

Anyone who has added chlorine bleach to laundry knows that unless one has much air movement/ventilation, or is wearing protective gear, it is virtually impossible to work directly with cleaning chemicals and not breathe in at least some of the fumes. What is less well known is that airborne fumes from many cleaning chemicals can do significant harm to the body. Absorption through the skin is another common route for possibly harmful cleaning chemical exposure. Exposures do not have to be large to affect health - research and experience are showing that low-level exposures can produce measureable effects, and that long-term, low-level exposures can do accumulated harm. Choosing the least toxic products to begin with is the first step toward prevention of possible harm. In our schools, at particular risk are the custodians because they work most closely and constantly with cleaning chemicals, and often in tiny janitorial closets that have no ventilation. As for the children, they are at special risk because of their smaller, developing bodies. Researchers at the University of California at Irvine have concluded that children are as much as six times as vulnerable to toxins as are adults.

Floor wax, stripper, urethane floor surfacing, caulks, paints, cleaning solutions, and many other chemically based products contribute to the Total Volatile Organic Compound (TVOC) levels in school air. In this article we will examine, as examples, some of the chemicals contained in the products in use in Halifax schools, and we will also take a look at some alternatives.

Regulations require that Material Safety Data Sheets (MSDS) be on location for all WHMIS (Workplace Hazardous Materials Information System) controlled products in use. As you may know, MSDSs are prepared by the manufacturer according to government specifications, and their purpose is to communicate important information about products used in the workplace. They may, however provide us with a false sense of security. They are only partially useful for helping to identify potential hazards and for finding less-toxic or least-toxic products. Firstly, ingredients lists are protected information, so only those ingredients that must by law be reported may be on the MSDS. Secondly, standards are set for healthy adult males in the workforce, not women, children, the old, or the ill - and not to mention those individuals who have already developed hypersensitivity to chemicals. Thirdly, many chemicals have not been tested at all. The U.S. FDA receives an average of 50 new chemicals per day to examine and determine if they are safe and suitable for use. It is impossible to adequately test even a fraction of these for carcinogenic, mutagenic, teratogenic, or other hazard. (A teratogen causes birth defects by damaging the fetus.) Many of these are chemicals destined for the cleaning business. Fourth, not everything need be reported on MSDSs. Chemicals that are present in amounts less than 1% need not be listed, and carcinogens below .1% can be exempt. Inactive ingredients such as binders, fragrance, or pigments are not always reportable either. As an example, experts in the industry claim that many liquid handsoaps contain formaldehyde as the preservative - at less than 1% it need not be reported on MSDSs. Environmental Health Professionals and physicians assert there should be zero tolerance for formaldehyde exposure because of its sensitizing quality. (People sensitized to formaldehyde often develop broad sensitization to multitudes of chemicals and substances unrelated to formaldehyde.) According to the Hazardous Substance List it is also a "CARCINOGEN - HANDLE WITH EXTREME CAUTION".

Take as another example the product Odorgo Room Deodorant. Those concerned about scent-free schools complain of its particular potency, yet the MSDS lists under Ingredients: "NONE".

MSDSs of the products currently being used in our schools list content of many chemicals which would contribute to TVOC levels. All of those mentioned below are in products in current use in Halifax schools and are also on Hazardous Substance Lists (HSL). The chemical and hazard information below is from the peer-reviewed New Jersey Hazardous Substance Fact Sheet Right to Know Program, New Jersey Department of Health.

Wallglide Graffiti Remover contains *2-Butoxy Ethanol, Acetone, toluene, Isobutane, and Butane/propane*, all chemicals on the HSL.

"*2-Butoxy Ethanol* can effect you when breathed in and by passing through your skin. EXPOSURE MAY CAUSE REPRODUCTIVE DAMAGE. handle with extreme caution. Exposure can irritate the eyes, nose, and throat. Higher exposure can cause you to become dizzy, lightheaded, and to pass out. High or repeated exposure may break down red blood cells, and cause anemia. It may damage the liver and kidneys."

