Remediation Technologies and Processes for Subsurface Sewage Treatment Systems

Guidance Document for Practitioner Use

How this document is organized:

Introduction

The purpose of this guidance document is to provide guidance on the use of remediation practices for Subsurface Sewage Treatment Systems (SSTS) in Minnesota. System remediation has no single meaning; it can be defined in different ways and has different meanings to manufacturers of proprietary remediation products, practitioners, regulators and system owners. According to the Consortium of Institutes for Decentralized Wastewater Treatment (2009), *remediation is defined as the act or process of correcting a fault or deficiency in a system without changing system structure or form.*

In Minnesota, the state code does not specifically define system remediation nor does it provide requirements on the use of proprietary or non-proprietary remediation practices for septic systems. The Minnesota Pollution Control Agency (MPCA) does not review and register technologies and processes specifically for system remediation. There is no official listing for remediation technologies or processes in Minnesota. At the national level, there are no established standards or testing protocols for remediation technologies or for biologically clogged septic systems.

In 2008, the MPCA established a process to register SSTS treatment products and distribution media products. The lists of registered products are found on the MPCA website at: http://www.pca.state.mn.us/pyrib0b. When a treatment product (i.e. aerobic treatment unit or media filter) is used in Minnesota, the system is called a Type IV system. Type IV systems need to be designed by an Advanced Designer, constructed by an Installer, operated under a local operating permit and serviced by a Service Provider and Maintainer.

For remediation technologies and processes, there are no specific registration requirements identified in the rules. The local unit of government must be consulted to determine local requirements. However, treatment technologies independently tested for organic matter (Biochemical Oxygen Demand, BOD) and solids (Total Suspended Solids, TSS) removal and registered for use in Minnesota (with specified BOD removal rates listed by product and model), may be used for system remediation when organic loading is an issue, as approved by the local permitting authority. The addition of a registered treatment product to a system would classify it as a Type IV system, and would require an Advanced Designer and operating permit. The use of a non-registered treatment product as a component of a SSTS would classify the system as a Type V system.

The SSTS rules specify requirements for system maintenance (Minn. R. 7080.2450); in subpart 8 of this section of the rule, three basic requirements are identified for system remediation:

Any maintenance activity used to increase the acceptance of effluent to a soil treatment and dispersal system must:

1. Not be used on a system failing to protect groundwater as defined in Minn. R. 7080.1500, subp. 4(B), unless the activities meet the requirements of Minn. R. 7080.2350 and 7080.2400.

   The SSTS must provide the required vertical separation of soil to a limiting layer (i.e. bedrock) and to periodically saturated soil. Remediation cannot be used on systems that do not have the required vertical separation in order to properly treat wastewater.

2. Not cause preferential flow from the soil treatment and dispersal system bottom to the periodically saturated soil or bedrock.

   The remediation practice cannot 'short-circuit' or bypass the soil, which would transmit sewage through small channels or large pores (macropores) created as a result of the remedial action. Wastewater typically flows through soils slowly in small pores through unsaturated flow; large pores or channels created by a remedial action could move wastewater more rapidly through the soil via saturated flow and would be less effective in treating wastewater.

3. Be conducted by an appropriately certified qualified employee or an appropriately licensed business as specified in Minn. R. 7083.0790. Any substance added with the intent to increase the infiltration rate of the soil treatment and dispersal system must no contain hazardous substances.

   An SSTS licensed business, with oversight provided by a certified qualified employee, are needed to perform any remedial action. The specific certification and license required to do the work is either: 1) specified in state code or, 2) determined by the MPCA commissioner. The license required to perform system remediation depends on the type of the remediation being performed.

General background

A major symptom of system malfunction is plugging or clogging of the soil's infiltrative surface with a biological mat. This plugging often results in the discharge of inadequately treated sewage onto the ground surface or as a back up into the home or commercial establishment. This biological mat is often referred to as a biomat and is a layer of biological growth and inorganic residue that develops at the infiltrative surface (Consortium of Institutes for Decentralized Wastewater Treatment, 2009). Plugging or clogging of the infiltrative surface can result from a variety of physical, biological and chemical processes, including:

- Physical processes: solids in wastewater (i.e. organic matter, solids, oil and grease) and fines in backfill or drainfield rock are trapped; the surface soil can be compacted during construction.
- Biological processes: masses of microorganisms collect at the infiltrative surface.
- Chemical processes: waste products of microbiological metabolism accumulate.

