



PVC Flooring & Toxic Cleaning Products in Schools



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PVC flooring often requires the use of toxic cleaners to keep it durable and shiny. This wax and strip maintenance has long been a source of health concern due to the toxic VOCs such as formaldehyde (a known carcinogen) used in the maintenance products. A life cycle study of flooring installation and maintenance found that the amount of VOCs emitted from a single waxing of a floor may be comparable to the amount of VOCs emitted from the flooring itself over its entire life. While some PVC manufacturers have formulated “no wax” finishes for some of their flooring products, many PVC flooring products still require the use of toxic maintenance products.¹

Toxic Cleaning Products Threaten Students, Teachers and Janitor’s Health

Consider just some of these alarming statistics about toxic cleaning products used in schools:

- One out of three cleaning products contains ingredients known to cause human health or environmental problems.
- A study found the average janitor uses 48 pounds of hazardous chemicals per year.
- Some of the ingredients in conventional cleaning products can cause cancer, asthma, mutate genetic material, sensitive the skin, and cause chemical burns.
- A review of workers’ compensation data from Washington State found that 6 out of 100 janitors are injured by chemicals every year, the most common injuries are serious burns to the eyes or skin.
- Many cleaning products contain respiratory irritants, which can both cause and trigger asthma attacks.
- A study found that janitorial workers and firefighters experience the highest rates of occupational asthma.

- Improving indoor air quality will improve performance and reduce absenteeism and building related health problems.ⁱⁱ

Children More At Risk from Toxic Chemicals

Children are not “little adults” - their developing brains and bodies, their metabolism and behaviors make them uniquely vulnerable to harm from toxic chemicals such as those released by the PVC life-cycle:

- Exposure begins in the womb through the mother’s exposures to toxic chemicals. Infants ingest chemicals through breast milk, formula and contact with their environment.
- Rapid brain development in the fetus, infants and young children make them more susceptible to harm from chemicals that may impair brain

function and development.

- For their weight, children eat, drink and breathe more than adults - so pound for pound they take in a greater quantity of toxic contaminants. A small exposure translates into a big dose.
- Children put things in their mouths and spend a lot of time on the floor and ground, so they may ingest chemicals from toys, containers, dirt and dust on a regular basis.ⁱⁱⁱ

Hazardous Chemicals of Concern in PVC Cleaning Products

The following is a summary of hazardous chemicals of concern typically used to clean PVC flooring in schools. *Note: these chemicals are often but not always found in cleaning products used on PVC in schools (depending on the chemical formulation of the product).*

Table 1. Chemicals of Concern in PVC Cleaning Products

Products ^{iv}	Chemicals of Concern ^v	Health Hazards ^{vi vii viii ix}
Baseboard Cleaner	Diethylene Glycol Butyl Ether	Suspected cardiovascular, kidney, neurological and reproductive toxicant
Baseboard Cleaner	Potassium Hydroxide	Skin or sense organ toxicant
Floor Finish	Ethylene Glycol	Suspected cardiovascular, developmental, gastrointestinal or liver, kidney, central nervous system, reproductive, respiratory, and skin or sense organ toxicant
Floor Finish	Formaldehyde	Recognized carcinogen, suspected gastrointestinal or liver, immune system, central nervous system, reproductive respiratory and skin or sense organ toxicant, asthmagen ^x
Floor Finish	Styrene	Suspected carcinogen, cardiovascular, endocrine, developmental, gastrointestinal,

		immunological, kidney, central nervous system, reproductive, respiratory and skin and sense organ toxicant, asthmagen ^{xi}
Floor Finish	Tributoxyethyl Phosphate	May cause nervous system effects such as ataxia, breathing abnormalities and tremors with prolonged or repeated contact
Floor Finish	Zinc	Suspected cardiovascular, developmental, immune system, reproductive, respiratory and skin or sense organ toxicant
Floor Finish and Gloss Restorer	Dipropylene glycol Monomethyl ether	Suspected kidney, central nervous system and reproductive system toxicant
Floor Finish and Spray Buff	Diethylene Glycol Monoethyl Ether	Suspected cardiovascular, gastrointestinal, kidney, liver and central nervous system toxicant
Floor Stripper	Ethanolamine	Absorbed through the skin; suspected skin and sense organ and immunotoxicant, eyes and respiratory irritant, asthmagen ^{xii xiii}
Floor Stripper	Naphthalene	Recognized carcinogen, suspected respiratory, cardiovascular, developmental, gastrointestinal, skin and sense organ and central nervous system toxicant
Floor Stripper	Sodium Hydroxide (lye)	Caustic, contact burns eyes and skin, ingestion damages stomach and esophagus. ^{xvi} Suspected respiratory and skin or sense organ toxicant
Floor Stripper and Baseboard Cleaner	2-butoxyethanol	Suspected human carcinogen, cardiovascular, developmental, endocrine, gastrointestinal or liver, kidney, central nervous system, reproductive, respiratory and skin or sense organ toxicant. Absorbed through the skin ^{xv}

