

Sustainable and Affordable Sanitation Solutions for Small Towns
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Lecture – 12
Plastic Waste Management

So, a Plastic Waste Management as I said that plastic can be segregated for the brand auditing we did that recyclable and non recyclable waste.

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Plastic Waste Management

- Plastic cannot be recycled indefinitely
- All end up as waste since virgin plastic material can be recycled 2–3 times
- plastic material deteriorates due to thermal pressure after each recycling.
- Plastics are highly resistant to biodegradation.



Classification of Plastics – Bureau of Indian Standards

Bureau of Indian Standards (BIS) classifies plastic into seven types.

SYMBOL	SHORT NAME	SCIENTIFIC NAME	USE IN
1	PET	Polyethylene terephthalate	Water bottles, PET bottles etc.
2	HDPE	High density polyethylene	Milk or detergent bags, Carry bags, Container etc.
3	PVC	Polyvinyl chloride	Cables, Pipes, Floorings etc.
4	LDPE	Low density polyethylene	Carry bags, Films
5	PP	Polypropylene	Medicine bottles, Cereal liners, Packaging films etc.
6	PS	Polystyrene	Foam packaging, Tea cups, Ice cream cups, etc.
7	O	Others	Thermoset plastics, Multilayer and Laminated Plastics, PUF, Bakelite, Polycarbonate, Melamine, Nylon etc.

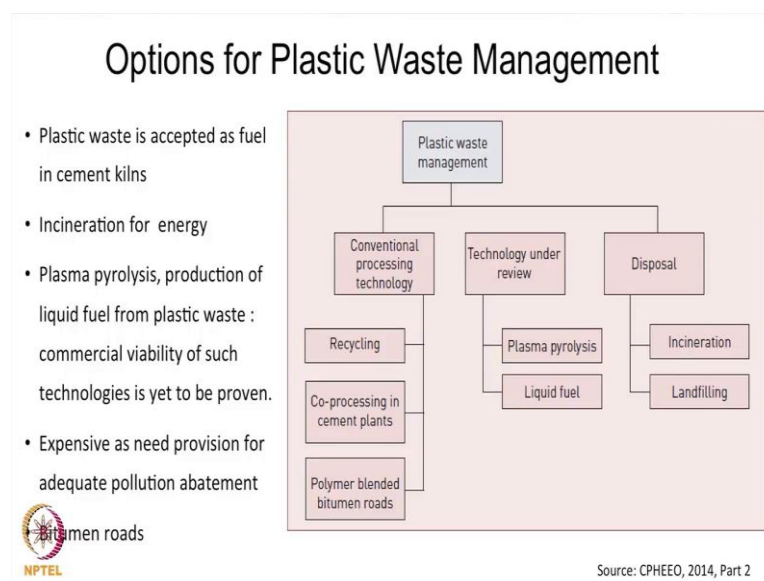
Source: BIS, CPCB

- Recyclable plastics (thermoplastics): PET, HDPE, LDPE, PP, PVC, PS, etc.
- Non-recyclable plastics (thermoset and others): Multilayer and laminated plastics, polyurethane foam (PUF), bakelite, polycarbonate, melamine, nylon, etc.

Source: CPHEEO, 2014, Part 2

So, these are the different categories for of plastics which you can you know recycle and use, but one thing one needs to be reminded of is that plastic cannot be recycled indefinitely. So, once is there in the economy once there in the system it will remain its very difficult to you know do anything about it once if there in the system. These are the different options from plastic waste management.

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I have always; I have already spoken about this thing the planting with the bitumen and the other thing is that incineration if you want to dispose off. Plasma pyrolysis is happening, but I think there are only two or three plants all over india that to an industrial level, its not happening at the city level, this is very very expensive technology and the most of the urban local bodies they cannot afford to have neither they have the capacity and nor they have the skills or the money for that (Refer Slide Time: 01:23). Paper waste management you know how it done.

