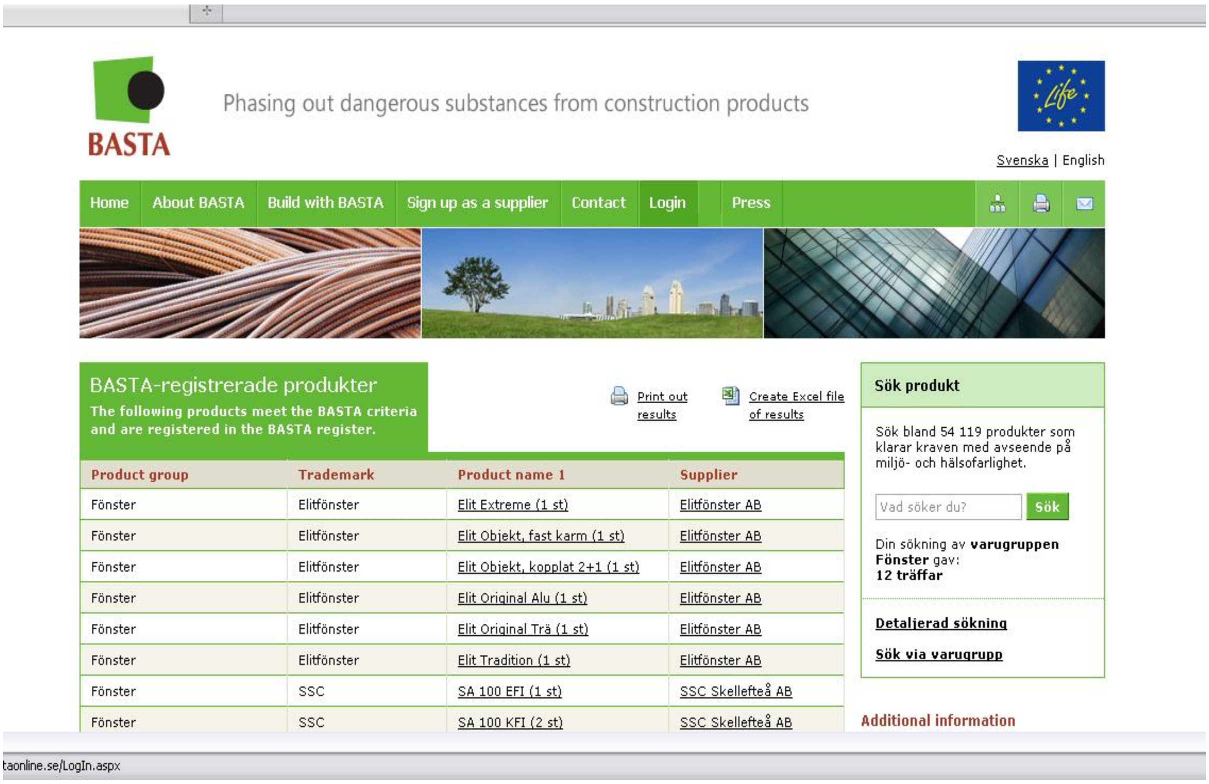
BASTA
www.bastaonline.se
Publishing Country: Sweden
Source Type: Public Database

BASTA is a non-profit jointly owned by IVL Swedish Environmental Research Institute and The Swedish Construction Federation. It is a free, publicly available, online database whose stated goal is to speed up the phasing out of hazardous substances in construction materials. BASTA publishes a searchable database of construction materials that comply with a set of voluntary criteria focused on environmental and human health impacts and building on the EU chemical legislation, REACH. While portions of the database are in English, the bulk of it is currently in Swedish. Due to increasing interest from other European countries, the remainder of the database may be translated into English in the near future.

For a product or material to be included in the BASTA database, the product supplier must perform a self-assessment of the material to determine whether it meets BASTA criteria. The material supplier is responsible for declaring the chemical composition of the product. BASTA states that suppliers must provide supporting documentation for the self-assessment, but does not specifically require third-party documentation. BASTA conducts regular system audits are performed to ensure that participating suppliers meet the terms of qualification, though it is unclear what these audits involve.

BASTA requires all listed products to meet REACH criteria, and specifically excludes products which contain chemical substances with the following properties: carcinogenic substances, mutagenic substances (cause heritable genetic damage), substances toxic to reproduction (impair fertility), persistent or very persistent organic substances (low degradability), bioaccumulative or very bioaccumulative organic substances (accumulate in tissue), substances harmful to the ozone layer, the content of lead, mercury and cadmium above regulated levels, and sensitizing substances, solvents, toxic and environmentally hazardous substances above certain levels.

Screenshot of BASTA registered products with links to manufacturer websites



LEED
US Green Building Council
http://www.usgbc.org
Publishing Country: United States
Source Type: Standards and Certifications

The U.S. Green Building Council is a non-profit organization that addresses building products and alternative green building products and practices, primarily through LEED, an internationally recognized green building certification program. LEED assesses materials and resources during both construction and operations phases. The material specific credit category encourages the selection of sustainably grown, harvested, produced and transported products and materials. It promotes the reduction of waste as well as reuse and recycling, and it takes into account the reduction of waste at a product's source.

The certification was developed to transform the way buildings and communities are designed, built and operated, enabling an environmentally and socially responsible, healthy, and prosperous environment that improves the quality of life. It is primarily geared toward building professionals, including architects, real estate professionals, facility managers, engineers, interior designers, landscape architects, construction managers, and lenders.

USGBC publishes multiple versions of the LEED Rating System for various building typologies including LEED for New Construction and Major Renovations (LEED – NC), a certification aimed at commercial and institutional buildings, and LEED for Homes, a certification aimed at residential homes. In general, the LEED rating systems are split into eight categories for evaluating various aspects of new home construction. Each category is broken down into credits; some prerequisite and others optional. A predetermined number of credits must be earned to achieve varying levels of LEED certification.

LEED 2009 offers several credit paths which addresses chemicals in materials. One path in Indoor Environmental Quality (IEQ) credit 3.2 includes testing of indoor air after building completion to prove certain concentration limits for formaldehyde, total volatile organic compounds (TVOCs), and 4-Phenylcyclohexene (4-PCH) where carpets and fabrics with styrene butadiene rubber (SBR) latex backing are used.

A second credit path in IEQ 4.3 addresses flooring and calls for use of low-emitting materials in flooring systems. The credit calls for carpet and padding to meet the requirements of the Carpet and Rug Institute Green Label Plus and for all hard surface flooring to meet the requirements of the FloorScore standard or, alternatively, interior flooring must meet the testing and product requirements of the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions. Exceptions are made for mineral-based flooring products such as tile, masonry, terrazzo, and cut stone without integral organic-based coatings and sealants and unfinished/untreated solid wood flooring.

A third credit path in IEQ 4.4 addresses composite wood and agrifiber products, prohibiting the use of added urea-formaldehyde resins.

LEED for Homes 2009 addresses CiP information in the Materials and Resources (MR) 2 credit category: Environmentally Preferable Products. MR 2.2 addresses specific assembly components giving limits for VOC emissions, prohibiting materials with added urea formaldehyde, requiring carpet and padding to meet the requirements of the Carpet and Rug Institute Green Label Plus and for all hard-surface flooring to meet the requirements of the FloorScore standard. The credit also calls for insulation material to be tested in accordance with California's 'Practice for Testing VOCS from Building Materials Using Small Chambers'.

In summary, LEED currently addresses CiP information related to VOCs, urea formaldehyde, and 4-phenylcyclohexene. Methods for addressing these chemicals include prescriptive guidelines for material selection as well as indoor air quality testing. Additionally, USGBE has launched "Pilot Credit 11: Chemical Avoidance in Building Materials" which more directly addresses chemicals of concern in building materials. The pilot credit prohibits interior finish materials that contain phthalates and halogenated flame retardants (HFRs). The credit also calls for a comprehensive evaluation of all interior finishing materials used as well as similar materials identified as industry standard with a focus on human health effects. The materials used must then be compared to materials identified as standard. LEED does not provide metrics to be used in this evaluation, but only requires that they be consistent. LEED stands to influence the availability of CiP information through its credit approach by placing manufacturers who do not disclose pertinent information at a disadvantage.

Carpet and Rug Institute (CRI) Green Label and Green Label Plus
http://www.carpet-rug.org/index.cfm
Publishing Country: United States
Source Type: Standards and Certifications (Industry-based)

The Carpet and Rug Institute (CRI) is a nonprofit trade association representing the manufacturers of more than 95 percent of all carpet made in the United States, as well as their suppliers and service providers. CRI presents extensive carpet information for consumers, writers, interior designers, specifiers, facility managers, architects, builders, building owners and managers, installation contractors and retailers. CRI conducts primary research and gathers data from other sources, which can be accessed from their website.

CRI created Green Label Plus to identify carpets and adhesives that are tested by an independent, certified laboratory and meet stringent criteria for low chemical emissions. The Green Label and Green Label Plus testing programs, overseen by independent labs, are designed for architects, builders, specifiers and facility managers who want assurances that carpet and adhesive products meet the most stringent criteria for low chemical emissions and help improve indoor air quality. Currently the program includes testing for carpet, cushion and adhesives, as well as vacuum cleaners.

