USGBC TSAC PVC Draft Report dated December 17, 2004 (released 12/22/04)
OFFICIAL COMMENT SUBMISSION FORM

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Comments submitted by:

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Pg	Ln	Comment	Supportive citations
		Note: This comment begins with a series of discussions aimed at identifying overall issues and concerns not addressed in the report that do not fit well in to the line by line technical comment table format as they do not generally apply to a specific line number in the report. These comments are based in part upon an earlier published briefing paper that many of the Task Group may have read earlier but have substantial changes so all are encouraged to read again. The overall comment is followed by an extensive line by line commentary using the TSAC provided table format.	

The Task Group conclusion that the available evidence does not support a conclusion that PVC is consistently worse than alternative materials…"[1] is surprising and troublesome in the face of the growing number of governments and institutions that have also analyzed PVC and established policies to avoid it based upon concerns for its association with key hazardous chemicals. The State of New York, cities like San Francisco and Boston, a host of healthcare institutions including Kaiser Permanente and Catholic Healthcare West,[2], leading manufacturers including the likes of Herman Miller, MechoShade, Construction Specialties and Shaw Carpet, have all taken actions to deselect PVC. Their choices are guided by market demand and sound environmental assessments using well tested tools such as the McDonough-Braungart Design Chemistry materials assessment protocol

[1] USGBC TSAC 10-22 Note: in these footnotes, this refers to the "10-22" reference indicates "page 10 line 22"
[2] See http://www.healthybuilding.net/pvc/corporate_policies.html for more companies that have deselected PVC.

Flaws lead the Task Group astray. The Task Group report clearly represents an impressive analytic effort by a hard working team. Why do the results contradict this growing scientific and market assessment of PVC? Our evaluation suggests that at least three fundamental problems led to the Task Group's inability to verify why PVC has been the target of hazardous chemical avoidance policies:

1) **Using a model that falls short of the capacities needed** for the task and simply is not designed to process some of the very important real world data that the Task Group collected related to the hazards of PVC and its environmental impacts – particularly key health related impacts. LCA can be an excellent tool for use in product development within a single company's product line where it can be used to test different process strategies to reach a single product endpoint. But it gets into major uncertainties that render its results very questionable in this type of cross industry evaluation. Then there is the additional challenge of assessing health impacts. LCA excels at dealing with energy and some other material flows, but stumbles seriously on assessing health impacts. The Task Group developed a very interesting but untested protocol to supplement life cycle assessment (LCA) with risk assessment (RA). While this experiment is laudable and does provide some new potential health impact insights, it is insufficient to make up for LCA's well established and recognized deficiencies in addressing human health problems. Other reviewers point out some serious basic methodological errors that make this integration of RA and LCA very questionable. Though many important material health concerns are revealed along the way in this report, the incredible limitations of both LCA and RA led the Task Group to neglect, ignore, set aside or average into meaninglessness vast amounts of evidence in the name of data harmonization. The result of this experiment in crossing a risk assessment with a life cycle analysis is an analytical tool that is as at least as blunt in its own way as the material based credit approaches that the Task Group critiques.

2) **Misinterpreting and ignoring important data** and scientific studies, and using improper statistical approaches that hide important data through averaging and other means. Examples are given in the line by line analysis that follows.

3) **Missing critical PVC environmental health issues**, including a primary one - elimination of the use of priority high hazard chemicals - upon which the proposed credit was based and the related priority issue of elimination of materials associated with PBTs that drives much of the concern around PVC. This LCA/RA hybrid gave the Task Group a "black box" look at a very limited set of material alternatives that totally misses a whole series of fundamental data points and issues that drive policy concerns about PVC. In so doing, it leaves the design and policy communities with an ambiguous result that contradicts environmental leaders in corporations, governments, and the health care sector.

Better tools are available to address the elimination of priority hazardous chemicals in green buildings: HBN starts from the value that protecting and enhancing the health of people is a critical part of protecting the environment through green building. How do we make this work in the building material marketplace? Public policy makers, green building professionals, and product manufacturers have determined that the protection of public and environmental health means putting a priority on eliminating certain particularly hazardous chemicals. They have therefore established simple, straightforward material assessments that screen material life cycles for the use and generation of these priority high hazard chemicals. These screening tools address the point of toxic chemical avoidance much more quickly, clearly, and effectively than the complex, arcane model that the TSAC assembled. Screening tools provide clear signals to governments, professionals, manufacturers and investors, and are already successfully moving the market. This issue was addressed in depth in the public comment one year ago and it is shocking that the Task Group did not see fit to address this issue. Indeed addressing it would have probably saved the Task Group a considerable amount of hard work that has in the end proved to be less than fruitful. The TSAC model gets bogged down in countless data limitations it can't handle, and leaves the unhelpful and incorrect impression that there is no meaningful way to distinguish the environmental attributes of building materials without spending inordinate amounts of time and money and that even then the answers will remain ambiguous. Other commenters such as Mark Rossi, the City of San Francisco, MBDC and others are covering this issue in more detail.

Missing issues: A range of concerns about PVC – primarily but not exclusively related to its use and generation of toxic chemicals - have been raised by the scientific research and the environmental health community. Bafflingly, the Task Group fails to address most of these issues and dismisses those it does – most often for lack of the right data to plug into the LCA model, not for lack of evidence. These issues are itemized numerically here for clarity but not put into the TSAC comment table format because they primarily deal with missing issue areas; i.e., there are no page and line numbers to refer to for most of them. The few exceptions (mostly under fenceline chemical releases and fire) are covered also in the line by line comment table.

1) Persistent Bioaccumulative Toxic chemicals (PBTs): PVC is frequently targeted as an important place to start in avoiding the production of persistent bioaccumulative toxic chemicals (PBTs) – most notably the Persistent Organic Pollutants (POPs) such as dioxin, the most potent carcinogen mankind has created. The United States joined with the rest of the world in the Stockholm Convention in defining 12 of the worst of the persistent bioaccumulative toxic chemicals (PBTs) for priority elimination, including by product substitution[3]. Studies have found that PVC is unique in the extent to which it produces four of the 12 Stockholm POPs (dioxins, furans, PCBs, and hexachlorobenzene) throughout its lifecycle.[4]

[3] See http://www.pops.int/documents/convtext/convtext_en.pdf for the language of the Stockholm Convention, http://www.chem.unep.ch/pops/ for the United Nations Environment Programme description of POPs issues

[4] Thornton, Joe, Ph.D., Environmental Impacts of Polyvinyl Chloride Building Materials, Healthy Building Network, Washington, DC 20002 http://www.healthybuilding.net/pvc/emerging_science.html

Given that many commenters discussed this issue in the public hearings in early 2004, it is baffling and distressing that the Task Group report does not address this issue. It totally fails to even acknowledge the existence of this international policy consensus committed to a Treaty. This is odd too given that the TSAC Task Group analyzing refrigerants anchored itself upon the Montreal Protocol on Ozone Depletion, and many of the energy related credits seek to address global warming, even though the United States expressly disavows the Kyoto Protocol on Climate Change. The words "Stockholm", 'treaty" "persistent" and "bioaccumulative" do not appear anywhere in the report.

Dealing with this issue would require the use of different tools. LCA and risk assessment are generally not well suited to address chemical elimination policies. Furthermore, these chemicals remain in the environment to travel long distances, build up cumulative exposures, and bioconcentrate in the food chain and the human body far from their source (like in Inuit women in the Arctic[5]). Therefore they don't perform the way risk assessments expect them to being designed more for analysis of non persistent exposures in a workplace or near a factory. The acronym PBT only appears once (undefined) under a discussion of backyard burning.[6] PCBs are apparently not included in the study at all and many of the largest ways that PVC manufacture, use and disposal contributes dioxins and furans to our environment are not plugged into their model, if they are acknowledged at all.

