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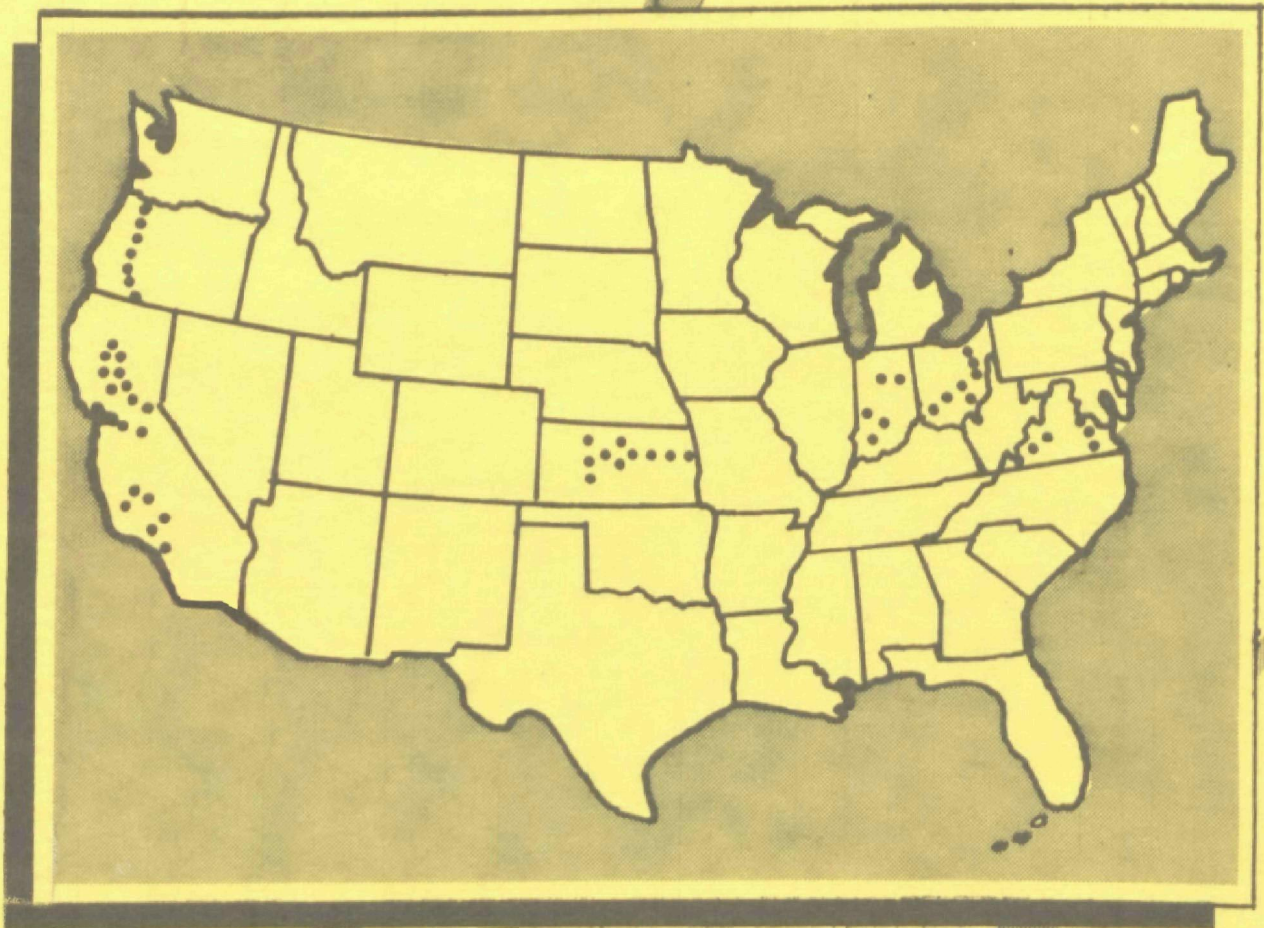
DRINKING WATER SYSTEMS for the TRAVELING PUBLIC

A STATUS REPORT



U.S. ENVIRONMENTAL PROTECTION AGENCY
Water Supply Division
Washington, D.C. 20460

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A STATUS REPORT

Prepared by:
Special Studies Section

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Water Supply Division

INTRODUCTION

In recent years increased attention has been directed to the quality of drinking water provided by municipalities to its citizenry. Much of this attention has come as a result of a study of community water supply systems (1) which showed that many communities cannot be assured of a continuous supply of safe and palatable drinking water. Despite this interest in the larger water supply systems, very little information has been gathered concerning the quality of water available to the traveling public at small water systems.

