

RECOMMENDATIONS TO ADDRESS THE ISSUES OF INFORMAL SECTOR INVOLVED IN E-WASTE HANDLING

Moradabad, Uttar Pradesh



Centre for Science and Environment

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1. Background

Moradabad, in Uttar Pradesh, on the banks of the Ramganga River, has become one of the biggest informal e-waste recycling hubs in India. Popularly known as the Brass City of India, it has also been affected by the global recession and consequent decrease in demand for brass products; manufacturers and handicraft workers are shifting towards the informal, unauthorized e-waste sector. Handicraft workers are now experienced at extracting metals from electronic products—computer monitors, CPUs, remote controls, radio transmitters, old mobile phones and keyboards.

The e-waste in Moradabad comes from all the metro cities, majorly from New Delhi (Shastri Park, Silampur, Mundka and Mandoli), Mumbai, Kolkata, Bangalore and Chennai. E-waste recycling has become a home business in the city, with most members in a family involved in processes right from dismantling to metal recovery.

Dismantling and recycling activities in Moradabad are carried out mostly in basements or rooftops of houses of people engaged in this business. The work involves hammering dismantled gadgets and motherboards to extract copper, silver and gold from the circuits. Workers burn motherboards that contain heavy metals in open piles which release deadly toxic fumes. Circuit boards are cooked over open flames or in shallow pans, exposing workers to lead fumes. Copper is extracted during this process. Gold is extracted from circuit board chips by acid baths, spewing even more toxic gases into the air. These processes are very hazardous to the environment and human health.

A meeting was called at the Cabinet Secretariat under the Chairmanship of the Cabinet Secretary on 29 January 2015 to discuss the issue of unscientific disposal of e-waste in Moradabad. Centre for Science and Environment (CSE) was asked at the meeting to give suggestions on improving the present state of affairs. Post the meeting, two representatives from CSE visited Moradabad from 11 February to 13 February 2015 to assess the situation and explore alternatives

Table 1: Results from analysis of water and soil samples collected at Moradabad

Sample	Cu (ppm)	Ni (ppm)	Zn (ppm)	Cd (ppm)	Pb (ppm)	Cr (ppm)	As (ppb)	Hg (ppb)
Water samples								
Daswa ghat	ND	ND	ND	ND	ND	ND	5.30	ND
Ramganga Vihar Colony	ND	ND	ND	ND	ND	ND	5.03	ND
Ramganga D/S Katghar	ND	ND	0.35	ND	ND	ND	3.25	8.12
Soil samples								
Riverbank side	2485	45	1565	ND	618	20	633	ND
1 km distance from the Ramganga River (small pond-like areas)	24596	800	108322	13	736	136	954	ND

ND - not detected

for people associated with e-waste handling at Moradabad. The team visited the Nawabpura, Karula, Daswaghat, Rehmat Nagar areas, where the majority of the population is engaged in e-waste dismantling and metal extraction. A neighbouring village, Bhojpur, which the team also visited, is also now involved in handling e-waste. The team collected water and soil samples from the banks of the river Ramganga, where acid baths are carried out and printed circuit boards (PBCs) are washed and burned. The samples were tested in CSE laboratory for heavy metals.

The analysis of soil samples collected from the banks of the Ramganga showed very high levels of heavy metals, such as zinc, copper, arsenic, chromium, lead and nickel. The water samples also show the presence of heavy metals such as arsenic and mercury above permissible limits. The test results show that the area is highly contaminated. ■

II. Nature and Extent of Problem

E-waste dismantling and recycling in Moradabad has its roots in the brass works that the city is famous for. The people's knowledge of metal processing made e-waste processing an obvious choice for them. The city is the biggest exporter of brassware in the country, but is hit by recession and the decreasing demand for brass.

Moradabad does not receive the discarded electronics in full. Recyclers in Moradabad buy only PCBs from Delhi, Kolkata, Chennai, Bangalore and other parts of India. The circuit boards are sourced from computer monitors, CPUs, keyboards, television, remote control sets, radios, CD/DVD players, cell phones, compact fluorescent lamps (CFLs) and other electrical appliances. According to an estimate, 50 per cent of the PCBs used in appliances in India end up in Moradabad. Recyclers process them to recover metals, including copper, aluminum, gold and silver. Some of the informal recycling hubs in Moradabad are Warsi Nagar, Nawabpura, Karula, Barwalan, Daswaghat, Rehmat Nagar and Bhojpur Village, adjacent to Moradabad. Workers can easily be seen on the banks of the Ramganga, washing the boards to recover fragment of metals.