The report does acknowledge that the PVC industry "lost" 65 tons of mercury in the year 2000 alone – more than the annual releases from all US power plants[7]. While appropriately calling this an "unacceptable risk" and "unique to the manufacture of PVC," they also note that their LCA model is unable to assess the impact on the general public. Hence this huge environmental health problem remains buried in the report and apparently has no bearing on the authors final conclusions. In fact, the entire issue of heavy metals that are added to (and leach out of) PVC apparently doesn't work in their model, highlighting again the shortcomings of the analytic approach.

While not addressing the issue of elimination of dioxins, nor the special issues raised by its PBT nature, dioxins do at least show up in the analysis. Unfortunately, the analysis relies upon a database which has been previously exposed to virtually completely ignore most of the relevant environmental flows of dioxin from the life cycle of PVC (manufacturing, building fires, landfill fires, and incinerators), thus missing what may be the largest single health impact of the life cycle of PVC[8]

[5] See "As Good As Mother's Milk: The US Green Building Movement" Healthy Building Network newsletter 1/28/05 www.healthybuilding.net
[6] USGBC TSAC 47-31
[7] USGBC TSAC 89-23
[8] See discussion below under 10-14, 23-26 and 49-2 for more in depth discussions of the highly significant dioxin flows that are unaccounted for in this analysis.

2) **Fenceline Chemical Releases**: PVC has been targeted as an environmental justice issue due to the release of toxic chemicals into neighborhoods surrounding plants, such as vinyl chloride monomer (VCM), a known human carcinogen. Submitted during the public comment period last year, were ambient air data indicating that PVC plants in Louisiana regularly release high levels of VCM and other toxics into the surrounding neighborhoods.

Once again, the Task Group's tools were ill equipped to evaluate the available data. LCA and generic risk assessments can only interpret data from industry models that project emissions from production under theoretical conditions. Neither is equipped to accept actual fence line monitoring data collected from real plant operating conditions – when operations don't follow the models or the regulations.

The report acknowledged this body of data but dismissed it, apparently relying entirely upon an analysis from Sage Environmental Services. Sage, it turns out, is no independent authority, but rather a consultant to industrial polluters[9]. It is no surprise that Sage's analysis hides the real impact of high exposures to VCM and other toxics, apparently by both averaging the high readings taken near neighbors at the company fenceline with other data from farther away from the plant and averaging high reading years with other low reading years to obscure the high readings. Neither the Vinyl Institute nor the USGBC released the Sage report in time for independent review and analysis for this comment period.

Ambient air is not the only pathway by which PVC plant pollution releases are entering the bodies of residents around these plants that was ignored by the report. There is no mention in the report of the widespread problems of groundwater contamination with vinyl chloride and ethylene dichloride (EDC). Over 10 million people in the US ingest EDC – a chemical used almost exclusively as feedstock for PVC – when they turn on the tap[10].

3) Toxic additives: PVC uses a wide range of additives, many of which have been targeted due to their effect on user health:

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[9] Neither the USGBC nor the Vinyl Institute had provided a copy of the report as of this date. Sage Environmental wrote the report for the VI and primarily works with oil company clients & legal firms that help corporations avoid class action suits. Sage Environmental web site: www.sageenvironmental.net/capabili.htm See also Edwards & Angell web site http://www.ealaw.com under Areas of Practice – Consumer Class Action Litigation "Our years of experience in consumer class action defense enable us to identify those cases susceptible to an aggressive challenge to the viability of the claim itself, discern potential avenues for challenging class certification, and where necessary put the matter in a posture for summary judgment".

[10] National Toxicology Program's 10th Report on Carcinogens citers EDC as "reasonably anticipated to be a carcinogen" based on animal testing and states that Exposure to 1,2, dichloroethane through ingestion of contaminated drinking water is expected to be an important source for 4 to 5% of the population. Four percent of the January 2005 estimated US population of 295 million (US Census Population clock) is 11.7 million. Sandra Steingraber addresses this in more depth in her comments.

Organotin stabilizers: The only mention of these toxicants is a note that reports describing the leakage of organotins stabilizers from water distribution pipes were "deemed to fall outside of the scope of this report" and not considered[11]. No explanation was given.

Lead stabilizers: This widely known neurotoxin is not addressed by the report. The PVC industry claims that it is phasing it out, but lead is still widely used in PVC wiring insulation, and has been found in PVC flooring and other PVC products.

Phthalate plasticizers: The task group dismisses DEHP's reproductive toxicity on the basis of one deeply flawed study, ignoring a whole body of literature that affirmed by the NTP, Health Canada and the FDA that led California to list DEHP for its reproductive toxicity under Prop 65[12]. A growing body of scientific evidence is increasingly linking DEHP exposure from PVC building products to asthma and other bronchial problems. Ted Schettler, PhD, addresses this issue I more depth in his comments. All of these peer-reviewed epidemiological studies were dismissed as being inadequate for a variety of reasons and apparently not considered further.

Amazingly, the Task Group went further and ignored all studies of residential exposure, because the available studies "do not discriminate between resilient flooring and wall covering…the latter of which are not considered in our report." In other words, they dismissed evidence that PVC building materials create bronchial problems because there might have been more than one PVC finish material contributing the chemical triggers in the homes studied.

This is a serious flaw with the analysis. The Task Group seems interested only in determining whether flooring alone (or pipe or window frames) is sufficient to degrade indoor air quality to the point of creating demonstrable health risks for building inhabitants. But few people in the real world are exposed to PVC from just one finish product. If there is one, there are generally multiple products, from office furniture to shower curtains, from resilient floor to carpet and wallpaper. The real life experiment on us all allows multiple pathways for us to be exposed to PVC.

[11] USGBC TSAC 22-26

[12] Office of Environmental Health Hazard Assessment (OEHHA) of the California Environmental Protection Agency, Proposition 65 - Administrative Listing : Chemical Listed Effective October 24, 2003 as Known to the State to Cause Reproductive Toxicity: Di(2-ethylhexyl)phthalate (DEHP) 10/24/03, http://www.oehha.ca.gov/prop65/CRNR_notices/list_changes/6Ddehpnot.html

4) Fire: Serious concerns have been raised by firefighters and researchers about the toxic chemicals released from PVC, not only when it is actually burned (such as dioxin), but also long before it ignites, as in the pre-ignition smoldering phase it releases hydrochloric gases that turn to acid on contact with water (such as in the throat)[13].

Building fires: Exposure of building occupants to toxics from accidental building fires is dismissed by the Task Group with the assumption that firefighters always have proper protective equipment that adequately protects them[14]. No analysis is done of the effect of the toxic chemicals released from PVC as it is heated even before it catches fire, as well as after it begins to burn, on unprotected occupants of the building as they try to escape.

Studies of a few major PVC related fires are cited that purportedly show that dioxin contamination remaining in the area was relatively light[15]. These studies miss the point. The EPA's dioxin assessment cites other studies showing that 90% of dioxin emissions from structural fires may be gaseous ones that leave the immediate area and hence were not captured by these analyses and instead are contributing to the larger global environmental load on us all[16].

Landfill fires: This is another major data set ignored in the report. EPA's preliminary estimate of the dioxin emissions from landfill fires is huge. Landfill fires could be the single largest source of dioxin to the environment[17] with at least half of that contribution likely to be from PVC products. Once again the Task Group is working with the wrong tools again. The EPA estimates that the landfill number is very large, but is very uncertain about what the exact number actually is. Therefore there is no agreed single number to meaningfully plug in to an LCA or risk analysis model. Once again, even if the Task Group had addressed the issue, the model couldn't evaluate it.

5) End of Life Recycling: Sustainable materials are renewable and either capable of closed loop recycling or are compostable into healthy nutrients at the end of their useful lives. The model used by the Task Group, however, does not credit renewable materials and does not assess the end-of-life sustainability of the materials. Thus a non-renewable, seldom recycled, and non-compostable material like PVC is not discounted for being an inherently unsustainable material. PVC is only minimally recycled and widely viewed as a

[13] Letters from fire departments of concern over PVC performance in fire. www.usgbc.org/Docs/LEED_tsac/PVC/CMPBS-Rebuttal%20Attach%203-Fire.pdf and http://www.oregontoxics.org/firefght.htm
[14] USGBC TSAC 10-15
[15] USGBC TSAC 49-35
[16] USEPA, Exposure and Human Health Reassessment of 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD) and Related Compounds Part I: Estimating Exposure to Dioxin-Like Compounds Volume 2: Sources of Dioxin-Like Compounds in the United States, Draft Final Report, EPA/600/P-00/001Bb, March 2001 http://www.epa.gov/ncea/pdfs/dioxin/part1/volume2/volume2.pdf p. 6-2 to 6-9
[17] USEPA, March 2001, p.1-38, 6-9

recycling contaminant, endangering other plastics recycling[18]. The automotive and beverage industry have moved away from PVC due to serious problems with recycling it. This is not addressed in the report.