"*Acetone* can affect you when breathed in and by passing through your skin. Exposure to high concentrations can cause you to become dizzy, lightheaded, and to pass out. Contact can irritate the skin. Repeated exposure can cause dryness. Exposure can irritate the eyes, nose, and throat. Acetone is a FLAMMABLE LIQUID and a FIRE HAZARD."

"*Toluene* can effect you when breathed in and by passing through your skin. Toluene may cause mutations. Handle with extreme caution. It may damage the developing fetus. Exposure can irritate the skin nose, throat, and eyes. Higher levels can cause you to feel dizzy, lightheaded, and to pass out. Death can occur. Repeated exposures can damage bone marrow, causing low blood cell count. It can also damage the liver and kidneys. Toluene can cause slowed reflexes, trouble concentrating, and headaches."

The carpet cleaners Solvoil and Solvoil with Citrus contain *Petroleum Distillates*, and *Citrus*.

Petroleum Distillates are also called Naphtha, Petroleum Ether, and Aromatic Solvents. They are used as a herbicide, degreaser, and paint thinner. Health risks include dizziness, lightheadedness, passing out, irritation to the nose, throat, and skin. "Prolonged contact can cause skin ulcers, severe irritation, and aplastic anemia (destroys blood cells). Chronic exposure will induce symptoms of central nervous system depression, and neurobehavioural disorders." (Dry Clene also contains Petroleum Distillates.)

Cleaners containing *Citrus* can claim to be "natural" - a good marketing tool in today's environmentally aware marketplace. However, D'limonene, a known Sensitizer, is the active ingredient. The US Department of Health reports that D'limonene can be more toxic than Toluene.

All Purpose Cleaner also contains D'limonene.

Wallglide and the Urethane, ICI Paints' MSDS057, (used in Halifax gymnasiums) contain *Xylenes* which "can affect you when breathed in and by passing through your skin. Xylenes may damage the developing fetus....can damage bone marrow. Exposure can irritate the eyes, nose, and throat. High levels can cause dizziness, passing out, and death.... can cause problems with memory and concentration." and much more.

This Urethane also contains *Mineral Spirits, Aromatic Naphtha, and Cobalt Octoate*, a suspected carcinogen in humans. All of these are listed on the HSL.

Wallglide also contains *Trichloroethane* which is a carcinogen, and also can cause headaches, dizziness, and possible liver damage.

Aquaress Liquid Handsoap (not a ServiceMaster product) contains *Ethylene Glycol*, or Antifreeze, which can effect you when breathed in or by passing through the skin. Absorption by the body is higher if Ethylene Glycol is heated or sprayed. (Hands warmed by warm water provide heat) It should be handled as a TERATOGEN--WITH EXTREME CAUTION (A teratogen causes birth defects by damaging the fetus). Exposure can cause a 'drunk' feeling, nausea, vomiting, and headache. Higher exposures can cause kidney damage and death. Exposure can cause kidney and liver damage even without other symptoms. It can cause an allergic skin rash. Like most of the ServiceMaster products, Aquaress also has added fragrance.

Glass clene Pro contains *Ammonium Hydroxide* and *Propylene Glycol Monomethyl Ether*.

"*Ammonium Hydroxide* can affect you when breathed in, can severely irritate the nose, throat, and lungs. Death may be caused by suffocation or fluid buildup in the lungs. It is a HIGHLY CORROSIVE CHEMICAL (their capitalization) and can burn the skin and eyes causing permanent damage. Long term exposures at low levels may cause chronic bronchitis "

"Propylene Glycol Monomethyl Ether can affect you when breathed in and by passing through the skin. Can irritate the eyes, skin, nose, and throat. Very high levels may cause you to feel dizzy and lightheaded, and even to pass out. Very high levels may cause lung, kidney, and liver damage."

Other Service Master cleaning products in use in Halifax schools contain substance on the Hazardous Substances List and have similar risks to those listed above. The following are a few examples:

Floorstar BFR (baseboard finish remover) contains *Butane* and *2-Butoxy Ethanol*.

Solvoil contains *Propylene Glycol Monomethyl Ether*.

Floorstar Degreaser II contains *Pyrenglycol n-Butyl Ether*.