The biomat typically has a low hydraulic conductivity. Soil pores can become filled over time with organic and inorganic residues; this clogging restricts the flow and subsequent infiltration of effluent into the underlying soils. Soil treatment systems can accommodate some degree of clogging over time (Bouma, 1975). However, severe clogging can produce too large a reduction in the infiltration capacity into the soil, which causes the effluent to pond even more in the soil treatment component (trenches, bed, at grade or mound), which can result in sewage backing up into the house or discharging onto the ground surface.

A variety of restorative actions may be proposed to improve the hydraulic performance of an organically overloaded system. For the purposes of this guidance document, these actions are called remedial actions or remediation. **Remedial actions may be effective only after properly troubleshooting or diagnosing a system for potential factors that may have contributed to the malfunction. This failure analysis is critical to understand why a SSTS is not functioning properly and to determine the root cause(s) of the problem.** A Designer, Advanced Designer, Inspector and Service Provider should have the necessary knowledge and skills to provide a diagnosis of factors that may have contributed to system malfunction.

The remedial actions may include non-proprietary actions, such as reducing wastewater flow, reducing the organic load, and resting the system; and other non-proprietary or proprietary practices to remove what has reduced the infiltrative capacity of the soil treatment system. If the remediation practice is successful, a replacement of the system may not be necessary. However, the best solution may be to replace a system.

A number of proprietary physical, biological and chemical processes have been proposed to 'open-up" or remedy the plugged surface or biomat and to restore the flow of effluent into the soil below the infiltrative surface. Examples of each of these remediation processes include the following:

- Physical: a process in which the plugged infiltrative surface is fractured/opened up by the injection of a large volume of compressed air and plastic beads or by physically removing the biomat (i.e. re-rocking a system).
- Biological: a technology that provides a combination of biological augmentation and aeration to the wastewater in a continuous manner to help digest and breakdown the excess biomat.
- Chemical: a process in which the oxygen concentration is increased at the infiltrative surface by mechanically adding air (aeration) or an oxygen releasing compound, such as an inorganic peroxide, to accelerate the decomposition of the excess biomat.

Converse and Tyler (1994) attempted to remediate 15 biologically clogged systems in Wisconsin through the addition of aerobic treatment units to malfunctioning systems. In this field evaluation, 12 of the 15 systems were successfully remediated during the study period. Two of the systems were monitored for ponding depths in soil absorption beds for several years; one system was monitored for nearly four years and one for six years. Of the 15 systems, one system was greatly overloaded and two systems had to be periodically pumped. As a result of these field evaluations, the State of Wisconsin allows the use of aerobic units and sand filters to renovate SSTS that meet soil and site separation requirements.

Other researchers have tried, with less success, to use the chemical, hydrogen peroxide, and other oxidizing agents to reduce a clogging mat (Harkin et al, 1975; Mickelson et al, 1989). These studies have shown that hydrogen peroxide is generally ineffective at remediating biological clogging mats (in the long-term) or that hydrogen peroxide may negatively impact systems (Hargett et al, 1984). A few publications have reported to remedy biologically clogged septic systems (Converse, 1994; Bishop and Logsdon, 1981).

This guidance document was developed to provide technical information regarding the use of remediation practices for SSTS and it pertains largely to the use of proprietary treatment technologies. However, this does not mean that other non-proprietary remedial actions cannot be used, such as reducing wastewater flow or reducing organic loading (i.e. eliminating the garbage disposal) to systems. More invasive non-proprietary remedial actions may also be used, where appropriate, including physically uncovering and removing the surface layer of the soil/biomat and replacing the infiltrative surface (i.e. re-rocking a mound). Both proprietary and non-proprietary process may be used separately or in combination with other remediation practices.

The document is expected to change over time as more information becomes available on remediation practices and their long-term effectiveness. The guidance contained in this document were developed for statewide application, with input from the SSTS Technical Advisory Panel, and posted on the MPCA Product Registration website for public review and comment.

Performance Standards

The intent of a remediation technology or process as addressed in this document is to reduce the clogged layer at the infiltrative surface and to restore effluent flow into the soil below it. Typically, a remediation practice is attempted in lieu of replacing a failed soil treatment system to reduce effluent ponding in a system. **Therefore, the performance standard established in this document is to restore the infiltration rate through and into the soil below the infiltrative surface to remediate or mitigate the existing malfunction.**

Improper use of remedial actions or products may cause unintentional physical damage to, or can have adverse effects upon, the SSTS function. A second performance standard applied in this document is that the remediation technology and process will not result in harm to the onsite system.

