Key findings:

Legacy Waste Management and Dumpsite remediation

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Content of Presentation

- Current status of legacy waste dumpsites
- What is legacy waste?
- Composition and percentage of waste fractions
- Approaches to dumpsite remediation- Bio-capping and biomining
- Steps in biomining and key considerations
- Successful case studies
- Challenges and way forward

Swachh Bharat Mission 2.0 and Dumpsite remediation

- SBM 2.0 aims to achieve the vision of **'Garbage Free Cities'** over the next five years
- 31st March, 2023 for ULBs < 10 lakhs population
- 31st March 2024 for ULBs > 10 lakhs population

- **Legal mandate** – Solid Waste Management Rules, 2016.

investigate and analyse all old open dumpsites for their potential of biomining and bio-remediation and take necessary actions to bio-mine or bio-remediate the sites

Dumpsites in India – current status

- 3159 dumpsites (according to Central Pollution Control Board) – an offshoot of waste mismanagement for decades
- Covering an area of 10,000 Ha
- Estimated cost of remediation INR 1,04,000 Crore
- SBM 2.0 (2021-2026) has a total budget outlay of INR 1,40,000 Crore
- About 74 per cent of the amount equivalent to entire SBM allocation would be required to be spent on remediation of our dumpsites

Environmental and health hazards due to Dumpsites

1 ton MSW → Landfill without methane capture → 1610 kg CO_2 equivalents

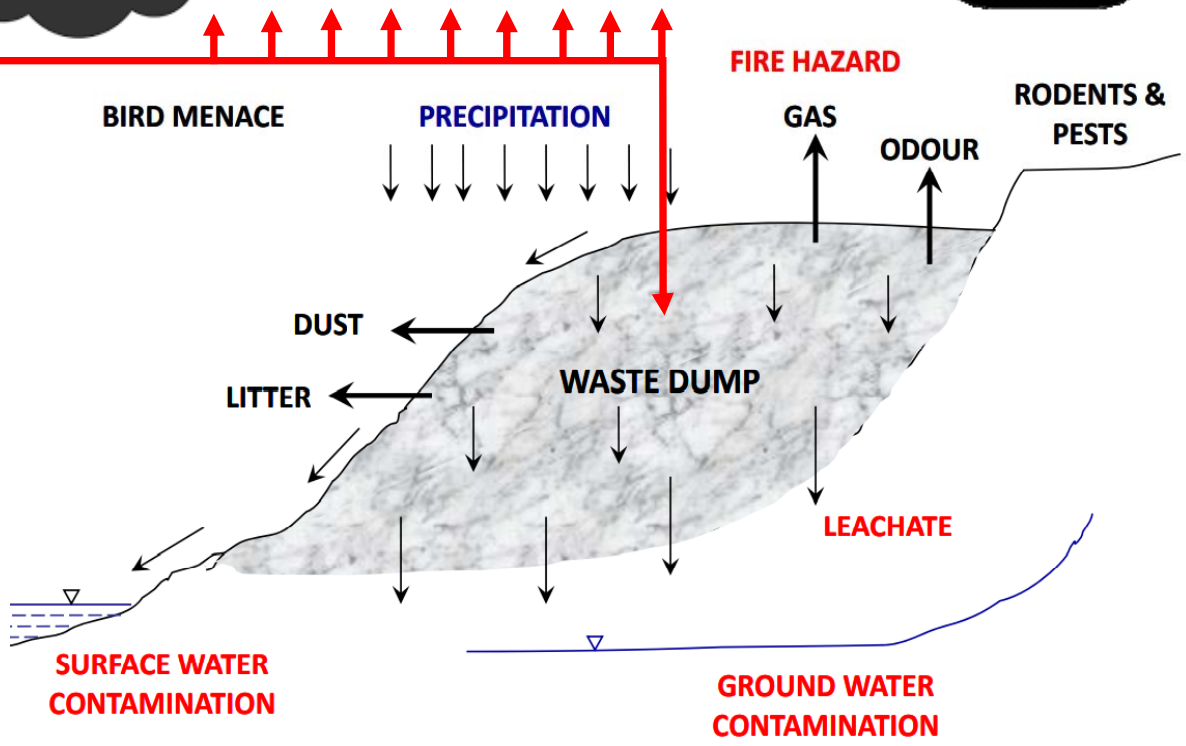
CH_4

Microbial degradation of wet waste causes **GHG EMISSIONS**

CO_2

"Mixed waste" Biodegradable (wet waste) & non-biodegradable (dry waste)

