

REPELLO PRODUCTS

BIZ – PIT TOILET & SEPTIC TANK TREATMENT

1 Introduction

Given that one in two South Africans has no access to adequate sanitation facilities - either no facilities, or an unsafe pit or bucket toilet - there is clearly no place for a "yuk" response from people helping to address the sanitation problems of the poor.

Those of us with daily access to clean and efficiently flushing toilets don't think twice about the hazards of unsafe sanitation, which include diseases like cholera, dysentery and environmental pollution. Cholera outbreaks tend to receive widespread media attention and speedy, crisis-management responses.

Less talked about, but just as deadly, is acute diarrhoea, which is a direct consequence of poor water and sanitation provision. **Diarrhoea kills more than 50 000 South African children** every year and affects millions more. HIV and Aids sufferers with compromised immunity are particularly vulnerable to diseases related to poor sanitation.

Seemingly less serious sanitation-related ailments like scabies and intestinal worms are also severely debilitating - the latter can stunt mental and physical growth and even result in death.

The acute health problems that exist or can potentially arise in certain of the urban and in almost all the rural areas of our developing country are as a result of either non-existing or inadequate waste matter treatment.

We are the first to concede that these conditions exist not because of the various authorities neglect but as a result of the almost unbelievable demands that are being made on resources that are not limitless.

It has been reported that half of Johannesburg and Durban's populations (to mention just two large cities) are without access to water-born sewage. These cities' municipalities have realised that they cannot afford to continue installing and maintaining water-born systems and are beginning to offer pit latrines options instead.

No consideration appears to be given to our rural countrymen.

BIZ can make a very significant contribution to the prevention to the spread of diseases such as cholera, dysentery, diarrhoea, and typhoid which are caused by the lack of waste treatment facilities.

2 Introduction to BIZ

The purpose of this document is to

1. introduce "*how*" BIZ will deal with the biological (***biological = to living organisms; bio = of or relating to life***) treatment of domestic effluent (***liquid waste or sewage***);
2. show the benefits of BIZ when used in toilets underground in mines;
 1. deal with those products that deodorise the toilet areas and degreasing of fat traps in mine hostels, butcheries, hospitals, portable toilets, hotels and restaurants.
 2. Illustrate the safety aspects of the products

1. **3 What is waste matter?**

Waste matter (faeces) is what remains after food has been digested, discharged from the bowels.

This material is often inadvertently contaminated with toxic organic and inorganic compounds.

Human waste is a [waste type](#) usually used to refer to by-products of [digestion](#), such as [faeces](#) and [urine](#). Human waste is most often transported as [sewage](#) in [waste water](#) through [sewerage](#) systems. Alternatively it is disposed of in nappies (diapers) in [municipal solid waste](#).

Human waste can be a serious health hazard, as it is a good vector (*an organism that transmits a particular disease or parasite from one animal or plant to another or both [viral](#) and [bacterial](#) diseases*)

A major accomplishment of human civilization has been the reduction of [disease transmission](#) via human waste through the practice of [hygiene](#) and [sanitation](#), including the development of sewage systems and plumbing. Human waste can be reduced or reused through use of waterless [urinals](#) and [composting toilets](#) and [grey water](#). The most common method of [waste treatment](#) in rural areas where municipal sewage systems are unavailable is the use of the [septic tank](#) systems.

In remote rural places without sewage or septic systems, small populations allow for the continued use of "honey buckets" and sewage lagoons without the threat of disease presented by places with more dense populations. Honey buckets are used by rural villages where conventional waste treatment systems can not be utilised.

4 What is Sewage treatment, or domestic wastewater treatment?

Sewage treatment, or domestic wastewater treatment, is the process of removing contaminants from wastewater, both runoff and domestic. It includes the physical, chemical and biological processes to remove physical, chemical and biological contaminants.

