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The Point-of-Use Water Treatment Industry: Expert Opinion on Regulation.

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THE POINT-OF-USE WATER TREATMENT INDUSTRY: EXPERT OPINION ON REGULATION

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Abstract. Concerns over declining water quality have led many home owners to install point-of-use water treatment units to improve potable supplies. This industry has grown considerably in recent years. However, some questions have been raised regarding misleading advertising and improper claims being made by some in the industry. The extent of this problem is not known, but regulation has been considered. This paper examines some views on regulation of the home water treatment industry. A detail report was presented to 120 water resource experts from the Mid-West for analysis and comment. Results from an accompanying questionnaire indicated favorable support for point-of-use units, provided they were not used as substitutes for long-term water protection measures and other management strategies. There was a consensus for mandatory regulations involving certification programs and control of equipment standards through independent third parties. Further research is recommended into the merits of controls already in place.

INTRODUCTION

Point-of-use (POU) water treatment devices have received increasing attention as concerns over contaminated drinking water have mounted (*U.S. Water News*, 1990a). Whether in rural towns relying on small local wells, or large cities with centralized purification systems, communities across the country have reported health problems attributed to contaminated water supplies (Rajagopal and Talcott, 1983). Many householders now install home water treatment devices to overcome aesthetic problems with odor and taste, and to raise the quality of potable supplies. According to a *U.S. Water News* (1990a) report, this is a fast-growing industry; in 1989 the residential POU device market stood at \$1.7 billion, and by 1995 it is expected to reach \$3.8 billion. An estimated six million households in the U.S. had installed POU home water

treatment units by 1985 (Geldreich *et al.*, 1985), while in Canada, sales of equipment are thought to be running at 100,000 per year (Tobin, 1988). There are now over 500 companies involved in the industry, with 50 dominating the market (*U.S. Water News*, 1990c).

A number of studies have examined the different POU devices. Regunathan *et al.* (1983), for example, commented upon the effectiveness of activated carbon filters and reverse osmosis units in supplementing centralized systems. Bell *et al.* (1984) reported on testing over 30 different home POU units for removal of volatile organic chemicals, and Geldreich *et al.* (1985) looked at problems of bacteriological colonization of various filters. Additional studies of water treatment devices can be found in reports by the U.S. Environmental Protection Agency (1988) and the Water Quality Association (Undated, a).

While these studies have focused on effectiveness of the equipment, less attention has been given to regulation and monitoring of the industry. Questions have been raised, though, regarding sales approaches, advertising campaigns, and salespersons' activities (EPA, 1988; Robb, 1988; Schwartz, 1989). The *U.S. Water News* (1990a) even suggested that the industry "rid itself of its existing poor marketing image," and in a later report pointed out the increase in consumer complaints received by the Federal Trade Commission and the National Sanitation Foundation (*U.S. Water News*, 1990b). According to the Freshwater Foundation (1988), "The thought that our drinking water may be hurting us is so

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R. Rajagopal has authored, coauthored, or edited over 100 journal articles, research reports, journals, and books in the fields of environmental science, management information systems, and groundwater quality monitoring. He is currently a professor of geography and civil and environmental engineering at the University of Iowa, Iowa City, IA 52242.

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frightening we don't know who, or what, to trust." However, what is not clear from these reports is the extent of the problem or the necessity for regulation.

This research focuses on regulation questions of the home water treatment industry. A report on POU water treatment devices was presented to a group of water resource experts from the Mid-West. Our premise was that such experts would be able to assess the need for regulation of the industry in the context of an overall water management strategy. After they had read the report, the experts were asked their opinions on various management/regulation options. This paper outlines the findings from the survey.

METHODOLOGY

A detailed report on POU home water treatment devices, with specific reference to Iowa, was presented to a community of water resource experts for analysis and comment. Responses were structured through a formal, mail questionnaire, consisting of both closed- and open-ended questions. Included were questions related to regulation, standards, and costs of implementing different programs. The analysis of participants' responses to perceptual, participatory, policy, and economic questions within a structured context formed the basis of this research. As far as we know, no such highly focused analysis of key water resource issues based on expert knowledge is available at this time. With careful interpretations, general conclusions regarding areas for further research can be drawn from survey results elicited from such targeted groups (Cortner *et al.*, 1984).

