

Problems with the NPC Tech Manual

onBalance – Que Hales, Doug Latta and Kim Skinner

The 2009 National Plasters Council's (NPC) Tech Manual contains incorrect statements, claims, or omissions of important workmanship issues for the making of a quality pool plaster product. The misinformation in the current 2009 manual misleads plasterers on proper workmanship concepts, and enables them to avoid responsibility for sub-standard work and poor quality pool plaster. Clearly, the NPC Tech manual it is not the main-stay of accepted practices as they claim.

Pool plaster is similar to concrete and cement flatwork. Pool plaster uses the same type (I) of Portland cement used in concrete flatwork. The large aggregate in concrete is tamped down below the surface and the cement and sand fines rise to the surface, which then is troweled just like pool plaster. Since pool plaster is only a half of an inch thick and is troweled to a very smooth surface (more so than most cement flatwork) makes it even more critical to follow appropriate practices and guidelines for a durable and aesthetically pleasing cement finish. Yet amazingly, when it is shown to the NPC that improper practices can lead to early deterioration or cosmetic defects, the NPC suggests that concrete studies (ACI and PCA) and our (onBalance) studies on pool plaster don't apply to them.

The following is a quote from the 2009 Sixth Edition NPC Technical Manual on page 3 under QUALIFICATIONS - *“Unsubstantiated theories” which do not have significant scientific data to support their position, or any conjecture that serves only to mislead the general public, will not be considered herein.*” Let's see how well this statement is adhered to by this Tech manual.

Section 2.4 – Water

There is no standard set for a maximum water-to-cement ratio. Both ACI and PCA literature mentions the importance of not allowing too much water to be added to cement products that require a durable surface. They set a general limit of .50, or a weight of water equal to half the weight of the cement for durable concrete. A high amount of water (wet mix) leads to severe craze cracking and “dusting” (similar to plaster dust forming in new pools). Not setting a limit allows plasterers to add too much water, and not be held responsible for the defects caused by a high water-to-cement ratio. We recommend a maximum ratio of .48 pounds of water to one pound of cement.

Section 2.5.1 – Calcium Chloride

This section states that the addition of 1% to 2% calcium chloride provides increased strength to cementitious products at an early age (one week), while not mentioning that the long-term durability can be negatively affected, which is the more important issue. Also, the wording states that “the 2% limit may not be critical to swimming pool plaster.” (This wording was added to the 2005 edition). We disagree and there is ample cement literature and studies by the ACI and PCA that documents the negative effects of adding calcium chloride, especially in excess. The Tech manual should caution plasterers against using too much calcium chloride in their mixes.

Section 4.3.1 – Mix Water

This section does not set a maximum amount of water that can be added to a mix. (See Section 2.4 above)

Section 4.3.2 Lubricating Water

This section incorrectly suggests that it is appropriate and acceptable to add water while troweling and finishing a plaster (cement) surface. According to the ACI and PCA, it is not acceptable to add water while troweling cement flatwork due to possible discoloring and durability issues. This also especially applies to colored plaster.

Section 6.2.2 – Closed shrinkage Cracks

This section does not mention that high calcium chloride and high water additions to the mix as possible causes of severe or excessive craze cracking (closed shrinkage cracks).

Section 6.3 – Inferior Materials

This section does not acknowledge that excess calcium chloride additions are a possible cause of an inferior surface and reduced durability as documented by the ACI and PCA.

This section does not mention that adding water while troweling can be a cause of inferior surface strength and durability, and doesn't mention that discoloration problems can result, including a porous surface causing streaking and mottling discoloration as documented by the ACI and PCA. An inferior or porous surface can not be remedied.

Section 6.4 – Debonding and Delaminations

In discussing this problem, the 2009 Tech manual omits that “nodules” (also known as “calcium nodules”) are a symptom of delaminations and bond failures. Yet the 1998 Tech manual acknowledged this phenomenon and correctly stated that the responsibility is with the plasterer or those who prepared the surface prior to plastering. Plasterers are now blaming this problem on improper water chemistry.

