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Demonstrating ESTs for Building waste
Reduction in Indonesia

The DEBRI Project

Preliminary Data Report on
Tsunami-generated Debris



International Solid
Waste Association



Ministry of Environment,
Government of Indonesia



United Nations
Environment Programme

This quick preliminary report on the tsunami-generated debris is intended to collate existing basic data that will form the basis for a full consultant-generated report. The data presented below will be substantiated and added to/confirmed by the consultant as per the agreed terms of reference and the Data Collection guidelines. The final report will be used primarily for three purposes:

- 1. to help identify technology components that will be procured under the project*
- 2. to develop the Waste Management Mechanism*
- 3. to fill in the gaps and discrepancies in the data below, where appropriate.*

Eventually a sound baseline data will help in a number of ways:

- Reduce public health risks through the sound environmentally safe handling, removal and disposal of Post-Tsunami wastes.*
- Assist the Local Authorities and regional/central governments in establishing and maintaining sound waste management policies and procedures residues.*
- Implement revenue generation initiatives from the wastes management.*
- Provide a process for the safe and sound management of hazardous and contaminated wastes (including clinical wastes, soils etc.).*
- Provide local employment and training within the waste management system through collection, sorting and recycling the waste stream.*
- Contribute positively towards the psychological image of the damaged areas by accelerating the waste clean-up process and assist the rehabilitation and reconstruction process through improved access.*

Debris in Banda Aceh

It has been estimated 4.7 million tonnes of recyclable demolition wastes will result from the planned recovery and reconstruction works in the Aceh Province. These demolition wastes include brick and concrete blocks that have been deposited around the buildings destroyed and damaged by the tsunami and wastes that will be generated immediately prior to reconstruction works. These demolition wastes include those derived from damaged buildings (domestic housing and commercial buildings) and infrastructure including roads and bridges.

The recycling of these wastes will have many benefits, including reduction of environmental risks, support and accelerate reconstruction works, sustainable employment generation, and demonstration and awareness-raising in waste recycling.

Background	<ul style="list-style-type: none"> • Most of the data available is based on work done by UN, international, and bilateral organizations on the ground. Of particular relevance is the data collected by UNDP (though very little, if any, of that data has actually been released to the public – most of it in the form of aggregate figures only), GTZ, etc. • Very little efforts have been made by Indonesian government agencies to systematically collect data on debris. Many local institutions in Banda Aceh refer to data of UN/international agencies anyway. • All data presented here is from secondary sources – project documents and reports of a number of organizations funding or working on issues related to waste. • Very few formal systems of systematic data collection and aggregation/reporting existed before the tsunami disaster, and new methods are only now being put in place.
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Overall debris waste volumes	<ul style="list-style-type: none"> • So far, in the entire Aceh area, more than 1,080,000 m³ of tsunami waste has been cleared (this is however, less than half of the debris actually generated from the tsunami). In addition, more than 90,000 m³ of municipal waste has been cleared. [World Bank, June 2007]. • For Banda Aceh alone, more than 457,860 m³ of waste has been cleared. Timber recovered and stockpiled for future use is 12,954 m³, while about 1,223 m³ has been processed for reuse and recycling. [BRR/UNDP, November 2006] • About 60-70 percent of the waste was generated from residential sources, and the remaining from non-residential sources. • 734 ha of paddy fields cleared of illegally dumped debris [World Bank, June 2007] • Analysis of SPOT5 aerial maps/photos has shown areas of highly damaged buildings to cover an area of 24,389 ha, and areas with building that are slightly damaged to cover 1,705 ha. [MoE 2006] • <i>Please see last page for an estimation of the Waste Streams (Tsunami and municipal) volumes</i>
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Composition of	<ul style="list-style-type: none"> • More than 17,000 m³ of wood has been recovered for construction purposes. These are being used in income-

debris waste	<p>generating workshops to create building components, furniture etc. [World Bank, June 2007]</p> <ul style="list-style-type: none"> • Most of the C&D debris, as expected, was completely mixed, consisting of stone/brick, timber, vegetation, metals, soil/mud, and other types. *) • More than 50% of the debris was mud, which was simply washed away into the ocean in the backwash. *) • Other estimates by volume include (m³ in brackets)*): <ul style="list-style-type: none"> ▪ Stone: 17% (1,000,000) ▪ Timber: 8% (440,000) ▪ Vegetation 22% (1,250,000) ▪ Metals 1 % (75,000) ▪ Soil/Mud 50% (2,900,000) ▪ Other 2% (100,000)
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Note:*) Source; OXFAM Report, 2005