Participant Profile

One hundred and twenty water resource experts from the Mid-West were identified and agreed to participate in the survey. The basic criterion for inclusion was an active involvement in water resource issues; all had been involved in aspects of groundwater protection policies. Respondents came from a range of educational backgrounds and from different institutions, and each was offered a small honorarium for participating (Table 1). Since this was part of a larger survey incorporating several lengthy case-studies of various water quality issues, it was thought that some form of monetary recompense for the time involved would be an incentive to take the questionnaires seriously (Rajagopal and Tobin, 1988). Ninety-seven individuals completed the survey, giving a response rate of 81 per cent.

Limitations

These respondents did not represent a random sample of the universe of available experts. Rather, they were selected specifically because of their active involvement in water resource and groundwater protection issues and because of their familiarity with problems in the Mid-West. Obviously, the results obtained from such a directed survey have serious limitations, and generalization is difficult. We viewed the study as an exploratory exercise that could generate new hypotheses, and thus advance our understanding of POU

water treatment devices. However, it is essential that the statistics on revealed preferences reported in this paper be validated with comparable data from other interested parties. The research, therefore, represents an opinion survey rather than any definitive answer to regulation of the water treatment industry. The unique feature of this research is the fact that the experts, who came from a variety of backgrounds, were all presented with exactly the same set of options.

Research Objectives

There were two parts to this research. The first focused on the opinions of experts regarding regulation of the home water treatment industry. We anticipated that any trends or patterns that emerged from the survey would indicate whether regulation of the industry was considered necessary and, if so, how this might be achieved. The second part examined these opinions for differences based on characteristics of the experts. The participants were categorized as follows: (1) Educational Level: participants were divided into two classes, those with formal training to a master's degree level or higher, and those with a bachelor's degree or lower; (2) Institutional Affiliation: three classes were distinguished, those affiliated with governmental institutions, those affiliated with universities/colleges/extension services, and those affiliated with all other institutions (private sector, nonprofit interest groups); (3) Professional Groundwater Experience: participants with 10 years or less of groundwater-related experience were distinguished from those with longer experience; (4) Residency Status: two classes of participants were determined, Iowa residents and nonIowa residents.

The Point-of-Use Report

The seven-page report read by the experts addressed five questions: (1) Have companies intentionally misrepresented the quality of tap water to the home owner in the interests of selling more units? (2) Have claims made by the industry regarding performance and effectiveness of treatment units been legitimate? (3) Should the water treatment device industry be subject to regulatory control? (4) Who or what agency should be responsible for regulating the industry? (5) What standards should be set, and how might enforcement be implemented? (For details see Rajagopal and Tobin, 1988.)

The text provided information pertinent to each question. Participants were informed of instances involving misleading advertising practices (Winston, 1988) and given details of regulatory legislation in Wisconsin and California (Trapp, 1988; Burns, 1988). Legislative proposals were also discussed for Iowa. (For further details of current legislation, see below). Finally, some details on costs of units were provided to show that potable water could be supplied at reasonable rates (Iowa Water Quality Association, 1984).

The second part of the report focused on policy options for controlling the water treatment industry. Three approaches were described, all involving regulations pertaining to equipment standards, promotional material, and personnel certi-

fication procedures. The first option concerned a voluntary regulatory program in which the industry would police itself. The Water Quality Association (1973; 1984; 1985a and b; Undated, b) was a strong advocate of this strategy. The second option described regulation procedures through a

third, independent party such as the National Sanitation Foundation (National Sanitation Foundation, 1982a and b, 1985). The final option involved mandatory regulation and put organizational responsibility in the hands of the state or federal governments.

Table 1. Survey Participant Profile

A total of ninety-seven individuals participated in the survey. All response frequencies are expressed in percentages.