Section 6.4.2 – Buckles, blisters, and spalls

This section incorrectly suggests that “aggressive pool water chemistry” can lead to spalling and delaminations. This is false. In fact, the earlier 1998 Tech manual acknowledged that improper finishing and mixing can lead to flaking and spalling and “that no definitive documentation currently exists to support the claim that aggressive water chemistry causes spalling.” But the 2009 NPC Tech manual now claims that aggressive water can cause spalling and delaminations! There is no documentation that identifies aggressive pool water as causing spalling or flaking of pool plaster. Yet, there is documentation from the ACI and PCA that improper workmanship (troweling) leads to flaking, spalling, and delamination.

This section should also include that another possible cause of spalling can be from “adding water while troweling.”

Section 6.5 – Discoloration

This section does not acknowledge the darkening (severe mottling) effect of adding too much calcium chloride. The 1998 Tech manual did mention this, and the ACI also has documented this along with late hard troweling. However, NPC field inspectors are blaming dark discolorations on aggressive water chemistry. There is no supporting documentation that proves this claim.

This section does not acknowledge that blotchy and whitening effects on dark colored plaster can result when calcium chloride is used (especially to excess), and also when adding water while troweling. Efflorescence (salt) is also incorrectly blamed for discoloration of the surface. The PCA has documented that efflorescence on a cement surface (also known as “dusting”) is the result of improper workmanship and material issues. (PCA Concrete Slab Surfaces Defects: Causes, Prevention, Repair 2001)

Section 6.6 – Long-Term Deterioration

This section does not mention that excess water in the mix, adding water during finishing, and adding excess calcium chloride can lead to early deterioration (low durability) as documented by the ACI and PCA. Insufficient fill delay can also cause deterioration.

Section 6.6.1.1 Aggressive chemical attack

This section incorrectly suggests that salt deposits emitting from cracks are the result of improper water chemistry (aggressive and/or scaling). This claim is false and plasterers are blaming “calcium nodules” on improper water chemistry instead of acknowledging them as symptoms of delamination, bond failure or cracks.

This section also incorrectly claims that “efflorescence” is due to improper water chemistry. [See Section 6.5)

Section 6.6.1.4 Carbonation

This section incorrectly suggests that “carbonation” is detrimental and causes discoloration, a weakening and early deterioration of plaster, and blames various improper water chemistry conditions for this condition, when in fact, carbonation strengthens a plaster surface. Carbonation is a natural, normal occurrence and benefits a cement surface by converting the soluble compound calcium hydroxide (in the surface) into calcium carbonate, a much more durable and water resistant compound. (Reference F.M. Lea)

This section also improperly blames carbonation for blotchy and mottled discoloration, and is even blamed for open cracks in the plaster. Instead, these conditions are caused by improper workmanship or material issues as documented by the ACI and PCA. Plasterers currently use the wording in this section to incorrectly suggest that the water hasn’t been maintained correctly and leading to “improper” carbonation.

While it is correct that secondary carbonation layers (precipitated calcium carbonate scale) can discolor a surface, it is removable, where often the workmanship issues are not.

Section 6.6.1.5 Aggressive Water Deterioration

This section states that aggressive water will “deteriorate” a cement surface. Instead, the more correct term is that aggressive water will “etch” a cement surface. Deterioration should be defined as the breakdown of a weak, soft, and porous plaster surface.

Section 6.6.1.6 Leaching Deterioration

The section states that “leaching” (as opposed to “etching”) is the dissolving of soluble (i.e., weak, soft, and porous) plaster material by water percolating through a plaster coating. That statement is correct if referring to “balanced” water that dissolves a weak, soft, and porous cement surface. A poor quality plaster surface (due to poor workmanship or materials) will deteriorate due to its own weakness. But this section incorrectly suggests that only imbalanced (aggressive) water is responsible for the deterioration of a cement surface. Poor quality plaster (or concrete) doesn’t require aggressive water to deteriorate.

