

Onsite Wastewater Systems



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Introduction

- Also known as septic system
- 40% of the homes in Arkansas are served by an onsite system
- Over 400,000 systems in the State.
- Alternative to municipal sewer system
- Used in some form or fashion for centuries

Out house



Straight pipe



Introduction-continued

- Lack of regulations prior to 1977
- “Arkansas ingenuity”
- Bad public perception
- Leaky, smelly sources of pollution
- Act 402
- Rules and Regulations
- Permitting requirement
- Who can design, install, pump, etc.

Introduction-continued

- System Design
- Under 2000 gallons per day-reviewed by local Environmental Health Specialist
- Over 2000 gallons- reviewed by Division of Engineering
- Over 5000 gallons- reviewed by Arkansas Department of Environmental Quality

Introduction-continued

- For the most part- systems function well
- Many factors affect their function
 - Soil
 - Rainfall
 - Water usage
 - Construction
 - Maintenance

Introduction-continued

- Flush and forget mentality
- More than just a tank and some leach lines
- Fragile system
- If expected to function properly, they must be designed installed and maintained properly
- Rules and Regs address all aspects of system

System design and installation

- Designated Representatives
 - Master plumber
 - Surveyor
 - Engineer
 - Registered Sanitarian
 - Professional soil classifier
 - Or, similarly qualified as defined by the DR committee. (30 hours math and science and documented experience)

System design-continued

- DR's are private individuals who do not work for the ADH
 - Must attend annual training provided by ADH
- Responsibilities:
 - Evaluate the site and soils
 - Design the system based on house location, size and site
 - Complete permit application
 - Submit application to the local EHS

System design- continued

- Onsite review by EHS
 - Evaluate soils for proper sizing
 - Evaluate site characteristics
 - Check setbacks
- Permit review by EHS
 - Ensure application is complete and accurate
 - Check for approved products
 - Check for any lot restrictions

Soil pit evaluation



System Installation

- Licensed installer requirement
- Must pass exam
- Must attend annual training
- Private individuals, not employees of ADH
- Installed system inspected by the local EHS
 - Proper installation
 - Proper materials used
 - Setbacks maintained

Site Requirements

- No minimum lot size
- Lot must be large enough for:
 - House or structure
 - Properly sized system
 - Alternate area
 - Setbacks
 - Well if applicable

Soil

- The soil is the most important component of the system
 - Renovation of wastewater
 - Storage of wastewater during periods of wetness
 - Dispersal of wastewater
- Soil too fine-no storage
- Soil too coarse-no renovation

Surfacing sewage



Soil-continued

- Before early 1990's, Perc test were used for system sizing
 - Three post holes 24" deep
 - Saturate holes for 4 hours
 - Measure time required for water level to drop 1"
 - Indication of soils hydraulic conductivity-ability to transport water

Soil-continued

- Problems with the perc test
 - Only indicated hydraulic conductivity
 - Does not evaluate ability of the soil to store water
 - Results vary greatly depending of time of year and soil wetness
 - Test performed in August would yield much better results and smaller system than test performed in February.
 - Some states require perc test season.

Soil-continued

- Soil morphology program began in early 1990's
- Based on research from U of A
- Considers ability of soil to store water during periods of seasonal wetness
- Results are consistent, regardless of the time of year.
- 4' deep soil pit required

Soil-continued

- Soil morphology considers:
 - Soil structure
 - Consistency
 - Texture
 - Porosity
 - Arrangement of the individual horizons
 - Redoximorphic features

Soil profile



Soil-continued

- Redoximorphic features:
 - Determined by soil colors
 - Red, brown and black colors caused by iron, manganese and organic matter
 - Iron and manganese are reduced through a biological and chemical process when saturated with water (anaerobic)
 - Become dissolved in soil water solution when reduced

Soil-continued

- Redoximorphic features-continued
 - Reduced iron and manganese are redistributed throughout the soil profile
 - Areas void of Fe and Mn are colorless (grey) and are called depletions
 - When water drains away, concentrations of Fe and Mn are left behind
 - When exposed to air (aerobic) they oxidize and become visible as red or black concentrations.

