Efflorescence

The Portland Cement Association (PCA), in their *Efflorescence Trowel Tips* publication defines efflorescence as a crystalline deposit, usually white, that may develop on the surfaces of masonry construction.

Efflorescence can be seen on mortar joints, concrete block faces, brick faces. A combination of conditions must be present for efflorescence to form: 1, there must be soluble salts in the masonry and 2, there must be moisture migration through the masonry, carrying the salts to the surface.

On a more technical note; in masonry work, Portland cement is generally used in the manufacture of concrete block, mortar, and stucco. The cement, in the hydration process contains calcium hydroxide. Naturally, water is used to make mortar or block-fill. Moisture, migrating through the body of the feature carries this calcium hydroxide to the surface where it combines with the carbon dioxide in the air forming a new substance….the white powdery material, now calcium carbonate.

Actually, at this point this material is water soluble, so it is usually easily cleaned off during the masonry cleaning effort. If left alone, though, and if there is a continual problem with water migration or leakage from external sources, the efflorescence becomes carbonate deposits or lime runs. These can be quite stubborn to remove, requiring more aggressive cleaning efforts.

Figure 1. Efflorescence on dark charcoal mortar joints. You can see where the joints have been cleaned using water and a brush. The restored wall matches the color sample being held up to the joint.

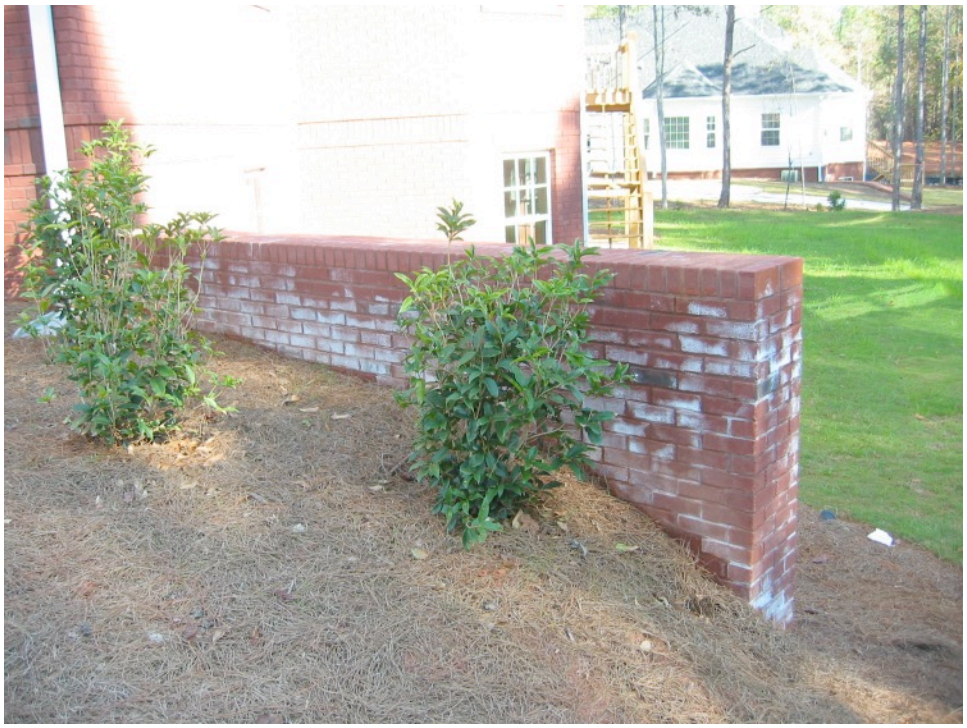

Figure 2: Efflorescence on retaining wall. In contact with the soil, exposed to sprinker system, no weep holes or flashing. Downspout continually saturates the ground.

Figure 3:

Lime runs. This wall is not a retaining wall, but a “parapet” wall on one side of a handicap ramp at a doctor’s office. Rainwater running on the ramp saturates the masonry and migrates to this outside surface.

The PCA further states that “All masonry and concrete materials are susceptible to efflorescence or staining. Interestingly enough, during periods of slow drying, and cool, damp conditions, such as in the winter, efflorescence can be more prevalent than in the summer.

Most efflorescence, especially on new construction, is temporary, very often called “new construction bloom”. It is most often removed during the masonry cleaning portion of the work. Recurring efflorescence indicates a chronic moisture or water flow problem such as

from ground water in retaining walls, around un-caulked window openings, non-full mortar joints. Another source of “salts” can be where the masonry contacts the soil, such as basement and retaining walls. Also, some raw materials found in brick, for example, manganese, can cause brown stains.

Figure 4:

Brown manganese staining

There are a host of different types of staining that most refer to as efflorescence: In addition to the above:

- White scum, Silicate deposits
- Vanadium, green or yellow stains
- Manganese, brown stains
- Rust colored stains from embedments.
- Organic stains, algae, mold, hard water from sprinkler systems.
- Runoff stain from paint, copper.

Prevention: to name a few.

- Tool all mortar joints using a “v” or concave jointer. This provides the most weather resistant joint. Use full mortar joints.
- Limit entry of water. Caulk around wall openings. Provide exit locations via flashing and weep holes. Maintain clean cavities and weep holes.
- Cover the top course of masonry at the end of each day’s work, especially if rain is expected.
- Do not clean masonry with unbuffered hydrochloric (muriatic) acid. (may cause yellow staining)
- Carefully plan the positioning of lawn sprinkler heads so that walls are not subject to excessive wetting.

- Keep masonry units at the construction site off the ground and covered.

Removal:

- Avoid the impulse to immediately clean off efflorescence on new construction, especially in cool, damp weather. This usually forces more water into the wall making the condition worse. Give the masonry time to dry. It very well may disappear by itself, or may just require a light cleaning.
- Use propriety cleaning agents if necessary, starting with a mildly diluted solution of 1 to 10 %. Always check with the brick manufacturer for his recommendation. For colored concrete masonry units or colored mortar, use only 1-2% solution. Always presoak the masonry with water so the cleaning solution will work on the surface and not be drawn into the masonry.
- It is important to determine the type of salt in the efflorescence so the appropriate cleaner can be used.
- Always treat a test area prior to the entire work.
- In cases of recurring efflorescence, the source of the moisture needs to be determined and corrected.

On a side note:

I'm reminded of a conversation with probably the most knowledgeable, architectural brick sales women I've ever met, from South Carolina. She told me that "efflorescence was (or could be) our friend". I was surprised to hear her say that since it was such a complaint area. But she explained that if you have continued efflorescence then you have a water /moisture problem that may not be discovered until severe damage occurs. As I mentioned above, this can happen from excessive moisture in the building, leakage around windows or doorways, flashing or weep hole problems, leaking chimney caps, non-full joints, etc. She was right.

Naturally, the migration of salts and the formation of efflorescence and its' removal remedies can be a complex issue. Certainly more in-depth than can be addressed in this brief article. For additional information the following organizations, to name a few, have detailed, publish information.

- Portland Cement Association
- American Society of Home Inspectors
- American Society of Testing and Materials
- Brick Industry Association

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