

# **ALTERNATIVES to DUMPING waste**

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# What we need ....

- A long-term perspective in urban planning
- Treat waste as a resource
- Awareness among the public of consequences of their behaviour
- Financial and human resources in municipalities for adequate waste management
- Labour intensive rather than capital intensive methods
- Cooperation of Safai Karmcharis or privatisation
- Use both the carrot (incentives) and the stick (polluter pays principle)

# Structure of my presentation

1. Some alarming statistics
2. The Rule Book
3. Current practice in Almora and its consequences
4. Reduce, reuse, repair and recycle
5. Segregation: Why and How
6. Composting biodegradables
7. Recycling plastic
8. Insanitary waste - To burn or to bury
9. Waste to Energy - is it feasible
10. Green Hills proposal

# Estimates of Municipal Solid Waste (MSW) Generation

- Urban India generates about **68.8 million TPY** or **188,500 TPD**
- On average, **500 gms** per capita per day
- There has been a **50% increase** in waste generation between 2001 and 2011
- In Mumbai alone, open burning of solid wastes release **22,000 TPY** of pollutants (Carbon Monoxide, Hydrocarbons, Particulate Matter, Nitrogen Oxides and Sulfur Dioxide) plus an estimated **10,000 TEQ grams** of dioxins/furans
- Composition: 51% organics, 17.5% recyclables, 31% inerts
- Moisture content 47%
- Calorific value 1,745 Kcal/kg

Source: Earth Engineering Center, Columbia University,  
*Sustainable Solid Waste Management in India, 2012*

# MSW (Management & Handling) Rules, 2000

- Awareness programmes for segregation at source
- House-to-house collection of segregated waste
- Bio-degradable waste from markets and slaughter houses to be made use of
- Demolition debris, bio-medical and industrial waste not to be mixed with household waste
- Closed storage facilities that are aesthetically acceptable and user-friendly
- Land filling restricted to non-biodegradable, inert waste not suitable for recycling. Landfill sites away from habitation clusters, forest areas, water bodies monuments, National Parks, Wetlands and places of cultural, historical or religious interest. Wastes shall be covered at the end of each working day with minimum 10 cm of soil. Prevention of run-off from landfill area entering any stream, river, lake or pond.
- Air and water quality monitoring in the vicinity of landfill sites
- Incineration – combustion efficiency 99%

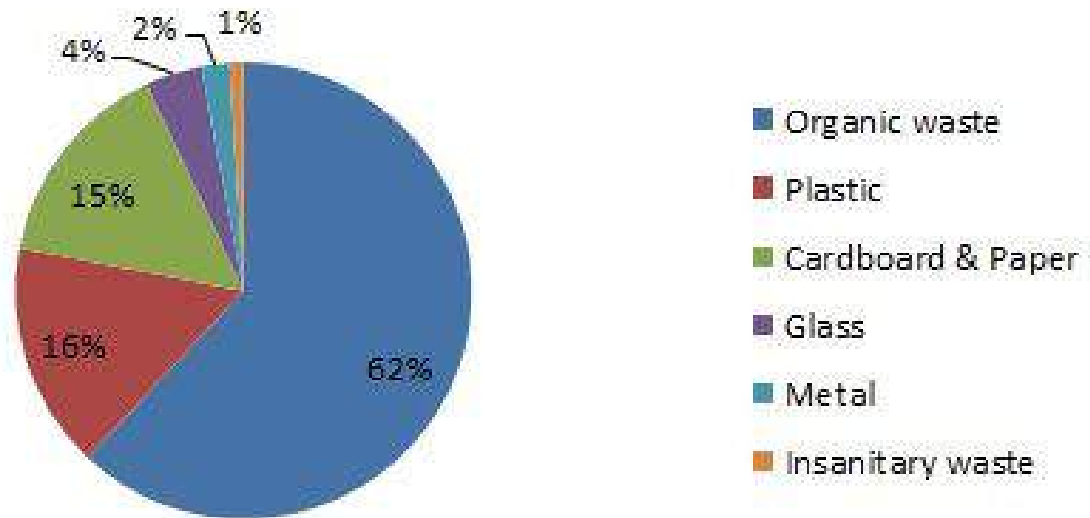
# Special rules for special wastes

- Bio-medical Wastes (Management and Handling) Rules, 1998
  - Disinfection by auto-claving or microwaving
  - Incineration by plasma pyrolysis
  - Deep Burial allowed only in hilly areas
- Hazardous Wastes (Management and Handling ) Rules, 1989
  - Includes GMOs, plastic waste, e-waste, batteries
  - Extended Producer's Responsibility - environmentally sound management of product until the end of its life.

