



Issues & Concerns- HCWM

By: Homi R. Mullan



Welcome to the Talk On . . .



"Issues and Concerns Towards Safe Management of Health Care / Hospital Waste - History and Future Horizon"

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Paper Background . . .



- 1. Historical Background of the Eighties in U.S.A. & Europe**
- 2. Scientific Findings**
- 3. Environmentalist Views**
- 4. Legislative Developments**
- 5. Sociology Aspects**

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Ground Rules of HCWM . . .



- 1. An Environmental Concern**
- 2. Each Facility is Unique**
- 3. Not a 'Technology' Issue, but a 'Management' Issue**
- 4. Incrementally Implement**
- 5. 'Sustainable' Plan**
- 6. 'Small' & 'Big' handlers are of Equal Concern**

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Realities of HCWM . . .



1. 21st Century is of Mega Cities
2. Epidemics at any Location, A Worldwide Concern
3. '*Cornucopian*'- Technology & Economic Driven **V/s** '*Catastrophists*' – Planets Resources & Life System Driven

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A Short History Of The Universe

_ Environmental Awareness: Graham Roberts-Phelps



Think! Planet Earth as a 46 yr. Old Person, thought to be around 46 million years Old. This person is a late developer.

- **First 7 yr.: Nothing is Known**
- **Next 35 yrs.: Sketchy information exists**

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A Short History Of The Universe

_ Environmental Awareness: Graham Roberts-Phelps



- At 42 yrs.: It began to support Life
- At 45 yrs.: Dinosaurs & Great Reptiles appear
- 8-months ago: Mammals arrived

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A Short History Of The Universe

- Environmental Awareness: Graham Roberts-Phelps



- Mid of last week: human-like apes evolved
- At the weekend: last ice age evolved
- About 4 hrs. ago: modern humans arrived

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A Short History Of The Universe

- Environmental Awareness: Graham Roberts-Phelps



- During last hour: discovered Agriculture
- Just 2 min ago: Industrial revolution
- During last 60 sec, **Bio-time**: Humans have made a Rubbish tip of Paradise

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Health Care Waste Management- *TREND*



_Driven by in the ... :
1950s by “Improved Infection Control” and ultimate “Quality Control”
1990s by “Environmental and Economic Concerns”.

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Historical Incidences of the '80s HCWM



- 1. March 24, 1986, Boston & Massachusetts:** - GTX waste handlers notified, will not lift Medical Waste
- 2. July 30, 1987, New York**
- 1400 waste bags illegally dumped discovered at warehouse by Fire Dept.

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Historical Incidences of the '80s HCWM



3. June, 1987, Indianapolis, Indiana
- 12 children played with vials of blood, Two of which were infected

4. June 19, 2000 Valdivostok, Russia:
- Eight children playing with Smallpox vaccine at garbage dump, hospitalised

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Historical Incidences of the '80s HCWM



5. July 9, 1987, Los Angeles County

Five employees files \$50 M suit after pipe burst and possibly dumped contaminated Blood, Fluids.

6. September, 1987, USA

[**On-site**: Incinerators 67% Autoclave/LF 16%][**Off-site**: Treatment approx.. 15%]

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Historical Incidences of the '80s HCWM



7. The degree of Risks with Medical Waste, other than injury due to sharps, is not known.

8. **March 04, 1998 Morton, Washington USA**

The first reported case of TB transmission from medical waste at second largest providers of medical waste management services in US.

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Outstanding & Current Issues



1. Quantity
2. Composition
3. Classification
4. Segregation
5. Source Reduction
6. Packaging
7. Compaction
8. Shredding

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Outstanding & Current Issues



- 9. Syringe Needles disposal**
- 10. Sewage disposal**
- 11. Isolation Ward**
- 12. Autoclave**
- 13. Incinerator**
- 14. Small generators**
- 15. On-site**
- 16. Off-site**

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QUANTITY



Waste Generated:

- *Not known: Today or in Past*
- *Estimating is Problematic*
- *Determines All Treat. & Disp. COSTS*
- *Necessary to determine Actual Quantity of 'Segregated 'Harmful' Waste, on Regular basis*

