

**39<sup>th</sup> WEDC International Conference, Kumasi, Ghana, 2016**

**ENSURING AVAILABILITY AND SUSTAINABLE MANAGEMENT  
OF WATER AND SANITATION FOR ALL**

**How to improve sanitation in Mae La refugee camp:  
Solidarités International sludge treatment unit**

*F. Cavalazzi (Italy)*

**BRIEFING PAPER 2436**

---

*Since 2007, Solidarités International is actively supporting Burmese refugees living in Mae La temporary Shelters (Thailand – Tak) in order to satisfy their basic needs in terms of Water Hygiene and Sanitation minimum standards. The camp was created in 1984 but the lack of an efficient waste and sludge management system led to the contamination of soils and aquifers. This largely impacted the health of both Burmese displaced people and Thai people in the surrounding villages.*

*Despite being a context of emergency, Solidarités International chose to implement a combined system of watertight latrines and Sludge Treatment Unit (STU), d. The STU was built in an area close to Mae La camp and transforms sludge into a bio-fertilizer.*

---

## **Background**

Mae La Camp was created in 1984 to host Burmese refugees who fled conflicts between armed ethnic groups and the Myanmar national army.

The camp is controlled by local representatives of the MoI (Thai Ministry of Interior) and managed by the KRC (Karen refugee Council) and camp based committees (Camp Committee – Water Committee – Livelihood committee). According to the last census update edited by TBC (The Border Consortium) and UNHCR in 2015, the population of Mae La camp is estimated at 38,000 people (90% Karen).

Mae La camp is concentrated in a very small area with very limited services. The high population density (38,000 people in 2,5km<sup>2</sup>), the location of the camp (problems of accessibility) and its “temporary shelter” status (Thai authorities refuse to designate it as a refugee camp) are a few of the obstacles faced by humanitarian actors for the provision of adequate basic services in the camp, such as WatSan facilities.

Before the arrival of SOLIDARITÉS INTERNATIONALE in Mae La camp (2007), there was no agency in charge of sanitation. The risk of soil and water contamination was high due to unprotected WatSan facilities (latrines) and to the camp residents’ bad practices in terms of sanitation. This situation created an ideal environment for the proliferation of mosquitoes and for the development of water-borne and vector diseases such as cholera and dengue.

In light of this specific situation and being the only WaSH actor in the camp, SOLIDARITÉS INTERNATIONALE decided to combine the construction of watertight latrines and of a Faecal-sludge Treatment Unit to guarantee the evacuation, treatment and management of Mae La camp sludge. After having weighed the different options, the STU appeared as the only solution possible in view of the different contextual elements mentioned above, despite being in a humanitarian context. The activities therefore extend beyond a situation of emergency to a more mid-term and long-term scenario, although the sustainability of the structure is not an objective in itself. This aspect of building a permanent structure for a temporary camp is innovative in terms of WaSH emergency activities.

## **Technical justification**

- To maintain a sanitary and non-infectious environment (particularly cholera-free) and to reduce soil and aquifer contamination;
- To ensure the proper disposal and treatment of latrine sludge from the population in Mae La camp and in the surrounding villages;
- To reuse and transform latrine sludge into bio-fertilizer.

## Methodology

### STU Concept

The SOLIDARITÉS INTERNATIONAL STU model and concept is based on a project developed in Nonthaburi (Nonthaburi District), located in the north of Bangkok. The “*Bio-fertilizer plant project*” implemented by the Municipality of Nonthaburi follows the *Guidelines of the Royal Development project* to ensure a safe sanitation process in the city through the collection, treatment, and re-use of faecal sludge as a bio-fertilizer for vegetables.

SI followed eight steps to implement the STU: assessment, design, land agreement with surrounding villages, site survey, purchases, running, monitoring, evaluation and handover strategy. The procedures to obtain authorization from Royal Thai Authorities (MoI, Forestry Department, District and Sub-District) were launched at the beginning of the project and are still ongoing due to the complexity of the process and to the different scales of negotiations to be finalized with authorities.

### Process

The Sludge Treatment Unit is linked to 3 complementary activities which are carried out in different locations:

- Desludging (in Mae La Camp and in Thai Villages)
- Transforming sludge into bio-fertiliser (at the STU site)
- Testing the fertilizer (at the STU plot site, in Mae La Camp and in Thai Villages)

The following table lists the human, material and financial resources that are required to construct an STU and to implement the desludging and operating activities linked to the STU.

