REPORT ON ASBESTOS/CEMENT PIPE USE IN THE CITY OF HAYWARD, CALIFORNIA

PREPARED FOR:

THE A/C PIPE PRODUCERS ASSOCIATION
1600 WILSON BOULEVARD
ARLINGTON, VA 22209

PREPARED BY:

WADE MILLER ASSOCIATES, INC.
6260 15TH PLACE NORTH
ARLINGTON, VA 22205

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Introduction

The City of Hayward Water System is the second of ten systems studied as part of the Municipal Analysis Program of the A/C Pipe Producers Association. In this detailed site visit, the objective was to gather as much data as possible on the use of A/C pipe; the overall objective of the MAP program is to build a comprehensive data base on A/C use. The broad functional categories covered by this fact-finding mission are as follows:

- Institutional
- Operational
  - Specification, Decisionmaking and Procurement
  - Installation and Testing
  - Operation and Maintenance
  - Repair and Replacement
  - Detection and Prevention
- Financial

Background on the Hayward Site Visit

The two-day site visit was conducted on January 7-8, immediately following the heaviest rainfall and flooding period in the history of northern California. Hayward is located only 20 miles south of the San Francisco/Oakland Bay area, but neither Hayward nor the site visit was impacted by the weather conditions.

The primary contact in Hayward is L.R. "Bud" Blair, now Director of the Water System Office. Blair, a veteran of 32 years in the City, was formerly head of the entire system prior to an organizational structure change 2-3 years ago. Most of the two days was spent with Blair. He can be characterized as a crusty, cynical (perhaps with reason), but very nice person. Blair and other officials were extremely cooperative, though not enthusiastic about the site visit.

One final set of notes about Bud Blair: he is knowledgeable and aware of health issues surrounding A/C pipe use; he is very aware of the need to maintain an aggressiveness index of greater than 11; and the Hayward installation specifications for contractors and developers (authored by Blair) are the most comprehensive and detailed set encountered during the ten-city study with respect to A/C pipe use.

The Hayward site visit was successful even though the data obtained are incomplete and somewhat qualitative. Moreover, no comparative bid data were obtained. The paucity of data reflects the state of management in the City and the fragmented reporting responsibilities in the Water System more than the quality and effectiveness of system staff members.

City officials interviewed are as follows:

L. R. Blair, Director, Water System Office
Joe Noonan, City Finance Director
John Stevko, Superintendent, Streets and Utilities Division, DPW
Sam Lugo, Field Operations Supervisor, Streets and Utilities Division
Vince Maldadano, Purchasing and Materials Control Manager, Utilities Division

Institutional and Organizational

The institutional aspects of Hayward are more significant than in any system studied. The reasons for this are several: Hayward is beginning to suffer from lack of growth as well as the Proposition 13 (Jarvis-Gann Amendments) of 1979. Hayward buys its water from the City of San Francisco and currently is engaged in litigation against that city. Finally, the Water System's relationship to the City and its overall organization appear to hamper service delivery capabilities.

Hayward has a strong city manager form of government. The current city manager is Don Blubaugh. The Public Works Director is Edward Phillips. The Water System, operated as part of Public Works, is one of four enterprise funds. Accounts and revenues of these four (Sewage System, Air Terminal, Parking Meter, and Water System) are kept separate from the general fund. There are no indications of subsidy to the general fund from the Water System.

The responsibility for operating and maintaining the Water System is split among three divisions of the Public Works Department. The Water Bureau, which is a section of the Streets and Utilities Division, is responsible for distribution mains, customer services, meter reading and repair, and the cross-connection program. The Facilities Maintenance

Division is responsible for the operation and maintenance of pump stations, reservoirs, pressure-reducing stations, fluoride stations, and the wells. The Water System Office (Blair is Director) is responsible for customer relations, billing, records, system valuation, and system engineering. This split of key functional responsibilities occurred about two years ago when Blubaugh became city manager and decided to reorganize several departments. The Water System employs about 40 persons total.

