

**USGBC TSAC PVC Draft Report dated December 17, 2004 (released
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Comments:

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		The comments attached below discuss concerns with the application of the LCA methodology, including scoping and boundaries, transparency, allocation, and handling of uncertainties and missing concerns. Concern is also raised about the integration of risk assessment with LCA, the use of PELs, the exclusion of information and assessments and the inconsistency of the application of conservatism in select risk values. Detailed line by line comments follow.

February14, 2004

After having reviewed the report entitled “Assessment of Technical Basis for a PVC-Related Materials Credit in LEED,” the following comments are submitted for your consideration. Before I begin, I would like to acknowledge the obvious effort put forth by the members of the TSAC to complete this large scope of work. It is a thankless job to be sure.

That being said, the analysis documented by the report leaves much to be desired. The extensive reliance of the study on secondary data and assumptions is disappointing, and the relative lack of transparency debilitating, making it difficult to determine even basic aspects of the research. There also appears to be a lack of consistency in the way issues were handled throughout the study (e.g., exclusion of data or the assumption of default parameters), some of which are pointed out below. Overall, the quality of the report along with the reliance of the study on convenient assumptions and secondary data do much to undermine the confidence and credibility of the analysis. Neither the risk assessment nor the LCA would pass a peer review process as presented.

Life-Cycle Assessment

There are several aspects of the life-cycle assessment portion of the study that are troubling. The following are comments regarding the life-cycle portion of the analysis.

1) The report, as released, is insufficiently documented to allow consideration of the results in any meaningful manner. Widely accepted guidance has been established by the International Standards Organization (e.g., ISO 14040+) and the scientific community to standardize practices and ensure the quality and transparency of LCAs. These standards require that a scoping process be undertaken that, among other things, states clearly the system to be analyzed, the functional unit, system boundaries, data acceptance criteria, data allocation procedures, etc. The communication of this information ensures that the process is open and transparent and that the results and the inherent trade-offs analyzed can be properly understood and interpreted, protecting against the misuse and misunderstanding of the study. It also protects the integrity of the study against the insertion of bias by those performing the analysis. The report clearly falls short of this standard, as pointed out below:

- Nowhere in the report are system boundaries for the analyses defined or discussed. It is entirely unclear what processes are included in the analyses and which are not. Some detail regarding product manufacturing is provided in a discussion of alternatives in Appendix B, but this detail is both inconsistent and incomplete. No detail on processes for other life-cycle stages are presented, nor are suitable diagrams defining the scope and boundaries of the analysis.
- Secondary data contained within Simapro and BEES were used for the study. Data quality for such secondary sources can vary widely, but tend to be poor as they often are incomplete and contain assumptions and uncertainty that exert an inconsistent affect across alternatives. Some of these inconsistencies are noted and described in Appendix B. While the use of such databases is an unfortunate necessity in LCA for many upstream and end-of-life processes, LCAs based primarily on secondary data are typically referred to as screening-level LCAs to both acknowledge and communicate the relative uncertainty in the data and resulting conclusions. This LCA clearly falls well within that category.

In addition, secondary data sets within the same lifecycle stage likely have different process boundaries. For instance, an upstream tin mining data set might include inventory from the both the mining and smelting processes, while an upstream iron mining data set might not include the smelting process, but instead include transportation. These differences should be reported and the data quality assessed, as required in ISO14041.

- Data allocation and other modeling parameters are not described anywhere in this report. Was the EOL stage considered in this analysis? If so, how were the various dispositions of the product at EOL weighted? No detail could be found regarding the basic modeling assumptions used in this analysis. Given the specific material-related concerns of some of the products at EOL (e.g., dioxin formation), the results are meaningless without this context.

- The discussion of uncertainties and limitations inherent to the methodology appear to be incomplete as they are presented in various places throughout the paper. For example, the disposition of EOL product to various processes should be documented and discussed, along with any uncertainties in the analysis of these various dispositions (a common source of uncertainty in LCAs). The exclusion of the EOL analysis (if it is excluded) should be mentioned prominently in Sections 4, 4.2, and in the discussion of the life-cycle assessment contained in the Executive Summary, as a minimum. Either way, virtually no mention of the limitations of the LCA modeling is presented.

The importance of complete and thorough documentation of these issues cannot be overstated and is underscored by the creation and acceptance of the applicable ISO standard. The absence of these basic details is alarming and acts to undermine any conclusions based on this study. Without the proper context, it is ultimately unclear what the results represent and with what confidence they should be viewed. Until this basic information is provided, the findings of this report cannot be adequately reviewed or considered as the basis for an informed decision-making process.

