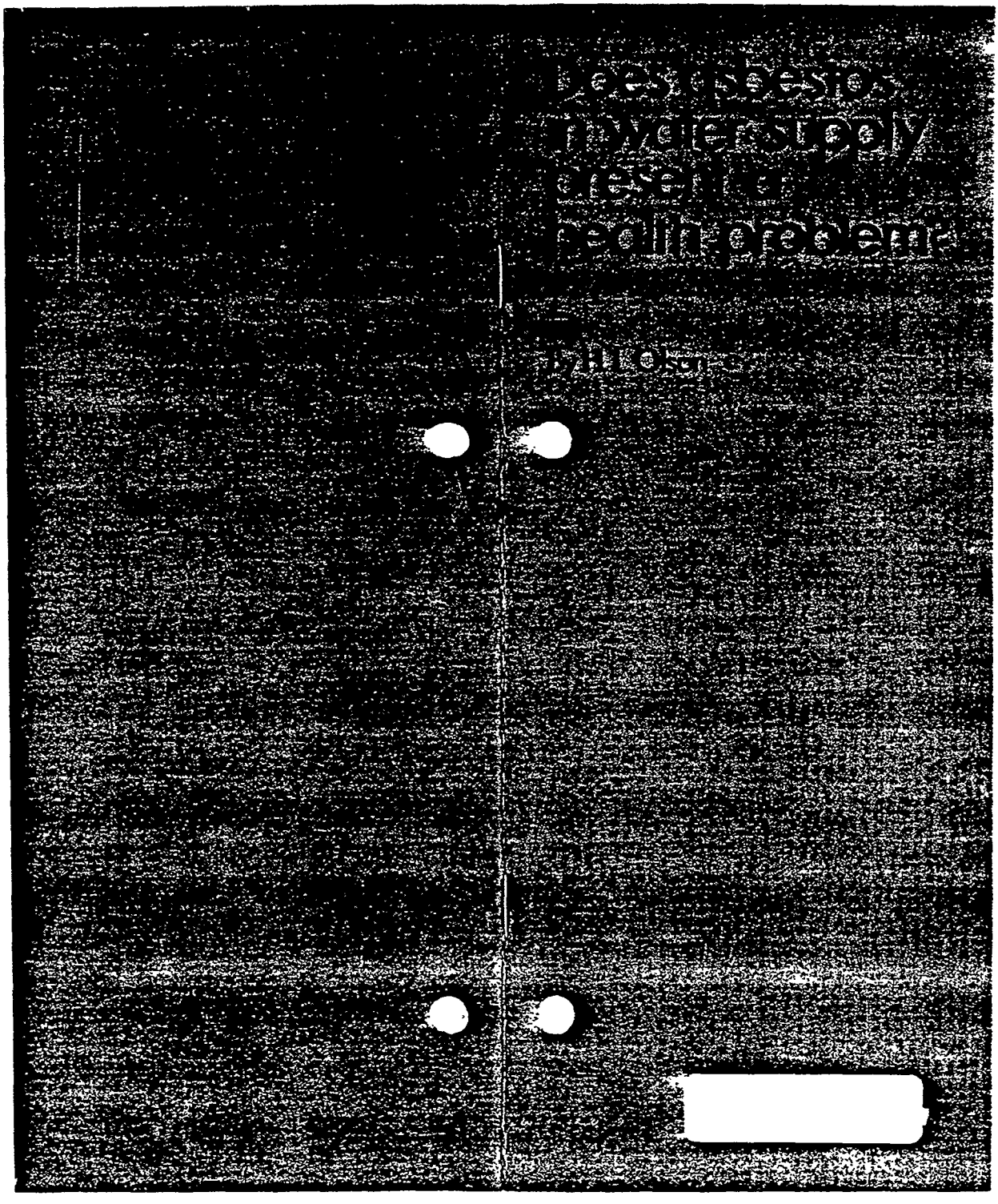
PLAINTIFF'S EXHIBIT

CAP-1044



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Does asbestos in water supply present a health problem?