The Water Supply Division of the Environmental Protection Agency has therefore instituted a series of pilot studies to assess the water quality, construction, maintenance, operation and surveillance of water systems serving the traveling public. Several of these studies have been completed, including a study of water systems around Corps of Engineers reservoirs entitled: Sanitary Survey of Drinking Water Systems on Federal Water Resource Developments, a Pilot Study, (2), a second study: A Pilot Study of Drinking Water Systems at Bureau of Reclamation Developments, (3), a third study entitled: A Pilot Study of Drinking Water Systems on and along the National System of Interstate and Defense Highways,(4)

These studies become significant because of the large number of travelers using these small water systems. There are an estimated 323 million visitors per year at Corps of Engineers reservoirs, 55 million visitors per year at Bureau of Reclamation reservoirs, and one million people per day using small water systems along interstate highways. These three classes of systems are typical of a much larger group of systems including those in State and National Parks and in the National Forest system.

1. L.J. McCabe, J.M. Symons, R.D. Lee, and G.G. Robeck, 1970 Survey of Community Water Supply Systems, Journal of the AWWA 62 (11): 670-687.
2. Water Supply Division, 1971, Environmental Protection Agency, Washington, D.C.
3. Water Supply Division, 1973, Environmental Protection Agency, Washington, D.C.
4. Water Supply Division, 1973, Environmental Protection Agency, Washington, D.C.

SCOPE OF WORK

233 WATER SUPPLY SYSTEMS IN SEVEN STATES

Rapid dispersal of those people using these small water systems is an inherent characteristic. Therefore, if there is a waterborne disease outbreak at any one of these water systems, the affected person may have traveled to far reaching locations before symptoms appear. One of the problems this poses is the extreme difficulty in attempting to trace the origins of a disease to its source.

There are many diseases associated with contaminated water. These inclued infectious hepatitis, salmonellosis, shigellosis, dysentery, typhoid fever, cholera, amebiasis, and gastroenteritis, a term used for an enteric disease when the etiologic agent is not determined by laboratory analyses.

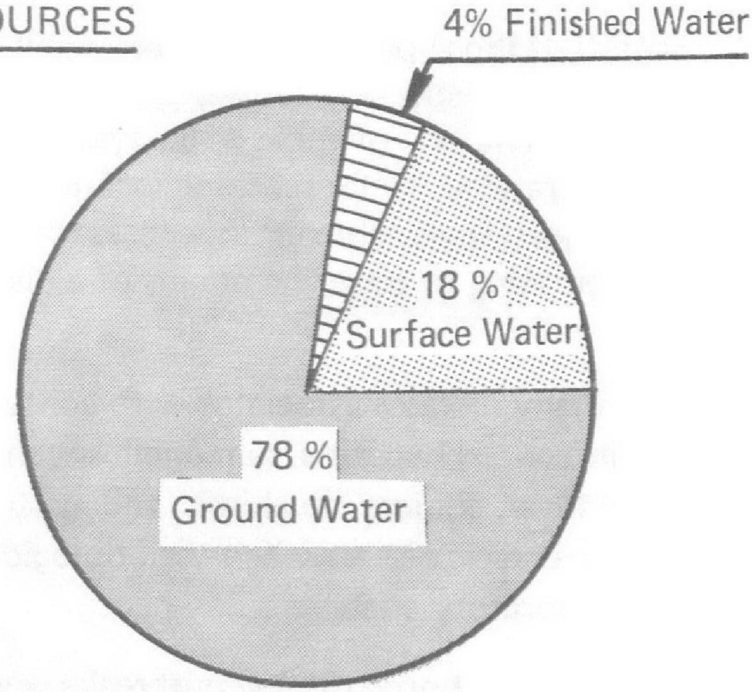
The problem of waterborne disease outbreaks was addressed by Craun and McCabe (5). During the period 1961-1970, there were 128 known outbreaks of disease in the United States attributed to contaminated drinking water; these affected 46,374 individuals and resulted in 20 deaths.