Working in cooperation with California's Sustainable Building Task Force and the Department of Health Services Indoor Air Quality section, the carpet industry voluntarily enhanced its Green Label program for carpet and adhesives to meeting the testing protocol used by the Collaborative for High Performance Schools (CHPS). CRI has exceeded the CHPS criteria in several respects, including testing annually for specific chemicals, testing for six additional chemicals, maintaining a chain of custody process and performing an annual audit of the testing facility.

To receive Green Label Plus Certification, carpet and adhesive products undergo a series of rigorous testing processes, as required by Section 01350 guidelines that measure emissions for a range of chemicals (including six specified by Section 01350 plus an additional 7 VOCs as noted of special concern) and is administered by an independent laboratory. The test methodology for small scale environmental chamber testing was developed in cooperation with the U.S. EPA.

European Plastic Pipes and Fittings Association (TEPPFA)
http://www.teppfa.com/index.asp
Publishing Country: Belgium
Source Type: Trade Association

The European Plastic Pipes and Fittings Association (TEPPFA) is the European partnership of manufacturers of plastic pipe systems used in building, infrastructure and civil projects. The TEPPFA HSE Working Group deals with many interesting issues. But issues are not the only agenda items discussed by these industry representatives. Policies are also worked out and given a mandate for action.

TEPPFA plays a coordinating role in preparing its industry members for REACH legislation, supporting and providing guidance on new regulations of chemicals and their use in building products. Beyond following the REACH initiatives, TEPPFA has begun other environmental programs, for example collection and recycling schemes for post-consumer plastic pipe waste. Subsequently, many municipal authorities now insist that all the products they purchase are recyclable. As a mark of faith, the producers represented by TEPPFA signed a Voluntary Commitment, together with most other PVC producers and converters, to recycle increasing quantities of PVC waste. The industry also agreed to replace lead stabilizers.

Perhaps most importantly for CiP information, TEPPFA has commissioned independent LCAs of several applications of plastic piping commonly used in building projects, including:

- Polyethylene pipe systems for water distribution (PE);
- Cross-linked polyethylene pipe systems for hot and cold water for buildings (PEX);
- Polypropylene pipe systems for soil and waste removal in buildings (PP);
- PVC solid-wall sewer pipe systems for drainage and sewage (PVC).

The LCAs and third-party audits of the reports are posted publicly on the TEPPFA site.

The Council of European Producers of Materials for Construction (CEPMC)
http://www.cepmc.org/en/index.html
Publishing Country: Belgium
Source Type: Trade Association

The Council of European Producers of Materials for Construction (CEPMC) is a European confederation of national umbrella organizations. A typical CEPMC member federates a large number of national associations, which cover various types of construction materials and building products, including mineral, wood, plastic and metal-based products. CEPMC is constituted as an AISBL, a non-profit organization under Belgian law.

CEPMC represents the interests of its members at the European level and deals with a variety of issues. CEPMC acts as a liaison between its members and European governmental institutions as well as other construction industry associations, architects, contractors, and developers. It also engages European construction materials sector organizations, the majority of which have joined CEPMC as Associate Members.

CEPMC monitors European legislative, administrative and economic measures affecting the construction materials and building products industry and represents its membership's interest in the legislative process. Consensual industry views on important issues are posted to the CEPMC website along with position papers authored by CEMPC representatives. Examples of position papers addressing CiP information include "A harmonized approach relating to dangerous substances under the Construction Products Directive," and "Development of horizontal standardized assessment methods for harmonized approaches relating to dangerous substances under the construction products directive (CPD)." These position papers aid in ensuring that their members have information for providing consistent chemicals and product information, especially as relate to non-mandated data such as voluntary marks.

The CEPMC website provides links to position papers and technical reports regarding the CPD (end-of-use, possible use and dangerous substances), environment (eco-labeling, sustainable construction guides, and waste reduction), and mineral resources (critical raw materials, alternative materials, and waste).

V. Stakeholder Use of CiP Information: Needs and Constraints

Stakeholder needs and uses for CiP information were identified through both the literature search and survey process. For purposes of this section, stakeholder groups are organized according to stakeholder categories inside and outside the product chain as distinguished by Kogg and Thidell, with addition of subcategories unique to the building sector. These categories include:

Inside the supply chain:

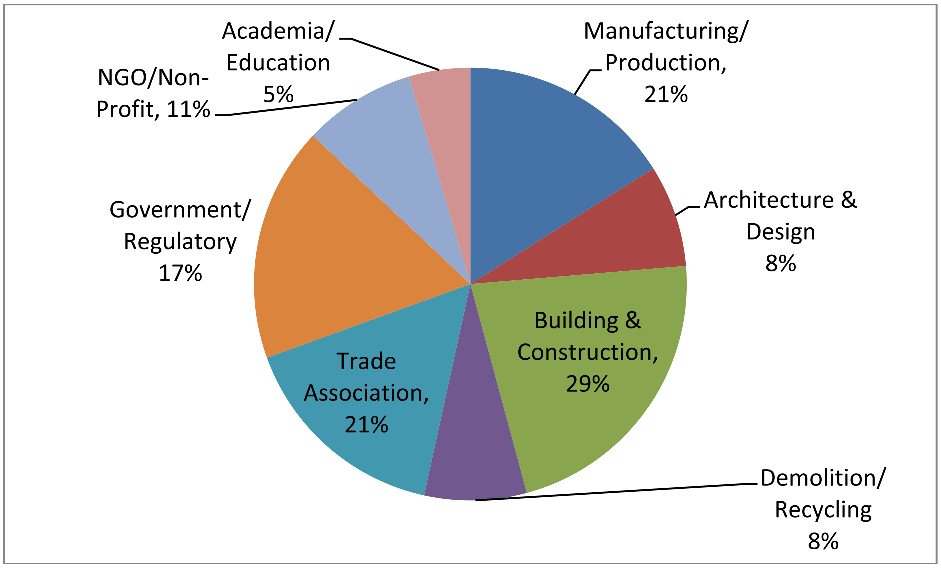
- Producers and Distributors
- Consumers
- End-of-life actors

Outside the supply chain:

- Government agencies and policy makers
- NGOs

For purposes of stakeholder aggregation, our survey respondents were asked to identify the sector in which they work. The corresponding distribution is shown in Figure 10.

Figure 10: Distribution of Professional Sector Representation, as Self-Reported by Survey Respondents

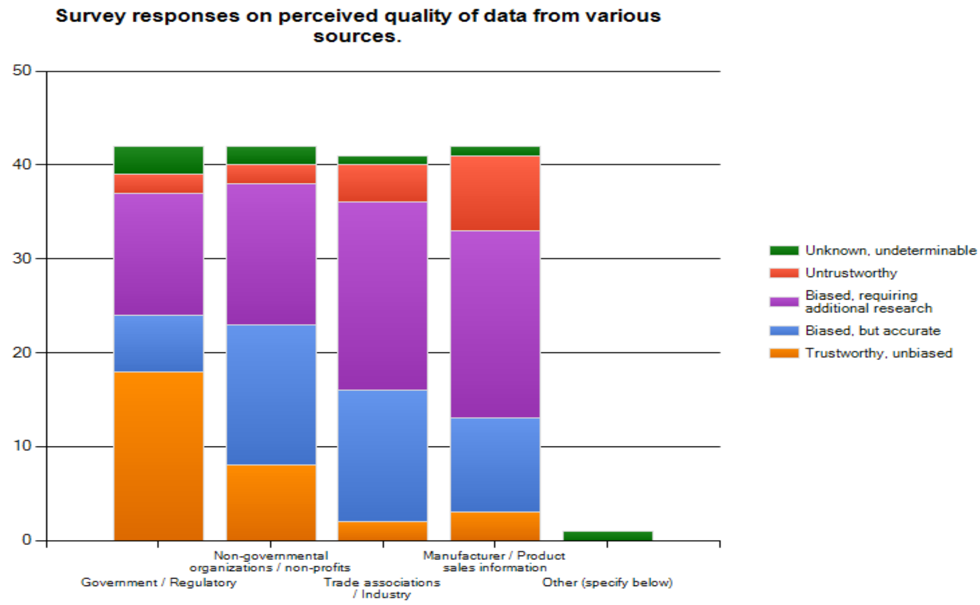


In survey results, 72% of survey respondents reported regularly seeking information about chemicals in building and construction materials, with another 24% of respondents saying that, while they do not currently seek such information, they plan to do so in the future. Key reasons for seeking such information across the survey group included risk reduction for the protection of workers, policy development, risk reduction for the protection of occupants, and public or consumer advocacy and protection.

In terms of the formats in which respondents commonly seek information, there were a few notable findings. While the most routinely sought sources of information were predictably from web-based systems (78.6%), this was closely followed by use of MSDSs (71.4%). The widespread use of MSDSs as a source of information, given their limitations, points to a need for better communication about what should be expected from such a report. In addition, information from manufacturers and trade associations (reports, product statements, marketing material, etc.) is often used as a key source of information (69%).

When asked about the quality of sources of data, respondents rated government sources as the most trustworthy and unbiased. NGOs and industry trade association information sources were almost equally ranked as biased but accurate, and manufacturer and industry trade associations were closely ranked as biased and requiring addition research (see Figure 11).

