PCI Plant Quality Talk
Quality Enhancement Committee

NPCA NATIONAL PRECAST CONCRETE ASSOCIATION
PCI Precast/Prestressed Concrete Institute

SERIES 4, ISSUE 2 – REMOVING EFFLORESCENCE

Efflorescence is a whitish, powdery residue on the surface of concrete. It occurs due to the presence of soluble salts, such as calcium hydroxide, which can be in the materials used to make concrete. When efflorescence occurs during or immediately following construction, your first impulse may be to immediately wash it off with water or an acid cleaning solution. This is *not* advisable, particularly in cool or damp weather, because such action can introduce more water into the concrete. The water or cleaning solution will wash some of the alkali salts from the surface, but it will also dissolve and carry the salts back into the concrete, thus causing a reoccurrence of the efflorescence. In almost all cases, if you can wait a year or two before acting, most of the salts will migrate to the surface—thus, the problem may solve itself by normal weathering. The water-soluble alkali salts will gradually weather away.

Heavy calcium carbonate efflorescence, although less common, is extremely difficult to remove because it forms a hard white crust. After weathering to calcium hydrogen carbonate, it may be easily removed; otherwise, acidic cleaners may be necessary.

Efflorescence Test Area

Before beginning efflorescence cleaning operations on a large scale, a small area (at least 1 square yard) of the concrete surface should be cleaned and checked to be certain there is no undesirable effect on the concrete surface finish or adjacent corrodible materials such as glass, metal, or wood. A strip-off plastic can be sprayed onto glass and aluminum frames to protect them. The effectiveness of the method on the sample area should not be judged until the surface has dried for at least one week. If possible, concrete should be cleaned when the weather conditions, including temperature and relative humidity, allow for rapid drying. Slow drying increases the possibility of recurring efflorescence and discoloration.

Suggested Testing Process

When choosing a cleaning method to remove efflorescence from precast concrete, the least-damaging option should be tested first. The following is a suggested order for testing efflorescence removal procedures (beginning with the least damaging technique):

1) Dry scrubbing with a stiff fiber brush (particularly if the surface is brushed shortly after appearance of efflorescence).
2) Abrasive blasting with industrial baking soda. This abrasive will minimally affect the concrete surface. Residues should be blown, vacuumed, or brushed from the surface. Do *not* use water to remove residue on the surface—the water could dissolve salts and carry them into concrete, causing additional efflorescence.
3) Vigorous dry scrubbing of the finish with a stiff fiber brush followed by low-pressure washing of the surface.
4) Chemical cleaning compounds such as detergents, hydrochloric (muriatic) or phosphoric acid, or other commercial cleaners used in accordance with the manufacturer's recommendation. To prevent the chemicals from being absorbed deeply into the surface of the concrete, areas to be cleaned chemically should be thoroughly saturated with clean water before the cleaning material is applied. Surfaces should also be thoroughly rinsed with clean water after application so that no traces of detergents or acid remain on the surface of the concrete. Cleaning solutions should not be allowed to dry on the concrete surface. Residual salts can flake or spall the surface, or they may leave difficult-to-remove stains. Misapplication of hydrochloric (muriatic) acid can lead to corrosion of adjacent or embedded metals with shallow cover. Care should be taken to use diluted solutions of acid to prevent surface etching, which may reveal the aggregate and slightly change surface color and texture. Apply the solution to just one small area (less than 4 ft^2) at a time, and then wait about 5 minutes before scouring off the salt deposit with a stiff bristle brush and moving on to the next small area.

Any of the following diluted solutions of acids will effectively remove efflorescence:

- 1 part hydrochloric (muriatic) acid in 9 to 19 parts water
- 1 part phosphoric acid in 9 parts water
- 1 part phosphoric acid plus 1 part acetic acid (vinegar) in 19 parts water
- 1 part acetic acid in 5 parts water

Hydrochloric (muriatic) acid may leave a yellow stain on white concrete. Therefore, if an acid solution is needed to clean white concrete, a solution with phosphoric or acetic acid should be used.

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Safety Precautions

- Materials used in chemical cleaning can be highly corrosive and are frequently toxic. Therefore, rubber gloves, safety eyewear, a respirator, and other protective clothing should be worn, in accordance with the manufacturer's recommendations, when using acid solutions or strong detergents.
- All precautions on a product label should be followed as these cleaning agents can affect eyes, skin, and breathing.
- Materials that can produce noxious or flammable fumes should not be used in confined spaces unless adequate ventilation can be provided.

Other Resources

Additional information on efflorescence can be found in PCI Technical Note TN-3, *Efflorescence on Precast Concrete*.

Note: Please complete this form and return to the Quality Control Manager. All crew members should be observant and report to their supervisor anything out of the ordinary on a project. See something, say something.

NOTES	ATTENDEE SIGNATURES
_____ DATE _____ PRESENTER	_____ _____ _____ _____ _____ _____