Additional omissions by the 2009 Tech Manual

1. The current manual does not advise plasterers to avoid plastering pools in extreme weather conditions and temperatures, or take precautionary steps to mitigate the detrimental effects of extreme weather conditions on cement flatwork. Curiously, the 1998 Tech Manual did advise plasterers to not conduct plastering operations when extreme weather conditions exist.
2. The term “hydration” is also currently used by plasterers to blame improper water chemistry, improper startups procedures, or other problems for discolorations (graying or light streaking) that are actually caused by improper workmanship and material issues. The 1998 Tech manual properly acknowledged improper workmanship and material causes for “hydration” discoloration, while the current 2009 NPC manual does not.
3. The NPC Tech Manual does not address the proper waiting time before filling a newly plastered pool with water. This is an important issue and plasterers should be warned that starting the fill water before six hours has elapsed after final troweling can result in a damaged surface which leads to early deterioration and staining.
4. The NPC Tech Manual does not advise plasterers to test the tap water to assure that it is appropriate and balanced enough to be used for filling the pool. Plasterers or builder contractors should not allow “soft” fill water to enter the pool, since that can have adverse consequences and dissolve some of the cement surface and make it more porous. Currently, plasterers blame the service tech for not balancing the water properly after the pool is already filled with potentially inappropriate water. This is known as securing the barn door after the horses have run away.

5. Without any documentation, the current NPC Tech manual claims that “spot etching” (a term coined by pool plasterers, but more appropriately known as soft spots or streaking) is caused by improper water chemistry. The 1998 Tech Manual acknowledged that this theory by the NPC has not been proven. Recent research by onBalance and independent laboratories has confirmed that spotting and streaking of plaster is a workmanship defect.

6. The NPC has a “colored plaster” disclaimer (or contract) claiming that colored plaster may become streaked, blotched, mottled, and crazed (check cracks or hairline cracks), conditions over which the plasterer has no control. That is false, and there are plastering steps that can be taken to prevent or minimize these cosmetic problems. Yet, when colored plaster jobs discolor, NPC members or consultants point the finger of blame on the service tech or pool owner for improper water chemistry maintenance as the cause of these issues! It is inexcusable for plasterers to not acknowledge that following good workmanship practices can avoid the problems of streaky, blotchy and fading colors, while leading to a quality, long-lasting, and more esthetic pleasing colored plaster finish.

7. Interestingly, while the Technical manual contains the above errors and omissions, which can lead to poor quality plaster, the NPC is imposing their demands on the service industry to maintain pool water in a “perfect” water balance condition. In section 7.0 – terminology, the NPC states that balanced water means within the APSP “ideal” range. This means that when the “carbonate” alkalinity is 70 ppm, it is automatically deemed “aggressive” even if the overall water parameters is balanced and the SI is 0.0 or above. Also, the long-standing LSI standard of -0.3 to +0.5 has been rejected by the NPC. And this has been decreed by the NPC without citing any supporting studies.

This bogus narrowing of water chemistry parameters is being promoted by the very people who refuse to accept reasonable, scientifically validated standards on their own products and methods!

8. The NPC promotes the use of more durable plaster products to sell to clients. Their reasoning is that typical white plaster and marble aggregate is inherently weak or soft, and that imperfect water chemistry and maintenance programs (which the NPIRC says are inevitable) will quickly deteriorate this “naturally” weak product. Their “solution” is that more expensive quartz and pebble finishes will eliminate the problems that normally results with standard white plaster. Yet, the NPC now states that when problems or defects develop on these improved surfaces, it is mostly likely because of improper chemistry! This agenda removes incentive for plasterers to perform quality workmanship if they are able to blame all problems (discoloration, cracking, and deterioration) on water maintenance. And obviously, plasterers will benefit by being paid to redo the pool again (much sooner than usual) with the more costly upgrade.

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