



**ENVIRONMENTAL IMPACT OF THE MANAGEMENT
AND TREATMENT OF CLINICAL WASTE FROM
HEALTHCARE FACILITIES;**

**ARE WE PROTECTING HUMAN HEALTH BY
ADEQUATELY PROTECTING THE ENVIRONMENT?**

A LITERATURE REVIEW

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SUMMARY OF PRESENTATION

- Objective
- Context
- Healthcare Waste, Terminology
- Pathogenic Risks, Environmental Emissions
- Conclusions
- Recommendations
- Qs & Discussions

OBJECTIVE

Large volumes of Clinical Waste are generated every year by hospitals. Statutory Regulations require these to be managed and sterilised to strict standards to reduce the threat to human health.

The objective of this presentation is create debate regarding the environmental/human health risks associated with clinical waste itself and its subsequent sterilization treatment.

CONTEXT: ETHICAL RESPONSIBILITY

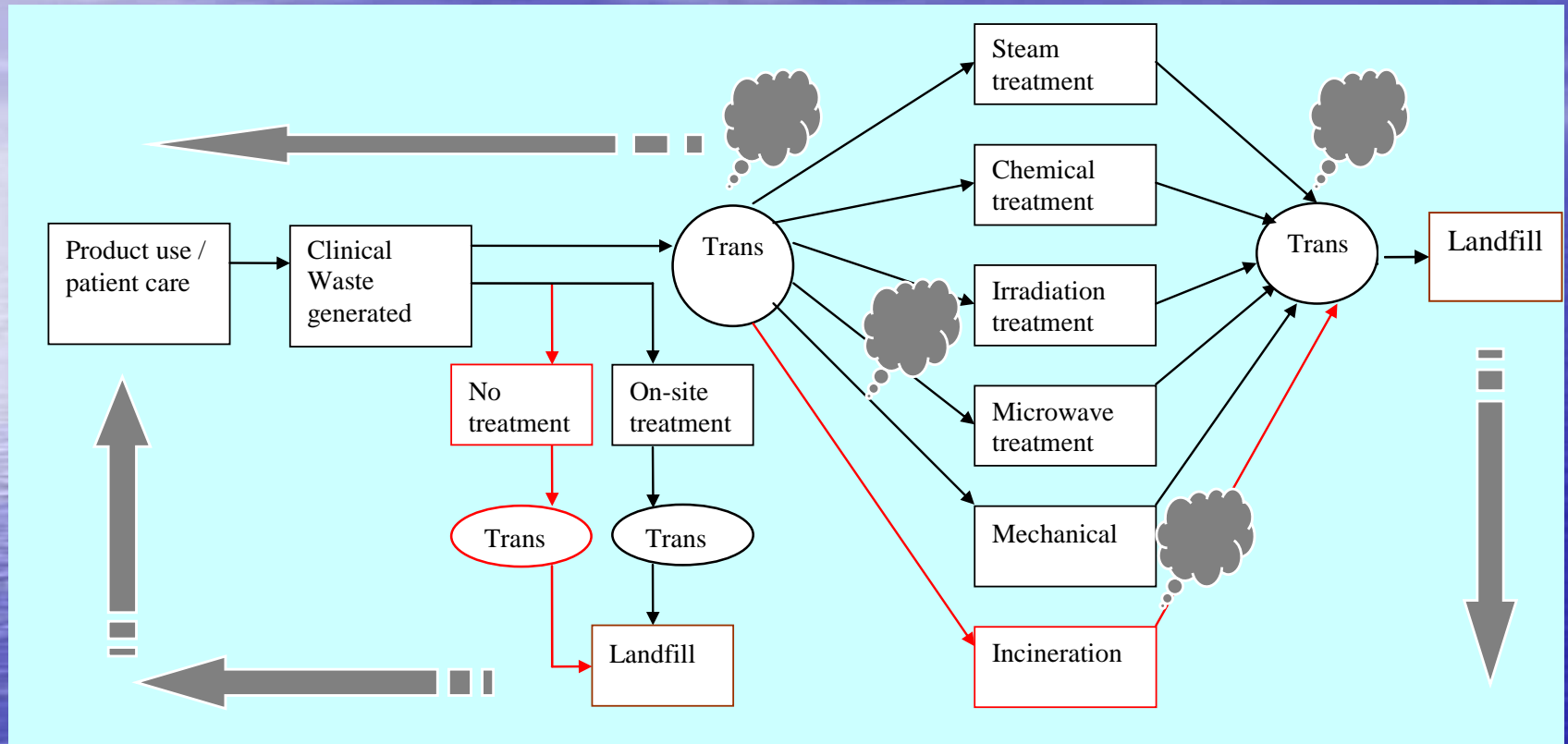
- Never do harm to anyone!
- Healthcare organisations have an inherent responsibility to ensure that their activities do no harm to human health either directly or indirectly. Therefore measuring and minimising their impact on the environment should be part of their business model
- “In a very fundamental sense, ecosystems are the planet’s life-support systems - for the human species and for all other forms of life...”
UN Millennium Ecosystem Assessment

CONTEXT: WHAT IS CLINICAL WASTE?

