

Cleaner Concoctions

Tailgate Safety Talk

Each year, thousands of Americans have to call their local poison-control center and some even end up in a hospital, simply because they don't know how dangerous it can be to mix household cleaners. Countless more suffer from burning eyes, sore throats, headaches, nausea, and labored breathing. These exposures can happen in our homes, our garages and workshops, and at work.

Reading labels and understanding how cleaning chemicals work with (and against) each other cannot be overemphasized. While commercial cleaning products go through substantial safety testing, you must still be vigilant in their proper use.



A Brightener's Dark Side

Chlorine bleach whitens, brightens, and generally lightens the load on cleaning day. It's great for removing stains, and it's a powerful disinfectant as well. But, as any label will tell you, there are two things you should never mix with chlorine bleach: ammonia and acids.

Favored for its degreasing action, ammonia combines with chlorine bleach to form harmful vapors called chloramines. Sodium hypochlorite is the active ingredient in chlorine bleach. It is found in household bleach and many other disinfectants. Sodium hypochlorite reacts with ammonia, drain cleaners, and other acids. Found in a variety of products (and existing naturally in vinegar and lemon juice) acids turn liquid chlorine into chlorine gas. Chlorine gas and water combine to make hydrochloric or hypochlorous acids.

When you inhale chloramines and chlorine gas, they damage the mucous membranes in your respiratory system, causing acute irritation of the nasal passages, throat, and lungs. Prolonged exposure can make it hard for your lungs to extract oxygen from the air.

In [2018](#), the American Association of Poison Control Centers reported that household cleaning substances were the second most frequent human exposures and tallied 2,168 cases of exposure to chloramines (derivatives of ammonia), 3,176 exposures to chlorine gas, and 2,554 exposures to chlorine gas (when household acids were mixed with hypochlorite). Of these, the vast majority could be treated at home with fresh air and water. However, 419 (chloramines), 977 (chlorine gas), and 510 (acids/hypochlorite) individuals, respectively, needed medical attention. 825 of those suffered moderate or major medical outcomes and one exposure to chlorine gas resulted in death.

In addition to ammonia purchased as a cleaning product, ammonia may be found in some glass and window cleaners, urine (e.g., cleaning toilets, diaper pails, or cat litter boxes), and some interior and exterior paints. Products containing acids include vinegar, certain types of brick and concrete cleaners, and some



glass or window cleaners, automatic dishwasher detergents, toilet bowl cleaners, drain cleaners, and lime, calcium and rust removal products.

Although it's easy enough to remember not to pour straight ammonia into a bucket of chlorine bleach, you should never mix any household chemicals. Formulations change all the time and you can never be sure exactly what chemicals may be in what product.

POW! Right in the Kitchen!

A less common but equally real danger lurks in the plumbing under your kitchen sink. Most commercial drain openers are chemically "basic" (as opposed to "acidic"). When the greasiest, most stubborn clogs refuse to break up, some people resort to using sulfuric acid on top of what they tried first. The result? "It's like a volcano. There's a second or two of fizzing, then POW!" says Donald Wink, a chemistry professor at the University of Illinois at Chicago. "When they (the bases and acids) neutralize each other, they create sufficient heat to boil the water and create splatter."

Do the Alternatives Match Up?

BAKING SODA TO CLEAN? Chemical reactions can be avoided by using food-grade products in place of commercial cleaners. Mold or mildew can be removed with vinegar (a natural disinfectant) and salt (an abrasive) in equal parts. Home recipes exist for ink spots (cream of tartar, lemon juice, and water) to toilet bowls (baking soda and castile soap) to windows (vinegar and warm water).

ARE THEY SAFE? The greatest danger in using homemade cleaners lies in storing them in unmarked containers. Remember, even "natural" cleaners like lemon juice are made of chemicals (such as citric acid) that can react negatively with other chemicals. To guard against a problem, always list the exact ingredients on the container. That way, your poison-control center will know how to respond in an emergency.

DO THEY WORK? Mix-at-home recipes certainly work better than plain water, but studies show that they pale in comparison to commercial products. According to a study published in the Journal of Environmental Health, alternative cleaners, such as lemon juice, vinegar, and baking soda, were less effective both as disinfectants and as soil removers than conventional cleaners.

Remember This Formula: Bleach + Ammonia = Poison Fumes!

- Read the labels.
- Do not mix bleach and ammonia.
- Do not mix bleach and acids.
- Do not use two drain cleaners together, or one right after the other.

Users of this tailgate talk are advised to determine the suitability of the information as it applies to local situations and work practices and its conformance with applicable laws and regulations.

Table 17A. Substance categories most frequently involved in human exposures (top 25).

Substance (Major Generic Category)	All substances	% ^a	Single substance exposures	% ^b
Analgesics	275,747	10.85	174,269	9.45
Cleaning Substances (Household)	185,139	7.28	166,408	9.02
Cosmetics/Personal Care Products	165,959	6.53	159,328	8.64
Sedative/Hypnotics/Antipsychotics	140,692	5.53	51,495	2.79
Antidepressants	132,807	5.22	56,891	3.08
Cardiovascular Drugs	111,194	4.37	46,499	2.52
Antihistamines	110,346	4.34	74,698	4.05
Foreign Bodies/Toys/Miscellaneous	93,197	3.67	90,166	4.89
Pesticides	83,305	3.28	77,623	4.21
Alcohols	71,878	2.83	21,274	1.15
Stimulants and Street Drugs	71,117	2.80	39,238	2.13
Anticonvulsants	66,340	2.61	25,936	1.41
Topical Preparations	64,274	2.53	62,512	3.39
Dietary Supplements/Herbals/Homeopathic	59,259	2.33	49,485	2.68
Vitamins	58,862	2.32	48,630	2.64
Hormones and Hormone Antagonists	56,167	2.21	36,033	1.95
Cold and Cough Preparations	54,719	2.15	36,977	2.00
Antimicrobials	51,767	2.04	41,183	2.23
Gastrointestinal Preparations	47,622	1.87	33,952	1.84
Chemicals	45,378	1.79	39,175	2.12
Bites and Envenomations	43,337	1.70	42,671	2.31
Plants	42,495	1.67	40,233	2.18
Fumes/Gases/Vapors	34,144	1.34	31,476	1.71
Other/Unknown Nondrug Substances	31,739	1.25	29,677	1.61
Electrolytes and Minerals	30,046	1.18	24,052	1.30

^aPercentages are based on the total number of substances reported in all exposures (N = 2,541,958)

^bPercentages are based on the total number of single substance exposures (N = 1,844,966).