ANTI-HYDRO COMPLIES WITH ACI 318

TECHNICAL BULLETIN

W-1-2 Rev.1/26

SUMMARY

ANTI-HYDRO complies with Building Code Requirements for Reinforced Concrete (ACI 318) when used at recommended dosages in reinforced concrete exposed to chloride in service, in reinforced concrete that will be dry or protected from moisture in service, and in other reinforced concrete construction. The use of **Anti-Hydro** in a Portland cement concrete mix containing 517 lbs. of Portland cement results in a maximum water soluble chloride ion (Cl) (in the hardened concrete after 28 days) of .073 percent or less by weight of cement.

ACI 318 AND ANTI-HYDRO® PRODUCTS

ACI 318 is one of the most influential standards of the American Concrete Institute. It is widely adopted by local governments as part of their building codes. It is essential to understand that the restrictions of ACI 318 apply to soluble chloride ion.

PERCENTAGES OF Cl CONTRIBUTED BY ANTI-HYDRO & ANTI-HYDRO-R

When calcium chloride is dissolved in water, it dissociates into calcium ions and chloride ions. The amount of chloride ion contributed by flake calcium chloride is approximately 50% on a weight/weight basis. The chart to the right is a listing of initial chloride ion contribution made by **Anti-Hydro** & **Anti-Hydro-R** to representative concrete mixes. It is essential to note that the maximum chloride ion concentration allowed by ACI 318 is the *water soluble* portion in hardened concrete at an age of 28 days. The soluble chloride ion contributed to concrete by **Anti-Hydro** ***decreases*** as a result of chemical combination with the cement paste.

CEMENT LBS P/CUBIC YARD	INITIAL AMOUNT OF SOLUBLE Cl SUPPLIED BY:	
	ANTI-HYDRO	ANTI-HYDRO-R
400	0.50	0.19
500	0.46	0.15
600	0.38	0.13
700	0.33	0.11

WATER SOLUBLE Cl CONTENT IN HARDENED CONCRETE SUPPLIED BY ANTI-HYDRO

CEMENT LBS P/CUBIC YARD	AGE/DAYS	H2O SOLUBLE Cl IN CONCRETE, % BY WEIGHT OF CEMENT
517	7	.070 max
517	28	.073 max

Independent laboratory studies show a rapid decrease in water soluble chloride ion content in an Anti-Hydro mix from 0.435% to a maximum of 0.070% at 7 days, then remaining constant through 28 days. This represents an 85% reduction from the initial level. Even greater reductions occurred in mixes containing significant amounts of tricalcium aluminate (C3 A), with up to 75% to 90% of the chloride becoming part of the chloraluminate of the hydrated cement. Additionally, it was observed that chloride is incorporated in other ways within the cement that lacks C3A.

Note: *Shimel and Sor Testing Laboratories, Inc., Report No. 84-273 R*

COMPARED TO

ACI 318 TABLE 19.3.2.1
MAX Cl CONTENT FOR CORROSION PROTECTION

TYPE OF MEMBER	MAX H2O SOLUBLE Cl IN CONCRETE, % BY WEIGHT OF CEMENT
PRE-STRESSED CONCRETE	0.06
REINFORCED CONCRETE EXPOSED TO CHLORIDE IN SERVICE	0.15
REINFORCED CONCRETE THAT WILL BE DRY OR PROTECTED FROM MOISTURE IN SERVICE	1.00
OTHER REINFORCED CONCRETE CONSTRUCTION	0.30

THE CORROSION PROCESS

Reinforcing steel corrosion is an electrochemical process involving chemical and electrical processes. Reinforcement is usually in a protective alkaline environment. Chloride intrusion lowers the pH to near 10, reducing concrete electrical resistivity. **Chloride ions accelerate corrosion, but moisture and oxygen are also necessary.** Corrosion requires chloride ion concentrations above a threshold of 1.1 to 1.6 pounds per cubic yard at or near the surface of embedded steel.

NON-CHLORIDE ACCELERATORS

As a result of the "Chloride Scare" a number of commercial non-chloride accelerators have appeared on the market. In-house studies have indicated that none of these products compare favorably with the cost effectiveness of chloride accelerators. They are costly, performance is not comparable, and most importantly their long term effects on concrete have yet to be determined.

CONCLUSIONS

1. **Anti-Hydro** contributes initially a soluble chloride ion concentration that is below the limitation of ACI 318 for dry reinforced concrete structures, and is close to the limitation for other reinforced concrete construction.

2. **Anti-Hydro** contributes **initially** a soluble chloride ion concentration that is below the limitation of ACI 318 for all classes of reinforced concrete structures **except pre-stress and post-tension applications.**

3. **Anti-Hydro** was added to concrete containing 517 lb. of cement per cubic yard. The initial soluble chloride ion concentration contributed by **Anti-Hydro** in this instance was 0.435% based on weight of cement. After 7 days, the water soluble chloride ion in the hardened concrete was determined to be a maximum of 0.070%.

   This level meets all requirements of ACI 318 limitations for all concrete structures except pre-stress and post-tension application. Further, this represents a reduction of 85% in soluble chloride ion concentration from that initially added.

ANTI-HYDRO PRODUCTS, LLC®

PRODUCTS & TECHNOLOGY FOR CONCRETE AND MASONRY WORLDWIDE SINCE 1904

For over 120 years, Anti-Hydro Products, LLC has been integrally waterproofing many concrete and masonry structures all over the globe. The success of our core product **Anti-Hydro "AH-1"**, has been attested not only by the commercial recognition accorded by its use in many prestigious projects worldwide, but also by tests performed by many governmental agencies and accredited independent laboratories.

Tel: +1- 908-284-9000
Fax: +1-908-284-9464

45 River Road · Suite 300
Flemington NJ 08822-6036 USA

info@anti-hydro.com
www.anti-hydro.com