Hayward's Water System serves some 95,000 persons and has 25,000 service connections. The population was predicted to reach 100,000 "ages ago," but has never done so. The major contributors to sales tax--autos and retail businesses--have fallen on hard times, causing a decline in City revenues. This lack of growth, coupled with restrictions on property taxes improsed by Proposition 13 measures, have forced the City into a strained financial posture. According to Joe Noonan, the City Finance Director, they lived off accumulated surpluses the past two years, but budget realities have caused the City to reorganize, lay off staff, and automate as many functions as possible including finance.

Hayward is a member of the San Francisco Bay Water Users Association. The Association has some 28 members, all of which purchase water from the City of San Francisco. San Francisco obtains its waters from reservoirs located in the Yosemite area; the impounded waters are pumped through large aquaducts (Hetch-Hetchy and South Bay) more than 140 miles long. The water rights are held by the users which are listed as "co-grantees" in the appropriative documents. These same documents preclude San Francisco from making a profit from customer charges. Hayward customers pay 17 percent more for water than do San Francisco customers. As a result, the Users Association has sued San Francisco in federal court. The Association allegedly wants reduced rates and parity. It is not clear whether refunds are being sought.

The Transmission and Distribution System

The transmission and distribution systems consist of 335 miles of pipe. About 320 miles is distribution pipe. It is primarily an A/C system. About 275 (82.1%) is A/C; the remainder is unlined cast iron and some ductile iron. Transmission lines, which range from 16-42 inches in diameter, are welded steel cylinders.

Asbestos/cement pipe has been used since 1950 and, according to Blair, they have "found no reason to change." Most of the A/C is 6-12 inch, but they do have some 16-inch and even some 30-inch in the system. The City purchases from Johns-Manville, CertainTeed, and CAPCO; they also have some Belgian pipe in the system.

Most of the Hayward system was started around 1950. The system has virtually been replaced in the past three decades mainly because of hydraulic undersizing.

The main replacement job is not complete, however. A total of 29.95 miles is scheduled for replacement over the next five years. Replacements are divided into three classes: Class 1 consists of 894 feet of steel lines installed during the period 1921-29; Class 2, consists of 35,073 feet of unlined, fully depreciated cast iron mains that are subject to corrosion. and electrolysis, also installed in the 1920's; and Class 3 consists of 13,840 feet of unlined cast iron of improper size and having cement joints.

The trend in pipe use is that no changes are anticipated. Some ductile iron is purchased for use in rocky areas and on steep slopes. According to John Stevko, the PVC people want to penetrate the market. At present, however, the overwhelming choice is A/C. Contractors and developers are allowed to purchase only A/C or ductile iron and invariably choose A/C.

The total quantities of A/C and ductile iron installed since 1974 show A/C to be the pipe construction material of choice in Hayward:

Material/Size

	Ductile Iron				Asbestos/Cement				Total	
Year	4"	6"	8"	12"	4"	6"	8"	12"	A/C	% A/C
1974	--	--	--	353	3118	960	8570	3460	16,461	97.9
1975	--	--	--	1804	--	7885	6754	9221	15,664	93.0
1976	--	80	--	177	125	637	1231	4422	6,672	96.1
1977	48	--	--	189	--	292	1915	2301	4,745	95.0
1978	--	67	227	--	181	4475	7565	9440	21,955	98.7
1979	--	--	--	--	307	21728	12872	6439	41,346	100.0
1980	--	--	--	21	--	6145	2385	15761	24,312	99.9
1981	--	--	--	--	--	1974	2317	3836	8,127	100.0
TOTAL	48	147	227	2544	3731	44096	43609	54880	149,282	98.0

The statistics reveal a broad fluctuation in total quantities installed over the eight-year period. The extremely low installation figures for 1976-77 probably reflect the recession experienced in the economy in 1975-76. Correspondingly, 1978-80 was a boom period for the national economy, and this is reflected in installations. One fact has remained fairly constant, however, and that is the percentage of A/C installed versus other materials. A/C pipe has consistently captured 93 percent or more of the market in Hayward.