They reported that "the size of outbreaks in (non-municipal water)" systems increased to 93 illnesses per outbreak during 1966-1970 (the last 4 years of the reporting period) primarily due to a number of large outbreaks associated with recreational areas."

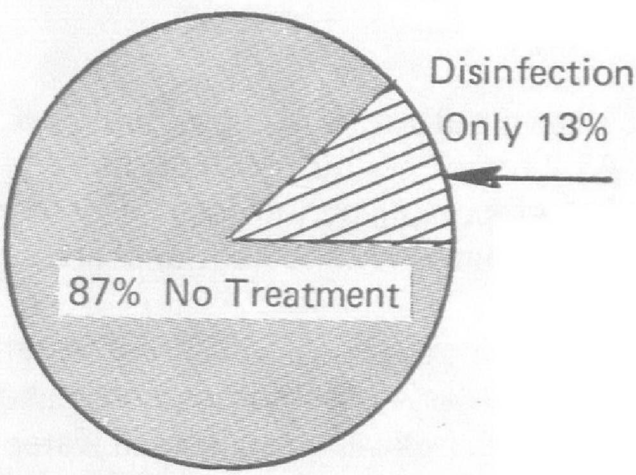
This report describes the three pilot studies on drinking water systems for the traveling public, discusses the findings, and makes recommendations that are generally applicable to all small water systems. Hopefully, these studies will focus more attention on the problems inherent with these water systems to help improve the overall health protection of the public.

5. L.J. McCabe, and G. Craun, 1971, Waterborne Disease Outbreaks, 1961-1970, American Water Works Association, annual meeting, Denver, Colorado.

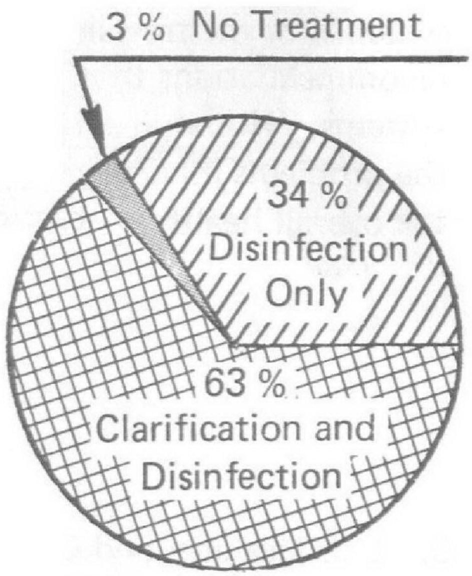
TYPE OF SOURCES



KIND OF TREATMENT



Ground Water



Surface Water

CHARACTERISTICS OF THE SYSTEMS EVALUATED

As shown in the adjoining figures, the majority of the systems evaluated used wells or springs (ground water) as a water source. Approximately one fifth used lakes or rivers (surface water) while a few systems purchased treated water from nearby municipal systems.

