



Fig. 1: Project location

	biowaste	faeces/manure	urine	greywater	rainwater
collection		Urine diversion dehydration toilet (UDDT)	Urine diversion dehydration toilet (UDDT)		
treatment		Storage in vault (dehydration)	Storage in container		
reuse		Planned to be used as soil conditioner	Used as fertiliser		

Fig. 2: Applied sanitation components in this project.

## 1 General data

### Type of project:

New construction of pilot urine diversion dehydration toilets (UDDTs) at a school

### Project period:

Start of construction: June 2008

End of construction: July 2008

Start of operation: March 2009

Ongoing monitoring period planned for: 24 months

Project end: March 2010

### Project scale:

Number of persons covered: 56 (school teachers)

Total investment: EUR 1753

### Address of project location:

P.O. Box 3013, Arusha, Tanzania

Daraja II Primary School, Sanare street, Daraja II ward

### Planning institution:

ROSA Tanzania

Resource-Oriented Sanitation for peri-urban areas in Africa

### Executing institution:

Arusha Municipal Council & University of Dar es Salaam

### Supporting agency:

European Union



The work was carried out within the project ROSA (*Resource-Oriented Sanitation concepts for peri-urban areas in Africa*; Contract No. 037025-GOCE; duration: 1.10.2006 – 31.3.2010), a Specific Target REsearch Project (STREP) funded within the EU 6th Framework Programme, Sub-priority "Global Change and Ecosystems".

## 2 Objective and motivation of the project

The general objective of the ROSA project is to promote resource oriented sanitation concepts in schools, and the specific objectives of this project are to:

- Raise awareness of teachers on resource oriented sanitation concepts and to use this awareness as a basis for transferring the concept to students.
- Use the project for training of the community around and creating a rapid multiplying effect of the concept within the municipality.

The main expected impact of the project is to have a critical mass and wide spread adaptation of the concept.

## 3 Location and conditions

The project area (school) is located in one of the ROSA project pilot wards namely Daraja II in Arusha. The school has a small land area of less than two hectares (19,600 m<sup>2</sup>) with pit latrines being used for excreta management. The school has a total enrolment of 2,457 students who share 17 pit latrines.



Fig. 3: UDDT toilet block (2 cubicles with 2 vaults each) made of concrete blocks in Daraja II primary school. The plastic tank for urine collection can be seen on the left side of the toilet. All pictures in this document are from the ROSA project in Arusha 2008-2010.

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Fifty-six (56) teachers share two pit latrines. The idea was to give time for the teachers to understand the resource oriented concepts and especially the O&M part with their own new UDDTs. Scaling up for the students toilets is left for the future when the capacity will have been built in the school. The estimated population of Arusha is 516,000 with 4% annual growth rate and the distance to the capital Dar es Salaam is 647 km. The average household size is 4.5 people.

Arusha municipality consists of people with multicultural religious backgrounds. About 95% of households are washers (meaning they use water for anal cleansing). This is so because apart from Muslims that do anal cleansing, non-Muslims also use water for anal cleansing due to limited funds to buy toilet paper.

In Tanzania, the under-five child mortality rate is currently 108<sup>1</sup> children per 1000 (compared to 163 per 1000 in 1990).

### 4 Project history

The selection and implementation of urine diversion dehydration toilets (UDDTs) in Daraja II primary school was based on a baseline survey carried out by the ROSA project and a series of stakeholder meetings (Fig. 4) to discuss sanitation challenges within the ward. Daraja II primary school was chosen as it was considered that it would bring impacts to the students and also community around the school. Due to limitations of resources (finance) it was decided that demonstration units should be designed for only members of staff (56 teachers) in the school.



Fig. 4: Stakeholder meetings in Daraja II ward.

### 5 Technologies applied

Urine diversion dehydration toilets were chosen by the project team for this project. This is due to the fact that the structure is permanent and there is a possibility of using the products

<sup>1</sup> The under-five mortality rate is the probability (expressed as a rate per 1,000 live births) of a child born in a specified year dying before the age of five if subject to current age-specific mortality rates. (<http://www.childinfo.org/mortality.html>) and (<http://www.childmortality.org/>)

from the toilet for local agriculture. Lack of smell and flies as a result of keeping faeces dry is a further advantage of this technology. Provision of two vaults per UDDT will give the product time to dry. Once one vault is full, the other vault will be used.