OPERATIONAL

Specification, Decisionmaking and Procurement

Specification

Both purchasing and installation specifications are developed by Bud Blair. Blair describes the purchasing specification for A/C as being "pretty much set." The A/C pipe spec is shown on page 6.

Specification of maximum outside diameters is the only atypical requirement. This is due to a long-term problem which Hayward views as significant, but has not received enough attention from the industry. According to Blair, some years ago the City received pipe that had BOD's that were too large to facilitate standard fittings and repair clamps. Blair, who was then on the materials performance committee of AWWA, alerted the fittings and repair clamp manufacturers to the problem and attempted to get the A/C industry together with these parties. Again according to Blair, the A/C manufacturers' response was to go to his bosses, noting that Blair was "the only (water director) complaining."

This was years ago, but everyone interviewed here still considers large BOD's a problem. The problem is more than cosmetic. When the crews wet tap, it costs substantially more ($500 was the figure quoted) if a tapping saddle cannot be used due to the oversized pipe. This concern about larger than nominal outside diameters has been expressed by several other cities, Pueblo representing another example.

Design Considerations

All A/C pipe purchased is Class 150. Primary design considerations are soil conditions, fire flow, topography and seismic conditions. Hayward officials registered more concern with respect to sizing of lines to ensure adequate fire protection than other cities studied. Twelve-inch lines are used in all industrial subdivisions. They install a 12-inch grid system; since the system takes three years to construct, the larger size is installed to ensure adequate fire protection. Six and 8-inch mains are installed in residential subdivisions. Developers also must adhere no City-developed criteria. Fire flow criteria calls for a 1500 gallon per minute minimum.

Hayward has aggressive soils which "chewed up" galvanized pipe in the 1950's, but the soils are not considered a major factor either in the replacement of cast iron mains or the decision to use A/C.

PART 2 - MATERIALS

2.01 ASBESTOS-CEMENT PIPE

Asbestos-cement pressure pipe shall conform to AWWA C-400 except as herein amended. All pipe shall be Class 150 unless otherwise indicated on the plans.

One coupling with two rubber rings shall be furnished with each length of pipe. It shall be of the same material and by the same manufacturer as the pipe.

Rubber rings shall conform to ASTM D1869 "Rubber Rings for Asbestos-Cement Pipe".

Couplings shall be designed to insure a water tight joint with the pipe when subjected to the same hydrostatic test as designated for the pipe.

All asbestos-cement pipe and couplings shall be designed and machined to the tolerances of, and be interchangeable with, pipe of other manufacturers.

The maximum outside diameter (rough barrel dimension) shall not exceed the following:

Size	B.O.D.
4"	5.32"
6"	7.37"
8"	9.62"
10"	12.12"
12"	14.38"
14"	16.73"
16"	18.97"

NO OVERSIZED PIPE - SORT PIPE TO THESE DIAMETERS.

Testing of the pipe and couplings shall be made in accordance with AWWA C400. Regardless of the place of manufacture, all pipe shall be tested within the Continental United States.

A Certificate of Compliance with all provisions of these Specifications shall be furnished by the manufacturer for all pipe furnished.

2.02 CAST IRON FITTINGS

Cast iron fittings shall conform with the requirements of ANSI Standard A 21.10. Fitting shall be Class 250. Fittings shall be cement lined and seal coated in conformance with the requirements of ANSI Standard A 21.4. Joints shall be designed to accomodate the pipe joints.

Seismic faults are a problem. Hayward had three earthquakes in 1981, resulting in a rash of breaks due to ground movements. Unlike their neighbors to the north (EBMUD), A/C pipe use is not restricted to non-fault areas.

