How a **house** works

by **Spike Carlsen**

What happens after the flush

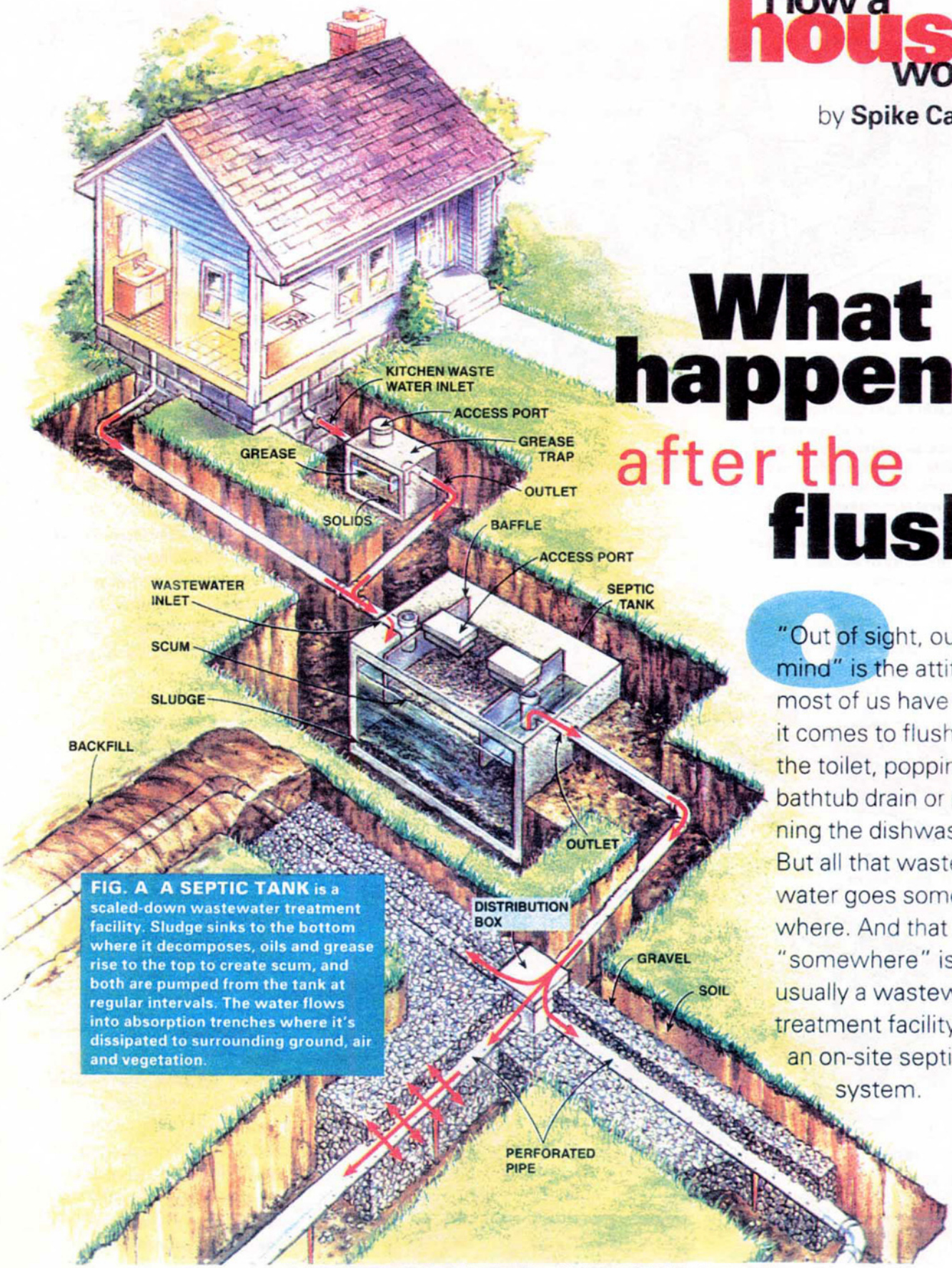

FIG. A A SEPTIC TANK is a scaled-down wastewater treatment facility. Sludge sinks to the bottom where it decomposes, oils and grease rise to the top to create scum, and both are pumped from the tank at regular intervals. The water flows into absorption trenches where it's dissipated to surrounding ground, air and vegetation.

