



## Project Summary

# Removal of DBCP from Groundwater, Volume 1, POE/POU Treatment Devices: Institutional and Jurisdictional Factors

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The results obtained from evaluating 10 GAC POE devices show that whereas these GAC units generally function very satisfactorily, their performance can change markedly over short periods of time. These units require conscientious, periodic monitoring. This unit operation requirement was not carried out by the owners or the vendor; the owners generally lack the expertise, and the vendor has no contractual authority or responsibility to monitor the POE GAC units.

Several institutional models exist for achieving the desired degree of supervision and control over individual or small private water systems. Among these are the following concepts that are not necessarily exclusive:

1. Use existing districts or like entities that already have a physical system and personnel.
2. Create through legislative act or through county ordinance, if permitted under state law, a new special water quality district or sub-district for the intended purpose.
3. Numerous other possible models exist including homeowner associations and cooperative organizations.

A third party evaluation of POE/POU treatment equipment to

verify the manufacturers' claims is an important mechanism for providing consumer protection. Such an equipment testing program could be established by legislation and implemented through a state laboratory, or one or more independent testing facilities designated by the state and financed by fees from equipment vendors who wish to market their products within the state would require the certification of specific types of POE/POU treatment devices that can have an adverse effect on consumer health if they do not properly function.

*This Project Summary was developed by EPA's Risk Reduction Engineering Laboratory, Cincinnati, OH, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).*

### Introduction

Providing safe drinking water to residents in areas of low population density is a common problem to many areas in California's San Joaquin Valley. No central water treatment facilities exist for these areas, and the costs associated with the development of central water treatment facilities generally are prohibitive. A water treatment alternative for individual homes in locations without

access to central water treatment facilities is the use of individual treatment installations, commonly known as point-of-entry/point-of-use (POE/POU) devices depending on whether the installation of the treatment device is on the wellhead or at the point-of-entry into the home, or is at the point-of-use such as attached to a particular pipe leading to a faucet, or to the faucet itself. Another drinking water alternative is using bottled water, which at best is an unhandy and inconvenient operation, often falling short of providing an available source of safe and economical water. Of these alternatives, the point-of-entry (POE) devices are the most desirable, but their use for the removal of organic contaminants from drinking water is made particularly difficult for two major reasons: (1) the operation and maintenance requirements for the granular activated carbon (GAC) units; and (2) the units are typically installed on many dispersed wellheads.

Opposition to POE/POU systems, especially in connection with public water supplies, has been voiced by various public health agencies and water service providers. They advance convincing arguments based on their reasoning that too many uncertainties are associated with GAC treatment of water. First, studies have shown that GAC may provide a compatible environment for bacteriological growth and, therefore, the product water from GAC contractors may contain high concentrations of bacteria, their concentration apparently depending on the feed water's temperature, flow rate, and quality. Further, as the carbon in a GAC treatment unit nears exhaustion, increased concentrations of organics may be desorbed from the carbon and appear in the product water.

### **Institutional-Jurisdictional Concerns**

With the consideration of POE/POU devices as a water treatment alternative, numerous institutional, jurisdictional, and technical questions must be resolved. These questions include the following:

1. Determining what agency has responsibility for validating the effectiveness of the POE/POU devices.
2. Identifying what agency has responsibility for monitoring the installation and use of the POE/POU devices.
3. Determining what institutional arrangement is desirable for

ownership and operation of the POE/POU devices.