Phase	HR	Material/Equipment	Budget
Construction of the STU	± 20 workers	4 digestion tanks (18 m <sup>3</sup> ), 4 sand/gravel beds (10.8 m <sup>3</sup> ), 1 small pond, 1 office, pathways, and security equipment.	± 50,000 EUR (2,013,759 THB)
STU activities	4 STU officers	Truck, Effective Micro-organisms, fuel, desludging equipment, sludge treatment equipment, spare parts.	± 1,220 USD 43,360 THB (depends on the running costs)

### Step 1: De-sludge

During this first phase, SOLIDARITÉS INTERNATIONAL collects the sludge from Mae La camp in order to reduce the risk of soil contamination and to supply the STU with a stable sludge flow to be processed into bio-fertilizer.

There are two methods of collecting the sludge in Mae La camps depending on the accessibility of the watertight latrines:

- In the latrines that are easily accessible by road (they represent 25% of total latrines in the camp), a truck is used for the pumping and to transfer the sludge to the STU.
- In the latrines that are very difficult to access by truck (75% of latrines in the camp), the sludge is pumped with a mobile pump and discharged into a 50 L plastic closed bucket and transported immediately to the STU with a light vehicle (SOLIDARITÉS INTERNATIONAL pick-up).

To ensure correct faecal management in the camp and that the service is accessible to all camp residents, SI created a Beneficiary Selection Grid that is used to define if a “services fee” is applied; the criteria used include the status of the requester (camp resident/ agencies/ Community Based Organizations/ Camp authorities), the location of the latrine pit (whether inside or outside the camp or in surrounding villages) and the type of structure (public: hospital, health centers, schools, or private). This strategy was determined in order to offer free service to very vulnerable camp residents, and the fees were set to keep the service attractive if the STU was to be transferred in the future (service fees covered by external service users to cover part of STU running costs).



**Figure 1. Sand gravel bed**



**Figure 2. Effluent storage pond**

### ***Step 2: Sludge treatment***

The collected sludge is then brought to the STU in order to be transformed into bio-fertilizer that will be used in agriculture and crop production. The treatment of the sludge is composed of four different processes that involve both anaerobic and aerobic natural cycles and that correspond to four different sections in the STU: 1) digestion tanks, 2) sand gravel beds, 3) effluent storage ponds, 4) dry area.

### **The sludge digestion cycle**

As soon as the sludge is poured into the anaerobic tanks, it is treated with an Effective Micro-organism (EM). Anaerobic digestion uses naturally occurring micro-organisms in an oxygen free environment to convert sludge into fertilizer. EM preserves the organic matter placed in a closed tank during 28 days and increases the quality and performance of the fertilizer. The factors influencing the interaction between EM and micro-organisms are the pH (potential hydrogen) of the soil, the shade, the temperature of the soil, and the floods of the soil. The sludge has to be kept in an anaerobic tank to ensure the treatment.

There are three different kinds of micro-organisms:

- **Positive micro-organisms:** they positively influence the decomposition of organic matters (regeneration);
- **Negative micro-organisms:** they negatively influence the decomposition of organic matters (decomposition, degeneration);
- **Opportunistic micro-organisms:** there are bacteria and viruses that take advantage of certain opportunities to cause diseases.

Opportunistic micro-organisms will either contribute to the regeneration or to the degeneration in a medium (soil, water, air, the human intestine) according to the ratio of "positive" and "negative" microorganisms. Scientists claim that it is possible to positively influence the given medium by supplementing it with "positive" micro-organisms. EM is therefore a mixture of approximately 80 different micro-organisms that positively influence the decomposition of sludge in order to provoke regeneration.

### ***Digestion Tanks***

The sludge is first poured into four concrete digestion tanks closed with a lid (to enable the pouring of the sludge into the tank) and with a ventilation pipe at the upper hand. EMs are added into the tanks to accelerate the anaerobic digestion of the sludge; it takes up to 28 days for the pathogens to be completely decomposed.