In fact, the report ignores most of the end of life issues of concern with PVC, including leaching of toxic additives from landfills and dioxin generation in incinerators. It does review the problem of burn barrels and acknowledges that "clearly reducing PVC in household waste would reduce dioxin and furan emissions"[19] but then dismisses it as something needing additional research and suggesting a "command and control" approach (which of course is out of LEED's purview) instead of just removing the source.

6) Chemical security: PVC is unique among building materials in that it is made up of more than 50% chlorine by weight, making it the world's largest end market for chlorine. Yet the Task Group does not address the potency of stored or transported chlorine and the very real risk of terrorist attack, and accidents, like the recent one in South Carolina[20]. It is only a matter of time before this scenario is replayed in a major city.

Governments and other industries are already starting to deal with this potential environmental health disaster scenario. Senator Jon Corizine (NJ) has introduced federal legislation to encourage industry to switch to safer alternatives to chlorine. In New Jersey, after the passage of the Toxic Catastrophe Prevention law[21], the number of water works using chlorine has dropped from 575 in 1988 to just 22 in 2001[22] – a data point that did not find its way into the Task Group's LCA. Pulp and paper, sewage treatment and other industrial sectors are all beginning to take action to move away from use of chlorine. Perhaps most notably, the USGBC's hometown of Washington, DC has decided to ban all shipments of both chlorine and vinyl chloride monomer from the city limits due to their toxic nature ("ultrahazardous chemical" in transportation jargon) and the potential for an accident or terrorist attack that could quickly cause "tens of thousands of deaths and a catastrophic economic impact of $5 billion or more"[23]. It is time for the building industry – at least the green building industry – to follow suit. Sandra Steingraber, PhD deals with issues of chemical security in more depth in her comments.

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[18] APR Declares PVC Recycling Unfeasible, Waste Age, 7/1/98 http://wasteage.com/mag/waste_update_apr_declares
[19] USGBC TSAC 48-19
[20] Growing Potential for Hazmat Accidents, ABC News, 1/7/05 http://abcnews.go.com/WNT/story?id=393986&page=1
[21] New Jersey Department of Environmental Protection, Toxic Catastrophe Prevention Act Program http://www.nj.gov/dep/enforcement/relprev/tcpa/tcpa.htm
[22] U.S.PIRG, Protecting Our Hometowns - Preventing Chemical Terrorism in America - A Guide for Policymakers and Advocates , March 7, 2002 http://uspirg.org/uspirg.asp?id2=5890&id3=USPIRG&
[23] Terrorism Prevention in Hazardous Materials Transportation Act of 2005, District of Columbia

Conclusions: the TSAC report shows PVC clearly warrants avoidance: Clearly the Task Group missed or dismissed a wide range of health concerns, some listed above, often echoing industry reassurances with distressing clarity. Despite the significant holes in the analysis however – and contrary to the stated conclusion – the report still provides sufficient evidence to determine that PVC should be avoided. In none of the applications studied is PVC the best material from an environmental impact standpoint, so it should certainly never be labeled as "green". In each application studied, PVC is worse than some or all of the alternatives from a health standpoint even within the incredible limitations of the analysis. Generally the PVC based alternatives do not fare well in the rest of the LCA analysis as well:

- Siding: "*vinyl siding leads to the highest total mortality risks*"[24] Vinyl siding also appears to come out worst of the four alternatives studied in almost half (5) of the LCA impact categories, more than any of the other materials.

- Piping: "*PVC and cast iron pipes lead to higher total mortality risks* than ABS pipe"[25] PVC and cast iron split the lead for worst in LCA impact categories also. Include the plethora of health issues ignored for PVC and it would probably stand out above cast iron in the final analysis.

- Flooring: *Using the mean values of all studies, VCT has the highest mortality risk.*[26] The Task Group only came up with a higher total mortality risk for linoleum by choosing to use the median instead of the mean, essentially throwing out **30**% of the studies of particulate matter from VCT for no reason other than that a larger number of studies had lower results – no analysis was offered of the validity of the studies kept or tossed. Meanwhile, VCT and vinyl flooring *both* came out worse than the non PVC alternatives in 8 of the 11 LCA categories. Only in one category, did any non PVC material clearly have the highest (worst) score (eutrophication for linoleum and that is contested)

- Window: Human health particulate numbers impact numbers are high in this application and don't vary much between the window alternative types, being dominated by the use phase energy usage (the heat loss out the window - which should not be a part of this analysis – see comments at 8-33 and 73-5 for more discussion). Cancer effects, which are apparently not as driven by energy usage, are more telling. Despite the lower energy usage, *PVC still comes out with the highest occupational cancer DALYs*[27]. A full analysis of the health impacts of PVC, not confounded by the irrelevant use phase energy analysis and including the plethora of PVC health issues ignored in this report, would probably only increase the health disadvantage of PVC.

[24] USGBC TSAC 7-34
[25] USGBC TSAC 8-4
[26] USGBC TSAC 71-12 This is discussed in greater depth under the line by line analysis
[27] USGBC TSAC 75-4

Flooring provides a particularly egregious case of selective interpretation where the Task Group muddles what is actually a fairly clear cut case. The Task group states "We do not observe one material option performing consistently poorest among the options across impact categories. Vinyl has the highest values in some impact categories, VCT in others and linoleum in others." This statement is baffling at best. The data as presented in the figure 17 immediately above this statement[28] indicates a very consistent picture of the two PVC alternatives performing generally worse than the alternatives in the LCA ratings. In fact, as mentioned above, in eight out of the eleven categories, both of the PVC alternatives have higher (worse) scores than both of the non PVC alternatives. In two of the remaining categories (particulate and fossil fuel), VCT, vinyl and linoleum are roughly comparable (within the uncertainty ranges) and only in one of the eleven categories (eutrophication), does a single alternative (linoleum) come out clearly worse than VCT and vinyl. VCT and vinyl still perform much worse than cork in this category[29]. Calling this an ambiguous result because vinyl and VCT are alternating in which is the worst performer is akin to saying it is not clear that cigarettes are bad for you because some brands lead to more cancer and others lead to more bronchial disorders.

What happened to precaution? In the "Review of Approach" PowerPoint presented before the public comment period the Task Group stated : "...we are attempting to integrate three methods or viewpoints which have sometimes in the past been cast as opposing: life cycle-based, risk-based, and precautionary-based methods." That attempt seems to have failed. Not only are there serious flaws in the integration of risk assessment and LCA[30], but the precautionary part appears to be quite missing from this analysis. Over and over again, whenever there are uncertainties about the data or the model is unable to handle the problem, the Task Group seems to give PVC the benefit of the doubt and defer any judgment.

