Builder's Guide to Energy Efficient Homes in Louisiana: Moisture and Moisture Management – Part 2

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The *Builder's Guide to Energy Efficient Homes in Louisiana* (*Builder's Guide*) is being updated to reflect new code requirements. This is the eighth in a series of articles that will summarize the information in the guide and highlight updates.

Now that we have discussed the damaging and deleterious ways moisture and condensation from moisture can affect buildings, we will look at common ways that moisture and moisture condensation enter residences and buildings as well as some methods to assist in preventing moisture intrusion into buildings and residences.

Moisture moves into a home or building during wet seasons and it moves out during drier seasons. Moisture is a major problem when it reaches a level that encourages termites, dust mites, dry rot and fungi. Water intrusion problems can determine how long a building or residence may survive.

Rain water leaks in the roof, walls, and foundation, are causes of moisture problems. Poor site drainage which allows capillary seepage into the foundation also causes moisture problems. Water moves easily as a liquid or vapor from the ground through porous building materials like concrete and wood. Another source of moisture problems is undetected plumbing leaks which drip water unnoticed into the building or residence.

Table 1. Common Ways That Moisture Enters Buildings

LIQUID FLOW	**Driven by gravity or air pressure differences or both; water flows into building's holes and cracks. Roof leaks and plumbing leaks can also deposit large amounts of water into a home or building.**
CAPILLARY SEEPAGE	**Liquid water creates a suction of it's own as it moves through tiny spaces within and between building materials. This capillary suction draws water seepage from the ground. Seepage also redistributes water from leaks, spills, and condensation.**
AIR MOVEMENT	**Air movement carries water vapor into and out of the building and its cavities. Air pressure difference is the driving force for this air movement. Holes in the building shell are the leakage paths. If the air reaches saturation (the dew point), condensation will occur.**
VAPOR DIFFUSION	**Water vapor will move through solid objects depending on their permeability and the vapor pressure.**
LIQUID FLOW	**Liquid flow is the most serious water threat because it can move large amounts of water into a home or building rapidly. Capillary seepage can also move water into a home rapidly through damp soil and a porous foundation.**

Water leakage must be prevented. The exterior walls and roof of any building should be absolutely watertight. Roof leaks and plumbing leaks should be stopped immediately and their sources repaired as soon as detected. (See Figure 1). The building site should be planned and graded to keep rainwater, ground water, and irrigation water away from the building. If the home or building is raised (not a slab foundation); and is in a moist area; consider permanently installing an impermeable ground cover (such as a 6 mill polyethylene sheet) over the surface of the ground under the first floor or under the foundation. This is called a "ground moisture barrier". This can serve as a capillary break to prevent ground moisture from entering the first floor or foundation via the building's "stack effect". The ground next to the home or building should slope away from the building to drain rainwater away as quickly as possible. Install rain gutters and grade the site if necessary to swiftly carry rainwater away from the building foundation. If water must flow near the building; cap the ground near the building with impermeable concrete or clay. (See Figure 2). Reduce capillary seepage with drainage ditches, French drains, perimeter water barriers, and foundation waterproofing. Dampness due to high groundwater may require sump pumps to keep the foundation dry.

High relative humidity[1] in indoor air causes comfort problems in summer; and condensation problems in both summer and winter. Experts on cooling say that the relative humidity of summer air should be less than 60% for summer comfort (in warm climates); and less than 40% in cold climates to avoid interior moisture condensation problems.

The average occupant evaporates 4 pints of water into the air daily through respiration or perspiration. Showers, house cleaning and cooking can add up to an additional 3 pints per person daily. Water tracked into the home on shoes, clothes, umbrellas, etc., evaporates and adds humidity to the interior air (see Figure 3). Moist firewood, houseplants, and unvented combustion heaters also add moisture and pollutants, affect relative humidity, and can be a source of water vapor and dangerous combustion by-products as well.

Methods of combating interior water vapor, and preventing moisture problems:

1. Remove moisture from indoor air by cooling the indoor air below its dew point. This is commonly done with central air conditioning systems, room air conditioners, heat pumps, and possibly with dehumidifiers.

2. Add insulation to walls, floors, and ceilings of the home or building.

3. Prevent moisture problems with "ground water moisture barriers", air barriers (in warm climates), vapor barriers in cold climates, maximum recommended insulation in building cavities, and sealing all penetrations in the building envelope.