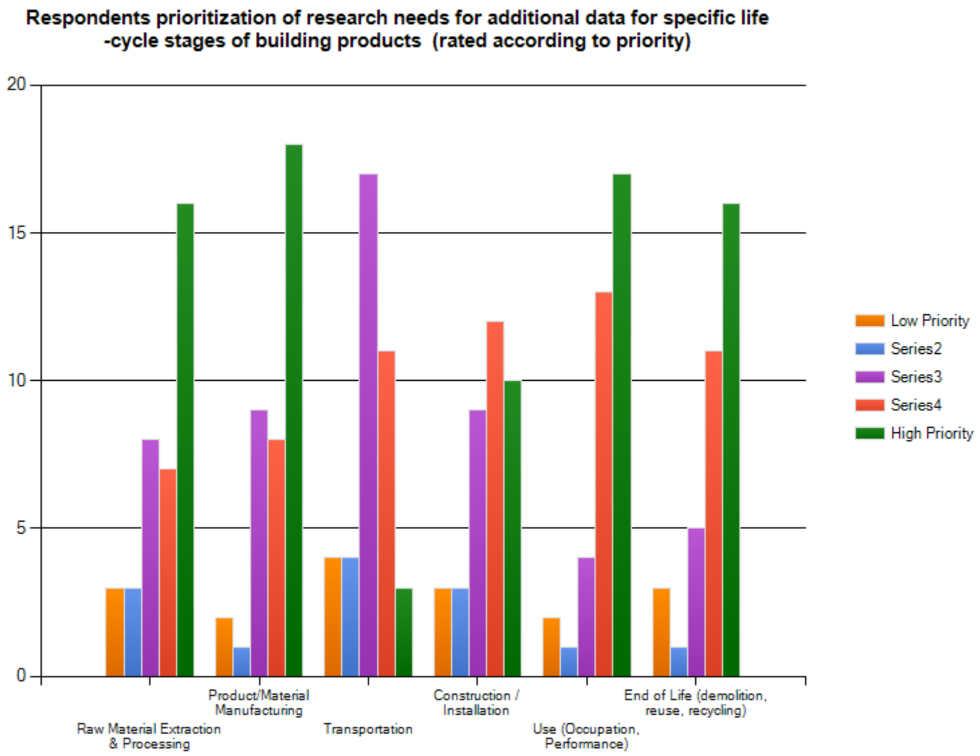
Figure 11:



In responses related to seeking CiP information for specific products, 62% of survey respondents stated that they do not find information when they need it. Further, for those that do find pertinent information, more than half report that the information found is inadequate, largely because it is not specific enough.

Respondents were also queried about their needs for chemical information across the product life-cycle. When asked whether respondents felt existing information systems provided balanced data across the life-cycle of most building and construction products, 77% of respondents said they do not currently provide balanced data. However, 50% of those respondents felt it was because the data for such information does not yet exist. When asked which life-cycle stages should be prioritized for future research to yield chemical-related information about building products, the highest rated lifecycle stages were the use phase (occupation and performance), product and material manufacturing, and end-of-life (demolition, reuse and recycling) (see Figure 12).

Figure 12:



In addition, there were several common concerns that were echoed across respondents in multiple stakeholder categories. The most common concerns included:

- Limited global regulation of CiP or chemicals of concern: several survey respondents referenced hopes that the requirements of REACH will make chemical information more available, and that the resulting information will trickle down for those seeking product information anywhere in the world.
- MSDSs, which are broadly relied upon as a source of information, often include proprietary or trademarked names for substances. As MSDSs are one of the most routinely found and used sources of information, these potential gaps in information make reliance upon them problematic.
- For those who seek and need information about chemicals in building products, an oft-cited issue was that substantive information takes too long to gather. Information must often be gathered from multiple sources and lists, requiring an assessment of varying data quality. Respondents report that trying to identify solid data is time consuming and difficult.
- Several comments reflected a concern that existing data, often designed for markets in the North America and Europe, do not adequately reflect chemical and material issues

for extremely humid or hot climates such as higher formaldehyde and VOC emissions that occur in hot climates.

- Data for the long-term reuse, recycling, and disposal implications for materials are often absent.

5.1 Producers/Distributors

Stakeholders in the production and distribution stage (generally referred to as manufacturers hereafter) of building materials and products have the most capability to provide CiP information regarding their products. Yet they also have unique constraints and drivers for the provision of such information. Some manufacturers, both for broad product sectors (ex., floor coverings, wood products) and for specific products have made laudable efforts at providing more transparent product information.

Chemicals and materials suppliers do not need information per se; they have access to the basic chemical information for everything they process and distribute. They are also the first-stage provider of reported information required for such documents as MSDSs. However, it is common practice for some ingredients or mixtures to be labeled as proprietary. As the primary intent of a MSDS is for conveying information about the chemical and physical properties of a material for use in an occupational or emergency response situation, the use of such reports as a chief source of environmental and human health information is awkward.

Manufacturers contacted for this case study stated specific needs and uses of chemical information related to their products. Many of the stated needs were common to any product sector; these included such needs as environmental, health and safety compliance for their employees and facilities, and selection of materials in compliance with regulatory and market-based standards and certifications. Other stated needs included compliance with corporate goals and provision of marketing and sales information about the “green” attributes of their products. A specific need voiced by manufacturers was timely information on chemicals that will trigger potential trade restrictions or barriers, so that they can appropriately communicate with importers.

One of the key CiP constraints stated by manufacturers was the difficulty in maintaining and tracking information on chemicals of concern (it should be noted that this was a common concern across all stakeholder groups). Manufacturers, in particular, noted the tremendous time and effort required to assess compliance with various regional and local requirements. In addition, manufacturers expressed frustration with the lack of standardized systems for communicating environmental impact. However, several manufacturers expressed the hope that full initiation of the REACH directive would make chemicals information easier to track.

5.2 Consumers

The consumer category for the building products sector is particularly complex—it represents a spectrum of stakeholders from architects and product specifiers to building occupants to a homeowner making decisions at their local hardware store. However, this was also the stakeholder segment that was most often cited as one of the key drivers for greater provision of CiP data in building products.

5.2.1 Architects/Designers

Architects and designers, in their unique role in both designing buildings and guiding specification decisions of materials use in buildings, are a key driver in this sector. In many ways, they are the intermediary between producers and other consumers who will be the ultimate occupants of buildings. As such, architects surveyed universally stated a desire and need for consistent and better information about chemicals in building products.

Architects surveyed for this case study expressed concern about the quality and completeness of current CiP data for the products that they use. Some respondents reflected on what they perceived as a lack of understanding in the architecture community about the true health and environmental impacts of chemicals of concern; respondents stated that many architects place "too much trust in the system," believing that if a chemical does not appear on a red list, then it must be fine. Further, red lists recognize known, "worst-in-class" chemicals, and may not include information about newer, untested materials. There were also stated concerns that the architectural community has limited knowledge about what government agencies do and do not regulate in terms of protecting public safety.

Stakeholders in this category also expressed frustration about the difficulty in finding CiP information for products in the time frame that is required for their decision-making. This frustration echoed those of producers who referenced the time-consuming nature of seeking out data related to specific materials. Architects and designers in Central America, the Middle East, and Southeast Asia stated frustration about the limitations of available information for their regions, largely because of lack of product information and performance data for hot and humid climates. A respondent from the United Arab Emirates commented that there need to be more precise data for insulation materials, glass U-values, and outer door-type electronics devices (such as electronic entry systems), which perform very badly in hot and humid climates. In addition, most available information is restricted to large, commercially-available products, which has limited use when trying to identify impacts of locally sourced, and sometimes handmade or artisanal products.

Cross-referencing performance data with CiP information was another area called out as time consuming and difficult. While disparate sources for both types of data may exist, a comprehensive collection of data addressing both data types at the same time is lacking. This lack of corresponding data impacts the ability of architects and designers to make material and design decisions in a timely manner without inevitably placing emphasis on one aspect or the other.

5.2.2 Building Occupants/Homeowners

Building occupants, including homeowners, are significant stakeholders for CiP information about building materials, especially when one considers how much time most individuals spend indoors, whether it be in schools, the workplace, or home. However, this was also the most difficult stakeholder group to adequately survey and pinpoint about their views on the availability of CiP information. Building occupants and homeowners need and want CiP information, but have the least role in providing information (other than in rare examples of individual bloggers).

Surveys and interviews with commercial property management and leasing organizations consistently stated the main need for CiP information as being risk reduction of potential health impacts of occupants (specifically concerns related to indoor air quality). In addition, respondents expressed seeking information related to impacts and opportunities for recycling and end-of-life disposition of construction materials. Respondents in this group also repeatedly referenced a lack of adequate information about end-of-life issues for materials.

When asked about the types of information that consumers, especially homeowners, request about building materials, both stakeholders from the architectural community and the NGO community report that homeowners typically want to know what chemicals or substances to avoid in order to limit personal risk. However, there is typically no depth of understanding about what associated risks or tradeoffs may be present. In addition, homeowners typically want to know which materials have attributes such as a high recycled content or preferable energy efficiency attributes. Further, homeowners often seek information about how to best dispose of construction materials in their own community.

5.3 End-of-Life Actors

Stakeholders at the end-of-life (EOL) of materials are those individuals or organizations involved in the collection, sorting, dismantling, processing, transport, recycling, and final disposal of waste. As stated in the above discussion of consumers, this may sometimes include homeowners. For building and construction products, it more typically includes construction companies, demolition companies, and waste haulers.