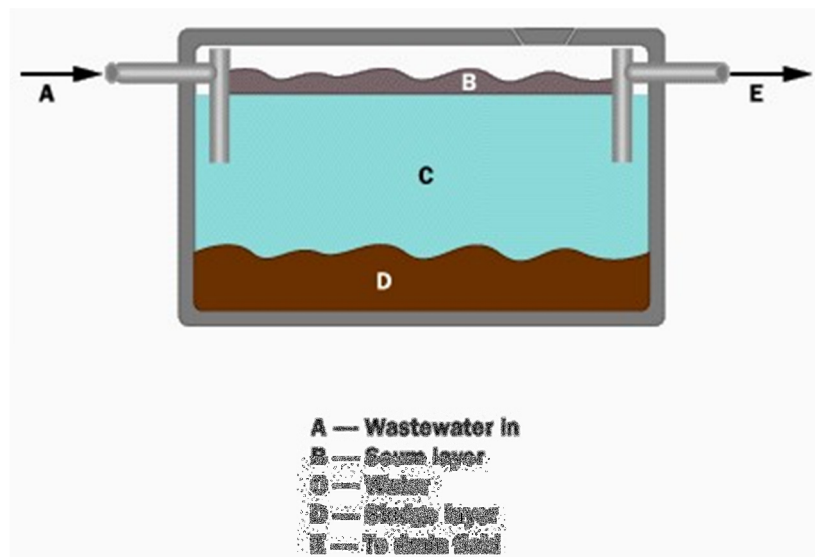
Its objective is to produce a waste stream (or treated effluent) and of solid waste ([sludge](#)) also suitable for safe discharge and/or safe re-use back into the environment.

5 Where are these waste matters generally found?

1. **Septic tanks**; A septic tank [also known as a septic system] is a small scale [sewage treatment](#) system common in areas with no connection to main sewerage pipes. Septic systems are a type of on-site sewage facility;

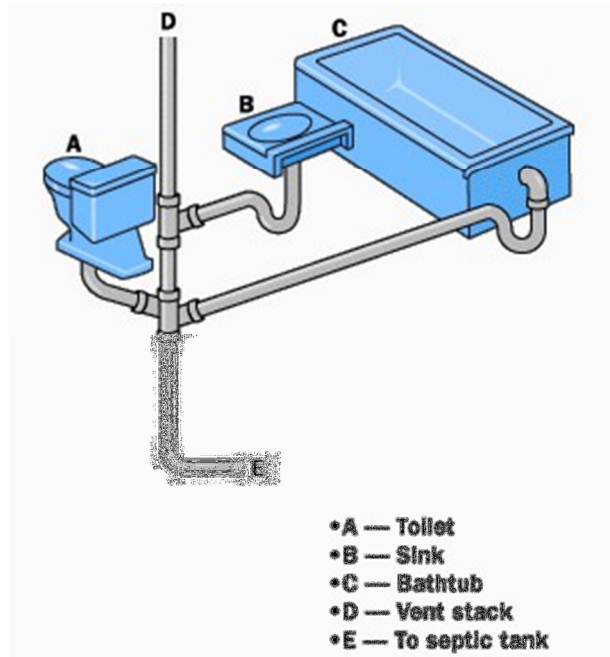
In rural area where houses are spaced so far apart that a sewer system would be too expensive to install, people install their own, private sewage treatment plants. These are called **septic tanks**.