Did the TSAC get the burden of proof backward? Instead of using the LCA to determine whether PVC is good or bad, perhaps the analysis should have been - as charged - an evaluation of the availability and quality of the evidence submitted to determine if indeed the life cycle of PVC leads to a large number of serious environmental health problems as critics charge. Then the Task Group could have used the LCA as one of a suite of tools to assure that the credit is adjusted to help attempts to insure that choosing alternatives to PVC avoids and particularly serious worse results in select key environmental impact areas. This would be akin to the approach that the other TSAC Task Group took with HCFCs assuming first an intent to avoid ozone depletion but then checking the tradeoff against global warming. If this Task Group's approach had been applied to the HCFC question, the whole ozone depletion credit would have

[28] USGBC TSAC 69-1

[29] It should be noted that Forbo has disputed this similar analysis in BEES, citing order of magnitude misinterpretations of data by BEES designers. Furthermore this issue (eutrophication) is not inherent in the production process – that is eutrophication can be solved in linoleum manufacture by organic farming methods. Dioxin production, on the other hand appears to be unavoidable in PVC manufacture (Thornton)

[30] See Jack Geibig's comments for a more thorough analysis of the methodological flaws in this integration as well s the use individually of these tools for this purpose.

just been tossed out on account of the higher global warming impact of the best materials for avoiding ozone depletion. Note also that HCFCs only were subjected to a two factor analysis (ozone depletion versus global warming) whereas the PVC credit is subjected to an eleven factor analysis, despite the fact that the intent of a PVC credit has nothing to do with the non health impact categories.

Conclusion

The Task Group spent a year and evaluated just 3 to 4 materials for each of four categories for a material that is far more widespread. The result is an inadequate analysis, ridden with major data holes and questionable analyses that miss important data points on every major concern about PVC. The report mischaracterizes and ignores important data and scientific studies, misses critical PVC environmental health issues, and uses a model that is fundamentally inappropriate for the task.

The TSAC Group missed their charge. They give no evidence that they reviewed much of the evidence that was offered - or that they reviewed other available models that might have been more useful for analyzing the data. They insist that alternatives must be evaluated for each application, yet their spectrum of applications and alternatives studied are extremely limited, and they explain that it would be impossible to do more in a reasonable amount of time. The tools are clearly not up to the challenge thrown at them.

Most importantly, they did not address the needs of architects and policy makers in providing guidance for how to tackle this issue or others like it in an efficient way that addresses key design and policy concerns. This report, with its limited ambivalent results, primarily serves to demonstrate that a focus on LCA and risk assessment tools will not provide useful guidance for designers or policy makers attempting to build a building that protects health, much less transforms the market.

Line by Line Comments:

Pg	Ln	Comment	Supportive citations
5	24	Why were LCA and Risk Assessment chosen? Significant critiques of the LCA/RA approach were provided at the public comment hearing and alternatives were suggested. There is no evidence that the committee gave any consideration to the public input and evaluated alternate approaches. LCA and RA can be useful to identify problems that need to be addressed with a particular material but there are far too many uncertainties to provide meaningful comparisons between materials	
7	2	"Since exposure data were not available for construction and end use phases for other building materials (other than classroom resilient flooring) no assessment was made." "Exposure of end users in a home environment was not assessed because comprehensive data of compounds ...was not available". This is not a precautionary approach. Known information of potentially very significant hazards (e.g., reproductive toxicants in the solvent cement used to cement PVC pipes together, asthmagens in the phthalates that are used to plasticize PVC) yet these disappear from the analysis because they cannot be quantified in a way that fits the risk analysis or LCA approaches.	
7	7	How does a risk assessment account for the persistence and bioconcentration that PBTs, particularly the POPs evidence? How are the exposures of Inuit women to dioxins from Louisiana PVC plants incorporated into the exposure analysis?	
7	22	We welcome the Task Group's careful scrutiny of occupational exposures and agree that they "should be considered more widely as part of comprehensive life cycle methodologies." We question, however, the validity of the comparisons between occupational and general population exposures given the different assumptions and data limitations of each analysis. How can you assure that a relatively high occupational risk is not simply a matter of having more data? For example, note the potentially large areas of general population exposure referenced above on this same page (7-2) that are not included in the analysis.	
7	34	"Vinyl siding leads to the highest total mortality risks" This appears to be evidence that PVC is worse than the alternatives from a human health standpoint.	
8	4	"Aggregated health impacts of carcinogens as well as particulate emissions show that PVC and cast iron pipes lead to higher mortality risks than ABS pipe." Again there is at least one clearly better alternative than PVC on a health basis and if all the health problems with PVC were included, cast iron might no longer even be equal.	
8	23	The report justifies virtually ignoring the meaning of 3 of the 10 studies on the particulate impact of VCT by using a median of the studies instead of an average, stating that "The median provides a measure of central tendency which is more robust, less susceptible to outliers" Calling 30% of the data "outliers" is hardly "robust". This approach is not compatible with a precautionary approach. Faced with almost a third of the tests showing a far higher concern (particularly if there is any clustering as the text seems to imply) should lead to further inquiry about the potential problem, not a statistical dismissal. Questions include: what factors might have led to the higher results? Difference in testing condition? Difference in sponsor of the research?	
8	27	"Cork has the lowest combined mortality impacts." Again there is at least one clearly better alternative than PVC on a health basis and if all the health problems with PVC were included, cast iron might no longer even be equal.	

8	33	"...the total life cycle results are not dominated by the frame material, but by the glazing and the usage phase energy use." A single number health impact from energy usage due to loss through a window is absolutely meaningless for a generic study like this. There is not a single number that you can plug in to meaningfully compare with material life cycle health impacts. The impact of window energy usage will vary widely, probably by orders of magnitude, depending upon the fuel mix in your area whether you are in coal fired Wisconsin or nuclear Illinois or hydroelectric Washington or natural gas and renewable California. This could be further driven down by selection of green power supply or a high efficiency natural gas or biodiesel turbine or cogenerator.
8	33	It will again vary widely, again potentially by orders of magnitude by your climate, whether you are in moderate Pacific coastal state or a high degree day upper Midwest state. It will again vary widely, *again* potentially by orders of magnitude by building design. In a LEED building, designers have high incentive already to create highly efficient envelopes, high efficiency HVAC equipment, renewable energy and otherwise tend to reduce this quantity, sometimes to the point that it may be come negligible. It will vary widely again, by the design of the window frame itself. Total window U values for all material types vary widely and again LEED designers have ample incentive to drive it down as far as possible (e.g. by utilizing the best thermal breaks if they feel they must use aluminum). It will vary widely again by the way the building is operated, e.g., thermostat settings, use of insulating and shading devices, etc.
8	33	Finally it is not static in time. The fuel mix and many of the other factors listed here are changing steadily over time and will continue to for reasons unrelated to the window frame material. Window material choices will have no significant impact on what happens to the health impact of this country's energy infrastructure but can have plenty of impact on materials markets. The analysis of this credit should be focused on reducing the real health impact of the material choices in question not of the unrelated glazing and HVAC and electric supply choices. Those are the purview of other credits and indeed there are 10 credits in LEED aimed at driving energy usage down and other focused on green energy purchases and renewable sourcing for the building. The analysis should have been based upon a given U value of given size and type of window as the functional unit to determine the marginal impact of the change in frame material. See 73-5 for more discussion of this issue
9	5	"...the total life cycle mortality results are dominated by particulate exposures" does this account for PBT effects? See further comment on 7-7 and 61-12
9	27	"...data were limited …precluding any substantive conclusion." There is plenty of data for making substantive conclusions of the prevalence of threat to public health in the proximity of PVC plants in Louisiana. See Wilma Subra comments for full critique of the Task Group analysis.
9	28	In general, however, the concentrations were low….two stations had averages that exceeded AAS…Averages taken over all available monitoring years… however, were below AAS. These values do not indicate a significant human health hazard." Comment: people don't breathe the "average" air of multiple stations; they breathe the air of the monitoring station they live near. Those two stations happen to be ones near people who live near to a PVC plant That is their reality, not some average of other air. Why is the evidence of those stations dismissed because the mythic "average" air is below AAS?