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COMPOSITION



Waste Composition:

- *Is of Concern given its Emission effects on Incineration Processes & Alternate Treatment Processes*
- *Solvents & Hazardous Chemicals are intimately mixed with the waste*
- *Determines the Equipment DESIGN, CAPACITY & COSTS*

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CLASSIFICATION



- ***Greater Classification Consistency Needed.***
- ***Nationwide Standardisation to be Necessarily Practiced***

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SEGRAGATION



- Inadequate Segregation Leads To Increased:
 - *Pollution*
 - *Treatment & Disposal Cost*
- **Toxic Waste must be Separately segregated, Treated & Disposed from Other wastes**

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SOURCE REDUCTION



- **First and Most Important Step of Health Care Waste Management**
- **Waste Reduction Begins by Understanding: What is Purchased – How Goods are Used – What it Discards & then Put to Use.**

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PACKAGING



- **Some Packaging Issues:**
 - ***'Dimension' Mismatch with Treatment & Disposal Equipment***
 - ***'Stacking' of Waste Bags & Boxes having of low mechanical strength.***
 - ***Unaware of Packaging Standards***

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COMPACTION



- Of Untreated Waste Leads to:
 - *Potential Aerosolization of Micro organisms*
 - *Retards the Process of Treatment & Disposal*
 - *Injury Potential to Waste Handlers*

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GRINDING / SHREDDING



- **Grinding / Shredding of Waste Prior to Treatment Leads to:**
 - **Potential Aerosolization of Micro organisms**
 - **Accelerates the Process of Treatment & Disposal**
 - **Injury Potential to Waste Handlers**

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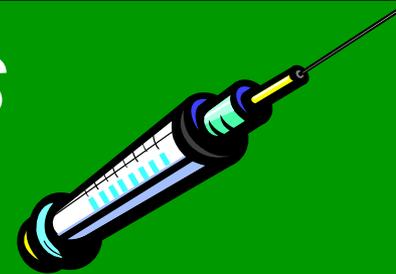


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SYRINGE & NEEDLES



- **Conditions to be Complied:**
 - **Disinfection & Mutilation**
- **Issue is what comes first: to Disinfect Or to Mutilate**
 - **Golden Rule: Least handling of Sharps for Safety of HC workers**

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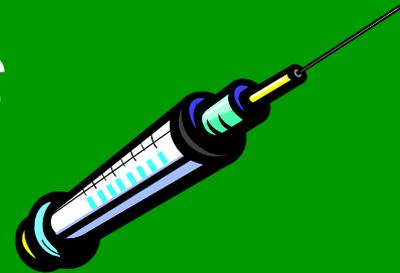


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SYRINGE & NEEDLES



- **Risks with DISTRUCTION First :**
 - **Cutter: Aerosolization**
 - **Thermal: Toxic Metal Oxides**
 - **Incineration: Toxic Emission & Residual ash; injuries due to un-destroyed Needles.**

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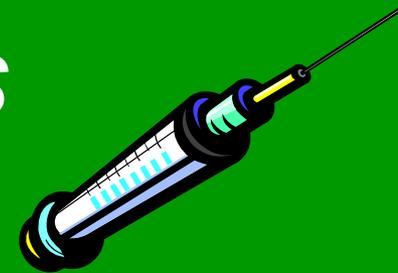


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SYRINGE & NEEDLES



- **Risks with DISINFECTION First:**
 - **Chemical:** May be Ineffective against strains of Pathogens Resistant Chem.
 - **Virus :** May Survive upto Eight-days. Disinfection at the Tip of needle.
 - **Efficacy Testing :** A must, otherwise continue you to consider it as PIMW

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SEWAGE DISPOSAL



- ***Diarrhoea Outbreak: Stools must be Disinfected before Discharge.***
- ***Cytotoxic Drugs : Should never be diluted and sewer discharged.***
- ***Epidemics: Treated Wastewater Discharge may lead to Public Hazards.***

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ISOLATION WARDS



- ***ALL Wastes From Isolation Wards (TB) should be regarded as INFECTED WASTE.***

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AUTOCLAVING



- ***NO Such thing such as ‘Standard Load’.*** Type of container, water addition, Volume, Density, have an important influence in effectiveness of process.
- ***Several factors have led some to abandon Autoclaving.*** Treated Waste becomes a suspect.

