38th WEDC International Conference, Loughborough University, UK, 2015

WATER, SANITATION AND HYGIENE BEYOND 2015:
IMPROVING ACCESS AND SUSTAINABILITY

Solid waste management in refugee camps: a case study from Myanmar

V. Di Bella (UK)

REFEREED PAPER 2101

This paper describes the solid waste management system adopted in the Internally Displaced People camps of Rakhine State (Myanmar). It analyses waste generation & composition, collection, recycling and disposal practices. Based on the data collected in the field, a technical and economical assessment of technology options proposed for waste collection was conducted. Recommendations for the improvement of the system in terms of safety of the workers, security of the equipment and efficiency of the overall system were provided. In addition, the adoption of a uniform system of collection was strongly recommended in order to replace the fragmented, uncoordinated approach that is often adopted by international agencies.

Study area

Rakhine State remains one of the least developed regions of Myanmar, characterized by high population density, malnutrition and widespread poverty compounded by natural hazards that are recurrent in this area. In addition to its relatively low development status, Rakhine currently faces one of the largest man made crises in recent years: ethnic violence. The first interethnic unrest in June 2012 left 115,000 people displaced of which only 40,000 have been able to return to their place of origin. Another 36,000 people were displaced when the violence erupted again in the last week of October 2012. In total, nine townships have been affected. The vast majority of the Internally Displaced People (IDPs) are Muslim whose freedom of movement was already restricted due to their stateless status. Most of the 110,000 IDPs are located in about 20 camps in Sittwe Township and have been moved to temporary resettlement sites. Almost all IDPs depend completely on external assistance to meet immediate basic needs. With tensions between communities remaining high, a return to places of origin is highly unlikely in the short term and additional flare ups of violence remain possible. Periodic protests erupt in conjunction with visits of international political figures to Rakhine State and anti-NGO actions, which can turn violent, often take place.

Although the government authorities, UN agencies and international and local NGOs have responded to the needs of the displaced population by providing assistance across sectors, the situation of the camp populations remains precarious, especially in terms of health and water and sanitation. While most of the international organisations in the camps promoted the construction of water pumps and latrines, there has been relatively little focus on the management of the solid waste being generated and open burning and other poor disposal methods were usual practice, generating negative health effects (UN-Habitat, 2010).

The solutions, which were chosen, typically included collection by means of handcarts and on-site incineration. There was a lack of standardisation in the practices adopted by each of the international NGOs (INGOs) in the geographical areas they covered; this despite the activities of a UNICEF-led WASH Cluster co-ordination group. There were also added complexities. Frequent changes in the oversight of WASH activities within IDP camps from one INGO to other did not allow consistency in delivery and exacerbated the absence of a standard approach.

The study described in this paper focuses on Ohn Taw Gyi Camp (OTG) and in particular on the part of the camp known as OTG 4. In February 2014, OTG 4 comprised 150 shelters1, which hosted about 6,000

people. The study was conducted through the consultation of key stakeholders and field surveys, which were conducted between January and February 2014 by the author. Stakeholders consulted included representatives of: the Department of Rural Development, which was responsible for the management of the camps; the two INGOs that had already started working or planning activities in the solid waste management sector; and the refugee population. IDPs were consulted during capacity building activities and field visits through unstructured interviews. Tailored semi-structured interviews were addressed to local government and INGOs and focused on practices of solid waste management in the camps. Field surveys included visits to the location where a transfer station could potentially be located and to the camps where solid waste management systems were in place at the time of the visit.

Current situation of municipal solid waste management in the camps

Waste generation and composition

Data on waste generation and waste composition in Sittwe IDP camps were extremely limited. This is in common with the picture internationally, where data is not only limited, but with values that demonstrate significant variability. For example, waste volume values have been found to range from 0.15 kg per capita per day in IDP camps in South Algeria (Garfi et al., 2009) to 0.7 kg per capita per day in IDP camps in the Palestinian territories (The Applied Research Institute, 2010).