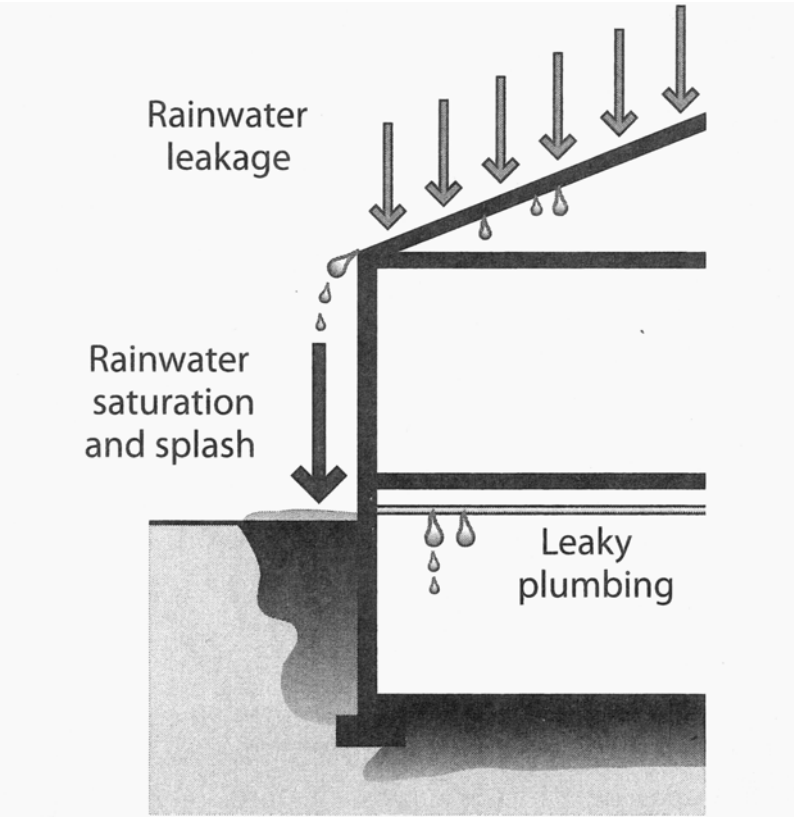
4. Kitchen and bathroom exhaust fans are acceptable for removing moisture and pollutants at their source. However, they are not recommended if whole house ventilation is being installed in the home (see ventilation discussion following).

[1] Relative humidity is the percent (%) of maximum moisture that air at a given temperature can hold. Relative humidity is 100% when the air is saturated with moisture. If more moisture is added to the air @100% relative humidity; the moisture condenses on cool objects throughout the building. Some of these objects may be visible, while others aren't visible. The moisture content of a building's components is directly related to the relative humidity of the air surrounding them.

Almost all residential and most commercial buildings allow some air leakage between indoors and outdoors. Hopefully this natural air leakage is enough to keep the indoor air quality (IAQ) relatively fresh. However, natural air leakage doesn't ventilate all areas of the building evenly. This leaves some home or building areas drafty and fresh and others stagnant and polluted. Air leakage is highest during severe weather, especially in winter because it is driven by temperature and wind. Air leakage during severe weather increases heating and cooling costs. Ventilation is an important health and safety concern in moderately airtight homes. A moderately airtight home has a blower door leakage rate of less than 1 cubic foot per minute at 50 pascals (1 cfm_{50}) per square foot or around .35 natural air changes per hour. Homes or buildings with less than .35 natural air changes per hour should have mechanical whole house ventilation systems installed. Whole house ventilation should be included in the original design whenever possible because of the high costs of installing whole house ventilation as a retrofit measure.