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INCINERATION PERCEPTION DRAWBACKS



- For Disposal of ALL Wastes 
- Automatic, Trouble-free, Continuous 
- Responsibility- Manufacturer 
- Distinguish the use for waste: 'Treatment' or 'Disposal'!!! 

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INCINERATION PLANNING DRAWBACKS



- 'Heat Release' capacity not determined
- 85% moist waste capacity planned
- Poor '**Location**': Basement, Main building, Remote Areas
- 'Drain & Sewer' not planned for liquid discharge

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INCINERATION OPERATION DRAWBACKS



- **COLD START:** emission of pathogenic micro-organism
- **OVER CHARGING:** emission of pathogenic micro-organism; incomplete combustion; high heat release structural damage; damage to burners

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INCINERATION OPERATION DRAWBACKS



- **LOW TEMP.:** 540°C to 760°C in primary chamber (PC) required for pathogen kill
- **HIGH TEMP.:** above 980°C in PC forms Slag; air blockage; damages refractory; oxidised metal vapour discharged through stack

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INCINERATION OPERATION DRAWBACKS



- GLASS: structural damage
- METAL: toxic emission; sharps injury
- PACKAGING: non-sturdy, low tear resistant and / or open waste results in operational problems
- EXPLOSIVE: damage & injury

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INCINERATION



- **Capacity: Dry; Wet; Batch, Intermittent & Continuous; Ash Camber Size**
- **Ash: Storage; Disposal**
- **Chimney: Height; Standards**

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INCINERATION



- ***Operator: Qualification; Training***
- ***Emissions: CEM; Dioxin***
- ***APCD: Specification & Costs***

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SMALL GENERATORS



- ***Greater Concern exists of 'Large number of, Small waste generators'***
- ***Most Vulnerable area where Unregulated waste discharges may lead to possible Risk to Public.***

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ON-SITE TREATMENT of HCW



- ***Most Established Treatment & Disposal facility, till Today.***
- ***High Investment to meet with New Regulatory Standards***
- ***'Sustainable' Operation & Maintenance Concern.***

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OFF-SITE TREATMENT of HCW



- ***Obvious HCWM Choice in Metro Cities***
- ***Uncertainty of Economics & ROI of setting up Off-Site Plant – Thereby T&D Costs***
- ***Waste Tracking Law needed***

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FUTURE ISSUES & CONCERNS



- ***Dioxin***
- ***Hazardous Toxic Wastes***
- ***Occupational Health***
- ***Radioactive Wastes***
- ***Household Wastes***

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DIOXIN: Known & Talked About



1. Most Toxic group of Chemicals known to humans.
2. Synonymous with Burning of Plastics (PVC)
3. HMIW Incinerators produce more PCDD/F than MSW Incinerators.
4. Carcinogenic, Mutagenic

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DIOXIN: Scientific Findings- not talked about.



SOURCES PCDD/F MAN MADE:

1. **Autoclave / Microwave** vaporise hazardous compounds, which act as precursors.
2. **Composting** of Organic waste containing Chlorinated compounds.
3. **Smoking, Automobile, Wood burn., Paper**
4. **60% of Boiler Stacks**

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DIOXIN: Scientific Findings- not talked about.



NATURAL SOURCES OF PCDD/F:

1. Widespread contamination. Virtually everyone - regardless of Age, Gender or Geographical location- is exposed on daily basis.
2. Forest Fires, Soils, Sediments, Rivers, Lakes, 8000 years old deposits.
3. Of total atmospheric deposits: Manmade only a fraction (10-30%)

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DIOXIN: Scientific Findings- not talked about.



4. Higher Chlorine content does not necessarily imply higher level of PCDD/F.
- **STUDY: 80% of 90 waste combustor facility examined no statistically significant relationship between chlorine input and PCDD/F stack gas concentration.**
 - **In fact, 9% displayed decreasing PCDD/F concentration**

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DIOXIN: Scientific Findings- not talked about.