"Out of sight, out of mind" is the attitude most of us have when it comes to flushing the toilet, popping the bathtub drain or running the dishwasher. But all that wastewater goes somewhere. And that "somewhere" is usually a wastewater treatment facility, or an on-site septic system.

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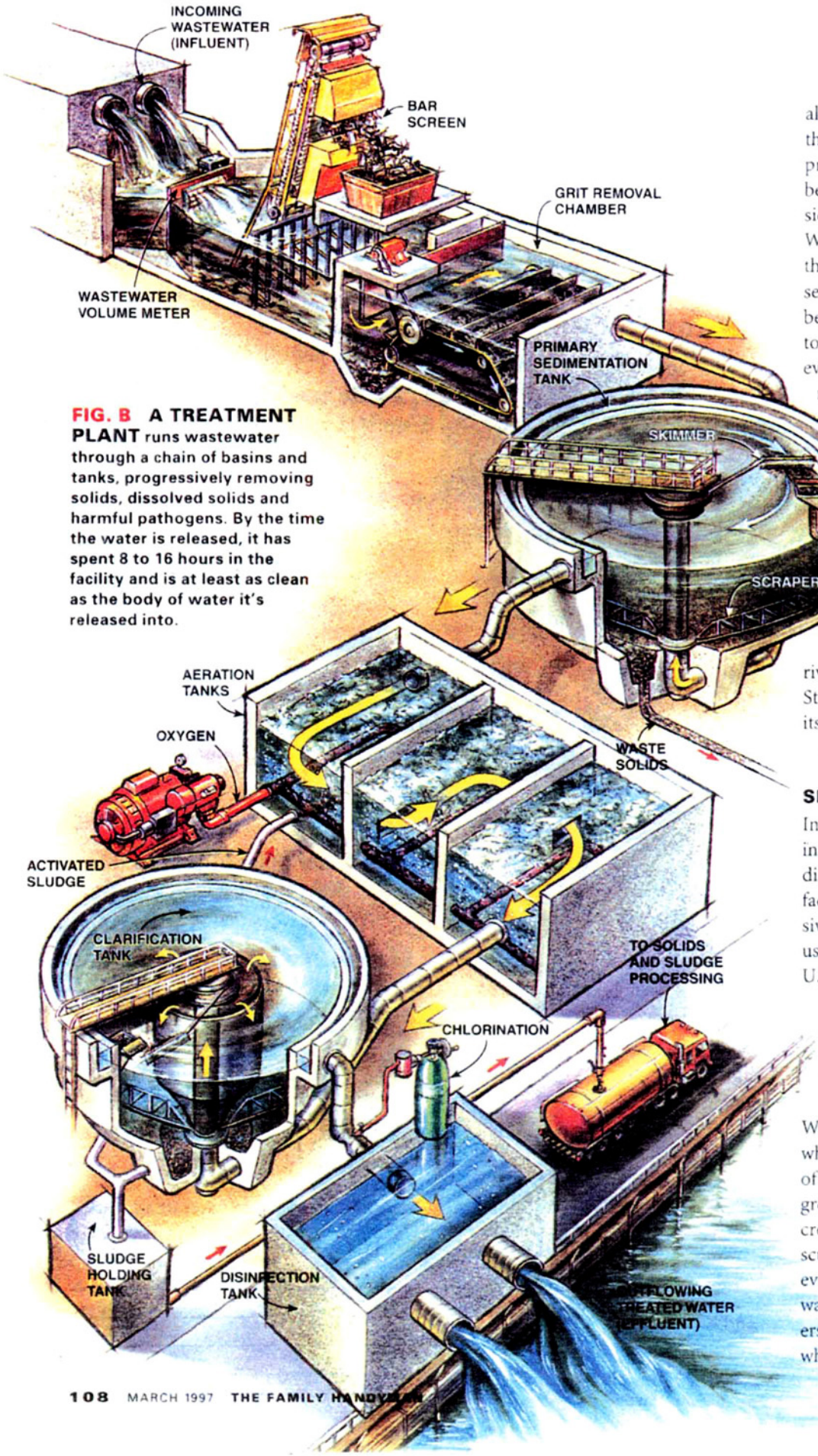

FIG. B A TREATMENT PLANT runs wastewater through a chain of basins and tanks, progressively removing solids, dissolved solids and harmful pathogens. By the time the water is released, it has spent 8 to 16 hours in the facility and is at least as clean as the body of water it's released into.