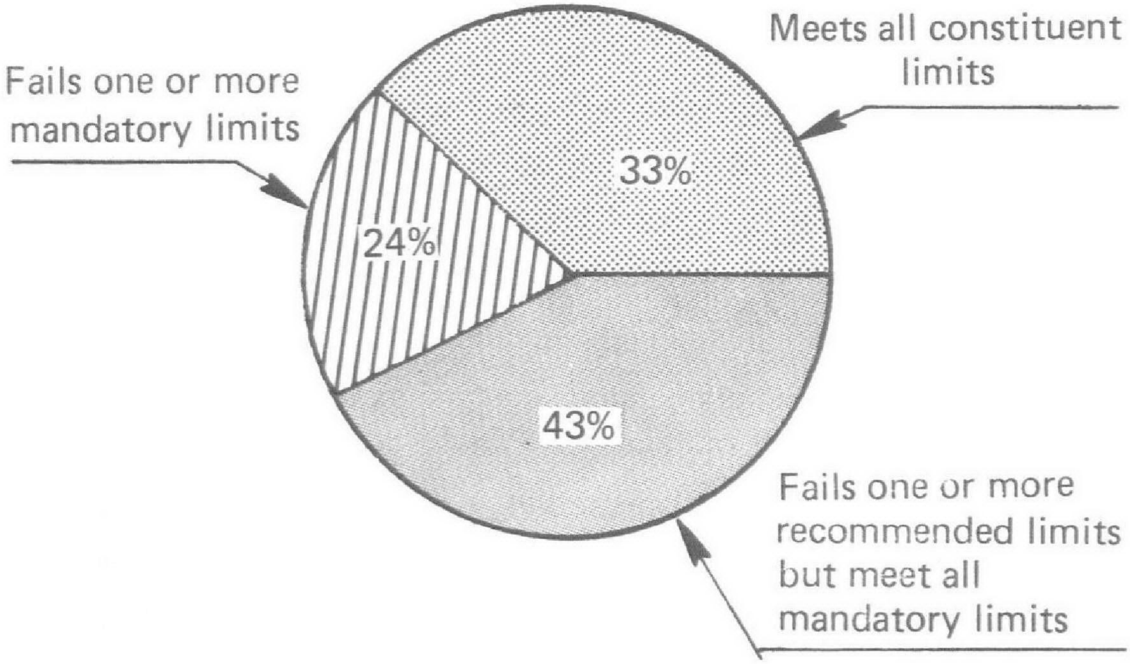
The Environmental Protection Agency recommends that all surface water systems be disinfected and that disinfection be a requirement for ground water systems unless there is a history of satisfactory bacteriological quality. Clarification may also be needed in the treatment process if the turbidity level of the water fails to meet the maximum limit in the Drinking Water Standards (6).

Of the systems studied that used ground water as a source, most (87%) provided no treatment, despite the frequent lack of a good historical record of bacteriological quality. While nearly all systems using a surface source provided treatment, one third relied only on disinfection, which was sometimes inadequate in view of the turbidity found.

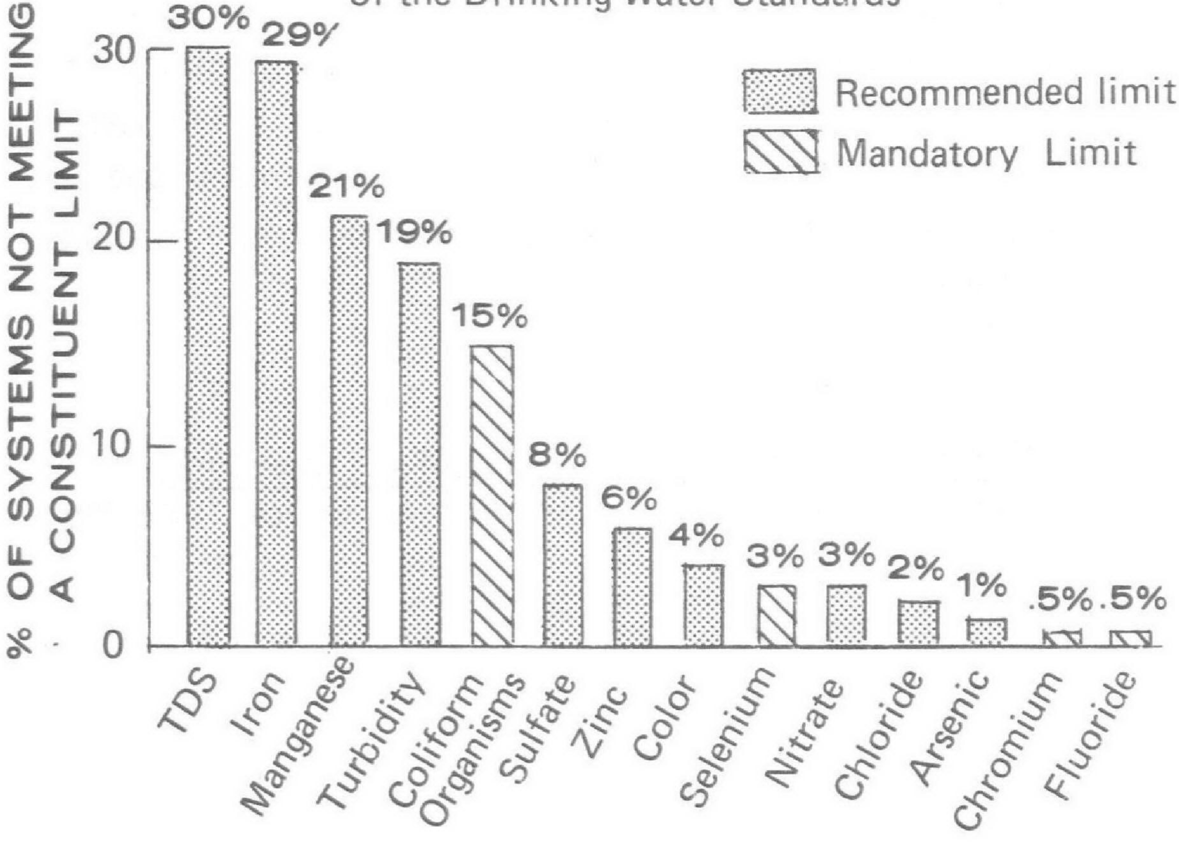
6. U.S. Public Health Service, Drinking Water Standards, Washington, D.C., Government Printing Office, 1962, 6lp.

