# WHAT LEVEL OF MAINTENANCE FOR ON-SITE DOMESTIC WASTEWATER SYSTEMS?

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## Abstract

Septic tank systems are the most common type of on-site wastewater system used where sewerage services are not available. Maintenance of the septic tank system is essential to ensure the integrity of the system, its long term use, thereby minimising opportunities for failure. Failing septic tank systems do cause public health and environmental concerns. An effective monitoring and maintenance program is necessary and must be supported by legislation. A regular inspection system, together with the development of operation and maintenance guidelines, will assist the property owner with the management of their system. Councils will need to introduce a licensing and management system, undertake community education and support the training of personnel involved with monitoring and inspection.

## Keywords

aerated wastewater treatment systems, inspection, maintenance, septic tank,

## 1 Introduction

The on-site system most often used in Australia, as in other countries, has been the septic tank soil absorption system or, as it is commonly referred to, 'conventional septic tank system'. It became the basic system for unsewered development for both domestic and non-domestic premises.

The growth in the use of the septic tank system has occurred over the past 50 years due to rapid urbanisation in metropolitan and country areas. The lack of reticulated sewerage to provide for these developments has meant the septic tank system was used as a temporary measure until such time as sewer could be provided. This catch up has not always occurred, as a result failing systems have too often become commonplace. There are many reasons why these systems are failing such as; age of system, inadequate design, etc. However the 'out of sight, out of mind' approach has also been a significant feature to the problem.

A septic tank system correctly designed, installed, operated and maintained provides a long term system for the treatment and disposal of wastewater. However, failing systems can give rise to surface seepage and cause pollution to ground and surfaces waters and present risks to public health and the environment.

It is estimated there are over two million septic tank systems serving households in Australia (Patterson, 1993).

This paper will address the issue of maintenance as it applies to septic tank systems. While alternative on-site technologies have been introduced in the past 16 years, the aerated wastewater treatment system (AWTS) is the main system, at present, competing with septic tanks. A brief account of the AWTS maintenance issue will be made further in the paper.

## 2 Identifying the Problem

Local government officers know only too well the specific problems of septic tanks in their area. Many reports have no doubt been written about septic system failures. The comprehensive study by Kinhill (1998) into effluent and disposal in the Caboolture Shire Council in Queensland provides

valuable information about systems in that area. The study found that of the 77 septic trenches inspected, 60% had disposal problems of some description, and 45% were noted to have seepage problems.

Such studies are important at identifying problems and finding solutions for those areas. However, there has not been any large scale surveys at a State or national level to determine the range of issues or problems associated with septic tank systems.

In 1994, the National Small Flows Clearinghouse surveyed 3500 health agencies in the United States to find out about on-site systems. The majority of these systems are septic tank systems. Therefore, the findings from this survey could readily be translated into the Australian scene.

Angoli (1998 p.1) reported the following:

> The most common reasons given for permit denial were inadequate lot size, high water table, poor/inadequate soils, shallow bedrock, and central sewer availability. Health departments attributed failure of on-site systems to the following factors: age, unsuitable soils, lack maintenance/pumping, high groundwater table and excessive water use. Many health departments noted a correlation between failing systems and either inadequate or non existent regulations. Inspections are generally performed by health department personnel or a designated representative. Maintenance is the responsibility of the home owner. One recurring observation made by the local health department was that sites which previously would never have been considered for on-site system use are now being purchased, planned and developed with on-site wastewater treatment in mind.
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> Yet, in spite of the physical differences such as climate, terrain, and soil, and administrative differences in regulations and agencies that exist between states, there is one comforting thought: no one's situation is unique. Every problem, mishap, disconcerting instance, or creative solution any sanitarian or health inspector has come across has also been encountered by others in other towns, in other countries, in other regions, in other states.

# 3 Impacts from Failing Systems

The Wallis Lake incident in New South Wales in 1996 has sent a very clear signal to the various levels of government that they cannot ignore problems and impacts associated with failing septic tanks. Wallis Lake is an oyster growing area and pollution from failing septic tanks around the lake contaminated the oysters with the hepatitis A virus. Subsequent consumption of the contaminated oysters lead to a major food poisoning outbreak.

The Wallis Lake case is particularly important to the health authorities as a class action was successfully brought against the Great Lakes Council, State of New South Wales and Graham Barclay Oysters and Distributors Pty Ltd. Justice J Wilcox in *Ryan v Great Lakes Council (1999) FCA 177* found that the Council and the State were negligent in their duty of care. They had knowledge about the septic tank failures and the likelihood of pollution to the lake, yet no action was taken to minimise the pollution.

