Date	To	Location and mail code
10/5/79	ALL DISTRICT SALES MANAGERS	
Subject ACPPA TESTIMONY ON AGGRESSIVE WATERS	From R. P. KOROBIJ/bam	Location and mail code VF P&PG #2B

PLAINTIFF'S EXHIBIT

CT-274

cc: L. C. Ambler
A. J. Buford

Around the end of August, the Asbestos-Cement Pipe Producers Association (ACPPA) testified at the EPA Public Hearings on the proposed amendments to the National Interim Primary Drinking Water Regulations. Attached is a copy of that testimony.

The testimony should interest you because of a factor which affects not just A/C pipe, but all piping materials - AGGRESSIVE WATERS.

It is the A/C pipe industry's desire that EPA include a minimum hardness requirement in the Safe Drinking Water Act to protect the public health and to save corrosion related pipe replacement costs.

If you have any questions, or if you would like to see a copy of the Aggressive Waters Study funded by the ACPPA, please let me know.

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Testimony to the
U.S. Environmental Protection Agency
Public Hearing on Proposed Amendments to
the National Interim Primary Drinking Water Regulations
Washington, D.C.
August 29, 1979

Joseph C. Jackson
President
Association of Asbestos Cement Pipe Producers
Arlington, Virginia

Dr. Robert L. Sansom
President
Energy and Environmental Analysis, Inc.
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My name is Joseph C. Jackson, President of the Association of Asbestos Cement Pipe Producers. The Association represents the three manufacturers of A/C pipe in the United States, as well as producers in Canada, Mexico, and seven other countries. I am here today with Dr. Robert Sansom, President of Energy and Environmental Analysis, and Arthur H. Kahn, Association Counsel, to comment on the proposed amendments to the National Interim Primary Drinking Water Regulations, specifically those which address corrosion control.

Corrosion has long been a major concern within the water works and the pipe industries. Despite technological advances that have reduced the susceptability of pipes to corrosion, the problem continues to be a serious and costly one. It is as much due to the so-called "universal solvency of water" as to the piping materials themselves. While we know more today about the mechanisms of corrosion than ever before, it is questionable whether these advances have been applied practically and prudently.

The presence of asbestos fibers in A/C pipe has obliged the industry to examine critically the corrosivity or aggressiveness of potable waters conveyed through it. This interest is not a new found one. It dates back to 1973 when AACPP funded a select committee of the American Water Works Association Research Foundation to study the problems of asbestos in drinking water, including the role of corrosive waters. In 1975, aggressive water guidelines were integrated in national product specifications for A/C pipe. The industry has a continuing program of research to refine these guidelines. In 1977, this interest led AACPP to retain Midwest Research Institute to conduct a comprehensive survey of the occurrence, economic impacts and health effects of corrosive waters in the United States. That research was completed earlier this year, and the results make a strong economic case for corrosion control.

But the issue of corrosive water transcends dollars and cents because it also is a potentially serious health problem. Cardiovascular disease and the presence of potentially toxic levels of lead and cadmium in drinking water all have been tied immutably to soft and/or corrosive water. The magnitude of these health concerns, and the need to objectively analyze, validate and refine the MRI data persuaded AACPP to engage Energy and Environmental Analysis to examine the problem, and most importantly, to assess its total impact on the water-consuming public in the United States. That report, "Health and Corrosion Impact of Soft Water," makes a persuasive, if not compelling, case for mandatory corrosion control.

Therefore, it is not only imperative that EPA assess the adverse health impacts of soft, or corrosive water, it also is necessary to determine an effective means of regulating corrosion in order to protect public health. Toward that end, AACPP endorses a two-pronged approach of (1) a minimum hardness requirement for all drinking waters, and (2) a maximum contaminant level for corrosivity, based on known corrosion indices.

(Dr. Robert Sansom)

EPA's current proposal for corrosion control will have little or no effect in reducing corrosion. Moreover, EPA's proposal stops far short of actions necessary to protect human health. Soft or corrosive water not only creates an economic burden on utilities because it shortens product life of storage, treatment, distribution and metering equipment, but more importantly, soft water poses a significant health risk to the 27 percent of the Nation's population who drink it daily. In our report entitled, "Health and Corrosion Impact of Soft Water," we estimate that over 13,800 deaths from cardiovascular disease could be prevented annually through proper water treatment in soft water areas. The health benefits from reducing potentially toxic levels of lead, cadmium and other contaminants are equally obvious.