Current status of waste clearance	<ul style="list-style-type: none"> ▪ Most of the above wastes come from an estimated 300,000 destroyed houses (partially or fully). Each house generated 50 to 75 tones of brick and concrete wastes. ▪ Most of the above wastes are now in temporary dump sites (18%) or in the main Banda Aceh landfill site of Gampung Jawa (60%). The remaining wastes of foundations still being cleared (10%). ▪ 8-10% of damaged houses still not demolished yet. 50-60% of destroyed houses still have their foundations intact on the original site. This represents a potential 0.8 to 1 million tones of demolition wastes still ‘intact’ in-situ. ▪ More than 85% of all metals such as copper, aluminum, iron/steel are being collected by informal scrap dealers from the sites itself or from temporary dumpsites and landfill site to be sold on the market (mostly in nearby city of Medan). This includes iron rods used in reinforced concrete buildings ▪ 300,000 m³ of waste still in temporary dumpsites, covering an area of about 21 hectares. These temporary dumpsites typical are paddy fields, fishponds, or private property. • A typical house of concrete and bricks probably comprises in the region of 50-75 tonnes of building waste (depending on size of the house and type of building material used). • Traditional wooden houses would have generated debris to the tune of 10-15 kgs/m² and modern brick and concrete houses of 20-25 kgs/m² [Estimates by Indonesian Achitect, Mr. Y. Hardjono]
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- About 25% of the damaged houses are only partially damaged and will thus not be demolished
- The remaining foundations are largely structurally intact and can be reused in situ
- More than 75% of the building waste generated has been swept away by the tsunami and either disposed of within sludge, removed in the initial clean-up works or brought out to sea by the tsunami
- A total of between 1.5 to 3 million tonnes of building waste is still largely "intact" on or near the plots of the damaged houses in Banda Aceh.

Waste / debris
dumpsites and
landfills

- A total of 1,635 ha have been used as waste dumpsites (including emergency and temporary sites). [UNDP, November 2006]
- Of this, about 669 ha have been recovered (consisting of rice paddy fields, fishponds, private properties etc.)
- More than 17,442 m³ of wood has been stockpiled in Gampung Jawa landfill site. Of this, about 1,398 m³ of wood has been processed for recycling and reuse in cash-for-work workshops [MDTF/World Bank, June 2006]
- The size of the existing Gampung Jawa landfill site is about 30 ha. An adjacent area, Pande, totaling about 12 ha was used for temporary disposal of C&D waste. The waste in this area is now being recycled and reused for in-fill and road construction and wood/metal recycled where possible.
- A new landfill site, Montasik, has been selected by the provincial government, based on a negative-mapping exercise carried out by GTZ for three potential sites. It will receive waste from Banda Aceh and the neighbouring province, and will be operational in 2-3 years. The area covered by Montasik is 30 ha, with a life of about 20 years.

Rehabilitation
work to be done
(that potentially
requires C&D
Waste)

- More than 6,000 houses to be repaired or rebuilt – needing timber, bricks, concrete, and other building components
- About 52 kms of roads has been built with recycled rubble so far. But more than 430 kms still need to be rebuilt, in Banda Aceh and the nearby provinces.

Day-to-day
municipal waste

- Banda Aceh has a per capita waste generation of about 0.6 kgs [GTZ]
- An estimated 96 tons per day (35,000 tons/year) was

collected from the Banda Aceh city in 2006, with a coverage rate of 60-80% of the city. [GTZ, Cleansing Dept.*]

- This represents a total volume of about 600-700 m³ per day [Cleansing Dept.*]
- The Cleansing Dept of Banda Aceh hires about 300 people to handle municipal waste. They possess the following vehicles*):
 - Dump truck = 20 units
 - Roll-on/roll-off Trucks = 11 units
 - Pick-up Trucks = 9 units
 - Compactor truck = 2 units
 - Heavy equipment = 15 units
 - Cesspit trucks = 9 units
 - Water tankers = 6 units
 - Waste containers (6 m³) = 62 units
- The operational budget for waste management in 2006 was IDR 8 billion (about USD 800,000).*)

Waste Type	Domestic		Commercial			Market	Landfill
	Permanent	Temporary	Grocery	Photocopy Centre & Printing	Food shop		
Organics	69%	38%	17%	9%	50%	58%	34%
Plastics	17%	23%	25%	27%	25%	17%	16%
Paper	5%	15%	42%	64%	17%	8%	13%
Metal	2%	8%	0%	0%	0%	8%	13%
Textile	7%	0%	0%	0%	0%	0%	8%
Glass	0%	0%	0%	0%	0%	0%	8%
Rubber	0%	15%	17%	0%	8%	8%	8%

Municipal Waste Composition Data

Note: *) Source: T. Saifudin, TA (Kadis DKP), “Pengelolaan Sampah di Kota Banda Aceh Pasca Tsunami”, 29 June 2007 [.ppt file]

Banda Aceh
Demographic data

- The population of Banda Aceh was about 214,000 in 2006 represented by 42,000 households
- The total area of the city is 61.36 sq.km. (2006)

Note: *) Source: T. Saifudin, TA (Kadis DKP), “Pengelolaan Sampah di Kota Banda Aceh Pasca Tsunami”, 29 June 2007 [.ppt file]

Related tools

Table: Selected C&D waste stream densities

Component	kg/ m³
Brick (whole)	715 to 1,795
Concrete	705 to 1,100
Metal, non-ferrous	540
Metal, steel	650
Wood	240