9	33	“Air data taken closer to ground level via … TAGA truck… in 1999, indicate concentrations that were significantly higher than the AAS. Because these data are obsolete, additional data would be necessary to determine if potential health risks exist to residents nearby..." Comment: Why is data that is only 5 years old considered "obsolete" and not worthy of consideration?	
10	1	"Two studies have shown link between asthma and rhinitis…and phthalates in home environment." The authors dismiss these stating that data are lacking from these studies of other risk factors. These studies, however, are part of a growing literature on the connection between phthalates and asthma. The authors seem to be taking an anti-precautionary approach. Single studies that help dismiss concerns about PVC (such as the DEHP study) are accepted without comment. Multiple studies that raise concerns about PVC however are subject to much higher level of scrutiny and dismissed if they can find any ways the studies could be more complete.	
10	4	See Ted Schettler comments for a thorough critique of the task group's analysis of the science around DEHP	
10	14	Fire discussion gives no indication that the task group considered dioxin formation from landfill fires fed by PVC sourced chlorine content. In my written testimony in the first public comment period in February 2004, I pointed out that "the EPA estimates that landfill fires alone (with PVC the primary chlorine donor and therefore a major dioxin factor) may contribute 1000g TEQ of dioxin per year - several orders of magnitude higher than the current EDC/VCM manufacturing estimates" citing the EPA's report. This means that PVC in landfill fires could be the single largest source of dioxin estimated by the EPA. I see no evidence that the task group considered this part of my testimony.	USEPA, Exposure and Human Health Reassessment of 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD) and Related Compounds Part I: Estimating Exposure to Dioxin-Like Compounds Volume 2: Sources of Dioxin-Like Compounds in the United States, Draft Final Report, EPA/600/P-00/001Bb, March 2001 http://www.epa.gov/ncea/pdfs/dioxin/part1/volume2/volume2.pdf p.1-38, 6-9
10	14	The fire discussion gives no indication that the task group even considered dioxin formation from incinerators. The Task Group has had an extensive discussion of the evidence that PVC is an important determinant of incinerator dioxin formation from Joe Thornton since the very first submissions of evidence in 2000 and resubmitted since in several forms. There is no evidence that the Task Group considered these submissions.	
10	15	"With proper protective equipment, firefighters are not at increased risk" from the hazardous emissions that PVC generates in a building fire. What about occupants trying to escape a fire who lack "proper protective equipment" What about when firefighters' protective equipment fails or oxygen runs out? It is important to include in the analysis the effect of the toxic chemicals released from PVC as it is heated and before it actually ignites especially as it affects unprotected occupants of the building as they try to escape.	
10	17	"Dioxin levels emitted from barrel burning varies significantly with the chlorine content of the fuel source." Therefore reduction of PVC to burn barrels would be a reasonable, scientifically sound way of reducing dioxin emissions form barrel burns - one of the largest sources of dioxin according to the EPA.	
10	30	"The results hold up even though we have subjected both the LCA and the RA to sensitivity analyses." There is no evidence in the report that the task group subjected the LCA or RA to analysis of most of the uncertainties that are acknowledged in the report, much less massive missing data gaps (such as noted above in 10-17). Not a precautionary approach.	
10	30	"...current body of knowledge as analyzed… does not support a credit for eliminating PVC or any particular material" such a simple credit could steer designers to use materials which performed worse over their life cycles with respect to the bulk of impact categories." The evidence presented in this report shows that in every application shown there are materials that perform substantially equal or better to PVC environmentally in most if	

not all categories of impact as measured. Large bodies of evidence that weigh against PVC are missing from the analysis, increasing the likelihood that this will only be strengthened as more evidence is incorporated. All credits have this supposed danger of steering designers to materials or design strategies that actually may perform worse in other categories. Perhaps LCA or RA can eventually be improved enough to help fine tune credits to reduce this potential, but the fear of occasional inexact responses is no reason to hesitate from sending strong necessary signals to the market to avoid known high hazard chemicals.

10	36	Data gaps … if information became available, could alter the results of the analysis." Comment: What is the standard of sufficiency? What is needed?
10	41	"Materials-based credits are unnecessarily "blunt instruments." Rather, human and environmental health would be better served by developing credits based upon issues or impacts such as those on human health and ecosystems." This is an excellent idea, one that is explored in the Green Guide for Health Care and one we would welcome further discussions upon. In fact we raised this idea in the public hearings one year ago. But issue based material credits must be informed by a strong dose of the reality of the material manufacture and building design and specification worlds. The methodology demonstrated in this report is useless to designers who need quick, cost effective and practical tools that provide clear results for making the many decisions that go into a building design, not complex, expensive tools that provide ambiguous answers. Manufacturers likewise need clear unambiguous signals to guide product development toward improvement. A certain bluntness is needed to provide clear market signals and to be usable by practitioners.
11	29	"...shorter term… allowing innovation and Design credits (that are)… working towards eliminating a class of pollutants and/or particulate emissions associated with building materials." We strongly agree that this would be a useful path to explore. We suggested that this (basing this on PBT avoidance instead of PVC avoidance) would be a more appropriate and practical approach for the Task Group to take a year ago and are disappointed that a year of effort has gone by without exploring that approach.
15	14	"VCM is now highly controlled in the United States" The evidence in the air monitoring section (page 79) provides sufficient evidence that VCM is not “well controlled” in the daily operations of typical PVC plants.
15	20	"Foreign manufacturers were not researched for this report" But this report claims to meaningfully quantify the relative impact of manufacturing. How can that quantification be meaningful if it leaves out a significant amount of the production? And there may be biases product by product for and against worker health and safety. For example, linoleum is only manufactured in the highly controlled EU, while many PVC products are made in far less worker protective third world countries.
15	26	"It was not feasible to study both the PVC-based materials and competing materials for all of these applications" Given that a heroic amount of work over a year plus of time only sufficed to study this narrow set of alternatives, this seems to indicate that this LCA/RA approach is an impractical method for evaluating the real world range of alternatives and determining how to effectively keep up with, much less move, the market towards healthier materials.

16	21	"It is difficult to make comparisons between the building materials in terms of the types of morbidity they induce because many occupational exposures involve multiple chemicals, dose response data are inadequate, or the data across studies represent endpoints that are not directly comparable." This is exactly correct. Quantitative risk based comparisons are ill fated and will lead to endless lack of action for all of these reasons. In order to make progress on public environmental health issues we need to set priorities and act to eliminate the causes of those priority concerns.	
19	11	The database is a big disappointment. One year ago, the work group promised an annotated database that we would be able to use to follow the work group's logic - i.e., to learn of the Task Group's assessment of the studies they looked at and how each study contributed to a final number for an LCA cell, etc., This critical paper trail of transparency to the group's process is totally missing. The database is just a list of references with only the most minimal indication of whether the study was used or not. There is no indication of how the study was used.	
22	25	"Articles not kept include … leakage of organotin stabilizers from the plastic matrix of water distribution pipes. These examples were deemed to fall outside the scope…" Comment: How does leakage of organotins fall outside the scope? I assume this is because the Task Group chose not to look at water delivery pipes. So a significant human health concern of the use of PVC is ignored because the Task Group chose not to look there.	
23	26	"SimaPro used … checked and enhanced with BEES" In previous submissions to the Task Group, I've demonstrated serious deficits in BEES ability to evaluate a key issue with PVC - dioxin contribution - in part due to use of the European plastics industry model for production contribution. My research revealed that the BEES model PVC analysis was based upon the APME model for PVC manufacture which provides no value for - it ignores - dioxin releases. It appears from the Task Group report references that SimaPro uses the same APME model (95-31). Despite my having brought this problem specifically to the attention of the Task Group, there is no evidence that the task group evaluated this fundamental problem. Note that there is no dioxin number in the LCA inventory for releases to water and the releases to air are similar in magnitude to the releases for cork, leading to the presumption that, as with BEES, SimaPro is basing its dioxin releases solely upon diesel transportation releases, completely ignoring manufacturing releases and other life cycle releases from combustion in fires or incinerators.	Lent, Tom, Toxic Data Bias and the Challenges of Using LCA in the Design Community, GreenBuild, 2003 http://www.usgbc.org/Docs/LEED_tsac/Toxic_Data_Bias_LCA_paper-Lent.pdf
24	6	"absolute cancer risk has been estimated" Comment: How can you estimate cancer risk when major sources of dioxin originating with PVC have yet to be characterized and some of those that have been are missing from the model? (see 23-26 comment)	
24	13	Disability adjusted life years only capture a portion of the health impacts of hazardous chemicals. What is a DALY for reduced fertility? There are many endpoints that you just can't merge together into a single number.	
24	13	Should read "reference dose through daily oral exposure"	
24	19	hazard index is highly dependent upon the validity of reference doses	
25	20	"An advantage of using intake fractions is that they are already averaged for the United States." Doesn't this mean that it will basically ignore acute and non linear exposures for those closest to the source plants? Not to mention long distance transport of persistent toxicants that then may bioconcentrate in other systems - including in ones outside of the US? See more comment at 97-9	

