

Research and development of the urine diverting toilet system in Erdos eco-town project

Jun Xiao

Former SEI Project Manager

Email: xiaojun_eco@yahoo.com

Erdos Eco-Town Project, Erdos 017000, Inner Mongolia, China

Qiang Zhu

SEI Project Senior Advisor

zhuq70@163.com

Background

- China-Sweden Erdos Eco-town Project (EETP) is part of the EcoSanRes Programme funded by the Swedish International Development Agency (Sida) and technically supported by the Stockholm Environment Institute (SEI).
- The Project aims at sanitizing and recycling all the wastes from households in urban areas.
- It is an ambitious attempt to generate the data, technologies and policies required to bring about a major change in the way urban settlements relate to the environment

Physical features of EETP

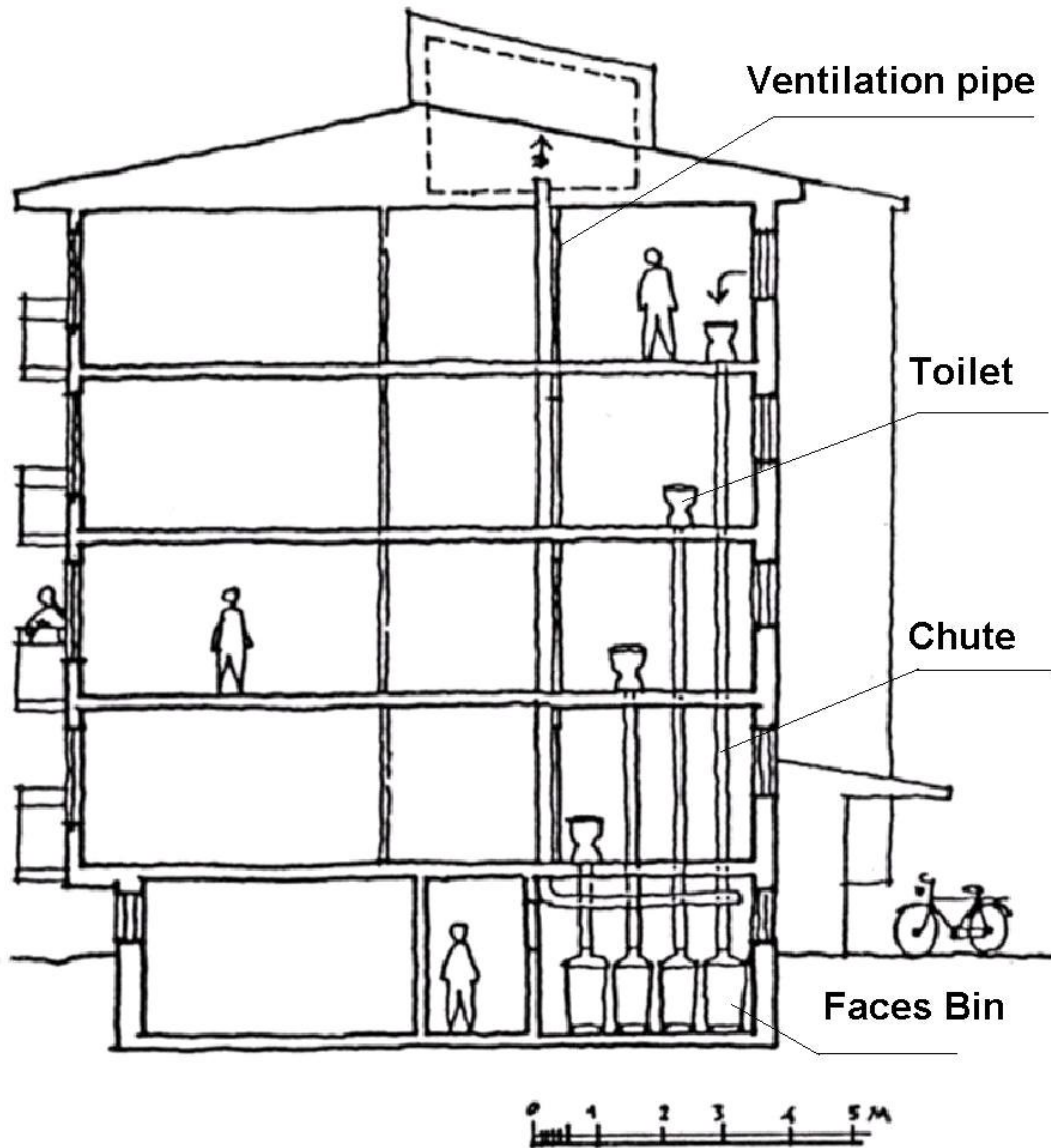


- Forty-two 4-5 story buildings equipped with urine diversion eco-toilet;
- 832 households with population of 2900;
- GRW and urine piping and 22 urine tanks close to the buildings.

Criteria for the eco-toilet design in EETP

The eco-toilet system is a key component of the ecosan system of EETP. The ecosan approach is based on source separation, containment, sanitization and recycling. In addition to them, the following criteria have been followed under the specific conditions of EETP:

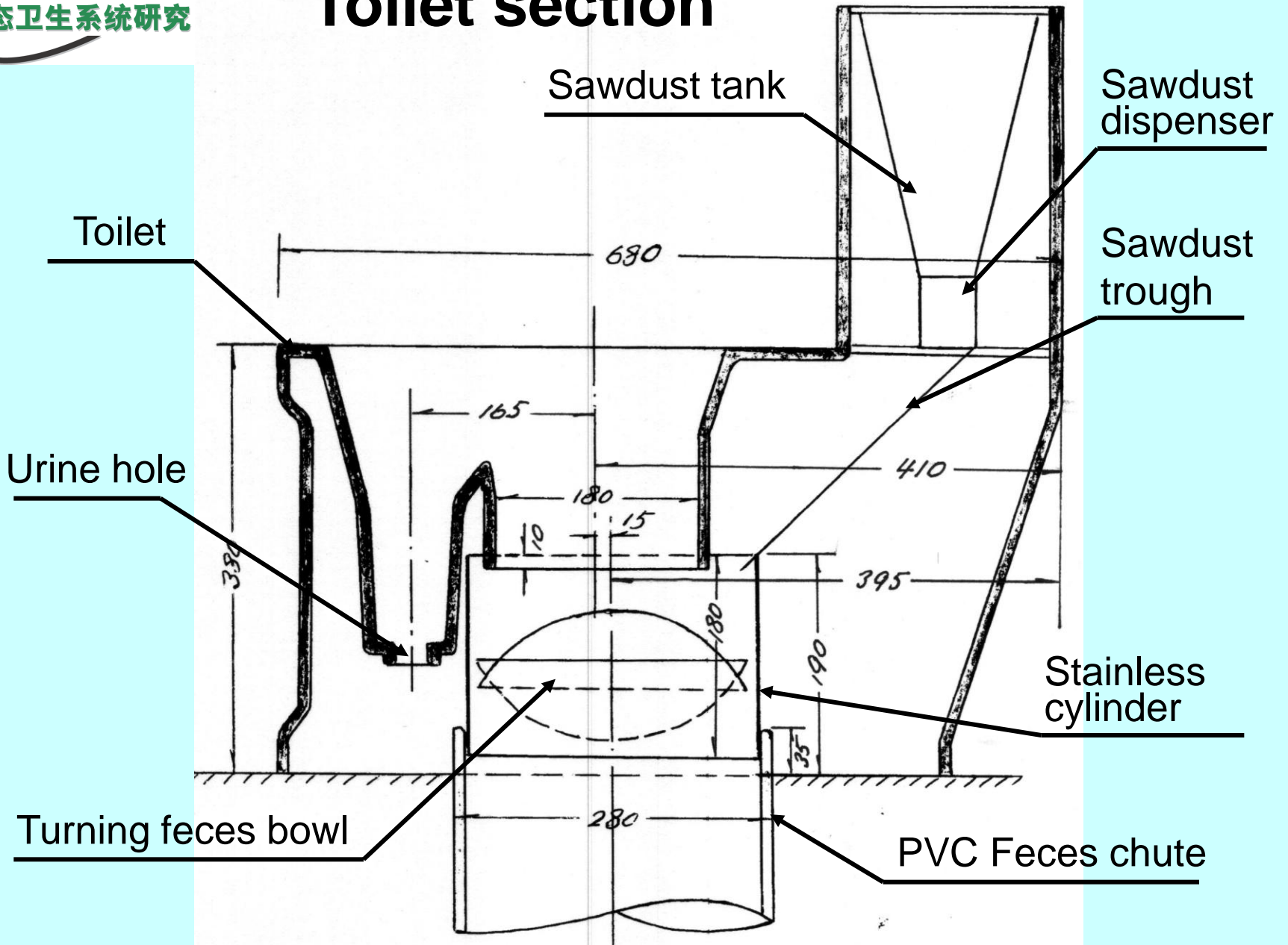
- Suitable for 4 and 5 storey building;
- Easy to use and maintain;
- Convenient to the users;
- Affordable to the households and the community