Floor Stripper and Baseboard Cleaner	Isobutane	Suspected neurotoxicant
Floor Stripper and Baseboard Cleaner	Monoethanolamine	Hormone disrupting chemical that can form cancer-causing nitrates. Use with caution Restricted in Europe due to carcinogenic effects. Asthmagen ^{xvi,xvii}
Floor Stripper and Floor Finish	Ammonia	Suspected gastrointestinal, central nervous system, and skin or sense organ toxicant. Forms toxic gas when mixed with bleach ^{xviii,xix}
Floor Stripper and Floor Finish	Diethyl Phthalate	Suspected endocrine disruptor, reproductive, developmental, central nervous system and kidney toxicant
Floor Stripper, Floor Finish, and Spray Buff	Dibutyl Phthalate	Suspected developmental, endocrine, gastrointestinal or liver, kidney, immune system, central nervous system, reproductive, skin or sense organ toxicant
Floor Stripper, Floor Finish, and Spray Buff	Nonyl phenol ethoxylates , Alkylphenol Ethoxylates (APEs), Ethoxylated nonyl phenols (NPEs)	Suspected endocrine toxicant, toxic to aquatic organisms ^{xx}
Shineline Floor Prep	Phosphoric Acid	Corrosive to skin and eyes. Suspected central nervous system, respiratory, and skin or sense organ toxicant
Spray Buff	Aliphatic petroleum distillates	Respiratory system, gastrointestinal and eye and skin irritant ^{xxi}

PVC Flooring is More Expensive Due to Toxic Cleaning Products

While PVC flooring is typically cheaper up-front than other alternatives, over the lifecycle of the product PVC flooring is significantly more expensive due to the toxic cleaning products and strippers used to maintain the flooring.

Additionally – PVC flooring often doesn’t last as long as other flooring materials. This combined with PVC’s higher-maintenance costs make it one of the most expensive flooring options on a life-cycle basis. Safer cost-effective alternatives include natural cork, traditional linoleum, synthetic rubber, and non-chlorinated polymers. According

Table 2. Life Cycle Costs of Flooring (per square foot) ^{xxiii}

Material	Brand, type	Initial cost: material and installation	Expect life span (years)	Initial cost per year of life span	Maintenance cost per year	Total cost over 20 years
Vinyl	Armstrong, Sold Vinyl	\$9.70	25	\$0.39	\$52.00	\$1,048
	Armstrong, VCT	\$2.65	15	\$0.18	\$52.00	\$1,044
Cork	Dodge, Regupol	\$7.25	40	\$0.18	\$25.70	\$518
	Expanko	\$10.30	30	\$0.34	\$25.70	\$521
Linoleum	Armstrong	\$6.30	25	\$0.25	\$40.00	\$805
	Forbo, Sheet	\$5.50	35	\$0.16	\$33.30	\$669
	Forbo, Tile	\$6.42	25	\$0.26	\$33.30	\$671
Non-chlorinated polymer	Amtico, Stratica	\$6.75	40	\$0.17	\$32.00	\$643
Rubber	Dodge, Regupol, Econights	\$6.50	30	\$0.22	\$40.00	\$804
	Dodge, Regupo, Ecostone	\$7.75	30	\$0.26	\$40.00	\$805
	Expanko, Treadmaster	\$7.50	30	\$0.25	\$32.00	\$645
	Flexco, Radial I, II	\$11.70	35	\$0.33	\$24.00	\$487

to an analysis by researchers at Tufts University, cork, linoleum, rubber, and non-chlorinated Stratica are all cheaper than PVC flooring over its lifecycle (see table below).^{xxii}

Safer Alternatives to PVC flooring in Schools

Safer cost-effective alternatives are readily available. When using these products, we encourage schools to use third-party certified green cleaning products.