A septic tank is simply a big concrete or steel tank that is buried in the yard. The tank might hold 1,000 gallons (4,000 litres) of water. Wastewater flows into the tank at one end and leaves the tank at the other. The tank looks something like this in cross-section:



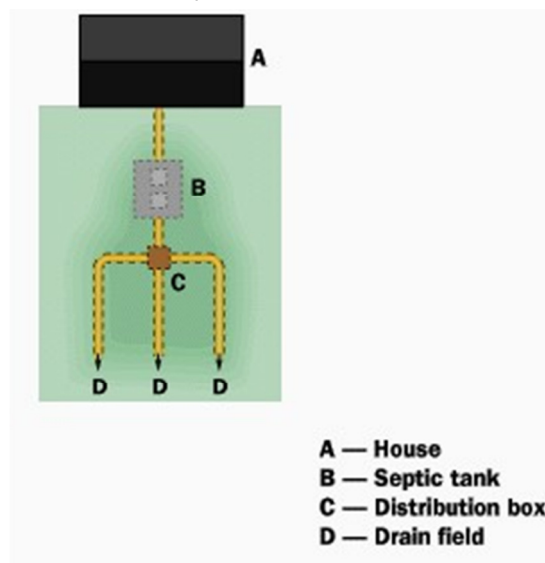
In this picture, you can see three layers. Anything that floats rises to the top and forms a layer known as the **scum layer**. Anything heavier than water sinks to form the **sludge layer**. In the middle is a fairly clear water layer. This body of water contains bacteria and chemicals like nitrogen and phosphorous that act as fertilizers, but it is largely free of solids.

Wastewater comes into the septic tank from the sewer pipes in the house, as shown here:

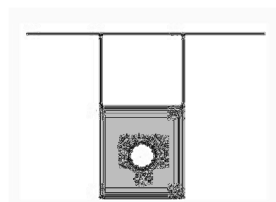


A septic tank naturally produces gases (caused by bacteria breaking down the organic material in the wastewater), and these gases don't smell good. Sinks therefore have loops of pipe called **P-traps** that hold water in the lower loop and block the gases from flowing back into the house. The gases flow up a vent pipe instead -- if you look at the roof of any house, you will see one or more vent pipes poking through.

As new water enters the tank, it displaces the water that's already there. This water flows out of the septic tank and into a **drain field**. A drain field is made of perforated pipes buried in trenches filled with gravel. The following diagram shows an overhead view of a house, septic tank, distribution box and drain field:



A typical drain field pipe is 4 inches (10 centimetres) in diameter and is buried in a trench that is 4 to 6 feet (about 1.5 m) deep and 2 feet (0.6 m) wide. The gravel fills the bottom 2 to 3 feet of the trench and dirt covers the gravel, like this:



The water is slowly absorbed and filtered by the ground in the drain field. The size of the drain field is determined by how well the ground absorbs water. In places where the ground is hard clay that absorbs water very slowly, the drain field has to be much bigger.

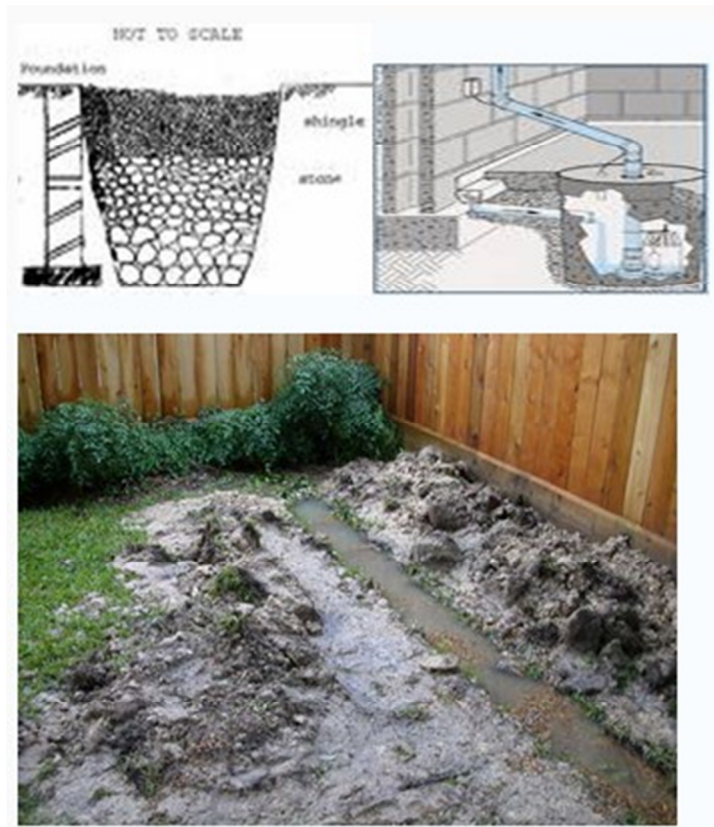
A septic system is normally powered by nothing but [gravity](#). Water flows down from the house to the tank, and down from the tank to the drain field. It is a completely **passive system**.