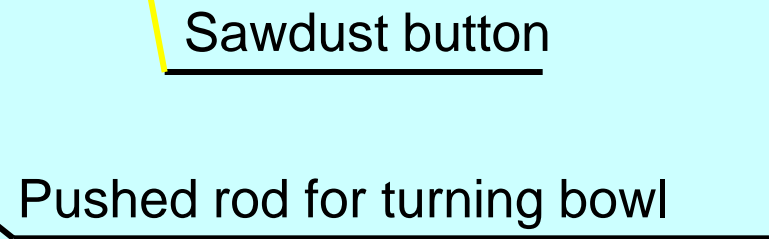
Composition of feces system

- Urine diversion eco-toilet
- Feces drop chute
- Feces bin and bin cover
- Ventilation system

Toilet section



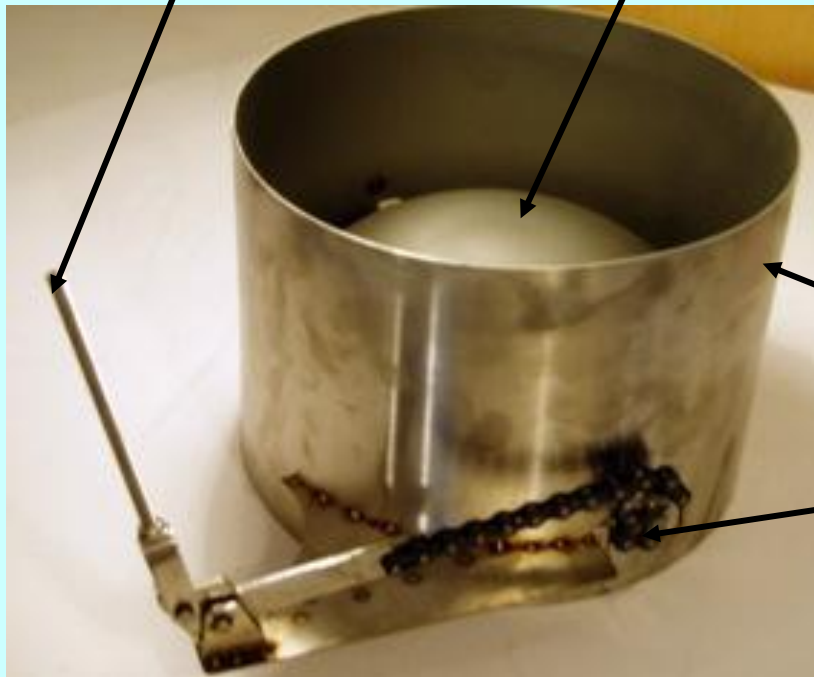
Original toilet design



Feces bowl and turning mechanism

Upside down bowl
when not in use

Push rod



Cylinder supporting bowl

Spring for re-position bowl

Feces bin and bin cover

Feces chute

Bin cover



Basement