Speedball 2000 Power Cleaner (95% volatile) contains *Isopropylamine*.

Bowl Descaler contains *Hydrogen Chloride* (Hydrochloric Acid) which is highly toxic.

Drymop Treatment contains *petroleum oil* (85-95% volatile by weight)

Wallglide contains *Trichloroethane*, a CARCINOGEN.

Virtually all of the cleaning products in use routinely in Halifax schools also have added fragrance, making Scent-Free programs impossible. With hazardous chemicals in daily use, however, Scent-Free, as important as it is, becomes just a small part of the health concern.

Health, Behaviour, and the Ability to Learn:

There is substantial evidence from the National Research Council, the World Health Organization, Environmental Health experts, and others, that children are at significantly more risk from toxin exposures than are adults. Current peer reviewed research is showing, however, that exposures to common airborne household chemicals is potentially harmful to all, not just the young, the small, or the weak. Researchers report changes in cognitive functioning/attention/learning ability, mood/emotion, behaviour, and more. (see references) Airborne chemicals can be especially harmful to those with respiratory conditions, allergies, and related illnesses, and to those who have developed Chemical Hypersensitivity. Some of these studies have been done on low-level mixes of common chemicals found in the indoor air of homes. It may be significant to note that cleaning products in schools tend to be more potent, industrial-strength chemical products.

Because of the possible presence of mutagens and teratogens in cleaning products, it makes sense for female custodians and teachers of childbearing age to check out the MSDS sheets of the products used in their schools. (It bears noting, however, that recent research reported in the media has also linked birth defects in offspring to chemical exposures involving fathers.) Most high schools have a few pregnant students, and some high schools have daycares to care for the infants and young children of students. Caution is warranted because of newer evidence that daily long-term exposures to low levels of harmful materials may cause previously unrecognized health impacts.

So far we have only looked at single chemicals and the health effects that research has found can result from exposure. Random mixes of chemicals from several sources (for example, the photocopy fumes, a perfume, the Room Deodorant, and fresh floor wax all in the same room) mingle in the air and form unknown chemicals with unknown effects. These chemical "soups" further complicate the overall issue of low-level chemical exposures. Several chemicals, each at a low level, can combine to make a soup with a combined TVOC level that can be of significant health impact. Imagine, a combination that makes an entirely new and unpredictable chemical -an unknown chemical with unknown health effects and at a significant TVOC level.

We also have said little so far about those who have developed Chemical Hypersensitivity. Many of these were healthy people who were made ill by environmental contaminants such as chemical soups, or long term low-level exposure to one or more contaminants (for example, a custodian who cleans with ammonia every day), or from single toxic doses such as accidental pesticide poisoning. These people can be made ill in often profound

and unexpected ways by even extremely low level exposures to chemicals. For children and staff like this, going to school poses a sometimes impossible obstacle. Their disability makes scent-free/less-toxic schools a must. Most of this article, however, has been aimed at keeping healthy people healthy by limiting the toxins in schools.

The New Jersey Department of Health HSL has a question and answer section as follows:

Q: If I have acute health effects, will I later get chronic health effects?

A: Not always. Most chronic (long term) effects result from repeated exposures to a chemical.

Q: Can I get long-term effects without ever having short-term effects?

A: Yes, because long term effects can occur from repeated exposures to a chemical at levels not high enough to make you immediately sick.

Q: What are my chances of getting sick when I have been exposed to chemicals?

A: The likelihood of becoming sick from chemicals is increased as the amount of exposure increases. This is determined by the length of time and the amount of material to which someone is exposed.

Q: When are higher exposures more likely?

A: Conditions which increase risk of exposure include dust releasing operations, (grinding, mixing, blasting, dumping, etc.) other physical and mechanical processes (heating, pouring, spraying, spills, and evaporation from large surface areas such as open containers), and "confined space" exposures (working inside vats, reactors, boilers, small rooms, etc.).

Q: Is the risk of getting sick higher for workers than for community residents?

A: Yes. Exposures in the community, except possibly in cases of fires or spills, are usually much lower than those found in the workplace. However, people in the community may be exposed to contaminated water as well as to chemicals in the air over long periods. Because of this, and because of exposure of children or people who are already ill, community exposures may cause health problems."