There are three basic performance standards for remediation technologies. The remediation practice(s):

1. Restores the infiltration rate into and through the soil below the infiltrative surface to remediate or mitigate the existing malfunction to accommodate the applied flows.
2. Does not result in harm to the SSTS.
3. Does not contaminate groundwater (i.e. due to preferential flow, chemical additives, or excessive loading).

Remediation technologies or processes are not considered treatment technologies when used at a site that require a specific treatment level (i.e. Treatment Level A with 12 inches of suitable soil). Remediation technologies and processes are not specifically reviewed by the MPCA for remediation purposes and, therefore, there is no official listing of remediation technologies or processes in Minnesota.

SSTS additives are products added to the sewage or directly to a SSTS with the intent to lower accumulated solids. SSTS additives are not subject to the product registration process. Additives must not be used as a means to reduce the frequency of proper system maintenance or the removal of sewage solids from sewage tanks. Furthermore, SSTS additives cannot contain hazardous materials (Minn. R. 7080.2450, subp. 5).

The MPCA does not evaluate or investigate the validity of performance claims by manufacturers of either SSTS additives or remediation products. For this reason, the MPCA does not evaluate their effectiveness nor endorse or recommend their use for remediation purposes.

The local unit of government should require the issuance of a construction permit and/or an operating permit for systems proposed for system remediation. The requirements for system remediation fall under the authority of the local SSTS permitting authority. This guidance document may be useful to local units of government as they consider whether or not to allow system remediation in their jurisdiction and to identify possible permitting limitations and requirements.

Application Standards

General conditions

This guidance document does not address nor does it recommend that a remediation technology be used as a preventative measure to prevent excessive plugging of the SSTS's infiltrative surface. A system owner, subject to local permitting requirements, may choose to try remediation to see if the existing problem can be resolved, if acceptable to the local permitting authority. The system owner is responsible and bears the risk and cost of this attempt. There is no guarantee that the problem will be resolved. To help ensure proper application of remediation technologies, the local permitting authority must provide effective oversight of remedial actions, inspection of the installation of remedial technologies and implementation of operating permits to ensure a surface discharge does not occur.

SSTS can have malfunctions for a variety of reasons. Many problems can be caused by the owners themselves because of improper use of the system. Other malfunctions may be due to poor design and/or construction practices; these issues typically 'show up' during the first few years following system construction. Finally, there can be problems due to improper maintenance of the system. Whatever the suspected cause, a thorough analysis of the reasons(s) for system malfunction is needed before any remediation is attempted.

There are practices that a system owner may employ to try and remediate their SSTS problem. For example, if they have a system with excessive sewage ponding, they may be able to apply some specific water use conservation practices that may be beneficial, such as reducing flow and organic loading, eliminating the water softener, or eliminating the garbage disposal. Furthermore, system owners may also need to use their septic tank as a holding tank for a period of time to let the system rest. In other situations, the clogging has progressed 'too far' and more significant practices are required (i.e. addition of an aeration device or even replacement of the system). The bottom line is that a thorough analysis of the reasons for system malfunction is needed before any attempts are made to fix the system. A brief overview of some remediation techniques, and who is responsible to perform the work, is shown in Table 1.

Failure analysis

Before any attempt is made to fix or remediate a system, a thorough analysis of the malfunctioning system is needed. This evaluation is referred to as a failure analysis. The failure analysis should be performed by the Designer, Advanced Designer or Service Provider, with input from other licensed practitioners. A Maintainer may also be a valuable source of information. A failure analysis would be submitted to the local permitting authority, along with a design and permit application (if required), that identifies the reason(s) for system malfunction.

Table 1. Identification of some example remediation practices used by system owners, SSTS practitioners and SSTS business license(s) needed to perform the remediation practice, and typical local permitting.

Remediation technique	Description of the technique	SSTS business license(s) required	Typical Local Permits
Reduce wastewater quantity	System owner uses less water, eliminate water softener, iron filter, add low flow fixtures and appliances, fix leaky toilets and faucets, etc.	None	None
Reduce wastewater quantity, peak flows (i.e. surge storage)	Timed-dosing with surge storage.	Designer Installer	Construction permit Operating permit
Reduce organic loading to the system	Eliminate garbage disposal or other waste additive equipment or activities.	None	None
Reduce organic loading to the system	Use composting toilets to provide hydraulic and organic discharge reductions.	None	None
Reduce organic loading to the system	Add a treatment product (use Registered Treatment Products) to reduce organic loading.	Advanced Designer Installer	Construction permit Operating permit
Rest a section of the soil treatment area	Rest a portion of the system (trenches and other systems with more than one zone).	Service Provider Installer	Operating permit
Adding compressed air and 'beads' to open up the soil	Opens up the soil, reported to inject beads and create cracks (larger pores).	Installer Service Provider	Operating permit
Re-build and replace the distribution media in the system (typically a mound)	This is when the top of a mound is removed and the clogging mat is removed.	Designer Installer	Construction permit Operating permit
Pump the tank and system (i.e. operate as a holding tank)	Pump the tank and components and hope the system recovers.	Maintainer	Operating permit
Physically uncover and rake the infiltrative surface	To remove or break-up the biomat.	Installer	Construction permit Operating permit