- 2) The LCA methodology and impact categories do not address many of the concerns posed by PVC and the related materials. Compounds such as lead, organotins, cadmium, and other compounds are persistent bioaccumulative toxins (PBT) that are not captured in the impact categories selected. This is a typical weakness of LCA, requiring additional consideration of these issues outside of the LCA framework. No such effort to address these concerns appears to have been made.
- 3) The reliance of LCA and Risk Assessment (RA) as the definitive scientific guidance for making important decisions regarding environmental and human health performance is ill-advised. As practitioners of both LCA and RA for organizations such as the EPA, our analyses frequently need to be supplemented with additional research to address issues that are not adequately characterized through the rigid formats of RA and LCA. Only through a combined approach, selected and tailored to the specific concerns present, can a properly informed decision be made. The use of LCA and RA as an exclusive determinant of environmental and human risk is insufficient in light of other more targeted scientific research for such issues as PBTs, complicated fate and transport mechanisms, synergistic chemical effects, other environmental performance such as carbon sequestration, to name a few.

Risk Assessment

The TSAC decision to use RA is an acknowledgement of the limitations of LCA to address specific human health effects to workers. The attempt to use RA to supplement the LCA is laudable. However, much like the LCA, the RA is hampered by a lack of actual data to drive the results. Performing a risk assessment without any attempt at characterizing the specific exposure settings incurred in the occupational setting amounts to nothing more than an academic exercise, and dilutes the resulting conclusions. Like the LCA, this risk assessment should also be considered a screening-level risk assessment.

- 1) The authors stress repeatedly throughout the report that the RA likely overestimates risk to occupational workers. Justification for this statement is provided on p.31 lines 18 to 35, as well as in other places. This approach is typical in RA, so that there is high confidence in a result indicating no appreciable risk to the affected population. Typically, in situations where a decision is required, the most conservative choice is made providing an upper-bound estimate that over-estimates risk to human health. The authors state repeatedly the benefits of this approach.

However, in several instances the TSAC makes decisions contrary to this concept. The following are some examples:

- Exclusion of DEHP despite the fact that it has formerly been classified a human carcinogen and is currently under review. A conservative approach would require any chemical suspected to be carcinogenic to be assessed for potential threat to human health. Exclusion of this chemical from the assessment introduces uncertainty that the results are representative of any potential risk to human health.
- Absence of chemicals known to be hazardous to human health, such as lead. Risk assessments of occupational exposure in other industries have shown lead to pose a risk to workers in the occupational setting (EPA, 2000). The absence of these chemicals, or any mention or discussion of them in the risk assessment suggest an underestimation of potential human health impacts.
- Determination to focus exclusively on inhalation exposure. Other routes of exposure such as ingestion or dermal absorption might result in higher risks in some cases. Knowledge of the exposure setting is required to determine if the focus on inhalation ignores other significant exposure pathways.
- Exclusion of chemicals with known chronic human health effects. For example, on p.53 line 21 states that solvents used for cleaning during PVC and ABS resin production were excluded from the study to prevent a large amount of uncertainty from entering into the analysis through the use of PELs. While the extra steps taken by the TSAC to quantify the affect of this decision provide some clarification, they are not definitive. It is simply not clear why use of the PEL on this occasion is different than all of the other instances where PELs are used. Exclusion of the data runs the risk of underestimating a known chemical of concern and runs counter to the upper bound, conservative approach. Likewise, for the exclusion of latex paint manufacturing also mentioned on p.53.

To be clear, if a question exists about human health safety, the data should be included and the assessment made. If the subsequent results show that no health threat exists, then the inclusion of the data did not matter and we can be confident of the findings. If results indicate an unacceptable risk, then the data should be flagged and revisited for clarification or further scrutiny. Without including them, however, their affect on human health will remain unknown.

- 2) The selection of PELs as a substitute for knowledge of the exposure setting is troubling for many reasons. First, PELs are used as surrogates for exposure concentrations in air and limit the analysis to inhalation exposures only. This assumption potentially ignores both ingestion and dermal routes of exposure that studies have shown may be significant, despite the use of protective equipment.