<p>1. What is the highest level of education you have obtained?</p> <table border="0"> <tr><td>High School</td><td>9</td></tr> <tr><td>Bachelor's</td><td>24</td></tr> <tr><td>Master's</td><td>28</td></tr> <tr><td>Doctorate</td><td>27</td></tr> <tr><td>Other (D.Ed.)</td><td>12</td></tr> </table>	High School	9	Bachelor's	24	Master's	28	Doctorate	27	Other (D.Ed.)	12	<p>4. What is your current institutional affiliation? (Check one.)</p> <table border="0"> <tr><td>Government</td><td></td></tr> <tr><td> State</td><td>28</td></tr> <tr><td> Federal</td><td>16</td></tr> <tr><td> Local</td><td>5</td></tr> <tr><td> Other</td><td>2</td></tr> <tr><td>Private Sector</td><td></td></tr> <tr><td> Farming</td><td>6</td></tr> <tr><td> Well Drilling</td><td>2</td></tr> <tr><td> Dealers/Distributors</td><td>1</td></tr> <tr><td> Chemical Industry</td><td>1</td></tr> <tr><td> Other</td><td>9</td></tr> <tr><td>Other</td><td></td></tr> <tr><td> University/College</td><td></td></tr> <tr><td> Extension Service</td><td>25</td></tr> <tr><td> Public Interest Group</td><td>5</td></tr> </table>	Government		State	28	Federal	16	Local	5	Other	2	Private Sector		Farming	6	Well Drilling	2	Dealers/Distributors	1	Chemical Industry	1	Other	9	Other		University/College		Extension Service	25	Public Interest Group	5																								
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SURVEY RESULTS

The responses of the water experts to the questionnaire survey are shown in Table 2. These results are discussed in detail under three themes of inquiry: seriousness of the problem; regulation, standards, and testing; and financial responsibility. The response statistics were analyzed based on the differences in selected participant profiles. To test simultaneously for the significance of these profile variables on observed responses, standard multivariate modeling methods (analysis of variance using General Linear and Categorical Models) for the study of cross-classified data were employed. Only on a few occasions were significantly different responses found, and at no time did interaction effects between variables become a problem.

The Problem

According to the respondents, the practices of the home water treatment industry do not pose serious concerns to water management. In question one, respondents were asked to rate the seriousness of quality assurance on a scale of one (no problem) to five (a serious problem). The mean response was 3.3, with 79 per cent of participants seeing this issue as warranting some attention, and only 11 per cent perceiving a very serious problem. Similarly, the responses to question two indicated that regulation of the industry was probably desirable, but not urgent or critical (mean score 3.4), with 80 per cent ranking the importance of regulation in the middle categories. There were no significant differences between profile variables in response to these questions.

Very few respondents were in favor of relying on home POU treatment units as a permanent water treatment strategy. Question nine asked respondents whether preventive action should be taken to minimize the need for such devices. The response was highly skewed toward the upper end of the scale, with 63 per cent of respondents stating that it is most important to undertake preventive actions to protect water supplies. A further 26 per cent ranked such action in the next highest category, for a mean score of 4.2.

There was, therefore, very strong support for implementing safeguard measures to protect water quality, rather than relying on options oriented towards domestically-based "cures." It is worth noting, though, that there was considerable range in responses among individuals. Those respondents with less groundwater experience showed significantly greater support for implementing preventive actions to minimize the use of POU systems than those with more experience. However, generally respondents were in agreement about the nature of the water treatment issue.

Regulation, Standards, and Testing

Respondents were required to determine whether the water treatment industry should be regulated and, if so, how this might be achieved. Regulation of the water treatment device industry has been an issue in various states and was addressed

specifically in this case study. First, respondents were asked what form of regulation would be appropriate for the industry (question three). A majority of respondents (52 per cent) indicated that regulation should be mandatory with control for testing carried out through an independent third party. A further 20 per cent wanted mandatory regulation, but with state control of testing. There was, therefore, very strong support for some form of control of the industry, even though respondents did not consider treatment devices a serious issue. There was a lack of faith in the ability of the industry to regulate itself, although 24 per cent of participants did support voluntary regulation programs through an independent third party. There were no significant differences identified between the various classes of participants.

The same attitudes were apparent in other questions pertaining to regulation (see question six). Few respondents believed that the industry should set its own standards with respect to water treatment devices (3 per cent) and 85 per cent thought such standards should be determined by an independent organization or the state. In question seven, respondents were asked to indicate what form any regulation should take. Seventy per cent of respondents perceived a need for strict standards and testing of water treatment devices, while 43 per cent saw a need for certification, and 46 per cent for restrictions on promotional material. There was some debate over such restrictions. Those employed in government institutions showed significantly greater support for the measure than those affiliated with universities or private industry. Also, those with less professional groundwater experience were more likely to support restrictions on promotional material.

