# DEVELOPING A UNIVERSAL PLATFORM FOR REMOTE MONITORING AND MANAGEMENT REPORTING FOR PRIVATE ON-SITE SEWAGE MANAGEMENT FACILITIES

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## Abstract

In Australia over the past 15 years regulatory control of on-site wastewater systems has been generally based on prescriptive requirements for system design, installation and maintenance. Although this approach has generally worked, problems persist and documented studies of many system failures have raised certain barriers that preclude widespread confidence and acceptance of advanced on-site treatment technologies as a viable alternative to centralised sewage treatment.

This paper describes a simple parameter-based system and method for monitoring and reporting the maintenance and servicing of private on-site sewage management facilities (SMF). There are real benefits for all stakeholders using the system. Local government receives trusted, meaningful and timely management reports of the operational status of on-site wastewater systems. Service providers benefit with significant savings through better management of field staff and system controls. With improved system monitoring householders can benefit through increased savings in routine maintenance and system operating and ownership costs.

## Keywords

aerated wastewater treatment systems, data base management, monitoring, on-site sewage management, wastewater,

## 1 Introduction

Domestic on-site aerated wastewater treatment systems (AWTS) were introduced into Australia around 1985. Over the past years there has been a rapid increase in installations in unsewered areas. It is a reasonable assumption that some housing developments would not have proceeded without the introduction of the AWTS. Generally householders recognise the potential economic advantages of these advanced treatment when the systems produce resource savings through recycling the effluent. It is widely recognised that, properly managed, these SMF are a viable alternative to central sewage treatment. What is evolving is a need for a practical decentralised 'management' structure that makes everyone accountable up the line from the homeowner at the grass root level, the local government body, the environmental engineer, the system designer, the service technician right to the regulatory agency at the top.

At the regulatory level there have been ongoing concerns that an unacceptably high percentage of AWTS are failing to meet appropriate effluent standards. A survey conducted by NSW Health (1995) concluded that AWTS did not generally comply with the

Department's performance criteria for those parameters tested in the survey. Queensland Department of Natural Resources and Mines (2001) completed a detailed evaluation of on-site aerated wastewater treatment systems between 1995-1998. This report concluded that only 32% of the 216 plants tested complied with all of the DNR's approval criteria for $BOD_5$, SS and thermotolerant coliforms.

Similar investigations into the long term performance of AWTS (Campbelltown City Council; - Rogers 1994 and Western Australia Health Department – Devine and Waterhouse 1997) have generally concluded that the system failures were generally due to: inadequate capture of solids within the system, lack of appropriate maintenance; non-compliance with performance criteria; and irrigation areas not performing within the guidelines. NSW Health concluded that $BOD_5$ and TSS were universally treated within requirements. The major concern was that almost 25% of all systems tested produced thermotolerant coliform (TC) levels outside the standard 100 cfu/100mL. Disinfection systems need to be upgraded to ensure reliable dosing within the required limits.

The general conclusion was that, provided the systems were serviced quarterly by an accredited service provider and that disinfection was correctly applied then the final effluent would comply with the statutory performance criteria. This emerged to become the management process for AWTS.

Overall it is agreed that supervision and maintenance of AWTS requires better monitoring by councils and service providers alike. In response to the need for increased system management many councils have recruited staff specifically to inspect on-site wastewater systems and ensure they are performing as required. Currently the quarterly service log reports are sent to the appropriate councils. These forms are generally hand-written reports and with some councils processing 500 or more reports monthly there is growing pressure for industry to develop more efficient processing to eliminate the mountain of paper work.

This paper proposes a simplified management system for on-site SMF to overcome the difficulties with paper reporting. The system also recognises the evolving technology and newer advanced systems emerging in the market place.

## 2 *Earthsafe* Experience over 15 years

*Earthsafe* Australia has installed over 10,000 advanced on-site systems (AWTS, pump to sewer, sand filters and commercial/village scale packaged units) over the past 15 years. It has an active database recording management and maintenance history of these units ranging from current systems back to systems 10-15 years and older.

*Earthsafe* performs quarterly service inspections and generates almost 20,000 service reports annually. As required under accreditation with NSW Health these quarterly service reports are recorded on the *Earthsafe* database and copies are sent to 84 councils in NSW and Qld. These reports form the basis for monitoring and management of these systems as input for each individual council system.

It is our opinion that the reporting form, while a useful tool for internal management does not represent the best overall management system for all situations. *Earthsafe* clients range from individual AWTS owners (some have been with the company since 1985) to community titles, village systems and industrial/commercial clients such as resorts, mines and other special applications such pump to sewer and low pressure common effluent systems. All active, 'engineered' systems require periodic maintenance and monitoring to deliver the

designed performance over the long term. Not all systems require the same level of service and with improvements in technology and component reliability it is now possible to design management monitoring programs appropriate to meet statutory reporting requirement while producing long term cost savings to the system owner.