You may have heard the expression, "The grass is always greener over the septic tank". Actually, it's the drain field, and the grass really is greener -- it takes advantage of the moisture and nutrients in the drain field.

(b) French drains. French drain refers to a [ditch](#) filled with [gravel](#), [rock](#) that [redirects](#) surface and [ground water](#) away from an area. They are commonly used to prevent ground and surface water from penetrating or damaging [building foundations](#).

French drains are also used to accommodate water that flows from the outlet of a typical [septic tank](#) sewage treatment system.

A French drain to a [ditch](#) filled with [gravel](#), [rock](#) that [redirects](#) surface and [ground water](#) away from an area. They are commonly used to prevent ground and surface water from penetrating or damaging [building foundations](#).



A recently completed and poorly functioning French drain after a rainfall

French drains are also used to accommodate water that flows from the outlet of a typical [septic tank](#) sewage treatment system.

In addition to this; French drains are used behind retaining walls to relieve pressure from ground water.

The earliest forms of French drains were simple ditches, pitched from a high area to a lower one filled with gravel. An inclination of 1 in 100 to 1 in 200 is typical. Lining the bottom of ditch with clay pipe increases the volume of water that can flow through the drain.

Landscaping textiles are used to prevent dirt and roots from entering and clogging the drainage pipe. The perforated pipe provides some underground storage volume but the prime purpose is for the perforations to drain the area along the full length of the pipe and to discharge any surplus water at its end. The direction of percolation will depend on the relative conditions inside and outside the pipe.

(c) Pit Toilets.

A pit toilet or compost toilet is a method of collection of [human](#) waste, used for [composting](#), [controlled decomposition](#), or disposal used most often in areas with no [sewer](#) system. Pit toilets are used in [rural](#) and [wilderness](#) areas as well as in much of the [developing world](#). Many variations exist, but at its simplest, the principle is that waste is controlled and with the use of **BIZ** can be treated into harmless by-products

Honey buckets in South Africa (Pit type toilet)

The "bucket system" is used in rapidly developing parts of [South Africa](#). The South African government hopes to eliminate the bucket system by [2007](#). This is far from a reality

A honey bucket is a bucket that is used in place of a [flush toilet](#) in communities that lack water borne [sewerage](#) system.

The honey bucket sits under a wooden frame affixed with a toilet seat lid. The honey bucket gets its name from the actual five-[gallon](#) (19 [litre](#)) buckets which were once used as containers for [honey](#). These are the same type of plastic buckets used for shipping many paints, cleaners, and solvents, as well as institutional quantities of food products.

Furthermore, pit toilets have often been the target of environmentalists who argue that these systems pollute the country's underground water resources. **BIZ** is user friendly and its simple process in that waste is controlled and [decomposed](#) into harmless by-products and underground water resources are NOT POLLUTED

Long-term pit toilets

The waste pit, in some cases, will be large enough that the reduction in mass of the contained waste products by the ongoing process of decomposition allows the pit to be more or less permanent. In other cases, when the pit becomes too full, it will need to be periodically [backfilled](#), and the associated structure is moved or rebuilt over the new waste pit, dug in a new location. Pits may be dug or filled by hand, using shovels, but commonly [excavation equipment](#) is employed for such tasks.