In survey responses, EOL stakeholders responded that their greatest need for CiP information is to ensure that materials being disposed are safe and appropriate for separation for recycling, incineration or land disposal. Many respondents stated that this information was not typically easy to come by, as large quantities of materials may be commingled for disposal. It was noted that while chemicals information may be available at the beginning of a building's useful life, this information is typically lost by the time a building is deconstructed. Further, one survey respondent from Southeast Asia commented that sometimes there is a lack of appropriate disposal facilities to manage waste containing materials such as asbestos.

5.4 Government

Governments possess a unique position related to CiP information. Governments have regulatory responsibility for ensuring safe products and protection of natural resources; this often includes such tasks as documenting and tracking uses of substances, procuring preferable products for government use, and investigating marketing claims. However, government rarely has a direct role in the production or manufacture of products, making them dependent on relationships and data from other stakeholders in the product chain.

Significant feedback was received from government stakeholders related to this case study. Government stakeholders stated key needs for information that assist in their mandates for risk reduction from hazards to public and environmental health, scientific data for setting public policy, and compliance with international rules and treaties such as the Stockholm and Rotterdam Conventions. In additional, government respondents have complex needs for chemical information for a variety of reporting needs, such as implementation of EPR and other product policies, annual materials recycling and disposal reports, etc.

Several government stakeholders reported using several CiP sources with success for their needs. Examples of useful information sources included:

- The Swedish database, BASTA (highlighted previously in the case studies)
- A Swedish building material assessment program called Byggvarubedömningen
- The EU Classification, Labeling, and Packaging Regulation.

5.5 NGOs

NGOs are performing a growing role in the provision of CiP information for building materials. While the sharing of such information is a traditional role for NGOs, the development of green building standards and certifications has elevated that role for this product sector.

NGO survey respondents highlighted their need for chemical information in their role of protecting public health and environmental advocacy, as well as to develop materials and lists related to green building compliance. But they also report that availability of such information is lagging behind the demand created by the green building marketplace. One survey respondent from Vietnam stated that “the existing resources on building materials without any specific information, just on vendor and products types is abysmal…we have a very long way to go." Other NGO respondents stated concern for lack of information about new materials, especially growing use of nanomaterials, in building materials, which have no required labeling.

VI. Potential ways to address the gaps and obstacles

Research results for this case study have identified significant background information on the types of existing CiP material available, as well as the use and perceived limitations of such information by those stakeholders seeking it. There are a variety of sources, of varying quality, that are commonly used, including eco-labels, reference lists of materials for green building certifications and standards, industry reporting initiatives, and so on. Existing resources such as BASTA in Sweden, NaturPlus, and the Pharos initiative were commonly cited as useful resources. However, in most cases, stakeholders find existing resources either inadequate for their needs or too time-consuming to use efficiently for their needs.

Many stakeholders stated a hope that pending regulatory systems or enhanced public databases would address some of these gaps. For example, many stakeholders referenced the intended information from REACH as a potential source which will reduce the time commitments for identifying pertinent chemical information about chemicals in building products. The recent ISO declaration, ISO 21930:2007, for "Sustainability in building construction – Environmental declaration of building products" establishes a methodology to ensure a transparent methodology for developing environmental product declarations for building products which will provide better consistency in EPDs. Similarly, stakeholders referenced the potential of information exchange from the European Construction Products Directive, as more harmonized product standards are developed.

In addition, numerous obstacles were cited in the exchange of chemical information in building products. Examples of reported obstacles, as discussed previously, include:

- Perceived lack of data and lack of data that is specific enough;
- Available information is more germane to European and North American countries;
- Time-consuming nature of finding CiP information, particularly amidst shifting regulatory requirements at local and regional levels;
- Time-consuming nature of cross-referencing performance data with CiP data;
- Potential gaps in data from existing chemical reporting mechanisms, such as MSDSs; and
- Poor CiP information for end-of-life disposition of materials.

As with many product categories, there was a perception that manufacturers of products are reticent to share chemical information. While this may sometimes be the case, especially with factors such as trademarked or proprietary substances, it was also noted by several manufacturers that sometimes they struggle to get adequate information on substances from their suppliers (this was especially a concern noted with recycled feedstocks). This admission indicates a potential willingness of manufacturers to provide more information to the market.

Stakeholders across all categories stated a belief that part of the problem with provision of chemicals information for building materials is that the information simply has not been collected or is not available.

Ultimately, the question of how to best facilitate the exchange of chemicals information in building products is quite germane. Stakeholders across all stakeholder categories reported limitations and perceptions of inadequate or non-existent information exchange. While existing systems are a laudable starting point, a number of opportunities and suggested collaborations have been identified for potential improvements.

6.1 Leverage the Role of Green Building Standards & Certification Programs

Given the growth in green building certifications and standards, as well as the growing network of regionally- and country-specific green building councils, an opportunity exists to leverage these as information exchange resources. Green building standards are continuously in the process of developing future versions with updated requirements, and can serve in a powerful supply-and-demand position. Many prominent green building standards have fairly open and transparent standard development processes; the managing organizations of such programs would likely be receptive to partnering to discuss enhanced CiP needs for the building product sector.

There are many types of needed CiP information identified through this case study that could be prioritized for inclusion in future versions of standards. An example includes requirements to maintain long-term CiP information for specific products within the reporting and maintenance requirements for building certification; this would mitigate EOL information needs when buildings are refurbished or materials are reused.

Another opportunity exists with the expansion of green building councils in various geographic regions; regionally-specific criteria can be defined that address unique materials and climate needs. Currently there are more than 70 national member councils under the World Green Building Council (WGBC); these councils are in various stages of membership. However, these organizations are an active and growing driver for green building information, including CiP information. In a recent survey conducted by the green building industry publication *Green Business Insider,* 47 WGBC councils were surveyed about the status and expectations for the green building industry in their countries; the survey shows expectations of 100 percent growth in council membership and at least a doubling of certified green buildings in the next five years (see Table 3).[82]

Table 3: Expectations for Growth in Green Building Council Membership and Certified Buildings by 2015

Country	Current Number of Members (est.)	Expected Members in 2015	Current Number of Certified Buildings (est.)	Expected Certified Buildings in 2015
Botswana	20	1,000+	0	10
Brazil	420	1,100 companies	20	260
Bulgaria	60 member companies	400	2	50-100
Colombia	130	650	1	60+
Costa Rica	550 prospective on the list for launch	5,000 or more	2	200
Croatia	18	150	0	3-5
Czech Republic	63	120	2	30
Dominican Republic	40	100s	3	25
Ecuador	10	150	0	5
Egypt	1,000	200,000	30	500
Germany	950	2,500	~180	5,000+
Greece	10	500+	8	10-20
Guatemala	20	1,000	3	14
Hong Kong	200	1,000+	400+	5,000
Hungary	29 (companies and individuals)	Questionable	1	--
India	--	--	--	--
Indonesia	90	400	--	100
Ireland	17 founding member organizations	15-200 organizations +individuals, students	Perhaps 6 LEED + some BREEAM	Unknown
Israel	40	600-700	7	About 500
Japan	31	5-10	125	200-300
Jordan	200	2,000	1	50
Korea	200+	1,000+	384 plus, less than 5 LEED	2,000+
Mauritius	0	"Can't forecast. 1,000 member organizations?"	1	30
Mexico	60	500	104	--
Netherlands	320 organizations	500	15	1,000
Palestinian Authority	20	At least 500	0	At least 10
Panama	90	500	1	20
Peru	50	250	3	50
Philippines	200 companies +	1,000 corporate	2 (LEED)	50 (BERDE)

	200 individuals	members		
Qatar	65+	100+	--	500
Romania	103	750+	10	200+
Russian Federation	120	2,000	1	500-1,000
Singapore	250	500	450	800
Slovenia	11	100	2	30
South Africa	730	1,000	3	100
Spain	100	300	8	100
Syrian Arab Republic	0	1,000	0	--
Thailand	30	1,000	180	1,000
United Arab Emirates	250	1,000	15	100
United States	16,000	--	16,048 (LEED)	--
Uruguay	5	60	0	30-50
Venezuela	10	100	--	100+

Source: *Green Building Insider, 2010.*

6.2 Promote Standardized Reporting of Environmental Data

A common frustration amongst stakeholders was lack of knowledge about differing reporting requirements across various regulatory platforms. One option for future discussion is identifying opportunities to better standardize reporting of environmental data. An example of one such "success story" would be the expanding use of the Globally Harmonized System of Classification and Labeling of Chemicals, or GHS; the GHS is now being cited in developing standards for products such as paints and cleaning chemicals.

Further, there may be opportunities for better outreach to stakeholders about what type of information they should and should not expect from certain reports. It may be useful to develop a common resource, akin to a "frequently asked questions" reference for the broad community of stakeholders to access as they determine whether a resource such as an MSDS, product declaration, or life-cycle study serves their information needs.

6.3 Support development of additional life-cycle research

While much life-cycle research has been done, an obstacle noted in this case study is the real and perceived lack of balanced life-cycle data for many building products. This was cited by many survey respondents as a need behind their belief that much of the scientific data for CiP information for this sector "does not exist." An option for potential discussion might include identification of priority materials and building materials for which no life-cycle data has been developed. An important issue to consider for this recommendation would be the time and resource requirements of rigorous collection of life cycle data; this constraint would suggest a need to select key subsets of the building products sector for prioritization of data collection. Yet another opportunity may exist to commission a study of emerging or newer technologies, such as nanomaterials or antimicrobials, which are increasingly being used in multiple product sectors.

