**MID TERM EXAMINATION**

**Subject:** Water supply and waste water management

**Instructor:** Engr Muhammad Hasnain

**Name:** Shahab Shah

**ID::** 13020

**Answer 1a:** “It is the water which is discharged from buildings, houses etc which is unfit for consumption.”

**Wastewater** is the polluted form of water generated from rainwater runoff and human activities. It is also **called sewage**. It is typically categorized by the manner in which it is generated—specifically, as domestic **sewage**, industrial **sewage**, or storm **sewage** (stormwater).

**Answer 1b:**

* Wastewater is a complex matrix containing significant concentrations of solids (total solids 350–1200mg/l), dissolved and particulate matter (chemical oxygen demand 250–1000mg/l), microorganisms (up to 109 number/ml), nutrients, heavy metals and micro-pollutants.
* Most wastewater from a building is sanitary wastewater which includes
* human waste,
* cleaning solutions,
* oil and grease from cooking,
* food particles, and
* soil from cleaning clothes and floors
* Commercial establishments may also discharge metals, acids and bases, and small particles of plastic, glass, stone, etc

**Answer 2a:**

* Domestic households, industrial and agricultural practices produce wastewater that can cause pollution of many lakes and rivers.
* Sewage is the term used for wastewater that often contains faeces, urine and laundry waste.
* There are billions of people on Earth, so treating sewage is a big priority.
* Sewage disposal is a major problem in developing countries as many people in these areas don’t have access to sanitary conditions and clean water.
* Untreated sewage water in such areas can contaminate the environment and cause diseases such as diarrhoea.
* Sewage in developed countries is carried away from the home quickly and hygienically through sewage pipes.
* Sewage is treated in water treatment plants and the waste is often disposed into the sea.
* Sewage is mainly biodegradable and most of it is broken down in the environment.
* In developed countries, sewage often causes problems when people flush chemical and pharmaceutical substances down the toilet. When people are ill, sewage often carries harmful viruses and bacteria into the environment causing health problems.If not treated properly causes water pollution.
* Can lead to various health hazards
* Can cause soil pollution
* Any oxidizable material present in a natural waterway or in an industrial wastewater will be oxidized both by biochemical (bacterial) or chemical processes.
* Since all natural waterways contain bacteria and nutrients, almost any waste compounds introduced into such waterways will initiate biochemical reactions
* Those biochemical reactions create what is measured in the laboratory as the Biochemical oxygen demand (BOD) and Chemical oxygen demand (COD)
* Both have been widely adopted as a measure of pollution.

**Answer 2b:**

## On wastewater reuse can reduce water use in both urban and rural households. At present, most homes use potable (drinkable) water for practically everything in the house and garden.

Two types of wastewater are created in a home: greywater and blackwater.

**Greywater** is wastewater from non-toilet plumbing fixtures such as showers, basins and taps.

**Blackwater** is water that has been mixed with waste from the toilet. Because of the potential for contamination by pathogens and grease, water from kitchens and dishwashers should be excluded from greywater and considered as blackwater.

**Advantage** of reuse of wastewater as a resource rather than a waste product you can:

* reduce water bills
* use fewer water resources
* irrigate the garden during drought or water restrictions
* cut down the amount of pollution going into waterways
* help save money on new infrastructure for water supplies and wastewater treatment
* decrease demand on infrastructure for sewage transport, treatment and disposal, allowing it to work better and last longer.

The **Disadvantages** of reusing wastewater also need to be considered. Currently, the main disadvantage for most households is the financial cost of installing and maintaining a reuse system. The attractiveness of the investment would depend on:

* the extent of centralised wastewater treatment services available
* the price of water in your area (urban) or scarcity of water (rural)
* whether you are replacing an existing system or starting from scratch
* the length of time you intend to live in your current house
* the type of system — annual operating and maintenance costs vary between systems
* whether a restriction free, reliable water supply is valuable to you — wastewater reuse is often a much more reliable secondary source of water than common rainwater tank installations (see Rainwater).

**Recycle**

* Closed-loop treatment systems
* Used to capture, treat, and reuse waste water on-site
* E.g Car wash System
* Wastewater reclamation
* Treats waste water and use it for a different purpose
* E.g MC waste water treatment and use for irrigating parks.

**Answer 3a:**

The benefits of **reusing water in agriculture** are many and beyond doubt: it saves considerable amounts of first-use **water** that may be assigned to critical uses; it provides nutrients that may substitute chemical fertilizers, increasing soil fertility and **crop** yield, and reducing production costs; it makes it possible to expand agricultural land in arid areas.