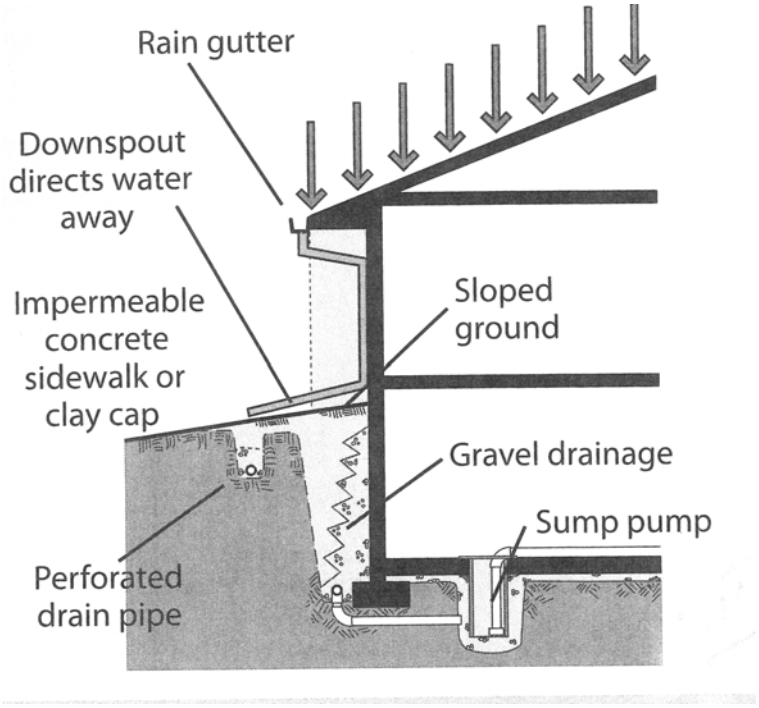
More information on energy savings features, and the full text of the *Builder's Guide*, can be found on the DNR Technology Assessment Division website at URL: http://www.dnr.louisiana.gov/tad and click on the *Builder's Guide* link.

Figure 1. Water Leakage and Seepage



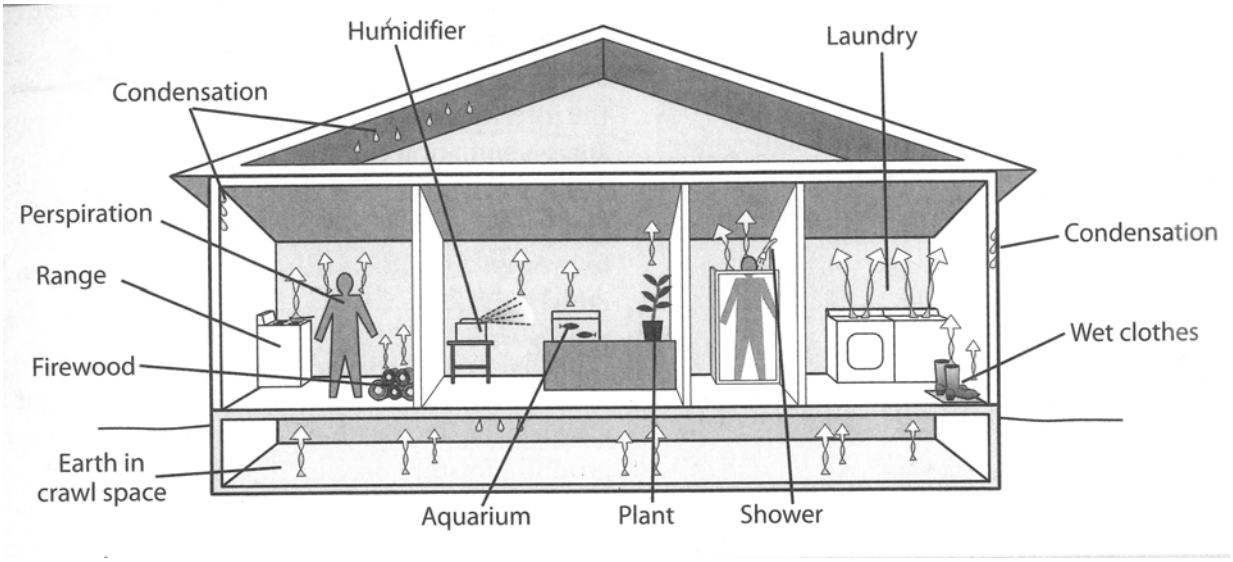
SOURCE: John Krigger and Chris Dorsi, *Residential Energy: Cost Savings and Comfort for Existing Buildings*, Saturn Resource Management, Inc., Montana, 2004.

Figure 2. Preventing Water Damage



SOURCE: John Krigger and Chris Dorsi, *Residential Energy: Cost Savings and Comfort for Existing Buildings,* Saturn Resource Management, Inc., Montana, 2004.

Figure 3. Sources of Water Vapor



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