- Cork - harvested from the cork oak tree. Cork tiles are either left unfinished or finished with a wax of polyurethane topcoat. Refinishing with polyurethane is required only every three to four years.

- Linoleum - is made from renewable materials: linseed oil, pine or other rosin, ground cork dust, wood flour, mineral fillers, and pigments. Linoleum is available in both sheet and tile.
- Stratica - is a non-chlorinated plastic whose appearance is most similar to vinyl flooring among other resilient flooring materials.
- Rubber - is manufactured from natural rubber, recycled automobile and truck tires, or from synthetic rubber compounds including styrene butadiene rubber (SBR), ethylene propylene diene monomer (EPDM), nitrile, or Nora rubber. Available in both files and sheets.^{xxiv}

Resources to Learn More about Green Cleaning

- Asthma Regional Council of New England – Health Considerations When Choosing School Flooring - <http://www.asthmaregionalcouncil.org/about/documents/HealthConsideration-swhenChoosingSchoolFlooring.pdf>
- CHEJ's Green Cleaning Resources – http://childproofing.org/green_cleaning_the_basics.htm
- Cleaning for Healthy Schools Toolkit <http://www.cleaningforhealthyschools.org/>
- Green Flag Schools – <http://www.greenflags.org>
- Green Seal – <http://www.greenseal.org>
- Green Schools Buying Guide – <http://www.greenschools.net/display.php?modin=54>
- Health Care Without Harm – http://noharm.org/us_canada/issues/toxins/cleaners_pesticides/
- Health Care Without Harm's Resilient Flooring & Chemical Hazards report – <http://www.healthybuilding.net/docs/HBN-Resilient-Flooring&ChemicalHazards-Report.pdf>
- Healthy Schools Network <http://www.healthyschools.org>
- Household Products Database – <http://householdproducts.nlm.nih.gov/cgi-bin/household/brands?tbl=brands&id=5021>
- INFORM - Cleaning for Health: Products and Practices for a Safer Indoor Environment – <http://www.informinc.org/cleanforhealth.php>
- Informed Green Solutions – www.informedgreensolutions.org
- Janitorial Products Pollution Prevention Project <http://www.wrppn.org/Janitorial/jp4.cfm>

What Can I Do? Take Action for Healthy PVC-Free Schools

Safer and cost-effective alternatives are already available for virtually every PVC product in our nation's schools. Here's how you can help today:

- **Encourage your school** to renovate or build their school with PVC-free building materials such as PVC-free linoleum flooring and TPO roofing.
- **Encourage your school district, county or state** to adopt a healthy PVC-free policy to avoid the use of PVC building materials and office supplies in favor of safer cost-effective alternatives.
- **Educate parents, teachers and students!**
Organize a screening of Blue Vinyl and Sam Suds for your PTA, teacher's union, or concerned students.
- **Encourage organizations**, such as teacher's unions and parenting groups, to endorse the campaign.
- **Back to school – go PVC-free!** When buying your back-to-school supplies, shop for PVC-free products.
- **Get involved today!** If you're interested in getting involved, contact CHEJ at mike@chej.org or 212-964-3680.

References

ⁱ Lent, T., Silas, J. and Vallette, J. 2009. *Resilient flooring & chemical hazards – a comparative analysis of vinyl and other alternatives to health care*. Arlington, VA: Health Care

Without Harm. Online: <http://www.healthybuilding.net/docs/HBN-ResilientFlooring&ChemicalHazards-Report.pdf> (20 October 2009).