6 How is the wastewater in these three systems biologically treated?

The wastewater treatment in regard to the above three systems is based on the principles of **biodegradation** **Biodegradation** is the process by which [organic](#) (*derived from living matter*) substances are [broken down](#) by other living organisms.

Biodegradable matter is generally organic material such as plant & animal matter and other substances originating from living organisms

Biodegradation is nature's way of recycling wastes, or breaking down organic matter into nutrients that can be used by other organisms.

"*Degradation*" means decay, and the "bio-" prefix means that the decay is carried out by a huge assortment of (*living*) bacteria, fungi, insects, worms, and other organisms that eat dead material and recycle it into new forms.

In nature, there is no waste because everything gets recycled. The waste products from one organism become the food for others, providing nutrients and energy while breaking down the waste organic matter. Some organic materials will break down much faster than others, but all will eventually decay.

By harnessing these natural forces of biodegradation, people can reduce wastes and clean up some types of environmental contaminants.

Through composting natural biodegradation organic wastes are accelerated and converted to a valuable resource.

[Wastewater treatment](#) using BIZ also accelerates natural forces of biodegradation. In this case the purpose is to break down organic matter so **that it will not cause pollution problems** when the water is released into the environment.

Wastewater treatment uses microbes (*micro-organism, especially a bacterium causing disease or fermentation*) to decompose organic (*organic relating to or derived from living matter*) matter in sewage.

If too much untreated sewage or other organic matter is added to a lake or stream, dissolved oxygen levels will drop too low to support sensitive species of fish and other aquatic life.

Wastewater treatment systems are designed to digest much of the organic matter before the wastewater is released so that this will not occur.

Sludge, the collection of solids that are removed during wastewater treatment, requires processing to reduce odour and water content. Depending on the disposal method, the sludge also may undergo treatment to decompose organic matter or kill disease-causing organisms.

Appendix 1 is a series of pictures showing BIZ at work!!!

Bio-augmentation (bio-see above; augmentation means to increase) this is simply the introduction of a group of natural microbial (*microscopic organism see next paragraph*) strain or a genetically engineered variant so as to achieve [bioremediation](#).

Bioremediation can be defined as any process that uses [micro organisms](#) (*microscopic organism, especially a bacterium, virus, or fungus*) [fungi, green plants](#) or their [enzymes](#) (*a substance produced by a living organism and acting as a catalyst to promote a specific biochemical reaction*) [*catalyst: a substance that increases the rate of a chemical reaction without itself undergoing any permanent chemical change*] to return the [environment](#) [The natural environment comprises all [living](#) and non-living [things](#) that occur naturally on [earth](#)] altered by [contaminants](#) (*matter that makes impure by exposure to or addition of a poisonous or polluting substances*) to its original condition.

The sludge accumulated in a wastewater treatment process must be treated and disposed of in a safe and effective manner.

7 [Treatment of sewerage by the local authorities or mining institutions](#)

7.1 [Local authorities](#)

In by far the majority of cases untreated sewage is collected by the local authorities by either:-

7.1.1 The collection of honey buckets (pit toilets) the contents of which are then poured into a tank/trailer adapted to accept the contents; or

7.1.2 By employing a vehicle which sucks up the contents from the pit toilets, French drains and septic tanks into a tank

The contents of the tanks are normally deposited into sewage farms, sewerage trenches, or oxidation ponds.

An illustration of the problems of that can be caused by depositing raw sewerage into a trench will clearly be seen from the pictures in **Appendix 1**. The trench in the pictures is 5m wide; 4m deep and 100m long. The stench was overpowering and that the trench was a source of danger cannot be over emphasised

In order to treat the raw sewerage BIZ is being regularly added to the trench. Due to neglect (or not having the knowledge or resources the trench became clogged with solidified sewerage. The sludge being treated is about 2,500 cubic meters

The effect of the BIZ is shown as digesting the sludge and will eventually have digested the sludge leaving reasonably clean water.

