

Safe Handling of Plastics



Acid vapors released from degraded plastic materials (center) have corroded a metal pan (center top) and a metal box (lower right) in same drawer. Domestic Life Collections at NMAH photo credit Preservation Service, NMAH

Since their introduction in the early 19th century, plastics have developed extensively. Consequently, they are a significant part of any museum's collections and are found in textiles and costumes, furniture and industrial machinery, books and papers, recorded sound, as single entities or in composite forms. They can also be found in building facilities, exhibitions, installations, offices, shops, and restaurants as construction materials, appliances and tools, making their presence a vital part of museum life.

Research on the theory and mechanics of plastic degradation and plastics-related health and safety issues has made steady progress over the years; however, research on the handling of plastics is in dire need of an update. These safety practices are especially relevant to conservators, curators, museum specialists, and exhibition preparators who must handle and evaluate many types of plastic materials as part of their daily responsibilities.

Plastics old and new have begun to show signs of instability. Plastics behave and degrade differently from more traditional materials such as metal, glass, or ceramic. Because they're organic, they're subject to degradation by light, heat, moisture, and pollutants. They have a relatively long induction period during which the material is stable, followed by accelerating, irreversible degradation. Manufacturers who seek only to promote the widespread use of their products often downplay the risk of handling plastics. Furthermore, data from the scientific community and regulatory agencies are controversial, conflicting, and inconclusive, making it difficult for museum workers to sift through rapidly emerging scientific data and to separate solid information from myth and alarmism.

As new findings on plastics become available, new risks and concerns will undoubtedly emerge. For now, the major risks associated with new and degraded plastics are the migration of plasticizers and emission of volatile organic compounds (VOCs) from plastics.

Migration of Plasticizers

Migration of plasticizers via evaporation is the major cause of plastics' instability. Plasticizers are low-molecular-weight resins or liquids that form a noncovalent (weaker bond) to plastics. Plasticizers are added to reduce a plastic's tensile strength, hardness, and density. For example, PVC pipes have no plasticizers (phthalate); PVC-based toys have 30-50% phthalate. Migration refers to a component that leaves a material as a gas, liquid, or solid. Plasticizers can evaporate into the environment as a gas and deposit as a liquid or solid onto the surface of the plastics. Plasticizers such as phthalate and bisphenol-A (BPA) are recognized as endocrine disruptors by the medical community and are classified as priority pollutants by most regulatory bodies. The sticky films on the surface of plastics are often associated with the liquid plasticizers. These sticky films trap dust. Never use a bare hand to touch this dusty sticky surface; instead wipe the sticky films with a non-abrasive cloth or microfiber, and dispose of the waste properly.

green tip

Green Exhibits, Gradually

The Madison (WI) Children's Museum developed and maintains greenexhibits.org, a website dedicated to sustainable museum exhibit design and fabrication. Divided into six sections (begin, rethink, plan, build, connect, dream), greenexhibits.org offers a systematic guide to "going green."

In this time of rapidly blossoming interest in eco-friendliness, one thoughtful observation on the site bears quoting:

"While some institutions may evaluate the impact materials have on environmental life cycles, or make exhibits that contribute to regeneration of our environment, others may simply switch to paints that are less toxic as a starting point. Sustainability is not about getting it all perfect right away. It's about working toward changing the way we do business in honor of the children we serve. Start small or start big: just start."

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Off Gassing of Plastics

This type of off gassing is associated with what is often described as “new car smell” or “new shower curtain smell.” When warmed to 50-60°C, plastics give off odors ranging from the sweet, fruity smell of acrylic to an odor similar to the preserving fluid urea-formaldehyde (Shashoua 2008, 119).¹ Studies of workers in the building industry have shown that eye irritation, sore throats, and other nonspecific symptoms were often linked to VOCs such as phthalates (plasticizer used in PVC). High concentrations of phthalate, an endocrine-disruption chemical, have been detected in dust samples taken from building sites (Hutter 2006).² Plasticizers may be responsible for up to 50% of VOC emissions from flooring (excluding the adhesive).

Safe Handling of Plastics in Museums

Hand washing is the single most important way to prevent the spread of contaminants arising from new and degraded plastics. Regular hand washing with simple soap and water has proven absolutely crucial. Hand washing should thus be regarded as a job requirement, not an option. When handling plastics, always wear gloves that are impermeable to acid, dust, and plasticizers. Check a chemical compatibility guide for suitable gloves (Ezfacts, 2002).³ Ventilate the work area with fresh air and use local exhaust ventilation whenever possible. Temperatures at or below 20°C and relative humidity 30-50% are suitable conditions for plastics.

References

¹Shashoua, Y. 2008. *Conservation of plastics: material science, degradation and preservation*. U.K. Butterworth Heinemann. 119.

²Hutter, H.P., H. Moshammer, P. Wallner, B. Damberger, P. Tappler, and M. Kuni. Health complaints and annoyances after moving into a new office building: a multidisciplinary approach including analysis of questionnaires, air and house dust. *International Journal of Hygiene and Environmental Health* 209(1): 65-68.

³Ezfacts, 2002. *Chemical compatibility guide for gloves*.

<http://www.lss.com> (accessed November 2, 2008).

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Composting at the Smithsonian Greenhouses



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Two years ago, the Smithsonian Horticulture Services Division (HSD) formed an environmental stewardship committee to “actively apply the concepts of sustainability and environmental awareness of the local and global environment.” Our goals are further explained in our policy statement: “HSD recognizes its responsibility to manage the nature and scale of environmental impacts of its activities, products, and services. This policy is to ensure the appropriate procedures are followed to minimize environmental impacts affected by energy consumption, water consumption, chemical use, product purchasing, and waste management.”