The goal of failure analysis of a SSTS is to:

1. Determine the potential factors that may have contributed to the system malfunction. These factors need to be addressed and corrected prior to the installation or use of a remediation technology/process.
2. Evaluate the type of failure. The use of a remediation technology is not appropriate if the cause of the failure: a) cannot be corrected, or b) resulted in a failure other than plugging of the infiltrative surface. This includes failures where the soil provides insufficient treatment prior to effluent reaching groundwater; this is when the SSTS does not meet the vertical separation requirements of a conforming system. Other examples where the use of remediation technologies is not appropriate include: 1) when excessive water use by a homeowner occurs and 2) when a leaky sewage tank (or its risers and pipe penetrations) is found.

Adams et al. (1998) provides a systematic method to evaluate the cause(s) of the failure of a septic system. This method includes a nine step process for troubleshooting septic systems. The 'Consortium of Institutes for Decentralized Wastewater Treatment' has a website that posts several 'Analysis Forms' and a 'Troubleshooting Worksheet'. These documents are found on the Consortium's website at: http://www.onsiteconsortium.org/awtschecklists.html.

It is critical that the cause(s) of the malfunction be determined before any attempt is made to remediate a system. Users must be aware that when a remediation practice is used to correct a failure from a clogged biomat, only the conditions are fixed; the cause of the failure may not be corrected. Therefore, all potential causes should be identified and appropriate corrective actions taken to prevent recurrences. Otherwise, the effectiveness of the remediation effort may be poor and its impact short-lived.

For system failure analyses, a Designer and Service Provider should be involved in this evaluation for Type I, II and III systems; an Advanced Designer and Service Provider for Type IV systems; and a licensed Professional Engineer or Geoscientist (Soil Scientist or Geologist) with SSTS licensure and Service Provider for Type V systems.

The failure analysis of the malfunctioning system would include the following items:

1. A review of the permit and as-built or record drawing for the last permitted action pertaining to the system. This may include the initial new construction permit, a repair permit, an operating permit, or a permit for some other system modification. This will provide information on system design, system component settings, and system component locations.
2. A review of monitoring and maintenance the system has received (or not received) throughout its life.
3. A determination of the actual wastewater flow and a comparison to the design flow.
4. A determination of the actual hydraulic and organic loading rates and a comparison to the design loading rates.
5. An inspection and verification of the performance of all system components, including any mechanical components.
6. A review of the soils to confirm that the soil descriptions in the design are accurate. If a soil evaluation is not included in an existing permit, an evaluation should be done to determine the soil characteristics and to locate any limiting layers in the soil that may be present.
7. A determination of the factor(s) that contributed to the failure. Prior to permit issuance, these factors need to be corrected or addressed so another failure will not occur.

Permitting

The local unit of government should issue both a construction (or repair) and an operating permit for system remediation. If a registered treatment product is proposed, the required construction (or repair) and operating permit needs to be issued by the local permitting authority. Specific requirements pertaining to system remediation may be contained in the local ordinance. The state rules do not address specific requirements for permitting systems where remediation is being attempted, other than meeting each of the three requirements identified on page two in this document.

When issuing a construction and/or operating permit, the local unit of government is permitting the use with some assurance the use will have a long-term beneficial effect. However, when permitting a remediation technology or process, the local unit of government allows the permitted use as an attempt to resolve a malfunctioning system; there is no assurance the remediation technology will have a permanent positive impact. The owner needs to be fully aware that the remediation practice may or may not fix the problem. The owner should sign off with a written statement (or as part of the operating permit) that they are aware of the limitations of the remediation practice; suggested language is contained in the example operating permits found in the Appendix.

The local unit of government may permit the use of a registered treatment technology for system remediation if the product is posted on the MPCA website at the following location: http://www.pca.state.mn.us/pyrib0b. An existing SSTS must meet the compliance criteria contained in Minn. R. 7080.1500, subp. 4, item B to use a remediation technology.