QUALITY OF WATER SUPPLIED TO THE PUBLIC

System Compliance with the Drinking Water Standards



Systems not meeting a constituent limit of the Drinking Water Standards



SUMMARY OF FINDINGS

WATER QUALITY

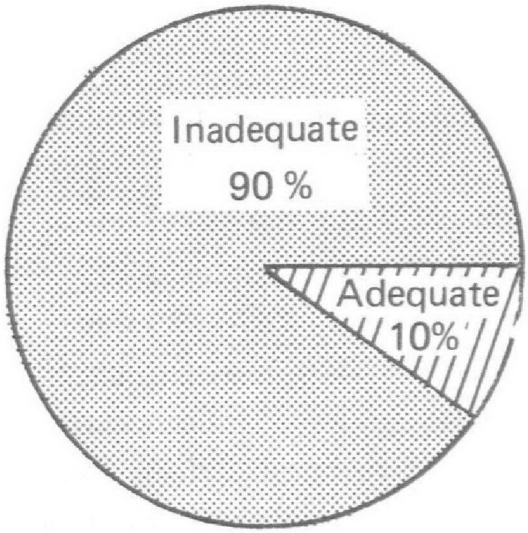
The Drinking Water Standards have been developed to provide a basis to judge the quality of drinking water. They are divided into mandatory standards and recommended standards. The mandatory standards place limits on the numbers of coliform bacteria which may be found in drinking water. Coliform bacteria, while not necessarily harmful in themselves, may indicate the presence of fecal contamination in the water. The mandatory standards also place limits on the concentrations of various chemicals, which, if exceeded may be injurious to health over a period of time.

The recommended standards are primarily esthetic in nature and are divided into chemical and physical characteristics. They relate to materials that impart objectionable taste, appearance, and odor to the water, and are important because a consumer may reject a safe water supply if its taste or appearance is unsatisfactory to him. Excessive turbidity can also interfere with proper disinfection. Therefore, these limits should not be exceeded when a more suitable water source can be made available.

Sixty-seven percent of the 233 water systems in these studies did not meet one or more of the constituent limits of the Drinking Water Standards. Sixty percent did not meet at lease one recommended limit and 24% distributed water which did not meet at least one mandatory chemical or bacteriological limit.