Primary and secondary collection and transportation

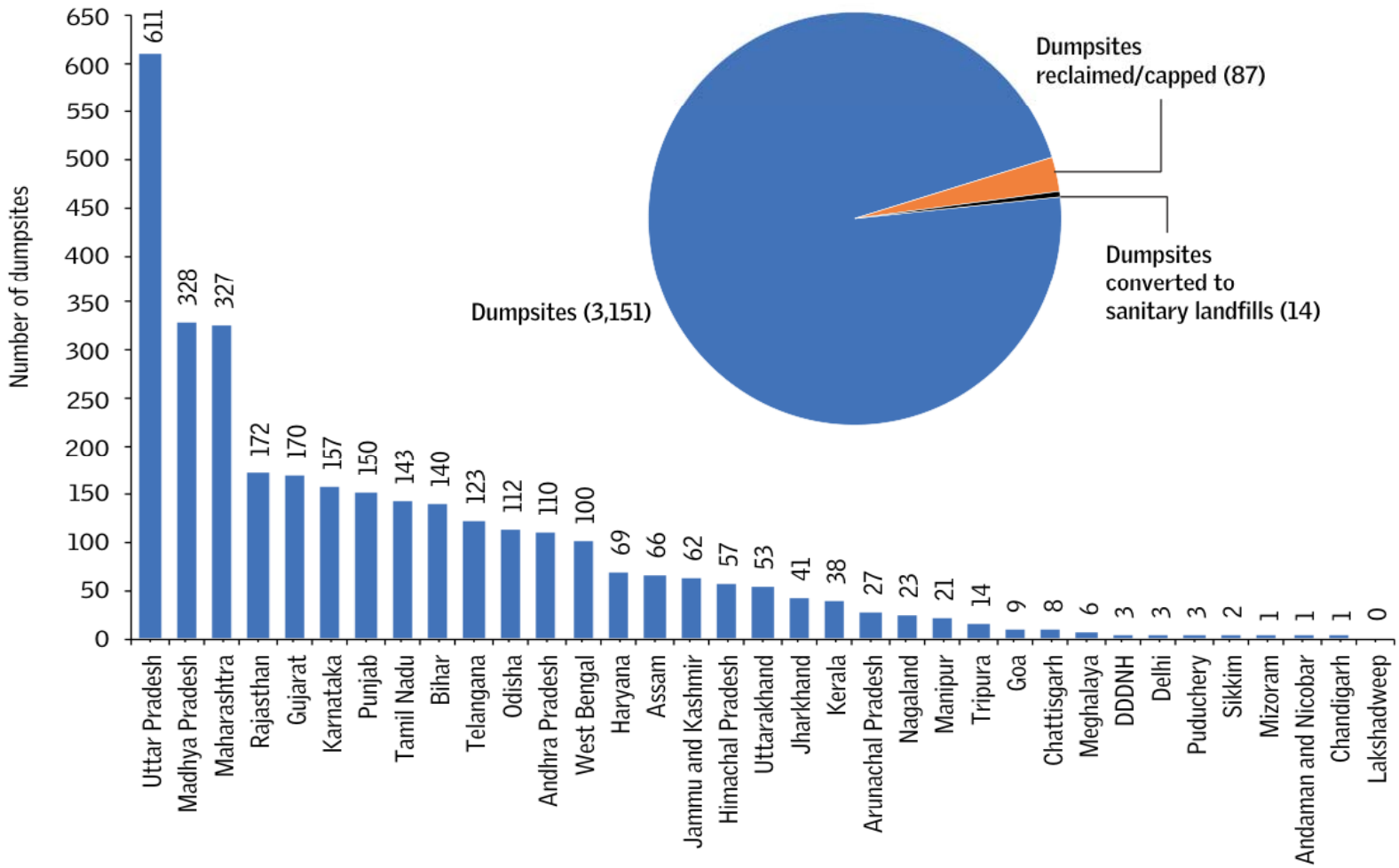


What is legacy waste ?

- Aged municipal solid waste
- Partly, completely, un-decomposed waste
- Contains scrap polymeric and combustible materials
- Inerts

Composition of legacy waste

- Indian dumpsite contains a mix of legacy waste (aged waste) and fresh MSW.
- Characteristics and composition are different – which affects the choice of treatment technology and end use of recovered material.
  - Significant proportion of fine-soil like material (40 to 60 per cent)
  - The combustible material ranges between 15 to 18 per cent on weight basis.
  - Coarser particles such as broken bricks, masonry, stones etc constitute nearly 20 per cent.
  - Other miscellaneous fractions comprising broken glass, metallic fractions such as razors, needles, sanitary waste, and diapers might constitute almost 1-5 per cent in the total waste quantum.



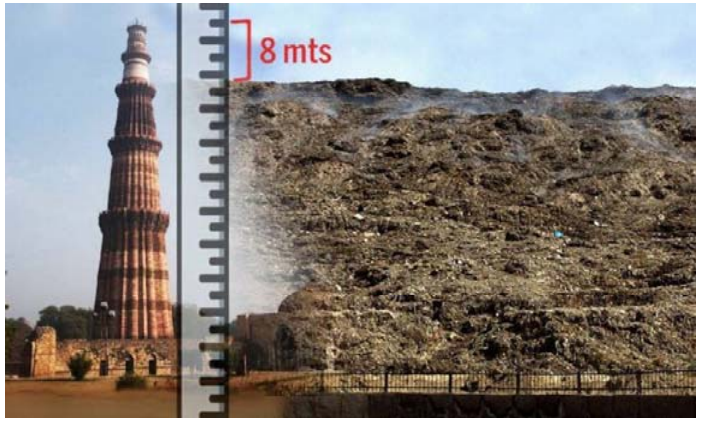
Source: CPCB annual report, 2019–20

Status of dumpsites in India

Dumpsites in India – current status

Okhla:
Land occupied: 46 acres of land
60 metres
Total volume: 55.6 lakh tonnes

Ghazipur:
Land occupied – 70 acres
Height – 65 m
Total volume – 140 lac tonnes



Kodungaiyur:
Land occupied – 258 acres
Height – 91 m
Total volume: 64 lakh tonnes

Deonar:
Land occupied – 326 acres
Height – 37 m
Total volume: 120 lac tonnes of waste

Available options for remediation

Biomining of dumpsite:

- entire waste is treated
- entire land is reclaimed
- entire waste fractions are used for gainful applications

Bio-capping of dumpsite:

- Leachate collection and treatment
- Land is not recovered. Legacy waste is not treated, no waste fractions utilized

Hybrid model (biomining and bio-capping)

- A fraction of waste is treated
- A fraction of land is reclaimed
- A fraction of waste are used for gainful applications
- Rest of the unused waste is bio-capped

Biomining for material and land recovery

Secondary Data collection

Site investigation

Execution plan

Installation of plant machineries & equipment

Resource mobilization plan

Commencement of legacy waste processing

Resource recovery

Disposal of non-processable rejects

Land reclamation

Reclaimed land, RDF, recyclables

Steps for biomining of legacy waste

1. Pre-feasibility assessment, including thorough site investigation studies, surveys and waste characterization;
2. Systematic excavation of legacy waste;
3. Stabilization by the spraying of bioculture to reduce the volume and mass of the waste;
4. Processing of the excavated fraction;
5. Utilization of extracted waste fractions in various gainful applications; and
6. Clearing and conditioning of recovered land