Some remediation practices may take time to correct the malfunctioning situations; others may show immediate results. The local permitting authority will need to balance a request to use a remediation technology with the risk posed by the on-going malfunction of the system. These risks could include risks to both groundwater and surface water and the potential for the public from being exposed to insufficiently treated sewage. The use of a remediation practice should not be permitted on a site, unless the risks are appropriately addressed.

Imminent Threat to Public Health or Safety

The local unit of government should consider issuing an operating permit to the owner of a system identified as an Imminent Threat to Public Health or Safety (ITPH) that is attempted to be remediated. Each operating permit would be tailored to the particular situation by the local unit of government. The length of time for the initial operating permit would be 10-months (or less). An example 10-month operating permit is provided in the Appendix.

If a system is shown to meet the conditions of the initial operating permit (operating properly for a period of 10-months with 'regular' use), the owner could then be issued a renewal operating permit for a suitable period of time (i.e. 1 year). After that time, the local unit of government would make the determination of the need for subsequent operating permits, depending on the remediation practice being used and risk factors. If the system is operating properly and is in compliance with its operating permit, a Certificate of Compliance may be issued. It should be noted that operating permits are not transferrable. If a property is sold, the new owner would be required to obtain an operating permit for the system.

Failure Analysis

The local permitting authority should not permit the use of a remediation practice without the submittal of an acceptable failure analysis with recommended actions. In situations when a design is not necessary, a plan needs to be developed by the designer prior to the permit being issued by the local permitting authority. The plan or design should:

1. Identify the results of the failure assessment.
2. Discuss the proposed course of action, including site-specific mitigation measures for containing and/or decontaminating sewage surfacing areas, and other measures for preventing the public from being exposed to inadequately treated sewage.
3. Provide detailed information about the remediation practice. The manufacturer's recommended method for product use must be included in this information.
4. Discuss alternatives or options considered.
5. Provide detailed follow-up actions, including items contained in the Operation, Monitoring and Maintenance section of this document, including the following information:
    - length of time monitoring the remediation practice and its effects will occur
    - who is responsible for doing the on-going monitoring
    - required documentation of an agreement between the Service Provider and the system owner
    - entity responsible for monitoring and reporting, and to submit these requirements to the local permitting authority

Since the permitted use of a remediation technology is to improve a malfunctioning SSTS with an overly restrictive biomat or plugged infiltrative surface, the local permitting authority should require the installation of at least one 6-inch observation standpipe in each trench, seepage bed, at-grade and mound system. This 6-inch observation standpipe will allow: 1) for pumping by a Maintainer, if needed, from the 6-inch pipe to remove excessively ponded effluent and 2) for observations related to the extent and depth of effluent ponding to determine whether the remediation practice is performing properly or not. The observation pipes need to extend down to the infiltrative surface in each soil treatment system. Each observation pipe must terminate above grade, be capped and anchored, so they cannot be accidently pulled out when removing the cap.

While on-going monitoring and maintenance is needed for all systems, the local permitting authority should require periodic inspections of the SSTS to verify the remedial practice is producing the desired effect; that the biomat or the plugged infiltrative surface has 'opened up' and effluent flow though the infiltrative surface and into the underlying soil has been restored.

If a malfunctioning condition persists after a remediation practice has been used for an appropriate period of time (appropriate length of time is dependent on the level of public health risk posed by the malfunction and attempts to remediate it), the local permitting authority would typically require a repair or replacement of the system. Temporary pumping of the system by a SSTS Maintainer may also be required.

Design

The remediation technologies covered in this document include registered treatment products that have a variety of design options, materials and methods. However, there are no specific recommended standards for the design of treatment technologies used specifically for system remediation; each manufacturer may have a manual on the design and use of their technology for system remediation purposes. For registered treatment products, a letter of 'product registration' was issued to each manufacturer from the MPCA. This letter lists the conditions of product use in Minnesota. Each of these letters is posted on MPCA's website at: http://www.pca.state.mn.us/pyrib0b. Advanced Designers should review these letters before using a treatment product to understand the conditions of product use in Minnesota.

Installation

The installation (or operation of equipment to perform the process for some physical or chemical remediation process) requires knowledge, training and experience in the process being used on a site, as well as in the basic principles of ongoing system design, installation, function, operation and maintenance. It is imperative that the local permitting authority ensure that properly certified and licensed practitioners are performing the work. Installers are typically the most qualified practitioners to install remediation technologies. Remediation installation and operational procedures cannot negatively impact treatment performance in any manner, nor cause any physical damage to the SSTS. The proprietary product manufacturer may have specific information on the installation of their technology for use in system remediation.