Sanitary disposal hasn't always been the norm. Up until the mid-1800s it was common practice to simply dump chamber pots and garbage into street-side gutters, ditches and cesspits. When Louis Pasteur discovered that microorganisms in raw sewage made people sick, cities began developing sewer systems to usher wastes out of town. Still, even 50 years ago, it was common for cities—even those with a population of more than a million—to directly channel untreated waste into rivers and lakes. It wasn't until the 1970s, when the Clean Water Act mandated that all wastewater be cleaned before being returned to rivers and lakes, that the United States really began cleaning up its act.

Here's the poop.

SEPTIC SYSTEMS

In outlying areas, where installing sewer pipes between distant houses and treatment facilities are prohibitively expensive, septic systems **(Fig. A)** are used. About one-quarter of the U.S. population (up to 50 percent of the population in some states) relies on these on-site wastewater treatment systems.

The process is quite simple. Wastewater enters the tank, where solids drop to the bottom of the tank to create sludge, and grease and oils rise to the top to create scum. The sludge and scum should be pumped out every one to two years. The wastewater between the two layers flows to a distribution box, which sends it out to a series of

absorption or leach trenches. From here the wastewater is absorbed by the surrounding gravel and soil; a small amount is wicked up to the surface to evaporate or be consumed by vegetation.

The sludge on the tank bottom decomposes with the help of bacteria. Lots of grease can slow or even wipe out the bacterial action of a septic tank, and if the grease is allowed to flow into the leach field, it can coat and clog the rock and soil and prevent absorption. Because of this, garbage disposals are not recommended for homes with septic tanks unless a grease trap is incorporated into the system. The grease trap, located between the kitchen sink and septic tank, has special baffles to trap grease before it enters the septic system. The grease in the trap must be pumped out regularly.

Septic system owners may not get nailed with monthly sewer fees—but those who neglect pumping their tank, or are careless with what they dispose of, will get nailed with a clogged drainfield and eventually a bill for a new septic system. Paints, varnishes, waste oil and pesticides can destroy the bacterial action of a system. These chemicals may also migrate into the drinking water supply if there's a well on the property. Likewise, plastics, diapers, condoms, coffee grounds, tampons and cat litter can contribute to the premature demise of a septic system.

Septic systems and drainage fields are carefully designed, based on soil conditions and the number of people living in a house. Lifespans of 20 years or more are traditionally projected, but with careful planning and maintenance, systems can last indefinitely.

Use less water; treat less water

Regardless of whether your house is connected to a septic system or wastewater treatment facility, the less water you use, the less wastewater needs to be processed.

Following are a few water-saving tips:

- When it's time to remodel, install a low-flush toilet. Older toilets use 5 gallons per flush, but those made within the past 10 years use 3.5 gallons, and many built today use 1.6 gallons. If we all converted to low-flush toilets, the United States would save 3 billion gallons of water PER DAY.
- Fix drippy faucets. A faucet dripping twice a second wastes 50 gallons of water—and treatment—per week.
- Don't leave the water running. Keep a jug of water in the fridge so you don't have to run water to get a cold drink. Turn off the water when it's not needed while shaving, brushing your teeth or washing your car.

