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**WATER, SANITATION AND HYGIENE:  
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**Resource-oriented toilet: a sustainable sanitation option  
adopted in Arba Minch, Ethiopia**

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*The ROSA project (Resource-Oriented Sanitation concepts for peri-urban areas in Africa) proposes resources-oriented sanitation concepts as a route to sustainable sanitation and to meet the UN Millennium Development Goals. These concepts are applied in ROSA's four pilot cities in Eastern Africa: Arba Minch in Ethiopia, Nakuru in Kenya, Arusha in Tanzania, and Kitgum in Uganda. Within the framework of the ROSA project several pilot units have been constructed for the treatment and safe use of human excreta, grey water and solid waste. Researches were also carried out targeting the gaps for the implementation of these resource-oriented sanitation solutions. In this paper the methods followed for the construction of toilet units constructed in Arba Minch town which include UDDT (urine diversion Dry Toilets), Fossa Alterna & Arborloo are described. In addition the implementation of the resource oriented concepts are addressed to share the knowledge acquired while implementing these toilet units.*

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## **Introduction**

Arba Minch town, with a population of about 79000, is administratively located in Gamo Gofa zone of the Southern Nations, Nationalities and Peoples Region at about 500 km south of Addis Ababa (capital of the country) while 275 km south of Awassa (capital of the region). Most households use a pit latrine for excreta disposal, with a superstructure made of local material, a privacy cover of old clothes or pit without any privacy cover. Gorges and jungle sites are potential open defecation areas and solid waste disposal sites. About 10% of the households in the town practice open defecation.

The ROSA project promotes resource oriented sanitation concepts as a route to sustainable and ecologically sound sanitation in order to meet target 10 of the MDG. Different resource oriented sanitation systems have been built in Arba Minch town that include 15 urine-diversion dry toilets(UDDT), 23 Fossa alternas, 10 Arborloos, 8 greywater towers, 1 biogas unit and more than 4 co-composting schemes and researches have been made to evaluate these units. The first two or three units were built for demonstration purposes. These units were considered as first testing units and the construction cost was covered fully from ROSA project budget. The remaining units were built with cost sharing as a strategic subsidy, (MoH, 2006), whereby about 75% of the total construction cost was covered by the households and the remaining 25% was covered from ROSA project budget. From now on there will be no subsidy and the households will cover all the costs; and the construction of the units will be made by micro and small enterprises that were trained and are capable of constructing such type of ecological sanitation units.

In this paper we have tried to show the concepts and construction methodologies adopted by ROSA project to construct the three types of toilets to share our knowledge based on the experience we acquired in the past two years of the project period.

## **Urine diversion dry toilet**

Urine-diverting dry toilets are toilets that use a special pedestal or squat plate in which the urine enters the front part of the pedestal and is then diverted through a pipe and is thus separated from the faeces which fall directly downwards into a vault or container. Some wood ash is added to cover the faeces after every visit.

This covers the deposit and helps to dry out the surface of the faeces and makes them easier to handle and transfer. The distinct advantage of this method is that the urine which is rich in nitrogen can be collected separately, making it available as a liquid fertilizer. Also the solid component, being in a semi dry state, is much easier to handle and is safer from the beginning, even if it does initially contain pathogens. Being semi dry, it does not smell so much and its potential as a fly breeding medium is much reduced compared to the mix of urine and faeces. Eventually the faeces become completely composted.

There are many types of urine-diverting toilets available for use. The ROSA project in Arba minch town implemented two different types:

1. A UDDT that uses a single vault in which the urine is collected by PVC pipe and stored in a storage plastic tank and the faeces, together with the added ash, is collected in a 110 litre barrel held in the vault. When the barrel gets filled, it is closed with a lid and put under a shade. And an empty barrel is replaced in the vault.
2. A UDDT that uses double vaults in which one vault is used first and when it is full the second vault is used. When the second vault is full the first is emptied and can be used as soil conditioner.

### ***The UDDT pan***

Urine diversion requires a specially designed seat-riser or squatting slab or pan that is functionally reliable and socially acceptable. The basic idea of how to avoid mixing urine and faeces is simple: the toilet user should sit or squat over some kind of dividing wall so that faeces drop behind the wall and urine passes in front of the wall through pipes. In recent years several factories have started producing squatting pans as well as seat-risers with urine diversion. The ones installed in the UDDT toilets in Arba Minch are squatting pans. There are five options which are made available for the community. Refer Figure 1.



**Figure 1. UDDT squatting pans**

1. A UDDT pan made of fibreglass which is manufactured by Ethio-fibreglass Factory in Ethiopia.
2. A UDDT pan made of plastic which is manufactured by Awassa Tabor Ceramic Factory in Ethiopia.
3. A UDDT pan made of plastic material which is manufactured by AquaSan Manufacturing Ethiopia Plc.
4. A UDDT pan made of reinforced concrete which is cast in ROSA project office compound.
5. A urine diversion pan cast on the toilet slab making use of concrete.