Licensing

The appropriate SSTS business license is needed to design, install, operate, monitor and maintain an SSTS with a remediation technology. Table 1 provides an overview of some remediation practices used by system owners and SSTS practitioners involved with this work.

Operation, Maintenance and Monitoring

The local permitting authority will make the determination of whether or not a construction permit and/or operating permit is needed for system remediation. It is recommended that the system owner provide a service contract or maintenance agreement to the local permitting authority, and that the local permitting authority issue an operating permit to ensure the system is remediated. A management plan should also be developed for the system and given to the owner.

For a period of at least one year, the system should be monitored to determine if the malfunction is resolved. Monitoring should document the timing of the malfunction and the remedial action done. The primary observations or measurements to make and record include:

1. Whether the symptom of malfunction (surfacing or backing up) stops.
2. Depth of effluent ponding in the observation standpipes in each trench, seepage bed, at-grade and mound.
3. Wastewater flow.

When a system is serviced or monitored for compliance with its operating permit, and the SSTS practitioner finds that the remediation practice is not correcting the malfunction (i.e. surfacing or backing up continues or effluent ponding in observation standpipes do not diminish), the owner of the system must take appropriate action, according to the direction and satisfaction of the local permitting authority (and as specified in the operating permit). These actions may include:

1. Discontinue the use of the remediation practice.
2. Potential interim use of another remediation practice.
3. Temporarily pump and haul.
4. Replace the system.

The manufacturer should have product specific user's manuals to ensure remediation products are used appropriately.

Septic system owners can obtain additional information related to operation and maintenance at the University of Minnesota's website at http://septic.umn.edu. The publication entitled *Septic System Owner's Guide* is available for purchase from the University of Minnesota.

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University of Minnesota Onsite Sewage Treatment Program website at: http://septic.umn.edu.

Appendix A. Example #1 Operating Permit for System Remediation

The following is an example of a 13-month operating permit with monitoring requirements for a mound system undergoing system remediation due to excessive clogging at the infiltrative surface.

King County Environmental Services
123 King Street
King, MN 12345

System Remediation

Wastewater Treatment and Dispersal Operating Permit

Operating Permit No. 22

Facility Information

Permittee name: George Hamilton
Phone number: 218-852-9583
Mailing address: 9346 Sand Lake Road
City: King City
State: MN
Zip code: 12345
Property ID number (GPS location): PIN = 10693064

King County authorizes the Permittee to operate a wastewater treatment and dispersal system at the address named above in accordance with the requirements of this operating permit. There is no assurance that the XYZ remediation technology added to the SSTS will have a permanent positive impact on your system's performance; the existing system will need to be replaced with a new compliant system if the system is found to be an Imminent Threat to Public Health (ITPH).

Issuance date: 10/29/10
Expiration date: 11/29/11
System type: Type IV (remediated system)
Treatment level: Level C
System design flow: 450 gpd
Residential/Commercial: Residential, 3 bedroom, Class I
System components: Existing 1000 gal. septic tank; new XYZ Model 450 remediation product (450 gpd) placed in the septic tank; Existing 500 gal. pump tank, pump and controls; new event counter; Existing mound with 34 inch soil separation

Monitoring Requirements

Parameter	Effluent limits	Frequency	Location
Design flow (gpd)	450 gpd	Per Management Plan	Event counter and/or running time clock
Average flow (gpd)	270 gpd		
$CBOD_5$ (mg/L)	125 mg/L	Based on the Failure Analysis recommendations	Following XYZ product
TSS (mg/L)	80 mg/L		
Fecal Coliform bacteria (#/100mL)	N/A		
Operational Field Tests: Temperature, Dissolved Oxygen, pH, Color, Odor, and Clarity	No limits	See below	Following XYZ product
Back-up, Ponding, and Surfacing of Effluent	No back-up or surfacing of effluent; minimal ponding of effluent in mound rock bed within 12 months	At 3, 6, and 12 month interval	House (back-up) Mound system (surfacing)

Monitoring Requirements Comment Field

At no time shall effluent be seeping, surfacing, or backing-up into the dwelling. At intervals of 3, 6, and 12 months, an MPCA-licensed Service Provider must perform and record the following tasks: a) extent of ponding; b) back-up, seepage, surfacing, or other indicators of failure; c) depth of sludge; d) condition of effluent screen; e) effluent color; f) effluent temperature and dissolved oxygen; and g) effluent odor and clarity.