Given that around 20% of homes in Australia are not connected to central sewerage systems there is a central need to resolve the long-term solution for on-site wastewater management. Increasingly rural communities, unsewered subdivisions and regulatory agencies are becoming aware of the issues and concerns associated with treating and managing human waste products using on-site wastewater treatment systems. Indeed this is the major theme for "On-site '03".

Well-designed, efficient on-site systems can treat wastewater for less than $1 per kilolitre. Site costs are $5000 - $10,000 and monitoring costs range from $240 to $350 annually. With over five years average life on pumps and blowers maintenance averages out at $100 per year. As such these systems are a viable alternative to centralised sewage treatment systems. Before this can be achieved there must be a simpler reporting and monitoring system and this has prompted this paper.

# 3 What Parameters Indicate Failure of the SMF?

Given emerging technologies and varying requirements to treat wastewater NSW Health (2003) has introduced the term Sewage Management Facility (SMF) in the Accreditation Guidelines September 2003 to cover AWTS specifically as well as other active systems such as sand filters, sequenced batch reactors, advanced septic systems, pump to sewer, and collection wells.

At the local government level typical indicators of SMF failure are:

- Irrigation – ponding, surface runoff, visible algae growth
- Mechanical – failure of pump or blower (tank overflowing, system smelly)
- Primary tank needs pumpout, trench failure-biosolids oozing to the surface
- Tanks leaking, manhole covers broken, equipment not maintained
- Alarm systems not operational or disconnected

Effluent quality is not generally reported except in the obvious circumstances such as when smelly, turbid surface runoff is observed.

## 3.1 The Ideal SMF System

From the householders point of view a SMF must be reliable and provide the same 'flush and forget' benefits as central sewage. For local government it must not become a source of damage to the environment or a risk to public health. We must understand that each of the stakeholders the home owner, local council, service provider have involvement in the management process for SMF. All must work together for the system to work.

One very pragmatic approach to SMF is to assume every system must meet four major parameters to be successful. These are:

1. The system must WORK
2. The costs of installing the system must be REALISTIC
3. The costs of maintenance and inspection must be as LOW as possible
4. The system must FIT the property.

In general as we move to a more regulatory regime we are moving to active 'engineered' treatment systems (in contrast to passive systems such as septics). While these active systems achieve greater control through process treatment and flexibility in effluent pumping, it does mean that all systems must be regularly maintained to achieve their maximum performance over their design life. The cost/economic argument is a real issue that requires special attention. Increasingly installers are under pressure from homeowners to install system at the lowest possible price and who are reluctant to pay what they see as any unjustified servicing and maintenance costs.

### 3.2 Reporting Parameters

In the past the regulatory process was prescriptive (e.g a manufacturer of an AWTS needed to submit the product for accreditation and ensure that future products complied with the required specifications). Under NSW Local Government Regulation 1999 (section 43) Councils can only approve construction of accredited systems and requires that the homeowner take out a quarterly service contract. These quarterly services ensure the system is operating correctly, maintenance and system upgrades are carried out and reports are sent to council as form of regular monitoring on the systems in the field.

With councils adopting increased management responsibility and undertaking field audits and reviewing service reports we are starting to move towards performance reporting. In some examples councils require expensive water quality tests, others identify non-complying systems through irrigation failure, need for pumpout, failed components, and/or system overflow.

What councils now require are trusted field reports as the basis for their management processes for SMF. Service providers, on the other hand, are required to manage decentralised field staff and ensure reliable performance of their assigned tasks. SMF owners really want to ensure that the necessary statutory reporting is carried out at the lowest possible cost. All require some better communications efficiencies.

### 3.3 *Earthsafe* Call Centre – The Management Hub

At *Earthsafe* a call centre links customers, field staff and councils through the INTERNET, remote monitors, dialling units and telephone calls and coordinates action.

Routine service calls are allocated to field staff along with any customer specific information encoded on the instruction sheets.

Emergency calls are routed to maintenance staff and system pumpouts and other routine maintenance are scheduled as required.

The heart of the system is a database that provides the necessary management controls, accounting, field service coordination, inventory control and client/council reporting .

### 3.4 'Frictionless' Electronic Monitoring and Management System

Communications tools like SMS text messages on mobile phones and email via the INTERNET have opened new opportunities to eliminate the paperwork.

The problems associated with managing a decentralised field service force are not unlike other industries such as freight and delivery and other service industries. Example is the DHL Tracking System via the INTERNET.

We have tools such as low cost GPS vehicle tracking systems providing irrefutable audit trail including driver details, time duration and location of system serviced. By combining the SMS text-driven messaging with automatic reporting from the vehicle management systems with electronic service reports we can generate electronic activity reports automatically.

Several NSW Councils have now asked service providers NOT to provide copies of service reports and only to report the systems that are not functioning correctly. While this exception reporting might appear to be efficient it introduces many problems, not the least is the increased legal responsibility for the service provider. After all the SMF client is paying the contractor for the service call and may be reluctant to authorise the contractor to report to council particularly if the council will then issue an order to correct the system. Any system that is not contracted to a service provider will not, by default, present any exception reports and these may ultimately prove to be the weak link in the management process.

