A Survey of Small Sewage Treatment Facilities in Ohio[1]

KAREN MANCL, Department of Agricultural Engineering, The Ohio State University, Columbus, OH 43210

ABSTRACT. **In 1987, a small sewage treatment facilities survey was conducted of all county and local health departments in Ohio. The objectives were to learn how local sewage treatment facilities programs are managed, the types of systems in use, the numbers of permits issued, and the number of systems that are failing. The survey results indicate that urban areas in Ohio have the largest health departments and had over 13,000 permits issued in 1986 which accounted for the greatest number of permits. Site evaluation procedures varied greatly across the state. In 25 counties, permits were issued without a visit to the site. Sanitarians estimated that 27% of the septic systems are failing. Aerobic systems are used heavily in Ohio, while alternative systems have limited use. To address the problems of failing systems and unsuitable sites for septic systems, more information is needed at the county level about alternative sewage systems and on-site system management.**

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INTRODUCTION

Close to one million homes in Ohio are located in areas not served by a public sewer system (Bureau of Census 1983). Homeowners in rural areas must treat the 50 to 100 gallons of wastewater generated per person per day on the lot through the use of a septic system or some other type of on-site sewage treatment system.

Septic systems are the most common type of on-site sewage treatment system. Sewage from the home enters a septic tank where the solids and greases are allowed to separate from the wastewater and are retained in the tank. The clarified wastewater then flows into a soil absorption system. A typical soil absorption system consists of a series of perforated pipes, buried in a layer of gravel 6 - 18 inches below the ground surface. The septic tank effluent is distributed beneath the soil surface through the perforated pipes and is absorbed into the soil for treatment and disposal (US EPA 1980).

The use of septic systems is limited by the characteristics of the soil and the lot. The site limitations are fully described in the Ohio Administrative Code (1988) in Chapter 3701-29. In Ohio, a minimum of 4 feet of soil is required between the soil absorption system and either bedrock or groundwater. The rate at which water is absorbed by the soil can also restrict the use of septic systems. In Ohio, the soil must have a percolation rate of between 3 and 60 minutes per inch to be suitable for septic systems. This rate can be measured with a percolation test (Machmeier 1985). The slope of the lot cannot exceed 15%, and the lot must be sufficiently large to provide area for the septic tank, the soil absorption system, and future replacement of the soil absorption system, and to provide setbacks from wells, ponds or streams, and lot boundaries.

If the lot is not suitable for a septic system, alternative on-site systems can be used to treat wastewater. The Ohio Administrative Code (1988) has provisions for the use of sand filter systems and aerobic systems for on-site treatment.

Mound systems can be used to treat septic tank effluent in areas with thin soils or a high percolation rate. In a mound system, a special sand fill is used to augment the natural soil in wastewater treatment (Converse et al. 1977). Unfortunately, the use of mound systems is not included in the Ohio Administrative Code and, therefore, its use is limited in Ohio to that of an experimental system, requiring a variance for installation.

A variation of the typical soil absorption system to treat septic tank effluent was introduced in Ohio in the early 1980s. The use of large diameter cloth covered pipe was proposed to replace the gravel used in soil absorption systems (Barnes 1981). These systems are called gravelless systems.

In Ohio, the discharge of sewage is regulated by the Ohio Environmental Protection Agency as stated in Section 6111.04 of the Ohio Revised Code (1988). The only exception to this is listed in subsection F which exempts septic tanks and other disposal systems serving single-family, two-family, and three-family dwellings. The discharge of untreated sewage from a private residence is considered a public nuisance, and is under the jurisdiction of the local Board of Health as specified in Sections 3707.01, 3709.20, and 3709.21 of the Ohio Revised Code. The Ohio Board of Health has adopted minimum standards for on-site sewage disposal in Chapter 3701-29 of the Ohio Administrative Code (1988). However, local boards of health can adopt more stringent standards.

Little information has been documented about the use of septic systems and alternative wastewater treatment systems in Ohio. In 1987, a survey was conducted of all county and local health departments in the state to gather information about small sewage treatment facilities. The objectives were to determine how local health departments were managing their sewage treatment facilities program, and to ascertain which alternatives were being used for sites not suitable for septic systems. Estimates were also obtained of the number of permits issued for septic systems in 1986 and of the number of septic systems which are failing to operate in the state.

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MATERIALS AND METHODS

A 16-question survey was prepared using the procedure described by Dillman (1978). The 6 x 8-1/2 in. questionnaire booklet consisted of a front cover with an illustration of a home with a septic system and 11 pages of multiple-choice and fill-in-the-blank questions. Prior to distribution, the questionnaire was tested by four former county sanitarians to insure that the questions were clear and appropriate. The complete questionnaire is available from the author.

