



Cost of Managing Waste in Contingency Operations: A Case Study from Bagram Air Force Base, Afghanistan



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Background

- The Sustain the Mission Project
- Developed method for calculating the fully burdened cost of fuel and water in theater



Waste Project Purpose

- Method to manage waste in contingency operations
 - Solid, hazardous, and medical waste
- Create a tool for users
- Test the method using the tool



Subject Matter Expert Outreach

- Critical to method development
 - Most of the information came from one-on-one interactions
 - Air Force Central
 - Army Central
 - U.S. Army Corps of Engineers
 - Defense Logistics Agency Disposition Services
 - Central Command
 - Army Medical Command
 - Army Public Health Command



Base Camp Solid Waste Management

Basic Self Supported

Expanded Contractor Supported

Enhanced Contractor Supported

Base Types

Patrol Base

- On-Site Burial
- Pack Out

Command Outpost

- On-Site Open Burn
- On-Site Burial

- Waste Collection Area
- On-Site Open Burn
- On-Site Burial
- Off-Site Local Disposal

Forward Operating Base;
Logistics Support Area;
Joint Base

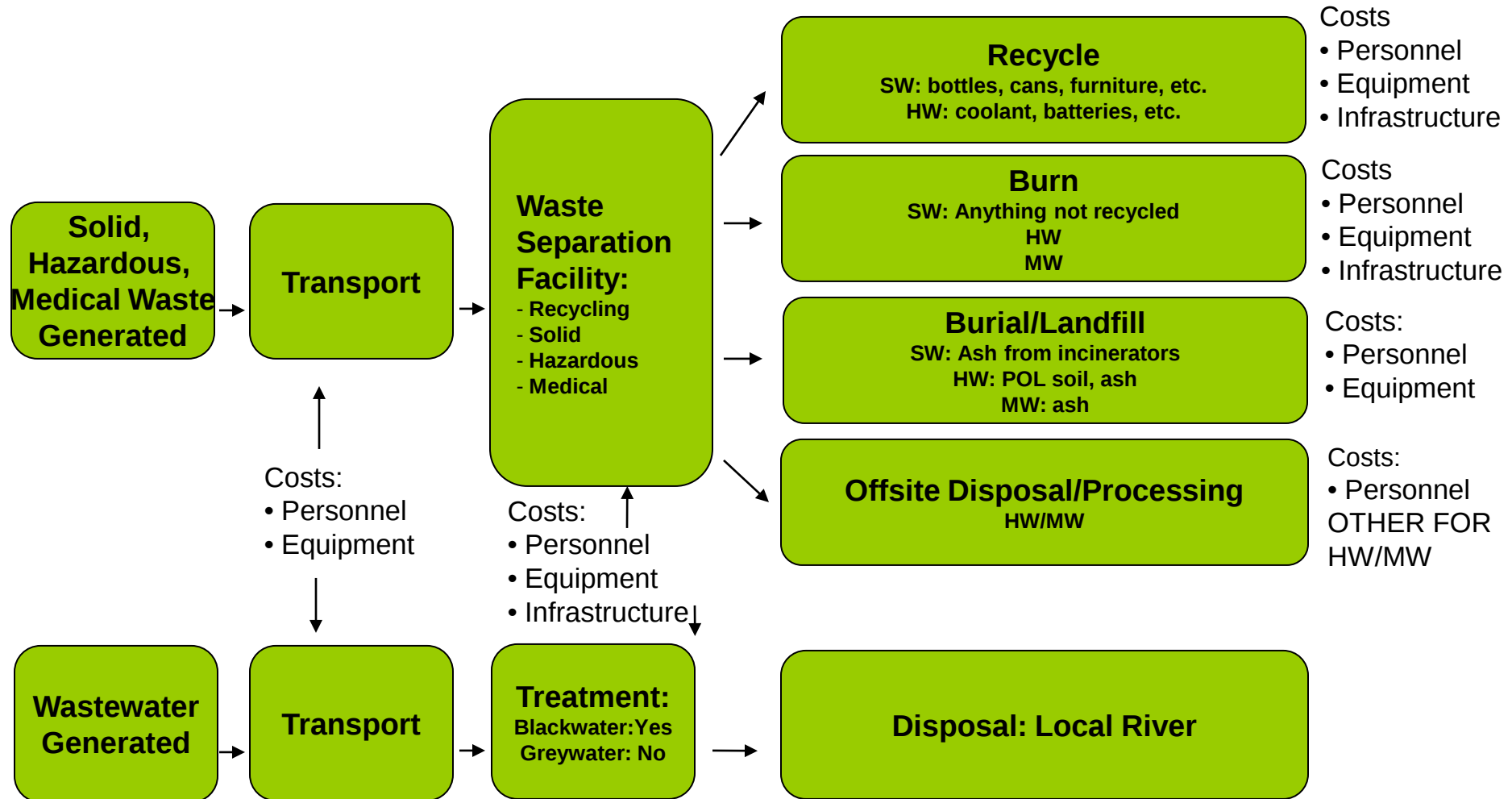
- On-Site Open Burn
- On-Site Burial

- Waste Collection Area
- On-Site Open or Containerized Burn
- On-Site Burial
- Off-Site Local Disposal