3

In addition, one sitting type UDDT pan, manufactured by Ethio-Fibre glass factory, is installed at the ROSA office toilet. Refer Photograph 1.

### ***Waterless urinal***

In all Urine Diversion Dry Toilets, waterless urinals are installed for men. The urinals, Photograph 2, are connected by a pipe to the urine storage tank. In some cases a urinal is locally prepared from used small and big jerry cans. An ecolily, a waterless female urinal where women can urinate in a standing position, was also installed in one of the toilets for trial. Refer Photograph 3.



Photograph 1. UDDT sitting pan



Photograph 2. Men waterless urinals



Photograph 3. Ecolily



Photograph 4. Urine collecting mechanism

### *Urine Storage Tanks*

Two types of urine storage tanks are used. One type is a 110L plastic barrel. In some cases where higher amounts of urine are produced 250L tanks are used. In both cases when the urine gets filled a hose which is fixed at the bottom of the tanks is used to empty the urine from the tank to a Jeri can put at lower position. The hose can also be used as urine level indicator. Refer photograph 4.

### *The UDDT house structure*

All the UDDTs are constructed above the ground. The slab is usually fixed on 10cm reinforced concrete slab. In some house holds a wooden log which is covered by concrete was also used. Two types of material, woven bamboo locally called 'karta' with canvas and corrugated iron sheet, were used for the super structure above the slab. Four types of construction material were used for constructing the wall structure below the slab. 1) Hollow concrete wall, 2) Stone masonry wall, 3) Brick wall and 4) Mud wall. Photograph 5 shows some of the UDDT structures constructed in Arba Minch town showing the different types of construction materials used.



Photograph 5. Some of the UDDTs constructed with different material

### **Fossa alterna**

Fossa alterna, a double pit compost toilet, is made up of six parts viz. two pits, two ring beams to protect the two pits, a single concrete slab which sits on one of the ring beams and the toilet house which provides privacy (Peter Morgan, 2007).

In this type of toilet urine was not separated from faeces. Three cups of soil and one cup of ash are added after every use. One pit fills up first. During the first season the second pit is unused. After the first one or two years, depending on the number of users, the first pit will get filled. When the first pit is full, the toilet slab and structure are moved on to the second pit and top soil is placed over the contents of the first pit which is then left to compost. The second pit is then put to use whilst the contents of the first pit are composting. When the second pit gets filled, the first pit will be ready to empty the compost in the pit. After the original pit is emptied the toilet slab and structure can be placed back again over the empty pit and the recently filled pit covered with soil and left to compost for a further year. This changing of the pits can continue for many years in the same site.

The two pits dug for Fossa alterna are having a depth of 1.5-1.8m and have a square section of (0.9mX0.9m). Square ring beams, made of hollow concrete blocks, are cast on the pits. The external measurements of the beam are 1.3m X 1.3m and the internal measurements are 0.9mX0.9m. The reinforced slab has 5cm thickness and a dimension of 1.2mX1.2m. It can be cast on site or be cast at a central place and transported to the construction sites. A mould of wooden purlin (5cmX7cm) was used to cast the slab. The reinforcement used is 6mm in diameter. The toilet superstructure is portable and is made of either woven bamboo or corrugated iron sheet. Refer Photograph 6 to see some of the units constructed in Arba Minch.



**Photograph 6. Fossa alternas constructed with different material**

### Arborloo

The Arborloo, a single pit compost toilet, is a simple toilet that is made up of 4 parts viz. a pit, pit protection, a concrete slab and a toilet house (Peter Morgan, 2007).

Like the Fossa Alterna three cups of soil and one cup of ash are added after every use. When the Arborloo pit is full, the parts of the toilet are moved to another place, rebuilt and used in the same way again. A thick layer of soil is placed over the filled pit. A young tree is planted in this soil and is watered and cared for. Refer Photograph 8. The content of the pit will decompose over time and be utilized by the planted tree.

The pit dug for Arborloo is shallow and has a depth of 1.2m. It is circular and has a diameter of 80cm. To prevent the collapse of the pit a sheet metal or a half barrel was used. In stable soils protection was not used. The slabs used for the Arborloo are made of concrete and have a dome shape. These slabs are 5cm thick and have 1m diameter. A pile of sand is used to create the dome shape and a 5cm wide sheet metal is used as a mould. Reinforcement was not used. Three slabs are cast from one bag of cement. Easily movable shelter is placed on top of the pit. In most of the Arborloos, the material used for the superstructure is the locally available woven bamboo. Refer Photograph 7.



**Photograph 7. Typical Arborloo in Arba Minch**



**Photograph 8. . Papaws grown on filled Arborloo pits**

## Conclusion

Locally available material and simple methodology was used for the construction of the UDDTs, Fossa alternas & Arorloos and an opportunity to use the products of the toilets was demonstrated. The community of Arba Minch liked the toilet units and the demand is increasing. The selection of the toilet units depends on the site condition and available area in the compound of the households. Therefore such types of toilets can be adopted in peri-urban areas of Ethiopia and other developing countries.

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