United States
Environmental Protection
Agency

Risk Reduction
Engineering Laboratory
Cincinnati OH 45268

Research and Development

EPA/600/S2-89/027 Feb. 1990

EPA

Project Summary

Point-of-Entry Drinking Water Treatment Systems for Superfund Applications

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The U.S. Environmental Protection Agency (EPA) and State Superfund agencies need a technical assistance manual to assist their personnel in the selection of an effective drinking water treatment system for individual households in areas where the drinking water has been adversely affected by Superfund site contaminants and no other alternative water supply is available or feasible. Commercially available water treatment systems for individual households are of two basic types: point-of-use (POU) and point-of-entry (POE). A POU device consists of equipment applied to selected water taps to reduce contaminants at each tap. A POE device consists of equipment to reduce the contaminants in the water distributed throughout that structure.

This study was initiated to collect monitoring, operation and maintenance, performance, and design data on existing Superfund POE water treatment systems. Evaluation of the collected data showed that existing data are not sufficient for the preparation of a technical assistance document to meet the objectives of EPA and State Superfund personnel.

There is a need for additional study to develop a technical assistance document. Because most of the existing data and field experience related to POE water treatment is concerned with granular activated carbon filters and air strippers for the treatment of organic contaminants, the authors recommend that further detailed study center around these two technologies.

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

Point-of-entry (POE) systems can take a variety of forms, entail the use of various technologies, and be used either singularly or in combination to address numerous water quality problems. Generally, the three contaminant categories of concern are organic compounds, inorganic compounds, and microbiological agents. The most common POE systems for removal of organic chemicals involve the use of granular activated carbon (GAC) and/or aeration. Those used for removal of inorganic contaminants can involve reverse osmosis (RO) or deionization (DI). Systems used to eliminate microbiological agents may include filtration (through ceramic filters), chemical disinfection, and ultraviolet (UV) irradiation.

When properly selected, operated, and maintained, POE systems can be both effective and safe. Often, the operation and maintenance of installed units is critical to health protection. For example, GAC filters can act as a growth medium for bacteria. In some cases, water being treated with GAC may also require some type of disinfection (e.g., UV irradiation).

Superfund-financed POE water treatment systems have been installed on individual household wells in which the well water has been contaminated with

toxic compounds from a Superfund site. These installations have been made on a case-by-case basis depending on the ability and resourcefulness of the persons involved.

This report presents the findings of the study to evaluate POE water treatment systems for Superfund applications. It involved an assessment of the status of currently operating POE systems at Superfund or comparable sites and the collection and evaluation of available operating, performance, and design data for these systems. Based on this assessment, recommendations are made concerning the development of a technical assistance manual.

Data collection consisted of contacting EPA Regional Superfund offices to identify sites where POE treatment is being used. Several State and local agencies also were contacted to obtain information related to State-supervised POE system installations. The available information consisted of monitoring data, system descriptions, some system design details, and operation and maintenance practices. Several suppliers/manufacturers of the POE treatment systems also were contacted to obtain information on the design and operation of their systems. Data on GAC filter systems and aeration systems were obtained from these sources.

Conclusions

Data collection activities resulted in the following general findings:

- Existing Superfund applications of POE treatment systems are primarily located in EPA Regions 2, 3, and 5.
- State and local agencies in Florida, Maine, New York, and New Jersey are also applying POE water treatment at sites with types and levels of contaminants similar to those found as a result of Superfund site contamination.
- The application of POE treatment has occurred primarily at sites where organic contamination (i.e., chlorinated solvents, pesticides, and petroleum products) has affected drinking water supplies.
- Granular-activated-carbon (GAC) filters and air stripping are the two most common POE technologies used for treating organic contaminants.
- The use of GAC filters, either single units or two units in series, is successful in treating water contaminated with chlorinated solvents and pesticides.
- Air stripping, either diffused or packed-tower aeration, is more effective than GAC for treating water contaminated with petroleum products.
- In some cases, air stripping is used to pretreat water with elevated levels of solvents before the water passes through a GAC filter. This is done to extend the effective life of the carbon filter.
- On individual wells in which radon contamination is a problem, POE treatment by air stripping is being used.

Most of the existing Superfund applications of POE water treatment were identified during this phase of the study. Some information relative to system design and operation was identified; however, the level of detail of the design information (i.e., unit specifications) is somewhat lacking. System suppliers and designers have been either reluctant or unable to provide the type of information needed.

In most cases, no quality control (QC) data on the analytical data obtained during Phase I were available, including test methods, protocols, and QC samples. Some samples were analyzed by field gas chromatographs to determine the presence or absence of contaminants. Although these data are useful for determining contaminant exposure, they may not provide the level of confidence required for the development of a technical assistance document.

Recommendations

Although the POE systems being applied at Superfund or comparable sites are capable of effective treatment of the contaminants of concern, the design, development, operation, maintenance, and monitoring of these systems varies from site to site. There is a need for additional study to develop a technical assistance document. Because most of the existing data and field experience related to POE water treatment are concerned with GAC filters and air strippers for treatment of organic contaminants, it is recommended that further detailed study center around these two technologies for treatment of organics.

The document user may need specific guidance on the following technical issues:

- Design flow requirements for operating the POE system.
- Sampling points of interest for t POE treatment systems.
- Design life of activated carbon the contaminants of concern.
- Effect of contaminant mixtures carbon life.
- Cost-effectiveness of changing a tivated carbon frequently versu sampling and analysis to monitor f breakthrough.
- Design considerations for spac restrictions in homeowner basements.
- Minimum contact time for raw wat with GAC or air stripping systems.
- Properties of activated carbon crit cal to designing a POE treatme system (e.g., pore size, carbo mass, particle size).
- Ground-water constituents that a fect GAC filter or air stripper effec tiveness or operation (e.g., dis solved solids, pH, heavy metals hardness).
- Spent carbon disposal practices.

The full report was submitted in fulfill ment of Contract No. 68-03-3413 by PE Associates, Inc., under sponsorship of th U.S. Environmental Protection Agency.

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The complete report, entitled "Point-of-Entry Drinking Water Treatment Systems for Superfund Applications," (Order No. PB 89-195 010/AS; Cost: $15.95, subject to change) will be available only from:
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