Supplementary Information (SI) for Environmental Science: Processes & Impacts.

Table S1: Overview of legacy waste remediation technologies and their implications for plastic and microplastic management

Technology	Function	Recovered Materials	Limitations	Microplastic Risk	References
Biomining (Mechanical Segregation)	Excavation + Trommel screening of legacy waste	Metals, RDF, recyclables, soil-like fines	High heterogeneity; difficulty in separating multilayer and light plastics	MPs remain embedded in <16 mm fines; lack of MP detection protocols	CPCB, 2020; Kumar et al., 2022
Refuse-Derived Fuel (RDF) Production	Combustible waste sorted and processed into RDF for incineration	High-calorific plastics, textiles, paper	Mixed feedstock lowers efficiency; low-quality RDF may include plastic fragments	Incomplete combustion may release airborne MPs; ash may contain residual MPs	Singh and Mondal, 2020
Co-processing in Cement Kilns	High-temperature thermal treatment of non-recyclables	Energy recovery from plastics	Requires strict feedstock control and emission monitoring	High-temperature destroys MPs; poorly operated kilns can emit nanoplastics	Nanda and Berruti, 2021
Recycling (Mechanical)	Segregated plastics are washed, shredded, and remanufactured	Rigid plastics (HDPE, PP, PET)	Cannot handle MLPs or contaminated film; informal sector dependent	Reduces MP risk if clean input; unregulated operations may release MPs	Joshi and Ahmed, 2016
Compost Use of Soil-like Fines	Fines from trommeling used as landfill cover or road base	Soil-like fines (30–50% of legacy waste mass)	Often contaminated with MPs and heavy metals; lacks quality standards	High risk of MPs in soil and terrestrial ecosystems	Pardeshi and Dhodapkar, 2024; Meena et al., 2023
Landfilling of Residuals	Residual inert or unusable fractions are reburied	Low-value mixed waste, rejects	Re-burial undermines volume reduction goals	Long-term fragmentation of buried plastics into MPs	Annepu, 2012; Kumar et al., 2017

Table S2-State-wise distribution of legacy waste dumpsites and remediation progress under SBM-U 2.0

State/UT	Total Dumpsites Identified	Sites Remediated	Legacy Waste Processed (Lakh)	Notable Comments

State/UT	Total Dumpsites Identified	Sites Remediated	Legacy Waste Processed (Lakh)	Notable Comments
Uttar Pradesh	611	14	21.52	Highest number of identified dumpsites
Madhya Pradesh	328	53	8.73	Moderate remediation progress
Maharashtra	327	52	134.82	Highest volume of waste processed
Tamil Nadu	250	86	34.54	Strong progress across major ULBs
Telangana*	82	2	120.50	Large sites like Jawaharnagar remediated
Delhi	3	—	—	Bio-mining initiated at Ghazipur & Bhalswa
Gujarat	Not specified	12	10.99	Moderate progress
Haryana	Not specified	22	25.27	Moderate progress
Rajasthan	Not specified	8	0.61	Limited treatment coverage
Odisha	Not specified	2	2.03	Minimal progress
Punjab	Not specified	2	1.76	Minimal progress
Andhra Pradesh	Not specified	2	8.52	Targeted regional efforts
Bihar	Not specified	1	0.05	Very limited action
Chhattisgarh	Not specified	7	3.15	Regional progress in select cities
Goa	Not specified	2	0.08	Small scale effort
Jammu & Kashmir	Not specified	1	1.70	Recent remediation efforts
Jharkhand	Not specified	1	0.35	Limited data available
Tripura	Not specified	1	0.20	Early-stage treatment
Total (approx.)	**2,450+**	**268**	**~374.8**	As of 2023 under SBM-U 2.0

Source: Ministry of Housing and Urban Affairs (MoHUA, 2023); Central Pollution Control Board (CPCB, 2022); Swachh Bharat Mission Toolkit (SBM-U 2.0); NITI Aayog & EU-REI (2022).
* Telangana total estimated from multiple sources. † Totals are approximate due to data variation across sources.