Another item for discussion would be to potentially provide a central funding mechanism to support broad reporting of information collected for other studies. In many circumstances, academics doing LCAs for specific projects have collected large quantities of data from the industry or market sector of interest for a particular project. Much of this data is not passed into publicly-available databases. This is often not due to confidentiality requirements, but rather is due to a lack of resources to organize the data into a publicly-useful format once the original project has been completed. A central funding mechanism could efficiently use relatively modest resources to provide grants to "mine" and refine these sources of valuable data.

6.4 Provide ways for architects, designers, and specifiers to cross-reference performance and application data with CiP information

When selecting a building material appropriate for specific applications, architects, designers, and specifiers must take into account myriad aspects of a material's physical, chemical, and aesthetic properties. Materials must be selected to serve specific functional and aesthetic requirements while meeting health and environmental standards. This selection process requires constant cross-referencing of different types of data. Existing information sources do not adequately address the needs of this design process in a central manner. For example, a designer might be searching for formaldehyde free insulation. While existing sources may provide a list of formaldehyde-free insulation materials, a designer will typically still need to explore each product to determine its specific performance qualities including r-value per unit thickness, type of facing used, whether it acts as a vapor barrier, air barrier, or moisture barrier. These specific performance qualities are not addressed through broad categories of organization (i.e. "insulation") often seen with CiP data sources.

VII. Conclusions

This case study has established that useful information systems are on the increase for CiP information in building materials, yet there is a significant unfulfilled need for information. The need is global and spans stakeholder groups. But there are unique challenges faced by economies in transition and southern hemisphere countries, which are presently forced to rely on predominantly European and North American information resources, which often have limited applicability to both available products and regional climate pressures.

In addition to follow-up discussions about some of the recommended opportunities for bridging gaps in information sources and flows, there are also future research opportunities that may have value. While the analysis of broad product sectors is quite illuminating, a sector such as building materials is almost too large to identify a “one size fits all” solution to information provision. It would be useful to conduct a study of a focused subset of building materials with specific chemical information needs and outcomes, for example chemical information related to interior finishes, which can have significant indoor air quality implications. By conducting a study with a more constrained product scope, it might be possible to develop working relationships with key stakeholders in the product chain, and identify and test different methods for sharing information. Such a study would inform the creation of mechanisms for information sharing between stakeholders that could be modeled and replicated across products and product sectors.

Finally, the confluence of traditional drivers such as mandated regulatory reporting requirements and more recent voluntary certification and standards programs creates a timely opportunity for greater discussion and partnerships for provision of CiP information for building materials. In the past, the provision of CiP information in the building materials industry has been more of a struggle on the demand side, with government, NGOs and consumers desiring information and feeling the need to create it themselves. However, increasingly, manufacturers of building products want to provide more information to the market, in order to be a player in the growing green building industry. This suggests a brighter future for chemical disclosure if the market pressure of certifications and public policy can be efficiently harnessed.

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Appendices

Appendix 1: Table 1 - Information Sources Related to CiP information on Building Products

Source	Country / Scope	Organization Type	Information Focus	Audience	Website
Argentina Green Building Council	Argentina	Professional Organization; Non-Profit	General Environmental Building	Professionals	http://www.argentinagbc.org.ar/
Australian Building Codes Board (ABCB)	Australia	Government	Design Standards	Professionals; Regulatory Agencies	http://www.abcb.gov.au/
Australian Housing Industry Association (HIA)	Australia	Trade Association	General Building	Professionals	http://hia.com.au/
Commonwealth Scientific and Industrial Research Organization (CSIRO)	Australia	Non-governmental Organization	General-Standards	Professionals; Standard Developers	http://www.csiro.au/
NSW Government: National Australian Built Environment Rating System (NABERS)	Australia	Governmental	General- Existing Building Environmental Rating System	Professionals; Consumers; Regulatory Agencies	http://www.nabers.com.au/default.aspx
Austria Green Building Council (ÖGNI): Blue Buildings	Austria	Professional Organization	General Green Building; Design Standard or Guide	Professionals	http://www.ogni.at/
European Alliance of Companies for Energy Efficiency in Buildings (EuroACE)	Belgium / Europe	Non-governmental Organization	General: Energy Efficient Building	Professionals; Standard Developers	http://www.euroace.org/
Industrial Minerals Association (IMA Europe)	Belgium / International	Trade Association	Regulatory; Policy; Industry Representation	Manufacturers; Standard Developers; Regulatory Agencies	http://www.ima-eu.org/
Society of Environmental Toxicology and Chemistry (SETAC)	Belgium / International	Non-profit	General Environmental Chemistry; Policy; Health	Professionals; Standard Developers; Regulatory Agencies	http://www.setac.org/
Green Building Council Brasil	Brazil	Professional Organization; Non-Profit	General Green Building; Design Standard or Guide	Professionals	http://www.gbcbrasil.org.br/in/index.php
Bulgarian Sustainable Building Council	Bulgaria	Professional Organization	General Green Building	Professionals	http://www.bgsbc.org/?lang=en

Appendix 1: Table 1 - Information Sources Related to CiP information on Building Products (Continued)

Source	Country / Scope	Organization Type	Information Focus	Audience	Website
Chrysotile Institute	Canada / International	Industry Association	Regulatory; Health and Environment; General Chrysotile Information	Professionals; Standard Developers; Regulatory Agencies	http://www.chrysotile.com
International Initiative for a Sustainable Built Environment (iiSBE)	Canada / International	Non-governmental Organization	General Green Building; Information Dissemination	Professionals; Standard Developers	http://www.iisbe.org/
British Columbia Building Code: Green Building Code (under development)	Canada / North America	Non-governmental Organization	Design Standard or Guide; Regulatory	Professionals; Standard Developers; Regulatory Agencies	http://www.bccodes.ca/bccode_building.htm
Canada Green Building Council	Canada / North America	Professional Organization; Non-Profit	Design Standard or Guide	Professionals	http://www.bccodes.ca/bcgreencode.htm
Canadian General Standards Board	Canada / North America	Government	Standard Development; Certifications	Standard Developers; Professionals; Regulatory Agencies	http://www.tpsgc-pwgsc.gc.ca/cgsb/home/index-e.html
Ecolabel Index	Canada / North America	Web Publication	Directory of Label and Certification Programs	Professionals; Standard Developers; Consumers	http://www.ecolabelindex.com/
Green Globes Environmental Rating System	Canada / North America	Label or Standard	Design Standard or Guide	Professionals; Consumers; Standard Developers	http://www.greenglobes.com/
Green Building Council Chile	Chile	Professional Organization	General Green Building	Professionals	http://www.chilegbc.cl/chilegbc/www/admintools/index.asp
CCPIT China Council for the Promotion of International Trade	China	Trade or Industry Association	General Trade	Professionals; Manufacturers	http://www.ccpit.org/
China Building Materials Information (BMI)	China	Trade or Industry Association	General Materials Trade Information	Professionals; Manufacturers	http://www.cbminfo.com/Default.aspx?alias=www.cbminfo.com/e
China Building Materials Market Association	China	Trade or Industry Association	General Materials Trade Information	Professionals; Manufacturers	http://www.cbmmarket.com/

Appendix 1: Table 1 - Information Sources Related to CiP information on Building Products (Continued)

Source	Country / Scope	Organization Type	Information Focus	Audience	Website
Colombia Green Building Council (CCCS) (Under Development)	Colombia	Professional Organization	General Green Building	Professionals	http://www.cccs.org.co/
Costa Rica Green Building Council	Costa Rica / Central America	Professional Organization	General Green Building; Design Standard or Guide	Professionals	http://www.crgbc.org/
Green Building Council of Croatia	Croatia	Professional Organization	General Green Building	Professionals; Manufacturers	http://www.gbccroatia.org/en/
Czech Green Building Council	Czech Republic	Professional Organization	Material Directory or Database; Design Standard or Guide	Professionals; Manufacturers	http://www.czgbc.org
Dominican Republic Green Building Council	Dominican Republic	Professional Organization	General Green Building	Professionals; Manufacturers	http://www.drgbc.org/letter_from_our_president
Emirates Green Building Council	Dubai	Professional Organization; Non-Profit	Policy; General Green Building	Professionals; Manufacturers	http://www.emiratesgbc.org/egbc/
Ecuador GBC	Ecuador	Professional Organization	General Green Building	Professionals; Manufacturers	http://www.ecuadorgbc.org/
Egypt Green Building Council	Egypt	Professional Organization	General Green Building	Professionals; Manufacturers	http://egypt-gbc.org/
European Coal Combustion Products Association (ECOBA)	Europe	Industry Association	General Coal Combustion Product Information	Professionals; Manufacturers; Consumers	http://www.ecoba.com/
The Building Information Foundation (RTS)	Finland / Europe	Non-profit	Material Directory or Database; Design Standard or Guide	Professionals; Standard Developers; Academia	http://www.rakennustieto.fi/index.html
International Union of Laboratories and Experts in Construction Materials, Systems and Structures (RILEM)	France / Europe	Non-governmental Organization	Materials Science	Professionals; Manufacturers; Academia	http://www.rilem.net/

Appendix 1: Table 1 - Information Sources Related to CiP information on Building Products (Continued)

