Off Track: A Critical Analysis of the USGBC TSAC PVC Report

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In late December of 2004, the PVC Task Group of the US Green Building Council (USGBC) Technical Scientific Advisory Committee (TSAC) released their 121-page draft report on PVC[1]. Charged with evaluating the evidence for a PVC related credit, the report concludes that "PVC does not emerge as a clear winner or loser … the available evidence does not support a conclusion that PVC is consistently worse than alternative materials…"[2]

This conclusion 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,[3], 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 environmental assessments including the McDonough-Braungart Design Chemistry materials assessment protocol. How did the USGBC TSAC reach a conclusion at odds with so many other analyses of the same material?

Flaws lead the Task Group astray: Our evaluation suggests that three fundamental problems led to the Task Group's failure to understand why PVC has been the target of hazardous chemical avoidance policies. The report misses the mark by:
- **using a model that is fundamentally inappropriate** for the task and can't accept much important real world data.
- **misinterpreting and ignoring important data** and scientific studies.
- **missing critical PVC environmental health issues**, including the primary one upon which the proposed credit was based, and

The Task Group developed a new, untested protocol that supplements life cycle assessment (LCA) with risk assessment (RA). While this experiment is laudable, it is insufficient to make up for LCA's well established and recognized deficiencies in addressing human health problems. Though many important material health concerns are revealed along the way in this report, the incredible limitations of both LCA and RA led the authors to neglect, ignore, set aside or average into meaninglessness vast amounts of evidence in the name of data

[1] The complete report and instruction for commenting are available at http://www.usgbc.org/LEED/tsac/pvcvinyl.asp

[2] USGBC TSAC 10-22 Note: in these footnotes, this refers to the "10-22" reference indicates "page 10 line 22"

[3] See http://www.healthybuilding.net/pvc/corporate_policies.html for more companies that have deselected PVC.

harmonization. The result of this experiment in crossing a risk assessment with a life cycle analysis is an analytical tool that is even blunter than either of its parents[4].

TSAC model misses key data and issues: 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

Green buildings can eliminate priority hazardous chemicals: 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. The TSAC model grinds to an analytical gridlock, and leaves the unhelpful and incorrect impression that there is no meaningful way to distinguish the environmental attributes of building materials.

Major technical concerns with the report: HBN has convened a panel of experts to review and comment on the USGBC report. This briefing paper reviews some of the major areas of concern with PVC and identifies where our panel has found that the TSAC Task Group failed in its handling of these key data points. These issues are summarized in brief below then in more detail in following pages:

1) Persistent bioaccumulative toxic chemicals (PBTs): The Task Group ignores the international consensus to end the production of the worst of these particularly potent chemicals, including dioxin and three others which are uniquely associated with the entire life cycle of PVC, It's model is even incapable of including 65 tons of mercury recently revealed to be "lost" from PVC manufacture.
2) Fenceline chemical releases: The Task Group relies upon flawed data from a chemical industry study to dismiss concerns about airborne toxics in the neighborhoods of PVC plants and entirely ignores with groundwater contamination that affects the drinking water for millions of Americans.
3) Toxic additives: The Task Group mischaracterizes or ignores significant bodies of scientific study highlighting the dangers of common toxic additives used in PVC.

[4] Remember LCA was designed for use in product development or academic investigation, not for cross product evaluation. TSAC member Nadav Malin wrote an EBN article in March of 2003 warning designers to exercise caution when using an LCA, reasoning "the science behind (LCA) is still very new and will continue to evolve" (Malin, EBN-03/02). On the other hand, risk assessment is the same 'cigarette science' that chemical and plastics industries have hidden behind for years.

4) Fire: The Task Group mischaracterizes the role of PVC in fire, ignoring bodies of work pointing out the unique hazards of the combustion of PVC, and fails to address EPA estimates that landfill fires fueled by PVC may represent the single largest source of dioxin.
5) Recycling: The Task Group fails to account for PVC's inherent unsustainability attributable to the insurmountable technical challenges that have rendered PVC incapable of being recycled in large volumes and a threat to other recycling streams.
6) Chemical security: The Task Group does not address the potency of stored or transported chlorine (that uniquely makes up over 50% of PVC) and the very real risk of terrorist attack or more accidents like the recent one in South Carolina.