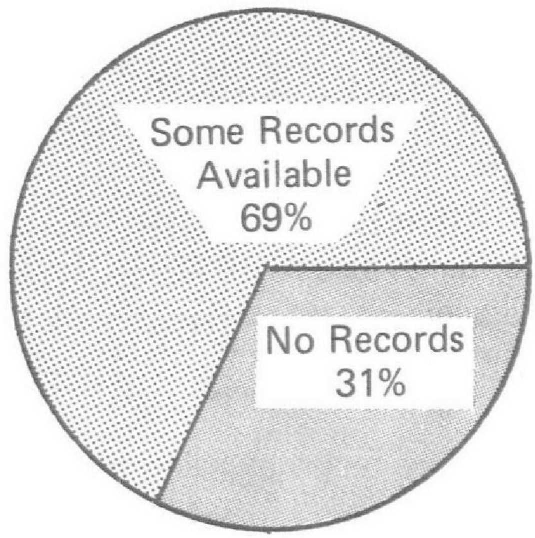
Most of the systems not meeting the Drinking Water Standards used ground water as a source. The most frequent problems found related to excessive levels of iron, manganese, and total dissolved solids. Most of the problems with surface water came from systems using the Colorado River. The problems were a result of the high mineral quality of the river. Five percent of the systems using wells as a raw water source and 16% of the systems using surface water showed coliform contamination.

BACTERIOLOGICAL SURVEILLANCE



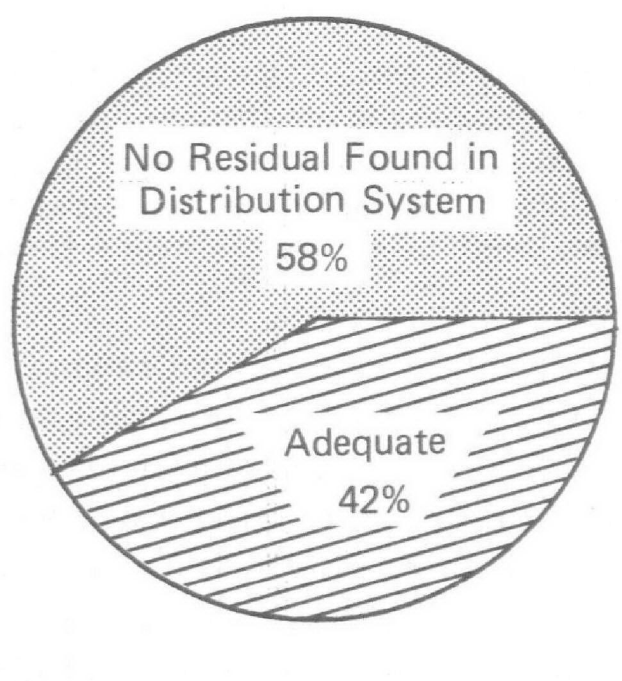
Compliance with
Drinking Water Standards

Existence of any Bacteriological
Records for 12 months
Prior to the Study



ADEQUACY OF CHLORINATION

Where Chlorination was Practiced:



SURVEILLANCE, FACILITIES, AND OPERATION

The bacteriological surveillance of the systems studied varied widely. Only 10% of the systems were sampled frequently enough to meet the Drinking Water Standards. Records could not be found for any bacteriological testing within the preceding twelve months at 31% of the water systems. Of the systems for which some records were available, 24% had bacteriological samples which showed coliform contamination during at least one month within the past year Sixteen percent of the systems showed contamination in two months or more. This becomes even more significant with the realization that only two or three bacteriological samples per year are taken at many of these systems.

Very few of the systems surveyed were subject to routine surveillance. Complete chemical analysis was not made on the water every third year, as recommended by the Environmental Protection Agency, at any of the water systems. Some of the water systems had been sampled for chemical constituents prior to placing the system into operation; however, no samples had been collected afterwards.

The adequacy of the facilities to treat, distribute and to store drinking water was determined by site surveys and interviews with operating personnel.

Operation and control of the water systems studied was generally poor. This was particularly true at the commercial water systems where daily surveillance of the system was not usually conducted. Where chlorination was practiced, daily chlorine residuals were generally not taken and in some cases the chlorination equipment was not operative at the time of survey. Among the systems which practiced chlorination, no residual was found in 58% of the distribution systems.