25	22	"Existing intake fractions do not include metals and therefore we do not include metals in our human health impact analysis...Although HTP values are available for metals, there are large uncertainties..." Comment: but metal additives are a major component of concern for PVC. This is another case of the chosen model driving the analysis instead of the issues driving the model selection. If the issue of concern doesn't fit the model, the issue disappears. See also 90-9
26	13	"New characterizations developed for unspecified dioxins, PAHs, aldehydes and phthalates" The authors state they were "forced" to use a simple average of characterization factors. Nothing forced this choice. This is a selective decision among alternative. The simple average is not a conservative precautionary assumption. With widely ranging factors in a group it easily could be wrong by an order of magnitude *(dioxin toxicities vary by 4 or 5 orders of magnitude for example)* and so becomes quickly meaningless. A precautionary approach would make some effort to calculate distribution and in any case take a higher than average assumption. Most precautionary would use the high end factor rather than an average.
27	19	Data gaps seem to be evaluated very conservatively. If there is not rigorous robust data that works with the model selected, the issue is not deemed worthy of precautionary action. This is akin to deciding that since we cannot yet link an individual cancer to the act of smoking or an individual climate impact, such as a drought year, to global warming that action on those issues is not warranted
31	8	"it is expected that companies strive to put good industrial hygiene practices in to place… risk estimates … have relied solely on OSHA PELs in the absence of more accurate data." Does this mean that the more heavily studied PVC industry gets lower estimates based upon actual study levels while the less studied alternate materials all are assumed to be exposing their workers at maximum PELs? (Greg Norris implied this in a public presentation in Lowell MA in late 2004) This would introduce systematic bias favoring PVC.
31	8	When trying to estimate the absolute risk of a single material or process, using a high end assumption is an appropriate conservatism. However, when comparing relative risks of multiple alternatives, using only a high end assumption can introduce systematic bias and should be accompanied by an uncertainty analysis to determine the effect of the assumption. This also could explain the relatively high occupational impacts.
32	10	"Lack of accurate exposure data prevents the estimation of potential health risks…it is believed that people involved in the transport of VCM… may be exposed via leaks from transport trucks... it is not possible to determine what those exposures might be with accuracy." Once again uncertain data, leads to no conclusion, no action. Where is precaution?
32	18	"...dermal exposures difficult to quantify" Once again uncertain data, leads to no conclusion, no action. Where is precaution?
32	40	The authors used a CIWMB study for flooring installer exposure assessment. This is an inappropriate use of that study. These are tests conducted after 14 days of conditioning designed to reflect longer term exposure to installed material, *not* a test of what installers will experience during installation. (as noted in text at 33-12). There is no reason to believe that the relationship will be linear and that this provides any relative indication of installer exposure that can be compared across materials.
32	44	The CIWMB materials emissions study is already old obsolete data for linoleum. Forbo has already rectified high 1350 VOC emission levels identified in that test and had the material retested successfully.

33	27	"Residential exposures for vinyl products are not considered here as most …do not discriminate between resilient flooring and wall coverings and other flexible vinyl products, the latter of which are not considered in this report." So evidence that PVC interior finish products individually or collectively create an indoor air quality problem is "not relevant" because the Task Group is only looking at resilient flooring? This is an absolutely stunning avoidance of potentially useful data.	
48	19	"Clearly reducing PVC in household waste would reduce dioxin and furan emissions but that change alone would not eliminate emissions." This is a puzzling assessment. The Task Group has "clearly" determined that PVC is contributing to dioxin and furan emissions, yet does not appear to add this to the weight of evidence against PVC, because this "change alone would not eliminate emissions" This is akin to suggesting that the fire code is irrelevant because it alone doesn't along eliminate fires.	
48	19	I assume that the reason this is not added to the weight of the evidence is that despite being charged with considering the state of the evidence, the Task Group decided to take an approach that is primarily based upon the ability to find numerical data that can be plugged into their specific model, this LCA/RA not upon the weight of the evidence. While there are some extensive discussions like this one about a few of the particular issues that don't fit into their model, their is no final assessment that brings together the results of these individual discussions. The final arbiter is not the weight of all this evidence; it is just what makes it through the filter of having quantitative data that fits into an LCA/RA model. The rest of these bodies of evidence disappear from the final analysis. Why do we need to wait to have confidence of the exact amount of impact before taking preventive action that will clearly help what the EPA has identified as one, of if not the largest, sources of dioxins? The USGBC does not apply the same standard to taking action on climate change. And what about construction burn barrels?	
49	2	"These values (for burn barrel dioxin emissions) are an order of magnitude higher than emissions calculated for PVC and EDC/VCM manufacturing facilities, produced by the Vinyl Institute (1998) and audited and agreed to by the US EPA (2000) audited by the EPA" This statement reflects a common fundamental misunderstanding of the meaning of the inventory published in the US EPA's Draft Dioxin Reassessment: The direct contribution of PVC manufacturing to dioxin in the environment is controversial and may be grossly underestimated in the EPA inventory. The EPA dioxin inventory lists 33g TEQ in the primary table from the entire chlorine industry and only 12.3 g TEQ from EDC/Vinyl chloride manufacturing. The industry makes much of the fact that this is a small proportion of the 3,252 g TEQ quantified in the EPA analysis for 1995. The concept is repeated here in the TSAC study apparently to indicate that the contribution from manufacturing is insignificant compared to burn barrels. Deeper scrutiny, however, reveals that the 12.3 g listed in this table is only a small part of the PVC manufacturing dioxin story. The EPA inventory number estimates only the fugitive and stack air emissions and water emissions directly from manufacturing plants. Far more dioxin is generated in the manufacturing process than is captured in this analysis as is indicated below:	USEPA, 2001 Database of Sources of Environmental Releases of Dioxin like Compounds in the US, EPA/600/C-01/012, 3/2001, http://cfpub.epa.gov/ncea/cfm/dioxindb.cfm?ActType=default

49	2	The chlorine industry as a whole (of which PVC manufacture is a major portion) reported in its Toxic Release Inventory (TRI) data that it sent 20 times that much dioxin (260 g TEQ) in heavy ends, tars and other hazardous materials to land fills and injection wells in 2000, only 100 g TEQ of which went to hazardous waste landfills .	Chlorine Chemistry Council, 2000 Dioxin Data from Major Chlorine Producers and Users, Dioxin Data: Disposal of Dioxin to Underground Injection Wells and Landfills, http://www.c3.org/2000_dioxin_data/land.php
49	2	Another 810 g TEQ was transferred to "off site management", some incinerated, some land filled, some unspecified.	Chlorine Chemistry Council, 2000 Dioxin Data from Major Chlorine Producers and Users, Dioxin Data: Transfers to Off-site Locations, http://www.c3.org/2000_dioxin_data/transfers.php
49	2	Finally a massive 6900 g TEQ are "treated on and off site" most commonly in hazardous waste incinerators which do not accomplish complete destruction of the dioxins.	Chlorine Chemistry Council, 2000 Dioxin Data from Major Chlorine Producers and Users, Dioxin Data: Source Reduction Activities, http://www.c3.org/2000_dioxin_data/source_reduction.php
49	2	Indications are that these flows are not being kept out of the environment. Significant dioxin contamination has been found in sediments in the vicinity of EDC/VCM manufacturing facilities Netherlands, Italy, Finland, and the United States.	Thornton, PhD, Joe, Environmental Impacts of Polyvinyl Chloride Building Materials, Healthy Building Network, 2002 p.29
49	2	A 1999 study by the Centers for Disease Control found that residents near an EDC/VCM plant in Louisiana have significantly elevated levels of dioxins in their blood, averaging three times that in a comparison population of US residents with no known exposure to dioxin other than background levels.	CDC (U.S. Centers for Disease Control). 1999. Health Consultation: Exposure Investigation Report, Calcasieu Estuary, Lake Charles, Calcasieu Parish, Louisiana. Washington DC:
49	2	This 12.3 g TEQ dioxin number for manufacturing releases is itself also suspect as it is derived solely from the PVC industry's self assessment and not independently verified. According to Joe Thornton, PhD: "In this self-characterization, the PVC industry decided when and where to take samples, how to collect them, how to analyze dioxin content, which data to present, and how to interpret this data before submitting their results to EPA. While an independent panel reviewed the submission, the industry chose which data the panel saw. Information about the samples—including which facility they came from—was completely confidential, so neither reviewers or the public had the opportunity to determine whether sampling times and locations accurately represented typical dioxin releases. Most importantly, no one was able to independently evaluate, confirm, or act on the information. It would be naïve to take at face value the industry's own estimates of the magnitude of its releases of dioxin—a substance that is the subject of major public concern and regulatory activity—particularly when those estimates conflict with a large body of information gathered by independent sources."	Thornton, PhD, Joe, Environmental Impacts of Polyvinyl Chloride Building Materials, Healthy Building Network, 2002 p.38