5. EPA: Impacts on emissions of shifting the waste composition from chlorinated plastic to non-chlorinated polymers is inconclusive, and, questionable.
6. **Meat and dairy products intake account for more than 90% of PCDD/F exposure.**
7. **Daily PCDD intake in food in industrial nations is 1.3 to 2.3 pg TEQ kg⁻¹ day⁻¹**

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DIOXIN: Scientific Findings- not talked about.



8. No significant difference in comparative blood levels of PCDD/Fs in 24 **Vegetarians** and 24 **Omnivores** (32.6pg and 34.3 TEQ kg⁻¹ day⁻¹, respectively).
9. **Dioxin is an Occupational hazard, not an Environmental hazard.**
10. The hundreds of millions of Dollars spent on Scrubbing (air/soil/ water) of only recently perceptible particles, be better utilised.

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Future Issues



1. Hazardous toxic waste from hospitals.
2. Occupational Health.
3. Radioactive Waste Management: Patient stools, urine, body fluids, vomit blood samples. Procedure of body disposal, when patient dies during treatment.
4. Hazards of Hospital waste V/S Household waste.

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Mercury (Hg) Waste - HCWM



- Hg is a ‘POISON’ that will accumulate over time
- Even Small, seemingly Insignificant sources of Hg must be Safely managed
- Only “4 grams” of Hg can contaminate ‘1,000,000,000’ (one billion) gallons of water
- **Enforcement Level: <math><1.0\ \mu\text{g}/\text{L}</math> or ppb**

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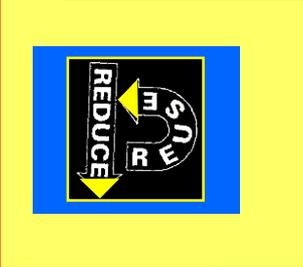
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Mercury (Hg) Waste - PATHOLOGY

Enforcement Level of Hg: <1.0 µg/L or ppb



<u>LAB</u>	<u>BENCH</u>	<u>Hg µg/L</u>
Chemistry	Electrophoresis	8,800
Bacteriology	C Spor	10,000
Bacteriology	Parasitology	25,000
Chemistry	Plating Solution.	600

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Mercury (Hg) – BLOOD BANK REAGENTS

Enforcement Level Hg: <1.0 µg/L or ppb



REAGENT

Hg µg/L

Reagent Mix

14,300

Waste from Drain

5,800

Dade Immusal (saline)

44,200

Immu Add (LISS)

206

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PERSPECTIVE QUESTIONS



1. Can we afford '**Zero Risk at Any Cost**' Solutions?
2. Do we take '**Best Practicable Environment Option**' BPEO
And,
3. '**Best Available Techniques Not Entailing Excessive Cost**'
BATNEEC, Approach?

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CONCLUSION



- 1. Look at Historical Developments, Research Work and Experiences of Developed Nations**
- 2. Require Continued Research & Trials, Nationwide**
- 3. Share Experiences, Nationwide**

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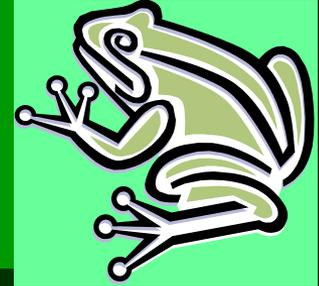


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BOILED FROG SYNDROME



**JUMPS IN
BOILING
WATER**

**JUMPS
OUT
INSTANTLY**

**SITS IN COLD
WATER, PUT TO
BOIL**

**SITS UNTIL
IT IS
BOILED,
AND DIES**

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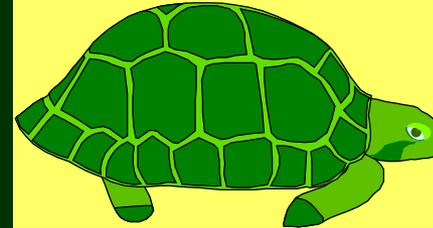
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