Alternatives

Is it possible to get the job done well without using such toxic chemicals? Yes, it is. Finding truly non-toxic solutions for some needs is impossible, so choosing Least-Toxic alternatives becomes the goal. For example, disinfectants are registered with government as pesticides, designed to kill living organisms. (Wilkenfeld, I.R. Prescription Environments. 1994.) The Centre for Disease Control in Atlanta found normal scrubbing to be as effective as disinfectants. Scrubbing, however takes a bit more time and effort. Additional research was conducted for one year in a U.S. hospital where the commercially available disinfectant was compared to a mixture of borax and hot water. The monitoring bacteriologist reported that borax satisfied all the hospital's germicidal requirements. (Dadd, The Nontoxic Home and Office, p.22) Dr. Doris Rapp, physician, allergist, and Environmental Health Specialist suggests a 3% solution of Hydrogen Peroxide as a safer alternate disinfectant. (Healthy School Handbook)

Some companies are responding to the need for safer cleaning products by formulating commercially available and effective, less toxic alternatives. There are many Scent-Free lines available and others that claim to be "natural" or "environmentally Safe". BUT BEWARE. Care in choosing must be exercised even with these products, and for several reasons. "Natural" is not always safer - many natural materials are naturally toxic (methane gas, poisonous plants, uranium,...), and some man-made chemicals can be less toxic than some natural substances (citrus). Some "natural" cleaners also have added natural fragrance that can be as potent as

chemically added fragrance. Beware as well of "Scent-free" products. A cleaner containing toxic substances would still be toxic even if the fragrance were removed. To further complicate the issue, some scent-free products can be more toxic because the scent is covered by a masking chemical(s). As for "Environmentally Safe" claims, try this example: pesticides making such claims may protect Mother Earth by breaking down relatively quickly, but before they do so they are very effective killers.

I thought it would be interesting to compare MSDSs of the cleaning products in use in our schools to those used in our local hospital system and to Allerjan products, a locally available line of less-toxic commercial janitorial products. My comments are not to be seen as endorsements, but my general conclusions are that the hospital line is less toxic than the school line, and Allerjan is less toxic than both of the others. Some of the hospital products have Ethylene Glycol (highly toxic, risk of brain, liver, and kidney damage), and several other chemicals of concern, such as Petroleum Distillates, Ammonia, and Diethyl Ether, that require caution according to the Hazardous Substance Lists. But, all things considered, they seem to be a good step in the right direction. Allerjan products contain few chemicals on the Hazardous Substance Lists, and no phosphates, preservatives, dyes, perfumes, or petroleum solvents. Although their metal cleaner and one of their floor strippers contain Glycol Ether, their other stripper does not. Their all purpose cleaner, Vision, was the first in Canada to be awarded the ECOLogo label. Even the floor wax appears to be less toxic and, to my mind, worth trying in the school system.

There are other comparable "less-toxic" cleaners available such as Shaklee and Nature Clean, and there are safer natural products as well. The Shaklee cleaning products have been around a bit longer than some of the other less toxic lines, and last time I checked were in use at Woods Hole and The Biosphere research facility in Arizona, and on Jacques Cousteau's boats. As part of their renowned Green Program (which saved the company over \$200,000.00 in the first year alone) CP Hotels use combinations of baking soda, borax (with caution - do not breathe the powder), and vinegar for much of their cleaning needs. Tougher, although still less-toxic, products are saved for the tougher jobs.

Please note that when you settle on your choice of safer products, keep room for flexibility. Some individuals may have health difficulties that need use of yet another alternative.

I hope I have shown both the importance of, and the possibility of, using less toxic cleaning and maintenance materials in our schools. I also hope school decision makers have seen that the issue is complex - it is unfortunately not as simple as choosing the most effective cleaner at the lowest price. Also, that it takes particular expertise to judge what may be safest. We know so much more now about the impacts of chemicals on the body. Dr. Dick Irwin, toxicologist at Texas A&M Universities states, "Chemicals have replaced bacteria and viruses as the main threat to health. The diseases we're beginning to see as the major causes of death in the latter part of this century...are diseases of chemical origin."