# MSW Generation in ALMORA

12.55 TPD or 4,580.75 TPY

## Composition of Municipal Solid Waste in Almora



# Consequences of mixing waste





# Consequences of dumping



- Emission of cancer causing dioxins from slow burning of plastics
- Accidents causing deaths of Safai Karmcharis

# The heritage of future generations

## **Time required for disintegration**

- Glass bottles: 4,000 years
- Plastic bottles: 100 to 1,000 years
- Aluminium cans: 100 to 500 years
- Packaging: 100 to 450 years
- Cigarette butts: 2 to 15 years
- Chewing gum: 2 to 5 years

# Pollution of major rivers



Suyal to Kosi to Ramganga to Ganga

# REDUCE, REUSE, REPAIR, RECYCLE

*'na main gandagi karoonga, na main  
gandagi karne doonga'*

## As Consumers:

- Don't throw trash on roads, mountain paths, railway tracks or into drains or water bodies
- Cook what you will consume
- Use cloth shopping bags in place of polythene carry bags
- Choose to buy durable and recycled products that have less packaging
- Avoid using disposable products (diapers and sanitary pads) that generate trash

## As Citizens:

- Create Mohalla Swachhta Samitis
- Monitor the work of municipal safai karmcharis
- Demand that local authorities enforce the ban on polybags
- Agitate for more recycling and an end to dumping

# Good reasons to recycle

- Recycling creates 36 times more jobs than incineration
- For every tonne of paper that is recycled, 17 trees are saved.
- Recycling one plastic bottle can save enough energy to power a 60 watt light bulb for six hours.
- You can make 20 aluminium cans out of recycled material using the same amount of energy as it takes to make just one new one.
- The energy saved from recycling one glass bottle is enough to power a 100 watt light bulb for one hour

# WHY SEGREGATE?

- A must in order to extract value from waste
- Considerably reduces pollution as mixed waste can only be incinerated or land filled
- Creates jobs
- Avoids moisture in recyclables – better prices for them
- Causes the death of animals
- Composting mixed waste is dangerous for agriculture

# Three-way segregation



Wet - Compostable



Dry - Recyclable



Insanitary waste

# Biodegradable Wet Waste

- Aerobic composting – NADEP or vermi-compost
- Household Anaerobic composting – Bokashi method
- Neighbourhood level Biomethanisation
- Centralised composting unit



# Bokashi method

- Bokashi is Japanese for "fermented organic matter"
- Uses a specific group of microorganisms to anaerobically ferment all food waste
- Since the process takes place in a closed system, insects and smell are controlled, making it ideal for urban or business settings.
- The process is very fast, with compost usually ready to be integrated into your soil or garden in around two weeks.

# Dry Recyclables

## PLASTIC

- Use in Road Construction
- Pelletisation and remoulding – Kathgodam factory
- Refuse Derived Fuel through Plasma pyrolysis

## PAPER

- Pulped and used to make recycled paper or cardboard

## GLASS

- Refilled
- Powdered and remoulded

## METAL SCRAP

- Melted and remoulded

# Dr. Vasudevan's method

- Uses polyethylene, polypropylene and polystyrene (carry bags, plastic bottles, laminates, thermacole cups, etc) but not PVC
- Gravel is heated to 170°C and shredded plastic spread over it. Melts in 30 seconds.
- Bitumen is then added and the mix used for road construction

## RESULTS

- 1 ton of bitumen saved per km of 3.75 m wide road (INR 20,000)
- Each ton of plastic used avoids release of 3 tons of CO<sub>2</sub>
- Durability of roads increased from 5 years to 10 years
- Load bearing capacity enhanced

# Plastic waste into pipes - Kathgodam



# Refuse Derived Fuel

- Depolymerisation is thermo-catalytic decomposition (By using heat & catalyst) or cracking of polymers (plastic or tyres) in absence of oxygen
- Inputs: plastic, rubber, waste oils and laminates
- Output: Synthetic oil similar to Light Diesel Oil used in electricity generators, boilers, diesel pumps, etc.
- Can be purified into petrol, jet fuel, kerosene, diesel, mineral turpentine oil, gear oil, wax

# Installation in Navi Mumbai



# Insanitary waste

- Incinerators equipped with wet scrubbers, secondary combustion chambers and chimneys
- Plasma pyrolysis  
(Ash from both these processes to be land-filled)
- Deep Burial

# Plasma Pyrolysis system

**Plasma is a means to convert electrical energy into heat energy efficiently.**

**Plasma torch used for bio-medical waste**

**Cost: INR 26.5 lakhs for a capacity of 25 -30 kg per hour**

**Temperatures of 950 to 1,100°C as compared to 600 -850°C in a incinerator**





# Waste to Energy

## Advantages

- Does not require source segregation
- Bridges the power deficit

## Disadvantages

- High Capital Cost
- Calorific value of MSW in India is 1,745 Kcal/kg. Minimum calorific value recommended for economically feasible energy generation is 1,790 kcal/kg.

# Changes recommended by Green Hills

- Source segregation into three
- Set up of Mohalla Swachhta Committees that monitor Safai Karmcharis, collect user fees and arrange for Shramdaan on a regular basis
- Composting at home or at neighbourhood level
- Door-to-door collection of insanitary waste daily by the Nagar Palika and centralised incineration of it
- Door-to-door collection of recyclables once a week
- Arrangement with kawadis to take all waste in exchange for interest free loans
- Banning polythene carry bags
- Fines imposed on those who litter or do not segregate

# THE WAY FORWARD

- Citizens' participation in waste management
- Civic duties to be integrated into school curricula
- Nagar Palika imposes different work ethic on Safai Karmcharis or outsources the work
- Propose a strategy for the Swachh Bharat Abhiyan for which the government will spend nearly Rs 2 lakh crore in a five-year span to completely clean India by October 2019
- Knowledge network between States