Right segregation initial sorting and this is the process of making handmade paper. A waste to energy I have already spoken about little bit the bio degradation part and the most preferred part in most preferred technology in Indian case is incineration or biomethanation ok. But they are if you see we have about 8 systems all across all across India in Andrapradesh-2 to Maharashtra-2.

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Waste to Energy

1. AP (2), Maharashtra (2), Delhi (3), Kerala (1) has Waste to Energy systems and 29 RDF systems (Planning Commission, 2014)

2. Challenges

- Expensive option
- Require skilled staffing
- Require adoption of high-level technologies.
- Failure to provide required quality and segregated MSW
- Have potential to cause significant environmental impacts through emissions and fly ashes

Reasons for Closure of W-E plants in India

Reason	Timarpur	Vijaywada	Hyderabad	Lucknow	Kanpur
Lack of due diligence on the part of investor and public sector.	Yes	Yes	Yes	Yes	Yes
Non-supply of committed quantity / quality of waste to the plant by the municipal authority	Yes	Yes	Yes	Yes	Yes
Presence of inerts - dust & C and D waste in MSW delivered for processing, making the operations difficult and very expensive.	Yes	Yes	Yes	Yes	Yes
No market for sale of compost / RDF	NA	NA	NA	NP	Yes
Public outcry against the location of the plant	Yes	NA	NA	Yes	NA
Lack of financial viability of the project etc.	Yes	NA	NA	NA	Yes

Legend: NA = Not Applicable, NP = No Production

Source: Planning Commission, 2014



And these this is the different kind of waste to energy systems all across India These are the challenges as I said or waste to energy systems is the most biggest challenges to provide sorted waste which is very difficult in Indian cities, you cannot provide a sorted waste and the required waste.

And obviously, there are environmental impacts of these waste to energy, if you are not employing any air pollution method and obviously, these are very expensive again ok. So, sanitary land we discuss about the landfills actually most of the cities are not landfills those are dumping sites. So, there is a difference between landfills and the dumping site. So, these sanitary landfill means where the final and safe disposal of residual solid waste.

Student: Question maam.

Student: (Refer Slide Time: 00:52).

Its not the as I said before its not, but then ultimately there will be certain materials which you cannot process or reuse you have to ultimately dispose; so.

Student: If there are items in that particular (Refer Slide Time: 03:10) which we cannot.

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Student: So, what is the solution?

There is no solution you have to dispose off that is that is the only thing you can do. As I said that plastic you can even if you know converted into and use it as a mixture with bitumen ultimately plastic is there, floods will come, roads will go the plastic will remain ok.

So, there are certain things which you cannot do away with it you have to dispose it in some maybe more controlled manner if not like openly you are throwing them away its like more controlled approach to disposal and management. So, sanitary landfills I do not think, so we have any example in India of sanitary landfills, correct me if I am wrong.

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Sanitary Landfill Facility (SLF)

What is SLF?

- Final and safe disposal of residual solid waste and inert wastes on land in a facility, which is designed with protective measures against
 - pollution of ground water, surface water and fugitive air dust,
 - wind-blown litter,
 - bad odour,
 - fire hazard,
 - animal menace, bird menace, pests or rodents,
 - GHGs,
 - persistent organic pollutants slope instability and



And these are the things sanitary landfills have to take care off. They have to take care of pollution of ground water, surface water, any air, dust, a bad odour, fire hazard, animal menace, GHGs and persistent organic pollutants slopes instability and erosions. Sanitary landfills are necessary for any non bio degradable and inert waste mixed waste not found suitable for waste processing.

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Sanitary Landfill Facility (SLF)

Sanitary landfilling is necessary for	Sanitary landfilling is not allowed for
• Non-biodegradable and inert waste • Mixed waste not found suitable for waste processing; • pre-processing and post-processing rejects from waste processing plants; • Non-hazardous waste not being processed or recycled	• Biodegradable waste or garden waste (composted preferably); • Dry recyclables (recycled preferably); • Hazardous waste (needs hazardous waste sites with special containment).