The basic principle of biological wastewater treatment is the bio-degradation of organic pollutants by a diversified population of bacteria. This population or community is known as the biomass (*the total quantity or weight of organisms in a given area or volume*)

Treatment systems are prone to failure due to a loss of members of the biomass i.e. there is insufficient bacteria to process a specific volume of wastewater. This can be solved by adding microorganisms (BIZ) **specially formulated** for its enhanced biodegradation capabilities.

The application of bacteria in this manner is termed **Bio-augmentation**. The use of bio augmentation enhances the degradation potential of existing microbial populations.

BIZ is formulations of treated bacteria and enzymes when water is added BIZ is returned to its active state.

The enzymes are included to maintain a high biodegradation while the bacterial community acclimatizes to its environment and begins secreting enzymes.

The purpose of bio augmentation is to reduce the amount of organic matter (*is matter which has come from a recently living organism; is capable of decay, or the product of decay*) and the number of disease-causing microorganisms, (*organism an individual animal, plant, or single-celled life form: a bacterium, virus, or fungus*) present in the solids.

8 HOW BIZ "DIGESTS" ORGANIC MATTER AND DISEASE-CAUSING MICROORGANISMS

Aerobic digestion

Aerobic digestion is a bacterial process occurring in the presence of oxygen. Under aerobic conditions, bacteria rapidly consume organic matter and convert it into carbon dioxide

Aerobic means "requiring air" (where "air" usually means oxygen).

An aerobic organism or *aerobe* is an organism that has an oxygen based metabolism (*the chemical processes in a living organism by which food (from the waste material) is used for tissue growth or energy production*). Aerobes, in a process known as cellular respiration use oxygen to oxidize (*cause to combine with oxygen*) the sludge, fats and sugar in order to obtain energy.

Facultative aerobes can use oxygen, but also have anaerobic methods of energy production

1. Obligate anaerobes are organisms that cannot survive without oxygen

The opposite of aerobic is anaerobic

Anaerobic digestion

Obligate anaerobe an organism that cannot survive in the presence of oxygen

An **anaerobic organism** is any [organism](#) that does not require [oxygen](#) for growth.

Obligate (strict) anaerobes die in presence of oxygen due to the absence of the enzymes

Anaerobic digestion is a bacterial process that is carried out in the absence of oxygen

Anaerobic digestion (AD) is harnessed and contained; in a naturally occurring process of [anaerobic](#) decomposition an **anaerobic organism** is any [organism](#) that does not require [oxygen](#) for growth.

Obligate anaerobes will die when exposed to atmospheric levels of oxygen.

Some anaerobic bacteria produce [toxins](#) (*poisons*) (e.g., tetanus or botulinum toxins) that are highly dangerous to higher organisms, including humans

9 Benefits of Wastewater Treatment Compared To Benefits of Sewage Collection and Deposited in Trenches or Oxidation Dams

Waterborne diseases that are prevalent in informal settlements and/or rural areas, such as diarrhoea, typhus, and cholera, are caused primarily by poor hygiene practices and the absence of improved household [sanitation](#) facilities.

The process of collection of untreated wastewater from various locations carry the seeds of disaster as during the collection process spillage is bound to occur at random places or the collection takes place at irregular intervals resulting in a build up of the untreated wastewater

The risk to public health of treated wastewater during the collection phase by the use of **BIZ** significantly much lower. In fact with the treatment of the wastewater with **BIZ** at its point of accumulation there will be no need to make a collection because there is no health risk neither any danger of ground water pollution.

10 The Process

1. By adding lukewarm water to **BIZ OTT** the bacteria and enzymes are activated:
2. The bacteria and enzymes aerobically and anaerobically digest (biodegradation and bioremediation) the sludge and waste water to metabolically convert these organic substances for their energy, which in turns produce water of such a quality that the water table and surrounding soils are not polluted or contaminated.