Similarly, waste composition differs widely. Garfi et al. (2009) report that organic waste was absent in the waste stream in IDP camps in South Algeria, where the main waste streams were made up of plastic, rubber, wood, textile and metals. This contrasts with examples from IDP camps in the Palestinian Territories where organic waste amounts to 59% of the whole waste stream, followed by cardboard and paper (12%) and plastic (12%) (The Applied Research Institute,2010) and in Dadaab refugee camps in Kenya (Kinyanjui and Brasa, 2001) where animal dung constitutes the highest percentage of solid waste by volume (50%), followed by putrescible waste (25), rags and scrap metal (15%) and paper (9%).

The amount of waste generated in Sittwe IDP camps was likely to be relatively low, around 0.1 kg/per capita per day. This estimate was also reinforced by the fact that some types of waste (e.g. plastic bottles and tin cans) were usually reused or recycled and seldom entered the waste stream. The main waste types produced in the camps included plastic bags and plastic items (about 80% of the waste), kitchen waste and dry grass and leaves (about 15%), and in far smaller quantities paper and cardboard (about 5%). The quantity of household waste produced in OTG 4 was calculated as being equal to 600kg/day and its density about 100 kg/m^3. Other sources of waste in Sittwe IDP camps included the waste produced in market areas and in healthcare facilities, which were not directly considered in the study.

Waste collection

There was no uniform collection method being implemented in the camps; numbers of workers employed varied; there were differences in the number of storage/collection items distributed and in the design of facilities. This led to reports of unfairness from IDPs and created the potential for problems when the supervision of WASH activities in the camps passed from one INGO to another.

Bamboo or plastic containers were the most common storage method at domestic level and fixed collection points were typically used for waste collection. Three types of fixed collection points were observed in three camps.

- In Dar Paing camp bamboo fenced areas were used. They allowed the entrance of animals and were not suitable for the rainy season (not resistant enough; at ground level and uncovered). According to the INGO, which provided water and sanitation services in that camp, IDPs were consulted and involved in the design of this type of collection point.
- In OTG 1 the adoption of a 3-sided concrete collection point proved unsuccessful. After the construction of the collection points, there was no safeguarding of land around the structure, which meant that new additional shelters were built closer and closer to them, as observed during field surveys. Moreover, the construction of the collection point was not supported by a regular collection system. Waste was, therefore, not removed in a timely fashion and IDPs complained that the collection points were producing bad smells and attracting rodents and insects. It was also observed that waste tended to be disposed close to the entrance of the collection points, as typically happens with this type of system.
- In Bo Du Pa a 4-sided concrete collection point was built and used by the community. IDPs reported that, even though the collection point was accepted and used by the community, a regular system of

collection was not in place and the collection point was not regularly emptied. This system was also not suitable for the rainy season since it was uncovered and rain would percolate into the waste, creating difficulties during the following phases of collection (e.g. corrosion of collection equipment and vehicles and heavy weight of waste).

Primary collection (from houses to collection points), when in place, was conducted through handcart. Interviews with INGOs and field observations showed that those handcarts, with an area of 1.1 m^2, had proved to be successful in the camps. Their limited size gave them easy manoeuvrability; they did not become too heavy when loaded; they could access narrow streets and the 3 wheels conveyed stability to the vehicles.

Waste recycling and disposal

Small scale reuse and recycling were common practices in Sittwe IDP camps. Plastic bottles were used, for instance, as toys, as seed containers and in small drainage systems. Tin cans were also reused as containers, and as parts of toys. Children also often used plastic bags as kites. The use of cow dung, occasionally mixed with rice husk, for the production of fuel briquettes was also common. IDPs also used other types of waste as fuel, such as sawdust, wood residues and some types of grass and leaves.

