SOCIO-ECONOMIC IMPACTS OF THE SAFE DRINKING WATER ACT ON ARIZONA'S WATER SYSTEMS

by

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INTRODUCTION

The Arizona Department of Health Services (ADHS) is responsible for insuring that the State's 2,000 public and semi-public water systems are serving water that is safe for consumption and other public needs. The basis for this responsibility is vested in State statutes (A.R.S. 36-132, A.R.S. 36-136), and in the delegation of the enforcement authority for the Federal Safe Drinking Water Act (P.L. 93-523) to ADHS from the U.S. Environmental Protection Agency (EPA).

The introduction of the National Interim Primary Drinking Water Regulations by EPA in December 1975 led to the development of the new drinking water regulations for the State of Arizona in order for the State to assume "primacy" for the Safe Drinking Water Act requirements. The State regulations (ADHS, 1978) became effective on May 26, 1978 and resulted in the following major modifications to the previous regulations:

1. Establishment of periodic sampling requirements for inorganic, organic, and radioactive chemicals.
2. Addition of variances and exemptions to allow flexibility for some water systems having difficulty complying with a maximum contaminant level. This program requires that all water systems comply with the maximum contaminant levels by January 1, 1981, or demonstrate that they have exhausted all economic, and technically feasible alternatives for achieving compliance.
3. Each water system is responsible for notifying its customers when it fails to comply with a maximum contaminant level, sampling requirement, or is granted a variance or exemption.

The additional requirements cited above, in addition to a cutback in funding levels for both State and County Health Departments, has resulted in a shift of monitoring responsibilities to the water system. The public notification requirement is also borne by the water system, albeit somewhat reluctantly, as the water system owner must publicly "chastise" himself for failing to comply with particular aspects of the regulations.

The impacts of these regulatory changes is examined herein following a brief summary of the effectiveness of the State's water systems in complying with the new requirements.

COMPLIANCE STATUS

In February 1980 ADHS released a report which summarized the compliance status of the State's water systems with the drinking water regulations. The following criteria were used to determine full compliance with the regulations (ADHS, 1980):

1. Submission of regular Bacteriological samples.
2. A current acceptable Inorganic Chemical Analysis.
3. A current acceptable Organic Chemical Analysis.
4. Employment of a Certified Operator.
5. No Operation and/or Maintenance Deficiencies.

Of the 1,955 systems reviewed, only 97 systems (5%) were in compliance with all the criteria listed above. However, close scrutiny reveals that these 97 systems serve 51% of the population. This statistic bears out the point that the larger systems are more capable at this point in time of complying with the regulatory requirements than the smaller systems, which make up the majority of Arizona's water systems. Table I provides a synopsis of the relationship between the population served by a water system and its compliance status.

TABLE I

STATEWIDE SUMMARY REPORT OF COMPLIANCE WITH STATE REGULATIONS BY PUBLIC AND SEMI-PUBLIC WATER SYSTEMS FOR THE PERIOD 10-1-78 THROUGH 9-30-79

SYSTEMS OPERATING

Population Served	Number of Systems		
	Compliance	Noncompliance	Total
1-24	6	464	470
25-1,000	57	1,237	1,294
1,001-2,500	12	87	99
2,501-3,300	3	14	17
3,301-4,100	3	13	16
4,101-4,900	2	3	5
4,901-5,800	2	7	9
5,801-6,700	1	4	5
6,701-7,600	1	2	3
7,601-8,500	2	4	6
9,401-10,300	0	2	2
10,301-11,100	2	0	2
11,101-12,000	2	1	3
12,001-12,900	0	1	1
12,901-13,700	0	2	2
13,701-14,600	1	1	2
14,601-15,500	0	1	1
15,501-16,300	0	1	1
16,301-17,200	0	1	1
17,201-18,100	0	1	1
19,801-20,700	0	1	1
20,701-21,500	0	1	1
25,001-28,000	0	2	2
28,001-33,000	0	2	2
33,001-37,000	0	1	1
46,001-50,000	1	0	1
50,001-54,000	0	2	2
83,001-90,000	0	1	1
111,001-130,000	0	1	1
130,001-160,000	0	1	1
360,001-410,000	1	0	1
840,001-910,000	1	0	1
TOTAL	97	1,858	1,955