### ***Sand/gravel bed***

The decomposed sludge is then transferred into the sand/gravel beds (Figure 1) that consist of 4 non-porous concrete constructions sheltered by transparent roof tiles and connected to the effluent storage pond with gutters. The beds are composed of three porous materials (sand, gravel and size-1 pebbles) in order for the liquid part of the digested sludge to percolate and drain into the storage pond. The residual

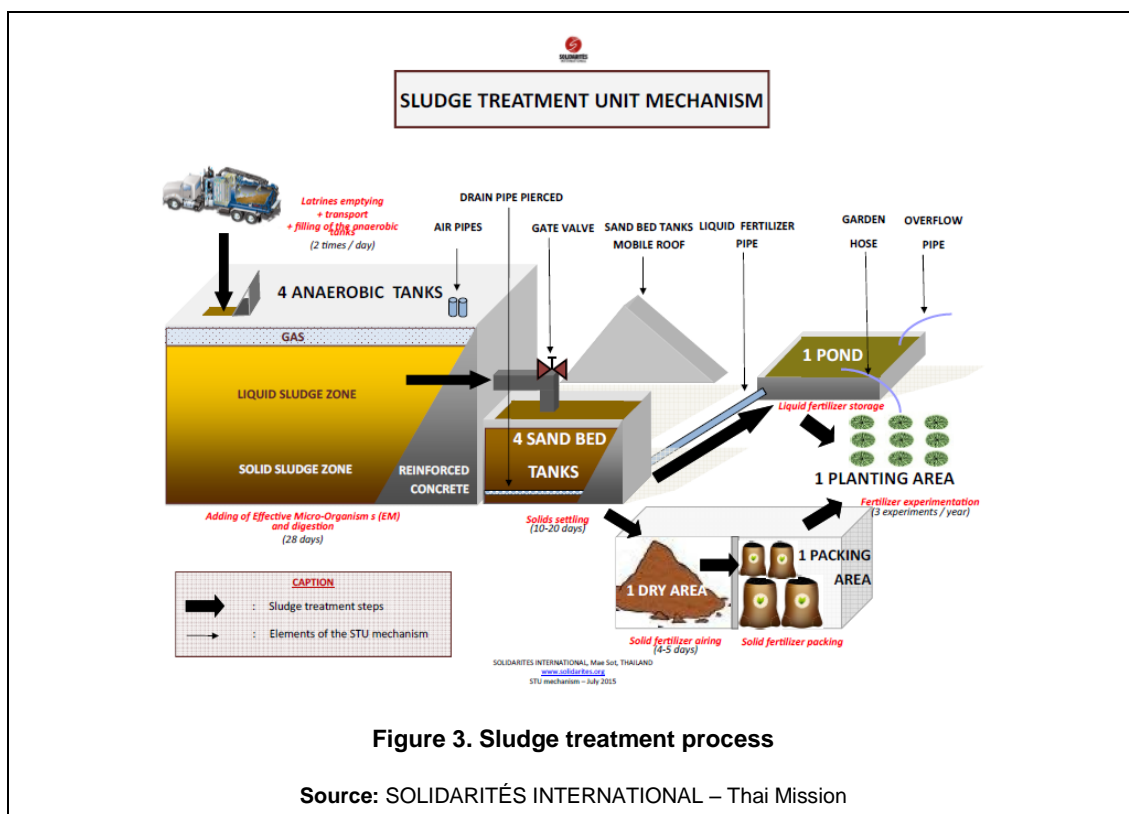
solid part of the sludge is left to sun-dry for 10-20 days before being moved to the dry area for the final drying process.

#### *Effluent storage pond*

The pond is in a square-rectangle shape and is lined with HDPE plastic tiling to prevent the direct infiltration of the treated liquid into the ground. The effluents that have seeped through the sand/gravel beds are stored in the pond and can be used as liquid bio-fertilizer for agricultural purposes. The fertilizer is currently used freely by the beneficiaries.

#### *Dry Area*

The dry area is a concrete slab on which the sludge from the sand/gravel beds is placed between 3 and 5 days for the final drying process. Once completely dried, the transformed sludge is packed into bags for the production of solid bio-fertilizer.



#### **Step 3: Fertilizer Plot Test**

Once the four processes are completed and the resulting fertilizer is produced and stored in bags in the fertiliser dry area, the quality of this fertilizer is tested by the STU team. Plot experiments are conducted three times a year (following the cycle of the sludge transformation) with three local vegetables (*Roselle*, *Lady Fingers*, *Flowering Pak Choy*) in order to compare the nutritional quality of the fertilizer produced by the STU with a chemical fertilizer and without fertilizer. Each experiment is designed to last 8 weeks. During the experiments, the solid fertiliser produced by the STU is used as manure and the liquid fertilizer is sprayed directly on the plants.