### 6 Design information

The UDDT was made based on EcoSan Club Manual ([www.ecosan.eu](http://www.ecosan.eu)). Four vaults were constructed (Fig. 5) in which two vaults were intended to be used by female teachers and the other two vaults for male teachers. Each vault has a size of 1 m<sup>3</sup> and a 1000 L plastic tank was placed adjacent to the stairs for urine collection. It is estimated that if the UDDTs are fully used it will take about four weeks to fill the urine tank. A valve has been provided at the bottom of the tank, which is used for emptying the urine tank.

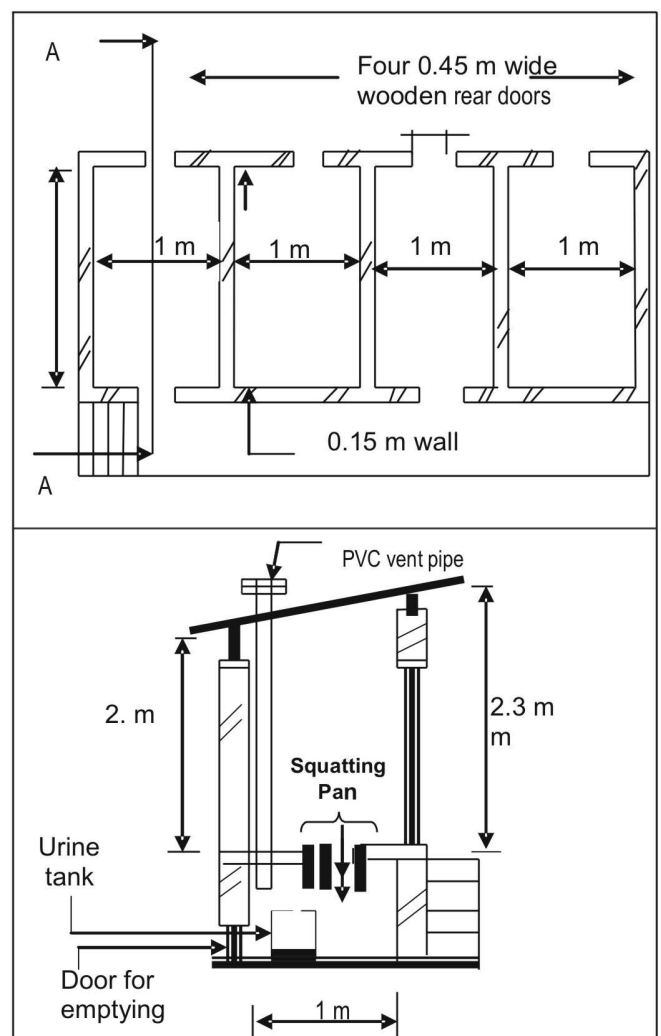


Fig. 5: Floor plan and cross section of the double vault UDDT.

For the UDDTs, concrete blocks of 12.7 cm thickness were used as substructure and the super structure was also built using concrete blocks of the same size. The plastic urine diversion squatting pans were imported from a supplier called Kentainer (Embassy area in Nairobi, Kenya). Access to the

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vaults is facilitated through black painted timber panels. The unit has an ablution place for washers, and the wash water is simply discharged to the ground. Emptying of faeces vaults is done through a rear wooden door painted black for facilitation of pathogen destruction.

### 7 Type and level of reuse

Since the beginning of its operation urine from the UDDTs is being used for fertilising flowers around the school compounds. This offers an opportunity for pupils in the school to learn how useful the products of UDDTs can be.

It is expected that in future urine and faeces will also be applied in other areas of the municipality where urban agriculture is carried out. Although this has not taken place yet, a ROSA project staff member from the municipality has established a section in the sanitation department to deal with the resource oriented issues in the future.



**Fig. 7:** Flowers in school compound fertilised by urine from UDDTs.

### 8 Further project components

There are no further project components.

### 9 Costs and economics

The costs for construction of the UDDTs in Daraja II primary school were fully covered by the ROSA project. The toilets were built by Kiure Construction Company at a total cost of EUR 1753 (see table below for a basic break-down; a more detailed cost break-down was not available).

The amount would correspond to **EUR 850** (1753 divided by two) for *one* UDDT. The cost is very high because the idea was to make the toilet impressive and nice. Also, a contractor<sup>2</sup> was hired to build it. Hiring a contractor is costly, because they pay tax and also charge high to make a profit. In other

places where local masons were used the cost was much lower.

**Table 1:** Construction cost of two double vault UDDTs at Daraja II primary school including labour.

S/No	Particulars	Costs (EUR*)
1	Construction of substructure	878
2	Construction of superstructure	875
Total		1753

\* 1 EUR = 1600 Tshs.