### 3.5 US Proposal for Monitoring and Management System for SMF

It is widely recognised that SMF that are not properly inspected, maintained and serviced can ultimately become serious risks to public health and the environment. As a result of public safety and environmental concerns we are seeing increased regulation and enactment of laws governing design, installation, inspection, maintenance and servicing of SMF.

In October 2002 the US Patent Office issued a Patent (US 2002/0143596 A1) *System And Method for Monitoring, Recording and Reporting, the Servicing of Private Wastewater Treatment Systems*.

The inventor, Charles Scott Carmody, developed the system to meet the statutory reporting requirement required by the different agencies, departments and government entities. He recognised the diversification of responsibilities can also result in confusion for the service providers and SMF owners trying to adhere and abide by the law. The example used in the patent is for the state of Wisconsin.

While the system described is applicable in another jurisdiction it does represent a systematic approach and provides answers to virtually all the issues facing today's regulators. The system covers all types of SMF including anaerobic (septic tanks), holding wells, advanced aerobic treatment and land application systems. The patent may make interesting reading for regulators who want to benchmark Australian SMF management systems to those in the US.

Key Elements of the Reporting are:

- SMF Identifying number
- Location of the SMF
- Date of Inspection, Maintenance or Servicing
- The license, certification or registration number of the person performing the inspection, maintenance or servicing
- Any other information required by the approved management plan for the SMF

### 3.6 Structure of the US System

The Carmody system can be based on a web server hosting a system web site. System databases can be stored on the site or on another remote system database. A call centre is provided to receive the service requests from SMF owners and the call centre communicates with the web server or indeed the SMF owners can communicate directly with the web server by logging on directly using their own unique password and ID. Service providers communicate with web server via their own computers.

Reference 2 shows the flow chart when the owner of a SMF needing service calls the call centre and requests service on his SMF.

# 4 Proposed Platform for Remote Monitoring of SMF

For any system to work it must be simple and cost effective. If anything it could offer such increased efficiencies that substantial economies of scale will result in further savings to service providers and homeowners of SMF.

**Proposed Key Management Parameters**

- Unique ID number for each system (password access restricted to owner, council and system operator).
- Location, council area and owner contact details
- System type, accreditation certificate, manufacture date, serial number
- Database showing dates and records of inspection, maintenance or servicing
- License Number of accredited technician performing the service
- Output from Management Plan for the accredited SMF

The essential elements of the database might seem too obvious. The difference is the degree of accountability and authority attached to each level. In a way this system closely parallels the way we register and manage our motor vehicles. The RTA issues the licence plate to the vehicle owner, the vehicle has been made to comply with regulatory performance and safety standards, the service is carried out by an approved mechanic according to the vehicle service manual. A non complying vehicle cannot be re-registered until the vehicle is roadworthy.

The unique ID should ultimately be issued by the council when the system DA is approved. This reference number should survive for the life of the installation. During the economic life the responsible owner might pass from builder, first home owner, tenant and future home owners. This fixed reference should be the key field for any database enquiry.

The system location, council area and owner details are obvious but must be updated from time to time. Generally the service provider and council should ensure that their records match. This information could be GPS, road address and if possible should overlay the council records.

The system type, accreditation certificate, date manufactured and serial number should coincide with the requirements and conformance with licence under Australian Standards.

The service history, records of inspection, and maintenance is obvious. This should be kept by the service provider or as part of a log book at the SMF location.

In order to develop a more trusted measure of effective service each service technician should sign off after the service has been completed. The qualifications and basis for authorisation will ensure a stronger degree of accountability.

Given that there are several types of approved SMF we should ensure that each approved system is serviced and maintained in compliance with the manufacturers original management specifications for the system. For example, an AWTS tank installed on a holiday home and fitted with UV disinfection might only require 6- monthly inspections to ensure the system in operating correctly. A heavily used village scale system might need daily monitoring coupled with regular monthly service and maintenance. To avoid generalisation we must ensure that appropriate management plans are developed and approved at the time of installation.

## 5 Conclusion

As we have now adopted more advanced technology for SMF we have moved from the totally passive septic tank to more active 'engineered' wastewater treatment solutions. Without proper maintenance any active machine will ultimately fail. We need to provide regular maintenance and supervision.

It is clear that we need a level of reporting for long term effective management of SMF that protects public health and the environment The cost of compliance and system monitoring and repairs are separate parts of meeting the reporting requirements. There needs a recognisable economic benefit to the owner of the SMF, not just a compliance with red tape regulatory pressures. In simple terms the cost of ownership of SMF can be summarised as:

- Annual Service Contract
- Equipment Replacement and System Upgrades
- Running Costs
- System costs are between $1 per 1000 litres for waste treated suitable for reuse on site
- Management costs are comparable to central sewers systems.

With a trusted remote monitoring and reporting platform we can develop a sound platform for Best Practice Management of On-site Systems.

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