POPULATION SERVED

[1]Compliance	[2]Noncompliance	[3]Noncompliance (Over 1,000)	[4]Total (1 & 2)
1,463,495	1,382,198	1,164,481	2,845,693

COMPLIANCE CRITERIA

Criteria	Number of Systems Compliance	Noncompliance	Total
Operation and Maintenance	882	1,073	1,955
Bacti Samples	464	1,491	1,955
Inorganic Samples	328	1,627	1,955
* Organic Samples	4	28	32
Certified Operator	1,005	950	1,955

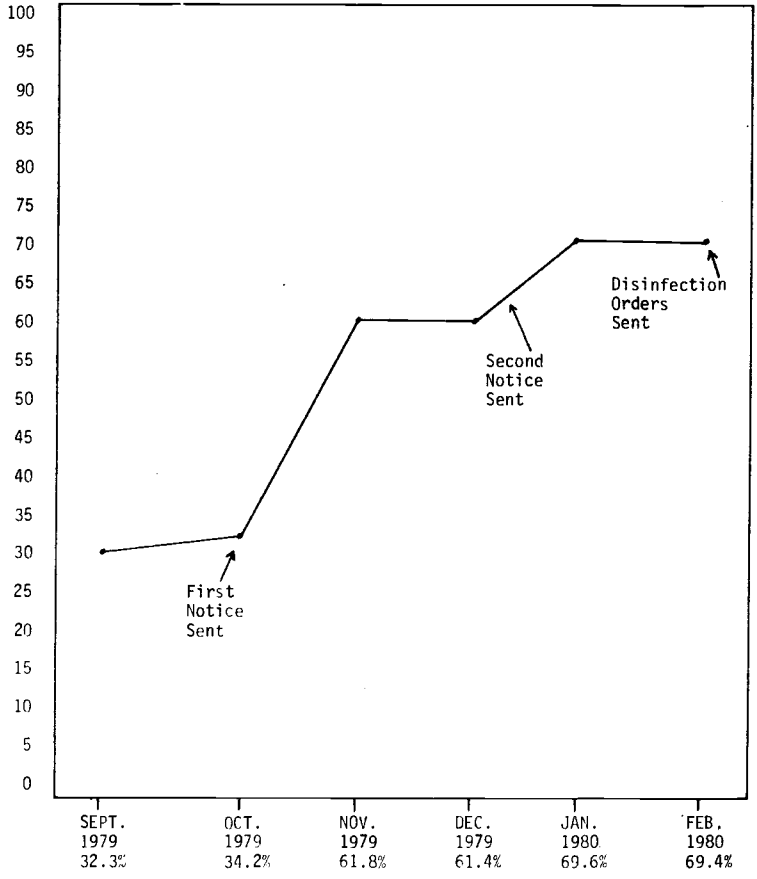
* applicable only to community water systems using surface water.

For the period of time analyzed by the Compliance Status Report (10/1/78 to 9/30/79) the State program for implementing the drinking water regulations was based on a low profile, voluntary compliance approach, with the emphasis placed on educating the water systems regarding the new requirements. The only conclusion that can be reached upon reviewing the compliance status summary as presented in Table I is that the voluntary compliance program was a dismal failure.

As a result of the above findings, ADHS initiated an aggressive program aimed at increasing the statewide level of compliance with the regulations. This program consists of Notices, Certified Letters, Administrative Orders, and ultimately court injunctions aimed at those systems which have repeatedly failed to comply with one or more of the previously mentioned criteria. The level of success of this program is demonstrated in part by the increase in the percentage of water systems complying with the bacteriological sampling requirements, as depicted in Figure 1.

FIGURE 1

PERCENTAGE OF WATER SYSTEMS COMPLYING
WITH BACTERIOLOGICAL SAMPLING REQUIREMENTS



To date it is projected that the aggressive compliance program implemented by ADHS will result in approximately sixty percent (60%) of the water systems being in conformance with the minimum drinking water requirements. The systems in compliance will be serving an estimated ninety percent (90%) of the State's population. This leaves about forty percent (40%) of the State's smaller water

systems still out of compliance with the regulatory requirements. Initial analyses by ADHS staff indicate that the small water systems within the State may be economically over-stressed in order to achieve full compliance with the current regulations. The following sections examine the economic costs associated with the measures necessary for regulatory compliance, and the subsequent impact on the smaller water systems.