- ⁱⁱ INFORM. 2006. *Frequently asked questions: cleaning for health*. NY, NY. Online: <http://www.informinc.org/cfhfaq.pdf> (22 October 2009).
- ⁱⁱⁱ Landrigan, P. et al. Children's health and the environment: a new agenda for preventive research. *Environmental Health Perspectives* June 1998.
- ^{iv} Informed Green Solutions. Ingredients Checklist. Rev. 10-7-09. Information compiled from Informed Green Solutions, INFORM, MSDS sheets, Janitorial Pollution Prevention Project, and Green Seal.
- ^v Informed Green Solutions. Ingredients Checklist. Rev. 10-7-09. Information compiled from Informed Green Solutions, INFORM, MSDS sheets, Janitorial Pollution Prevention Project, and Green Seal.
- ^{vi} Informed Green Solutions. Ingredients Checklist. Rev. 10-7-09. Information compiled from Informed Green Solutions, INFORM, MSDS sheets, Janitorial Pollution Prevention Project, and Green Seal. Online: www.scorecard.org (22 October 2009).
- ^{vii} Green Seal. Online: <http://www.greenseal.org> (22 October 2009).
- ^{viii} Janitorial Products Pollution Prevention Project. Online: <http://www.wrppn.org/Janitorial/jp4.cfm> (22 October 2009).
- ^{ix} U.S. Department of Health and Human Services. "Household products database." Online: <http://householdproducts.nlm.nih.gov/cgi-bin/household/brands?tbl=brands&id=5021> (22 October 2009).
- ^x Association of Occupational and Environmental Clinics. "Exposure code list." Online: <http://www.aoecdata.org/ExpCodeLookup.aspx> (22 October 2009).
- ^{xi} Association of Occupational and Environmental Clinics. "Exposure code list." Online: <http://www.aoecdata.org/ExpCodeLookup.aspx> (22 October 2009).
- ^{xii} Association of Occupational and Environmental Clinics. "Exposure code list." Online: <http://www.aoecdata.org/ExpCodeLookup.aspx> (22 October 2009).
- ^{xiii} Savonius, B. et al. 1994. Occupational asthma caused by ethanolamines. *Allergy* 1994; 49:877-88 Online: <http://www3.interscience.wiley.com/journal/119269139/abstract?CRETRY=1&SRETRY=0> (22 October 2009).
- ^{xiv} Manufacturer MSDS – available at <http://www.msds-online.com>
- ^{xv} EXTOTOXNET. Online: <http://pmep.cce.cornell.edu/profiles/extoxnet/pyrethrins-ziram/tributyltin-ext.html> (22 October 2009).
- ^{xvi} Association of Occupational and Environmental Clinics. "Exposure code list." Online: <http://www.aoecdata.org/ExpCodeLookup.aspx> (22 October 2009).
- ^{xvii} Savonius, B. et al. 1994. Occupational asthma caused by ethanolamines. *Allergy* 1994; 49:877-88 Online: <http://www3.interscience.wiley.com/journal/119269139/abstract?CRETRY=1&SRETRY=0> (22 October 2009).
- ^{xviii} U.S. National Library of Medicine and the National Institutes of Health. "MedLine plus – sodium hypochlorite poisoning." Online: <http://www.nlm.nih.gov/medlineplus/ency/article/002488.htm> (22 October 2009).
- ^{xix} Hughes, J., Hathaway, G. and Proctor, N.. 1996. *Proctor and Hughes' chemical hazards of the workplace* Wiley.
- ^{xx} U.S. Environmental Protection Agency. "Key characteristics of laundry detergent ingredients." Online: <http://www.epa.gov/dfe/pubs/laundry/techfact/keychar.htm> (22 October 2009).
- ^{xxi} Manufacturer MSDS – available at <http://www.msds-online.com>
- ^{xxii} Ackerman F. and R. Massey. 2006. *The economics of phasing out PVC*. Somerville, MA: Global Development and Environment Institute, Tufts University. Online: http://www.ase.tufts.edu/gdae/Pubs/rp/Economics_of_PVC_revised.pdf (22 October 2009).
- ^{xxiii} Ackerman F. and R. Massey. 2006. *The economics of phasing out PVC*. Somerville, MA: Global Development and Environment Institute, Tufts University. Online: http://www.ase.tufts.edu/gdae/Pubs/rp/Economics_of_PVC_revised.pdf (22 October 2009).
- ^{xxiv} Ackerman F. and R. Massey. 2006. *The economics of phasing out PVC*. Somerville, MA: Global Development and Environment Institute, Tufts University. Online: http://www.ase.tufts.edu/gdae/Pubs/rp/Economics_of_PVC_revised.pdf (22 October 2009).