4. Identifying who has responsibility for consumer related issues including advertising practices.

### **Design Considerations**

Evaluation of unit design must also consider this operation characteristic in view of the chemical matrix to be applied to the GAC contractor. Substantial competition for adsorption sites by the contaminants of concern and other organics in the source water, large hydraulic loading, moderate to poor adsorption to the GAC by the contaminant(s) of interest, and significant exhaustion of the GAC bed all contribute to penetration of the mass transfer zone into the carbon bed and earlier than anticipated breakthrough of detectable amounts of contaminant from the bed. Bed volume and depth must be sufficient to contain the mass transfer zone for the expected design life of the GAC unit. This is a function of the adsorptive characteristics and rate of application of the chemical matrix to be applied to the GAC unit. The hydraulic loading rate must be constrained to a level allowing sufficient time for adsorption of the contaminant(s) by the GAC. This can be accomplished by equipping each GAC unit with a flow constrictor. Bacterial growth on the GAC or the water quality of the source water may contribute to rapid clogging of the GAC unit. This requires consideration of the need for pretreatment of the source water before its application to the GAC unit, and the need for disinfecting the treated water. Without a continuous monitoring program, exhaustion of a GAC bed cannot be expeditiously determined. Consequently, isotherm data and pilot testing data are needed that are representative of the chemical matrix and GAC specific to the application of each POE unit. With this knowledge, the theoretical bed life can be calculated, a suitable safety factor applied to reduce the expected life of the GAC unit (in terms of the recommended volume of source water applied to the unit), and an automatic cutoff valve installed to inactivate the unit when this predetermined volume of water has been applied to it.

### **Fresno Area Study**

The study entailed the investigation of the removal of a selected pesticide from well water using GAC adsorption. Dibromochloropropane (DBCP) is a common contaminant in the

groundwaters on the eastern side of San Joaquin Valley because of previous widespread application of a chemical control for nematode infestations of vineyards and other crops. Therefore, DBCP was selected as target chemical for this study.

Ten existing private wells southeast of Fresno were monitored. These wells were located in an area where extensive farming had been practiced. All of the wells were equipped with POE (point-of-entry) water treatment units. Institutional/jurisdictional arrangements were also explored to identify feasible means of providing guidance for the selection, operation, and maintenance of POE (point-of-entry) units to ensure the provision of safe water to the consumer.

### **Results and Conclusions**

Central water treatment is preferred alternative over POE/POU installations and should be given priority consideration whenever technically and economically feasible.

The costs for the construction and operation of water treatment systems generally vary inversely with the size of the system. The cost for GAC treatment using POE devices is particularly expensive with added representation costs ranging from \$3.00 to over \$5.00 per 1,000 gal of treated water.

An operational and maintenance problem often not considered with POE/POU GAC units is the ultimate disposal of the spent carbon material. An operational protocol must address this problem and provide for the proper handling and disposal of the spent carbon in accordance with applicable hazardous waste regulations.

Because of colonization of some primary and opportunistic pathogens on GAC, and the high concentrations of bacteria found at times in the product water from the POE GAC units, these devices are best used on waters that meet the bacteriological standards for drinking water. Post-disinfection should be considered following POE/POU treatment for waters having questionable bacteriological quality.

POU units should be used with great caution. While POE units can be designed to reliably and effectively remove organic contaminants over an extended period of time, the small physical dimensions of POU units often does not lead to safe application. POU units tend to be mass marketed and the purchaser is not expected to possess the sophistication to determine if the POU

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unit is suitable for the intended application.

Results obtained from monitoring 10 POE GAC installations indicated that the unit performance can change markedly over short periods of time. Therefore, these types of devices require conscientious periodic monitoring. It was found that this unit operation requirement for monitoring and maintenance was not being carried out by the owner nor the vendor; an owner generally lacked the expertise, and the vendor had

no contractual authority or responsibility to monitor the POE units.

Several models exist for achieving the desired degree of supervision and control over individual or small private water systems. These include using existing districts or like entities having an adequate physical system and sufficient personnel, or the creation through legislative act or county ordinance of a special water quality district for the intended purpose. Examples of existing jurisdictional bodies suitable for

administering POE/POU unit programs are counties, towns, public or private water service districts, irrigation districts, community service districts, and sanitation districts.

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The complete report, entitled "Removal of DBCP from Groundwater, Volume 1, POE/POU Treatment Devices: Institutional and Jurisdictional Factors," (Order No. PB 89-198 808/AS; Cost: \$15.95, subject to change) will be available only from:

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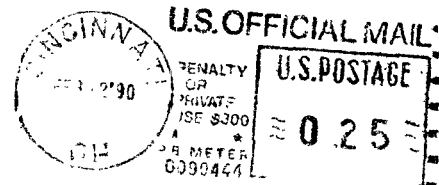
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