Numerous epidemiological studies have been conducted throughout the world examining the potential correlation between soft, corrosive water and cardiovascular disease (CVD). An overwhelming majority of these studies have indicated that a significant correlation does in fact exist. Although no study has identified a precise cause and effect relationship, the aggregate data show a definite association exists between soft water consumption and an increased risk of cardiovascular disease. This association is not a chance one, but is backed by substantial medical evidence. Calcium and magnesium are known protective elements essential to heart function. A high percentage of these elements can be introduced into some our daily diets through drinking water. Since soft water, by definition, contains only low levels of calcium and magnesium, many people in soft water areas may not get enough of these elements daily and thus, are at higher risk of CVD. In addition, since soft water almost always is corrosive, cadmium, lead, and asbestos are leached from distribution pipes and consumers' plumbing. Cadmium and lead exposure can produce adverse health effects. Chromium, copper, iron, manganese and zinc also can be leached from water distribution lines and cause a potential health risk. In some cases, this leaching creates violations of current Primary Drinking Water Standards, and thus, a potential health risk.

Through comparison between statistically similar communities, EEA estimates the CVD rate decreases .63 lives/100,000 for each 1 ppm increase of hardness, assuming a base level of 0 ppm of hardness. Therefore, if EPA were to set a minimum hardness level of 60 ppm as a Primary Drinking Water Standard, tens of thousands of deaths could be prevented annually. For each dollar spent to harden the water, an estimated $300 of health benefits would be derived.

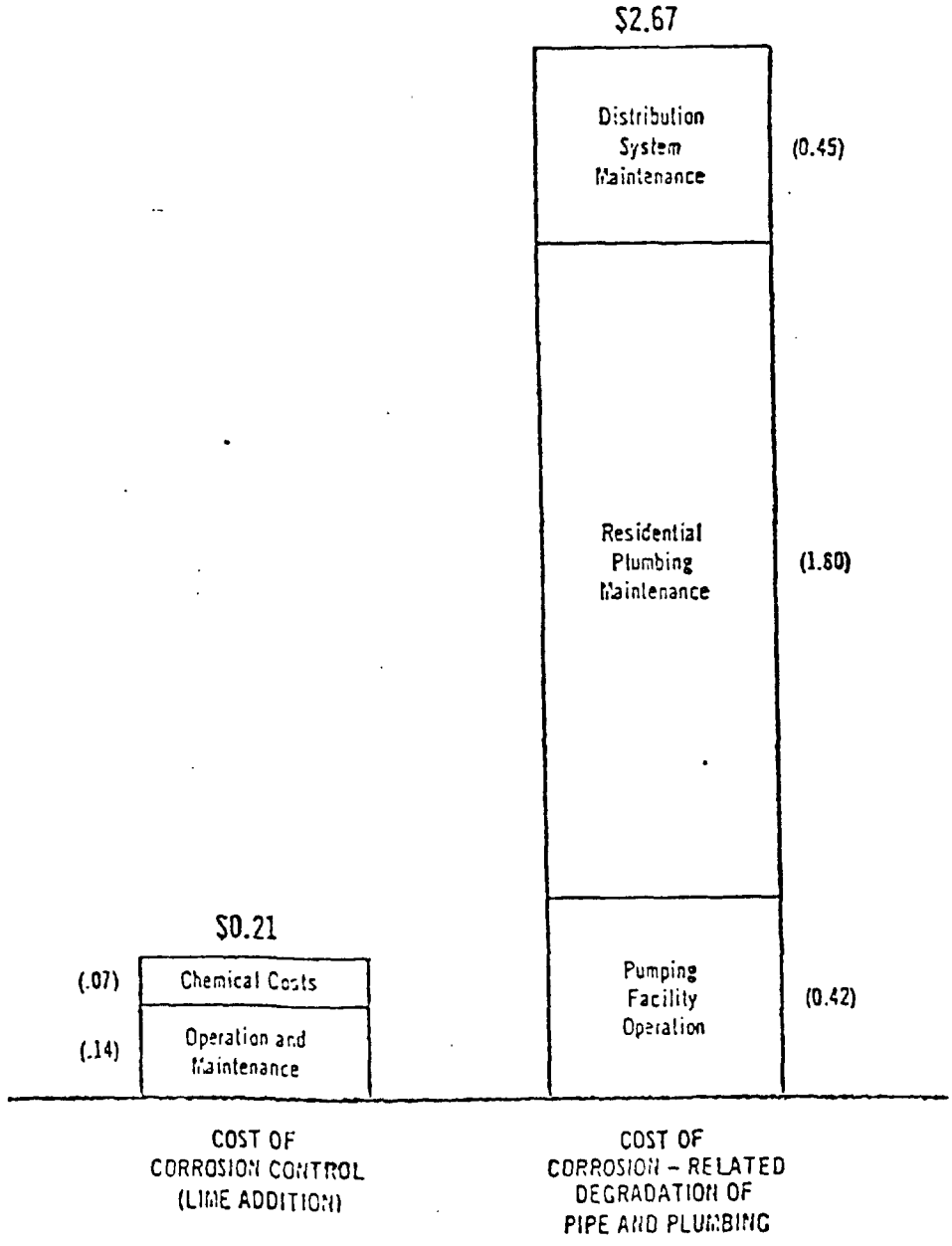
The water treatment technology to harden water currently exists and is readily available. The average national costs for the control of soft water would be approximately $.21 per capita per year. However, the benefits of corrosion control extend beyond the health aspects to include the lower corrosion costs as well. Your attention is directed to Figure 1 for the cost breakdown of corrosion, treatment, and a cost/benefit ratio.