Perhaps we should cleanup our schools by cleaning up the cleaning materials first!

I hope this article helps your school take another important step toward providing a clean and safe place for your children to spend their days.

Karen Robinson
National Healthy Schools Editor for The UPdate

References

1. AMICUS Journal, Natural Resources Defence Council, Vol. 11, No.1, 1989.
2. Berthold-Bond, A.. Clean & Green, Ceres Press, NY, 1994.
3. Dadd, Debra Lynn, The Nontoxic Home & Office, St. Martin's Press, NY, 1992.
4. Indoor Air Quality: Tools for Schools the US EPA's project on indoor air quality in schools. Superintendent of Documents, P.O. Box 371954, Pittsburgh, Penn. 15250-1800.
5. Ingredients/MSDS, Allerjan, Bebbington Chemicals, Dartmouth, N.S.
6. Ingredients/MSDS, Shaklee product line.
7. Jackson, E.M. PhD. Substantiating the Safety of Fragrances and Fragrance Products. Cosmetics and Toiletries, Vol.108, June, 1993, p.44.
8. Kjaergaard, S. Human Reactions to a Mixture of Indoor Air Volatile Organic Compounds. Atmospheric Environment, Vol. 25A, No. 8, 1991, p.1417-1426.
9. Kreiss K, The Epidemiology of Building-Related Complaints and Illness Occupational Medicine. State of the Art Reviews, Vol. 4, No. 4, 1989.
10. Lorig, TS EEG and ERP Studies of Low-Level Odor Exposure in Normal Subjects Toxicology and Industrial Health, Vol. 10, No. 4/5, 1994.
11. Lorig TS, et al. The Effects of Low Concentration Odours on EEG Activity and Behaviour. Journal of Psychophysiology, 1991, p.471-479.
12. Management Services Agreement, between Halifax District School Board and Service Master Canada, June,1993.
13. Miller, ed., The Healthy School Handbook, the U.S. National Education Association. 1995.
14. Molhave L, et al. Human Reactions to Low Concentrations of Volatile Organic Compounds. Environ Int. 12:167-176, 1986.
15. Morrow, L.A. et.al. Alterations in Cognitive and Psychological Functioning after Organic Solvent Exposure. Journal of Occupational Medicine. Volume 32, No. 5, p. 444-450, May 1990.
16. MSDS, Cleaning products, QEII Hospitals, Halifax, N.S.
17. MSDS, Service Master MSDS manual, in Halifax schools.
18. New Jersey Department of Health, Hazardous Substance Fact Sheet Right to Know Program. CN 368, Trenton, N.J., 08625-0368.
19. Nova Scotia Department of Labour, Discussion Paper on Indoor Air Quality, Occupational Health and Safety Advisory Council, November 21, 1994.
20. Nova Scotia Department of Labour, Taking Responsibility.
21. Rapp, Doris M.D., Is This Your Child's World? 1996, ISBN 0-553-10513-2
22. Rapp, Doris M.D., The Impossible Child, 1989,ISBN 0-9616318-1-3
22. Rapp, Doris M.D., Is This Your Child? 1991, ISBN 0-688-08623-3
23. RATE (Real Alternatives to Toxins in the Environment), Pesticide Facts
24. Report to the New York State Board of Regents on the Environmental Quality of Schools, New York State Education Department, Albany, New York 12234, 1994.
25. Rogers, S. M.D. Tired or Toxic, Prestige Publishing, N.Y. 1990,p.12-24.
26. Rousseau, Rea, & Enwright, Your Home, Your Health and Well-Being. 1988.
27. Wilkenfeld, I.R. Patient Education: Scents Make No Sense. The Environmental Physician. Fall,1991.
28. Wilkenfeld, I.R. Prescription Environments: Solutions to the Sick Building syndrome. 1994.
29. Wilkenfeld, I.R., Patient Education: Contaminated Classrooms: when Learning Becomes Lethal. The Environmental Physician, Winter 1991, pp. 30-32.
30. World Health Organization, Environmental Criteria 59, 1986, Geneva.