



# How a Conventional Ground Absorption Septic Tank System Treats Household Wastewater

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# World Health Organization

- ▶ Reported in August of 2002
- ▶ “3.4 million people, mostly children, die annually from water related diseases”
- ▶ The most prominent reason for these deaths is that “2.4 billion people have inadequate sewage disposal facilities”
- ▶ Protection of public health is a primary goal of your job.



# Plumbing Code

- ▶ Requires water using fixtures to dispose
- ▶ of waste generated in every house
- ▶ This water carried waste must in turn be
- ▶ treated by either an on-site or central
- ▶ disposal system if Public Health is to be
- ▶ protected.



# Conventional Septic Tank System

- ▶ Combined wastewater stream from the house is first discharged to a septic tank thru a single pipe at the inlet of the tank.



# Household Wastewater

- 1.) Water – 98%
- 2.) Suspended Solids
- 3.) Oil and Grease
- 4.) Nitrogen
- 5.) Phosphorus
- 6.) Virus and Disease Organisms
- 7.) Fecal Coliform



# Concentration in Wastewater

Suspended solids(mg/l)	-	250
Oil and Grease(mg/l)	-	60
Total Nitrogen(mg/l)	-	70
Total Phosphorus(mg/l)	-	24
Fecal Coliform/ 100 ml	-	10E6
Virus and Disease	-	present



# Strength of Waste

## Biochemical Oxygen Demand (BOD)

Def.–The amount of oxygen used during the decomposition of organic material contained in the wastewater.

Household Wastewater – 250 mg/l





# Treatment by the Septic Tank

Primary Treatment

- Settling

- Anaerobic Digestion

Required Detention Time

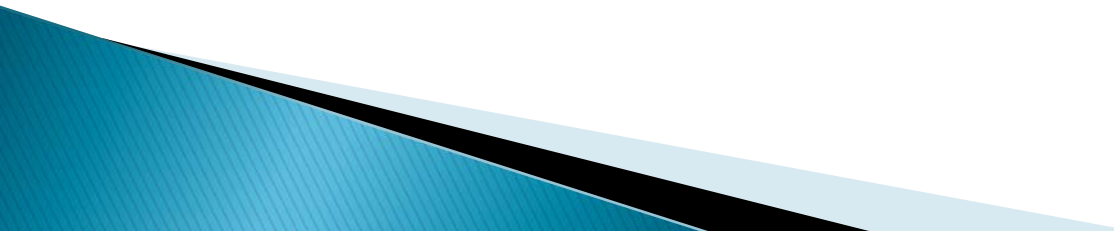
- 2 days





# Concentration of Tank Effluent

	House	Tank
Suspended solids (mg/l)	250	100
Oil and grease (mg/l)	60	20
Total Nitrogen (mg/l)	70	40
Total Phosphorus (mg/l)	24	12
Fecal Coli (org / 100ml)	10E6	10E6
Virus and Disease	pres	pres





# What happens to the effluent after it leaves the septic tank?

- ▶ The sewage enters a distribution device
- ▶ The sole function of this device is to spread
- ▶ the effluent equally to trenches in the soil of
- ▶ the yard.
- ▶ The trenches store the sewage until it
- ▶ infiltrates the soil.
- ▶ The soil must treat the remaining
- ▶ concentration of contaminants in the effluent.



# Treatment by Soil

## Suspended Solids

1.) Filtration

2.) Digestion by Organism

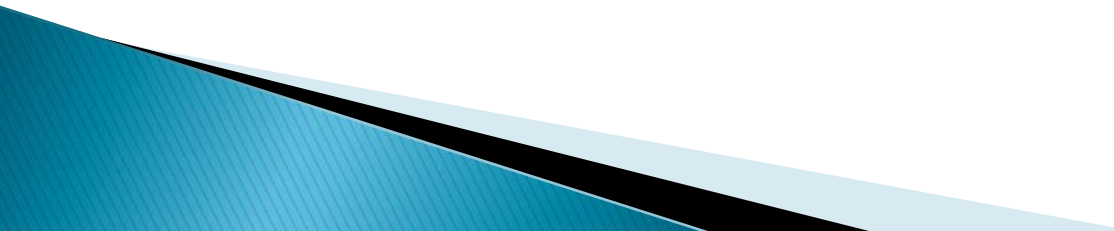
- > aerobic

- > products of digestion

  - carbon dioxide

  - water

3.) Aerobic soil, allows aerobic organisms to digest the solids & prevent clogging of the trenches





# Treatment by Soil


## Grease and Oil

- 1.) Filtration
- 2.) Digestion
  - > aerobic
  - > products – water and CO<sub>2</sub>
- 3.) BOD – Higher for grease and oil than most other O. M.