Maintenance Requirements

Maintenance requirements shall be performed as specified in the Management Plan as prepared by the system's Advanced Designer.

System component	Maintenance	Frequency
Septic tank and effluent screen	Check sludge level; pump as needed; record pump-out date(s) and volume(s); check and clean effluent screen	At 3, 6 and 12 month intervals; per Management Plan or Use
XYZ treatment product	Per XYZ maintenance documents	At 3, 6 and 12 month intervals; not less than Management Plan
Pump tank and controls	Check sludge level; pump to remove solids; check floats and controls	At 3, 6 and 12 month intervals; not less than Management Plan
Soil treatment and dispersal	Check for seepage, ponding, surfacing, and other signs of failure; pump as needed; record pump-out date(s) and volume(s); maintain vegetative cover	At 3, 6 and 12 month intervals; not less than Management Plan

Monitoring Protocol

Any sampling and laboratory testing procedures shall be performed in accordance with the proprietary treatment product's protocol, Standard Methods, and at a Minnesota Department of Health approved laboratory. Results shall be submitted to the permitting authority at: King County Environmental Services, 123 King Street, King, MN 12345 no later than sixty (60) days prior to when the permit to operate the system expires.

Contingency Plan

In the event the wastewater treatment system does not meet required performance requirements as contained in this operating permit, the owner shall notify the local unit of government within 30 (thirty) days of receiving non-compliant information. The owner is responsible to obtain the services of a Minnesota Pollution Control Agency (MPCA)-licensed Service Provider or other qualified practitioner to complete the required corrective measures.

Authorization

This permit is effective on the issuance date identified above. This permit and the authorization to treat and disperse wastewater shall expire in 15 months. The Permittee is not authorized to discharge after the above date of expiration. The Permittee shall submit monitoring information on forms as required by King County Environmental Services no later than sixty (60) days prior to the above date of expiration for operating permit renewal. This permit is not transferable.

The owner is required to obtain the services of a MPCA licensed 1) Service Provider to provide ongoing system operation, maintenance, and monitoring and 2) Maintainer to pump the system's sewage tanks and components. The owner is responsible to provide the name of the Service Provider business prior to the issuance of this operating permit. The owner has secured the services of SSTS Services, Inc. as the Service Provider for this system (signed Service Provider contract attached). The Service Provider is hereby authorized to provide the required monitoring data and routine maintenance service records to both the local unit of government and manufacturer of the proprietary treatment product.

I hereby certify with my signature as the Permittee that I understand the provisions of the wastewater treatment and dispersal system operating permit including maintenance and monitoring requirements. I agree to indemnify and hold King County harmless from all loss, damages, costs and charges that may be incurred by the use of this system. If I fail to comply with the provisions of this operation permit, I understand that penalties may be issued. If I sell this property during the life of the permit, I will inform the new owner(s) of the permit requirements and the need to renew the operating permit.

The Operating Permit is hereby granted to: George Hamilton

Permittee (please print): George Hamilton

Title: Homeowner Date: 10/28/10

Signature: ____________________

Permitting Authority (please print): Alice Johnson

Title: SSTS Inspector Date: 10/29/10

Signature: ____________________

Appendix B. Example #2 Operating Permit for System Remediation

The following is an example of a 10-month operating permit with monitoring requirements for a trench system undergoing system remediation due to periodic hydraulic failure from organic overloading and clogging at the soil's infiltrative surface.

King County Environmental Services
123 King Street
King, MN 12345

System Remediation

Wastewater Treatment and Dispersal Operating Permit

Operating Permit No. 23

Facility Information

Permittee name: George Hamilton

Phone number: 218-852-9583

Mailing address: 9346 Sand Lake Road

City: King City State: MN Zip code: 12345

Property ID number (GPS location): PIN = 10693064

King County authorizes the Permittee to operate a wastewater treatment and dispersal system at the address named above in accordance with the requirements of this operating permit. There is no assurance that the XYZ remediation technology added to the SSTS will have a permanent positive impact on your system's performance; the existing system will need to be replaced with a new compliant system if the system is found to be an Imminent Threat to Public Health (ITPH).