Following Dillman's technique, the surveys were distributed to all 88 county and 67 city health departments through a four-part mailing. The first mailing contained a personally addressed and signed cover letter, the questionnaire booklet, copies of new Ohio State Extension Service publications on septic systems, and a pre-addressed and stamped return envelope. After 10 days, a reminder postcard was sent to all who did not respond to the first mailing. Two weeks later a second personally addressed and signed letter, the questionnaire booklet, and return envelope were sent to all who did not respond. Finally, one week later, a second reminder postcard was sent to all who had not responded.

RESULTS

In total, 82 (93%) of the county health departments and 53 (79%) of the city health departments responded to the survey. The response to the first mailing was only 29%. By simply sending the first reminder postcard, the response was raised to 46%.

Twenty-four city health departments indicated that they were operating a small sewage treatment facilities program. The cities of Cincinnati, Columbus, Toledo, and Akron, as well as a number of medium and small communities, are included in this group. These communities are depending on as many as 6,500 on-site sewage systems for wastewater treatment. One city health department issued as many as 490 permits in 1986. Permit fees ranged from nothing in four communities to $75 in one. The median fee was $20.

The management of small sewage treatment facilities programs in Ohio rests primarily in the hands of the county health departments. County health departments range in size from 1 to 30 full-time sanitarians with as many as three part-time sanitarians (Fig. 1). The average

FIGURE 2. Number of septic system permits issued by county health departments in 1986.

FIGURE 1. Number of full-time sanitarians in county health departments.

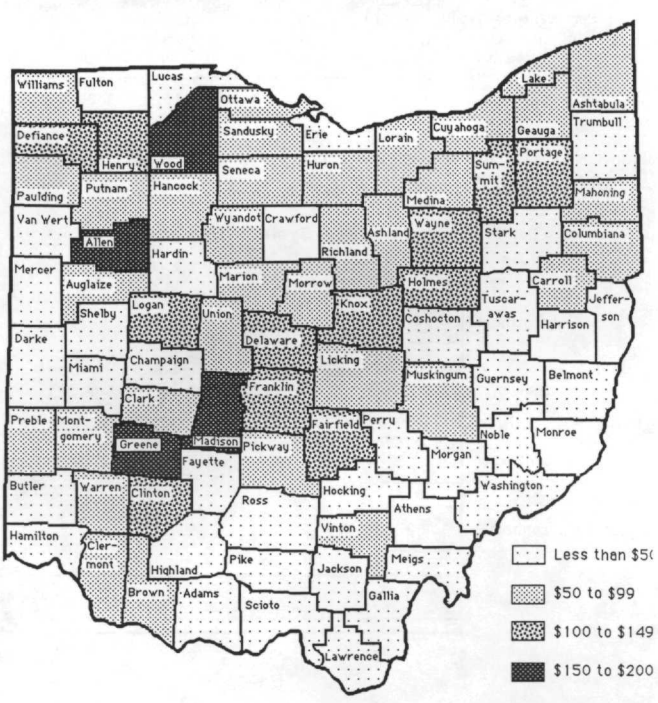

FIGURE 3. Fees for permits issued by county health departments in 1986.

number of sanitarians is four. The most common number of sanitarians for a county health department is two (23 health departments have two sanitarians).

The 82 (93%) health departments issued a total of 13,136 permits in 1986. The number of permits ranged from 25 for one county to 548 for another (Fig. 2). Thirty-five (43%) of the counties indicated that this was a normal year. Fewer than the normal number of permits were issued in 10 (12%) counties, and more than the normal number were issued in 26 (32%) counties. The remaining 11 counties (13%) were not able to judge if a normal number of permits were issued in 1986.

Fees for permits ranged from $15 to $200 (Fig. 3). The average permit fee was $60. The most common fee of $50 was charged by 15 (19%) of the counties, followed by $25 charged by 14 (17%), and $100 charged by 11 (14%) of the counties. For this fee, 74 of the counties (90%) provided site and soil evaluation, 63 (77%) provided system design, and 77 (94%) provided installation inspections. Only nine (11%) counties conducted periodic inspections, one county provided sample analysis, and six counties provided other services.

Site and soil evaluations were conducted by the sanitarian in 57 (69%) of the counties, a team including the sanitarian in 17 (21%), and by someone other than the sanitarian in seven (9%) of the counties. Percolation tests were used as a part of the site and soil evaluation in 17 (21%) of the counties. Examination of the soil profile was used in 49 (59%) of the counties, and soil surveys were used in 49 (59%) of the counties. Twenty-three (28%) of the counties relied on the soil survey alone (Fig. 4).