Hayward, like EBMUD, has lots of steep slopes and rocky areas. Ductile iron is normally used in these areas; Stevko notes that with ductile, a thrust block can be installed behind every belljoint on a steep slope. This cannot be done with A/C because it simply presents an additional point of stress. Ductile iron also is specified for installation between tbe mains and fire hydrants, also under culverts.

Decisionmaking

Decisionmaking depends more on inventory control than other factors. Blair, as Water System engineering, decides on quantities and materials needed for replacement or extension. His recommendations are reviewed and approved by the Deputy Director of Public Works and the Director.

Although Blair says there are practically no consumer constraints on decisionmaking, a letter file which he maintains indicates a moderate amount. One letter to the editor of a local newspaper poses the following question: "Wouldn't it be wise to discontinue the use of A/C before it might possibly be found to be cancer forming? There should be a policy of health first and financial savings second."

Blair addressed the Public Services Commission of Hayward in December 1978 on the subject of asbestos in the water system. He concluded with the statement that "there is insufficient evidence on the subject to determine whether or not there should be cause for alarm about the presence of asbestos in Hayward's drinking water."

The subject arose again in 1980. In February, Blair wrote the memo included on page 8 which outlines procedures for keeping the introduction of asbestos fibers to a minimum.

Hayward also was one of few cities having copies of the A/C advisories. Whereas the advisories are helpful as "supporting evidence" of the absence of any confirmed health risks, Blair felt it would be wiser to have the advisories come from a source other than the AACPP. He received his copy from Richard Anklam, District Sales Manager for Johns-Manville.

CITY OF HAYWARD

INTEROFFICE MEMO

TO: D. BUTLER. DATE: Feb. 27, 1980

SUBJECT: ASBESTOS FIBERS IN WATER.

Asbestos in water has received widespread publicity and has been of concern to the water industry and health study groups.

The most recent report appears in the February, 1980 AWWA Journal.

Review of the report does not indicate any apparent concern for our system as water received from SFUC is in the moderately aggressive index range.

We must assure that asbestos-cement taps to new or existing pipes are only performed:

(a) "wet" with line under pressure.

(b) with a flushing device on the tapping machine.

The introduction of asbestos fibers into pipelines must be eliminated as much as possible.

Checking of the distribution system for fiber release by pipe reaction should be initiated by:

1. Logging of weekly analyses of delivered water to check for changes of aggressiveness index.

2. Retain and examine tapping coupons from various sections of the system and check sections of removed pipe.

3. Collection of screen sample from customers during quality checks to check for evidence of pipe deterioration.

4. Establish a program of analyses of pH and Calcium through the system under various water quality conditions of our supply source.

L. R. BLAIR,
WATER SUPERINTENDENT

LRB/bl

Procurement

Hayward buys pipe for its own use "about every two years." The specification is issued to Johns-Manville, CertainTeed, and a local industrial distributor named Groeniger. The purchase of A/C is one item in an omnibus order, part of an annual purchase of other water-related items. The A/C purchase is in such low volume, it is a miscellaneous item.

Inspection of inventory levels and 1981 usage levels provide an insight into exactly how much Hayward purchases. The current inventory level is 130 feet of 4-inch, 10,419 feet of 6-inch, 104 feet of 8-inch, and 1209 feet of 12-inch. In 1981, city forces installed 3900 feet of 6-inch and 400 feet of 8-inch.

Reasons given for use of A/C are as follows: 1) initial cost; 2) ease of installation; and 3) simplicity of installation.

Installation and Testing

In an average year, developers and contractors install most pipe in Hayward. Contractors are not allowed to work on live lines. In 1981, it appears that city forces installed 52.9 percent (4300 of 8127 feet). By law, the City is not supposed to do any job costing more than $2000. This statute is easily circumvented by breaking an installation into smaller increments. The modus operandi in the past has been to have city forces install small jobs and contract out large ones. However, Hayward is expecting some lean years starting with 1982; with the City suffering from financial difficulties, indications are that city forces will perform additional installations.