Feces bin

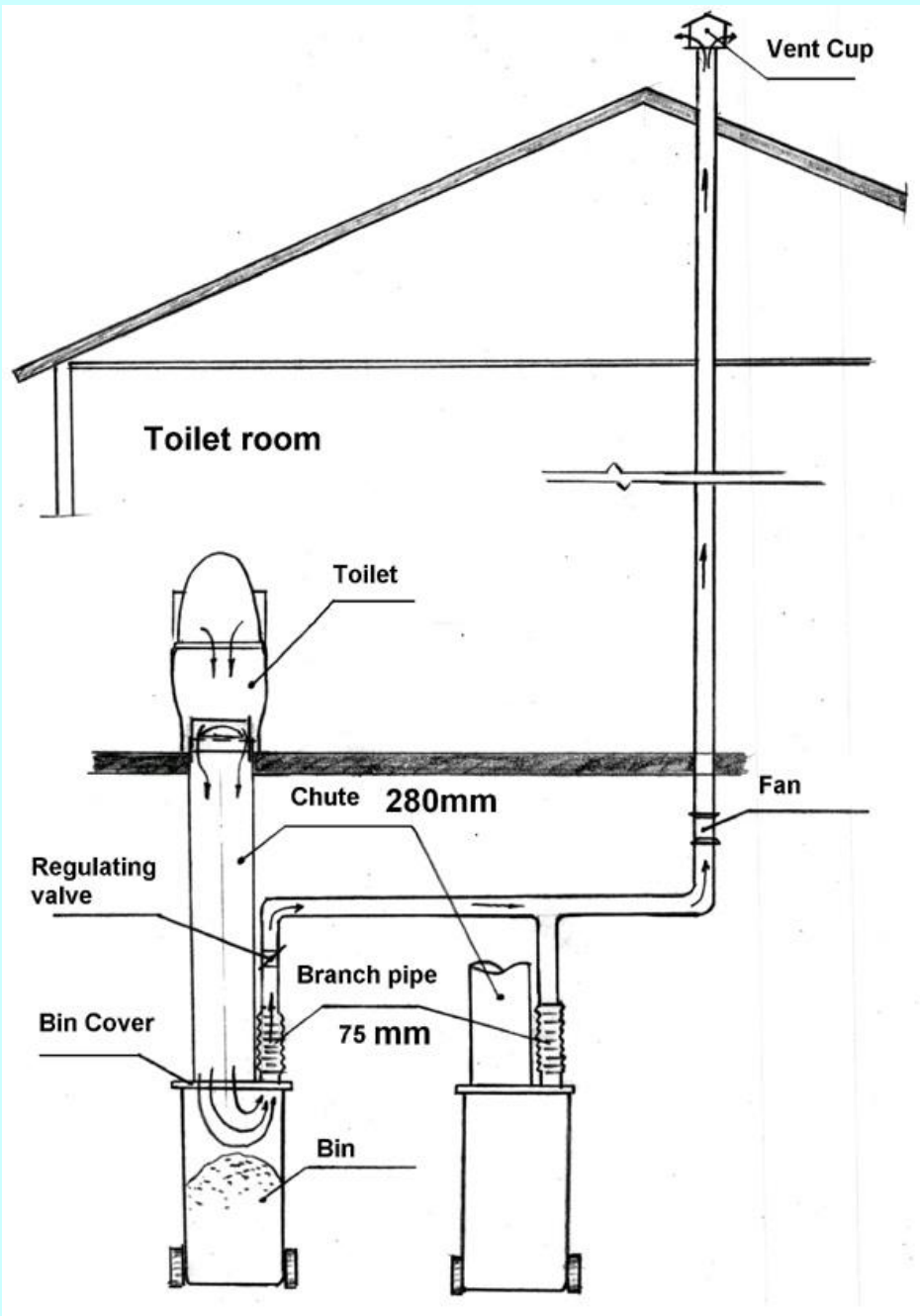


MGB120 980*500*480mm
MGB240 1140*675*580mm



Composition of urine system

- Urinal
- Urine pipe system inside and outside of building
- Urine tank



Ventilation system

- Fan: equipped in the basement for four households;
- Vent duct extending to above the roof;
- Vent branch pipe connected with each bin;
- Regulation valve;
- The chute, bin and bin cover is parts of the vent system.