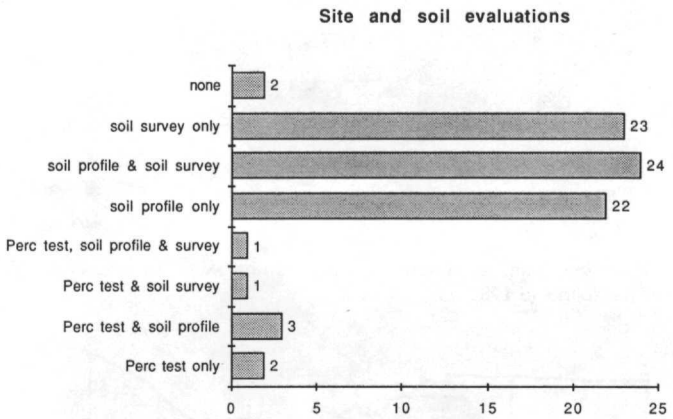

FIGURE 4. Site and soil evaluation procedures used by county health departments in 1986.

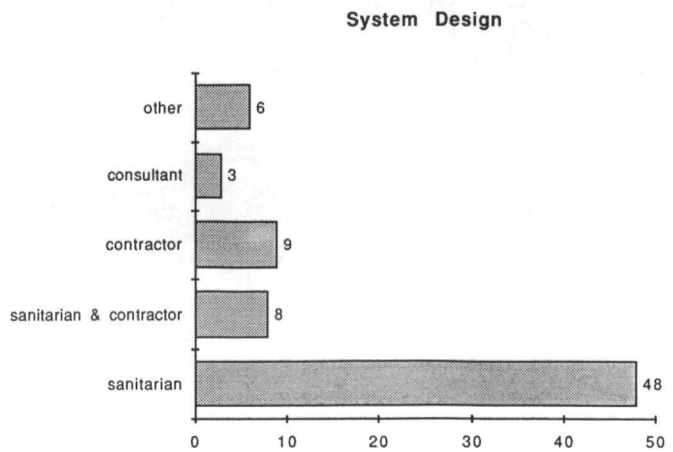

FIGURE 5. Individuals designing septic systems in Ohio's counties in 1986.

System designs were developed solely by the sanitarian in 48 (58%) of the counties, and solely by the contractor in nine (11%) of the counties. A team of the contractor and sanitarian designed the systems in eight (10%) of the counties. In nine (11%) of the counties, someone else, such as a consulting engineer or soil scientist, designed the systems (Fig. 5).

The exact number of on-site sewage systems actually in use in some areas of Ohio is difficult to determine. Forty-three (53%) of the counties responding were not sure how many on-site sewage systems were being used in their county. The responses ranged from 500 to 37,000 systems per county. Forty-five (56%) of the counties responding were not sure how many septic tank-soil absorption systems were being used in their county. The responses ranged from 400 to 30,000 systems per county.

The use of alternatives to the traditional septic system was measured in the survey. Seventy-nine (96%) of the counties are currently using aerobic systems for wastewater treatment. Reporting authorities in 20 counties (24%) were not sure how many aerobic systems were in use. Estimates of 3 to 5,000 were reported in 58 counties (71%) (Fig. 6). Of the 12 brands of aerobic systems approved for use in Ohio (1987 approved list in Appendix A), 10 are reported to be in use in at least one county in Ohio. Jet systems were, by far, the most widely used (71 counties or 87%), followed by Norweco (32 counties or 39%), Oldham (26 counties or 32%), and Multi-flo (25 counties or 30%) (Fig. 7). Gravelless systems have been used in many Ohio counties. Fifty-three (65%) of the counties reported from one to as many as 100 systems installed