Several experts questioned the necessity for legislation on grounds of its perceived effectiveness. A few even believed that it would be just as difficult to keep out dealers who did not adhere to mandatory standards as it would to prevent unscrupulous salespersons under the current voluntary system. In general, however, the respondents thought that the industry should not be expected to regulate itself.

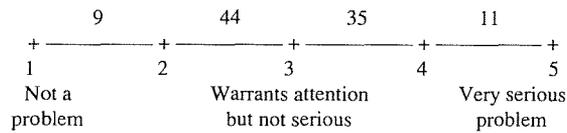
Financial Responsibility

If a community is to rely on home treatment devices as a means of improving water quality, then costs to the home owner become important. Respondents were asked to address this in question four: How much should individuals be expected to pay for this technology? The modal value was between \$50 and \$200 (41 per cent), although a very large proportion (40 per cent) suggested costs between \$200 and \$500. However, survey participants were not supportive of subsidizing home treatment devices, as indicated by responses to question eight. Over 80 per cent believed no subsidies should be made from any source, be it federal, state, local, or the private sector. With regard to state and federal subsidies, respondents with less professional experience advocated more subsidies than those with longer experience.

TABLE 2. QUESTIONNAIRE RESPONSES

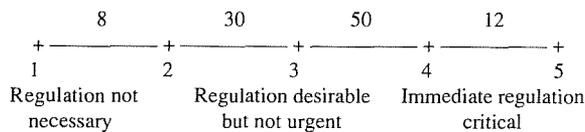
Where applicable, response frequencies are expressed in percentages instead of numerical counts. Ninety-seven individuals completed the survey. There were no interaction effects between the independent variables.

1. How serious is the problem of quality assurance (for consumer protection) within the water treatment device industry? (Put an X on the line below.)



Mean = 3.3 Maximum = 1.0
Standard Deviation = 0.8 Minimum = 5.0

2. How important is it to regulate the Water Treatment Device Industry? (Put an X on the line below.)



Mean = 3.4 Maximum = 1.0
Standard Deviation = 0.8 Minimum = 5.0

3. What form of regulation is most appropriate for the water treatment device industry?

- a. No regulation necessary 1
- b. Allow the industry to regulate itself 4
- c. Voluntary regulation through a third (independent) party 24
- d. Mandatory regulation through a third (independent) party 52
- e. Mandatory regulation through state controlled laboratories and inspectors 20

4. How much should individuals be expected to pay for home water treatment devices?

- a. Less than \$50 4
- b. Between \$50 and \$200 41
- c. Between \$200 and \$500 40
- d. Between \$500 and \$1,000 12
- e. \$1,000 + 2

5. Who should pay for the testing and regulation of treatment devices?

- a. Individual companies/the industry (private sector) 79
- b. The state - public sector 10
- c. The consumer 8
- d. Other 2

6. Who should set the standards for testing and regulation?

- a. The industry 3
- b. The state 45
- c. An independent body 40
- d. The local government 1
- e. Other 10

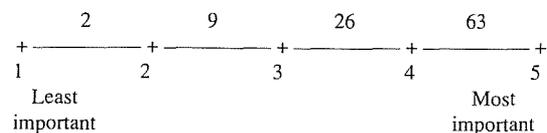
7. Regulation of the water treatment device industry should include (Circle all those that are appropriate):

- a. Certification of persons within the industry 43
- b. Restrictions on promotional material 46
- c. Strict standards and testing of water treatment units 70
- d. A combination of the above 55
- e. Other, specify 2

8. Should individual home owners' purchases of water treatment devices be subsidized by:

	Yes	No
a. Local government?	16	84
b. State government?	14	86
c. Federal government?	6	94
d. Industry?	13	87

9. How important are preventive actions so that the need for point-of-use treatment devices are minimized? (Put an X on the line below.)