The City Utilities people believe they can do a better job of installation. Whereas the contractors work faster, their workmanship is of a lesser quality. Contractors take shortcuts; they do not handle pipe as carefully; they do not check every joint with a thickness gauge to ensure a seal; and do not always clean the pipe prior to installing it.

Pipe Installation

Water mains are installed five feet from the curb line unless otherwise approved by the city engineer. The depth of cover is 36 inches for 6-inch pipe, 42 inches for 8-inch, and 48 inches for 12-inch. The cover is measured from the established street grade to the top of the pipe barrel. The objective is to bury the pipe above sewer lines.

Trenching provisions require a depth which will provide a uniform and continuous bearing and support for the pipe at every point between bell holes or joints. For A/C pipe, the

requirement is to excavate a minimum of 2 inches below the bottom of the coupling. As per manufacturer recommendations, mounds are placed one-fifth (1/5) of the pipe length from each end.

One provision in the installation specs not encountered elsewhere deals with special care to prevent empty pipeline floating. The contractor is specifically cautioned as to the possibility of empty pipeline floating due to flooding of the trench by groundwater, rain water or backfill consolidation. Any such occurrence of this type must be remedied by dewatering the trench and reinstalling new pipe sections.

The specs are quite detailed with respect to A/C installtions. Some of the special provisions are summarized below:

- the pipe ends within an assembled coupling shall be separated at least ¼ inch to allow for expansion;
- A/C pipe in sizes 6-12 inches shall not be deflected more than 2° during assembly and not more than 5° when finally installed;
- fourteen and 16-inch pipe shall not be deflected more than 1½° during assembly nor more than 4° after assembly.
- transition from mechanical joint cast iron pipe to A/C pipe shall be made using mechanical joint adaptor fittings.

Backfill and Compaction

Either quarry fines or Class 2 aggregate slurry (depending on street conditions) are used for backfilling. Officials found that use of native materials was "just not worth it." Compaction by city forces is accomplished with mechanical tampers or by hand; according to Blair, if the workers do not know how to use the tampers, they beat the pipe to pieces. The philosophy with respect to compaction is "if the road settles, the trench will be a hump." The City allows contractors to water jet trenches.

Testing and Disinfection

Pressure testing is performed after compaction of backfill but before replacement of permanent pavement. New lines are pressure tested for 2 hours at 200 psi. The pressure must be maintained within 10 psi for the entire period.

Leakage testing also is required. The pressure maintained is 150 psi at the highest point in the pipeline to be tested. Duration of the leakage test is four hours. If leakage exceeds the quantities shown below, the contractor must locate and replace the defective pipe or joint:

Pipe Diameter	Maximum Leakage for 1000 Feet of Pipeline (Gallons)
6"	2.85
8"	3.80
12"	5.70

Disinfection is performed in accordance with AWWA Standard C601, "Standard for Disinfecting Water Mains." Bacteriological tests are conducted, and results approved before the main can be placed in service.

Tracer Tape and Tracer Wire

Tracer tape, two inches wide, blue, and carrying the inscription "Caution Buried Water Line Below," is installed one foot above and along the centerline of A/C mains. Tracer wire made of 14 gauge insulated or bare copper wire is installed on the trench bottom under the vertical projection of the pipe.

Tapping

All wet tapping, the only method used, is performed exclusively by city forces using Mueller, Hays, or Dresser tapping machines with flushing devices. Tapping machines are required to employ a guiding mechanism for the drill tap which permits disengagement of the pressure feed when tapping and keeps the drill tap in alignment. Tapping is required to be of sufficient depth to allow one to three threads exposed when the corporation stop is inserted. Double bail tapping saddles are used on all sizes of A/C; Hayward used to employ a single bail saddle, but experienced some breaks as a result.