Improvement for the toilet system during operation

The households have strongly complained the odor problem, reasons for which are:

- Feces caused odor
 - Imperfectness of the toilet design;
 - Improper arrangement of the branch pipe;
 - Inadequate capacity of the fan;
 - Poor sealing performance of the bin cover.
- Urine caused odor: mainly due to bad quality of installation of urine system
 - Top cover of urine tank and outlet of the drainage pipe had not been sealed;
 - “S” trap was not installed under urinal;
 - No odor isolator at the urine hole of toilet.

Two ways of arrangement of the vent pipe

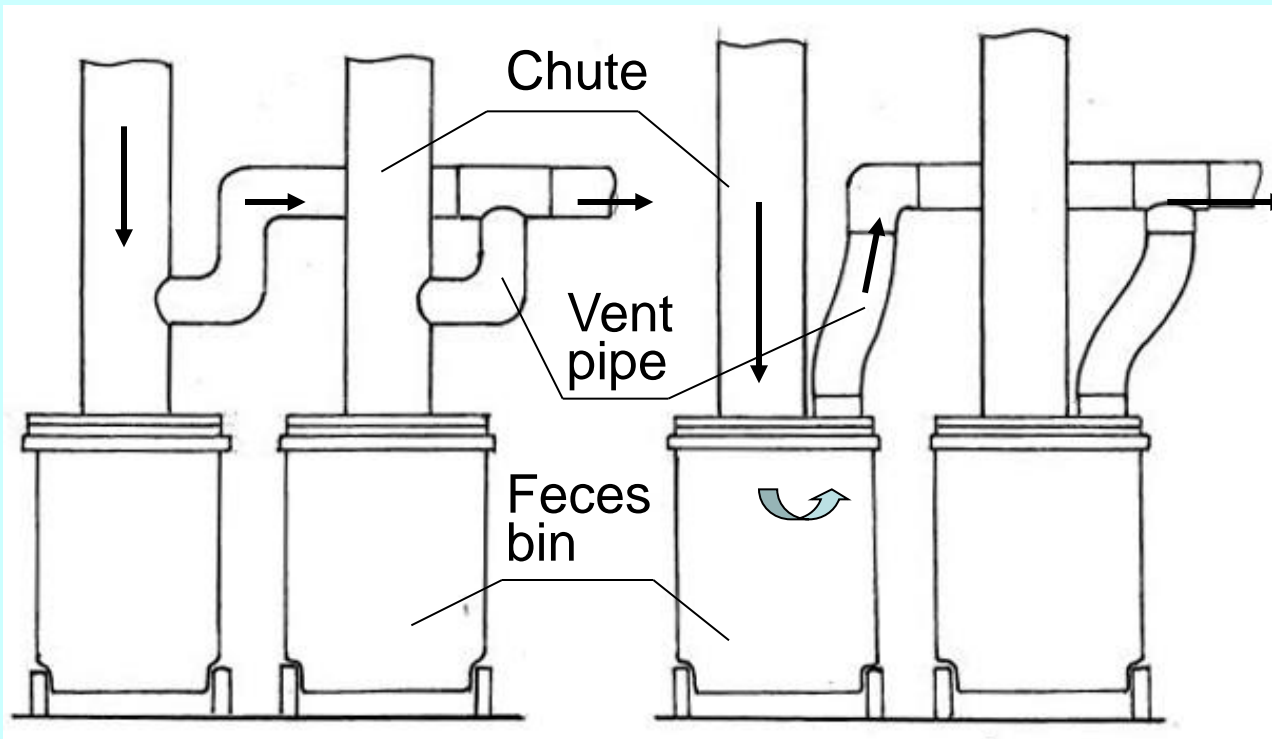
- Branch pipe connected with the bin cover or the sealed cabinet;
- Branch pipe connected with the feces chute.

In the latter case, plastic bag, tissue and other objects are easy to be sucked into the vent pipe. So it will be changed into the first way.