A similar situation to Wallis Lake occurred in Thurston County, Washington, USA, around Puget Sound, a shellfish growing area. Of all the potential pollution sources in the Sound, failing septic tanks were identified as representing 82% of the causes in restricting the harvest of shellfish (Gover, Nancy 1993). Another case involved an outbreak of cryptosporidiosis in a recreational lake in New Jersey (Kramer. *et al.* 1998).

A septic tank serving a toilet block adjacent to the lake failed and effluent pooled over the ground. The next day a rain event occurred with run-off to the lake. An estimated 2070 persons were affected.

The Department of Local Government (1998) response to the Wallis Lake incident was to produce a very detailed document, *Environmental and Health Protection Guidelines – On-site Sewage*

*Management for Single Households.* The objective of the guidelines is to guide communities in New South Wales towards sustainable on-site management of domestic sewage and wastewater while protecting and enhancing the quality of public health and the environment in the long term.

# 4 Need for Maintenance

Many benefits will be derived from a proper maintenance and monitoring program for septic tank systems. The main benefits would include: (1) reduce the risk of premature failure, (2) reduce long term costs and (3) reduce risk of contamination of ground and surface waters as well as public and private water resources (eg. shellfish, drinking water) which in turn helps protect public health (Washington State Department of Health, 1996).

The importance of operation and maintenance (O&M) is emphasised in the draft standard AS/NZS 1547 (1998) – on-site domestic wastewater management. O&M is seen as an integral part of the overall framework in the management of on-site systems. It is suggested, that in areas of concentrated development, a community wide O&M scheme be administered by the local authority. The scheme could be contracted out with cost recovery through rates or a levy on each property owner. Pump-outs every three years are indicated for densely populated areas. In the less dense areas eg. rural, a self monitoring scheme could be put in place.

# 5 Maintenance Program

Hoover, *et al.* (1998) cites management as the key to effective continuous performance of mechanical and biological devices such as septic systems. He suggests that management which includes (1) monitoring the performance of each system in a community and (2) tracking the cumulative impacts of all on-site systems closes the loop for on-site technologies. Performance monitoring should include checking the solids level in the tanks, the functionality of mechanical components and the drainfield for any surface malfunction.

The need to institute on-going maintenance of the septic tank systems in Australia has received little attention in the past. However, in the past four years awareness to on-site issues has resulted in several States instituting inspection programs.

In Queensland, the Maroochy Shire Council (1995) recommends a two year inspection program against a detailed checklist. The owner is required to contract a registered inspector to inspect the system and report back to Council. This program has not been introduced as yet due to legislative difficulties (J. Carlton, *pers. comm.*).

In South Australia, four Councils have implemented inspection programs on a three or five year basis. Inspections are carried by contractors (M. Kayaalp, *pers. comm.*).

The New South Wales program detailed in the Environmental and Health Protection Guidelines (Department of Local Government, 1998) is perhaps the most progressive approach to be taken in Australia. Local governments are required to prepare an on-site sewage management strategy for their areas. This will involve Councils determining the number of systems in their area, condition of system and how to manage any impacts resulting from such systems. As from April 1998 all new on-site systems installed are issued with a licence to operate. Property owners with existing systems must notify Councils of the fact by end of June 1999. (T. Bles, *pers. comm.*). To assist Councils in the development of on-site management programs, the New South Wales government is providing financial assistance to Councils of up to $3.8 million over two years. This will enable Councils to identify sources of sewage pollution, to develop sewage management strategies and, in environmentally sensitive areas, to develop risk based sewage pollution action plans (Department of Local Government, 1998). It will be interesting to see the outcomes of the NSW program over the next three years.

In the United States, Florida requires, under the Florida Administration Code (1998), all property owners with on-site systems to obtain an annual operating permit and have systems tested and at a frequency determined by the country health department. In the State of Washington the Washington Administrative Code (1995) requires the owner to have the septic tank system checked every three years. And in special areas of concern an approved person shall inspect on-site systems every three years and make a report to the health officer and property owner.