Millions of dollars are lost each year from corrosion-related repair or replacement of water pipes, storage and metering equipment, and consumer plumbing and appliances. EEA estimates that costs due to the distribution of soft or corrosive water are $2.67 per person per year. Through its proposed policy on corrosion control, EPA hopes to lower these losses by allowing the States to select municipalities to implement corrosion control programs. But past experience suggests that this approach will be ineffective. In a survey conducted of State water programs, we found that 75 percent of those states responding in soft or corrosive water areas have already instituted some type of "voluntary" corrosion control program (refer to Figure 2). However, results of utilities surveyed by Midwest Research Institute in these States showed corrosion was still a pervasive problem. If the current State program approach has not been successful, it is doubtful EPA will succeed where others have failed.

There are specific reasons why the current State implementation of programs to control corrosion have not been successful. Pipe specification and selection procedures have not been an effective means to control corrosion because a large percentage of the water transmission and distribution pipe were in place prior to implementation of State corrosion control programs. Therefore, corrosion is still, and will continue to be, a major problem in the older, less resistant systems. Currently, only a small portion of material selection or regulation procedures are correcting the problem.

FIGURE 1

PIPE COSTS AND SAVINGS FROM CORROSION CONTROL



Note: Results from benefit/cost ratio equal 300:1.
(Refer to EEA study on "Health and Corrosion Impact of Soft Water.")

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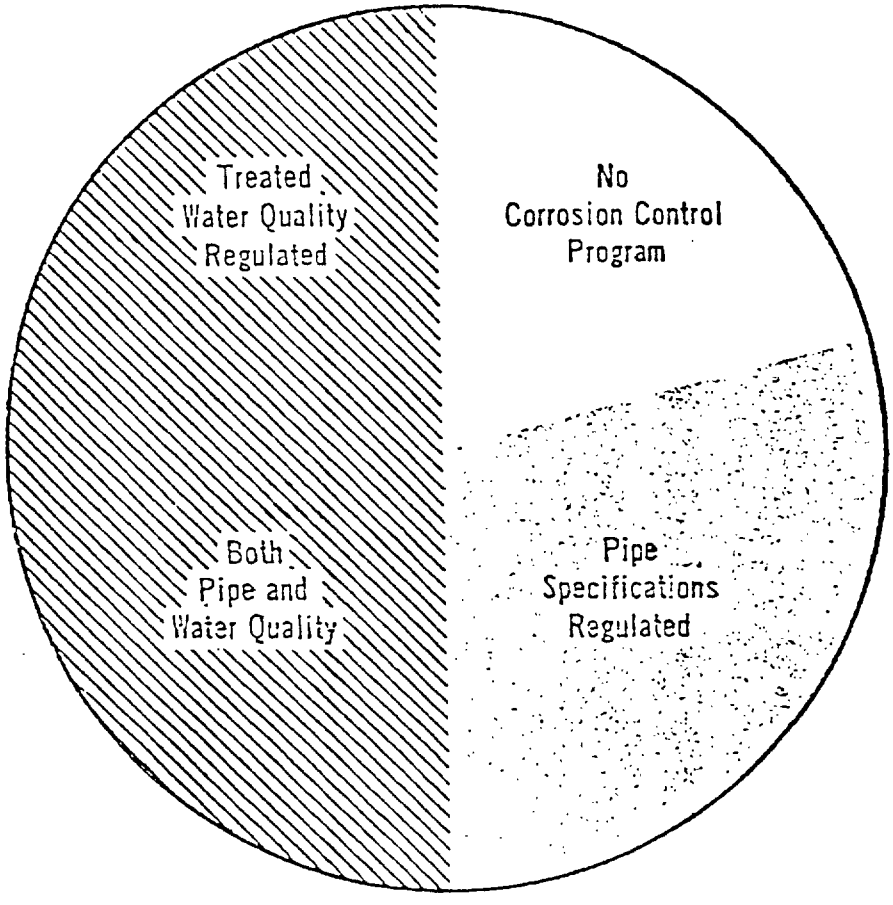
FIGURE 2
CURRENT CORROSION CONTROL PROGRAMS
IN AGGRESSIVE WATER STATES