Incineration was the most widespread method of final disposal. Small-scale incineration is usually only recommended as an emergency solution when no other process is applicable or for the treatment of specific waste streams. In addition, incinerators used in the camps were often not designed and built according to best practice. As a consequence, even when the incinerators were provided with two chambers, smoke was often released directly from the first chamber, bypassing the treatment process and emitted at head height, as witnessed during field surveys. This also increased the likelihood of incomplete combustion processes taking place. Another issue was linked with the location of the incinerators. Due to land pressure issues, additional shelters were often built too close to the incinerators, increasing health risks for the population and potentially also creating fire hazards. Moreover, representatives of INGOs reported that incinerators had not been tested during the rainy season, when it was likely that their operation was going to be more difficult. Finally, appropriate pits for the disposal of ashes had not been identified.

At the time of the visit, another option that had started being explored was taking the waste to Sittwe disposal site. The main disposal site in Sittwe was located at about 4 km from the town centre. Disposal of municipal waste took place on a semi-controlled disposal site[2] (WEDC, 2010), which had been active for about 20 years. Open burning of waste and the presence of animals and scavengers were observed.

Technology options and assessment of their feasibility

Innovative waste collection system

An innovative waste collection system was under trial in OTG 4 at the time of the visit. The system foresaw the adoption of plastic containers of two different sizes to be used for the collection of waste from households and shelters respectively. The container for domestic storage had a capacity of about 54 L. The container used for collection from the shelters (referred as a ‘shelter container’ in the following), had a capacity of 136 L. Both of them were made of plastic and provided with a lid. This was particularly relevant for the shelter container, making it water proof and suitable for the rainy season. The provision of lids, provided they were actually used, mitigated the spread of bad odours and lessened the attraction of animals and insects. Lids also prevented rain infiltrating through the waste during the rainy season. Plastic was a light material, compared to metal or wood and this made the transportation of those containers easier.

However, there were inherent risks. Household containers were likely to be used for purposes other than waste collection or potentially even sold, whereas at shelter level the containers were potentially going to be stolen. Therefore, it was advised that householders were responsible for both the household container and the shelter container. Based on the agreement that each family living in a shelter was going to be responsible for the ‘shelter container’ for one week, a monitoring system was set up.

Waste would be collected from the ‘shelter containers’ twice per week by means of handcarts (each of them with three waste workers), which would transfer the waste directly onto trucks. The renting of trucks from a private company was envisaged. Trucks would transport the waste to Sittwe disposal site.

Technical and economical assessment of the system under trial

1. **Quantity of waste and equipment provided**
   Assuming a generation rate of 0.1 kg per capita per day and a collection rate of twice per week, the maximum quantity of waste that was going to be stored in the shelter containers was about 16 kg. Assuming a density of the waste of 100kg/m^3 and a certain degree of compaction, the shelter containers, which had a capacity of 136 L, were likely to be able to collect all the waste produced by one shelter.
2. **Trips and duration of the collection phase**
   Two shifts were planned for the collection of waste, serving respectively 75 shelters on Monday and Thursday and 75 shelters on Tuesday and Friday. If the trucks used had a capacity of 5 m^3, two trips to the disposal site each day were going to be necessary. The collection time for each out of the four handcarts was estimated equal to 17 minutes per trip. Assuming a maximum distance from the truck of 13 minutes, it was estimated that 30 minutes were needed for trip from the shelters to the truck. A maximum time of 50 minutes per handcart trip was therefore assumed. Potential parking spaces for trucks in OTG 4 were also identified. It was also estimated that a return trip to the disposal site in Sittwe was going to take 90 minutes (including 40 minutes for the manual offload of the waste).
3. **Further technical considerations**
   A high degree of contact between workers and waste was expected to occur when the containers were transferred to the truck and emptied. An operator was required to stand inside the truck lifting the containers and emptying them, practice that can lead to serious health issues for the worker, such as back and joint injuries, and exposure to infectious diseases (Cointreau, 2006). In addition, waste on the truck was usually uncovered, leading to spillages.
4. **Economic assessment**
   The total cost of the collection from OTG 4 was estimated equal to 120,000 kyats per week (about 120 US$ per week). Detailed costs of the simplified economic assessment are presented in Table 1. If further reusing and recycling practices were in place, the amount of waste generated would reduce and the costs would decrease too.