ECONOMIC FACTORS

The economic costs related to complying with the drinking water regulations are dependent upon the classification of the water system, the source of the water supply, the population served by the system, and the ambient quality of the raw water. These factors influence the economic costs as follows (Energy Resources Co. Inc., 1975):

1. Water System Size: there are two classifications of water systems, with the monitoring requirements differing as noted:
   a. Community Water Systems are defined as those which serve at least 25 year-round residents, or at least 15 connections used by year-round residents. Community water systems must monitor for bacteriological, inorganic and organic chemicals, and radiochemical contaminants.
   b. Non-community water systems are defined as serving at least 15 connections or 25 people for more than 60 days per year, but which have less than 25 year-round customers. Non-community water systems are required to sample for bacteriological and inorganic chemical contaminants.
2. Water Supply Source: The source of the water supply (i.e., either groundwater or surface water) influences the frequency of the monitoring required by a water system as follows:
   a. Systems which only use groundwater are required to sample for inorganic chemicals at three-year intervals.
   b. Systems which have surface water sources are required to perform yearly inorganic chemical analyses, and must also test for turbidity on a daily basis.
3. Population: The population served by the water system is used to determine the number of bacteriological samples required to be submitted each month. Table 2, which is extracted from the regulations, depicts the relationship between system population and bacteriological sampling requirements:

TABLE 2

BACTERIOLOGICAL SAMPLING REQUIREMENTS

Population Served per Month	Minimum Number of Samples Per Month
25	1 every 3 months
25-1,000	1
1,001 to 2,500	2
2,501 to 3,300	3
3,301 to 4,100	4
4,101 to 4,900	5
4,901 to 5,800	6
5,801 to 6,700	7
6,701 to 7,600	8
7,601 to 8,500	9
8,501 to 9,400	10
9,401 to 10,300	11
.	.
.	.
.	.
970,001 to 1,050,000	300
.	.
.	.
.	.
4,690,001 or more	500

4. Water Quality: The ambient quality of the water supply raw water source is probably the most important determinant relative to the economic costs associated with compliance. The new regulations set forth required maximum contaminant levels (MCL's) for all the contaminant groups previously mentioned. All water systems are required to comply with the MCL's by Janaury 1, 1981. This can be accomplished either through the application of an appropriate treatment technique, the blending of water sources, the development of a new water source for the water system, or by joining a regional system. All of these alternatives create a tremendous economic burden, especially for the smaller water system. The most prevalent contaminant problems experienced in Arizona are fluoride, arsenic, and nitrate violations, all of which occur naturally in portions of the State.

ECONOMIC IMPACTS

The economic impact of complying with the drinking water regulations is highly dependent upon the size of the population served by the water system. The number of customers determines the economic base for a system, and directly relates to the per capita distribution of the costs associated with regulatory compliance. The two major activities with costs directly attributable to the regulations are routine monitoring and treatment costs.

As presented in the preceeding section, the amount of routine sampling required is a function of the number of persons served, the classification of the system, and the source of the water supply. The current fees charged by commercial laboratories in Arizona for conducting the required analyses are as follows (G.H.T. Laboratories, 1980):

Bacteriological	$ 5.50
Complete Inorganic Chemical	135.00
Organic Chemical	87.00
Radiochemical (gross-alpha)	15.00
Turbidity	6.00

The annual economic burden for complying with the routine sampling requirements can thus be calculated for the varying types of systems assuming the characteristics as used in the following examples:

Example 1.	Community Water System Population = 100 Groundwater source	Bacteriological samples Inorganic Chemical (1/3 of $135.00) Radiochemical (1/3 of $15.00)	$ 66.00 45.00 5.00
			$ 116.00
Example 2.	Community Water System Population = 800,000 Surface Water Source	Bacteriological samples Inorganic Chemical Organic Chemical (1/3 of $87.00) Radiochemical (1/3 of $15.00) Turbidity	$17,820.00 135.00 29.00 5.00 2,190.00
			$20,179.00
Example 3.	Noncommunity Water System Population = 225 Groundwater Source	Bacteriological samples Inorganic chemical (1/3 of $135.00)	$ 66.00 45.00
			$ 111.00

The annual per capita costs for the monitoring requirements ranges from $0.025 for Example 2 to $1.16 for Example 1. While it is obvious that the smaller systems per capita cost is much higher than the per capita costs associated with larger systems, the monitoring costs are not considered excessive when compared with the public health protection provided by the analyses.