A more structured approach to maintenance programs is occurring in several States in the United States. Referred to as community-wide management programs they are introduced to manage on-site systems within communities or subdivisions within a town. Communities which are established around or in environmentally sensitive areas are adopting this approach. A central agency is usually set up which takes on a range of responsibilities including, design inspection and operation and maintenance services to serve owners (Hoover. 1998). Two such programs are reported by Ricker *et al.* (1994) for the San Lorenzo River Watershed, California, and by Hantzsche *et al.* (1991) for the Sea Ranch California.

Also in the United States, there has recently been developed a systematic method to evaluate the causes of on-site system failures and to provide repair solutions that are appropriate to correct the problems. The system is a detailed flow chart known as FACTSS (Failure Analysis Chart for Troubleshooting Septic Systems) (Adams *et al.*, 1998). The flow chart guides the user through nine steps for troubleshooting.

A monitoring and maintenance program for septic tank systems is highly desirable. However, the effectiveness of such program can only be achieved through a legislative framework requiring property owners to monitor their systems.

In most situations this monitoring may only require the regular inspection of the system. The frequency for inspecting septic tanks systems is suggested in the literature and codes at three yearly intervals. This time frame fits in well with the study by Caldwell Connell (1986). The study included pump-out frequency for septic tanks in Perth, Western Australia. With a tank capacity of 3180L the 'average' four person home was at four-year interval and for the '90 per centile' at two years for pump-outs. In environmentally sensitive areas, particularly where there are a large number of systems in use, or in situations where large scale septic systems operate eg. caravan parks, annual inspections may be appropriate. The inspection will involve a check of the operational condition of the system. A suggested checklist is shown in Appendix 1.

The introduction of any monitoring and management program will be the responsibility of local government. This will involve the licensing of systems, establishing a database for each property, conducting surveys of known problem areas and requiring upgrades to failing systems. The inspection program could be carried out by Council or contracted out with cost recovery through rates or direct payment to contractor. In rural communities a self management report is all that may be necessary.

To support the inspection program, education of property owners is essential, and can be achieved through development of information packages. Also it will be necessary to introduce training programs for personnel conducting inspections of the septic tank systems.

In regard to the maintenance of the AWTS, because of their technology these units require regular maintenance. This is usually performed every three months. However, since they were introduced in the early 1980's local governments across Australia have experienced numerous problems with the units. The performance of AWTS found in the study by (Kinhill, 1998) is indicative of situations found within other Councils. Of the AWTS tested in this study 58% failed to meet the Council's standard.

Inadequate servicing of the units is the one main reason failures are occurring. Industry and government agencies in Queensland are addressing this issue and have set up a specific training course for service contractors. Improvements in AWTS performance have already been observed.

In addition to the quarterly maintenance requirement on the AWTS, there should also be a requirement for units to be tested annually to ensure they continue to meet the approved performance standard. This annual monitoring could be undertaken by the Council or as a requirement placed on the manufacturer. The monitoring would involve selecting a representative sample of in-use units for evaluation.

# 6 Summary

A regular monitoring and maintenance program for septic tank systems is recommended. Such program would involve inspection of systems at regular intervals, eg. three years, or more frequently in special situations. Other key elements for the introduction of an effective program are: legislative controls, licensing, inspection protocol and reporting system, education and training.

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# Appendix 1

### Suggested Checklist For Inspecting Septic Tank Systems

**Septic Tank**

- Accessibility – septic tank, grease traps, pump chamber, diversion boxes/valves
- Determine septic tank volume
- Note odours
- Appearance of wastewater
- Position of baffles and tees (damaged/blocked)
- Check scum layer and sludge depth – exceeds recommended level, pump out
- Access opening and manholes
- Water tightness of tank – cracks, leaks and water level at inlet and outlet
- Evidence of high wastewater level in septic tank (clogged outflow, indication excess in house use, stormwater or high groundwater intrusion)
- Check pumps, alarms and controls (level control, switches)
- Check all structures for damage, corrosion to material
- Ensure drainage lines are functioning (root intrusion, damage)
- Check filters on outlets

**Disposal Area**

- Determine size of area and type of disposal system (number of drain, alternation)
- Access and determine water level in trenches
- Evidence of failure (odours, overflow or seepage, saturated soil, lush vegetation, tree/shrub intrusion)
- Tampering of system (overflow pipes, diversions)
- Ensure disposal area not built over or subjected to activities which will compact area
- Not subject to run-on or stormwater discharge
- Conduct dye test (suspect seepage to streams, bores etc)
- Check soil morphology and permeability rating if system failing