Axial fan will be changed into that with bigger capacity in the 1# – 4# buildings.



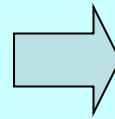
Axial fan



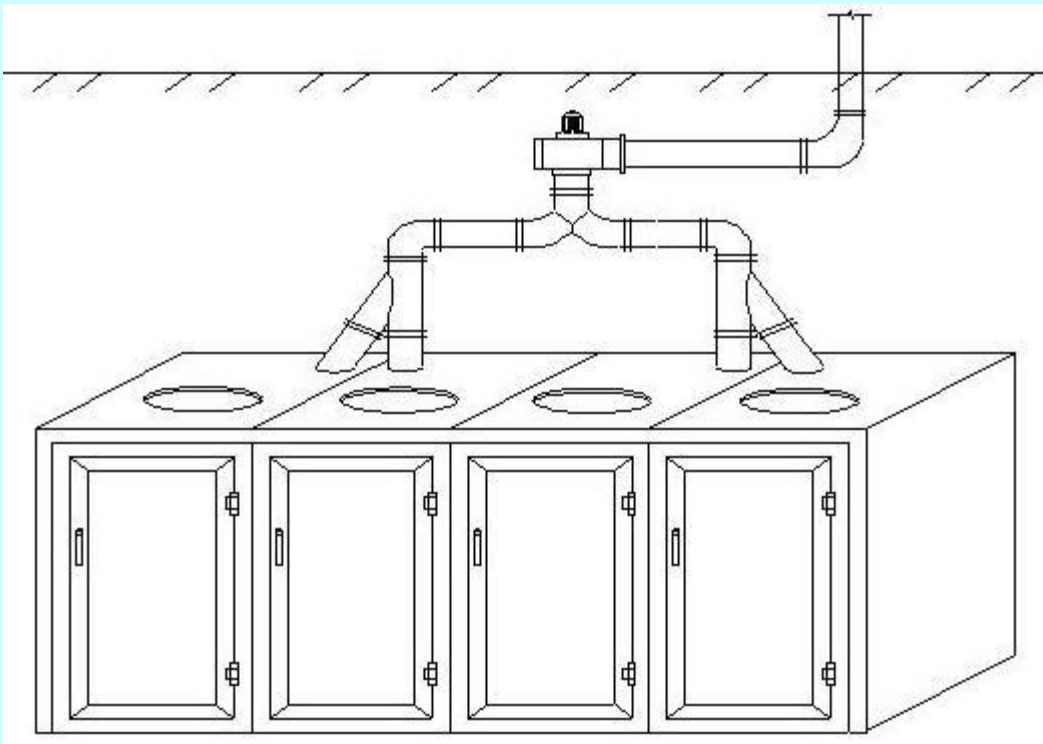
Centrifugal fan

Feces bin is changed to sealed cabinet

O&M in the past years showed that the sealing performance of the bin cover is not good enough. A trial of replacing the bin covers with sealed cabins showed good result. Up to now, 51 basements have been provided with the sealed cabins.



Improvement of the vent piping has balanced the air pressure in the four bins and reduced the energy loss