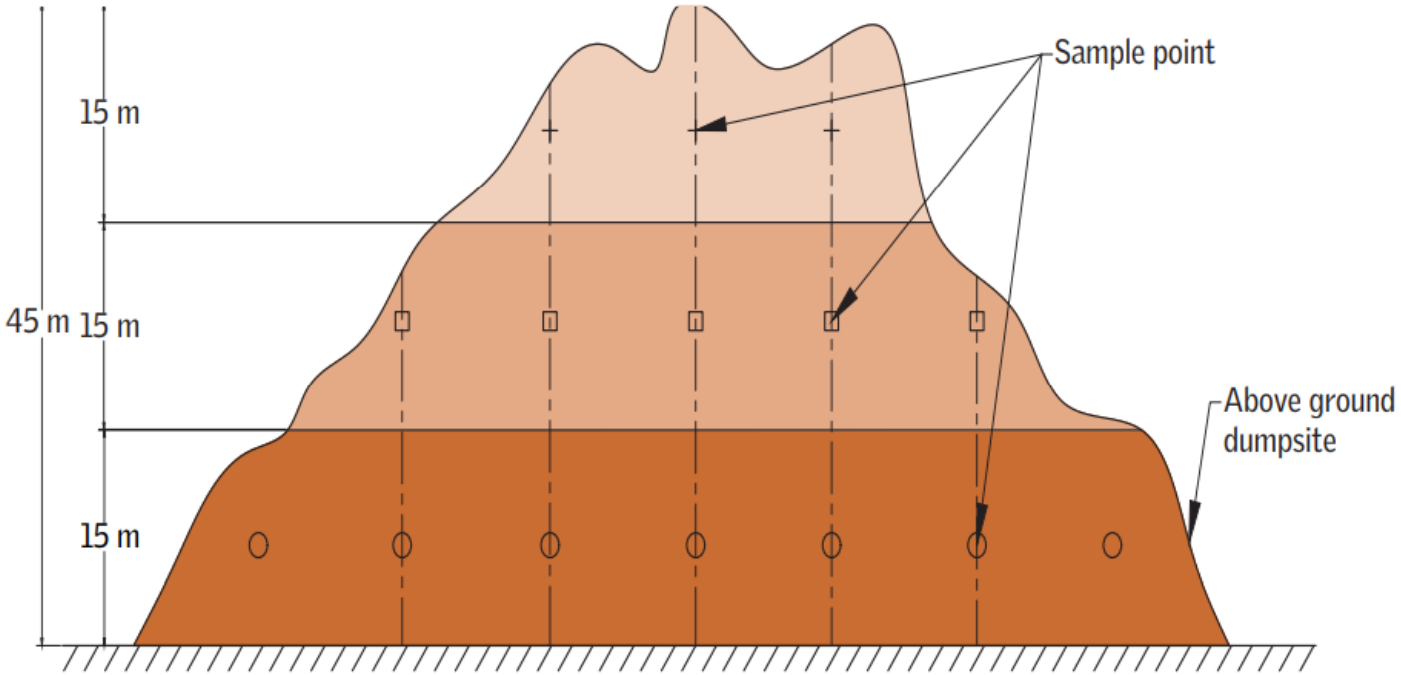
Pre-feasibility assessment

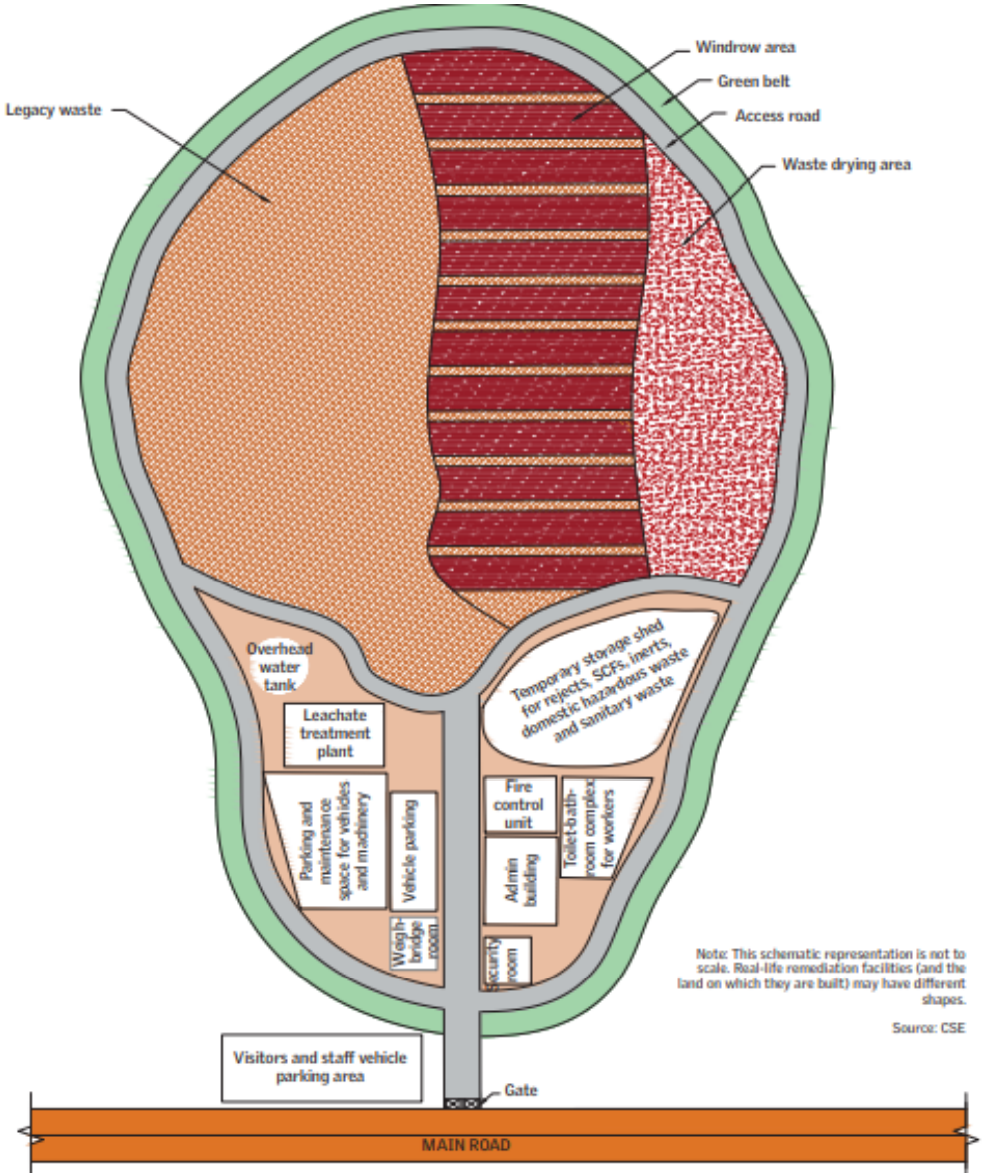
- Technical and operational feasibility
- Economic feasibility
- Legal feasibility
- Timeline feasibility

Requirements of the planning phase

- Alternative plan for treatment and scientific disposal of fresh waste
- conduct risk assessment and emergency planning
- Training and capacity building of the manpower involved
- Low-lying areas in the city and surrounding areas to be identified to ensure end-use of fine fractions;
- Tie-ups and collaborations with nearby cement plants
- Potential recyclers to be explored;
- Availability of sufficient water and power supply to be ascertained.