Issuance date: 10/29/10 Expiration date: 07/29/11

System type: Type IV (remediated system) Treatment level: Level C

System design flow: 450 gpd Residential/Commercial: Residential, 3 bedroom, Class I

System components: Existing 1000 gal. septic tank; new XYZ Model 450 remediation product (450 gpd) placed in the septic tank; Existing 500 gal. pump tank, pump and controls; new event counter; Existing trench system with 34 inch soil separation

Monitoring Requirements

Parameter	Effluent limits	Frequency	Location
Design flow (gpd)	450 gpd	Per Management Plan	Event counter and/or running time clock
Average flow (gpd)	270 gpd		
$CBOD_5$ (mg/L)	125 mg/L	Based on the Failure Analysis recommendations	Following XYZ product
TSS (mg/L)	80 mg/L		
Fecal Coliform bacteria (#/100mL)	N/A		
Operational Field Tests: Temperature, Dissolved Oxygen, pH, Color, Odor, and Clarity	No limits	See below	Following XYZ product
Back-up, Ponding, and Surfacing of Effluent	No back-up or surfacing of effluent within 10 months	At 3, 6, and 10 month interval	House (back-up) Trench system (surfacing)

Monitoring Requirements Comment Field

At no time shall effluent be seeping, surfacing, or backing-up into the dwelling. At intervals of 3, 6, and 10 months, an MPCA-licensed Service Provider must perform and record the following tasks: a) extent of ponding; b) back-up, seepage, surfacing, or other indicators of failure; c) depth of sludge; d) condition of effluent screen; e) effluent color; f) effluent temperature and dissolved oxygen; and g) effluent odor and clarity.

Maintenance Requirements

Maintenance requirements shall be performed as specified in the Management Plan as prepared by the system's Advanced Designer.

System component	Maintenance	Frequency
Septic tank and effluent screen	Check sludge level; pump as needed; record pump-out date(s) and volume(s); check and clean effluent screen	At 3, 6 and 10 month intervals; per Management Plan or Use
XYZ treatment product	Per XYZ maintenance documents	At 3, 6 and 10 month intervals; not less than Management Plan
Pump tank and controls	Check sludge level; pump to remove solids; check floats and controls	At 3, 6 and 10 month intervals; not less than Management Plan
Soil treatment and dispersal	Check for seepage, excessive ponding, surfacing, and other signs of failure; pump as needed; record pump-out date(s) and volume(s); maintain vegetative cover	At 3, 6 and 10 month intervals; not less than Management Plan

Monitoring Protocol

Any sampling and laboratory testing procedures shall be performed in accordance with the proprietary treatment product's protocol, Standard Methods, and at a Minnesota Department of Health approved laboratory. Results shall be submitted to the permitting authority at: King County Environmental Services, 123 King Street, King, MN 12345 no later than sixty (60) days prior to when the permit to operate the system expires.

Contingency Plan

In the event the wastewater treatment system does not meet required performance requirements as contained in this operating permit, the owner shall notify the local unit of government within 30 (thirty) days of receiving non-compliant information. The owner is responsible to obtain the services of a Minnesota Pollution Control Agency (MPCA)-licensed Service Provider or other qualified practitioner to complete the required corrective measures.

Authorization

This permit is effective on the issuance date identified above. This permit and the authorization to treat and disperse wastewater shall expire in 10 months. The Permittee is not authorized to discharge after the above date of expiration. The Permittee shall submit monitoring information on forms as required by King County Environmental Services no later than sixty (60) days prior to the above date of expiration for operating permit renewal. This permit is not transferable.

The owner is required to obtain the services of a MPCA licensed 1) Service Provider to provide ongoing system operation, maintenance, and monitoring and 2) Maintainer to pump the system's sewage tanks and components. The owner is responsible to provide the name of the Service Provider business prior to the issuance of this operating permit. The owner has secured the services of SSTS Services, Inc. as the Service Provider for this system (signed Service Provider contract attached). The Service Provider is hereby authorized to provide the required monitoring data and routine maintenance service records to both the local unit of government and manufacturer of the proprietary treatment product.

I hereby certify with my signature as the Permittee that I understand the provisions of the wastewater treatment and dispersal system operating permit including maintenance and monitoring requirements. I agree to indemnify and hold King County harmless from all loss, damages, costs and charges that may be incurred by the use of this system. If I fail to comply with the provisions of this operation permit, I understand that penalties may be issued. If I sell this property during the life of the permit, I will inform the new owner(s) of the permit requirements and the need to renew the operating permit.

The Operating Permit is hereby granted to: George Hamilton

Permittee (please print): George Hamilton

Title: Homeowner Date: 10/28/10

Signature: ____________________

Permitting Authority (please print): Alice Johnson

Title: SSTS Inspector Date: 10/29/10

Signature: ____________________