Mean = 4.2 Maximum = 5.0
Standard Deviation = 0.7 Minimum = 2.0

While subsidization of consumers was not considered necessary, regulation of the industry was deemed important by many respondents. The costs for any testing or regulation program was the focus of question five. There were very strong opinions that all such costs should be borne by the private sector. Nearly 80 per cent of respondents stated that individual companies should pay for testing of their equipment, and only 10 per cent suggested state or public funding. In this instance, Iowa residents showed significantly greater support for private sector responsibility than nonIowans.

DISCUSSION AND CONCLUSION

The water experts regarded practices of the home water treatment industry as a relatively minor problem in the context of overall water management. There was very strong support for mandatory controls by independent, third-party organizations to protect the public from possible dangers of ineffective equipment and misuse of promotional materials. There was also a strong feeling that more should be done to protect water supplies through control of source pollution in the first place, rather than relying on point-of-use technology to provide clean water. Nevertheless, it may be that in some small communities, POU home water treatment units could become a viable option for providing clean water, especially where local aquifers already are contaminated. If this is the case, then some controls would seem appropriate, and should be supported by private industry and controlled by independent organizations or the state, according to the experts surveyed. Further research would help determine how important or successful such options would be in any overall water management strategy.

Several respondents suggested that water treatment devices could be used as short-term solutions to particular problems, but did not believe they should be employed over long periods. In this respect, it was apparent that further information on costs and benefits associated with implementing, operating, and maintaining treatment equipment would have helped the analysis. Most respondents were firmly against any subsidized support for this industry or for persons using the equipment, but several respondents accepted that, under certain circumstances, this may be an acceptable means of alleviating a problem. On the other hand, those respondents with least groundwater experience were most strongly in favor of reducing the need for POU devices by implementing other management strategies.

Home water treatment devices, therefore, may provide an alternative to traditional options considered in water quality protection in certain instances. If so used, then legislation to control the water treatment device industry may be necessary. Many respondents expressed concern that traditional protection measures would be overlooked if emphasis was given to these treatment devices. Thus, there were many participants who first advocated looking at other water management strategies before utilizing point-of-use technology.

The second part of the research did not advance our understanding greatly, for only in a few cases were significant differences found between profile variables. For example, respondents with less groundwater experience were more likely than those with more experience to support additional water protection measures that would render home treatment devices unnecessary. Similarly, those affiliated with government institutions showed greatest support for control of promotional materials, and Iowa residents were more likely than nonresidents to favor testing and certification procedures. However, for the most part, the four identified, independent characteristics were unimportant. These results suggest a strong, uniform consensus amongst the experts regarding home water treatment devices. Further research, however, might identify greater differences between other interested groups, such as those involved with the industry and domestic users.

Since this research was undertaken, the state of Iowa has passed an act regulating the home water treatment industry (Iowa Code, 1989). The Act calls for some of the same measures supported by the experts. The new law requires that all POU water treatment devices be tested by an authorized third party or that the industry's own data be approved by a similar authorized agency. A "manufacturer's performance data sheet" must be attached then to each unit, and buyers supplied with "consumer information pamphlets" compiled by the Iowa Department of Public Health. In addition, deceptive advertising tactics are precluded specifically by the Act. While such measures may ensure that POU water treatment devices are effective up to their stated levels, the Act includes no certification procedure to guarantee any degree of expertise in selling or installing the units. Furthermore, the Act does not address directly the question of appropriate standards, although it does penalize companies for making bogus claims as to the effectiveness of their products.

Recently, other states also have introduced legislation to set up regulation procedures for the home water treatment industry. These include Massachusetts, New York, Connecticut, North Carolina, and Tennessee. Follow up research, therefore, should explore the impact of this new legislation on the industry. In contrast, other work should look at the effectiveness of different regulatory approaches. For instance, the voluntary regulatory programs advanced by the Water Quality Association are now quite well established. Standards have been developed by the National Sanitation Foundation and third-party inspection of plants is supported (Dougherty, 1988). Since 1977, over 1,800 people have been certified through the voluntary program of the Water Quality Association (Cole, 1988). Such voluntary programs contrast with the more formal regulatory approach advocated by the experts in this survey. Therefore, it would be interesting to determine what effect these programs have had on the water treatment industry, and how they might be incorporated into a comprehensive water management program.

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