Source	Country / Scope	Organization Type	Information Focus	Audience	Website
German Sustainable Building Council (DGNB)	Germany	Professional Organization; Non-Profit	Design Standard or Guide; General Green Building	Professionals	http://www.dgnb.de/_en/
Guatemala Green Building Council	Guatemala	Professional Organization	General Green Building	Professionals	http://www.guatemalagbc.org/
Hungary Green Building Council (HuGBC)	Hungary	Professional Organization	General Green Building	Professionals	http://www.hugbc.org/
Indian Green Building Council	India	Professional Organization	Design Standard or Guide; General Green Building	Professionals	http://www.igbc.in/site/igbc/index.jsp
Indonesia Green Building Council	Indonesia	Professional Organization	General Green Building	Professionals	http://www.gbcindonesia.org/
International Construction Information Society	International	Non-governmental Organization	Specification Standards	Professionals; Consumers; Standard Developers	http://www.icis.org/
International Trade Administration	International	Government	Regulatory	Regulatory Agencies; Professionals; Manufacturers	http://trade.gov/
Intertek	International	Corporation	Materials Testing Services	Professionals; Manufacturers	http://www.intertek.com/
Israel Green Building Council	Israel	Professional Organization	General Green Building	Professionals	http://www.ilgbc.org/
Green Building Council Italia	Italy	Professional Organization	Design Standard or Guide; General Green Building	Professionals	http://www.gbcitalia.org/
Japan Sustainable Building Consortium (JSBC): CASBEE	Japan	Professional Organization	Design Standard or Guide	Professionals; Standard Developers	http://www.ibec.or.jp/CASBEE/english/index.htm

Appendix 1: Table 1 - Information Sources Related to CiP information on Building Products (Continued)

Source	Country / Scope	Organization Type	Information Focus	Audience	Website
Jordan Green Building Council	Jordan	Professional Organization; Non-Profit	General Green Building	Professionals	http://www.jordangbc.org/
Korea Sustainable Building Council (KGBC)	Korea	Professional Organization	General Green Building	Professionals	http://www.hkpgbc.org/page5_5_4.html
Mexico Green Building Council	Mexico	Professional Organization	General Green Building	Professionals	http://www.mexicogbc.org/
Morocco Green Building Council (Under Development)	Morocco	Professional Organization	General Green Building	Professionals	http://www.moroccogbc.org/
New Zealand Green Building Council	New Zealand	Non-profit; Professional Organization	Design Standard or Guide; General Green Building	Professionals	http://www.nzgbc.org.nz/main/
Environmental Health Association of Nova Scotia (EHANS)	Nova Scotia	Non-governmental Organization	Health	Professionals; Consumers	http://www.environmentalhealth.ca/
Green Building Council of Panama	Panama	Professional Organization	General Green Building	Professionals	http://www.panamagbc.org/
Peru Green Building Council	Peru	Professional Organization	General Green Building	Professionals	http://www.perugbc.org.pe/
Philippine Green Building Council	Philippines	Professional Organization; Non-Profit	General Green Building	Professionals	http://philgbc.org/
Polish Green Building Council	Poland	Professional Organization	Material Directory or Database; Design Standard or Guide	Professionals	http://www.plgbc.org/
Qatar Green Building Council	Qatar	Professional Organization	Material Directory or Database; Design Standard or Guide	Professionals	http://www.qatargbc.org/index.php

Appendix 1: Table 1 - Information Sources Related to CiP information on Building Products (Continued)

Source	Country / Scope	Organization Type	Information Focus	Audience	Website
Romania Green Building Council	Romania	Professional Organization; Non-Profit	Material Directory or Database; Design Standard or Guide	Professionals	http://www.rogbc.org/
Green Building Council Russia	Russia	Professional Organization	General Green Building	Professionals	http://www.rugbc.org/
Singapore Green Building Council: Singapore Green Building Product Certification	Singapore	Professional Organization	Material Directory or Database; General Green Building	Professionals	http://www.sgbc.sg/
Green Building Council of South Africa	South Africa	Professional Organization	General Green Building	Professionals	http://www.gbcsa.org.za/home.php
Green Building Council España	Spain	Professional Organization	General Green Building	Professionals	http://www.gbce.es/
Byggvarubedömningen	Sweden	Non-governmental Organization	General Green Building; Design Standard or Guide	Professionals	http://www.byggvarubedomningen.se/sa/node.asp?node=455
Sweden Green Building Council	Sweden	Professional Organization; Non-Profit	General Green Building	Professionals	http://www.sgbc.se/
Swedish National Testing and Research Institute	Sweden / Europe	Government	Material Testing and Technology	Regulatory Agencies; Professionals	http://www.sp.se/en/Sidor/default.aspx
EMPA: Swiss Federal Laboratories for Materials Science and Technology	Switzerland / International	Government	Material Science and Technology	Professionals; Standard Developers; Manufacturers	http://www.empa.ch/plugin/template/empa/3/*/---/l=2
International Organization for Standardization (ISO)	Switzerland / International	Non-governmental Organization	Policy; Standard Development	Professionals; Standard Developers; Regulatory Agencies	http://www.iso.org/iso/home.html
Taiwan Green Building Council	Taiwan	Professional Organization	General Green Building	Professionals	http://www.taiwangbc.org.tw/

Appendix 1: Table 1 - Information Sources Related to CiP information on Building Products (Continued)

Source	Country / Scope	Organization Type	Information Focus	Audience	Website
Dutch Green Building Council	The Netherlands	Professional Organization; Non-Profit	Material Directory or Database; Design Standard or Guide	Professionals	http://www.dgbc.nl/
CEDBIK Turkish Green Building Council	Turkey	Professional Organization	Material Directory or Database; Design Standard or Guide	Professionals	http://www.cedbik.org/
U.K. Green Building Council	United Kingdom	Professional Organization; Non-Profit	Material Directory or Database; Design Standard or Guide	Professionals; Standard Developers	http://www.ukgbc.org/site/home
United Kingdom Department for Communities and Local Government: Code for Sustainable Homes	United Kingdom	Government	Regulatory; Design Standard or Guide	Professionals; Consumers; Standard Developers	http://www.communities.gov.uk/planningandbuilding
WRAP: Material Change for a Better Environment	United Kingdom	Non-profit	General Green Materials	Consumers; Professionals	http://www.wrap.org.uk/
Building Research Establishment (bre)	United Kingdom / Europe	Non-governmental Organization	Third-party Certification	Professionals; Regulatory Agencies; Manufacturers	http://www.ecosite.co.uk/depart/backinfo/bldmat.htm,
BREEAM Environmental Assessment Method	United Kingdom / International	Label or Standard	Design Standard or Guide	Professionals; Consumers; Standard Developers	http://www.breeam.org/
CERAM	United Kingdom / International	Non-governmental Organization	Materials Testing	Professionals; Standard Developers	http://www.ceram.com/
Sustainable Build UK	United Kingdom / International	Non-governmental Organization	Material Directory or Database; Design Standard or Guide	Professionals; Standard Developers; Regulatory Agencies	http://www.sustainablebuild.co.uk/
American Concrete Institute	United States	Industry or Trade Association	Regulatory; Material Directory or Database; Concrete	Professionals	http://www.concrete.org/general/home.asp
American National Standards (ANSI)	United States	Standard Developer	Standards	Professionals; Regulatory Agencies; Manufacturers	http://www.ansi.org/

Appendix 1: Table 1 - Information Sources Related to CiP information on Building Products (Continued)

Source	Country / Scope	Organization Type	Information Focus	Audience	Website
Building Green, LLC: Environmental Building News and GreenSpec	United States	LLC	Material Directory; General Green Building	Professionals	http://www.buildinggreen.com/menus/
Energy and Environmental Building Alliance, The	United States	Non-governmental Organization	General Green Building; Design Guidelines	Professionals; Consumers	http://www.eeba.org/
EPA Industrial Materials Recycling	United States	Government	Regulatory; Policy; Recycled Building Materials	Professionals	http://www.epa.gov/osw/conserve/rrr/imr/
Green Building Products Coalition (Under Development)	United States	Coalition	Material Directory or Database; Design Standard or Guide	Professionals; Standard Developers; Regulatory Agencies	http://www.greenbuildingproductscoalition.org/
Green Building Resource Guide	United States	Non-profit	Material Database; General Green Building	Professionals; Standard Developers	http://www.greenguide.com/
Healthy Building Network (HBN): The Pharos Project	United States	Non-governmental Organization	Material Directory; General Green Building	Professionals; Consumers; Standard Developers	http://www.pharosproject.net/
National Association of Home Builders	United States	Industry or Trade organization	Material Directory or Database; Design Standard or Guide	Professionals; Standard Developers; Regulatory Agencies	http://www.nahb.org/
National Center for Healthy Housing	United States	Non-profit	General Green Building	Professionals; Consumers; Standard Developers	http://www.nchh.org/Home.aspx
National Institute of Building Sciences: Whole Building Design Guide:	United States	Government	Regulatory; Policy; Design Standard or Guide	Professionals; Standard Developers	http://www.wbdg.org/
Peaks to Prairies: Pollution Prevention Information Center	United States	Government	Policy; Regulatory; Pollution Prevention	Professionals; Standard Developers; Regulatory Agencies	http://peakstoprairies.org/
Southern Building Code Congress International, Inc. (SBCCI)	United States	Non-governmental Organization	Building Code; Regulatory	Professionals; Standard Developers; Regulatory Agencies	http://www.standard-building-code.com/sbcci-

Appendix 1: Table 1 - Information Sources Related to CiP information on Building Products (Continued)