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There are ways to control soft or corrosive water. Firstly, we suggest setting a minimum hardness level in the Primary Drinking Water Standards. This type of enforcement mechanism is more effective. Further, it would lessen the confusion of the States' implementation and effect a high and desirable degree of uniformity of approach in controlling soft water. Utilities would recognize the adverse health issues associated with the consumption of soft, corrosive water and would be forced to comply with the regulation.

Secondly, we suggest establishing a maximum contaminant level for corrosivity, based on current corrosion indices. While corrosion indices cannot be applied universally to all types of water and piping materials, there can be little doubt that used singularly or collectively, these indices can predict corrosion with sufficient accuracy to safeguard public health from soft water or corrosion-related toxic metals.

EPA has a responsibility to protect public health. Of the many standards I have seen EPA regulate, the evidence to implement a minimum hardness requirement in the Primary Drinking Water Regulations is among the strongest, along with the case for lead removal. The benefit/cost ratio for controlling soft, corrosive water far exceeds that of most pollutants currently being regulated. Upon review of the Safe Drinking Water Act, I would recommend and conclude that EPA must establish primary drinking water standards for the regulation of soft, corrosive water to protect public health.

HEALTH AND CORROSION
IMPACT OF SOFT WATER

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August 28, 1979

*Copies of the complete report are available, upon request, from the A/C Pipe Producers Association.

1. EXECUTIVE SUMMARY

1.1 INTRODUCTION

Certain chemical constituents released into public drinking water systems by corrosive action can pose potential health hazards. Further, extensive epidemiological research has strongly suggested that consumption of soft and sometimes aggressive drinking water may be related to increased incidence of cardiovascular disease. It has also been recognized that aggressive water in distribution systems rapidly increases corrosion rates and thereby increases the rate of pipe replacement and the costs associated with it. The purpose of this report is:

- to delineate the health issues involved in consumption of soft and/or corrosive water
- to elucidate mechanisms by which soft water is implicated in cardiovascular disease
- to quantify health and corrosion costs of aggressive water
- to examine corrosion treatment options in terms of cost-effectiveness and health benefits.

1.2 SUMMARY OF FINDINGS

Health Impacts

- Medical studies have shown a high statistical correlation between soft water and cardiovascular heart disease (CVD).
- All known risk factors account for only 50 percent of the incidence of cardiovascular disease, excluding the risk from the consumption of drinking water. Drinking water may account for a significant fraction of the remaining 50 percent.
- As shown in Table 1-1, the cause and effect mechanisms of this relationship can be hypothesized into three classes.

TABLE 1.1

CLASSIFICATION OF RELATIONSHIPS OF DRINKING WATER TO CARDIOVASCULAR DISEASE

Class I	One or more of the major components of hard water are protective. These beneficial elements are lacking in soft water. o Magnesium o Calcium
Class 2	One or more of the minor components ("trace" elements) that tend to be present in hard water, but absent or deficient in soft water, are protective. o Lithium o Chromium o Vanadium o Selenium o Manganese o Strontium
Class 3	One or more components in soft water are harmful -- this includes metal ions that are leached from the distribution system. o Cadmium o Copper o Lead o Beryllium

- As shown in Table 1-2, water treatment techniques may reduce the incidence of CVD.

- Over 55 million people are exposed to soft water (less than 60 ppm hardness $CaCO_3$ equivalents) in the United States (see Figure 1-1 and Table 1-3).

- The death rate from CVD can potentially be decreased in soft water areas by 0.65 deaths per 100,000 population for each increase of 1 ppm of hardness ($CaCO_3$).

- By increasing the hardness (greater than 60 ppm) through pH adjustment, 13,825 lives could be saved annually in soft water areas. This amounts to a minimum annual health savings of $3.5 billion per year.