Building UDDTs by using local masons trained by ROSA is cheaper compared to those built by using contractors. Double vault UDDTs built by contractors cost EUR 877 as compared to those by local masons which cost EUR 410. These contractors normally offer services at high costs to earn good profit, which is contrary to local masons trained by ROSA project who do not have a company but good skills to do the work. The UDDTs for demonstration built by ROSA project followed government procurement procedure, which led the cost to be very high. This is a lesson which local authority has to take seriously.

The cost of a concrete squatting pan is EUR 3 in Tanzania, and the plastic urine diversion squatting pans from Kenya were about EUR 33 (the plastic one was used in this project). The company Henkel limited in Arusha also made glass fibre urine diversion squatting pan at a cost of EUR 63.

### 10 Operation and maintenance

There was a delay between the end of construction and commissioning of the new toilets due to some government protocol in commissioning of various projects. The school management wanted to make the occasion very official and to be done during independent torch day which made the whole process very much delayed. To date, the operation and maintenance of the UDDTs in Daraja II primary school has been left to the school management after receiving minimum training on how to use the toilet and reuse the UDDT products.

The headmaster has appointed one of the teachers (Ms Happiness) to be responsible for day-to-day maintenance of the toilet. She has to make sure that ashes and toilet papers are available and that general cleaning is done properly. The cleaning is done by students as part of their extracurricular (outside class) works as per school regulations.

There have been some problems in operating the UDDTs due to urine pipe blockage which has been experienced once. ROSA project staff was called to unblock the system (Fig. 7). The blockage occurred because some users poured ash into the urine compartment instead of the faeces hole. ROSA staff was called to unblock it because the school was still learning and some of the staff needed to learn as well since they were not following the required procedure.

<sup>2</sup> A "contractor" in the Tanzanian context is a specialist with a relatively high education level who might run a proper business.



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**Fig. 8:** ROSA project staff unblocking urine pipes at Daraja II primary school UDDT.

## 11 Practical experience and lessons learnt

There has been a follow up by the ROSA project to see what are the challenges and local constraints in operating this demonstration unit. Information on transportation and emptying operators has been collected. Through monitoring, some interventions and experiences have been shared with various stakeholders including the Daraja II primary school.

The operation and maintenance study which is mentioned in Section 13 has analysed the system in detail. Some findings are summarised below.

The estimation of transportation costs, which will allow operators to make profit, is affordable to majority of residents in the study area and as such there is a high chance for O&M of UDDTs to succeed in Arusha municipality. The important issue here is for the Municipal authority to establish resource-oriented section within the sanitation department to coordinate the process. There has been increase in the number of UDDTs by 60% from 5 UDDTs in 2008 to 8 UDDTs in 2009 as a result of the availability of masons trained by the ROSA project and promotion activities.

There have been challenges in operating the UDDTs in Arusha. These include:

- Blockage of urine pipes due to wrongly applying ashes to the urine hole.
- Smelling of toilets from time to time due to delay or inadequate application of ashes and not cleaning the urinal system.
- Delay in emptying of urine when the container is full.
- Using water for anal cleansing instead of paper or toilet paper (and not ensuring that the anal washwater is kept away from the faeces hole).

Observation on constructed UDDTs has indicated that those people who use their toilets properly (applying ashes after defecation and not allowing water to enter the faeces vault through the vent pipe or during moping, clean urinal pipe sometimes with little water) have their toilets with no flies,

smell and as such their sanitation has been improved significantly. However there are some families (25% of UDDTs) who do not use their toilets properly. As a result they have flies, smell and the faeces become wet.

Much is expected to be done by ROSA project staff instead of school management: Since the unit was fully financed by ROSA project, the school management is expecting the project to continue supporting the O & M of the unit such as buying toilet paper and making follow-up visits. Hence, the ownership is low. Effort has been made to reduce this attitude.

## 12 Sustainability assessment and long-term impacts

A basic assessment (Table 2) was carried out to indicate in which of the five sustainability criteria for sanitation (according to the SuSanA Vision Document 1) this project has its strengths and the aspect not emphasized signify (weaknesses).

**Table 2:** Qualitative indication of sustainability of system. A cross in the respective column shows assessment of the relative sustainability of project (+ means: strong point of project; o means: average strength for this aspect and – means: no emphasis on this aspect for this project).

Sustainability criteria	collection and transport			treatment			transport and reuse		
	+	o	-	+	o	-	+	o	-
health and hygiene	X			X			X		
environmental and natural resources	X			X			X		
technology and operation	X				X			X	
finance and economics			X			X	X		
socio-cultural and institutional	X			X			X		

### Sustainability criteria for sanitation:

**Health and hygiene** include the risk of exposure to pathogens and hazardous substances and improvement of livelihood achieved by the application of a certain sanitation system.