The largest economic impact relative to the regulations arises when a system's raw water source exceeds one of the maximum contaminant levels (Public Utilities Association of Arizona, 1980). A study released by EPA (Energy Resources Co., 1975) analyzed the costs associated with providing treatment in order to comply with the MCL's. Table 3 summarizes the per capita cost data relative to treatment for control of various contaminant group violations in relationship to the size of the water system.

TABLE 3

ANNUAL PER CAPITA COSTS ASSOCIATED
WITH VARIOUS TREATMENT SYSTEMS

TREATMENT	POPULATION SERVED			
	25-99	100-9,999	10,99,999	>10,000
Disinfection	3.85-2.10	2.75-0.30	0.45-0.15	≤0.25
Turbidity Control	152.00-52.00	78.00-16.00	20.00-12.50	≤15.00
Heavy Metal Removal	237.00-101.00	142.00-25.50	35.00-13.00	≤18.00
Fluoride/Arsenic Removal	11.80-7.85	11.30-3.15	5.00-3.15	≤3.55

Assuming that the treatment costs are directly passed on to the consumer (U.S. EPA, 1979a), and that an average of three people reside at each water connection, the average monthly water bill increase for a system providing treatment to correct a heavy metal violation will range from $4.50 per month increase for residents on a very large system to $59.25 per month increase for residents served by a very small system. Obviously small water systems would be forced to go out of business before they could increase their monthly water bills by nearly $60.00 to provide the needed treatment.

There are alternatives available to the water system if they choose not to provide treatment. Some of the options available are (U.S. EPA, 1979b):

1. Developing a new, less contaminated source;
2. Joining a regional system; or
3. Blending water from the existing source with water of higher quality.

While some of these measures may involve a substantial capital expenditure, it may be offset by the smaller operating costs associated with those options as compared to treatment operating costs.

Regardless of the alternative strategies available for MCL compliance, it can be predicted that strict enforcement of the MCL regulations by the state will result in the closure of numerous, smaller water systems which find it economically infeasible to comply with the regulations (U.S. EPA, 1980).

It is currently estimated that ninety-five systems in Arizona, serving less than 1,000 customers, have MCL violations which need to be corrected (Shafer, 1980). The cumulative capital expenditures necessary to achieve compliance for these systems is estimated to total $9.5 million.

SOCIAL IMPACTS

The social impacts resulting from the drinking water regulations are primarily related to the new requirement for public notification. The regulations (R9-8-268) state that a water system is to inform its customers when one of the following situations occur:

1. Failure to comply with an applicable MCL; or
2. When the water system is granted a variance or exemption from an applicable MCL; or
3. Failure to comply with a schedule contained in a variance or exemption; or
4. Failure to perform any of the sampling and analytical requirements.

The Notice, which is distributed through the available media and in water bills, is required to state the nature of the violation, the health aspects of any violation, and appropriate preventative measures to be taken by the public.

The public notification requirement has resulted in the following socio-related impacts:

1. Increased public awareness of the quality of their water supply, and the health effects associated with various contaminant violations.
2. Water system owners become more anxious to comply with the regulations, rather than facing the "embarrassment" of having to inform their customers of the applicable regulation violations.
3. Compliance has been more rapid as pressure to comply not only is directed at the water system owner by the State, but also by his customers.

The social impacts resulting from public notification have primarily been beneficial from the perspective of the regulatory agency. However, the potential for adverse impacts is present due to the possibility of a panic situation presenting itself should a notice be improperly worded. Guidance to water system owners concerning the preparation of public notices should minimize the potential for such an event occurring.

CONCLUSION

The socio-economic impacts resulting from the implementation of the new Arizona Drinking Water Regulations are minimal when compared to the public health protection provided, and the increased public awareness of its drinking water quality. The exception to this is the circumstance when a small water system has a maximum contaminant level violation, which may present economic ramifications that could result in the closure of some of the State's smaller water systems. This situation points to the need for ADHS to develop a strategy for providing technical guidance and/or administrative relief to the smaller water system owner in order to ensure the economic viability of the system and the maintenance of acceptable public health levels for the affected customers.

REFERENCES CITED

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