Piloting Non-Burn Technologies for Treatment of Healthcare Waste

Presenter:

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Outline

- Background Information
- Introduction of Non-Burn Technologies
- Autoclaving Medical Waste
- Testing and Validation of Autoclaves
- Shredding Medical Waste
- Non-Burn technologies in Kenya
- Other Integrated Technologies
- Acknowledgements

Background – Kenya HCWM Project

- A 5-year, PEPFAR-funded project through CDC
- Project period: October 2010 to September 2015
- Implementation is lead by PATH in collaboration with the Kenyan Ministry of Health.
- ETLog Health (Germany) provides technical assistance.

Background- Waste Treatment in Kenya

- Waste treatment method in Africa is mostly done by burning- open burning and incineration
- Kenya – with over 4000 health facilities, 30 % of hospitals have a form of waste treatment in place – Incinerators – Diesel-fired and DeMonfort-type
- Tier 1-3 facilities do not usually have technology in place for waste treatment- rely on open burning
- Incineration has pollution effects such as dioxins, furans, nox, CO, and SO_2. Effects even great burning at low temperatures.

Case Study – Kenyatta National Hospital and MTRH Incinerators

Variable	MTRH	KNH	NEMA Recommendation	Remark
Combustion Efficiency (CE)	60.8%	48.1%	99%	Below
Stack Temperatures	811^0	746^0	850^0 - 1100^0	Below
Oxygen	5%	9.9%		
Carbon Dioxide	11.2%	8.2 %		
Carbon Monoxide	212.7mg/m^3	26.7 mg/m^3		
Sulphur dioxide	159.4 mg/m^3	45.7 mg/m^3		
NO	604.8 mg/m^3	104.1mg/ m^3		
Nitrogen dioxide	0.4mg/m^3	0.4mg/m^3		
NO_X	115.6mg/m^3	104.5 mg/m^3		
NO_X as NO_2	190.6 mg/m^3	159.4 mg/m^3		
Fuel Type	Low Sulpur diesel	Ultra – low Sulphur diesel		

Case Study of the Two Teaching and Referral Hospitals in Kenya has Journal of Community Health: Volume 37, Issue 6 (2012), Page 1168-1171

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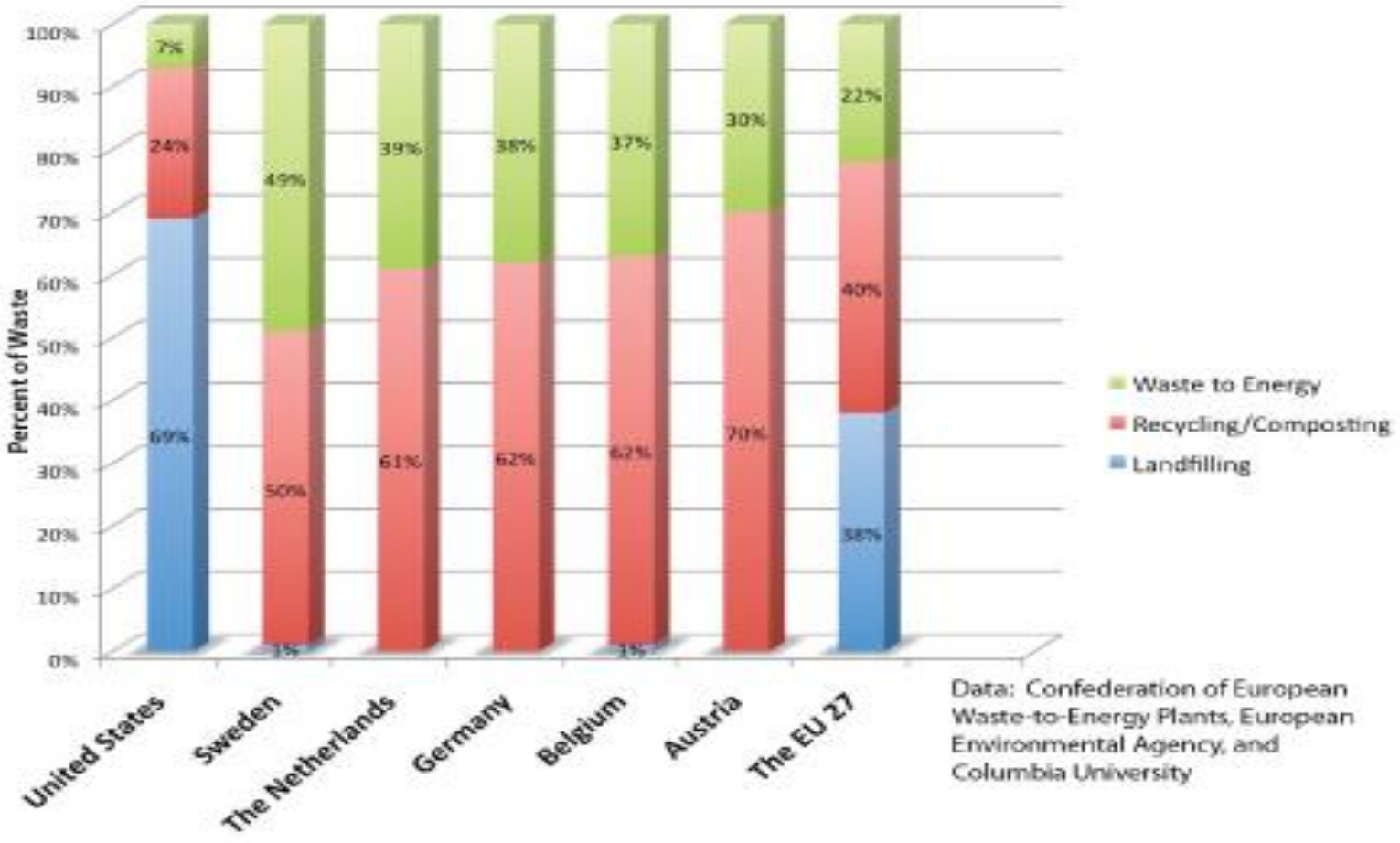
Transition to Clean Air Technologies in US

- In 1994, the US Environmental Protection Agency announced that medical waste incinerators were responsible for 40% of the US' air pollution from dioxins.
- Introduction of clean air technology cut emissions by over 99%.