- Health benefits from hardening soft water exceed treatment costs by about 300 times.

Corrosion Related Impacts

- Soft water may be corrosive to water distribution systems, leading to significant damage of pipes, pumps, meters, and storage equipment, as well as household plumbing appliances.

- Past studies have shown an increase in certain toxic trace metals from corrosion due to leaching of pipes. These elements, particularily lead and cadmium, can represent a potential health hazard.

- Costs for replacement of water-related pipe corrosion in distribution systems with aggressive water can range up to $20.16 per capita annually, with an average of $2.67 per capita annually.

- Water loss from leakage of pipes in distribution systems can amount to as much as 50 percent. A nationwide water loss average is 15 percent. Of these water losses, 38 percent (equivalent to six percent of distributed water) may be due to corrosion as a result of aggressive water areas.

- Power requirements are higher in many aggressive water areas because of decrease flow capacity in corroded pipes.

Corrosion Control Techniques

- There are two major corrosion control techniques: pH adjustment and addition of corrosion inhibitors.

TABLE 1-2

WATER TREATMENT EFFECTS ON CVD MECHANISMS

	Theory	Treatment Type I	II	III	IV
1a	Calcium lowers CVD.	B	NE	PB	NE
1b	Magnesium lowers CVD.	PB	NE	NE	NE
2a	Lithium beneficial.	NE	PB	PA	PA
2b	Strontium beneficial.	PA	PA	PA	PA
3a	Cadmium related to CVD.	B	B	B	B
3b	Lead related to CVD.	B	B	B	B

NE - No Effect - Treatment will not lower or increase incident of CVD.

B - Beneficial - Treatment will lower incident of CVD.

PB - Potentially Beneficial - Treatment may lower incident of CVD.

A - Adverse - Treatment will increase incident of CVD.

PA - Potentially Adverse - Treatment may increase incident of CVD.

Treatment Types

I - pH adjustment using lime.

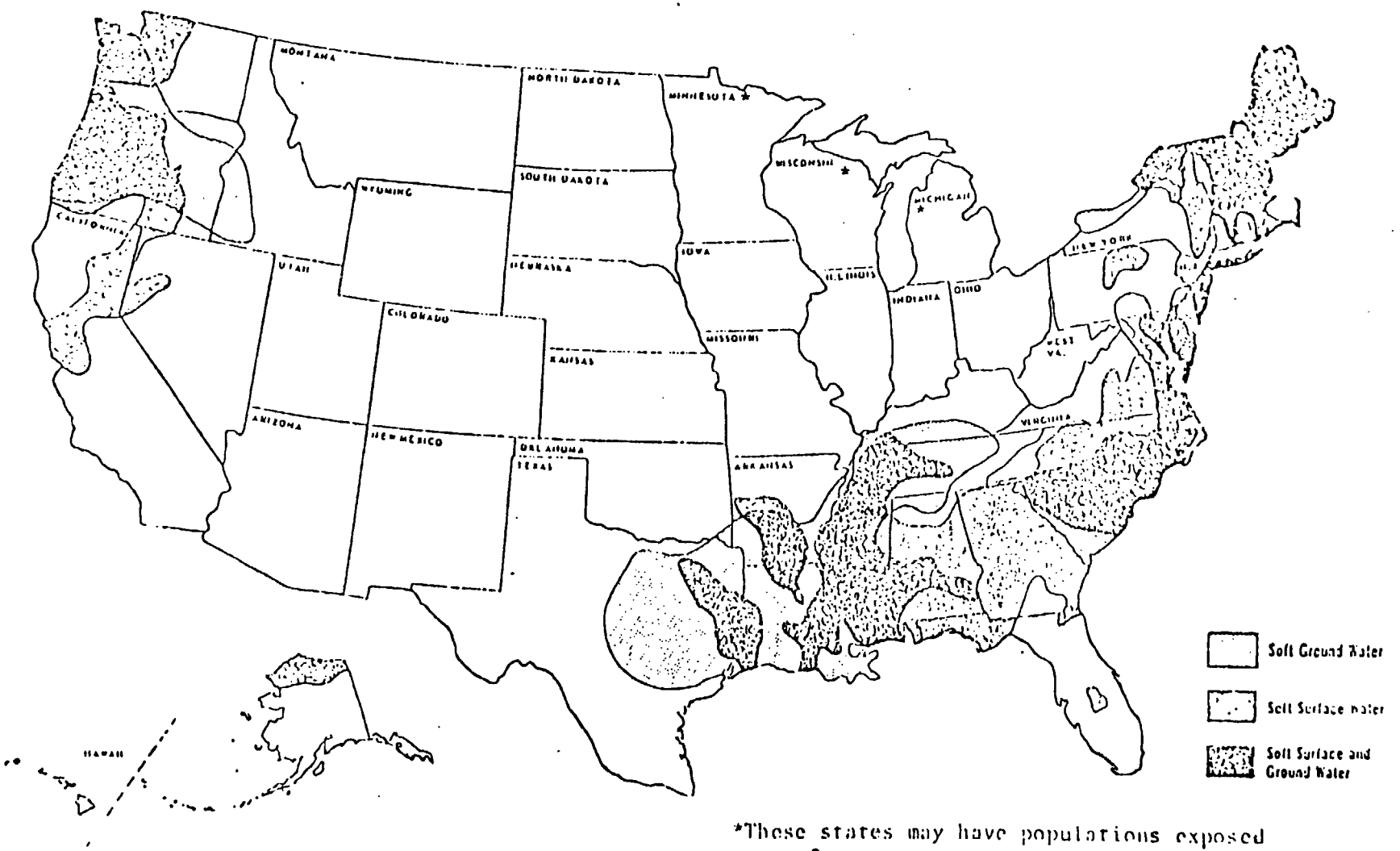
II - pH adjustment using sodium hydroxide or soda ash.