Relevant
documents
Sources

- Please see annex 1 for the list of documents available collected by UNEP and MOE
- Other information resources is available on the internet as indicated in annex 2

Annex 1 : LIST OF INFORMATION COLLECTED

Information Collected	Sources/Contact Person
Draft of Government Law on Waste Management (hc, B)	Ministry of Environment (MOE)
MOE pilot project on waste management in Jombang District <ul style="list-style-type: none"> • 3R Design (.ppt, B) • 3R Waste Stream Mapping Report of District Jombang (.doc, B) • Waste Stream Data (.xls, B) • 3R Need Assessment (.xls, B) • General Guideline of 3R and its Data Collection Manual at city scale (.doc, B) • Jombang Map (.jpg, B) • Example of Waste Processing Unit (.doc, B) 	Ministry of Environment (MOE)
<ul style="list-style-type: none"> • MOE DEBRI Kick Off Meeting Report in Banda Aceh (.doc,E) • Pre-Selection of a Sanitary Landfill Site for the City of Banda Aceh, GTZ (.hc,E) • Minutes of Meeting with BRR (.doc, E) 	Ministry of Environment (MOE)
<ul style="list-style-type: none"> • Report on Sanitary Landfill Development, May 2007 • Agreement on Site Selection for Integrated Final Disposal Site for Banda Aceh and Aceh Besar districts. • Short description on GTZ technical Specification : (crusher, hand and hydraulic press machines) – hc, B • Governor Letter on Coordination Team for Integrated Waste Management in Banda Aceh and Aceh Besar District (.hc, B) 	GTZ Banda Aceh
<ul style="list-style-type: none"> • Governor NAD Province Letter to BRR on Development Planning of Integrated Sanitary Landfill Site, March 21, 2007 (.hc, B) • Agreement between Banda Aceh Municipality and Aceh Besar District on Integrated Final disposal Site in Makmur Village, Blan bintang, Aceh Besar District. • Paper on Domestic Waste Management Responsibility in Aceh Besar Districts (.hc, B) • Positive Mapping for the Sitting of a Sanitary Landfill – Banda Aceh, 1:10.000 (color map print out) • Positive Mapping for the Sitting of a Sanitary Landfill – Montasik, Aceh Besar, 1:10.000 (color map print out) • Positive Mapping for the Sitting of a Sanitary Landfill – Banda Aceh, 1:25.000 (color map print out) • Positive Mapping for the Sitting of a Sanitary Landfill – Contour Lines (color map print out) • Negative Mapping for the Sitting of a Sanitary 	Provincial Government Tim Terpadu Penangan Sampah Propinsi

Landfill – Contour Lines (color map print out) • Solid Waste Management in Malaysia, Study Tour Reports, December 2006..hc and .ppt, B)	
• Post Tsunami Waste Management in Banda Aceh, presented by T. Saifudin, Head of DKP, Workshop on Innovative Technology for Treatment of Domestic Wastewater and Leachate Liquid from Landfill Site (.ppt, B) • Community Participation in Waste Management, DKP and Rotterdam Assesment (.ppt, B) • DKP Operational Zone Maps (.jpg) • Organizational structure of DKP • Table of Daily waste disposal Frequency • DKP Newsletters on Waste Management activities in Banda Aceh	Cleansing/DKP
UN Post Tsunami Waste Management Workshop (Banda Aceh, May 2005) (.pp5,.doc)	UNEP/MOE

Notes: .ppt = power point file, .doc=word file, .xls=excell file, .jpg=picture, hc= harcopy;
B=Indonesian Language, **E**=English

Annex 2 : Internet Sources

Multi Donor Trust Fund for Aceh

<http://www.multidonorfund.org/>

UNDP Tsunami Recovery Programme

<http://www.undp.or.id/tsunami/publication.asp>

Waste Stream Estimation

Waste Type	Tsunami Waste (as of May 2005, OXFAM)			Estimated Municipal Waste (as of May 2005-June 2007, DKP)*			Total Estimated Volume		Estimated Uses (m ³) (as of June 2007)		
	% by Volume	Volume (m ³)	Temporary Dump (m ³)	% by Volume	Volume (m ³)	Temporary Dump (m ³)	Volume (m ³)	Temporary Dump (m ³)	UNDP (as of December 2006)	DKP (as of June 2007)	Other (?)
Stone	17	1,000,000	52,000					52,000	60 km road, 350 sqm port		
Timber	8	440,000	23,000					23,000	13,186		
Vegetation	22	1,250,000	65,000	34%	97,920	41,126		106,126	50 tones compost	56,792	
Metals	1	75,000	4,000	13%	37,440	34,444		38,444		2,994	
Solid/Mud	50	2,900,000	150,000					150,000			
Other	2	100,000	6,000	53%	152,640	96,888		102,888		54,950	
Total		5,765,000	300,000		288,000	172,458		472,458		114,738	

Note: Other+ Plastics, paper, textile, glass, rubber *) based on an assumption of 400 m³/day, 1 year=365 day