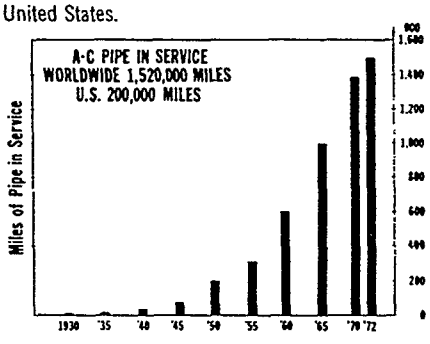
By H. L. Olson
Market Manager, Public Water Pipe Division
Johns-Manville Sales Corp.

A Paper Presented at the
Conference of State Sanitary Engineers
San Francisco, California
May 7–10, 1973

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Asbestos cement pipe was developed in Italy some 60 years ago. Like many other inventions, its mother was necessity. Corrosion in the salt water street flushing and fire protection lines of seacoast towns in Italy motivated a search for a more corrosion resistant pipe. In the years 1906 to 1913, an Italian company, Societa Anonima Eternit Pietra Artificiale of Genoa, Italy, combined asbestos fibers with cement to produce a reinforced pipe that would take the high pressure necessary to pump salt water up into the City of Genoa for their street flushing system. From this early origin, born of a necessity for pipe that would withstand the corrosive salt water in a street flushing system, the acceptance of asbestos cement pipe spread rapidly through Europe and the rest of the world.

By 1938, there was some 40,000 miles of asbestos cement pipe in the ground. Today, there is an estimated 1,500,00 miles of asbestos cement pipe in service, and over 200,000 miles are in the United States.



What Caused This Worldwide Acceptance and Rapid Growth of This Product?

1. Asbestos cement pipe is a pipe that is resistant to corrosion both internally and externally. This has been demonstrated by tests run by the U.S. Bureau of Standards on buried samples and by the U.S. Bureau of Mines through tests conducted using corrosive mine drainage water.
2. Asbestos cement pipe is a pipe that has high strength to withstand the high internal forces imposed by water hammer and shock earth loads from earthquakes.
3. Asbestos cement pipe is a pipe that has contributed to high water quality. Asbestos cement pipe pioneered the concept of rubber ring joints; joints that contained no jute that offered a focal point for bacterial growth. It is also a pipe that did not rust and cause discoloration of the water.
4. Asbestos cement pipe is a pipe that is light in weight and easy for the contractor to install; resulting in lower installation costs.
5. Asbestos cement pipe is a pipe that has a permanently smooth interior wall resulting in low pumping costs.

These are the major factors that have made asbestos cement pipe one of the most widely used water main materials in the world today.

Asbestos fibers have been recognized as a health hazard when inhaled in substantial amounts into the lungs for quite a few years. Much work has been and is being done to clean up the atmosphere in occupational areas where asbestos is being used. Threshold limits for airborne asbestos have been established. It is interesting to note, however, that lung cancer where asbestos fibers have been determined to be a factor have only occurred in workers who smoke regularly.

In late 1967, the U.S. Public Health Service was asked to look into the question of a potential health hazard from asbestos fibers in water supply, especially as it might be related to the risk of Gastrointestinal (GI) cancer. Public Health Service officials discussed the matter with two prominent medical authorities in the field of asbestos and health. They were Dr. George W. Wright, chairman of the Scientific Advisory Committee of the Institute for Occupational and Environmental Health, and head of the Medical Research Department, St. Luke's Hospital, Cleveland: and Dr. Irving J. Selikoff, Professor and Chairman, Division of Environmental Medicine, Mount Sinai School Of Medicine, New York City.

> Dr. Wright's position was summed up as:
> "To my knowledge, there have been no reports in medical literature of a relationship between Gastrointestinal (GI) cancer and the drinking of water supplied through an asbestos cement pipe water system. There is no evidence that the ingestion of one, or a hundred, or a thousand asbestos fibers on one or more instances, is related to Gastrointestinal cancer."

Dr. Selikoff's view:
There is "no evidence at all at this time that the presumably very low level exposure by

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ingestion which might occur by intake of water supplied through asbestos cement pipe has resulted in a recognized health hazard."

These two opinions supported the position of the U.S. Public Health Service that there is low probability of any health hazard associated with the use of asbestos cement pipe.