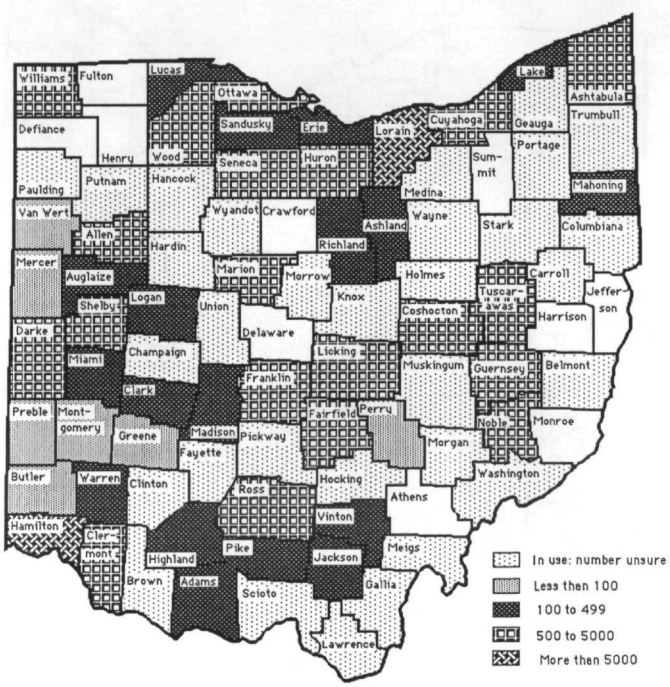

FIGURE 6. Counties with aerobic systems.

(Fig. 8). Sand filter systems are being used in 52 (64%) of the counties, primarily to filter aerobic system effluent. While authorities from 21 counties (26%) were not sure how many sand filters were being used, others reported from three to 5,000 in use. Twenty-two counties (27%) reported the use of mound systems for wastewater treatment (Fig. 9). System numbers ranged from one to 100. Ten counties (12%) listed other alternative systems in use. These included dry wells, evapotranspiration systems, and waterless toilets.

State-wide, the sanitarians who responded estimated that 27% of the septic tank-soil absorption systems were failing. Two counties in western Ohio estimated that more than 90% of the systems were failing. Seventeen counties believed that less than 10% were failing in their county.

Failure to pump the septic tank (60 counties or 73%) and slowly permeable soil (70 counties or 85%) were the primary reasons for septic system failure listed by the sanitarians responding. High groundwater table (39 counties or 48%) and inadequate design (28 counties or 34%) were also listed as important reasons. Physical damage to system (13 counties or 16%) and poor construction (16 counties or 20%), along with other reasons (10 counties or 12%), were less important.

Several concerns were identified with the operation of alternative systems. The most common problem (71 counties or 87%) listed with aerobic systems was inadequate maintenance (pump and motor maintenance). Next (65 counties or 79%) was improper operation (turning system off or using too much water). Ten counties (12%) reported inadequate design (too small) as a problem, and 11 counties (13%) listed poor construction as a problem with the use of gravelless systems. Seven counties (9%) felt that improper operation (using too much water) and physical damage to the system were common problems with gravelless systems. For sand filters, 20 counties (24%) reported problems with inadequate design and poor construction. Fourteen counties (17%) indicated problems with improper operation and 13 (16%) with physical damage to the sand filter. For mound systems, 10 counties (12%) reported problems with improper design, inadequate design, and poor construction.

Failure to pump tanks was listed as a problem for every alternative system. This was listed as an important problem in 32 counties (39%) for aerobic systems. Eight counties (10%) indicated that failing to pump the septic tank was a common problem with gravelless systems. Failure to pump the septic or aerobic tank was listed as a common problem in 42 counties (51%) for sand filters. Eight counties (10%) indicated failure to pump the septic tank as a problem for mound systems.

While treatment of wastewater from more than one home is not the responsibility of the local health depart-

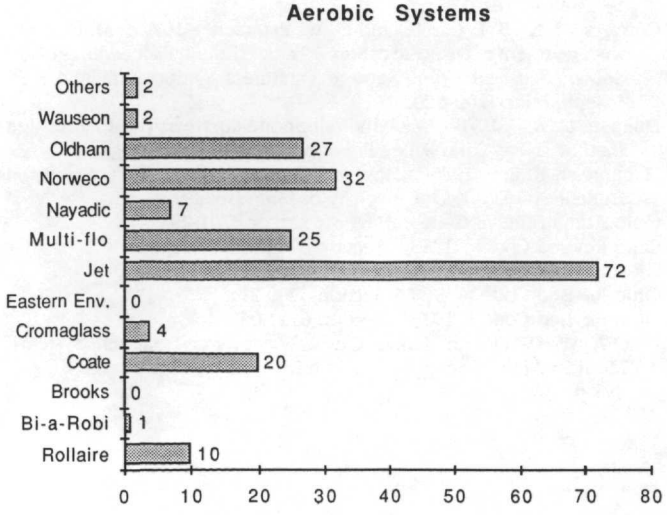

FIGURE 7. Aerobic systems used in Ohio's counties in 1986.

FIGURE 8. Counties with gravelless trench systems.

