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## **Solution Overview**

The request for a solution for the provision of safe and hygienic toilets for the refugee camps requires solving different problems that are adaptable to local conditions. The proposed solutions meet the requirements, namely:

- Lighting from a renewable source - the proposal is to use a solar lamp with a motion sensor so that energy is used only when necessary.
- Safe lock - it was proposed to use a simple lock made of simple and low-cost elements
- Signaling the use of the toilet - it is done by a lock, which indicates if the toilet is occupied and by a lighting lamp during the night
- Signaling if the toilet basin is full - a simple level indicator with external signaling and an alternative solution with a bioactivator, which ensures the decomposition of substances in the latrines and reduces the need for intervention for emptying, have been proposed.

The costs of the component parts are estimated.

## **Detailed description of proposed solution**

### **1. SUMMARY**

The request regarding safe toilets for women in refugee camps requires solving some problems regarding lighting at night, the safety of using the toilet and the security of the person and signaling whether the toilet is free or occupied and indicating the level of substances accumulated in the toilet basin.

There are a variety of toilets, latrines used in refugee camps, but in all cases the constructions are similar. There are differences in the construction of the superstructure.

The proposal responds to the requests as follows:

- Providing lighting at night with a solar lamp with a motion sensor
- Ensuring the toilet is locked with a lock fixed on the door and operated from the inside.
- Signaling if the toilet is occupied by the construction of the lock and by the interior lighting at night

- Signaling the level of substances accumulated in the toilet basin with a simple indicator.

As an alternative solution, the use of a bioactivator intended for latrines is proposed. It contains bacteria that break down organic matter and fluidize it, practically emptying the latrine without outside intervention.

## **INTRODUCTION**

This proposal relates to the requirement for safe and desirable toilets for women in refugee camps. Considering the destination of the refugee camps and the way in which the financing is provided, it is expected to find the minimum living conditions of the refugees.

The use of the toilets is necessary daily and requires minimum conditions of hygiene, safety and cleanliness. The requirements of the project refer to these hygiene, safety and privacy requirements.

## **PRESENTATION OF TECHNICAL SOLUTION**

The project has the following requirements:

- Lighting: automatic and adjustable lighting, non-removable and powered by renewable energy,
- Locking: methods of locking and providing secure, tamper-proof cabins that provide privacy and comfort,
- Alerting: warning systems when the toilet is in use and when maintenance is required

### **2.1. TOILET LIGHTING**

Considering the location of the refugee camps and the lack of energy supply, the proposal consists in equipping each toilet (latrine) with a photovoltaic lamp. This consists of:

- Photovoltaic panel located on the roof, above the toilet
- Contact cable
- The lamp placed inside on the ceiling provided with a motion sensor

The equipment has a battery inside that is charged from the photovoltaic panel and provides energy for 18 hours. All the elements are rigidly fixed on the ceiling of the toilet (the photovoltaic panel on the outside and the lamp on the inside), being difficult to dismantle. The equipment allows adjusting the light intensity on two adjustable levels.

## Operation

When a person enters the toilet, the lamp turns on and provides interior lighting. When leaving the toilet, the lamp turns off by itself after about 30 seconds.

The weight of the equipment is max. 1 kg.

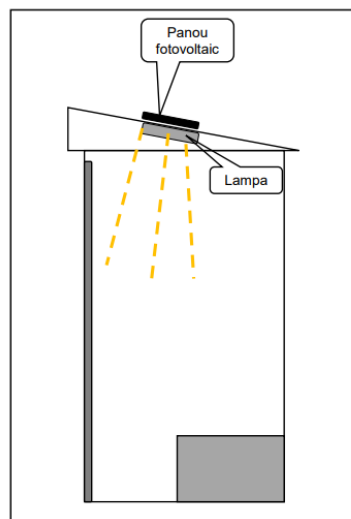


Fig.1 Toilet lighting

## 2.2. CLOSE THE TOILET

To close and secure the toilet door, a manually operated lock from the inside is proposed. The lock is mounted on the door and a safety support on the inner wall. The lock consists of:

- Threaded shaft provided with a disk indicating the state of the toilet (free or occupied)
- Metal stop fixed on the shaft
- Two nuts for adjusting the distance and locking the stopper
- Safety support

The metal shaft has an M10 or 1/4" thread and is milled lengthwise. The thinned part is 8 mm thick. At the outer end, a disk is fixed by welding on which is written: FREE and OCCUPIED at an angle of 90 degrees. The metal stop with dimensions: 100x20x10 mm is fixed on the shaft. It has a 10x8 mm oval hole at the end of the shaft, so that it does not rotate on the shaft. The stop is fixed between two M10 or 1/4" nuts. By turning the nuts, the position of the stopper is established so that the door is properly closed. The position of the stop is established according to the thickness of the door, so as to allow the rotation of the lock. The safety support is fixed on the inner wall with screws. The device is operated from the inside only.