A. How do PCBs travel to Moradabad?

The District Administration and Pollution Control Board in Moradabad told the CSE team that there are big transporters in Moradabad who come to Delhi to buy PCBs from areas such as Seelampur, Mandoli, Jafrabad, Badarpur and Mundka. They buy PCBs, load them on their trucks or small tempos and sell them in Moradabad, where families buy them to separate metals. The PCBs are stored in godowns until families buy them. As soon as they reach Moradabad, they are disbursed for fear of police clamp down. Some families travel to Delhi to buy PCBs and load them on small tempos to bring them back to Moradabad. Authorities say that around four to five trucks come every day to Moradabad from Delhi.

B. The Metal Recovery Process Adopted by Informal Recyclers in Moradabad

The PCBs are dismantled in households in Moradabad and neighbouring villages, such as Bhojpur. The activities which the CSE team saw while at Moradabad are the following:

1. Segregation

The PCBs are initially heated on a gas stove or through a blowtorch to loosen the lead soldering. The attached capacitors, ICs, diodes, resistors etc. are then removed with a hammer and segregated. The working parts are sold to traders for reuse. The non-working components are further processed for recovery of materials. Women and children are mostly involved in segregating the various components of PCBs at the household level.

There are families that work on dismantling and segregation of PCBs that traders employ. As per the locals, the women involved are mostly old, divorced or widowed, who do not have any other source of livelihood. They earn better

carrying out e-waste segregation than if they would as domestic workers. Also, families that buy PCBs from transporters employ all their members so that they're able to dismantle and segregate good quantities and earn more.

2. Open burning

After all the remaining components are separated, PCBs are put for open burning so the thin layer of copper foils laminated in the circuit board can be extracted. The ash content is washed out and copper, with some carbon impurity, is collected to be recycled.

The CSE team could not see open burning during their survey. The local police said that they arrest the involved people whenever open burning cases are reported. So, the locals now burn surreptitiously on the outskirts or near the banks of Ramganga River in the wee hours of night.

3. Grinding and washing

The boards with all the relevant components removed and burnt are later grinded in a ball mill. The fine powder/ash generated from the mill is sieved to separate chunks of metals. The left over ash from sieving is washed in the Ramganga River, where the ash flows and small quantities of copper are recovered.

The CSE team saw many units with ball mills where brass work is also carried out. The fine powder was being sieved by people in the units without any masks and the entire area was smoky. The team asked people if they suffered from any respiratory problems, which they denied.

