**ESP Phase 2 - Sludge Disposal Research WorkStream**

**Operationalization of combined sludge treatment: Workplan and Funding Gaps**

The Emergency Sanitation Project (ESP) is a consortium of humanitarian agencies and other partners dedicated to researching new technology and methodology for improving the ability of humanitarian organizations to provide sanitation in emergency response. Phase 1 of the ESP, funded by USAID, explored a number of new technologies for sanitation in emergencies. One of the research streams looked at sludge disposal methodologies. This included:

* Basic research into the effects of various substances on faecal sludge
* Heat treatment
* Anaerobic treatment
* Vermicomposting
* Bioadditives

Results are not complete for any of the above but all showed promise for enabling safe disposal of human waste. Two elements of sludge disposal in emergencies have not been explored. First, the methods have not been trialed in combination. It is possible that higher effluent quality and improved system efficiency can be obtained by running treatment methods in series and parallel. Second, apart from the heat treatment and anaerobic digester, most of the sludge treatment tests were proof of concept rather than operational trials of ready to use equipment. The sludge treatment methods identified in Phase 1 require more research, but that is true for most technology. The need for rendering human waste safe is both enormous and urgent.

Phase 2 of the sludge treatment research stream would turn sludge treatment methods into deployable kits and then test how the different methods complement each other.

Partial funding for Phase 2 has been secured. Unfortunately, a funding gap exists for the centralized treatment workstream. Support, financial or in kind, is needed for equipment and personnel for field trials.

**Operationalize Sludge Treatment Methods**

Most humanitarian agencies prefer to order equipment in kit form. Pioneered by Oxfam in the 1980’s and expanded upon by the Red Cross and others, equipment kits ensure that the necessary fittings, spares, and tools needed for emergency WASH activities are available for request as one item. The kit concept is more developed for water supply. However, there have been recent initiatives to extend the concept to raised latrines and desludging.

 Although faecal sludge treatment is significantly more complicated than water treatment, there is potential for ready to use treatment kits. Heat treatment was tested in Cote d’Ivoire in the form of A-Aqua’s Hygienizer. The kit was a step forward in deployable sludge treatment equipment but this unit needs work to make it more robust and easy to use in field conditions. A novel arrangement for anaerobic digestion in the form of the Flexigester was trialed in Malawi. The initial prototype functioned for some time before the seals on the unit failed, resulting in rupture. The unit has been improved and re-installed in its testing location.

This project would make further improvements to the Hygienizer and Flexigester as well as develop deployable equipment for bio additives and vermicomposting. Equipment would be flat pack or shippable in boxes or on pallets. A field laboratory kit would also be developed and tested. Complete specifications, including fittings, consumables, spares and tools would be developed and made available on platforms such as Oxfam’s and the Red Cross’s emergency equipment catalogues.

**Combined Treatment**

Most wastewater treatment plants employ an array of treatment technologies in order to ensure safe treatment for a variety of sludge characteristics. It is unlikely that any one technology would be sufficient for a task as difficult as treating human waste, particularly in an emergency context. Apart from one of the tested bio additives (which has its own limitations), none of the methods trialed or considered in Phase 1 is even theoretically capable of producing completely safe or nuisance free effluent. Combination trials would determine whether using more than one method in series would make the disposal process more efficient or the final effluent safer and easier to release into the environment. Furthermore, as all methods have different detention times, resource requirements and efficiencies with sludge of different characteristics, a matrix arrangement would create a sludge treatment facility that is flexible in a range of contexts and conditions.

**Waste Transfer Station**

**Bio additive**

**Heat Treatment**

**Vermi Composting**

**Anaerobic Digestion**

**Effluent Holding Tank**

**Work Plan**

1. *Develop and tender for field laboratory kit.*

In order to determine the characteristics of incoming raw sludge and ensure the safety of outgoing effluent, a laboratory will need to be part of any sludge treatment deployment package. A laboratory similar to those available for water quality testing needs to be developed. A basic range of test parameters will be agreed upon and the team would work jointly with suppliers to produce a deployable field laboratory kit.