WASTEWATER TREATMENT FACILITIES

Wastewater treatment simulates nature's purification process—but at a much accelerated pace. While water released from a treatment facility isn't "drinking water" clean, it is likely to match or exceed the purity of the body of water it's

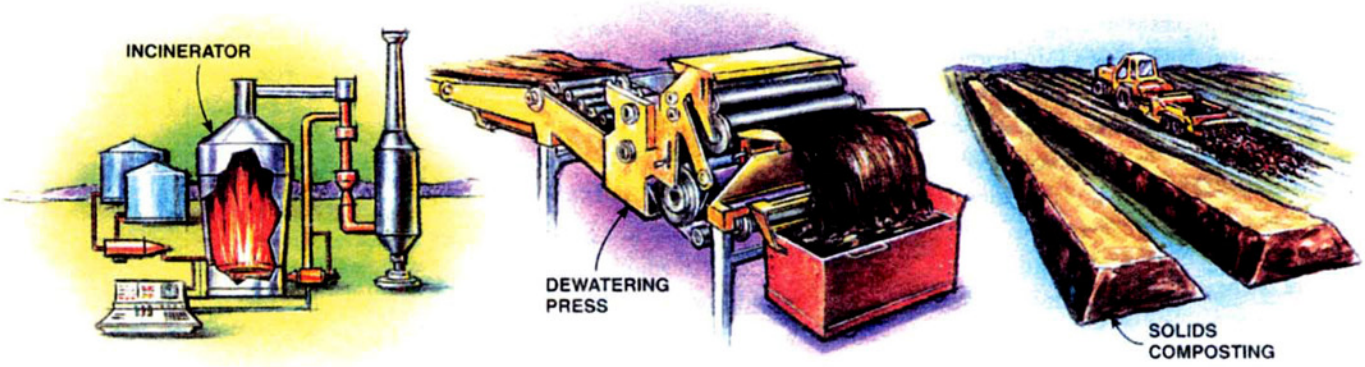

FIG. C SLUDGE, produced at the annual rate of about 500 lbs. per household, is disposed of in increasingly environmentally sound ways. After it's dewatered, it can be burned for heat, composted to create soil amendments, even incinerated and the ash turned into building materials.

released into.

Treatment **(Fig. B)** can be broken down into five basic steps, though processes may be combined and vary greatly from plant to plant.

In **preliminary treatment,** wastewater is delivered to the facility via sewer pipes, some as large as 12 ft. in diameter. At this stage, less than 0.5 percent of the wastewater is solids; the rest is water and dissolved matter. The wastewater flows through *bar screens* to remove trash and debris, then slowly moves through a *grit tank* where sand and heavy particles settle and are removed.

During **primary treatment,** water moves on to *sedimentation tanks* where it's undisturbed for a few hours. Solids that sink are scraped from the bottom of the tank and removed. Grease and oils that float to the top are removed with large rotating skimmers. About 15 percent of U.S. treatment plants discharge water after this stage.

Secondary treatment begins with the wastewater wending its way through a chain of concrete basins. The water is mixed and oxygen is introduced, to begin the *aeration* process. This sets up an environment where the active bacteria, called *activated sludge,* feed on the incoming waste solids and dissolved organic matter, thus speeding up the treatment process. The water then flows into *clarifying tanks* where the heavy, activated sludge microorganisms settle out. As odd as it seems, some of this sludge is recirculated back into the aeration tanks to provide active microorganisms to keep the bacterial treatment process alive.

During **disinfection,** harmful bacteria and other microorganisms in the water are killed by adding chlorine, or running the water past banks of high-intensity ultraviolet lights. This is to prevent the discharge of harmful organisms or pathogens into the receiving body of water. At this point the wastewater has been in the plant for 8 to 16 hours.

In some plants, water moves on to **advanced treatment,** most often to remove phosphorus and nitrogen, which stimulate algae growth and eventually deplete the oxygen levels of lakes or rivers. Some forms of advanced treatment are so thorough, the water is used to water yards and parks. In most cases though, it's discharged into streams, rivers, lakes or oceans.

Each household generates about 500 lbs. per year of the solids or sludge removed during treatment **(Fig. C)**. Often the sludge is simply buried, but increasingly it's being recycled. In some cases the sludge is dewatered and then combined with other ingredients to create fertilizers and soil amendments. Sludge may also be incinerated, and the ashes used as a soil conditioner or in construction materials. Sludge can also be composted or processed to produce methane gas, which can in turn be burned to supply heat for a portion of the facility.

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