- Segregated Waste Collection Areas (solid, medical, and hazardous)
- Recycling Operation for Local Resale Markets
- On-Site Reuse/Composting
- On-Site Incineration (all types) and/or Containerized Burn (solid)
- On-Site Landfills (with liners)
- Off-Site Local Solid Waste Disposal
- On-Site Hazardous/Medical Waste Preparation for Off-Site Permitted Facility (not local)



Waste Flow





Cost Components

Cost Component	Cost Drivers
Infrastructure	Facility type (e.g., waste separation facility, wastewater treatment facility) Facility purpose (e.g., utility building that houses both a waste separation facility and a recycling facility)
Personnel	Personnel type (e.g., military, U.S. contractor, third country national, host nation contractor)
Transport and Equipment	Vehicle/equipment type (e.g., dump truck, compactor) Vehicle/equipment quantity Vehicle purpose (e.g., transport of general waste or wastewater) Equipment purpose (e.g., baling, compacting)
Base Closure and Transfer	Exposure to risk of future liability



Base Case: Bagram Air Force Base



Base case: Bagram waste generation	Base case: Bagram waste disposal process
	Recycling facility 15,452 tons annually
Solid waste 39,420 tons annually	Incinerator (air curtain) 18,384 tons annually
	To sewage treatment facility then to river by pipeline 256,230,000 gallon annually
Blackwater 256,230,000 gallons annually	To river 384,345,000 gallons annually
Hazardous waste 2,557 tons annually	Various disposal methods, per regulatory requirements 2,557 tons annually
Medical waste 39.4 tons annually	Incinerator (medi-burns and others) 39.4 tons annually



Estimated Waste Management Costs

Waste Type	Waste generated (annually)	Cost	Bagram Per Person Estimate (~ 27,000)
General waste and wastewater	Solid waste 39,420 tons Blackwater 256,230,000 gallons	\$ 17,738,163	\$ 657
Hazardous waste	Hazardous waste 2,557 tons	\$ 1,791,085	\$ 66
Medical waste	Medical waste 39.4 tons	\$ 213,920	\$ 8
Fully burdened cost of waste (annual)		\$19,743,168	\$ 731



Method Demonstration

- Recycle used oil
- Reverse Osmosis Water Purification Units
 - Replacement for bottled drinking water
 - Eliminating bottle waste



Conclusions

- Bagram: bulk of waste management costs are from solid waste; followed by hazardous and then medical waste
 - May not apply to other bases
- Alternative technologies at Bagram
 - Recycled oil savings are inconclusive
 - ROWPU/bottle waste reduction cost savings ~1.5%
 - Cost savings will be base specific
- Lessons learned
 - Need better and additional data
 - Plan for waste early on



Non-Monetary Risks and Liabilities

- Landfills
 - Hazardous leachate
- Incinerator use
 - Exposure to flue gas
 - Hazardous components of fly ash
 - Hazardous emissions from incomplete combustion
- Burn pits
 - Ash and smoke
 - Hazardous emissions from incomplete combustion
- Improper wastewater management
 - Surface water pollution
- Transportation related risks
- Security and diplomatic risks



Recommendations

- Integrate method into contingency base initiative
- Link method to more robust decision-support tools
 - Include the entire sustainable life cycle of materiel use at base camps
 - Use green engineering and green chemistry principles in product design
- Conduct a pilot project
 - Track how the waste moves in time and space at large bases
 - E.g. hazardous waste interim storage
- Incorporate health risks and environmental liabilities
- Before and after at Bagram
 - Infrastructure investments to be made



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Report is available at <http://www.aepi.army.mil>



Backup





Army Strategy for the Environment

- Secretary of the Army and the Chief of Staff established Army-wide Sustainability Policy with the initiation of the *Army Strategy for the Environment (ASE)*—signed October 1, 2004
- ASE Goals
 - Foster sustainability ethic as an Army value
 - Strengthen Army operational capability
 - Meet current and future training, testing, and other mission requirements
 - Minimize impacts and total ownership costs
 - Enhance well-being
 - Use innovative technology





SMP Background

- In support of ASE Goals, AEPI initiated the Sustain the Mission Project (SMP) in 2005 to develop and demonstrate an analytic methodology for calculating the **fully-burdened costs of fuel and water (FBCF/W)** resources to sustain Army missions in theaters of operation and the training base
- AEPI developed an **alpha SMP Decision Support Tool** for evaluating costs and benefits of energy/water technology investments based on FBCF/W
- AEPI conducted an SMP Casualty Factor Study in 2008 to develop **casualty factors** for resupply convoys (fuel and water) which were incorporated in the alpha SMP Tool



National Defense Authorization Act for FY 2009

- The Secretary of Defense is required
 - To implement a fuel efficient key performance parameter
 - To include in life-cycle cost analysis for new capabilities the fully burdened cost of fuel
 - To consider in analyses and force planning the requirement for, and vulnerability of, fuel logistics



SMP Background

- HQDA G4 Logistics Innovation Agency (LIA) assumed proponentcy of SMP (Oct 09)
- HQDA G4 initiated a project in 2009 to
 - expand the capabilities of the SMP Tool (energy)
 - distribute the tool for Army-wide use
 - provide training to users
- Army offices began to receive SMP Tool training in 2010 – to include G4, ASA-FM, AMSAA, TRAC, CASCOT, the QM School, TRADOC HQ, Corps of Engineers, PMs, TARDEC, and RDECOM