One of the key elements of HSD’s environmental policy is our commitment to composting. The Greenhouse Nursery Branch on North Capitol Street generates large quantities of biodegradable waste every day in the form of weeds, soil, tree and shrub prunings, cuttings from herbaceous plants, and old, unhealthy, or discarded plants. In the past, these organic materials were tossed into our mixed waste and sent to the landfill. Since we instituted our composting program, all material is now brought to a collection pile adjacent to the greenhouse. The pile is mounded and turned periodically. The composting process is continued and finalized by an outside paid contractor—Pogo Organics, located in suburban Maryland. Approximately 3-4 times a year, or whenever we collect 30 cubic yards of material, the company sends a truck to pick up and take our pile to its large-scale facility, where the composting process is completed and usable organic soil produced.

HSD has taken the first step in removing a large amount of “green” material from the waste stream. Current staff and time constraints prevent us from realizing our ultimate goal of managing the entire composting process in-house and using the resulting soil in our greenhouse and on the grounds. However, we plan to continue to streamline and refine our composting process when our Greenhouse Operation moves to our new facility in Suitland, hopefully in the fall of '09.

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Demystifying VOCs

When it comes to improving your indoor air quality, one of the best things you can do is try to limit the emission of VOCs. But what exactly are VOCs and how can you control them?

VOC stands for volatile organic compound. Considered organic compounds because they all contain carbon, these chemical substances are easily emitted from solids and liquids at room temperature. The term “off gassing” typically refers to a material’s emission of VOCs, some of which have a noxious odor, while others are completely odorless.

Odorless or not, most VOCs are bad news. They have been known to cause numerous health issues from ear, nose, and throat irritation, to nausea and loss of coordination, and even damage to the liver, kidneys, and central nervous system. VOCs are also one of the leading contributors to Sick Building Syndrome. The EPA has found that VOC levels are 2-5 times higher indoors than a building’s exterior air conditions.

So where do all these VOCs come from? VOC sources range from cleaning supplies to printing materials, tobacco smoke, and cooking processes. However, one of the biggest culprits is building materials—something we can control as museum designers and fabricators.

When it comes to VOCs in building materials there are five main categories to be aware of:

Adhesives and sealants: Includes glues, caulks, and carpet adhesive

Paints: Both oil and latex, as well as varnishes and lacquers

Carpeting: All fibers and padding

Wood & wood-composite materials: Includes flooring and sheet goods

Furniture: Both seating and case goods

All of these materials have low-or no-VOC options that can be specified for a project. You can also limit VOC exposure by ensuring that the area where they are being applied and stored is sealed off from any occupied spaces and has adequate ventilation. When it comes to carpeting and furniture, much of their potential to emit VOCs is right after manufacturing. You can reduce this by specifying materials that have been stored off-site until their off-gassing levels have gone down. Or consider using second-hand furniture which will have most of its initial off gassing over with. It will emit fewer VOCs, plus it is a great reuse of a product! When using wood and wood-composite materials, avoid any products which have added urea-formaldehyde resins.

You can also limit the impact of VOCs by increasing a building’s ventilation, making sure smoking areas are at least 25 feet away from any doors, windows, or air intakes, and using air filters with a Minimum Efficiency Reporting Value (MERV) of at least 13.

When in doubt, your best bet is to adhere to the standards and tests below:

Adhesives and sealants: SCAQMD* #1168, Green Seal 36

Paints: SCAQMD #113, Green Seal 11 & 3

Carpeting: Carpet and Rug Institute Green Label Plus Testing Program

Furniture: Greenguard Certification Program, U.S. EPA ETV large chamber test protocol for measuring emissions of VOCs and aldehydes.

General Building Ventilation: ASHRAE 62.1-2004

*South Coast Air Quality Management District

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Material Showcase: For Now, Buy the Books

After reading an article in *ArchitectureDC* about Minnesota architect Blaire Brownell's Transmaterial website, I thought it could become a valuable resource for researching the latest in green building materials. As author of *Transmaterial* (Princeton Architectural Press, 2005) and its 2008 follow-up, *Transmaterial 2*, Brownell is known for identifying and cataloguing innovative materials and products. I couldn't wait.

But it seems I may have to. The website, www.transstudio.com, no longer exists as described. There is information about Brownell, some interesting design links, and you can order his books, but the highly touted, searchable database described in the article is nowhere to be found.

When I first discovered the website no longer existed, I sent an email inquiry and was impressed to receive a response from Brownell himself, explaining that he was in the process of migrating his account to a new domain registrar as the previous one had lost all of his files.

However, the new site, www.transmaterial.net, is formatted instead as Brownell's blog, with five easily found entries dating back to August 2008 and earlier ones listed under "Previous Posts." It still provides valuable information, just not in the magnitude expected. In lieu of checking the blog for materials, you can sign up to receive a Product of the Week email; it only takes a few weeks to activate your request.

So for now, I will be content with buying the books if I want comprehensive information on green building materials. But the blog, as well as the weekly product emails, is not a bad place to start.

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green events



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- The Get Green Expo is a two-day event whose purpose is to educate, inform, and inspire consumers about ways to make our environment, homes and lives safer, healthier, happier places to live.
- Our goal is to reach people who are passionate about the environment, their health, saving money and about America.

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to learn more about the si green team,
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