Johns-Manville research assumed the task of further evaluating this situation. At that time, the J-M research facility was located at Finderne, New Jersey, and over 300 scientists and technicians were employed at this facility. There were over 30 assigned to research in our pipe division.

The Research Project Was Conducted Along These Lines:

1. Review of all available published literature and statistics.
2. Development of techniques to measure the amount of fiber in water. Levels of asbestos in water were so low that existing techniques to measure asbestos fibers in air samples were not able to detect any asbestos in water.
3. Using a new technique that employed an electron microscope, water samples were measured:
   a. In source waters.
   b. In waters taken from distribution systems where asbestos cement pipe was used extensively.
   c. In a special asbestos cement pipe loop system constructed at our research facility where the quality of water could be varied to see if asbestos pickup changed with the different types of water.
4. A long term study of two cities was undertaken to check asbestos in water samples over an extended period of time.

I would like to review the progress that our research has made to date. Published literature revealed that animal experiments had been conducted where laboratory test animals had been exposed to airborne asbestos and direct feeding of asbestos dust to animals.

1. Animal experiments with airborne asbestos produced no GI cancer. Laboratory test animals were used extensively in cancer research to study their reactions to various substances that are suspected

of having some relationship to cancer in humans. Tests of this nature, using asbestos dust in heavy concentrations in inhalation chambers, had been conducted on mice for as long as two years and on dogs for four or more years. The amount of fiber not only inhaled, but also swallowed, by these experimental animals was far in excess of any comparable human exposures.

Dr. Wright points out that in inhalation experiments, "The food, especially of the small animals, is covered by the settled-out asbestos fibers in the experimental chambers."

Inhalation experiments of this type have been conducted for many years in many laboratories without a single report of GI cancer. Dr. Arthur Vorwald and associates at the Saranac Laboratory of the Trudeau Foundation have issued two reports covering more than twenty years of investigation.

Dr. J. C. Wagner had conducted similar animal inhalation experiments in South Africa and in Britain. Neither Vorwald nor Wagner ever noted GI cancer in any animal.

In addition, experiments conducted by Dr. Selikoff on hamsters generally support the dog and mice findings.

"Yet," Dr. Selikoff commented, "The exposure to ingested asbestos in this experimental work was very much larger indeed than might be anticipated in water obtained from asbestos cement pipes."

2. Direct feeding of asbestos dust to experimental animals has failed to produce GI cancer.

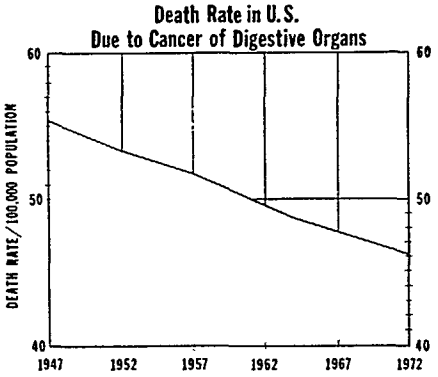
In 1968 two British doctors, Bonser and Clayson, reported an experiment in which 40 rats were maintained on a diet which included approximately 2 grams of asbestos per week. No tumors of any kind resulted, they said, adding "Nor were there any lesions in the intestinal wall which might have suggested a previous absorption of asbestos fibers."

3. U.S. Public health service records showed the incidence of GI cancer in the U.S. has steadily been declining during a period that asbestos cement pipe sales have been increasing.

Asbestos in water source samples after being transported through asbestos cement pipe is of a very low level. OSHA standards for occupational exposure call for examination of airborne samples by an optical microscope of 450X. Concern is only for asbestos fibers more than 5 microns long. No

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water samples checked either from source water or after flowing through asbestos cement pipe showed any asbestos when examined with optical microscopes. Only through the use of an electron microscope were asbestos fibers so thin and short as to require 4000X noted.



Source: National Office of Vital Statistics, U.S. Health

A procedure for checking the asbestos content of water samples by use of an electron microscope was developed and is described in Johns-Manville research reports number E404-37 and E404-67.