4. Acid bath

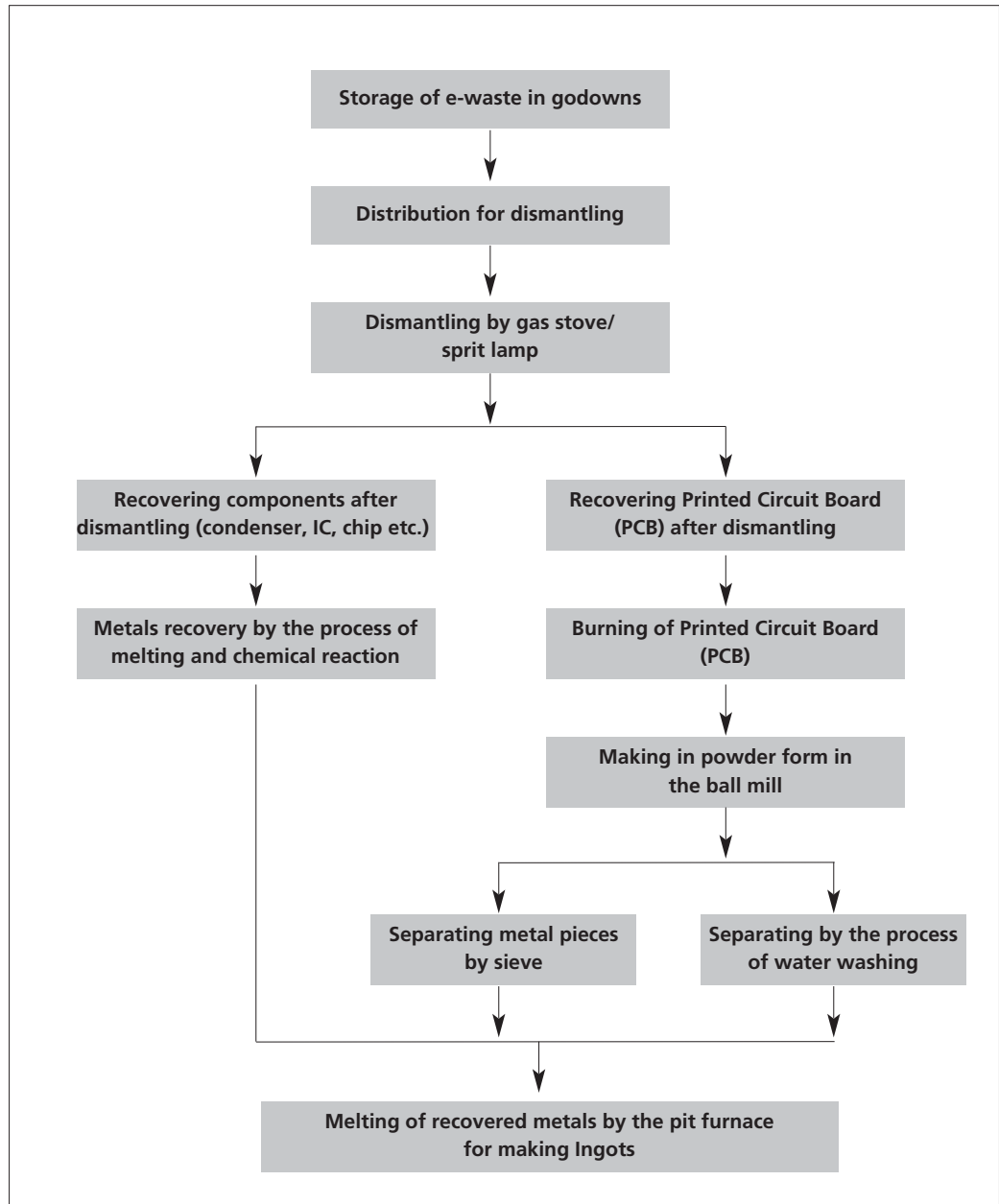
Some areas in Moradabad are famous for the recovery of gold and silver from e-waste, through the cyanide and mercury process. Circuit boards have gold-plated brass pins which are soaked in acid to recover the gold and brass separately. Recyclers who recover the gold and silver sell it to jewelers who give them loans on higher rates of interest and buy the gold and silver at a smaller rate from them.

The CSE team could not see any acid bathing in the surveyed areas. It may not have been carried out openly. However, the team did see a number of acid containers in some of the houses visited.

C. Extent of problem

The authorities in Moradabad did not have a clear idea of how many people were involved in the illegal business of e-waste in their city. The district administration (guess) estimates that around 1 to 1.5 lakh people are involved; however the municipal administration estimates that not more than 20,000 to 25,000 people are engaged in the sector. Locals are of the view that every family is involved directly or indirectly in the business. Some transport, some trade, others dismantle and recycle, while still others buy the recovered metals that are consumed within the city by businessmen and manufacturers of brass as well as aluminium and copper to make ingots.

Without clarity on the number of people involved, it is difficult to ascertain the extent of problem and propose for alternatives.

Flow diagram: E-Waste Processing in Moradabad

III. Economics of e-waste in Moradabad

The workers employed in the e-waste business in Moradabad earn around Rs 150-200 per day for dismantling activities. Women and children get only Rs 70-100 per day for 10 hours of work. According to sources from the Uttar Pradesh Pollution Control Board, almost 80 per cent of the population is involved in dismantling e-waste and segregating it into separate components while only 8-10 per cent is involved in the process of metal recovery.

Around four to five trucks come to Moradabad carrying approximately 9 tonnes of e-waste (PCB waste) per truck. Small tempos run by small and medium businessmen/traders also transport e-waste daily from Delhi. Most of the PCB components per 9 tonnes comprise TV remote/radio (almost 80 per cent), motherboards (8-10 per cent), Mobile boards (4-5 per cent), circuits of CFL lights and keyboards (3-4 per cent).