This briefing will also identify how the analysis of the health effects that *were* addressed in this report tend to support the assertion that *PVC is consistently the least healthy material alternative across applications*.

Finally this briefing will summarize the dangers posed by the TSAC report to the simpler, more efficient and transparent screening tools that are successfully transforming materials markets as they are employed and refined by designers, governments

The USGBC was founded with a core value to drive market transformation to safer more environmentally responsible buildings. The LEED Rating System's stated mission is to "accelerate global adoption of sustainable green building and development practices," and to create and implement "universally understood and accepted standards, tools and performance criteria."[5] The draft TSAC report on PVC turns these principles aside, if not on their head. Your engagement is needed to help the USGBC stay on track and meet its potential.

DETAILED ANALYSIS OF THE AREAS OF CONCERN

The next section of this briefing looks at the concerns about PVC – primarily related to its use and generation of toxic chemicals - that have been raised by the scientific research and the environmental health community, and reviews how the Task Group fails to address them. This represents selected highlights, not an exhaustive analysis of the problems with the report. A much more complete, detailed, referenced line by line critique of the report is underway and will be made available before the close of the comment period.

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[6]. Studies have found that PVC is unique in the extent to which it produces four of

[5] USGBC LEED Foundations Policy Manual, p.4
[6] 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

the 12 Stockholm POPs (dioxins, furans, PCBs, and hexachlorobenzene) throughout its lifecycle.[7]

The Task Group report totally fails to even acknowledge the existence of this international policy consensus committed to a Treaty – odd 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" and do not appear anywhere in the report.

Was the Task Group blinded to PBTs by being too focused on the wrong tools? LCA and risk assessment are generally not well suited to address chemical elimination policies. Furthermore, these chemicals that 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[8]), don't perform the way risk assessments expect that are designed more to focus on non persistent exposures in a workplace or near a factory.

The acronym PBT only appears once (undefined) under a discussion of backyard burning.[9] 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[10]. While 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 model.

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

[7] 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
[8] See "As Good As Mother's Milk: The US Green Building Movement" Healthy Building Network newsletter 1/28/05 www.healthybuilding.net
[9] USGBC TSAC 47-31
[10] USGBC TSDAC 89-23

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[11]. It is no surprise that their analysis hides the real impact of high exposures to VCM and other toxics, apparently by averaging the high readings taken near company fenceline residents with other data from farther away from the plant.

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[12].

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

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[13]. 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[14]. A growing body of scientific evidence is increasingly linking DEHP exposure from PVC building products to asthma and other bronchial problems. All of these peer-reviewed epidemiological studies were dismissed as being inadequate for a variety of

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[11] Sage Environmental is a consulting firm for the Vinyl Institute that 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".

[12] 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

[13] USGBC TSAC 22-26

[14] 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

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.

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 its smoldering releases hydrochloric gases that turn to acid on contact with water (such as in the throat)[15].

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[16]. 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[17]. 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[18].

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[19] 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

[15] 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
[16] USGBC TSAC 10-15
[17] USGBC TSAC 49-35
[18] 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
[19] USEPA, March 2001, p.1-38, 6-9

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 the model can't handle the issue.

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 recycling contaminant, endangering other plastics recycling[20]. 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"[21] 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[22]. 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[23], the number of water works using chlorine has dropped from 575 in 1988 to just 22 in 2001[24] – 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. It is time for the building industry – at least the green building industry – to follow suit.

