

# Forward Operating Bases Solid Waste Characterization

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# Report Documentation Page

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# Project Goals

- Acquire available data on the quantity and composition of solid and hazardous wastes at base camps
- Develop estimates of per capita generation of waste components



# It Is Valuable to Know Waste Characteristics

To plan waste disposal at base camps

To develop and implement new sustainable waste technologies



# New SW Management Options Needed

**Burn pits and box incinerators may have associated health risks**



# New SW Management Options Needed

**Sending wastes to off-site disposal has associated security risks**



# Goal for New Technologies

**Manage waste components to  
achieve more sustainable base  
camp operations**

***On-site reuse/recycle***  
***Waste to energy***



# Waste Components Affect Technology Used

## *Example:* *WasteAway Process*

**Cellulosic**  
**Wood**  
**Paper**  
**Food**

**Plastic**  
**Sludge**





# Characterization Data from Base Camps

- Detailed studies from Balkans (USAREUR)
- USARCENT AOR Environmental Component Plan



# First Balkan Study

	lb/yr/soldier	kg/yr/soldier	% of total
Plastic Bottles [1]	295	134	5.1%
Polystyrene	9.3	4.2	0.2%
Other Plastics	143	65	2.5%
Aluminum	10	4.7	0.2%
Other Metals	11	4.8	0.2%
Corrugated Paper	349	158	6.0%
Other Paper	179	81	3.1%
Scrap Wood	4,151	1,883	72%
Kitchen Food Waste	328	149	5.7%
Post-consumer Food Waste	51	23	0.9%
WWTP Sludge (dry weight) [2]	70	32	1.2%
Saw Dust	47	21	0.8%
Grass Clippings	39	18	0.7%
Glass	40	18	0.7%
Textiles	25	11	0.4%
Medical Waste	13	6.1	0.2%
Rubber	3.9	1.8	0.1%
Miscellaneous	5.3	2.4	0.1%
<b>Total</b>	<b>5,769</b>	<b>2,617</b>	<b>100%</b>

Table Footnotes:

- [1] Reflects 100% drinking water distribution via disposable bottled water
- [2] WWTP sludge weight expressed as 100% solids - multiply by 5 for a cake and multiply by 50 for a liquid
- [3] Survey includes all discarded solid waste except hazardous waste, recycled scrap metal, and salvaged construction material and equipment
- [4] Above values do not reflect additional loadings due to transfers of authority rotations (estimated to increase annual waste production by approximately one month for bi-annual TOAs)



# 2<sup>nd</sup> Balkans Study Compared to 1<sup>st</sup>

Results of Two Characterization Studies in Balkans				
	2006		2004	
Component	lb/person/yr	Per cent	lb/person/y	Per cent
Plastic bottles	196	3.0	295	5.1
Other plastic	502	7.6	143	2.5
Aluminum	46	0.7	10	0.2
Light metal	202	3.0	11	0.2
Cardboard (and paper)	529	8.0	349	6.1
Other paper	974	14.7	179	3.1
Food and vegetation waste	609	9.2	418	7.3
Textiles	95	1.4	25	0.4
Glass	37	0.6	40	0.7
Rubber	4	0.1	4	0.1
Polystyrene	21	0.3	9	0.2
Scrap wood	1076	16.2	4151	72.1
Sewage sludge	688	10.4	70	1.2
Ashes	811	12.2		0.0
Miscellaneous	838	12.6	52	0.9
Total	6627	100.0	5756	100.0



# Trash estimates (lb/soldier-day)

	<b>Balkans: Maturing temporary base camp</b>	<b>Balkans: Enduring base camp</b>	<b>Afghanistan: ARCENT Study</b>	<b>CONUS</b>
Scrap wood	11.4	2.9		0.3
Paper	1.4	4.1		0.7
Food	1.1	1.7		0.6
Other	1.9	9.5		2.9
<b>totals</b>	<b>15.8</b>	<b>18.2</b>	<b>9.4</b>	<b>4.5</b>



# Human Waste (excreta)

**Estimated waste based on medical literature:**

**0.33 lb feces / soldier-day**

**0.4 gal urine / soldier-day**



# Blackwater estimates

<b>Primitive gal/day</b>	<b>Flush toilets gal/day</b>
0.5	4 to 27



# Tech Transfer

Final report will be  
completed  
September 2010



# Available (?) Sources

- “AOR Environmental Component Plan”,  
USARCENT, prepared by CH2MHill, March 2009**
- “Base Camp Solid Waste Management”, Swedish  
Defence Research Agency, FOI-R--2849--SE,  
April 2010**
- “Solid Waste Generation Rates at Army Base  
Camps”, Corps of Engineers PWTB 200-1-51,  
prepared by ERDC/CERL, February 2007**
- “Force Provider Solid Waste Characterization  
Study”, Natick/TR-04/017, prepared by Hughes  
Associates, August 2004**





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