**Environment and natural resources** involve the resources needed in the project as well as the degree of recycling and reuse practiced and the effects of these.

**Technology and operation** relate to the functionality and ease of constructing, operating and monitoring the entire system as well as its robustness and adaptability to existing systems.

**Financial and economic issues** include the capacity of households and communities to cover the costs for sanitation as well as the benefit, such as from fertiliser and the external impact on the economy.

**Socio-cultural and institutional aspects** refer to the socio-cultural acceptance and appropriateness of the system, perceptions, gender issues and compliance with legal and institutional frameworks.

For details on these criteria, please see the SuSanA Vision document "Towards more sustainable solutions" ([www.susana.org](http://www.susana.org)).

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With respect to the longer term impacts of the project: The project concentrated in only three wards of Arusha: Daraja II, Lemara and Sokon I. The uptake of UDDTs has not been very good because of financial constraints. The private sector is not really enabled to get loans from banks due to lack of guarantees.

### 13 Available documents and references

Additional **photos** from this project are available at:  
<http://www.flickr.com/photos/qtzecosan/sets/72157626523775274/>

Information on Arusha, Tanzania can be found at the ROSA website:  
[http://rosa.boku.ac.at/index.php?option=com\\_content&task=view&id=11&Itemid=11](http://rosa.boku.ac.at/index.php?option=com_content&task=view&id=11&Itemid=11)

#### Further publications:

Lechner, M. (2007). Dry Toilets - EcoSan Club Manuals - Volume 2. EcoSan Club, Austria. <http://www.susana.org/lang-en/library?view=ccbktpeitem&type=2&id=1175>

ROSA (2006). Resource-oriented sanitation concepts for peri-urban areas in Africa - a specific target research project funded within the EU 6th framework programme sub-priority, Annex I - "Description of Work". <http://www.susana.org/lang-en/library?view=ccbktpeitem&type=2&id=1095>

ROSA (2007). Assessment and baseline study for sanitation development of strategic and sanitation waste - Work package 6 team Arusha, Tanzania. ROSA Project Report. <http://www.susana.org/lang-en/library?view=ccbktpeitem&type=2&id=1096>

Senzia, M.A., Markus, L., Elke, M., Kimwaga, R. (2009). Local requirements and constraints of O&M of urine diverting dry toilets - Final report on O&M research topic. ROSA project, Arusha, Tanzania. <http://www.susana.org/lang-en/library?view=ccbktpeitem&type=2&id=1093>

### 14 Institutions, organisations and contact persons

#### Planning, Design and Construction Supervision

M.A Senzia (main contact)  
Formerly coordinator in research activity for ROSA, focal person in O&M and WHO research topics  
Currently: Deputy Principal, Arusha Technical College,  
P.O:Box 296, Arusha  
E: [msenzia@yahoo.co.uk](mailto:msenzia@yahoo.co.uk)

Dr Tumain Kimaro (was package leader of ROSA project but passed away in 2010)  
ROSA Project - Package Leader (WP6),  
University of Dar es Salaam,  
Water Resources Engineering Department,

#### ROSA project Arusha

Team Leader, Dr. Ibrahim Isack

Arusha Municipality, P. O. Box 3013  
E-mail: [ibrah77@yahoo.com](mailto:ibrah77@yahoo.com)

#### Arusha Municipal Council

Patrica Kinyange (was local project coordinator)  
Arusha Municipality, P. O. Box 3013  
E-mail: [pattykiny@yahoo.com](mailto:pattykiny@yahoo.com)

#### Supplier of plastic urine diversion squatting pan

Elisabeth Mutua, Kenya-Kentainer  
Embakasi Rd. off Airport  
North Road, Nairobi  
Tel: +254-20 2519098/9  
[Elisabeth\\_mutua@kentainers.co.ke](mailto:Elisabeth_mutua@kentainers.co.ke)  
[www.kentainers.com](http://www.kentainers.com)

#### Case study of SuSanA projects

*UDDTs for teachers at a primary school  
Arusha, Tanzania  
SuSanA 2011*

Authors: M.A. Senzia (e-mail: [msenzia@yahoo.co.uk](mailto:msenzia@yahoo.co.uk))

Editing and reviewing: Norbert Weissenbacher (BOKU Vienna) [norbert.weissenbacher@boku.ac.at](mailto:norbert.weissenbacher@boku.ac.at), Elisabeth von Muench (GIZ, [ecosan@giz.de](mailto:ecosan@giz.de))

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