POLLUTANT	1990 Emissions (tpy)	2005 Emissions (tpy)	% Reduction
CDD/CDF, TEQ basis*	4,400	15	over 99%
Cadmium	9.6	0.4	96%
Hydrochloric Acid	57,400	3,200	94%
Lead	170	5.5	97%
Mercury	57	2.3	96%
Nitrogen Oxides	64,900	49,500	24%
Particulates	18,600	780	96%
Sulfur Dioxide	38,300	4,600	88%

*dioxin/furan emissions are in units of grams per year toxic equivalent quantity (TEQ), using 1989 NATO toxicity factors; all other pollutant emissions are in units of tons per year.

Waste Disposal Methods in US and Europe



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Non-Burn Technologies: Autoclaves and Shredders

- Use of autoclaves and shredders for treatment of medical waste allows for infectious waste to be disposed of as general, non-infectious waste.
  - Autoclave -sterilizes waste
  - Shredding- reduces the size of the waste to unusable, unrecognizable pieces up to 85%.
  - In Africa: facilities in South Africa and Tanzania (Bagamoyo Hospital) have adopted cleaner technologies.

Autoclaves

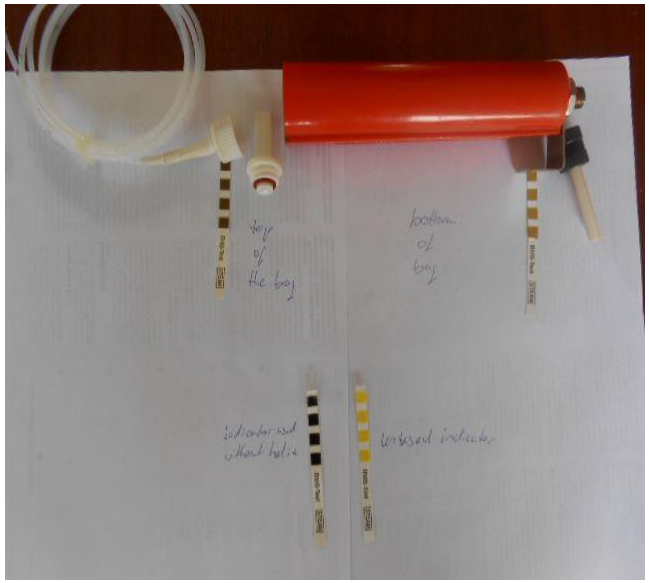
- Sterilizes waste by subjecting it to high pressure saturated steam at 121 °C for around 15-20 minutes depending on the size of the load and the contents.
- 2 types of Autoclaves
  - ***Gravity:*** Downward displacement (or gravity-type)
  - ***Vacuum:*** Has a vacuum pump sucks air or air/steam mixtures from the chamber.

- Kenyan Waste Mgt Regulations 2006 (121 °C) for 60 Mins – Gravity Autoclaves.

Autoclave Validation and Testing

- Validation- Running a series of tests to ensure the autoclave is operating optimally – including the necessary temperature and steam distribution levels to properly disinfect.
- Tests:
  - Chemical testing
  - PCD- steam challenge
  - Biological testing
  - Bowie Dick Tests – vacuum autoclaves.

Validation Tests



Steam Challenge Tests

Chemical Strip tests

Validation Tests

Bowie- Dick test

Biological Indicator Tests

Water Conductivity Tests

Shredding Medical Waste

- Shreds the autoclaved waste to unusable, unrecognizable pieces.
- Reduced the volume of waste for final disposal significantly.
- Shredder design feature - low torque to allow maximum shredding

Final Disposal

- Shredded waste packed in containers for disposal in the municipal dumpsite where available.
- Looking to future, explore waste to energy options and recycling of plastics and waste to energy through land-filling

Non-Burn Technology Pilot in Kenya

PATH and CDC piloting the system in Kenya in 6 sites.

- Karatina DH, Bungoma DH, Coast PGH, Malindi DH, KEMRI /CDC Kisian Site and National Public Health laboratories.

- ***Objectives***
  - Demonstrate the implementation of non- burn treatment technologies in Kenya.
  - Determine feasibility of scale up for expanded use of these technologies in Kenya.
  - Disseminate results of the pilot to the national (policy dvpt) and international community.

Cont……

Challenges

- Capacity of the Autoclaves
- Power rating of the shredder (240 V 3 Phase/ 415V)

Status

- Autoclaves and shredders installed in all the facilities
- Pilot launch and evaluation scheduled for early 2014

Factors to consider when starting up Non- Burn Systems

- Stakeholder Involvement- MOH,County Gvt, environmental Agencies – NEMA, Municipal, others.
- Environmental Impact Assessment.
- Housing to incorporate flow of waste – Clean/dirty side IPC principles.
- Capacity of autoclaves/ hospital bed capacity and waste generation rate.
  - Vacuum autoclaves preferred with Hepa Filter
- Autoclave testing and validation requirements
- Availability of distilled water /water deionizers.
- Power rating of equipment in reference to the implementing country

Other Integrated Technologies

- Pre-treatment of laboratory waste with small autoclaves before releasing for final treatment and disposal
- Maceration – disposal of placentas

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Or visit
http://www.path.org/projects/health_care_waste_Kenya_resources.php