## Operation

When there is a person inside, turn the stopper to the closed position. It rests on the safety support. The outer disk rotates simultaneously and the text: BUSY reaches the top position.

When leaving the toilet, turn the stopper in the opposite direction. The outer disc rotates and the text: FREE reaches the top

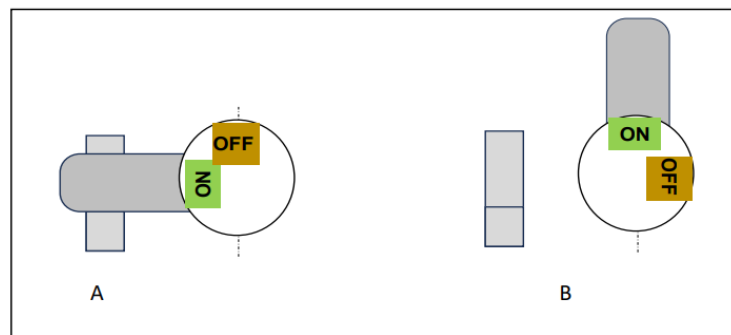


Fig.2 Door lock

A - position BUSY; B – position FREE

After establishing the locking position, the end of the shaft is chamfered and can no longer be disassembled

## 2.3. Signalization

- The alert function has the role of signaling:
- When the toilet is occupied
- When the collection basin is full.

### 2.3.1. Toilet status signaling

When the toilet is free or occupied, the following signals are displayed:

- On the door is the message FREE or BUSY on the lock
- At night when the toilet is occupied, the light comes on inside and you can see outside through the vent

### **2.3.2. Basin filling signal**

The collection basin of the toilet is filled with a mixture of liquid and solid matter. During this time it solidifies. This situation and the installation conditions make it difficult to place devices to signal the level of substances in the toilet basin. Two solutions are proposed.

**The first solution** consists in mounting a level indicator consisting of:

- Float – a hollow plastic body that is partially filled with water for balancing
- A steel or plastic cable with a thickness of 2...3 mm
- A metal indicator fixed to the toilet wall with a screw (possibly outside)

The float is connected to the indicator needle with the cable. The length of the cable is determined according to the position of the indicator and the maximum level in the pool

#### **Operation**

When the basin is empty, the float is lowered and the needle rises. When the pool fills, the float rises and the needle lowers. The position where intervention is necessary is marked.

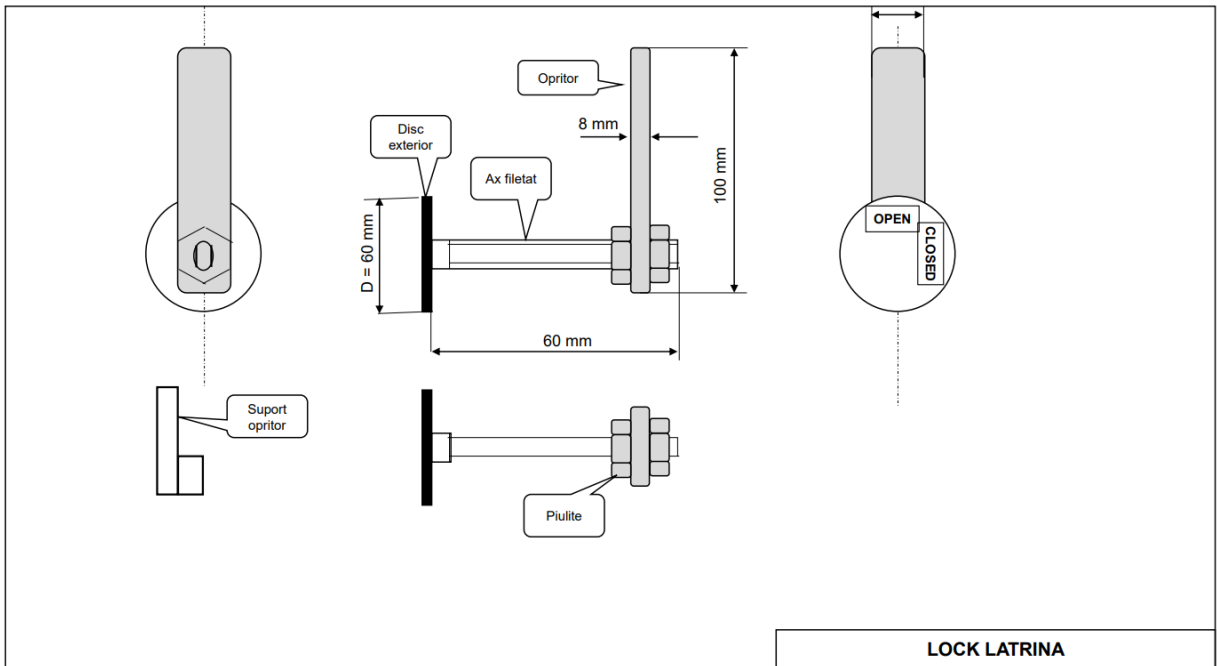
The second proposed solution consists in the use of bioactivator for latrines. It contains bacteria that break down organic matter and empty the pool. The activator is used weekly and consists of dissolving a dose in 5 l of water that is poured into the toilet basin. Bacteria develop and consume the materials in the pool.