Composition & characterization of legacy waste





- Secure entrance gate
- Security and reception office
- Weighing bridge
- Records room
- Laboratory
- Medical room
- Workers' area
- Parking for vehicles (heavy earth equipment, trucks, etc.) with tyre washing facility
- Administrative building
- Temporary storage area for rejects, domestic hazardous waste and sanitary waste
- Material storage area
- Environmental monitoring unit
- Leachate collection and treatment unit
- Fire control unit
- Waste drying and windrow area
- Toilet–bath complex, with personnel protection equipment (PPE) storage room)
- Overhead water tank

Considerations during legacy waste excavation and material handling

- Preparation of a detailed operation plan
- Availability of PPE
- Provisions for fire control
- Depth of excavation
- Procurement of machinery and equipment
- Trained manpower
- Odour and dust management
- Record keeping
- Regular monitoring
- Environmental monitoring

Considerations during legacy waste processing and material handling

- Space for waste stabilization and processing
- Procurement of equipment/machineries for sorting and processing of legacy waste fractions;
- Quantities, types and variability of material to be handled;
- Number and types of vehicles or other transport means required for segregation, separation and dewatering (procurement of equipment and machinery such as trommel, vibrating screen, disc/star handling equipment, loaders, conveyers and fork lifts);
- A record of quantity of waste treated and diverted should be prepared on a daily, weekly and monthly basis. A site manual giving all site investigation, design and construction details should also be prepared in case the remediation process is modified during the operational phase.

Utilization of extracted waste fractions for gainful application

- The following three factors are critical in assessing the potential of the scrap combustible fraction (SCF) used in cement plants:
- the calorific value of the waste should be greater than or equal to 2,500 kCal/kg;
- the ash content should be less than 20 per cent; and
- the moisture content should be less than 30 per cent.

Considerations for gainful application of recovered legacy waste:

- Fractions recovered from the mining of legacy waste should be tested, especially for the presence of toxic metals and organic contaminants.

Components of legacy waste & environmental concerns

Components of legacy waste	Potential applications	Environmental and health hazards
Fine soil-like material	As earth-filling and road-making material, and as substitute for clay in the construction industry	Presence of leachable heavy metals and organics
Coarser inert material	In filling up low-lying areas and as aggregate in C&D waste processing industry	Presence of leachable heavy metals and organics
Scrap polymeric combustible material	RDF and road-making	Contamination with inerts, and high ash and sulphur content
Hazardous material	Disposed of in a scientific landfill	Can lead to many environmental hazards if not disposed of properly

Case studies

Dumpsites covered	Vadodara, Vijayvada, Agra, Indore, Noida, & Bhopal
Age of dumpsites	5 to more than 50 years
Total dumpsite area	4 - 100 Acres of land
Accumulated waste quantity	1 to 15 Lakh Metric Ton
Percentage of land reclaimed	57 to 100 per cent
Waste utilization	30 to 100 per cent
Leachate treatment plant (for capped area as per CPHEEO manual and Solid Waste Management regulations)	Only in case of Bhopal (50 KLD LTP for the capped landfill)
Total project cost	Rs 12 to 54 crore
Legacy waste treatment and disposal cost	Rs 360 to 1193 per tonne

Dumpsite remediation in hilly regions

- Higher service delivery cost
- Local use of recovered material: Substantial quantities of the recovered material can be locally reused in:
- Plastics: For road construction, recycling, etc.
- Soils and fines: For levelling of undulating land and as construction fillers
- Rocks and stones: For construction locally (cost of construction in the mountainous regions is very high, using local material might drive down costs)
- Extended project timelines

Dumpsite remediation in hilly regions

- Need for specialized policy for mountainous regions
- Outsourcing of services
- Comprehensive scoping
- Cluster-based approach
- Waste quantification
- Waste processing