Overall health concerns – damning PVC with faint praise: Clearly the Task Group missed or dismissed a wide range of health concerns, often echoing with distressing clarity, industry

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[20] APR Declares PVC Recycling Unfeasible, Waste Age, 7/1/98
http://wasteage.com/mag/waste_update_apr_declares
[21] USGBC TSAC 48-19
[22] Growing Potential for Hazmat Accidents, ABC News, 1/7/05
http://abcnews.go.com/WNT/story?id=393986&page=1
[23] New Jersey Department of Environmental Protection, Toxic Catastrophe Prevention Act Program
http://www.nj.gov/dep/enforcement/relprev/tcpa/tcpa.htm
[24] 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&

reassurances. Interestingly, however, reading past the conclusions, one still finds damning health evidence against the use of PVC throughout the report even in the Task Group conclusions for three out of the four applications they studied:

- Siding: "*vinyl siding leads to the highest total mortality risks*"[25]

- Piping: "*PVC and cast iron pipes lead to higher total mortality risks* than ABS pipe"[26]

- Flooring: Linoleum came out with higher total mortality risk but only after they threw out **30**% of the studies of particulate matter from VCT. *Using the mean values of all studies, VCT has the highest mortality risk.*[27]

- Window: The Task Group totally lost its way here, basing their evaluation on the health impact of the difference in energy used during the life of the window, which it suggests overshadows the health impact of emissions during manufacture[28]. This presumes that the relative energy efficiency of the different window materials is fixed and that this difference in fixed heat loss will result in a fixed amount of fossil fuel use that lead to a standard amount of emissions. How realistic is this? There is not a single number that you can plug in to meaningfully compare fuel emissions from a "generic aluminum window" with other material life cycle health impacts. The impact of window energy usage will vary widely, probably by orders of magnitude[29] rendering the results meaningless. A much more robust basis for evaluating the impact of the window materials would not cloud the issue with the independent energy design of the window, which will be maximized for other reasons in a green building.

Unfortunately, the endpoint of this extended example in which the real number result may vary by many orders of magnitude rendering any calculation meaningless is repeated over and over again in the report. A much simpler example is where they combine a whole group of dioxins that have carcinogen impacts that range over ***four*** orders of magnitude (the most potent is 10,000 times worse than the least potent) by simply averaging their factors all together.

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

[25] USGBC TSAC 7-34
[26] USGBC TSAC 8-4
[27] USGBC TSAC 71-12
[28] USGBC TSAC 8-31
[29] What would drive this kind of variation? Start with the local fuel mix. Whether in coal fired Wisconsin or nuclear Illinois or hydroelectric Washington or natural gas and renewable California will make an order of magnitude differences in electric power emissions per kWh. This could be further driven down by selection of a green power supply or a high efficiency natural gas or biodiesel turbine or cogenerator. 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 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 finally again by the way the building is operated, e.g., thermostat settings, use of insulating and shading devices, etc. Exhausted yet? It goes on.

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.

What happened to precaution? The precautionary approach that the committee promised would be an important part of their approach appears to be totally missing from this analysis. Over and over again, whenever there are uncertainties about the data or their model is unable to handle the problem, they give PVC the benefit of the doubt and defer any judgment.

The TSAC Group missed their charge. They apparently did not review evidence that was offered, nor apparently did they review 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.

Meanwhile governments and major corporations have tackled and solved this challenge much more effectively and clearly. Rather than grappling with highly uncertain mounds of LCA and risk assessment data, government and corporate policy makers have looked at the science and determined that certain chemicals are simply too hazardous for any safe use and must be phased out as rapidly as possible. The world's governments, including the United States, have recognized this in signing the Stockholm Convention designating twelve persistent organic pollutants for elimination. Progressive corporations like Herman Miller, Shaw, Carnegie Fabric, Nike, MDBC and others have taken the next step of identifying more persistent, bioaccumulative toxic chemicals and other carcinogens, reproductive toxicants, mutagens and endocrine disruptors for elimination. A toxic chemical screening approach is relatively simple to use, much less ambiguous in its answers, and can be transparent with assumptions clearly laid out. This is unlike the Task Group analysis, in which much of the actual calculations and assumptions remain invisible to the reader.

The USGBC was founded with a core value to drive market transformation to safer, more environmentally responsible buildings. On this issue, as with the FSC wood issue, trade associations are working hard to derail the Council from this path. Your engagement is needed to help the Council stay on track and meet its potential.

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