Source protection throughout the studies was good. Ninety-four percent of the systems were judged adequate. The remaining 6% were judged inadequate with respect to source protection because of a flooded well pit or lack of a sanitary well seal.

Four percent of the water supply systems had pressures of less than 20 psi in the distribution system at the time of the survey. This condition was usually caused by high volume instantaneous water demands on the system.

SUMMARY OF
RECOMMENDATIONS AND CONCLUSIONS

In order to rectify the problems highlighted by these studies, the following general recommendations have been offered:

1. State and County governmental agencies are primarily responsible for the surveillance of the drinking water systems serving the traveling public. These agencies need to devote a higher priority to initiating and maintaining an acceptable program of bacteriological and chemical surveillance and to providing regular sanitary surveys of the water systems. The cost of an adequate surveillance program which would typically include a complete chemical analysis of the water every third year, two bacteriological samples per month and one sanitary survey each year approaches $300 per system.

These agencies should also establish and implement a permit program for water systems serving the traveling public. A permit should be required before any private or public entity would be allowed to provide drinking water to the public.

2. The Federal agencies involved with the construction or operation of drinking water systems need to assure that their regulations and policies include compliance with the Drinking Water Standards. An identifiable organizational unit or specific positions in an existing office should be established at the regional office ana headquarters level of each agency with well defined water supply responsibilities. This group of positions would control the centralized approval of construction plans for new systems and should provide for the monitoring and operational review of all systems. Where water quality problems are indicated, the agency should seek a better source of water and/or provide additional treatment. The agency should make sure that those people responsible for the operation and maintenance of the water systems have the appropriate training to execute their responsibilities.

The Specific Recommendations Of These Studies Are:

1. Disinfection should be a mandatory requirement for all systems using surface water. Other treatment should be employed as necessary to insure that the turbidity level does not fail to meet the limit established in the Drinking Water Standards. Disinfection should be a mandatory requirement for all drinking water systems using ground water unless a history of satisfactory bacteriological sampling and sanitary surveys has been developed. However, disinfection should not be considered as an effective substitute for correcting system deficiencies or for an adequate health surveillance program.

2. Systems failing to meet the mandatory chemical limits should be provided with proper treatment equipment to produce a water meeting the Drinking Water Standards and/or another raw water source meeting these Standards should be found. Systems failing to meet recommended limits should also employ proper treatment or seek another raw water source where economically feasible.

3. Increased attention should be given to improved well construction and to the monitoring of well performance.

4. Cisterns should be replaced by other water systems if at all possible, because of the many avenues of contamination of cistern water.

5. Daily inspection of the chlorine feed equipment and daily records of the chlorine residuals should be maintained.

6. The State or local surveillance agency, or the Federal agency as appropriate, should assure that all persons responsibile for the operation of the water systems are properly trained and qualified.

7. A bacteriological sampling program which will meet the minimum requirements of the Drinking Water Standards should be required at each system.

8. The water from all drinking water systems should be tested for all chemical constituents listed in the Drinking Water Standards before the water is made available to the public. Regular chemical analysis is recommended for all systems.

9. Yearly sanitary surveys and continuing attention to each water system should be provided.

The following recommendations relate to problems that should be considered by appropriate Federal agencies and others having broad water supply responsibilities and interests.

1. The problems inherent in the operation of small water systems at recreational areas are unique. Criteria and standards should be developed for the construction, operation, and health surveillance of small public drinking water systems serving recreational areas. There is a need to reevaluate the bacteriological sampling frequency as required by the Drinking Water Standards for these types of systems.

2. Chlorination as a means of disinfection for small, isolated water systems, has several problems. In order to help rectify some of the problems in disinfection by chlorination, alternative means of disinfection should be reviewed.

3. Since this project is only a pilot study which involved isolated areas, the results indicate the need for further study. This study should be extended to other small water systems to fully assess the ability of these systems to continuously produce safe and esthetically pleasing water.

NOTES