Challenges in dumpsite remediation through biomining

- Gaps in data and preliminary planning
  - Incorrect estimation of legacy waste quantum
  - Absence of clear standards for post-mining activities
  - Lack of data on quantification, bore hole testing, and leachate and gas generation from dumpsite.
  - Lack of availability of sanitary landfill sites for scientific disposal of inerts (street sweepings and drain silt) as well as rejects.
  - Lack of protocols to ensure safety of personnel involved in biomining

Challenges in dumpsite remediation through biomining

- Statutory compliance (not uniform)
- Lack of disposal plans for recovered materials
- End use of reclaimed land
- Lack of a scientific disposal plan for non-recyclable and non-usable material

A legacy waste dumpsite in Kashmir

The way forward

- Developing a sustainable solid waste management plan
- Ensuring maximum utilization of recovered fractions
- Developing standards for gainful utilization of recovered fractions
- Utilization of the reclaimed land
- Incentives for proper management of recovered materials
- Capacity building of ULBs, SPCBs and state urban development departments
- Construction and sustainable operation of sanitary landfills

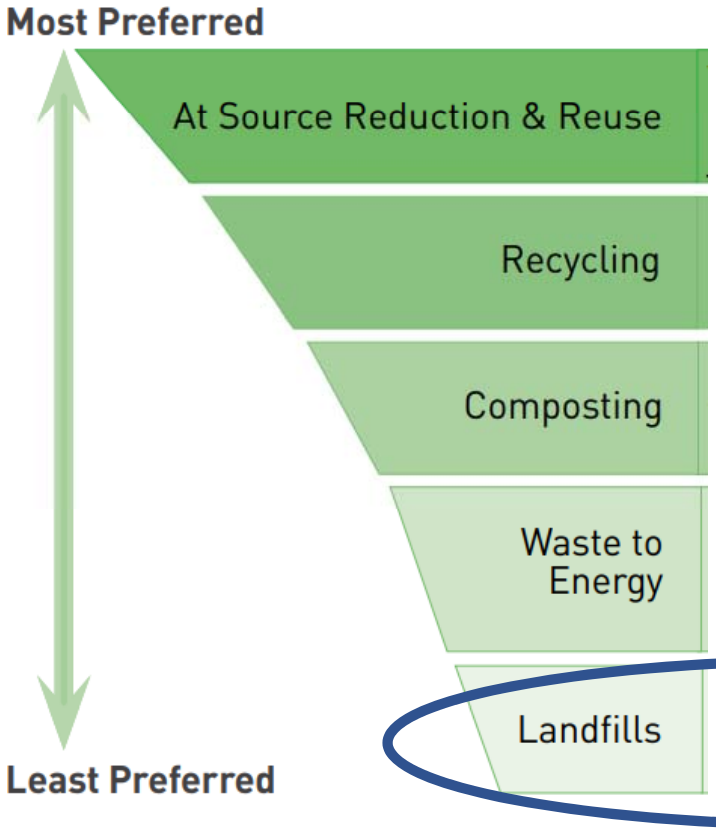
Key factors for success

- The key for successful dumpsite remediation is the maximum utilization of mined material so that maximum land is reclaimed and a negligible amount of residual wastes (rejects) should reach the sanitary landfill.

- It is also important that new legacy sites are not created; for this, the city waste management plan is critical focussing on:
    1. Source segregation
    2. 100 per cent waste processing and treatment
    3. Only rejects and inerts should be disposed of in sanitary landfill