- Highly secure and sealed HDPE sharps boxes containing plastic syringes, sharps and small volumes of body fluids
- Plastic bags containing incontinence wear, PVC/plastics, blood soiled items, paper
- Biological content potentially infectious with MRSA, Noro virus, Hepatitis, etc



PATH OF CLINICAL WASTE FROM PATIENT TO LANDFILL (and back to patient!)



PRODUCT USE WASTE GENERATED

WASTE TREATMENT

CONTEXT: VOLUMES & COSTS

- Majority of hospital waste is classed as “domestic” in nature
- Approximately 15% of hospital waste is Clinical and is infectious or potentially infectious
- Ireland, population 4m, generates ~8000t of which public hospitals generate ~6500t
- Although financial cost well documented (~€10m/a) very little is known of the environmental cost

CONTROLS

- 1988, Medical waste washed on coastline from Maine to Florida, Gulf coast and Great Lakes
- Public fears of hypothetical infection from HIV, Hep B, etc led to local and national regs
- Considerable European and International Regulatory Legislation regarding packaging, transport and treatment
- Clinical waste defined (European Waste Catalogue code 1801xx): wastes from natal care, diagnosis, treatment or prevention of disease in humans

TERMINOLOGY

- Confusion created with different classifications regarding meanings of similar terms and their application in waste management (Alvim-Ferraz & Alfonso, 2005)
- Hospital staff interchange terms; clinical waste, medical waste, infectious waste, healthcare risk waste !!!
- 15% Hospital Clinical Waste EWC defines as Hazardous e.g. residual pharma, cytotoxic, cytostatic.
Persist and bioaccumulate in the environment (Apoteket, 2006)
- Remaining **85%** treated as infectious waste
- To be infectious there must be pathogens of adequate virulence and number to infect a potential host; conflicts between state agencies in the US led to an over emphasis on the mere presence of pathogens (Rutala & Mayhall, 1992)

(In Ireland HCRW definition broadened to *infectious or **potentially** infectious*)

PATHOGENIC RISK

- Against common belief studies have shown that domestic waste contains a quantity and virulence of pathogens several orders of magnitude greater than household waste (Althus *et al*, 1983) (Kalnowski *et al*, 1983) (Trost & Philip 1985)
- Clinical waste is not a very good culture medium for pathogens and disease transmission, and modern properly managed landfills provide a good deal of protection (Mühlich *et al*, 2003)
- Biocidal conditions within a landfill; ~60°C, anaerobic, low pH & metal content (Collins & Kennedy, 1992)

PATHOGENIC RISK

- St Luke's Malta; blood contaminated clinical waste equated to 20l/1000 population vs 160l/1000 national population landfilled sanitary towels. Microbiologists need to be involved with designated authorities to define special waste requirements (Borg, 2005)
- People develop illness in the community and then arrive in hospital
- NHS UK state there are over 60 treatment technologies for clinical waste (NHS Estates, 1998) with selection becoming more difficult ... a system should have no emissions at all!!!
- All treatments focus to inactivate the microbial content and all generate a residue that needs to be disposed of (Diaz *et al*, 2005)

EMISSIONS

- In 1994 medical waste incineration was identified as the single largest source of dioxin air pollution in the US including the most carcinogenic 2,3,7,8-tetrachlorodibenzo-p-dioxin... heavy metals, fine dust particles, CO, NO_x, and dioxins in bottom ash (HCWH, 2004)
- No arrestment plant is 100% efficient. Captured fly ash and bottom ash!
- Other wastes present influence dioxin generation (Alvim-Ferraz & Alfonso, 2002) including PVC IVs and organic matter (Singh & Prakash, 2007)
- Despite the perceived Gold Standard of microbial destruction tests have shown that it offers only 10⁻⁶ reduction (Genazzini *et al*, 2005)

EMISSIONS: BURIAL OF DECEASED

- Approximately 30% of dead are buried in the UK – many due to illness
- Cemeteries vs. Engineered Landfill!
- Full decomposition 10 years, half-life 1.5 years
- British Geological Survey G/W contaminated with calcium, sodium and ammonium
- 19th Century burial ground (active 1813-1875) no longer a source of contamination

PROACTIVITY

Growing awareness that healthcare organisations have a responsibility to minimise their environmental impact:

- WHO HPH Network
- Healthcare Without Harm
- Vienna Hospital Association
- Karolinska University Hospital

CONCLUSIONS

- Lack of accurate data has led to no true understanding of risks
- No large scale objective study has been carried out to define the human health risks posed by Clinical Waste
- No single body has taken full control of the issues; politicians, legislators, regulators, healthcare orgs, etc
- No coherent logic to approach taken