III - addition of corrosion inhibitors - polyphosphates.

IV - addition of corrosion inhibitors - silicates.

FIGURE 1-1

SOFT WATER AREAS IN THE UNITED STATES



*These states may have populations exposed to soft water.

SOURCE: EEA

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TABLE 1-5

NUMBER OF PERSONS IN THE UNITED STATES
EXPOSED TO SOFT WATER IN 1970

	Population Exposed (in millions)	Percentage of Population Exposed
Eastern States	30.9	55%
Connecticut	2.9	96%
Delaware	0.5	100%
District of Columbia	0.7	100%
Maine	1.0	100%
Maryland	3.0	78%
Massachusetts	5.7	100%
New Hampshire	0.8	100%
New Jersey	4.5	63%
New York	5.6	31%
Pennsylvania	0.9	7%
Rhode Island	0.9	100%
Vermont	0.4	91%
Virginia	4.0	89%
Southern States	21.4	38%
Alabama	1.0	31%
Arkansas	0.3	17%
Florida	0.1	1%
Georgia	2.7	59%
Kentucky	0.3	10%
Louisana	0.3	8%
Mississippi	2.2	100%
North Carolina	4.4	86%
South Carolina	2.2	83%
Tennessee	2.0	52%
Texas	5.9	53%
Western States	3.7	7%
California	1.0	5%
Hawaii	0.8	100%
Idaho	0.2	25%
Nevada	0.003	0.6%
Oregon	1.5	74%
Washington	0.2	5%
United States	56.0	27%

SOURCE: EEA

- o pH adjustment using lime has beneficial health effects.

- o Corrosion control by deposition of $CaCO_3$ films on the interior surfaces of the water conveyors provides the broadest and most general protection to water systems and plumbing materials.

- o Any of the stability indices, Langlier Saturation Index (LSI), Aggressive Index (AI), or Ryznar Saturation Index (RSI), can be used interchangeably to measure the stability and corrosion potential of water.

- o Annual treatment costs to control corrosion range from $0.185 to $0.47 per capita.

- o The benefit to cost ratio of using corrosion control to reduce pipe damage ranges from 1.2:1 to 15.4:1.

Regulatory Findings

- o EPA has the authority under the Safe Drinking Water Act to regulate soft corrosive water.

1.3 CONCLUSIONS

Soft and/or corrosive water represents a substantial health risk to those dependent on it for drinking water. Several different water treatment methods can lessen the potential adverse health impacts. Technology to decrease water corrosivity is readily available and economically feasible. Not only could the use of this technology result in significant public health benefits, but it could also have the additional benefit of lowering corrosion in public water distribution systems.

EPA has the authority, in the Safe Drinking Water Act, to include a minimum hardness requirement and to establish an MCL based on corrosion indices. This authority should be exercised to protect public health, considering the potential adverse health effects of increased cardiovascular disease in soft water areas and increased toxic contaminants in corrosive water areas. Given the large percentage of the United States population exposed to soft or corrosive water, a minimum hardness requirement and a maximum contaminant level based on any one of the corrosion indices should be implemented nationwide.