Source: CPHEEO, 2014, Part 1

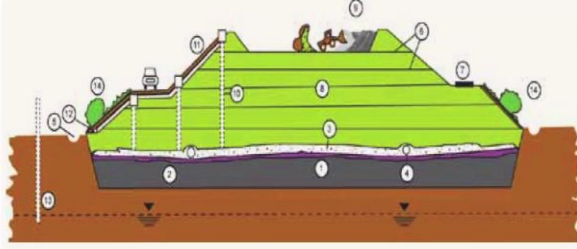
So, these are the things that should go ultimately to landfills and these are the things that are not allowed to go to sanitary landfills. Obviously, biodegradable waste should be preferably composted dry, recyclable and hazardous waste should be managed.

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Components of Sanitary Landfill

SWM Rules, 2016 provides regulations on

- Siting,
- Design,
- Operation of SLFs



1. Geological barrier	8. Landfill body
2. Impermeable base liner	9. Filling and compacting in layers
3. Drainage layer	10. Gas venting system
4. Leachate collection system	11. Protective cover system
5. Storm - water drain ditch	12. Gas collectors
6. Bordering dams	13. Groundwater control
7. Circulation roads	14. Re-planting

Source: CPHEEO, 2014, Part 1

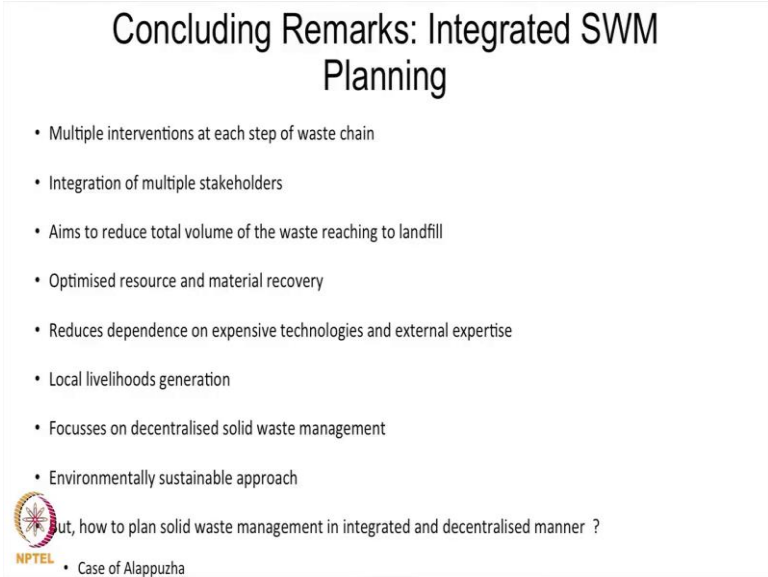
This is the typical diagram which is the recent CPHEEO manual also came out with and solid waste management rules. So, these this is the best sanitary landfill how it looks like it has a layer. So, that leachates would not go go it has a you know system here piping

system. So, that leachates will be drained out in a controlled manner. So, these are the different component of sanitary landfill.

Student: Yes.

So, before she has starts the next session. So, we spoken about integrated solid waste management planning which is multiple interventions at each step of the waste chain. So, segregation, collection, transportation, disposal it involves integration of multiple stakeholders. So, informal sector is not outside the realm of government or the value chain has to be incorporated within the formal chain. It aims to reduce total volume of the waste that is reaching to the landfill, it optimises resources and material recovery.

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Concluding Remarks: Integrated SWM Planning

- Multiple interventions at each step of waste chain
- Integration of multiple stakeholders
- Aims to reduce total volume of the waste reaching to landfill
- Optimised resource and material recovery
- Reduces dependence on expensive technologies and external expertise
- Local livelihoods generation
- Focusses on decentralised solid waste management
- Environmentally sustainable approach

 But, how to plan solid waste management in integrated and decentralised manner ?

NPTEL • Case of Alappuzha

So, these are the few principle of integrated solid waste management, but is it possible, can we do that? So, Alleppey as I mentioned that Alleppey experimented with the decentralized waste water management. It experimented with no bin policy. So, Shridar is going to talk about this efficacy of such kind of a model for small towns like.