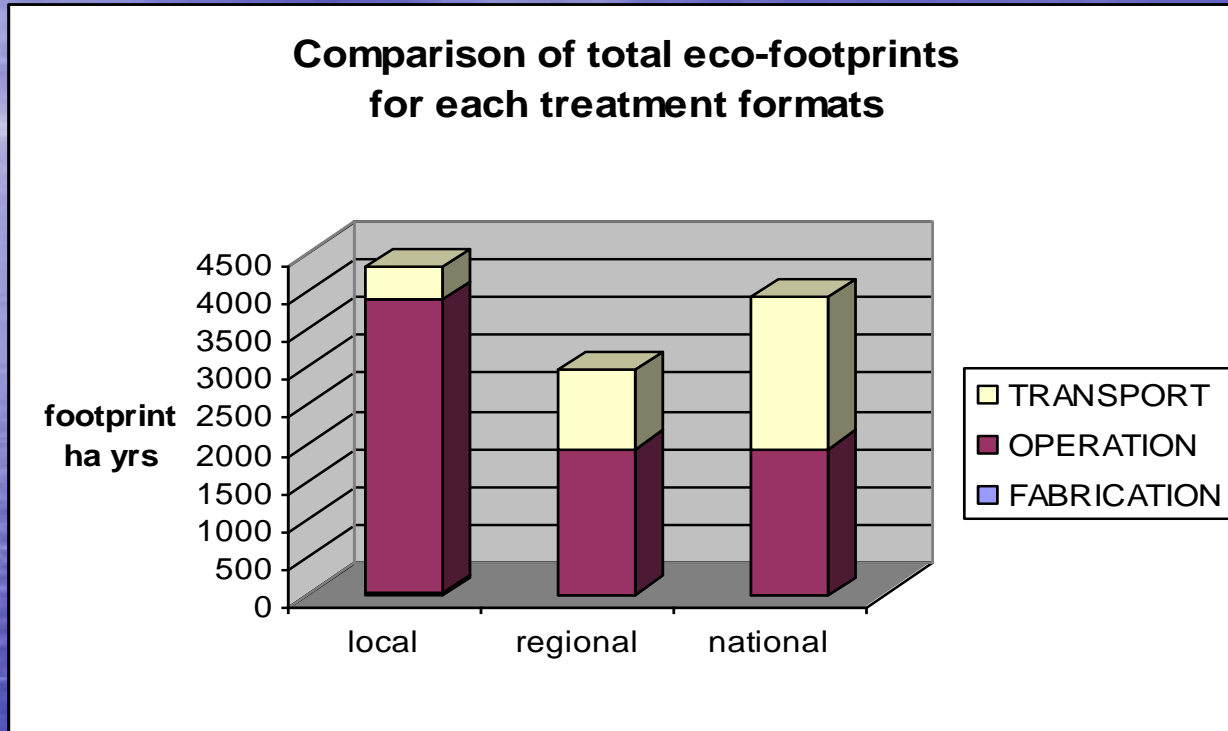
RECOMMENDATIONS

- Field trials and Risk Assessment should be conducted to establish true risk associated with healthcare waste, true risk fraction and the attenuation provided by landfill
- Field trials should be conducted including an Environmental Assessment and Life Cycle Analysis of clinical waste and the various treatment technologies
- The sterilisation of Clinical Waste is carried out based upon the removal of the *perceived* risk of transmitting pathogenic illness to humans. Scientific research needs to take place to verify this and the suggestion that normal household waste contains more pathogens and with greater virulence than Clinical waste. Therefore appropriate experts need to be involved e.g. microbiologists

ECOLOGICAL FOOTPRINT ANALYSES (EFA)

- Mathis Wackernagel is one of the founders of EFA, program director of Redefining Progress in the US and coordinator of the Centre of Sustainability Studies in Mexico
- Defines the Ecological Footprint as:
“a resource accounting tool that measures how much biologically productive land and sea is used by a given population or activity, and compares this to how much land and sea is available, using prevailing technology and resource management schemes”
- This common unit, hectare years, makes it suitable for comparative analysis of different products and services
- Conventional Environmental Impact Assessment does not provide a “number” to allow comparison between different products and services

SAMPLE RESULTS



TREATMENT FORMAT	TOTAL 20yr FOOTPRINT			ha yr
	FABRICATION	OPERATION	TRANSPORT	
<i>local</i>	20.5	3853	432	4305.5
<i>regional</i>	9.9	1914	1041	2964.9
<i>national</i>	3.3	1914	1991	3908.3

A large, bright yellow question mark is centered on a background of a vast, deep blue ocean under a clear blue sky. The sun is visible on the left side of the horizon, creating a shimmering reflection on the water's surface. The overall scene is serene and contemplative.

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