Regulation valve
being cancelled



Diversified design of the toilet for households with different preferences

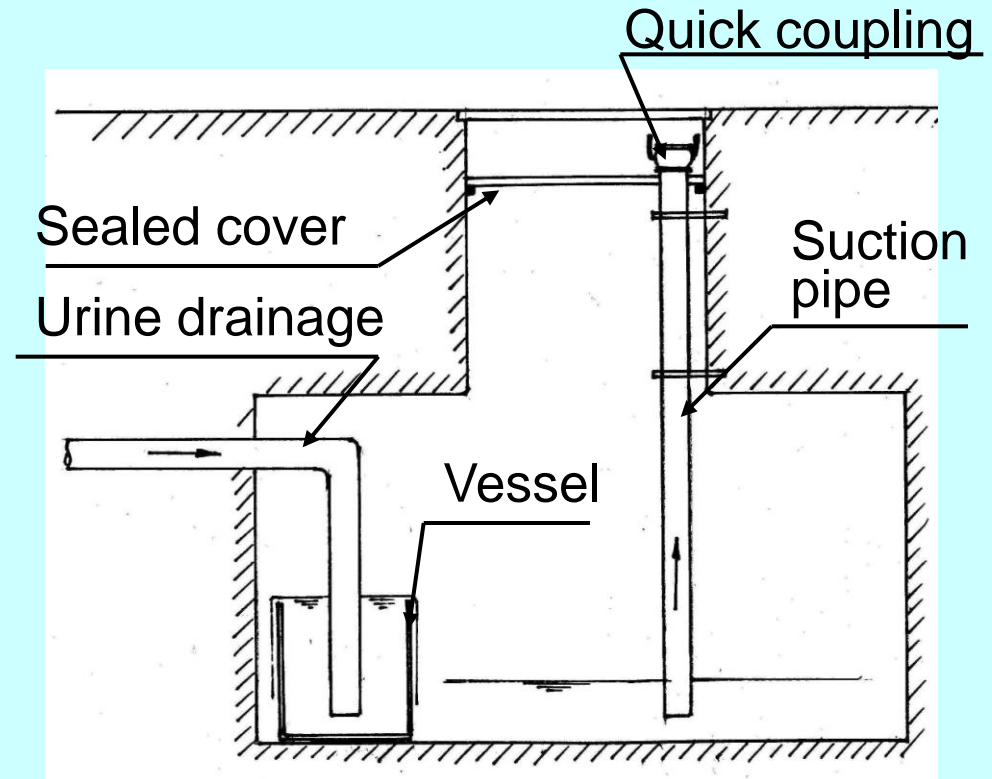
- New turning mechanism has been designed. When the toilet lid is lifted up, a lever system is driven to turn the bowl.
- Another design is to cancel the turning bowl. A movable plate will seal the feces hole and will be removed when the toilet is in use.

When the households want to change the existing toilet, SEI will pay most part of cost but the household has to pay part of the cost. Most households select to keep the original toilet.



Seal the urine tank

The ammonia gas being sucked into the toilet room through drainage pipe is the main reason of odour. To solve the problem, outlet of the urine drainage pipe has been put into a vessel placed at the tank bottom.



Isolate urine system from toilet room:

Develop odor prevention device for sealing the urine hole in the toilet. Paraffin oil is used for isolation.



“S” trap is installed under urinal

Improper use of the eco-toilet by the households is also one of the important reasons causing odour. Pouring too much water into the toilet worsens the smell problem. The project team has strengthened promotion of the households to help them understand better the significance of eco-toilet and the correct way of using toilet by frequently visiting households and distributing brochures and materials.



After taking the above measures, the odor problem has been much mitigated. According to two questionnaire investigations taken place in January and April 2007, respectively, answer to “no odor in the toilet room” increased from 33% to 49%. Tests showed ammonia concentration in the toilet room reduced by 7.8% to 78.1% from October 2006 to June 2007. Complain from households has also been decreased significantly



The acceptance of the eco-toilet by the inhabitants still remains problem. Many households are willing to have a flushing toilet instead of the dry eco-toilet, which they think is a backward technique to the modern civilization. Even their toilet rooms are free of bad smell and also even water supply happens frequently owing to the serious water shortage, many households hope to change the dry toilet into water-borne one. The eco-toilet in an urban setting is a complete new technology that needs decades to develop and improve. However, to change people's mind of preferring a "comfortable" "flush and discharge" toilet to a new toilet concept of environment protection and water resources needs longer time and hard efforts.



Conclusion – the main experiences in toilet development in EETP

- A well designed and installed ventilation system can avoid odor problem from the faeces system. The essential points of the vent system are: fan's capacity can change the air in the toilet room at least 1.5 times per hour, well arrangement of the vent piping, and a sealed containment for the faeces bin.
- Toilet design should be diversified to meet different preferences of the households.
- To avoid escaping of nitrogen in the urine, ventilation for urine system is not suggested. To avoid odor, measures for sealing of urine system and separation of urine from the air are the feasible choices.

Thank you!

