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Water Engineering Research
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# Project Summary

# Forecasting Onsite Soil Absorption System Failure Rates



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**Reviews were made of four statistical studies of onsite soil absorption system failure rates in four different areas of the United States. From this data base, a series of forecasting techniques were developed with varying levels of accuracy. The techniques are intended for use by facility planners in evaluating the costs of alternative plans for pollution abatement in small communities. The required input data and level of accuracy expected for each forecasting method are also provided along with the assumptions made in development and testing of the models against available data.**

***This Project Summary was developed by EPA's Water Engineering Research 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

This project was undertaken to provide small community wastewater facility planners with appropriate tools for assessing the total life-cycle costs of onsite wastewater disposal options so that the latter can be compared with other alternatives for abating water pollution or public health hazards. No guidance of this type has previously been available to facility planners. As a result, techniques of cost-effective analysis have been variable and often inadequate for small communities where the status quo and partial sewering options are evaluated against total community sewerage and centralized treatment and disposal.

## Procedures

A comprehensive literature search was conducted for analyses of failures of onsite soil absorption systems. This search yielded four excellent analyses performed in Acton, Massachusetts, Fairfax County, Virginia, Glastonbury, Connecticut, and Malibu and Topanga, California. The methods used in these studies were analyzed for their utility in developing a useful array of forecasting methods.

A rational approach was developed by first using linear regression on 14 individual cohorts. Some statistical attempts were then made to determine whether significant differences could be found between specific-year failure rates in an individual cohort. An attempt was also made to determine why individual cohorts exhibited significant differences. Community or study area failure rates were also compared.

The models were developed from past failure rate information and used to estimate future failure rates. The use of the models in the facility planning process was then delineated in a step-by-step manner, and an example was presented.

## Results

Evaluation of previous failure analyses indicated that except for potentially higher failure rates during the initial years, the rate was generally the same in each subsequent year up to 30. Newer codes generally reduced failure

rates, and system longevity was primarily a function of how well soil types and code requirements were matched. Larger systems in a given soil tended to last longer.

The simple model that best matched the available failure data is:

$$F = b_1 + b_2 A = b_3 E$$

where: F = failure rate (number/year)
A = age of system (years)
E = early failures (use value of 1 for ages <1-5 years)
$b_n$ = coefficients estimated from data

## Conclusions

1. The best compromise between accuracy and usefulness in forecasting onsite soil system failure rates is the use of the cohort raw failure rate approach described and demonstrated here. The reason is that it allows the forecaster to evaluate code changes, soil differences, and management method shifts.
2. The next best approach is the use of raw failure rates as an annual average during the planning period. However, this method fails to account for major categories of changes or differences that can significantly influence future failure rates.
3. More complex methods may be feasible if sufficient data are available, but the cost of gathering these data and the complexity of the analyses are not generally justified for rural communities.

## Recommendations

1. Rational failure forecasting methods should be applied to all small community facility planning alternatives that involve either continued use of existing onsite wastewater disposal systems or installation of new ones.
2. Application of the developed failure forecasting method (or more complex methods) is recommended as a prerequisite for any community contemplating a major revision in their onsite system codes. The forecasting method provides a basis for that decision and for a review of the revision at a later date.

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***James F. Kreissl** is the EPA Project Officer (see below).*
*The complete report, entitled "Forecasting Onsite Soil Absorption System Failure Rates," (Order No. PB 86-216 744/AS; Cost: $11.95, subject to change) will be available only from:*
*National Technical Information Service*
*5285 Port Royal Road*
*Springfield, VA 22161*
*Telephone: 703-487-4650*
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