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PLAINTIFF'S EXHIBIT

CAP-817

March 5, 1982

*File
A/C Pipe Corrosion
3-22-82*

W. H. Smith & Associates
P. O. Box 678
Flora, IL 62839

Dear Harry:

Life doesn't seem to slow down and I feel I'm getting further behind every day.

I have however drafted a short section on A/C pipe for the AWWA Corrosion Manual. I presented this to the other A/C producers on comment through the A/C Pipe Producers Assoc. They must be more behind than I for I've not received any comment during the four or five months they have had my rough draft. I am therefore presuming that what I wrote has concurrence of the A/C industry.

Sorry it took so long to get this to you. I look forward to seeing you in Miami.

Sincerely yours,

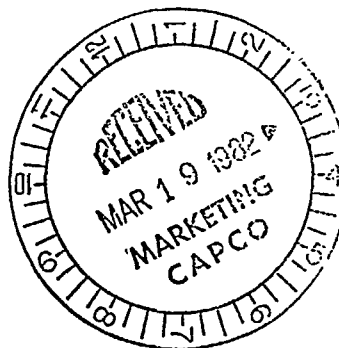
H. L. Olson / bja

H. L. Olson, Manager
Environmental & Engineering Development

HLO:bja

cc: Jay Baker - Certainteed
Lee Taylor - CAPCO
Joe Jackson - AACPP

attachment



CAPCO JEN 0020203

FOR AWWA CORROSION MANUAL

Asbestos Cement Pipe

Asbestos-cement pressure pipes for water transmission and distribution are manufactured in accordance with the following AWWA Standards:

AWWA C400	AWWA Standard for Asbestos-Cement Distribution Pipe, 4 In. through 16 In. (100 MM through 400 MM) . NPS, For Water and Other Liquids.
AWWA C402	AWWA Standard for Asbestos-Cement Transmission Pipe, 18 In through 42 In. For Water and Other Liquids.

Other AWWA standards relating to asbestos-cement pipe are:

AWWA C401	AWWA Standard Practice for the Selection of Asbestos-Cement Distribution Pipe 4 In. through 16 In. for Water and Other Liquids.
AWWA C403	AWWA Standard Practice for the Selection of Asbestos Cement Transmission and Feeder Main Pipe, sizes 18 In. through 42 In.
AWWA 603	AWWA Standard for Installation of Asbestos-Cement Pressure Pipe

AWWA C400 and C402 specify two types of asbestos-cement which define chemical requirements for the pipe.

Type I	No limit on uncombined calcium hydroxide*
Type II	1% or less uncombined calcium hydroxide*

* Test for uncombined calcium hydroxide in accordance with ASTM C-500.

In the U.S. only Type II A/C pipe has been produced for the past several decades. Type II pipe contains in addition to asbestos fiber and Portland cement, approximately 30%-35% crystalline ground silica. The curing process is completed in high pressure steam autoclaves where the temperature is approximately 300 degrees F. According to Committee 716 of the American Concrete Institute, higher strength properties,

more stabilized form, and increased resistance to sulfate are obtained for cement products with high pressure steam curing than by damp curing process. While the high strength developed in a few hours of steam curing is in part due to the acceleration of the normal process of hardening, a material contribution to strength comes from the reaction resulting in the formation of a hydrated calcium silicate from the lime and silica present. The more stabilized form of cement attributable to pressure steam curing results, in part, from the conversion (or partial conversion) of the amorphous calcium silicates to crystalline forms, which do not swell or shrink as much as do the amorphous forms with increase or decrease in moisture content. It was also noted by the committee that the series of compounds that are known as hydrogarnets, which result from steam curing of cement products are very stable and highly resistant to the action of sulfate solutions.

The AWWA specifications for asbestos cement pipe (AWWA C400 and C402) establish some guidelines for the use of A/C pipe under various soil conditions. The guidelines establish parameters which are intended to define conditions where indefinite life expectancy is anticipated.

For aggressiveness of acidic soils to A/C pipe the guidelines are:

<u>Water Conditions Within the Soil Environment</u>	<u>Minimum pH of Acidic Soils When Using Asbestos Cement Pipe</u>	
	<u>Type I</u>	<u>Type II</u>
Essentially quiescent	5.0	4.0
Mildly fluctuating	5.5	5.0
Rapidly moving or grossly cyclic	6.3	5.5

The above guidelines for the use of A/C pipe in acidic soils are based upon minimum pH factors alone. A/C pipe may or may not perform satisfactorily in acidic soil environments that have pH values below those listed above. To determine the suitability of A/C pipe in soils having lower pH values, each situation should be evaluated individually.

For chemical resistance to non-acid ($\text{pH} \geq 7.0$) soluble sulfates in soils, the guidelines are:

Type Designated	Chemical Resistance to Nonacid Soluble Sulfates in Water And Soils
Type I*	Will be attacked to various degrees by all but the nonaggressive levels of sulfate concentrations in waters and soils.
Type II	Resistant to all levels of soluble sulfates.

* The guidelines criteria for sulfate resistance of Type I pipe were taken from the Concrete Manual, 8th edition. Bureau of Reclamation 1971. Sulfate resistance here applies to all soluble sulfates, regardless of the cation.

AWWA C400 & C402 do not establish specific guidelines for acid soluble sulfate soils. The U.S. Bureau of Standards however have conducted tests on the attack on A/C pipe by various types of soils ("Underground Corrosion", U.S. Bureau of Standards Circular #579). Some of the soils sites tested were acidic soils containing soluble sulfates. The following data is from these U.S. Bu. Stds. tests and gives an indication of the magnitude of attack on A/C pipe from acidic soluble sulfate soils

Test Site	pH	Total acidity Milligrams Equiv. Per 100 Grams of Soil	SO ₄ Milligrams Equiv. Per 100 Grams of Soil	Depth Of Pene- tration (inches)	Years Exposure
<u>Inorganic Reducing Soils</u>					
Acadia Clay	6.2	13.2	22.00	.06	7.0
Sharkey Clay	6.8	4.9	0.91	0.038	12.8
<u>Organic Reducing Soils</u>					
Carlisle Muck	5.6	12.6	1.04	0.106	13.0
Muck	4.8	15.0	2.54	0.047	12.8
Rifle Peat	2.6	297.4	56.70	0.202	13.0
Tidal Marsh	6.9	14.6	36.60	0.032	12.7