Once the experiments are finalized, a fertilizer testing report is written and compares the evolution of both the dry and solid fertilizers with the chemical fertilizer used during the period of experimentation. The fertilizer is tested for certification by a University based in Chang Mai. The results obtained so far have been positive.



**Figure 4. Fertilizer experiment plot**



**Figure 5. Fertilizer test results**

### STU Sanitation impact

As previously noted, to complement the management of the STU, SOLIDARITÉS INTERNATIONALE also carries out hygiene promotion activities and constructs watertight latrines in order to reduce common water-borne diseases such as diarrhea. Since the installation of the STU and the implementation of desludging activities in the camp, the sanitary situation has improved as data from the weekly PU-AMI disease surveillance bulletin clearly exposes. The possibility to empty latrine pits and a more adequate latrine design are two elements that led to the reduction of the diarrhea rate.

**Table 2. Yearly Mae La watery diarrhoea cases (reduction)**

2011	2012	2013	2014	2015	% reduction
4,649	4,598	3,834	3,054	2,555	54,9%

### Challenges and conclusion

When SOLIDARITÉS INTERNATIONALE implemented the STU, there was no question of sustainability of the facility as the context was one of emergency and a classic urgent WaSH intervention was not suitable for the situation. The reflection has evolved since and SOLIDARITÉS INTERNATIONALE now wants to focus its strategy on the creation of value with the production of fertilizer, on the viability of the entire sludge chain and on the shared management (refugees and rural populations) of the STU. Although dismantling the facility is still considered a possible ending scenario, the project team is working to identify a reliable stakeholder to begin a potential handover process in the area under the supervision of Sub-District or District Thai authorities. SOLIDARITÉS INTERNATIONALE will support the creation and strengthen a STU management committee in order to facilitate the gradual change in leadership and management. The quality and appreciation of the fertilizer is ongoing through the partnership with Chang Mai University and the positive results help promote the fertilizer produced by the STU after a thorough and accurate market analysis (lesson learnt from the Nonthaburi project). In all these processes, one of the most challenging goals is to ensure that the original social/humanitarian approach related to this STU will be preserved and that the most vulnerable populations will keep benefiting from this service as long as it is required.

The positive results observed in the reduction and the prevention of soil/water faecal contamination in Mae La camp obtained with the installation of the STU and the possibility to convert an emergency activity into a lasting solution with income creation, provides SOLIDARITÉS INTERNATIONALE with a successful experience and added value to continue investing in STU projects and to develop new approaches to reach better results in sanitation management.

### **Acknowledgements**

The authors would like to extend thanks to the staff in Solidarités International Thailand Mission bases, Thomas Viger (former Solidarités International Program Coordinator) and Valentin Forand (former Solidarités International Program Coordinator Assistant) for their work done since the begin of the STU installation and for the quantity of internal documents produced on which we have based this paper.

---

### **References**

- GARG, N.K. and TANYIMBOH, T. 2009 *Multicriteria Assessment of Alternative Sludge, Disposal Methods*, University of Strathclyde, Department of Mechanical Engineering.
- MedicineNet, 2013, *Definition of Opportunistic microorganism*, Online WebSite:  
<http://www.medicinenet.com/script/main/art.asp?articlekey=11773>.
- The Border Consortium (TBC) 2015, Mae La, Online WebSite:  
<http://www.theborderconsortium.org/where-we-work/camps-in-thailand/mae-la/>
- UNHCR 2014 *Displaced Persons in the Temporary Shelters along the Thai-Myanmar border: future hopes and aspirations*. Mae Fah Luang Foundation under Royale Patronage
- Wikipedia 2014, *Effective microorganism*, Online WebSite:  
[https://en.wikipedia.org/wiki/Effective\\_microorganism](https://en.wikipedia.org/wiki/Effective_microorganism).
- PU-AMI 2015, *Mae La Disease Analysis 2004-2016*, Epidemiological Data Management.
- 

### **Contact details**

Fabrizio CAVALAZZI  
11/7-8 Soi Dornchai Prasartvitee Rd  
Mae Sot, Tak 63110 - THAILAND  
Tel: +66(0)89 859 8455  
maesot.coordo.prog@solidarites-thailand.org  
[www.solidarites.org](http://www.solidarites.org)

---