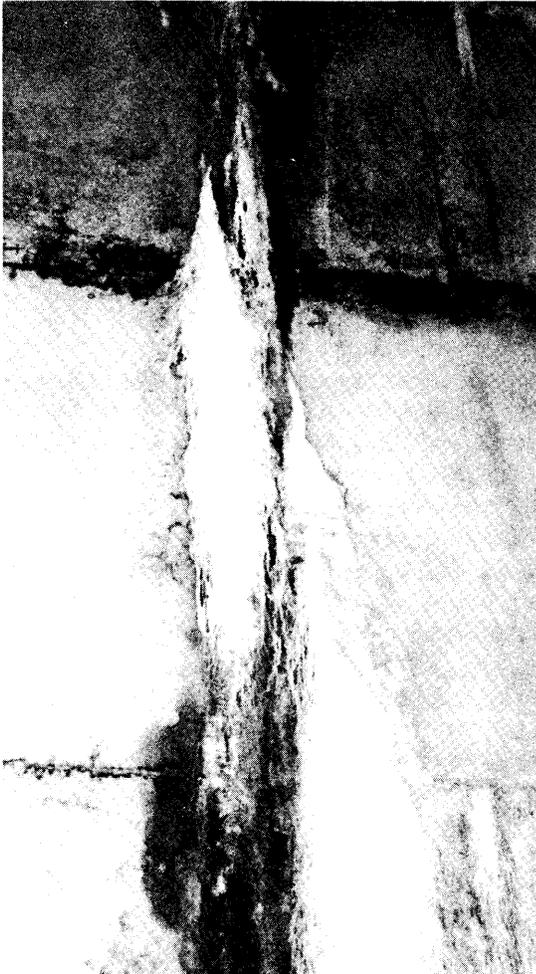




## REMR TECHNICAL NOTE CS-MR-4.3

### REMOVAL AND PREVENTION OF EFFLORESCENCE ON CONCRETE AND MASONRY BUILDING SURFACES



PURPOSE: To provide information on removing efflorescence from concrete and masonry building surfaces and preventing its recurrence.

APPLICATION: These methods can be used on any concrete and masonry building surface.

BACKGROUND: Efflorescence is a deposit of salt left on the surface of concrete or masonry by the evaporation of moisture which brought it from within the structure. Efflorescence is unsightly but harmless unless it accumulates within the pores of a material. Such accumulation can disrupt the surface.

Leaching of salts from within concrete or masonry is the most common cause of efflorescence. However, salts in soil that is in contact with a concrete or masonry structure unprotected by a moisture barrier can migrate upward as much as 2 ft and become deposited on the surface. A reaction between chemicals in concrete and masonry and those in the atmosphere can also form efflorescence. For example, calcium hydroxide in concrete and masonry can combine with carbon dioxide in the atmosphere to become calcium carbonate, which appears as a whitish deposit.

Affected by temperature, humidity, and wind, efflorescence forms more frequently in winter than summer as the slower rate of evaporation in winter permits greater migration of salts to the surface.

METHODS FOR REMOVING EFFLORESCENCE: Most efflorescence can be removed by one of the following methods: scrubbing with a dry brush, scrubbing with water and a brush, light waterblasting, or light sandblasting and hosing with clean water.

However, some salts become water insoluble shortly after reaching the atmosphere. Efflorescence from these salts can be removed with a dilute solution of acid. Suggested solutions include:

- a. 1 part hydrochloric acid (muriatic acid) in 9 to 19 parts water,
- b. 1 part phosphoric acid in 9 parts water, or
- c. 1 part phosphoric acid plus 1 part acetic acid in 19 parts water.

The solution should be tested on a small, inconspicuous area to determine whether there will be adverse effects.

APPLYING DILUTE ACID SOLUTION: First, saturate the surface with clear water to prevent absorption of the acid into the concrete or masonry and thereby minimize the effect of the acid on these materials. Apply dilute acid solution to small areas, not more than 4 sq ft at a time. Wait 5 min and then remove the efflorescence with a stiff brush. Immediately wash the area with clean water to remove all acid.

CAUTION: Since a dilute acid solution may slightly change the appearance of concrete or masonry, the entire wall should be treated to avoid blotching. Only 1 to 2 percent solution should be used on integrally colored concrete; stronger solutions may etch the surface, revealing the aggregate and hence changing color and texture.

SAFETY: Workmen using an acid solution should wear rubber gloves, glasses, and other protective clothing and should observe all precautions on labels. Acids can be harmful to eyes, skin, and breathing.

PREVENTING RECURRENCE OF EFFLORESCENCE: To prevent recurrence of efflorescence on concrete and masonry surfaces, it is necessary to keep water absorption low and to prevent moisture movement through the mass:

- a. Use a moisture barrier--sealer, membrane, impermeable overlay--on exterior walls or apply vaporproof paint to interior surfaces.
- b. Use wide, overhanging roofs to protect walls from rainfall.
- c. Locate lawn sprinklers or other water resources so walls are not subject to unnecessary wetting.
- d. Divert moisture flow away from the mass.
- e. Install drains to reduce high groundwater table.
- f. Use epoxy injection or chemical grouting at cracks or joints subject to efflorescence.

CAUTION: Water-repellent surface treatments can reduce the amount of efflorescence; however, such treatments can cause the dissolved salts to be deposited beneath the surface. If a construction material treated with a water-repellent contains large amounts of salt, and if these salts accumulate and crystallize beneath the surface, flaking and spalling can occur.

Concrete that is heavily laden with potential efflorescence can be treated with a poultice of paper pulp and water. When the poultice dries, remove it. Reapply several times, if necessary.

ENVIRONMENTAL CONSIDERATION: Improper use of concentrated and dilute acids may result in adverse environmental and water quality impacts. Care should be taken to implement all necessary precautions to prevent these potential adverse impacts. When in doubt, environmental specialists should be consulted to evaluate potential problems on a project specific basis.

REFERENCES:

- a. Concrete Construction. 1986 (Jun). "Methods of Removing Some Specific Stains from Concrete: Aluminum to Finishing Discoloration," pp 659-660.
- b. Concrete Technology Today. 1987 (Mar). "Efflorescence: Causes, Prevention, Repair," pp 4-5.