Source	Country / Scope	Organization Type	Information Focus	Audience	Website
US Green Building Council: Green Home Guide	United States	Government	General Green Building; Design Guidelines	Professionals	http://greenhomeguide.com/
Asbestos.net- Building Materials and Asbestos Exposure	United States / International	Non-governmental Organization	Material Directory or Database; Health; General-database of building products containing	Consumers; Professionals; Regulatory Agencies	http://www.asbestos.net
Building Code Discussion Group (BCDG)	United States / International	Non-governmental Organization	Discussion Forum; General Building	Professionals; Standard Developers	http://bcodes.infopop.cc/eve
Construction Specifications Institute	United States / International	Non-governmental Organization	Specification Standards	Professionals; Consumers; Standard Developers	http://www.csinet.org/default.aspx
Engineered Wood Association, The	United States / International	Trade Association	Wood products	Professionals; Manufacturers; Consumers	http://www.apawood.org/
Evergreen Building Products Association, The (EBPA)	United States / International	Trade Association	Wood products	Professionals; Manufacturers; Consumers	http://x.ep.org/
Green Building Pages	United States / International	Non-profit	Material Database; General Green Building	Professionals; Consumers; Academia	http://www.greenbuildingpages.com/
Green Guard Environmental Institute	United States / International	Certification Agency	Material Directory or Database	Professionals; Standard Developers	http://www.greenguard.org/en/index.aspx
International Code Council: International Green Construction Code	United States / International	Non-profit	Regulatory; Policy; Building Codes	Professionals	http://www.iccsafe.org/Pages/default.aspx
International Living Building Institute: Living Building Challenge	United States / International	Non-governmental Organization	Material Directory or Database; Design Standard or Guide	Professionals; Standard Developers	http://ilbi.org/
McGraw Hill Construction: Sweets Network	United States / International	Non-governmental Organization	Material Directory or Database; General Building	Professionals; Consumers	http://products.construction.com/

Appendix 1: Table 1 - Information Sources Related to CiP information on Building Products (Continued)

Source	Country / Scope	Organization Type	Information Focus	Audience	Website
World Green Building Council	United States / International	Professional Organization; Non-Profit	Directory of Green Building Councils	Professionals	http://www.worldgbc.org/index.php
Cascadia Green Building Council	United States / North America	Professional Organization; Non-Profit	General Green Building	Professionals; Standard Developers	http://cascadiagbc.org/
Collaborative for High Performance Schools	United States / North America	Non-governmental Organization	Material Directory or Database; Design Standard or Guide	Professionals; Standard Developers	http://www.chps.net/dev/Drupal/node
Western Building Materials Association (WBMA)	United States / Regional	Trade Association	Regulatory; Design Standard or Guide	Professionals; Manufacturers	http://www.wbma.org/
Oikos Green Building Source	Unknown	Online Publication	General Green Building; Material Database	Professionals; Consumers	http://oikos.com/
Uruguay Green Building Council	Uruguay	Professional Organization; Non-Profit	General Green Building	Professionals	http://www.uygbc.org/
Venezuela Green Building Council (Under Development)	Venezuela	Professional Organization; Non-Profit	General Green Building	Professionals	None
Vietnam Green Building Council	Vietnam	Professional Organization; Non-Profit	General Green Building	Professionals	http://www.vgbc.org.vn/

Appendix 1: Table 2 - EcoLabels Related to CiP information on Building Products

Label	Managing Organization (if Applicable)	Type	Country	Covered
Albania Green Building Council			Albania	
Australian Ecolabel Program			Australia	Finishings (flooring, windows, sealants...); construction materials
B Corporation	B-Lab	Non-Profit	United States	and tiles; insulation; Finishes; Timber and Wood materials; Adhesives and sealants;
BASF Eco-Efficiency	BASF Eco-Efficiency	For-Profit	Germany	Finishings (flooring, windows, sealants...); construction materials
Blue Angel		Government	Germany	Building Products
Brazilian Ecolabelling			Brazil	
Carbon Fund		Non-Profit	United States	Building Products; Finishes
China Environmental United Certification Center		Non-Profit	China	Building Products;
Chinese Taipei (Green Mark)			New Zealand	Thermal Insulation Porous Concrete Units, concrete wall blocks,
Cradle to Cradle	McDonough Braungart Design Chemistry, LLC (MBDC)	For-Profit	United States	Building products; Recycled content
Croatia Green label	Protection, Physical Planning and Construction	Government	Croatia	Floor covering, chimney stack
Czech Republic (Environmental Choice)		Government	Czech Republic	Building Products; Cement
Design for the Environment	EPA Design for the Environment Program	Government	United States	Building Materials:
Eco Mark			Japan	Gypsom plasterboard, finishings
EcoLogo	TerraChoice Environmental Marketing Inc	Hybrid/Social Venture	Canada	Finishings (flooring, windows, sealants...); construction materials
Environmental Choice			North America	Buildin materials: Residential Central Air-source Heat Pumps, windows, finishings.
Environmental Choice New Zealand	The New Zealand Ecolabelling Trust	Non-Profit	New Zealand	recycled wood products for buildings, recycled construction material

Appendix 1: Table 2 - EcoLabels Related to CiP information on Building Products (Continued)

Label	Managing Organization (if Applicable)	Type	Country	Covered
EU (EU Ecolabelling)*1		Government	Europe	Finishings
Green Choice Phillipenes	Clean and Green Foundation	Non-Profit	Phillipenes	Building Materials:
Green Circle	Sustainable Solutions Corporation	For-Profit	United States	Building Products
Green Crane: Ukraine	Living Planet	Non-Profit	Ukraine	Building Products
Green Guard	GREENGUARD Environmental Instit	Non-Profit	United States	Building Products
Green Seal	Green Seal, Inc.	Non-Profit	United States	Building Products
Green Tick Standard	Green Tick Certification Limited	For-Profit	New Zealand	Building material: Thermal insulation, roof tile paints,
Hong Kong Federation of Environmental Protection)	ENVIRONMENTAL PROTECTION LIMITED	Non-Profit	Hong Kong	Finishings (flooring, windows, sealants...); construction materials
Hong Kong Green Label	Green Council	Non-Profit	Hong Kong	pavements, flooring, finishing materials, heat pump systems.
Hungarian Ecolabel / Környezetbarát Termék Védjegy	KvVM Környezetbarát Termék Nonprofit Kft.	Non-Profit	Hungary	Finishings
(Institute Construction and Environment)	(Institute Construction and Environment)	Non-Profit	Germany	Finishings (flooring, windows, sealants...); construction materials
Korea Environmental Labelling			Korea	Building Products
M1 Emission Classification of Building Materials	The Building Information Foundation RTS	Non-Profit	Finland	Finishings (flooring, windows, sealants...); construction materials
Assessment and Ecolabelling in the Slovak Republik (NPEHOV)	Ministry of Environment	Government	Slovakia	Building Products
Nature Plus	Association of Sustainable Housing and Living	Non-Profit	Germany	Building Products
Nordic Swan	Nordic Council of Ministers	Non-Profit	Denmark, Finland, Iceland, Norway, Sweden	Finishings (flooring, windows, sealants...); construction materials
SCS Recycyle Content	Scientific Certification Systems	For-Profit	United States	Building Products; Plastics

Appendix 1: Table 2 - EcoLabels Related to CiP information on Building Products (Continued)

Label	Managing Organization (if Applicable)	Type	Country	Covered
Singapore Green Labeling Scheme	Singapore Environment Council	Non-Profit	Singapore	Building Products
Thai Green Label	Thailand Environment Institute	Non-Profit	Thailand	Building Products
The Level	Furniture Manufacturers Association (BIFMA) International	Industry Association	United States	Finishings (flooring, windows, sealants...); construction materials
UL Sustainable Product Certification	UL Environment	Non-Profit	United States	Building Products
USDA BioPreferred	USDA	Government	United States	Thermal Insulation Porous Concrete Units, concrete wall blocks,
Vitality Leaf	St. Petersburg Ecological Union	Non-Profit	Russia	Building products; Recycled content

Appendix 1: Table 3 - Journals Related to CiP information on Building Products

Journals	Intended Audience	Scope of Information	Focus	Publishing Country
ACI Materials Journal.	Academic; research organizations; Building professionals	Material composition, use, and performance.	Material composition	United States
Annual Review of Environment and Resources	Academic; Building Professionals	Human health; environmental health;	Environmtent	United States
BPI: Building Products Index UK	Building Professionals	Material composition, use, and performance. And Standards	Construction and building materials composition	UK
Building and Environment	Building Professionals; Architects	Health concerns associated with emissions from commonly used building materials	Chemical Composition; Environmental performance of building materials; Human health	United States
Building Magazine UK	Building Professionals	Material composition, use, and performance.	Construction and building materials composition	UK
Building Products Magazine	Building Professionals	Material composition, use, and performance.	Construction and building materials composition	UK
Building Research and Information	Building Professionals	Material composition, use, and performance.	Construction and building materials composition	
Construction and Building Materials	Academic; research organizations; Building professionals	Material composition, use, and performance.	Construction and building materials composition	United States
Environment International	Academic; research organizations; Building professionals			

Appendix 1: Table 3 - Journals Related to CiP information on Building Products (Continued)