# Treatment by Soil

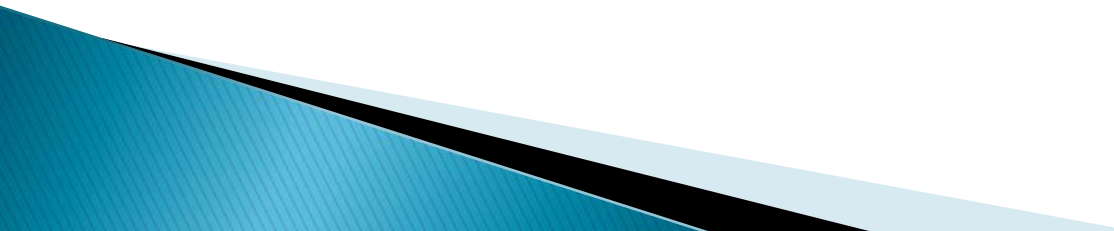
## Nitrogen

- 1.) Most nitrogen converts to ammonia in the tank.
  - 2.) Positively charged and attracted to negatively charged soil.
  - 3.) Aerobic nitrifying bacteria – NO<sub>3</sub>
  - 4.) 40 mg/l nitrate dilutes to <10 mg/l
  - 5.) 40 mg/l nitrate must be diluted to <10 mg/l, if it is to be safe for reuse
- 



# Treatment by Soil

## Phosphorus

- 1.) Chemically bonds to soil.
  - 2.) Concentration increases
  - 3.) Precipitates as combines  
with– Al, Fe, Ca
  - 4.) Insoluble
  - 5.) Fixation
- 



# Treatment by Soil

## Fecal Coliform Disease Organisms


- 1.) Anaerobes.
- 2.) Filtered by the soil and attracted to negatively charged sites.
- 3.) Cannot compete in aerobic environment
- 4.) Die off.
- 5.) Virus is small travels furthest.
- 6.) Fecal coliform are indicators of human contamination



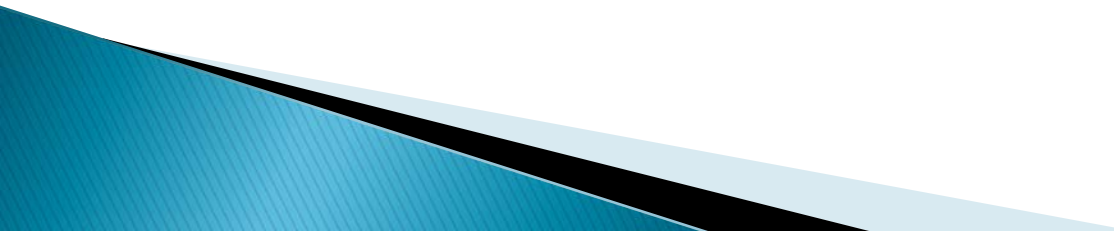
# Conventional Septic Systems Provide Public Health Protection which is:

- ▶ Simple
- ▶ Reasonable in cost
- ▶ Treatment effective
- ▶ Responsible for treating half of the sewage in our state





# The area of soil needed for treatment of the sewage depends on:

- ▶ 1.) The volume of sewage produced in the house
  - ▶ 2.) The long-term acceptance rate, LTAR, that the soil maintains for absorption of the sewage.
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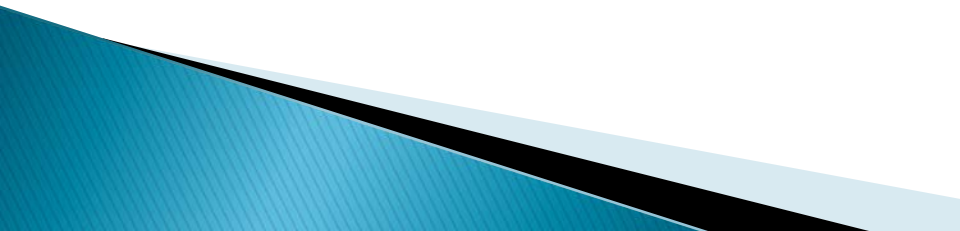


# Volume of Wastewater

Many studies have shown the average household occupant generates **60** gallons of wastewater in a day.

- we assume 2 people per bedroom
- $2 \times 60 = 120$  gal/bedroom/day
- 3 bedrooms  $\times 120 = 360$  gal/day

\* Smallest design flow for any house = 240 gal/day\*





# Required Trench Bottom Area Equals

- ▶ Design flow in gallons per day
- ▶ Divided by
- ▶ LTAR in gallons per square foot per day



# Purpose of site and soil evaluation

Match the assimilative capacity of the soil to treat wastewater to the amount of water coming from the house so that the septic system does not fail



# System Failure

Surfacing of untreated waste

–direct exposure to disease

Contamination of Groundwater

Contamination of Surface Water