FIGURE 9. Counties with mound systems.

ment, many had information to share on treatment plants that serve a small number of homes. State-wide, sanitarians reported that small treatment plants were being used for 379 housing developments, 418 trailer parks, 1,753 shopping centers and businesses, 386 office and industrial parks, 264 camps and recreational areas, 298 schools, and 781 other areas. Several individuals or groups were listed as responsible for these small systems. In many counties (30 or 37%) more than one was listed. The majority of the counties (66 or 80%) reported that the owner was responsible for these small systems. The county engineer's office was responsible in 23 counties (28%), and a sewer authority was responsible in 14 counties (17%). Some other authority was indicated in 17 counties (20%), with the Ohio Environmental Protection Agency given as a frequent response.

In Ohio, each wastewater treatment plant must have a permit for stream discharge. The discharge permit lists maximum levels of 5 day BOD, suspended solids, fecal coliforms, and other contaminants allowed in the effluent. Many sanitarians (33) could not estimate the percentage of small treatment plants meeting effluent requirements in their county. Thirty-six reported that at least 50% of the plants were meeting their effluent requirement, while 12 felt that less than 50% were able to meet their requirement.

DISCUSSION

The largest county health departments in Ohio are in the urban areas of the state. The urban areas also accounted for the greatest number of septic system permits in 1986. No pattern has yet been identified to describe the septic system permit fees charged by health departments.

Local sanitarians conduct site evaluations and design septic systems in most of Ohio. The percolation test was only being used in 17 (21%) of the counties in 1986. In 25 counties, permits are issued without a visit to the site.

There does not appear to be an accurate estimate of the use of septic systems for Ohio. Over half (56%) of the counties responding were not sure how many systems were in use in their county. Since the local health department has sole jurisdiction over sewage systems for single-family, two-family, and three-family dwellings (Ohio Revised Code 1988), it will be difficult to obtain an accurate accounting from another source.

If the health department estimates are accurate, only 27% of septic systems are failing in Ohio. Poor soils and inadequate maintenance were considered the causes for the failures. Rural homeowners in Ohio were relying heavily on aerobic systems for wastewater treatment when a septic tank-soil absorption system cannot be used. Improper operation and lack of maintenance were considered the leading causes for aerobic system failure.

Alternative systems have been tried in Ohio, but were not widely used. Gravelless systems were first marketed in 1981 (Barnes 1981) and have been tried in 53 of the counties responding. Mound systems, which were first developed in the early 1970s (Converse et al. 1977), have been tried in 21 of the counties responding.

CONCLUSIONS AND RECOMMENDATIONS

The findings of this survey show the inconsistent nature of the regulation of on-site systems in Ohio. Resources, such as staff and revenues, permit procedures, and the use of alternative systems, vary greatly across the state. Larger health departments with more activity in awarding permits are found in the more urban areas of the state, but that pattern does not carry over into increased services or experimentation with alternative systems.

Health officials at the local level need more information concerning on-site wastewater treatment and alternative systems. Information on treatment systems should enhance system design and encourage the use of alternative systems. State agencies, professional organizations, and universities will be important in filling the information needs. The state regulations provide a guidance document for the local small sewage treatment facilities programs in Ohio. The Ohio state regulation on home sewage disposal needs to be updated to include the latest information on septic systems and alternatives.

The management of the small sewage treatment facilities program presents tremendous opportunities and challenges for researchers, teachers, and regulators as Ohio moves into the 1990s.

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Ohio Revised Code 1988 Section 3709.20.

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Appendix A

Manufacturers of Individual Aerobic Wastewater Treatment Plants Approved by the Ohio Department of Health January 1987

Aquarobic Limited
171 Roberts Street, E.
Penetanguishene, Ontario, Canada LOK 2PO

Ashland Vault, Inc.
500 Virginia Ave.
Ashland, OH 44805

Bi-A-Robi Systems, Inc.
P.O. Box 133
Hamlin, PA 18427

Coate Burial Vault, Inc.
P.O. Box 159
West Milton, OH 45383

Cromaglass Corporation
P.O. Box 3215
Williamsport, PA 17701

Jet, Inc.
750 Alpha Drive
Cleveland, OH 44143

Multi-Flo Waste Treatment Systems, Inc.
2324 East River Rd.
Dayton, OH 45439

Nayadic Sciences, Inc.
R.D. #4, P.O. Box 235
Clarks Summit, Pa 18411

Norweco, Inc.
220 Republic Street
Norwalk, OH 44857

Robert R. Oldham, Inc.
P.O. Box 197
Sidney, OH 45365

Wauseon Silo Co.
P.O. Box 394
Wauseon, OH 43567

Ziegler-Hopkins Co.
#3 McNulty Drive
Manchester, MO 63011