Freshwater resources can be reserved for other uses

– Chemical fertilizer usage can be minimized

– Discharge of reclaimed wastewater to water bodies can be prevented

• Agro-irrigation = Largest Current User of Reclaimed Water

• Main uses (in order of “preference”)

– Non-food crops

• Commercial nurseries; Timber

• Animal Fodder

– Food Crops

• Fruit-tree Orchards

• Cereals

• Vegetables

• ALSO: Consider the Type of irrigation system.

**Shot Chart below:**

Crop Yield in tons/ha Increase

(%) Wastewater Fresh water

Maize corn 5.0 2.0 150

Barley 4.0 2.0 100

Tomato 35.0 18.0 94

Alfalfa 120.0 70.0 71

Wheat 3.0 1.8 67

**Landscape irrigation**

Landscape Irrigation

– Parks

– School yards

– Highway medians

– Golf courses

– Cemeteries

– Residential

• Recreational / Environmental Uses

– Lakes & ponds

– Marsh enhancement

– Fisheries.

**Answer 3b:**

**Introduction:**

In order to develop sustainable wastewater treatment it is needed to view the wastewater treatment systems using a holistic approach. A holistic approach implies considering the primary and secondary environmental effects and costs that the systems produce. Examples are the pollution produced at the power plant (generating electricity for wastewater treatment) and the energy cost of producing treatment chemicals. Designing or selecting a treatment system based on sustainability criteria.

**Reclamation:**

**Agricultural Production**

– Irrigation: the largest water user (~70-80% of total)

– 50% of food requirements are imported

– 30% of cultivated area is irrigated

• But it accounts for 75% of total agricultural production

• Capacity to Sustain Domestic Food Production

– 750 m3 / inhabitant year necessary

– 1990: 5 countries (Algeria, Israel, Jordan, Malta, Tunisia)

– 2050: 4 more countries (Egypt, Libya, Morocco, Syria)

• Water Availability

– Temporal and Spatial Asymmetries

– “Misguided” agricultural practices.

**Reclamation Technology with sustainable issue:**

**Sustainability of treatment method**

– WW reclamation and reuse; a sustainable practice

– Are the treatment technologiessustainable?

– Natural Treatment Systems

• Constructed Wetlands

• Duckweed Ponds

**• How much treatment is enough?**

– What is the source of wastewater?

• Greywater vs. Blackwater

– Who is the end user?

• Agriculture

• Industry

• Communities

**SUSTAINABILITY ANALYSIS OF WASTEWATER TREATMENT**

**SYSTEMS:**

In earlier times and even to day, engineers and politicians nearly always use a simple

cost/benefit analysis when choosing a wastewater system. This means that, for

instance, only the discharge of organic matter (BOD) or phosphorus and the cost is

looked upon. However, the quest for sustainability is necessary because we see many

problems are coming like global warming, acidification, diminishing ozone layer,

micro-organic pollutants and other toxic chemical matters, eutrophication,

diminishing important resources like phosphorus, potassium and oil and other threats

to mankind, flora and fauna. This shows that many indicators must be used when

deciding what type of wastewater systems we should implement. And we should

choose the wastewater system that contributes most to an overall sustainable future.

The notion sustainability should include ecology, economy and sociological aspects

and the sustainability must also perform on three different stages:

1. Local, where hygienic and health aspects are of concern in time scales of hours or

days.

2. Regional, where classic environmental problems operate in time scales of months

or years.

3. Global, where sustainability matters in a time scale of decades or centuries.

To compare two wastewater alternatives the following indicators may be considered

as relevant for a sustainability analysis (Lindholm and Nordeide 2000):

• Discharge of pollution to local recipients and major recipients. For instance:

phosphorus, nitrogen and organic matter (BOD).

• The amount of micro-organic pollutants and heavy metals in the sludge going to

agriculture.

• Amount of phosphorus, potassium and nitrogen recirculated for plant production.

• Discharge of climate gases like methane and CO2.

• Use of electric energy and fossil energy.

• Use of products with hazardous components.

• Use of finite or critical resources.

• Costs as present value of investments, operation and maintenance.

• The use of area, influence on the landscape, aesthetic- and recreational values.

• The service levels like clogging of sewers and flooding of basements.

• Noise, smell, insects and other disturbances in the operation and construction

period.

• Safety for children.

Indicators that are approximately the same for both alternatives may be eliminated.

The system borders for the analysis of the sustainability of a wastewater system are

very important for the assessment. A wider or narrower definition of the system.

TAINABILITY ANALYSIS OF WASTEWATER TREATMENT SYSTEMS In earlier times and even to day, engineers and politicians nearly always use a simple cost/benefit analysis when choosing a wastewater systemTAINABILITY ANALYSIS OF WASTEWATER TREATMENT SYSTEMS In earlier times and even to day, engineers and politicians nearly always use a simple cost/benefit analysis when choosing a wastewater systemSTAINABILITY ANALYSIS OF WASTEWATER TREATMENT

SYSTEMS