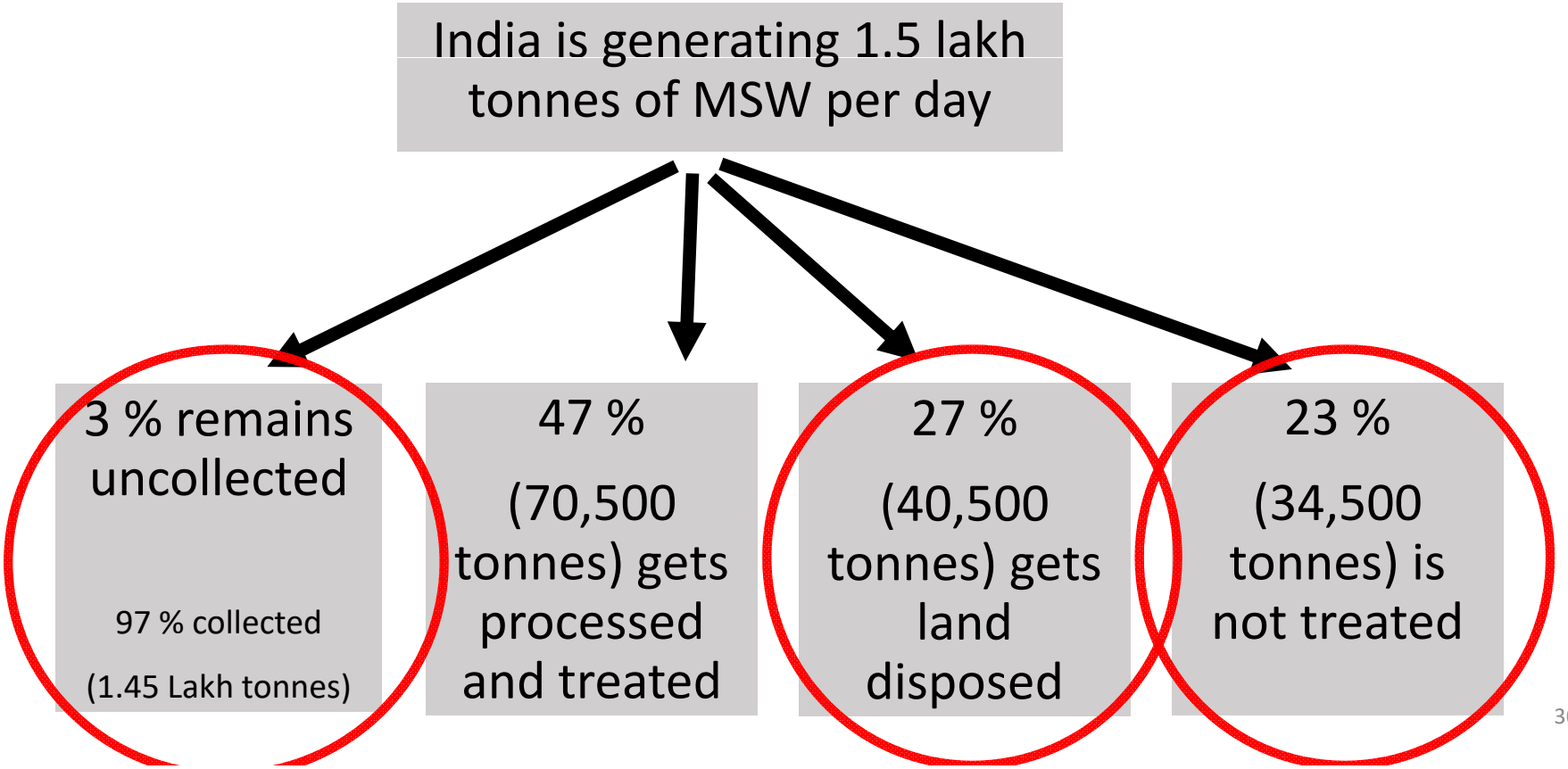
Waste Hierarchy in ISWM

- SWM Rule 2016 defines "**waste hierarchy**"
- Prioritizes source reduction (prevention), re-use, recycling, composting – as most preferred options
- **Disposal at the landfill – least preferred**



1. Sustainable consumption and prevention
2. Reprocessing of an item into a new raw material for use in a new product
3. Processing waste to recover commercially valuable products
4. Recovering energy from waste
5. Disposal in sanitary landfill

Waste treatment need to be enhanced



Thank you

Let’s build a zero landfill nation for our future generations…