Soil-continued

- Redoximorphic features-continued
 - As a result of seasonal wetness, soils develop depletions and concentrations
 - The intensity and number as a percentage indicate how long the soil is saturated
 - Very accurate indication of the annual levels of ground water in the soil.
 - Seasonal water tables are either brief, moderate or long duration

Redoximorphic features



Soil-continued

- Brief seasonal water table
 - System needs to store wastewater for 6 days after a significant rain even
- Moderate seasonal water table
 - System needs to store for 18 days
- Long seasonal water table
 - System need to store for 36 days

Soil-continued

- Arkansas leads the nation in this methodology
- Many states continue to use perc test even though they acknowledge its limitations
- Very progressive technology
- EHS's required additional training
 - Must pass DR exam including soils section
 - Training provided by soil classifiers and U of A

Soil-continued

- DR's required additional training
 - Required to pass soils portion of new DR exam even if licensed before reg change
 - Training provided by ADH and or private sector
 - May continue to size using perc test, but must be done in suitable soil

Alternate Systems

- Not all sites are suitable for standard onsite system
 - Bad soils
 - Cant meet setbacks
- Other options
 - Aerobic treatment systems
 - Media filters
 - Drip irrigation
 - Capping-fill system
 - Surface discharge

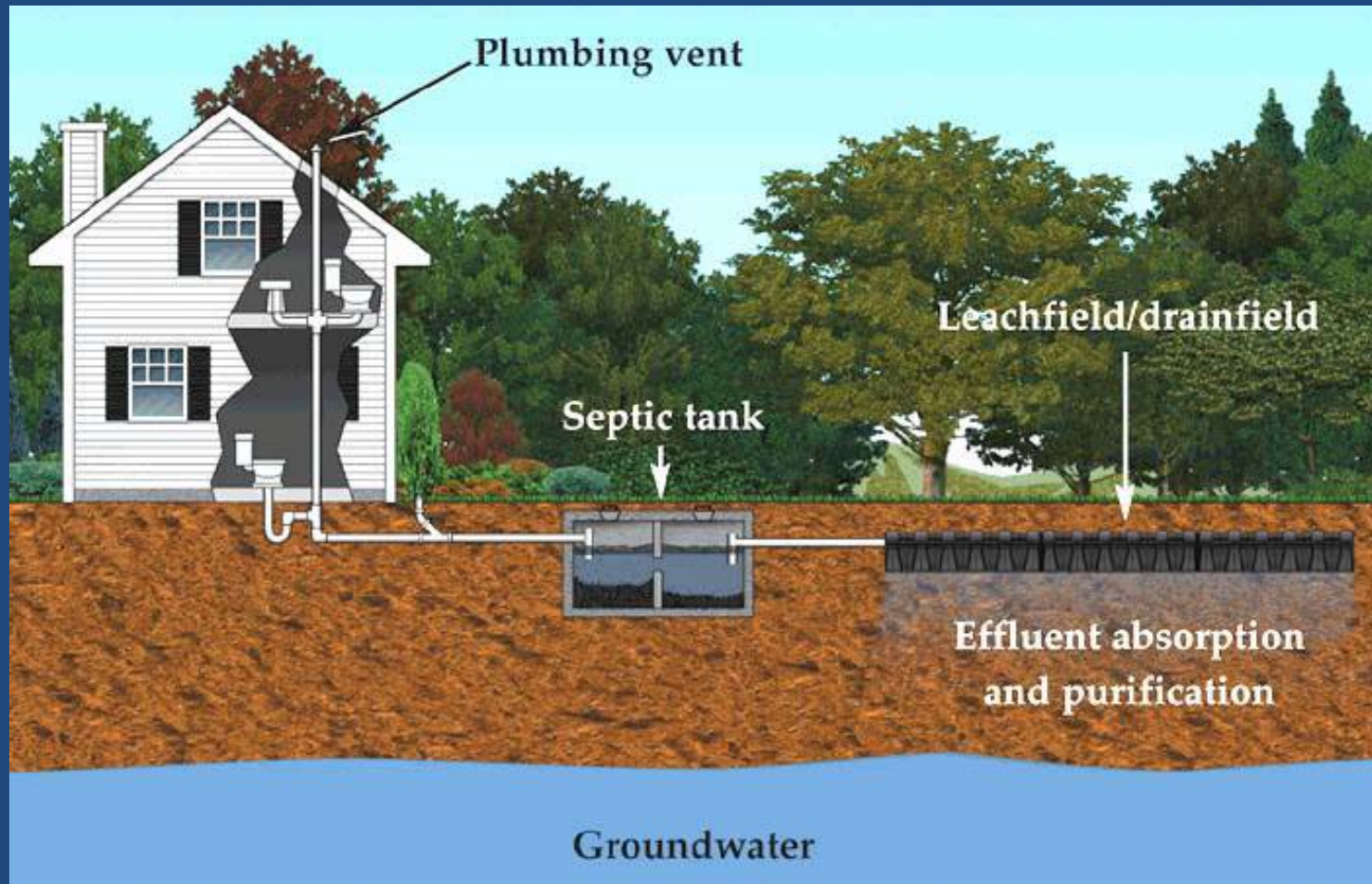
Alternate systems-continued

- Reviewed on case by case basis
- Not an guaranteed solution
- Some sites are unsuitable for any type of system
- Permit will not be issued just to appease land owner
- Always have soil test performed before purchasing property

System Components

- All wastewater must be sent to the onsite system
 - Black water-toilet waste
 - Grey water-sinks, showers, washing machine, etc
- House Sewer
 - the pipe that transports the wastewater to the septic tank
 - 3" or 4" diameter

Typical onsite system



System components-continued

- Septic tank
 - Constructed of concrete, plastic or fiberglass
 - Manufacturers are inspected and must sell approved tanks
 - Must be watertight and structurally sound
 - Sized based on the number of bedrooms or the estimated daily wastewater production for businesses.

