Moisture Calculations

Q. The otherwise fine article on indoor moisture (1/84) contains an error concerning moisture generation. It suggests that three people produce about 16 pounds of water per day from respiration and perspiration. A more realistic estimate would be 3.9-6.6 pounds.—*David A. Herbert, Seal Beach, Calif.*

A. Author Anton TenWolde used the standard values listed in the 1979 Equipment volume of the *ASHRAE Handbook*. These are 0.2 pounds per hour for a person at rest, 0.6 pounds per hour for hard work, and 0.4 pounds per hour average. He assumed a typical occupancy schedule. Environmental conditions, clothing, and level of activity all affect the level of moisture production. The values are conservative.

Q. Wouldn't exhausting 30 cfm of air cause an additional heat loss per day of 31,000 Btus (over 0.2 ACH infiltration) rather than the 11,000 stated in the article? —*Bill Stuble, Green River, Wyo.*

A. Running the exhaust fan reduces the rate of natural infiltration by tending to dominate the air exchange. Mathematically, the effect of combining natural and forced ventilation can be approximated by taking the square root of the sum of the squares of the two rates. Compared this way, the lower figure makes sense.

Radon Basics

Q. I plan to build an underground house of concrete. The location will be in the Northwest where there is a lot of granite. I would appreciate any information you can give me on radon in underground housing.—*Harold F. Williams, Lakeport, Calif.*

A. Radon is a colorless, odorless gas released during the natural decay of radium, an element found throughout the earth's crust. Concentrations vary greatly from an average of 0.7 picocuries per gram in North American soils to seven to 10 times that in New Hampshire granites. Radon enters the home primarily through cracks in the foundation, from unpaved and unvented crawlspaces, and from sumps. Water from deep wells can also be a source, as can stone and masonry construction materials themselves, particularly when directly exposed to interior spaces.

There is evidence that the average home contains twice the average atmospheric level of radon and that basements, on average, contain higher concentrations than upper stories. Radon levels are reduced by good building practices such as thorough sealing and waterproofing, positive drainage, and granular backfill—which keep the gas out of the house and allow it a route to the surface. Ventilation to 0.5 air changes per hour should minimize any health hazard except under extraordinary conditions and water-borne radon can be filtered out with charcoal. Medical experts agree that long-term exposure to low-level radiation increases the likelihood of lung cancer, but the degree of risk is unclear. Radon levels found in problem homes have been compared in risk to smoking one to three cigarettes per day.

If you are concerned about the proposed site, radon detectors from Terradex Corporation, 460 Wignet Lane, Walnut Creek, Calif. 94598 (415) 938-2545, can assess the levels in the soil.

Urethane Outgassing

Q. Thank you for an excellent article on insulation materials and techniques ("Building It Right," 11/83). Of all the areas in the field of energy-efficient materials and construction, none is so fraught with misinformation as is insulation. After many inquiries to manufacturers and extruders of rigid insulation I have been unable to find accurate information as to the rate of outgassing in foam insulation, or the relationship between thermal performance and time. Have you found any better information than I have?—*Michael Luttrell, Napa, Calif.*

A. Polyurethane foams lose R-value by two mechanisms: air infiltrating the foam and fluorocarbon gas diffusing out. Immediately after manufacture, polyurethane foam increases in conductivity quite rapidly. The rate of increase (loss of R-value) diminishes over time and the conductivity ultimately stabilizes at a plateau level, which can remain unchanged after more than 10 years. Since most of the change occurs in the first two to two-and-a-half years, manufacturers of residential products are required to publish a two-year aged R-value.

The rate and degree of R-value drift depends on many factors, such as cell size, closed-cell content, material thickness, and density. The main factors, though, are the permeance of the facing and how well it is bonded to the foam. Metal facings bonded at the time of manufacture to the wet foam appear to yield the highest R-values.

Through extensive testing at independent laboratories, Celotex Corp. has established that its foil-faced Thermax™ remains stable at about R-7.2 per inch at 75°F mean temperature for at least five years of aging. In its Bulletin U108, the Urethane Division of the Society of the Plastics Industry lists the stabilized R-value for unfaced foams or those with gas-permeable facings at 5.6 to 6.2 per inch. Consult the manufacturers for information on specific products.