Lime stabilisation for faecal waste treatment in emergencies
Experiences from Haiti and latest research into using lime stabilisation as a quick and easy method to treat faecal waste

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Outline

- Experience to date
- Future collaboration with Oxfam
- The bigger picture
Why was this work undertaken?

- Ten months after the devastating earthquake of 2010, cholera appeared in Haiti for the first time in nearly a century
- 300,000 people sick
- 4,500 deaths
- Potentially high levels of *Vibrio cholerae* in the wastewater from Cholera Treatment Centres (CTC) in Port-au-Prince
Drinking water network

CTC plan A and B: routine and medium severity

CTC plan C: emergency
The initial situation: **non** standard latrines
The result: wastewater slowly accumulated
Our arrival in Port-au-Prince: assessment...

...some stress...

...and the first action plan
High water table

- Traditional MSF approach is to put all the wastewater produced by a cholera treatment centre into on-site infiltration pits and latrines.

- High groundwater level at the site made the traditional approach impossible.
Lack of space and time

- Lack of space for an on-site treatment
- More than 80% of hospital area already occupied by the hospital infrastructure
- Considerable pressure for a solution that would remove over 500 m$^3$ of wastewater within a few months
- Need for a rapid start to treatment
Four possible solutions

1. Disinfection through “super-chlorination”: not effective
2. Off-site treatment/disposal: danger to the public health
3. Biological treatment: slow start-up, expensive, sensitive to disinfectants, unstable $\Rightarrow$ not feasible
4. On-site chemical coagulation/flocculation as the only feasible solution
Left: The sludge drying beds

Right: Health and safety

Right: Testing the integrity of the tank material between batches
Summary of results

- Faecal bacterial levels in the raw wastewater highly variable
- *E. coli* levels in the treated wastewater <10 per 100 ml (WHO maximum for irrigation of crops is 1000/100 ml)
- *E. coli* removal was greater than 99.9%
- Greater than 90% suspended solids removal was achieved
- Significant reductions in terms of turbidity were achieved
- COD removal was greater than 90%.
Results

River near MSF cholera treatment centre

Levels of *E. coli* in the local river were as high as 300,000 / 100 ml
Lessons learnt

- Disposal of cholera wastes to uncontrolled municipal sites is a clear hazard to human health
- Initial chlorination and onsite storage seemed to reduce numbers of *Vibrio cholerae*
- Biological treatment is not feasible (slow start-up, sensitive to disinfectants, etc.)
- Full disinfection with chlorine or other disinfectants is not feasible
- Undertaking good quality research in a disaster zone is difficult but...

Our simple onsite physicochemical methods appeared to be effective
Validation of the field results in order to demonstrate whether they accurately reflect the efficacy of microbial disinfection achieved.

- Improvement of disinfection and clarification rates by altering treatment protocols with regard to coagulant type dosage, and contact time.

The laboratory work at the University of Brighton.
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A new application: faecal waste treatment at Oxfam sites

Myanmar: Sittwe IDP camps
Philippines: Compostela Valley
Project outcome

- Gap-closure and optimisation of the treatment
- Collection of field data with the aim to produce an excellent evidence base for the use of lime to disinfect wastes in a variety of emergency settings
Treatment gaps

- Preamble
- Quality check
- Type of treatment: biological vs. physico-chemical
- Unexpected pH variations
- Mixing issues
- Lime slurry
The bigger picture: *Sanitation Safety Planning* as a risk management tool in emergency WATSAN interventions

Source: Professor Thor Axel Stenström
Overcrowding
(No. of people per household)

Leads to overuse of latrines and
Conditions conducive for spread of communicable/infectious diseases

Settlement density

Problems for installation of infrastructure and access for servicing of facilities.

Age (proportion of population < 5 years old)

Children < 5 are particularly at risk from excreta related disease

Socio-economic status

Poverty linked to malnourishment and higher susceptibility to disease

Source: Jonathan Parkinson and Philippa Ross
Which pathway poses the greatest risk?

Source: SANIPATH
<table>
<thead>
<tr>
<th>Treatment process</th>
<th>Viruses</th>
<th>Bacteria</th>
<th>Protozoan (oo) cysts</th>
<th>Helminth eggs</th>
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<tbody>
<tr>
<td><strong>Primary treatment</strong></td>
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<td>Primary sedimentation</td>
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<td><strong>Secondary treatment</strong></td>
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<td>Activated sludge + secondary sedimentation</td>
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<td>Aerated lagoon + settling pond</td>
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<td><strong>Tertiary treatment</strong></td>
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<td>Coagulation/flocculation</td>
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<td>2</td>
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<td>High rate granular or slow rate sand filtration</td>
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<td>Membranes</td>
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<td><strong>Disinfection</strong></td>
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<td>Chlorination (free chlorine)</td>
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</table>

Source: WHO (2006)
Can we integrate rational risk management practices into WATSAN interventions in emergency settings?

The challenges

- Quick decisions needed?
- Lack of access to simple risk management information to support these decisions?

The questions

- Can we simplify the processes of *Sanitation Safety Planning* and *Quantitative Microbial Risk Assessment (QMRA)* to produce usable decision-tree tools to support robust sanitation chains?
- How can we establish sustainable practitioner/research collaborations to provide and disseminate evidence-based interventions?
Thank you for your attention

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