



**WATER & WASTEWATER PRODUCTS**



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## Arsenic and Old Graves

By Jason Goodman

We're all going to die someday, and when we do, someone, probably a relative, will have to figure out what to do with us.

Our demise and eventual disposition, aside from affecting our friends and family in a profound and philosophical way, has a pretty significant effect on the environment. If you're one of the roughly 28 percent of people who choose (or are forced) to be cremated, then your most significant impact will be on air quality (many people opt to have their ashes buried after cremation, but the "ashes" that remain after cremation are composed almost entirely of sterile bone tissue, which has minimal, if any, environmental impact). But, if you are a hardliner who likes the idea of taking up permanent residence in a scenic cemetery with your body mostly intact, then you're going to impact the environment in a number of ways. Namely, the soil and groundwater around your plot will become contaminated.

There are about 109,000 [cemeteries](#) in the United States that are recognized by the U.S. Geological Survey. Regardless of how many people are interred at each of these cemeteries -- anywhere from one at the smallest private cemeteries to more than 260,000 at Arlington National Cemetery in Virginia -- there's no question that a lot of land either currently contains, or is earmarked to contain, the dead.

We're going to need every bit of that space, too. In 2005, according to estimates by the National Funeral Director's Association, roughly 2.5 million people died in the United States. After subtracting 28 percent who were cremated, we're left with 1.8 million people who chose some other option. Let's assume, just for argument's sake, another 5 percent of the deceased were sent down the path in some other, more fantastic way -- perhaps space burial (still technically cremation) or burial at sea, excarnation in a Zoroastrian Tower of Silence (don't ask about that one), or by funerary cannibalism (self-explanatory, but still, don't ask) -- that still leaves us with 1,675,000 people who, more than likely, were buried in a cemetery somewhere (excluding those who chose to have their ashes interred in the ground), which translates into a lot of little plots that could eventually leach out contaminants.

The first evidence of human burial dates from anywhere between 350,000 and 100,000 years ago, depending on whom you believe. Either way, we've been burying people for a long, long time, and the trend isn't likely to change.

So, we have to deal with it. But just what are the environmental impacts of this grounded tradition? More specifically, what is the impact to groundwater? Let's start with the worst and see where things lead.

Modern embalming techniques in the United States came into being around the time of the Civil War. Soldiers were dying on the battlefield, and their bodies needed to be shipped home for burial. Embalming was one way to make sure the bodies didn't decay too much before they made it home (it was much more efficient than packing the body in ice), so that loved ones, etc. could get a last look at the departed. For quite some time -- well into the 20th century --

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embalming fluid contained varying amounts of arsenic, which we all know is extremely toxic and presents a serious threat to drinking water sources. During the latter 1800s, there were numerous recipes for embalming fluid, with some calling for as many as 12 pounds of arsenic per corpse. Now, you might ask yourself, "Why arsenic?" and the answer is simple -- putting a huge dose of arsenic in a cadaver effectively kills enough of the bacteria present in the body to halt decomposition, at least for a little while. Luckily, arsenic has since been substituted with a number of other less-toxic compounds. But even these substitutes can pose some significant risks.

Today, the main ingredient in embalming fluid is formaldehyde, a known carcinogen that is potentially lethal if enough is swallowed. But formaldehyde is only moderately persistent -- its half-life is just two to 20 days in water, unlike arsenic, which, as a basic element, pretty much lasts forever. Just in case you were wondering, no state requires a body to be embalmed, and the practice is not all that common outside the United States and Canada. But if you're into the idea of an open-casket funeral, it's not a bad idea.

Another element of concern is mercury from dental fillings (which, in some cases, can be composed of as much as 50 percent mercury), pacemakers, esophageal tubes, and a host of other medical products, which can leach into groundwater once the body has decayed.

Sounds serious, huh? Well, this doesn't even take into account the contamination that might come from products (lacquers and such) used to treat the wood many caskets are made from; the metal knobs and fasteners also used in casket construction; mercury and lead from watch batteries; or contamination from the countless other personal effects that we sometimes include in a loved-one's casket. Nor does it include the microbial or pathogenic contamination that you might expect when a body begins decaying. There are, after all, certain health reasons that undoubtedly influenced our ancestors' decision to start burying the dead, but these aren't nearly as bad as most people think. Non-diseased cadavers don't all of a sudden become hotbeds of contagion when they start decomposing. Still, you shouldn't go poking around in a dead body, but if you choose to you probably aren't going to come down with some rare disease. Sure, if you have a cadaver infected with *Yersinia pestis*, and some of those bacteria get into groundwater, and then you happen to drink it, you might need to be treated for Bubonic plague; otherwise, the worst complication you might expect to encounter from relatively "healthy" cadaver pollution is a case of gastroenteritis.

In 2004, Britain's Environment Agency released a report called "Assessing the Groundwater Pollution Potential of Cemetery Developments." In it, the Agency estimated that more than half of the pollutant load in a body enters the environment during the first year, with less than 0.1 percent of the load remaining after 10 years (an average body fully decays within 10 to 12 years, all things being equal). Once the contaminants leave the body, they make a beeline for the underlying water table, and, in turn, they eventually make it into our water supply, but hopefully not into us.

In 1996, a group of Australians from the National Centre for Groundwater Management at the University of Technology, Sydney, conducted fairly extensive research on this very topic. As far as I know, this particular study is the only one like it ever conducted anywhere. They examined, over the course of 136 days between 1996 and 1998, a total of nine cemeteries and crematoria around Australia. They concluded that the biggest problem to groundwater sources underneath cemeteries comes from rainfall. Stormwater has a number of options when it hits the ground: It can evaporate, pool, run off somewhere, or infiltrate the ground. According to the Australians, it's this infiltration that poses the biggest threat. As the rainwater infiltrates the decaying wood of a casket, it soaks up all of the possible contamination from the contents and deposits it in the surrounding soil, and eventually into the underlying water table.

Ultimately, it's safe to say that there's nothing about cemetery contamination that presents that big a risk to our health. Although, if you have a family cemetery and you get your water from a well, you might want to consider getting hooked into a municipal drinking-water supply, or at least make sure you have some pretty heavy-duty filtration equipment, just to be safe. And for the majority of you who don't live near a family graveyard and a well, just don't drink any untreated water that comes from a source close to a cemetery, and don't eat the soil either. But hopefully you weren't planning on doing that anyway.

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### Green Burial

Yeah, you guessed it. There's a new kind of burial procedure out there that not only prevents you from leaving a negative environmental impact when you die but actually helps improve the surrounding area. Let's take a quick look at the facts of these so-called "green burials."

Susanne Wiigh-Mäsak, a Swedish biologist, has developed a process called Promession that reduces a cadaver to a fine organic, odorless, and hygienic powder. The body is submerged in liquid nitrogen to make it brittle enough to shatter. The fragments are dried -- reducing the weight by about 70 percent -- and then sifted to remove any metals. The powder is wrapped in a biodegradable "casket" and deposited in the ground where it degrades within six to 12 months. The powder can be used as a sort of fertilizer -- you can plant a tree at the burial site so that you'll end up with a constant, albeit slightly weird, reminder of your loved one. If you're really interested, there's a [foundation](#) for the advancement of the cause, where, if you're the entrepreneurial type, you can inquire about franchising your own Promatorium.

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