Using this newly developed technique, study of the waters from nine cities using asbestos cement pipe for periods varying from 8 to 17 years was made. Asbestos content of the water at the source to these city water systems was determined. Asbestos content was also checked at a point in the distribution system after the water had flowed through asbestos cement pipes. All source waters contained some asbestos fiber and the amount varied between less than one microgram per gallon to five micrograms per gallon. After flowing through asbestos cement pipe the fiber content was less than one microgram per gallon to six micrograms per gallon.

An experimental loop system of asbestos cement pipe was constructed at our research center. The physical properties of water flowing through the system could be varied and the asbestos pickup as a function of type of water could be determined.

This experiment is described in detail in J-M research report number 1425-T-1360. The following slides show the diagram of this loop system and the filters that were employed in obtaining samples for examination with the electron microscope.

Long term studies of two cities were made. One was Malvern, Pa. and the other Glendale,

Arizona. The results of the investigation of samples taken over an extended period of time at these two cities is contained in J-M research report E404-79

Conclusions Drawn From Our Research Program Are:

1. The incidence of GI cancer is down during a period of time where asbestos cement pipe sales have been increasing. This does not mean that the use of asbestos cement pipe will decrease the chance of developing GI cancer; however, it does suggest that GI cancer is not caused by using asbestos cement pipe.

2. Pickup of asbestos in water that flows through asbestos cement pipe is very small, and frequently, source waters contain more asbestos fiber than does water flowing through asbestos cement pipes.

3. Under conditions where the maximum asbestos fiber content in water was observed, the total amount of asbestos that would be ingested by a person during a seventy year life span would only be 0.077 grams.

Just last October, a meeting was held at Lyons, France, under the auspices of the International Agency For Research On Cancer. This meeting was attended by scientists comprising the majority of those from all over the world now actively working in the general field of the biological effects of asbestos. At the end of the Lyons meeting, an additional day and a half was spent by an invited group of outstanding scientists who took as one of of their functions the development of some rather broad statements that would be warranted at this time with respect to the biological effects of asbestos. The statement formulated by this group with respect to the effects of ingestion of asbestos is as follows:

> "Is there evidence of an increased risk of cancer resulting from asbestos fibers present in water, beverages, food or in the fluids used for administration of drugs?
> (Answer) Such evidence as there is does not indicate any risk."

It should be emphasized that the above quote represents the conclusion of the world's leading authorities working in the field of the biological effects of asbestos.

The amount of information developed to date on the subject of asbestos in potable water is quite extensive, and experts in this field have stated there is no indication that waters conveyed in asbestos cement pipes constitute any health hazard. Further

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work, however, will be done. During the AWWA National Conference in Las Vegas next week, the Asbestos Cement Pipe Producers Association will contract with the AWWA Research Foundation to make further studies. These studies, conducted by an unbiased foundation will deal specifically with determining the amount of asbestos to be found in drinking water, and what—if any—effect they may have on health. Results of these studies will of course be disclosed to the public.

Potable drinking waters contain many elements and substances other than H_2O. Some, like arsenic, are extremely harmful to human health unless taken in a very dilute form. Critical levels for many such substances have been determined.

The AWWA Research Foundation may address themselves to developing an acceptable level for fiber content in water supplies. From data available today, it would appear that most all water supplies have some asbestos content. Asbestos in source waters comes from water being in contact with serpentine rock containing asbestos fibers. Rock of this type is found in many areas in the United States.



Counties in which asbestos has been reported.

Boundaries of areas containing rock types in which asbestos might be found.

This map shows locations in the United States where asbestos bearing rock is found. Water flowing through asbestos cement pipe does not increase the level of fiber content significantly. We believe that asbestos in water is at a non-critical level, if, indeed, there is a critical level.

The benefits to the consumer in using asbestos cement pipe are basically that of a lower water bill every month. If this were achieved at the expense of a lower life expectancy, it would not be a good bargain for the consumer. The material Johns-Manville has gathered and which I have presented today leads us to believe the consumer *does* benefit from the purchase of asbestos cement water pipe. There is no evidence to support the belief that his life is shortened by drinking water flowing through asbestos cement pipe, but there is a wealth of data to support the position that he benefits by having a water system that brings him water dependably, of the highest quality, and at the lowest possible cost.

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