Table 1. Detailed costs for solid waste collection

Item	Unit cost (per day)	Total cost (per week)
Truck rental (including fuel and driver)	15,000 Kyats (14.7 USD)	75,000 Kyats (73.2 USD)
Handcart workers (3 workers for 5 days)	3,000 Kyats (2.9 USD)	45,000 Kyats (43.9 USD)

Recommendations and conclusions

Recommendations for the improvement of the system described are summarised in Table 2 in terms of safety of the workers, security of the equipment and efficiency of the overall system. The economic sustainability of the system under trial would need to be verified in the long term.

In addition, a 3 stage collection system, provided with a transfer station, could also be adopted. This system is not suitable for OTG 4 at the moment due to the fact that the distance between OTG 4 and Sittwe disposal site is limited. However, this system could be considered for camps located further from the disposal site.

International agencies working in these scenarios often approach the problem in a fragmented, uncoordinated manner, adopting collection methods that are not uniform and sometimes not appropriate for an environment that can change rapidly due to increasing numbers of refugees and the progression of seasons. It is therefore also strongly recommended that a uniform system of collection is selected and applied in all the camps.

Table 2. Recommendations for Improving the solid waste management system		
Aim	**Key Recommendation**	**Additional details**
Speeding up collection system	Adoption of empty containers mounted on the handcarts	The content of shelter containers could be emptied into these new containers (6 for each hand-cart); therefore, shelter containers would not need to be transported
	Adoption of other types of collection vehicles	Three-wheeler auto-rickshaws and/or small two-wheeled, pedestrian-controlled tractors have proved successful in similar contexts and could be adopted in the camps
Reduction of degree of contact with waste	Construction of a ramp	Technical details suggested: ▪ Slope no more than 12° ▪ Width at least 1.5 m ▪ Indicative height 1.8 m
	Covering truck once filled with waste	This reduces waste blown by wind during the transport to the disposal site
Increasing security of shelter container	Shelter containers mounted on and chained to a plastic or wooden support	This is feasible if containers do not need to be transported to the trucks

Photographs

Photograph 1. Three-sided concrete collection point in OTG1

Photograph 2. Malfunctioning two-chamber incinerator used in one of the IDP camps

Acknowledgments

The authors would like to extend thanks to ECHO, which funded the project "Humanitarian assistance to conflict affected populations in Rakhine State, Myanmar", and to Malteser International that led this project.

References

Cointreau, S (2006). *Occupational and Environmental Health Issues of Solid Waste Management – Special Emphasis on Middle- and Lower-Income Countries.* Urban Papers, The World Bank Group.

Garfì, M et al. (2009). *Multi-criteria decision analysis for waste management in Saharawi refugee camps*. Waste Management, Vol. 29, pp. 2729–2739.

The Applied Research Institute (2010). *Ayda Camp Profile*. Available at: http://vprofile.arij.org/bethlehem/pdfs/VP/%27Ayda_cp_en.pdf. Retrieved on 27th February 2014.

Kinyanjui, W and Brasa, C (2001). *Money from Waste*. 27th WEDC Conference. Lusaka, Zambia, 2001.

UN-Habitat (2010). *Solid Waste Management in the World's Cities* - Water And Sanitation In The World's Cities 2010. Earthscan. London.

WEDC (2010). *Solid Waste Management*. Handouts from postgraduate module on solid waste management, Loughborough University, Loughborough.

Notes

[1] Shelters (longhouses) include 8 households. An average of 5 people for each household has been assumed, according to information collected through informal interviews with IDPs

[2] An area which was identified for waste disposal but where no system for the protection of the environment is in place and where no operation takes place.

Contact details

Dr Veronica Di Bella
Address:
IMC Worldwide
64-68 London Road, Redhill, Surrey
RH1 1LG, United Kingdom
Tel: +44 (0)1737 231400
Fax: +44 (0)1737 771107
Email: veronica.dibella@imcworldwide.com
www: www.imcworldwide.com