1. *Work with suppliers and tender for kit versions of the vermicomposting and bio additive septic tank units.*

The vermicomposting and bio additive trials used prototype units in their field testing trials. Vermicomposting requires vermifilters and the bio additive identified in Phase 1 requires septic tanks. Fabricating units which can be easily shipped and assembled should be fairly straightforward. It will be more complicated to import worms and the materials involved in bio additives. It is hoped that import restrictions would be less constraining in large scale disasters. In the meantime, the field testing location in step 6 below will be chosen carefully to avoid long delays in customs clearance.

1. *Tender for improved heat treatment and anaerobic digester units and for the sludge transfer station.*

The heat treatment and anaerobic digester units have previously been procured and deployed in kit form. Based on this experience, improvements have been made in the design of the units. New and improved units would be procured for training and use in a combination configuration.

1. *Tender for any new technology that is deemed ready for deployment, including bio additives identified by ongoing work funded by HIF.*

The ESP consortium has continued to look at other treatment methods. The ESP and the London School of Hygiene and Tropical Medicine are looking at an array of bio additives for reduction of latrine pit volumes and pathogens. If these or other methods show promise for field deployment they may be considered for use in the combined treatment configuration. However, this work is about making proven technology operational. The work will not include proof of concept trials of new methods.

1. *Conduct trainings on unit assembly.*

Multi agency training would be a conducted, most likely held in Europe, to resolve issues with assembly prior to field deployment and identify personnel for the field deployment trial. The training would focus on assembly and operation of units. No human waste would be involved at this stage due both to the difficulty of sourcing this material and in order to ensure units are easy to transport to the location of field trial.

1. *Dispatch units to a location where field trials can be held.*

A testing site will be determined based on access to faecal sludge and the ability to import or locally procure equipment and items such as worms and bio additives. The trial would, as much as possible, simulate the operational conditions of an emergency setting.

In addition to providing information on the effectiveness of combining treatment methodologies, the trial would provide understanding on issues such as ideal layout and configuration, the start-up process of the facility, the operation and maintenance activities, consumption rate of consumables, and decommissioning.

1. *Document necessary improvements, disseminate results, and ensure equipment is ready for deployment.*

After a field trial the necessary improvements will be shared with suppliers and WASH sector partners, particularly through the WASH Cluster. The equipment would, where possible, be cleaned and stored in a manner allowing for deployment in future operations.

**Funding gaps**

The funding that has been secured for ESP Phase 2 allows for the purchase and transport of most of the equipment activities for Phase 2. However, four critical elements of the workstream still require financial or in-kind support.

* *Vermicomposting.* This was one of the most promising treatment methods identified in Phase 1. Funding is needed to design deployable vermifilters and carry out trials of vermicomposting in emergency conditions. This might include the development of a wormery, which would preclude the need to procure large amounts of worms in settings that lack large scale worm suppliers.
* *Biological or chemical treatment.* The trials on bioadditives carried out in Phase 1 had mixed results. However, a successful bioadditive has the potential to significantly improve the disposal of human waste in both the emergency and sustainable WASH context. IFRC is conducting trials of one bioadditive in South Asia. If those trials are successful, the IFRC would like to include trials of the bioadditive and equipment developed for its deployment in this research workstream. Should the currently available bioadditive not prove promising, the field trial will use chemical treatment techniques developed in Phase 1, including the use of lime.
* *Training.* As detailed in step 5 above, a training will be conducted prior to deployment of the equipment for the field trial. IFRC needs in kind support from a National Society to carry out this training. Equipment and shipping costs are already covered. Only venue and participant costs are required.
* *Personnel.* IFRC estimates that a minimum of 6 technicians should be trained and deployed for the field trial. A small amount pf funding has been secured for consultant costs. However, it is insufficient for the amount of time required. IFRC requests the in kind support of provision of ERU or RDRT personnel for the training and the field trial.

Total timeframe: Phase 2 is set to last 2 years. The training and field trials would likely occur in 2017.

**Outstanding financial and in kind support needed**

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| **Item** | **Amount (CHF) inc. PSSR** |
| Vermicomposting equipment and trial | 9000 |
| Bioadditive equipment and trial | 12000 |
| Field Personnel | In Kind |
| Training | In Kind |