49	2	Concerns about what happens to these flows and related issues led peer reviewers of the EPA dioxin inventory to express serious concern about the PVC manufacturing estimates. The reviewers indicated that they could not properly evaluate the EPA's results and raised questions about the basic validity of the estimation process: "No information is provided here on the process or industry structure. Coupled with information on the handling of in process materials and wastes this might help to increase the understanding of analytical data which is presented." and "No estimate is provided in the summary in section 2 for PVC manufacturing. It is incumbent on EPA to at least provide a rough order of magnitude estimate for this controversial source or at minimum address the issues in the summary section. The lack of closure on this subject appears to be out of balance with other sources with similar levels of uncertainties. EPA should use the same criteria used for every other source and make its best estimate of the emissions levels from this source given the currently available data." To suggest that these numbers represent something "audited and agreed" upon is quite an overstatement.	USEPA, Peer-Review Meeting for EPA's Inventory of Sources of Dioxin in the United States, April 1998, http://www.epa.gov/nceawww1/dioxpr.htm, p. B-26 & B-65
49	20	"It cannot be assumed that the sources that make the largest contributions to overall dioxin emissions also make the same relative contributions to human exposure." In fact, since as the report points out, meat and dairy food sources are an important dioxin pathway for humans and as the apparent largest contributors to dioxin contribution - PVC combustion in burn barrels and landfill fires (see below) - likely primarily take place in rural agricultural communities, it is reasonable to project that this influence might amplify the impact of these sources.	
49	33	"Additional research is needed on reducing total emissions through command and control technology" Why not act now with the tools that the USGBC has at its disposal (materials policies through LEED) that are known to be able to reduce the volume of feedstocks to these burn barrels that are known to be significant contributor rather than awaiting research on legislative tools that are not even within the USGBC's purview?	
49	35	Studies of a few major PVC related fires are cited that purportedly show that dioxin contamination remaining in the area was relatively light. The EPA's dioxin assessment however cites other studies showing that 90% of dioxin emissions from structural fires may be gaseous ones that leave the immediate area and hence were not captured by these analyses and instead are contributing to the larger environmental load on us all.	USEPA, Exposure and Human Health Reassessment of 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD) and Related Compounds Part I: Estimating Exposure to Dioxin-Like Compounds Volume 2: Sources of Dioxin-Like Compounds in the United States, Draft Final Report, EPA/600/P-00/001Bb, March 2001 http://www.epa.gov/ncea/pdfs/dioxin/part1/volume2/volume2.pdf p. 6-2 to 6-9
49	35	PVC in fires. See Deborah Wallace's comments expressing concerns about the depth of the Task Group's analysis of the health impacts on occupants and firefighters in burning buildings with PVC content. She indicates that there is a substantial body of literature that was not utilized by the Task Group that adds up to a compelling body of science indicating serious hazards from fires.	
49	35	Fire discussion gives no indication that the Task Group considered the emissions from landfill fires that may be the largest single source of dioxin. See 10-14 comment	

51	39	There is no discussion of why the Task Group considers the "identified 10 life cycle impact assessment (LICA) categories and two occupational categories" to be the appropriate ones to address the concerns that have been raised about PVC and its alternatives. It appears that the constraints of the tool are driving the analysis rather than the environmental issues raised by the question.
54	7	Forrest indicated that "compounds emitted from thermal processing of vinyl resin were low and represented negligible risks." Is this the only source used to dismiss concern about the contribution of the thermal process stage? Was this an independent study or industry financed? The TSAC data base did not indicate the sponsor of this study. No information was presented in the report to establish the validity of this study. Given that risks already differed by an order of magnitude or more (54-4 & 22) it would seem to be important to check the validity of this assumption to see if possible uncertainty in these risk estimates are even larger than indicated.
59	1	Vinyl siding tends to be worse than two of the three alternatives in most LCA categories.
59	3	"Different assumptions and data sources for the LCA modeling can lead to variations in the results … that range over more than an order of magnitude." The order of magnitude plus variations shown in this graph is a pattern that is reflected for each of the applications (except windows where the spurious inclusion of energy flows during use through the window throws the analysis as discussed elsewhere). This despite the fact that it appears that the uncertainty indicated in this analysis does not include many of the data uncertainty and data gap issues that are raised in the report, such as the "missing" mercury from chlor alkali plants, toxicity of chemical classes, fenceline community exposures, residential exposures, etc. With inclusion of all uncertainties and gaps in the data, even more of the uncertainty bars would likely be far larger than the mean differences, rendering the quantitative analysis meaningless for identifying differences. This indicates a fundamental problem with attempting to address this type of cross product and application policy question with a quantitative analysis like LCA. LCA is highly useful to identify potential problem areas for further exploration but its numeric results are simply not robust enough to meaningfully compare across manufacturing sectors as is attempted in this report.
61	12	"Population particulate risk to human health exceeds the estimated population cancer risk to human health" This conclusion is premature and may be totally invalid given that population cancer risk may be radically underestimated in this analysis due to the lack of dioxin environmental release data in the PVC manufacturing model, dismissal of the evidence of fenceline releases of EDC and VCM, and the lack of incorporation of analysis of dioxin releases in the remainder of the life cycle of PVC (structural fires, landfill fires and incinerators).
62	8	"Vinyl siding leads to the highest mortality risks, while wood siding leads to the lowest. However the differences are small and may be considered insignificant given the relatively large uncertainty levels…" The differences may well be small only because of a systematic bias of the analysis to exclude data that would disproportionately drive up the mortality risks for PVC. Given the large number of PVC risk factors cited elsewhere in this comment that have been excluded from the analysis, some of which might be quite large relative to those measured, it is particularly damning that PVC still rates as the worst mortality risk.
65	17	Particulate risk versus cancer risk: This conclusion is premature and may be totally invalid. See comment 61-12
67	6	"cast iron leads to the highest mortality risks" The validity of this conclusion is in doubt due to the multiple mortality related issues (such as environmental dioxin releases and fence line VCM and EDC releases) not evaluated for PVC.

