How to Stop Efflorescence

Keep water and salts out of the masonry; remove it with clean water or acid solution.

It's the end of summer. You've finished the job on time. It looks great. The architect and owner are pleased. Then, two months later you get an angry phone call: "I've got white blotches growing on the brick. It looks terrible. It's an eyesore. What's happening?"

Virtually every masonry contractor has run into the problem: efflorescence, the unpredictable white (or sometimes green) salt deposits that seem to attack masonry like a disease. What cause it? How do you prevent it? How do you remove it?

The Causes

Efflorescence results when soluble salts in the masonry units or mortar leach to the surface. Water penetrating the masonry dissolves the salts. Later, as the wall dries, the salt solution migrates to the surface, and the water evaporates, depositing the salt on the surface of the masonry.

For efflorescence to occur, three conditions must exist simultaneously:

- Soluble salts must be present within the masonry assembly.
- Water must come in contact with the salts to form a solution.
- The salt solution must migrate to a surface where the water can evaporate.

In conventional masonry construction exposed to weather, it is virtually impossible to eliminate salts, prevent water penetration, or construct the wall with no paths for water migration. The only practical thing to do is to minimize the extent of these three contributing factors.

Soluble salts may be present in the masonry units or the mortar, or the may be carried into the wall by rain or groundwater. Because the white efflorescence appears on the face of the maonsry units, the bricks are generally blamed. But this usually is not the case. Though virtually all clay brick contains some salts, their efflorescing potential is small. Brick relatively free from impurities is readily available throughout the United States. Dense to moderately absorptive units are least troublesome.

Researchers differ in their opinions on concrete masonry. Some say it has less efflorescing potential than clay products. Others claim it has two to seven times as much soluble material.

Mortars vary in the amounts of soluble salts they contain, depending on the type of cement used. The cement usually contains most of the soluble materials that cause efflorescence. Those with a high alkali content and limestone impuritites are most likely to cause problems. To remedy this, some companies have developed low-aklali, nonstainin cements for use in masonry mortars.

Hydrated limes are relatively pure and generally have 4 to 10 times less efflorscing potential than cements. Well-washed sand and clean, potable water also don't contribute much to efflorescence.

Masonry stored directly on the ground without pallets can absorb soluble salts from groundwater. In highly industrialized areas, acid rain also can contaminate the masonry with soluble salts.

The moisture necessary to produce efflorescence can come from rainwater that penetrates the masonry or from water vapor that condenses within the assembly. Rain and snow also may enter the wall during construction if the uncompleted wall isn't properly protected from weather.

Preventing Efflorescence

Regardless of the impurity of the materials used, efflorescence is not likely to occur if proper precautions and high-quality workmanship are employed. To prevent efflorescence, particularly in wet regions, follow these steps:

- Use masonry units of low to moderate absorption. Face brick should be rated as "no efflorescence" when tested according to ASTM C-67 (Ref.1).
- Use low-alkali, nonstaining, or white cements in the mortar.
- Use mortars of high lime-cement ratio.
- Store masonry units off the ground and protect them with waterproof covers.
- Cover the top course of unfinished walls to keep out water.

20 N. Coburn Ave. ♦ Orlando, FL 32805-2198 ♦ (407) 841-2940 ♦ Fax (407) 839-1890 ♦ (800) 432-4746

LAMBERT CORPORATION

- Flash parapet walls correctly.
- Install drips on cornices or projecting members.
- Install through-the-wall flashing at ground level to prevent the capillary rise of moisture from the ground.
- Install flashing in walls in places where water can accumulate once it enters; construct weep holes in the exterior width of the wall immediately above the flashing. Be sure joints of the flashing are lapped and sealed, and the ends are turned up and sealed.
- Caulk all joints between masonry and door and window openings.
- Construct full, tight, weatherproof mortar joints; use concave or V-shaped joints where the masonry wall will be exposed to rain or freezing and thawing.
- Seal cracked mortar joints.

Removing Efflorescence

Most efflorescence in well-designed, well-built masonry is temporary. Because the salts are water-soluble, the stain often disappears with washing or normal rain and weathering. As time passes, less and less efflorescence occurs, unless there is an external source of salts.

Other efflorescence disappears after heavy rains, then recurs over several years. In time, the efflorescence causes the mortar to disintegrate and the masonry units to spall, resulting in wall leaks. Soluble alkali salts, usually sodium and potassium sulfates, are the primary causes of this recurring efflorescence.

You can remove most efflorescence by dry blasting then flushing with clean water. Heavy accumulations or stubborn deposits of white efflorescence can be removed with a solution of 1 part muriatic acid to 12 parts water. Be sure to dilute the muriatic acid solution you buy. Strong acid solutions can bleach and disintegrate colored mortar or concrete block. For integrally colored concrete masonry, you may have to use a more diluted acid solution, maybe only 2% acid.

Always test the acid solution on an inconspicuous part of the wall to make sure it won't damage the wall's appearance. If even a weak solution discolors the masonry, you may have to treat the entire wall to avoid a mottled appearance. Don't use acid solutions on light-colored, brown, black, cream, or gray clay brick that contains manganese coloring agents; the acid can cause green or brown stans on these types of brick. Also, never apply acid to green efflorescence; contact the manufacturer of the brick instead.

Before applying the acid solution, always first saturate the wall with water so the acid doesn't penetrate deep into the wall and damage it. Then spray on the acid solution, wait about 5-minutes, and brush off the efflorescence. Afterward, flush the surface again with clean water to remove all the acid. Don't use metal tools, brushes, or mixing containers. And be sure to wear rubber gloves, glasses, and other protective clothing.

Clear water-repellent coating often are recommended as a solution for efflorescing problems. However, if a clear water repellent is applied to a wall that still contains moisture and salts, problems even more damaging than efflorescence may result. Instead of migrating to the outer face, most of the salt solution stops at the inner depth of the water repellent. The water then evaporates through the barrier as a vapor and deposits the salts inside the masonry unit. Eventually this salt build-up can exert tremendous pressure capable of spalling the unit face. Generally you shouldn't use clear water repellents as a preventative measure for efflorescence.

When to Worry

Clay, concrete and stone masonry all suffer efflorescence, but it's most noticable on dark-colored brick and stone.

Efflorescence can occur any time during the year, but it is more common in late fall, winter, and early spring when temperatures are cool and evaporation is slow. Because masonry wall dry quickly in the hot summer months, efflorescence usually doesn't occur in the summer.

So many factors contribute to the problem, it's impossible to guarantee that a building will not suffer from it. One industry expert recommends that contractors forewarn owners of new masonry efflorescence. Tell them what precautions were taken to prevent it and what can be done to repair it if it occurs. It may eliminate an angry phone call later.

End of Article

Visit the Lambert website:

www.LambertUSA.com

20 N. Coburn Ave. ♦ Orlando, FL 32805-2198 ♦ (407) 841-2940 ♦ Fax (407) 839-1890 ♦ (800) 432-4746

LAMBERT CORPORATION