# Environment

## Miscarriages and wastewater treatment

An epidemiological survey of the wives of a select group of workers at Exxon USA's oil refinery in Baton Rouge, La., has raised a few eyebrows. An apparent increase in the incidence of miscarriage and stillbirths occurred among the 89 couples surveyed after the husbands began working in the refinery's wastewater-treatment plant. The actual rate of miscarriage and stillbirth reported — 17 percent — is within the 10 percent to 20 percent range considered normal. What has raised concern is the fact that the rate had been only 8.3 percent prior to the husbands' work in the wastewater-treatment facility, according to Robert W. Morgan of Environmental Health Associates in Berkeley, Calif. Morgan directed the survey for Exxon.

Morgan says he analyzed the statistics, adjusting for smoking, education, number of pregnancies and other factors, but that it "really didn't change the estimates of risk." However, he notes that the actual number of pregnancies involved—157 before and 53 after the husbands began wastewater-treatment work — is small. Still the jump in rates for couples where the husband is a mechanic, electrician or instrument technician is unsettling: they climbed from 4 percent before to 20 percent after. Although Exxon says there are no chemical exposures in that area of its refinery exceeding acceptable levels, it will continue monitoring this group.

## Homely radon—how much to expect

Some buildings magnify to potentially dangerous levels the amount of radioactive radon and its "daughters" (decay products) to which dwellers are exposed. High levels of these natural pollutants, emitted by the outgassing of rock, brick and concrete, have been linked with lung cancer in Sweden (SN: 4/21/79, p. 264). And well-insulated homes can permit radon and its daughters emitted by the outside soil and ground water to accumulate inside to worrisome levels (SN: 11/7/81, p. 301). Robert Fleischer of the General Electric Research and Development Center in Schenectady, N.Y., who conducted that study of insulated homes, estimates thousands of Americans may die each year from lung cancer induced by radon levels typically found in homes. But which buildings pose the greatest risks? Two reports in the July issue of HEALTH PHYSICS offer clues.

A 1972 study showed concentrations of radon daughters in a building decrease in relation to the elevation of the measuring spot from the ground level. (Soil is usually considered the major source of radon.) Other data suggested the 1972 findings might be due to confounding factors. Research by F. Abu-Jarad and J.H. Fremlin at the University of Petroleum and Minerals in Dhahran, Saudi Arabia now lends credence to the latter hypothesis.

Monitoring polonium-218 and -214 levels on different floors, of 17- and 11-story high rises, they found "no clear relation between the reduction of activity of the radon daughters with the height of the floor above the first." Small variations between floors were attributed to differences in ventilation. The physicists point out that basement levels were "much higher" than those on other floors, probably owing to soil emissions.

Kerry Landman of Southern Methodist University in Dallas now reports on how the radon found in basements or the ground level relates to soil. Most homes sit atop a concrete slab—typically 10 centimeters thick. If it were intact, the slab should cut radon emissions into the house by a factor of 50 to 100 over those from a bare-dirt floor. But, Landman notes, slabs are usually not intact owing to such factors as the house settling at differential rates and gaps located about plumbing fixtures. That's important because radon will diffuse toward an air-filled crack. A crack 1 cm wide for each meter of slab will, Landman shows, release one quarter of the radon emitted by bare soil, more if there's a pressure difference across the slab. His recommendation: scout out cracks and plug them quick.

# Technology

## Solar collectors and Japanese swords

An ancient Japanese surface treatment for copper-gold alloys may produce the richest black ever formed on a metal. This patina, with its high resistance to atmospheric tarnish, may be a good model for solar collector surfaces. At Lehigh University in Bethlehem, Penn., Michael Notis has combined his interest in early east Asian metalcraft with research into materials for solar energy applications. He says, "In medieval Japan the ability to color metal surfaces was in all probability better than it is in today's modern coatings industries."

Of particular interest is a 14th century method that produces a deep-blue or purple-black patina on a copper-gold alloy, called *Shakudo,* used for art objects. The treatment solution used today to create this patina consists of nearly equal portions of copper acetate and copper sulfate dissolved and heavily diluted in warm water. Notis and his colleagues have examined samples of the surface layers from ancient objects and modern specimens. They determined that the *Shakudo* patina consists of nearly pure metallic gold particles in a copper oxide ($Cu_2O$) matrix. The alloy itself contains from 3 to 5 percent gold by weight. "A system of gold particles distributed in a copper oxide matrix is therefore expected to meet the criteria necessary for the production of efficient solar selective-absorber coatings." says Notis.

The efficiency of a solar collector depends on its ability to absorb solar energy while minimizing infrared radiation loss. (Although a simple black-painted surface absorbs almost all incident light, it is not efficient as a solar collector because it reemits in the infrared wavelength range much of the collected solar energy.) Because no single material possesses the optimum optical properties, current commercially fabricated surfaces are complex combinations of materials. These surfaces are relatively expensive to produce. Notis says study of the microstructure of the *Shakudo* patina may "provide both fundamental insight and the development of more economical fabrication processes for selective-absorber materials." An additional bonus is the durability of *Shakudo* patinas, which have withstood centuries of use and exposure on Japanese sword hilts and other objects.

## Reducing a waste of silver

Chemists at Oak Ridge National Laboratory in Oak Ridge, Tenn., have developed an efficient process for recovering silver from liquid photographic wastes, without producing silver sulfide, a pollutant itself. The silver-bearing effluent is pumped into a vessel containing excess hypochlorite. There, the fixer (sodium thiosulphate) is oxidized, and silver is released as silver chloride. Adding sodium dithionite converts silver chloride to pure silver. In initial tests, the process reduced silver content from 500 milligrams to less than 1 milligram per liter of photographic waste. The recovered silver was almost pure, with just traces of iron, magnesium and bromine. The process also effectively recovers silver from photocopier effluents.

## Steeling glassy corrosion resistance

Researchers at Battelle's Pacific Northwest Laboratories in Richland, Wash., have developed glassy stainless steel coatings with corrosion-resistant properties comparable to titanium. Rong Wang and M. D. Merz believe these coatings can be an inexpensive alternative to using titanium in environments like seawater, geothermal wells and nuclear power plants. The coating is produced when stainless steel solidifies at a cooling rate corresponding to nearly 1 billion degrees per second, giving the metal a disordered structure similar to glass. The coating can be applied to almost any metal surface. "The glassy stainless steel we've developed is a new product," says Wang. "It has a wide range of potential uses that we are just beginning to investigate."