68	10	"We do not observe one material option performing consistently poorest among the options across impact categories. Vinyl has the highest values in some impact categories, VCT in others and linoleum in others." This statement is baffling at best. The data as presented in the figure 17 immediately above it indicates a very consistent picture of the two PVC alternatives performing generally worse than the alternatives. In fact, in eight out of the eleven categories, both of the PVC alternatives have higher (worse) scores than both of the non PVC alternatives. In two of the remaining categories (particulate and fossil fuel), VCT, vinyl and linoleum are roughly comparable (within the uncertainty ranges) and only in one of the eleven categories (eutrophication), does one a single alternative (linoleum) come out clearly worse than VCT and vinyl. VCT and vinyl still perform much worse than cork in this category. Calling this an ambiguous result because vinyl and VCT alternate in which is the worst performer is akin to saying it is not clear that cigarettes are bad for you because some brands lead to more cancer and others lead to more bronchial disorders.
69	15	Particulate risk versus cancer risk: This conclusion is premature and may be totally invalid. See comment 61-12
71	4	"The median provides a measure of central tendency which is more robust, less susceptible to outliers" Calling 30% of the data "outliers" is not robust. This approach is not compatible with a precautionary approach. Faced with almost a third of the tests showing a far higher concern (particularly if there is any clustering as the text seems to imply) should lead to further inquiry about the potential problem, not a statistical dismissal. Questions include: what factors might have led to the higher results? Difference in testing condition? Difference in sponsor of the research? Lacking the answers to these questions, 30% of the tests showing a significant problem ought to be given serious weight. A minimum precautionary approach would be to use the mean leading to the conclusion that total mortality risks for VCT are highest.
73	5	"In contrast with the other product groups … the results for windows are remarkably similar across the product alternatives… because the total life cycle results are not dominated by the frame material, but rather by the glazing and the usage phase energy use.... from a life cycle human health perspective, the key issue is window energy efficiency rather than frame material" It is interesting and instructive to see that use phase energy has significant impacts on health, but not informative to the basic charge of the Task Group. Clearly energy loss through a window is important (though highly variable and so any single number assumption about it is suspect - see my comment elsewhere). With ten points devoted to reducing energy consumption in LEED, adequate attention is already provided to this issue to encourage use of efficient windows in LEED designs. By increasing the number of glazings or adding gas or selective surfaces, one can bring up the assembly U-value of an aluminum window - and hence its energy loss - to the equivalent to a PVC or wood window. The more relevant question the Task Group leaves unanswered is what impact frame choice has for a given U-value of window assembly.
75	1	Not surprisingly, the human health particulate numbers are high and don't vary much between the types, being dominated by energy usage. Significantly, however, the answer to the frame material question becomes clearer when one looks at the cancer effects which are apparently not so driven by energy usage. Despite the lower energy usage, PVC still comes out with the highest occupational cancer DALYs. A full analysis of the health impacts of PVC, not confounded by the irrelevant use phase energy analysis and including the plethora of PVC health issues ignored in this report would probably only increase the health disadvantage of PVC.

77	13	"The total life cycle mortality results are dominated by particulate exposures rather than cancer." This conclusion is premature and may be totally invalid given that population cancer risk is likely radically underestimated in this analysis due to the lack of dioxin environmental release data in the PVC manufacturing model, dismissal of the evidence of fenceline releases of EDC and VCM, and the lack of incorporation of analysis of dioxin releases in the remainder of the life cycle of PVC (structural fires, landfill fires and incinerators).
78	6	"Occupational cancer risks dominate the population cancer risks posed by the life cycle releases of carcinogens to the environment….these cancer risks are not found to be very important relative to the particulate emissions…" Both of these conclusions are premature and may be totally invalid for the same reasons as stated above. Until a real analysis is done of the actual emissions from PVC manufacture and incineration, any such conclusion downplaying the importance of cancers from PVC is inappropriate at best.
80	8	"a high spike was quickly corrected" On what reference does the task group know that the condition that led to the emissions spike was "corrected" and not likely to happen again (and indeed to have happened again already outside of the monitoring periods reported here)?
80	24	"Mean concentrations of vinyl chloride in air over the entire published monitoring period were calculated. Data were normalized…average of two samples fro the same date was used as one sampling event. Months with multiple sampling…etc" Averaging measurements to get four and five year mean concentrations create meaningless numbers that hide the exposure of residents to upset conditions and other high emission spikes. This is akin to telling an asthmatic not to worry about the fact that an acute asthmagen is being released from the carpet in his classroom in which he spends 6 hours a day because when averaged with the other 18 hours that he is not in the classroom, the average level he breathes in a day shouldn't be high enough to trigger an asthma attack. There is a distressing amount of this kind of averaging that hides significant data in this report.
82	18	"Air monitoring data …tabulated ...by Sage Environmental Consulting, Inc. were provided by the Vinyl Institute." Numerous efforts were made by several parties over many weeks to obtain a copy of this report for analysis from both the USGBC and the Vinyl Institute. Both the USGBC and the Vinyl Institute failed to produce a copy of the report. The veracity and analysis techniques of this report are worth checking given the source. This is important enough that we feel that opportunity should be provided for comment after the deadline when the Sage report eventually is shared for review.
84	14	"Consistent exposure of individual to these concentrations may indeed pose a significant health risk." An appropriately strong statement is made here but then disappears never to make it in to the final analysis or conclusions.
87	37	"Additional data are needed to determine the potential health risk of individuals living in neighborhoods near vinyl manufacturing facilities." Perhaps additional data would be helpful in better quantifying the level of risk for the TSAC model. However the data available and analyzed by the task group (that is the patterns of exceedances) is clearly sufficient to determine that individuals living in neighborhoods near vinyl manufacturing facilities are at serious potential health risk. A responsible analysis would include this determination in its comparative evaluation.

94	12	“Lack of more accurate data does not negate the findings or lessen their significance.” This is only true if the lack of data is not biased. If the data that is missing is primarily data that would tend in one direction, then the lack of data *does* negate the findings. In these comments and those of others, there is sufficient evidence that the data either lacking from this report or present but discarded from the analysis may be highly weighted against PVC.
94	24	"(PELs) can result in very high estimates of risk." This artifact could help explain the high level of occupational risk found in this study relative to population risks. On the other hand, it may not be a high estimate at all. As the report acknowledged (31-9) "exceedances of PELs do occur and are documented."
95	26	"TRI and Air Data, which are plant or industry-specific, are not usually adequate for process based analysis." While these data have many flaws and their cannot directly plug into an LCA model, they could provide a valuable audit of the model to insure that the chemicals actually being reported as emissions from the different alternatives are at least included in the model.
95	31	"SimaPro mainly contains data from the European sources (APME..." These are the databases I have previously critiqued as apparently almost completely disregarding the dioxin emissions issue from the manufacture (and rest of life cycle) of PVC. See comment 23-26
96	3	"Data Gaps in emissions data" Each issue may contain order of magnitude uncertainties rendering a quantitative analysis such as an LCA or RA meaningless with data uncertainty bars larger than the differences. Where is the analysis of the uncertainties and implications of the data gaps for this analysis?
97	9	"For the exposure estimates, intake fractions ... were used" This is another case of averaging hiding the real impact. The impact of releases in the immediate neighborhood of the plant will tend to be far more concentrated than an intake fraction would ever show. And far from the plant as well - particularly with the persistent bioaccumulative toxicants like dioxin, there can be long distance transport and bioconcentration leading to the astounding concentration of toxic chemicals in remote areas like the circumpolar Arctic where Inuit women's breast milk is contaminated with PCBs and dioxins from North American chemical plants.
97	21	"Intake fractions for metals have not been evaluated. Therefore this report's analysis could not take into account the impact from metals." Another case where the limitations of the analysis are driving the analysis rather than the key issues. If the tool does not work, another tool should be brought to bear to supplement or replace it. PVC has serious problems with metal additives. Ignoring this issue introduces yet another significant bias to the study.
98	8	The available evidence that actually survived the exclusionary filters of this tool does support a conclusion that PVC is consistently worse than alternative materials on a life cycle health basis. In some applications, such as flooring, there is sufficient evidence to demonstrate that it is consistently worse than any other material evaluated in almost every other environmental impact area as well. In the other applications there is insufficient evidence that other materials are consistently and significantly worse in other impact areas to warrant not moving forward on avoidance of PVC on the basis of environmental health intent. At best, the remainder of the evidence might provide basis for some adjustments to a PVC credit. Provisos on fiber cement siding and low efficiency aluminum windows could be explored to insure best health impact. In no way does this analysis provide sufficient evidence that designers should not act now to avoid PVC in materials and buildings in order to avoid the significant hazards with which it is associated.

See HBN News January 27, 2005 for a variety of references on this issue http://www.healthybuilding.net/news/mothers milk-012705.html