### 3. Equipments

For lighting, an assembly consisting of photovoltaic panel, cable and lamp is proposed. See Appendix 1 for specifications.



To close the toilet, the previously described lock is proposed.



Bioactivity. See Appendix 2 for details.



#### 4. Costs

No.	Name	Unit price	Mounting	Total
		USD	USD	USD
1	Solar lamp with motion sensor	9.5	2.5	12
2	Lock	6	4	10
3	Latrine basin level sensor	4	2	6
4	Bioactivator /week	1	0	1
	<b>TOTAL (1+2+3)</b>	<b>19.5</b>	<b>8.5</b>	<b>26</b>
	<b>TOTAL (1+2+4)</b>	<b>16.5</b>	<b>6.5</b>	<b>23</b>

#### 5. Conclusions

The request for a solution for the provision of safe and hygienic toilets for the refugee camps requires solving different problems that are adaptable to local conditions. The proposed solutions meet the requirements, namely:

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The costs of the component parts are estimated.

**Please share how the proposed solution meets stated Requirements and Acceptance Criteria.**

The proposed solutions meet the requirements

**What area of the latrine does this solution apply to?**

Two or more of the these

**How does the solution impact lighting, locking, alerting or other innovative improvement or integration propositions?**

The proposed solutions can solve the problems regarding the use of toilets.

The lighting is a solar lamp with a motion sensor

Lock operated from the inside and Free or Occupied signaling on the outside

Level alert with mechanical sensor or use of bioactivator

**What is the estimated cost for this solution?**

The cost are 19.5 USD and mounting 8.5 USD

**How can this be retrofitted to existing latrines? If it can't, please state your use case.**

The proposed solutions can be used in existing latrines. They were designed specifically for these cases.

**How will this solution be maintained?**

All equipment is rigidly fixed and difficult to disassemble.

**Please share the innovative highlights of your proposed solution.**

1. The lighting is a solar lamp with a motion sensor
2. Lock operated from the inside and Free or Occupied signaling on the outside
3. Level alert with mechanical sensor or use of bioactivator

**Are you interested in potential further collaboration?**

Maybe



## Appendix 1

Lamp 100 Led Cob power 100W with solar charging Waterproof IP65 and motion sensor



Price 9 USD

### Specifications:

- Easy to install, easy application on the wall
- Direct charging from sunlight
- Panel dimensions : 130x115mm / lamp 150x110mm
- Material : plastic
- Lamp : 100 LED COB
- Color : black
- Solar panel : latest generation polysilicon, 5.5V 1W
- Function : presence detection from 5-8 m
- Lumens : 500LM
- Charging time : 6 hours
- Autonomy : 12 hours
- Life time : 50 000 hours
- Built-in battery : 18650 lithium 3.7V 1200mAh
- Cable length : 5m

### Content:

- 1 X Lamp+Solar panel
- 1 X Installation accessories
- 1 X Instruction Manual

## Appendix 2



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Septonic Bioactivator septic tank envelopes is a revolutionary product from Canada, which dissolves the deposits and sludge formed inside a septic tank and the related piping. Thanks to its ability to stimulate beneficial bacterial activity, it liquefies organic waste and digests proteins and carbohydrates. After this process, the septic tank becomes decongested and starts to function properly. This product is available in the form of granules, very practical and very effective. Very easy application and the product can be used in any septic tank. It can also be used in chemical toilets, cisterns, yachts and caravans. Quantity: 12 sachets, 213 g Guaranteed result in 4 weeks. Septonic has a history of over 50 years and is the best-selling septic tank bioactivator in Canada and America. It is 100% organic, and the millions of bacteria of which it is composed help to unclog and eliminate unpleasant odors in a natural way, without affecting the sewer pipes or related accessories.

### Way of usage

**Latrine** : pour the contents of 4 sachets evenly. Depending on the use of the toilet, the operation is repeated between 2 and 6 month