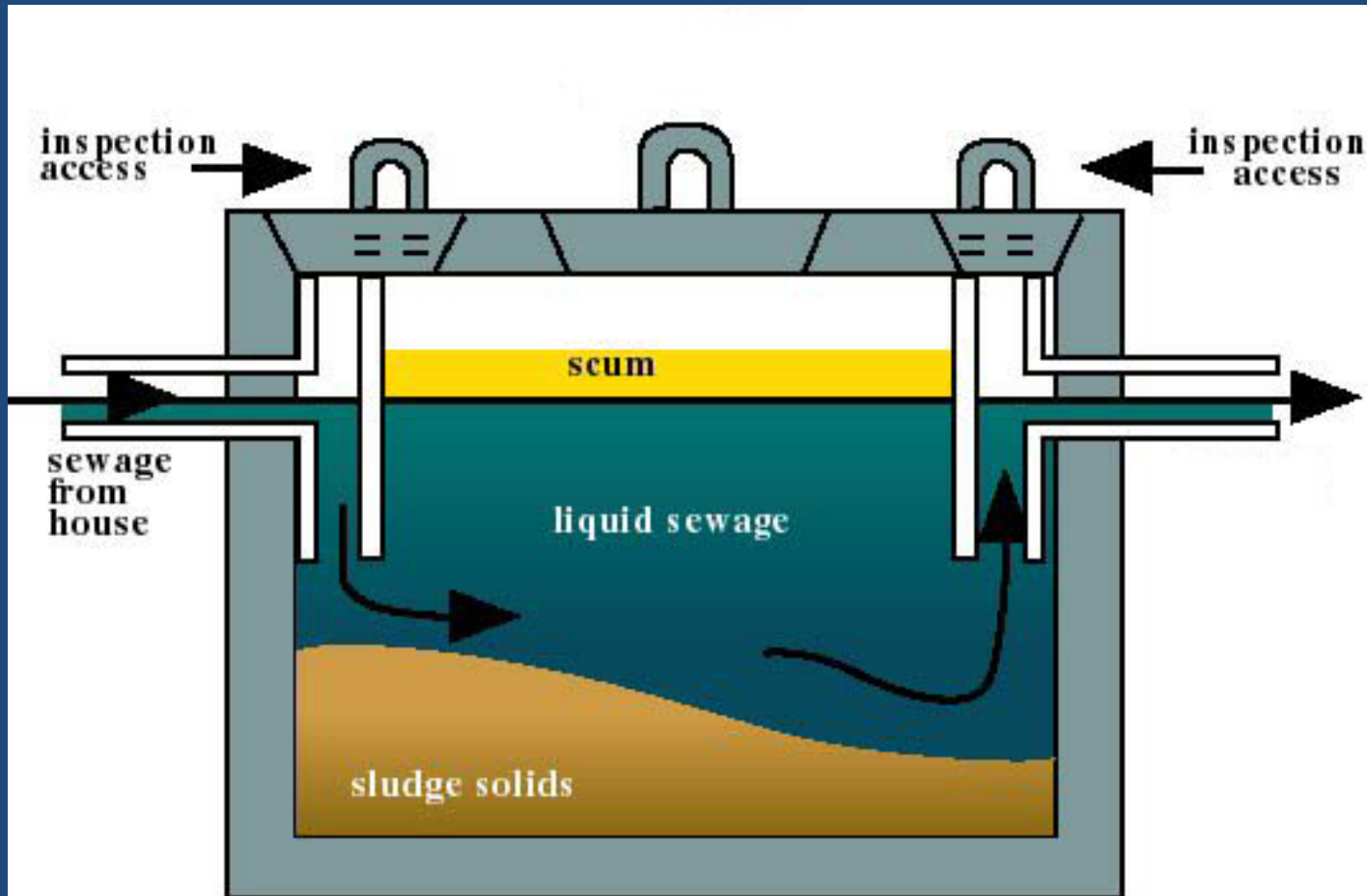
Concrete septic tank with risers



System components-continued

- Septic tank-continued
 - First level of wastewater treatment
 - Separation of liquids and solids
 - Floating solids become scum layer at top of water level
 - Those that sink become sludge at the tank bottom
 - Baffles or “T’s” at inlet and outlet ensure that only water leaves the tank
 - 95% reduction in Fecal coliform. ⁽¹⁾

Septic tank cross section



System components-continued

- Septic tank-continued
 - Anaerobic bacteria breakdown the solid components
 - Over time, scum and sludge layers increase in thickness and must be pumped out
 - Recommend pumping the tank every 5-7 years
 - Tank pumpers must be licensed and have an approved disposal site- municipal facility or land application

System components-continued

- Septic tank-continued
 - Never introduce chemicals into the tank
 - Solvents
 - Paint
 - Plastic
 - Latex
 - Large quantities of bleach
 - Discourage the use of garbage disposals

System components-continued

- Distribution system
 - Distribution box
 - Equal distribution to all lines
 - Diversion valve
 - Fills each line in series
 - Valve must be turned by homeowner twice a year

System components-continued

- Lateral lines
 - Dug on contour
 - Standard depth is 18"
 - Length and number determined by estimated water usage and soil loading rate
 - Standard media is 4" pipe and gravel
 - Gravel substitutes may be approved
 - Vehicular traffic must be restricted

Lateral Line



System components-continued

- Products
 - All products used in the construction of the system must be approved by the Product Review Committee
 - National and State standards must be met
 - NSF
 - ASTM

Summary

- When properly designed, constructed and maintained, onsite wastewater disposal systems can provide years of service
- Natural treatment of wastewater
 - 90-95% reduction of BOD ⁽¹⁾
 - 99% reduction of Fecal Coliform bacteria ⁽¹⁾
 - 85-95% reduction of Phosphorous ⁽¹⁾
- Eliminates cost involved with treating wastewater at a municipal facility

Summary

- No discharge into receiving stream
- Not the old leaky, smelly septic system of the past
- Biological process- all factors cannot be controlled or predicted
- Technology, research and experience continues to improve design and installation

Questions?



References

- 1. Onsite Wastewater Treatment Systems Manual. Environmental Protection Agency. February 2002
- Photos obtained from NRCS Website