(iii) **BIZ** is a safe, natural, biological process which reduces organic material to harmless water and soluble substances like nitrates and gases. In the process, pathogens and harmful micro-organisms are destroyed, so they cannot contaminate underground water or spread diseases like cholera. Pit latrines can cause underground water pollution and are less hygienic

11 BIZ: BENEFITS OF BIO-AUGMENTATION AND BIO-REMEDICATION

Septic tanks, conservancy tanks and pit-toilets

EVERY DELIVERY OF BIZ IS ACCOMPANIED WITH A CERTIFICATE THAT THE PRODUCT COMPLIES WITH THE STANDARDS AND SPECIFICATIONS OF THE SOUTH AFRICAN BUREAU OF STANDARDS

- **BIZ** contains natural harmless micro-organisms chosen for their specific abilities to accelerate the biodegradation process of human, vegetable, animal, fibrous and hydrocarbon waste;
- In addition some of the microbes used, due to their unique capabilities of converting an anaerobic to an aerobic environment, eliminate waterborne diseases such as dysentery, diarrhoea and typhoid;
- Other microbes in the products compete with the cholera and other disease producing bacteria for the same food source, starving these diseases producing bacteria and preventing it from spreading.

Benefits:

- Biodegrade, empty, the total sewerage and paper content of a pit toilet (long drop) in between 5 to 20 days **without contaminating the groundwater** with waterborne diseases including cholera **and kill the mosquito and black-fly larvae;**
- Biodegrade the hydrogen sulphides, the sewerage smell, within 24hrs to 48hrs;_
- Biodegrade the solid effluent in the chambers of a septic tank including decongesting the soak-away, rendering the system functional including the other health benefits referred to above;_
- Decongest the anaerobic and aerobic solid effluent in oxidation and maturation ponds at a far less a cost of conventional methods and with the added health benefits that mechanical methods don't have._
- Accelerate the biodegradation process in hydraulically overloaded sewerage works to accommodate the extra load and to ensure that the final effluent conforms to discharge standards, including the health benefits;_
- Biodegrade sewerage spills in rivers and dams rendering the water safe again;_
- Bioremediation of contaminated soil and water by hydrocarbons._

Other sewerage and waste related problems that will be remedied with the added health benefits the "BIZ" products enjoy:

- v Aqua privy toilets
- v Fat & grease traps
- v Aeration chambers
- v Clarifiers
- v Reactivate systems after hazardous chemicals have killed off the biomass
- v Biologically activate new systems
- v Clear sewerage blockages in drains and congested manholes
- v Conservancy tanks
- v Anaerobic reactors
- v Anaerobic digesters
- v Humus tanks
- v French drains
- v Bio-filters
- v Activated sludge systems

BIZ at work!!

A small municipality in the Eastern Cape had in order to “store” (dump??) untreated sewerage had a trench dug as the “receiver” of its untreated sewerage.

The untreated sewerage was collected in drums on a tractor from pit toilets and the sewerage that the municipality was incapable of treating and dumped into the trench

The trench is 5m wide; 4m deep and 100m in length (distances approximate)

The volume of the sludge in the trench is between 2000-2500 cubes. The sludge formed a thick crust over the whole length width and depth in and over the trench

Not only was the stench from the trench unbearable and because it was not fenced is a huge source of danger.

The municipality arranged for the contents of the trench to be treated with BIZ. In order to activate the BIZ large quantities of water had to be pumped into the trench

The following are a series of photographs showing the progressive “digestion” of the sludge.



The Solid Sludge Crust



Notice the vegetation growth through the sludge!!



BIZ at work. Notice the white areas indicating that the sludge is being digested



More white more digestion!!!!



Notice that there is no sludge between the sludge bulk and the wall of the trench



Sludge being treated Notice water - no sludge



This area of the trench - sludge free.

No more work left for BIZ!

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