Installation Costs

Installation costs were estimated by Blair to be $48 per foot including paving. His counterpart in the Streets and Utilities Department (Stevko) disagreed, feeling $48 was too high. He believes costs vary from $25-100 depending on soil conditions. Hayward has quicksand, clay, gravel, and hard rock.

Operation and Maintenance

Mainbreaks

Hayward experiences very few mainbreaks. The total number of breaks over the last four years is 105, an average of 26.3 per year. The majority of breaks is in A/C, but this is expected since A/C constitutes 82 percent of the transmission and distribution system.

Breaks are attributed to several causes: 1) ground movement, 2) faulty installation by contractors, 3) improper backfill, 4) improper placing of 0-rings, and 5) contractor breaks. There is no trend to breaks by season. Hayward did have a lot of breaks after the 1977 drought.

Pumping Costs and Service Pressure

Pumping costs were calculated by Blair at $137.56 per day or 0.069¢ per 1000 gallons. These figures do not mean much, however, since Hayward's problem is pressure reduction. Service pressure in the system ranges from 35-115 psi in lower elevations to about 140 psi in higher elevations. Most of the pumping costs are for furnishing water to the upper elevation areas.

Aggressiveness Index

The aggressiveness index is maintained between 11 and 12. Hardness and alkalinity are very low (16 and 14 mg/l, respectively). The pH of tbe purchased water normally is around 9; Hayward adjusts the pH to 9.4-9.9 if necessary in order to maintain the proper aggressiveness index.

Water Loss and Leak Detection

Unaccounted for water ranges from 4-6 percent, the lowest level encountered during the site visits. Hayward had a leak detection program after the drought in 1977, but currently leak location is by exception. Whereas the Water System is not devoting a lot of time now to leak detection, they expect to institute a more rigorous program in the future.

Repair and Replacement

John Stevko made a number of interesting observations about A/C versus competitive products during an interview. He feels ductile iron is the "Cadillac of pipe materials"; you can run over it, use it in crossings and bed and backfill it with native materials. Only price precludes Hayward from using it everywhere. Contractors prefer A/C for two reasons: ease of installation and because less equipment is required.

Stevko feels the only disadvantage of A/C is its brittleness. When the depth of cover is insufficient, it breaks. Also, if a street is being repaired in wet conditions, when one digs down 2½ feet, often the A/C will break.

Both Stevko and Sam Lugo, his field operations supervisor, expressed some concerns regarding the quality of pipe received from manufacturers. They reinforced the problem of oversized OD's creating problems with Mueller joint tapping tees. Stevko feels the Japanese pipe available in the early 1970's was superior to domestic pipe; he noted that Johns-Manville pipe is notorious for being out of round and that CertainTeed makes odd lots.

Repair costs are estimated at $700-5000 per indicent. The amount depends on whether paving is required.

Hayward does have infrequent problems with frozen mains and service lines. The remedy applied is to use a blowtorch to heat up the line.

FINANCIAL

For the fiscal year ending June 30, 1981, the Water System enterprise fund has an apparent surplus of $1.29 million. The unencumbered fund balance of the Water System now totals $2.68 million. Debt service coverage is more than adequate, mainly because long-term debt is almost non-existent. The System has no outstanding bond indebtedness; the last bond issue was in 1967. Although the City finds itself in a financial crunch, the balance sheet and income statements of the Water System reflect a pay-as-you-go policy. The Water System has substantial financial capacity should it elect or need to leverage its assets.

The System has three basic funds--an O&M fund, a replacement fund, and a capital improvements fund. Main replacements are paid for out of the replacement fund; this fund has a balance of $1.426 million. Pipe repairs are paid for by the O&M fund.

Conclusions

Hayward is a solid A/C account. There is no trend toward competitive materials. More than 80 percent of the transmission and distribution system is A/C and the percentage is increasing.

Water System personnel do have some technical service needs. They are concerned about oversized BOD's, out-of-round pipe, and odd lots. A small amount cf technical assistance and PR would not only ensure Hayward's continued use of A/C but would make them satisfied customers as well.