

# Grey Discoloration of White Swimming Pool Plaster

by onBalance

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The picture at right shows grey discoloration of a fairly new white swimming pool plaster surface. This discoloration develops over time, and usually appears sometime in the first year. In some cases, once it becomes noticeable, it can progress throughout the swimming pool. No change in water chemistry stops the progression of the discoloration. Acid treatments are largely ineffective at addressing this discoloration, although occasionally an acid wash will lighten it. Some plasterers have drained swimming pools with this problem and left them empty for several days, allowing the plaster to “dry out”. Anecdotal evidence shows that this is a hit or miss proposition, and in some cases, the discoloration has reappeared sometime after the swimming pool was refilled. The application of heat, using a process often called “torching,” has been effective in many cases of this greying discoloration. The surface is superheated using hand torches, the premise being that water trapped subsurface in the plaster is removed by the heat. However torching is a painstaking and inexact process, and small areas of the surface can pop off during the application. Most often, there is no effective remediation of the problem. This greying often accompanies other surface discolorations including so-called “spot etching”.



## What Causes the Greying?

Many years ago, the NPC formed as a result of a plague of a condition called “excessive hydration” – a dark grey mottling of new plaster. This was recently the subject of an article by the first chairman of the NPC, Bruce Hughes, in the February 2009 Water Shapes magazine article “20 Years After.” Hughes described that the mottling was being caused by moisture trapped in the plaster matrix, and could be removed by applying heat. Photographs describing this greying discoloration called “hydration” and “excessive hydration” are seen throughout the NPC’s first technical manuals. And, although not said in the Hughes article, the cause of the excessive hydration problem that created the NPC in 1987 was determined to be the change of cement blane size of one manufacturer which caused their cement to set faster, causing the entrapment subsurface.

As described earlier, heating, or “torching,” has been used in an attempt to remediate this greying of the surface and “entrapped water,” a condition that occurs when the plaster surface sets prematurely and does not allow bleed water to migrate out of the cement. Instead, it becomes trapped subsurface.

Last October, NPC Executive Director Mitch Brooks stated in a response in Service Industry News (October 15, 2008 issue) that “...*too much calcium (chloride) shortens the open time, reducing the time for compaction, and does help darken the cement.*” This statement appears to be consistent with the NPC Technical Manual, 5th edition, which sets forth on page 12, in section 2.5.1, “*Calcium chloride can alter the coloration of surface coatings. Calcium chloride can cause white surface coatings to exhibit a darker hue, and colored or pigmented surface coatings to exhibit increased blotchiness or mottling.*”

The Technical Manual also describes greying in section 6.5 – “Discoloration of the Cementitious Surface Coating,” point number 6. **Trowel burn**, *over-troweling, or troweling past final set, can cause an exaggerated form of mottling, or severe blotchiness. These dark gray appearances come from the metal of the trowel being deposited onto the cementitious coating surface. This discoloration is often in an arc or in the pattern that follows the motion of the trowel used by the plasterer. Trowel burn is created by over-troweling the cementitious surface finish,*

by troweling the finish near the final set without supplemental moisture to lubricate the finish, or by troweling the finish past final set.” Although onBalance disagrees with the use of supplemental moisture, which is known in the cement industry to create discoloration and porosity problems all by themselves, this section also clearly describes a known cause of “greying.”

The cement and concrete industry has also established that the use of calcium chloride admixtures can darken surfaces:

“The addition to concrete of calcium chloride or admixtures containing calcium chloride can darken a concrete surface. Light spot or dark spot (mottled) discoloration can occur depending on the curing method and the alkali content of the cement.” ( *Steven H. Kosmatka, “Discoloration of Concrete – Causes and Remedies” Portland Cement Association Document PL861*

“Concrete batched with calcium chloride will often appear darker than calcium–chloride–free concrete.”(*American Concrete Institute 302.1R–96 “Guide for Concrete Floor and Slab Construction”*)

“Factors found to influence discoloration were calcium chloride admixtures, cement alkalies, hard troweled surfaces, inadequate or inappropriate curing, concreting practices and finishing procedures that cause surface variation of water-cement ratio, and changes in the concrete mix...(p. 39)

Conclusions:

Calcium chloride in concrete is a primary cause of concrete discoloration. The chances for discoloration are much less if calcium chloride is not used.

Discoloration becomes more pronounced and more permanent with harder troweling. (from Conclusions, p. 48)”

Greening and Landgren. “Surface Discoloration of Concrete Flatwork.” *Journal of the Portland Cement Association*, Vol 8, No 3, pp 34-50 September, 1966 (Italics added)

So, we have both the cement and concrete industry, as well as the NPC, describing various “greying discolorations.” We have “hydration” and “excessive hydration” as described by Bruce Hughes and the NPC in earlier Technical Manuals, (although it should be noted that current manuals do not address either of these terms or entrapped moisture??) They all describe the greying and darkening of cement caused by calcium chloride admixtures. There is greying caused by “trowel burn.”

But, according to Greg Garrett, Board member and Technical Advisor to the National Plasterers Council, the greying discoloration is caused by filling the swimming pool with low calcium hardness water, or it is caused by high cyanuric acid levels in the swimming pool, or it is caused by “aggressive water.” Garrett has published these statements to the industry, in the January 31, 2008 issue of the Pool and Spa News (“Plaster Problems Point to Low-Calcium Water”), and on the NPC website (“Preventing Interior Finish Problems, Part III”). He has also repeatedly made these claims in reports submitted to poolowners, plastering contractors, pool builders and service technicians, often while representing the NPC. It should be noted that in most of these reports, Garrett recommends zero alkalinity processes ( a “no drain” acid wash), and in some earlier cases, “torching” as treatments.

However, there is no science that supports Mr. Garrett’s positions or statements that low calcium hardness fill water, high cyanuric acid levels, or aggressive water conditions create the greying discoloration. The fact of the matter is that aggressive fill water etches surfaces, it doesn’t turn them grey or spot them. An obvious contradiction in his reports is his recommendation to use an aggressive water treatment to fix a problem allegedly caused by an aggressive water condition. If aggressive water caused the greying problem, then how does aggressive water “un-cause” it? Although Garrett often describes “etching” of the surface, in cases where onBalance has investigated these same swimming pools, not only was there no evidence of etching or deterioration of the cement paste, the surfaces were extremely smooth to the touch. And, don’t forget that Garrett has also recommended “torching” as a solution.