Journals	Intended Audience	Scope of Information	Focus	Publishing Country
Environmental Building Solutions	Building Professionals	Material composition, use, and performance.	Chemical Composition; Environmental performance of building materials; Human health	UK
Environmental Health Perspectives	Building Professionals	Material composition, use, and performance.	Chemical Composition; Environmental performance of building materials; Human health	
Health Physics	Academic; research organizations; Building professionals			
Indoor Air	Consumer; Academic; Building Professionals	Health concerns associated with emissions from commonly used building materials	Health	United States
Indoor and Built Environment	Building Professionals	Material composition, use, and performance. And Standards	Chemical Composition; Environmental performance of building materials; Human health	
International Society of the Built Environment	Building Professionals; Architects	Material composition, use, and performance.	Chemical Composition; Environmental performance of building materials; Human health	Europe
Journal of Asian Architecture and Building Engineering	Academic; research organizations; Building professionals	global environment, architectural planning and design, project management, structural engineering, structural	global environment, architectural planning and design, project management, structural engineering,	Japan; Korea; China
Materials and Structures	Building Professionals; Architects	Material composition, use, and performance.	Operating Procedures; Materials treatment; Building materials	United States
Science of The Total Environment	Academic; research organizations; Building professionals			

Appendix 2: Survey for Stakeholders

UNEP CiP Survey for Stakeholders on Information Sources and Needs for Building and Construction Materials

Thank you for taking the time to complete this survey in support of the UNEP Chemicals Branch Chemicals in Products (CiP) Study. This international survey focuses on identification and analysis of information exchange mechanisms regarding Chemicals in Products (CiP) information specific to building products and materials.

Information gathered through this survey will be used to determine current trends in information exchange while attempting to determine how and why CiP information is being sought and used in the building industry.

General Questions:

1) In what geographic region do you primarily work?
___ United States and Canada
___ Central and South America
___ Central and Eastern Europe
___ Western Europe
___ Africa
___ Asia-Pacific

2) In what country do you work? ____________________________________

3) In what sector do you work?
___ Manufacturing / Production
___ Architecture / Design
___ Building / Construction
___ Demolition / Recycling
___ Trade Association
___ Government / Regulatory
___ Non-governmental or Non-profit
___ Academia / Education
___ Other (specify) ____

4) What is your role in your sector?
___Material / Product design
___Material / Product manufacturing
___ Building Designer
___ Material Specification / Purchasing
___ Policy development
___ Research
___ Health advocate (represent or protect consumers or the public)
___ Other (specify) ____

5) Do you regularly seek information about chemicals in building & construction materials/products?
___ Yes
___ No, but I plan to do so in the future.
___ No, and I do not plan to do so.

Chemicals in Products Questions:

6) For what purpose do you use/seek information on chemicals in building & construction materials/products?
___ Policy development
___ Risk reduction - protection of workers
___ Risk reduction - protection of occupants
___ Public or consumer advocacy/protection
___ Specifying materials choice at the design phase
___ Purchasing/Specifying
___ Product design
___ Other (please specify) ____

7) How do you use information on chemicals in building & construction materials/products? (check all that apply)
___ To identify materials which meet standards developed by my company/organization.
___ To identify materials which meet voluntary, third-party standards
___ To identify materials which meet regulatory standards set for my region or industry sector
___ To remain competitive in my industry sector
___ Other (please specify) ____

8) For what types of materials/products do you seek information about chemicals in materials/products? (Rate each according to priority, 1=low priority; 3=medium priority; 5= high priority)
___ Interior Finishes
___ Flooring
___ Sheathing
___ Insulation
___ Siding/Facades
___ Roofing
___ Structural Materials (Wood, Metal,Concrete)
___ Material feedstocks / raw ingredients for material production

9) When seeking information about chemicals in building materials/products, what information do you most often seek? (check all that apply)
___ Chemical contents of a material / building product
___ Environmental impacts of known chemical contents
___ Human health impacts of known chemical contents

10) Please rate the following according to availability of data for each. (1=inadequate data ; 3=some data; 5= adequate data)
___ Chemical contents of a material / building product
___ Environmental impacts of known chemical contents
___ Human health impacts of known chemical contents

Data Quality Questions:

11) What information formats do you use to find information on chemicals in building materials/products? (select all that apply)
___ web-based information systems
___ electronic newsletters
___ reports
___ peer-review periodicals (electronic or hardcopy)
___ material safety data sheets (MSDS)
___ manufacturer-based information

12) Rate the following sources of information on chemicals in building materials/products according to frequency of use. (1=Never, 3=Sometimes, 5=Always)
___ Government / Regulatory
___ Non-governmental organizations / non-profits
___ Trade associations / Industry
___ Manufacturer / Product sales information
___ Other (please specify) ____

13) Is the information on chemicals in building materials/products that you use most often subscription-based or freely available to the public?
___ Subscription-based
___ Freely available

14) Thinking about the quality of information provided in known information systems, please rate the following sources according to data quality. (1=Trustworthy, unbiased 2= Biased, but accurate 3= Biased, requiring additional research 4= Untrustworthy 5=Unknown, undeterminable
___ Government / Regulatory
___ Non-governmental organizations / non-profits
___ Trade associations / Industry
___ Manufacturer / Product sales information
___ Other (please specify) ____

15) Do the existing information systems on chemicals in building materials/products adequately address the needs of your company or organization?
___ Almost always
___ Frequently
___ Not often
___ Not at all or almost never

16) If you did not answer "Almost always" to question 15, what type of information would better address the needs of your company or organization? (Rate each according to priority, 1=low priority; 3=medium priority; 5= high priority)
___Chemical & material content of products
___ Scientific data on the health impacts of materials and chemicals
___ Scientific data on the environmental impacts of materials and chemicals
___ Recycling/disposal data on materials/products
___ Information/case studies on the performance of products
___ Other (specify) ____

17) Do existing information systems on chemicals in building materials/products data for building and construction products address issues specific to your country and/or region?
___ Almost always
___ Frequently
___ Not often
___ Not at all or almost never

18) If you did not answer "Almost always" to question 17, what type of information would better address issues specific to your region or country? (Rate each according to priority, 1=low priority; 3=medium priority; 5= high priority)
___ Information/case studies on the performance of products
___ Chemical & material content of products
___ Scientific data on the health impacts of materials and chemicals
___ Scientific/Life Cycle Data on the environmental impacts of materials and chemicals
___ Recycling/disposal data on materials/products
___ Other (specify) ____

19) The building and construction industry is quite broad and represents a range of building types/sectors, including commercial, industrial, residential, etc. Do existing information systems that you are aware of adequately cover the chemicals present for all building materials/products in use?
___ Yes
___ No

20) If you answered "no" to question 19, what building sector do you feel needs the most attention(Rate each according to priority, 1=low priority; 3=medium priority; 5= high priority)):

___ Commercial (offices, retail)
___ Industrial (manufacturing)
___ Residential
___ Institutional (schools, hospitals)

21) Can you find product-specific information about chemicals in products when you need it?

___ Yes
___ No

22) If yes, is the product-specific information that you find usually adequate?

___ Yes
___ No

23) If you answered "no" to question 22, how is the product-specific data inadequate?

___ Unavailable
___ Out of date
___ Not specific enough
___ Too scientific
___ Not in my language
___ Other (please specify) ____

Life Cycle Questions

24) Do you regularly seek information about chemicals in building & construction materials/products for specific lifecycle stages of materials/products?

___ Yes
___ No, but I plan to do so in the future.
___ No, and I do not plan to do so.

25) Rate the following lifecycle stages according to the availability of information on chemicals in building products/materials. (1=inadequate data ; 3=some data; 5= adequate data)

___ Raw Material Extraction & Processing
___ Product/Material Manufacturing
___ Transportation
___ Construction / Installation
___ Use (Occupation, Performance)
___ End of Life (demolition, reuse, recycling)

26) If you could prioritize research toward additional data for specific stages of a product's life cycle, which areas would be emphasized? (Rate each according to priority, 1=low priority; 3=medium priority; 5= high priority)
___ Raw Material Extraction & Processing
___ Product/Material Manufacturing
___ Transportation
___ Construction / Installation
___ Use (Occupation, Performance)
___ End of Life (demolition, reuse, recycling)

27) Rate the following building material categories according to the availability of chemical data across all lifecycle stages. (1= no or very inadequate data ; 3=some data; 5= complete and adequate data)
___ Interior Finishes
___ Flooring
___ Sheathing
___ Insulation
___ Siding/Facades
___ Roofing
___ Structural Materials (Wood, Metal, Concrete)

28) Rate the following building material categories according to need for additional research and data across lifecycle stages. (1=Significant Research Needed and 5=Sufficient Information Available):
___ Flooring
___ Sheathing
___ Insulation
___ Siding/Facades
___ Doors/Windows
___ Roofing
___ Structural Materials (Wood, Metal, Concrete)

29) Regarding information about chemicals in building and construction materials, do you feel that existing information systems provide balanced data for each stage of a material's life cycle?
___ Yes
___ No

30) If you answered "no" to question 29, why do you feel the information is not balanced?
___ the data does not exist
___ the data source is outdated
___ the data source is not accurate
___ the source of data is biased

Narrative questions:

Are there unique issues in your region (specific materials, climate, etc.) regarding CiP information in building and construction products that are underrepresented by existing information systems? Please describe. ____
____
____
____
____
____

If there are useful information systems/data sources that you use and would like to share, please provide citations or URLs. ____
____
____
____
____