Health Physics

Janet Raloff reports from Washington, D.C., at the annual meeting of the Health Physics Society

Elevated radon risk for passive smokers

Cigarette smoking and radon's radioactive decay products pose independent risks of lung cancer—and together, they form a potent synergistic duo. Three years ago, an assistant U.S. surgeon general noted that smoking raises a person's radon-related cancer risk to a level 15 times higher than that of nonsmokers (SN: 9/24/88, p.206). Now, a preliminary study suggests that even nonsmokers face intensified radon risks if they live or work with smokers.

In a series of two- and three-day tests, researchers lit one or more cigarettes in varying environments: a test chamber (small room), the basements of two houses, and the ground-level living room of a house without a basement. Though radon values varied little, room levels of radon's radioactive decay products, or "daughters," increased dramatically, report health physicists Raymond H. Johnson Jr. of Key Technology, Inc., in Jonestown, Pa., and Eric Geiger of Radon QC in Palmer, Pa.

For instance, within five hours of lighting a single cigarette in one nonsmoking family's basement, the researchers found that the room's radon-daughter levels jumped about 25 percent—an increase that lasted roughly nine hours before tailing off. A second cigarette, lit 24 hours after the first, spiked daughter levels 40 percent. In another test, Johnson and Geiger lit 20 cigarettes gradually over each of two 24-hour periods to simulate the presence of a pack-a-day smoker. Radon-daughter levels more than doubled within three hours, and tripled within 28 hours, of the first cigarette's lighting.

Burning cigarettes generate fine particles that can remain suspended in the air for a day or so (SN: 7/27/91, p.60). While short-lived radon poses little direct hazard to health, several of its longer-lived daughters readily adhere to surfaces, including walls, furniture and airborne particles. By seeding the air with copious quantities of respirable aerosols, says Johnson, smokers apparently enable radon daughters to prolong their stay in the air, where they remain available for inhalation.

Hidden ducts fan radon threat

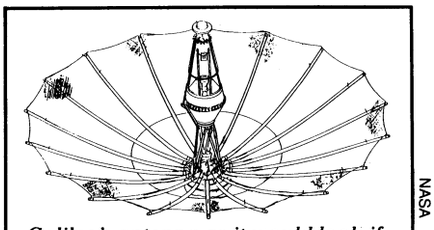
Some homes without basements contain duct systems embedded in the walls and beneath the first floor to facilitate the fan-driven circulation of air to furnaces and air conditioners. Because these "underground air returns" tend to be quieter, more efficient and less visible than standard air ducts, they have become popular in several areas of the United States. But many of these systems — especially concrete ones — may suck large amounts of radon from the soil because they were not well sealed during construction, observes Kimberlee J. Kearfott of the Georgia Institute of Technology in Atlanta. Her study of eight homes in Phoenix, Ariz., demonstrates that such underground returns can increase indoor radon concentrations by "10-fold or greater," she reports.

Kearfott collaborated with Arizona-based colleagues who monitored radon in each home, as well as outdoor temperature, air pressure, humidity and precipitation, for two weeks during the summer. Each home showed a clear diurnal variation in radon. "The only thing these variations correlated with was usage of the cooling system—in other words, when the underground returns were in use," Kearfott says.

Though many residents leave their cooling system fan running even when the air conditioner's compressor shuts down, this may not be wise, at least in some homes studied by Kearfott's group. For instance, radon levels in one home fell 35 percent when the occupants switched the fan from running continuously to running only when the thermostat called for it. If indoor radon levels prove worrisome — well above EPA's 4-picocuries-per-liter action limit — Kearfott recommends considering a more drastic measure: lining the ducts with a gas-impermeable sleeve.

Space Sciences

Chilling fails to open Galileo antenna



NASA

Galileo's antenna as it would look if scientists could unfurl it.

First they tried heating it. Now they've tried cooling it. But the latest attempt to fully open Galileo's main antenna has failed.

The craft, launched in 1989, is scheduled to begin orbiting Jupiter in 1995. NASA scientists reported last month that they still hope to unfurl the jammed, umbrella-like instrument in time for the Jovian rendezvous. And they have a strong impetus to do so. Without its key antenna, the spacecraft would send back only a small fraction of the data it will collect during its two-year visit to the solar system's largest planet, and the $1.3 billion mission would prove largely fruitless, says NASA's Robert Murray, former program manager for the mission.

If functioning correctly, the high-gain radio antenna will transmit 134,000 bits of data per second. Each picture of Jupiter and its satellites, taken with Galileo's near-infrared camera, will be radioed to Earth in a mere 40 seconds. The 4.8-meter antenna will rapidly relay information from the spacecraft's 10 other instruments as well. But if it stays closed, scientists will have to rely on the craft's two smaller antennas. Near Jupiter, these antennas would radio only about 10 bits of data per second and would take 10 days to transmit a single image, Murray says. And during those lengthy transmissions, he adds, researchers would lose other precious data too vast to be stored on the craft's tape recorder.

Scientists will face a more immediate, though less serious, problem if they can't fix the main antenna by October, when Galileo passes by the asteroid Gaspra. Because the craft cannot easily transmit data from the asteroid encounter without its main antenna, the onboard tape recorder will likely have to store all Gaspra information until Galileo passes near Earth again in December 1992.

NASA discovered the antenna problem on April 11, when mission scientists first signaled the spacecraft to unfurl the instrument. Special motors on the craft switched on but then stalled, as if they had met with a force too great to overcome. Ground tests indicated that two of the antenna's 18 "ribs" — graphite arms analogous to the spokes of an umbrella—did not open. The malfunction surprised researchers because six similar antennas on three communications satellites had unfurled without a hitch.

At NASA's Jet Propulsion Laboratory in Pasadena, Calif., recent ground simulations with an identical device suggested that the alignment pins, which help keep the ribs properly positioned around the main axis when the antenna is closed, somehow got stuck. Loosening the pins through thermal expansion or contraction appears the only practical means of solving the problem, says program manager Donald Ketterer.

On May 20, mission scientists rotated the craft so that its antenna basked in the sun's warming rays for two days. But tests with Galileo instruments, including two that help measure changes in the wobble of the spacecraft, revealed that the antenna remained stuck. Then, on July 10, NASA rotated the craft so that the antenna faced directly away from the sun for 32 hours. The same tests showed that nothing had changed, Murray says.

But NASA hasn't cooled off on the thermal strategy. On August 12, says Murray, scientists will try chilling the antenna to a lower temperature, this time for about 50 hours.