Second, the use of a PEL is not a substitute for characterization of the exposure setting. The broad application of PELs to fill data gaps can lead to a potentially significant overestimation of risk to any one chemical, which in turn might dwarf the real differences in risks that would occur had exposure data been actively sought and collected. For example, knowledge of the setting might suggest that a TLV or modeled data point be more accurate for the given exposure setting.

Specific Comments

Page #	Line #	Comment	Supportive citations
30	18	The assertion by the TSAC that “The majority of the scientific community does not consider DEHP to be a human carcinogen” is undocumented and shocking. There is wide on-going debate on the subject of DEHP carcinogenicity, which has prompted a reevaluation of its status. However, little epidemiological evidence has been offered that would refute current animal testing results which indicate a potential for a problem to human health. EPA still classifies DEHP as a probable human carcinogen. More importantly, it is unclear why a material that is under review is not included as a carcinogen in the analysis of a green building material credit meant to be protective of human health.	
9	36	<p>The consideration and dismissal of air monitoring data is inappropriate and does little to err on the side of assessing potential threat to public health. Although data from Louisiana averaged over all years and monitors were below AAS, the author’s point out that the annual average air concentrations for VCM at two stations exceeded AAS. The averaging of annual yearly data is inappropriate, as it could hide multiple exceedances to the air standard that can pose a human health threat. For an extreme example, the average air quality standard at Bhopal may very well have been below standards if averaged over a 5 year period. While I acknowledge this is an extreme example, puff model air distribution modeling can report extremely high air concentrations over limited periods of time from isolated events, very much capable of posing human health risks</p> <p>Even so, more information is required to determine if the concentrations measured at two stations pose a problem, or whether they are an aberration that should be viewed as not representative. For instance, are the two stations located in close proximity or perhaps downwind of vinyl production facilities or known routes of transport? For an <u>annual average</u> to exceed AAS</p>	

		indicates a continuous release contributing to ambient air rather than a one-time incident. Inclusion of the TAGA truck data indicates a significant suspicion of ambient air releases. Dismissal of five-year-old monitoring data as obsolete is irresponsible, given the lack of other more recent comparable data, and the heavy reliance of both the risk and life-cycle assessments on older citations and data. For example, p.54 line 7 cites a 1994 study as the basis for assuming compounds emitted from thermal processing of vinyl resins are well controlled, an assumption accepted by the TSAC.	
19	38	Determinations of characterization factors for chemicals with no listed factors were performed by taking simple averages of factors for chemicals within the same chemical category. Given the seriousness of the health impacts for the specific chemical groups listed (e.g., dioxins), taking the highest value within the category as the factor would be more appropriate, given the conservative approach to risk assessment espoused by the TSAC. A factor selected based on the average could likely underestimate the potential risk to human health substantially, depending on the range of values within a category.	
30	45	- "It is noted by ACGIH, however, that its PEL values... Replace PEL with TLV.	
91		The exposure assessment does not take into account ingestion of DEHP or any other route of exposure. This is another example of the selective nature of the risk assessment and the approach and decisions made by the TSAC. See my comments previously about this point. This exclusion is not an upper bound, protective approach to RA.	
55	Table 5	The footnote to the table indicates that shaded values were calculated using at least one PEL. However, no shaded values appear in the table. Does this indicate that no values were based on PELs? Several references on the previous page hint that PELs were used for these calculations.	
55	Table 5	<p>Normalization of risk data by production amount is not appropriate. This method assumes a correlation between production and exposure that is not valid. The relationship between production amount of a material (i.e. the functional unit) and the number of workers (and by extension, the number of worker hours) is not linear. For example, while 1 employee working one hour might produce 10 sq ft of flooring, 3 employees might produce 100 sq ft. The production worker hour/functional unit for the 3-employee scenario is 0.3 [3 hr / (100 sq ft/10 sq ft per f.u.)] where the initial single worker scenario is 1 [1 hr / (10 sq ft/10 sq ft per f.u.)]. These ratios get more unbalanced as the numbers of workers in the example are scaled-up. Normalizing by production amount ignores the fact that more than one worker might be exposed at the same time, and is thus an invalid comparison.</p> <p>Also, while the data used to normalize risks are presented in Table 5, it is unclear and goes unexplained by the authors how these data are combined to yield the results reported. It appears that yet another invalid factor - cost - may also have been used to normalize risk data. In a similar fashion as just demonstrated, the use of cost ignores the cost efficiency of mass production,</p>	

		further confusing the issue. While the ability to normalize risk is desirable, this method as stated appears scientifically unsound.	
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