The buying rate of these components on an average is as follows:

Table 2: Cost of components

Component	Cost/kg
TV remote/radio/monitor board	30-40
Motherboard	300
Mobile board (Cost differs from brands to brands. For instance the Chinese mobile boards fetches less than brands such as Nokia, Samsung etc.)	2,500-3,000
Server card/PBX card	600

Source: As per people engaged in business of e-waste in Moradabad

The recovery rate of different types of metals by the processing of e-waste is as follows:

Table 3: Recovery rate of different metals

Metal	Recovery rate
Platinum	40,000/10gms
Gold	28,000/10gms
Silver	400/10gms
Brass	330/kg
Copper	400/kg
Aluminium	120/kg
Solder	480/kg
Lead	150/kg
Iron	30/kg

Source: Uttar Pradesh Pollution Control Board, Regional Office, Moradabad

Workers associated with metal extraction said they do not get much gold and silver from the PCBs. They mainly extract copper, which is then routed to the brass industry. However, the presence of acids in some houses proved that gold was also being extracted.

Metals that can be recovered from 1,000 kg of PCBs is shown Table 3. However, methods employed to extract metal by the informal sector are rudimentary and lead to a loss of significant quantities of metals. Only about 60-70 per cent of metals are recovered by the methods used by the informal sector and rest goes to waste.

Table 4: Recovered metals per 1,000 kg of PCBs (from the formal sector)

Recovered metal	Weight
Gold	279.93 g
Precious metals (Pt, Pd, In)	93.31 g
Copper	190.512 kg
Aluminium	145.152 kg
Lead and tin (Pb/Sn)	30.844 kg
Silver	450 g

Source: http://academicjournals.org/article/article1380705620_Chatterjee%20and%20Kumar.pdf

IV. Recommendations for Efficient Management of E-waste in Moradabad

The e-waste business in Moradabad grew because of the decline of the brass industry in the city. However, market experts say that brass is regaining its lost position in the international market and imports have increased in the last few years.

There is a strong linkage between the e-waste recycling and the existing brass industry in Moradabad. Metals such as copper, iron and aluminium extracted from PCBs of e-waste are fed into the brass-making units. A lot of the brass work carried out informally in Moradabad is pollution-intensive and employs child labour. It is done mostly in small houses in narrow streets but also in well-furnished large units. In household units, the work is carried out within houses, creating noise beyond the decibel counts permissible for the human ear. Metallic dust, chemical fumes and smoke emanate from various processes and affect the respiratory systems of workers. In larger units, many workers work together in over-congested conditions.

The mushrooming of e-waste business in Moradabad is thus attributed to a combination of the expertise and experience of the people associated with brass work. Considering this, the following are the recommendations that CSE proposes for the efficient management of e-waste in Moradabad:

Inventorization

The number of people and families involved in e-waste dismantling and recycling in Moradabad is not known. The district administration estimates that around 1.5 to 2 lakh people are involved in the business; however, officials from the municipality are confident that there are not more than 15,000 to 20,000 people involved. Locals believe that the numbers run into lakhs. E-waste dismantling and metal extraction is not only restricted to Moradabad but has spread to neighbouring villages such as Bhojpur.

Until an inventorization of people involved in this business is carried out, it is difficult to arrive at alternatives. District and municipal administration should map the number of people involved in different streams of engagement, such as transportation, dismantling, metal extraction and trading.

Allow dismantling but with protective equipment, capacity support

The dismantling and segregation of PCBs can be allowed at the household level in Moradabad but with requisite training, personal protective equipments and with check on potential health hazards. Workers carry out segregation and dismantling with their bare hands and use a blow torch/flame to loosen the soldering of PCBs, inhaling in the process noxious air fumes. Gloves and masks can be provided to workers involved in this operation (mostly women and children).

Formalize the chain of supply

E-waste will continue to find its way illegally to Moradabad unless the entire chain of supply is formalized. The informal sector engaged in e-waste dismantling and metal recovery in Moradabad can be formalized with the

intervention of an external agency such as an NGO or a government authority. The external agency can build capacities on getting formalized, obtaining registration and authorization and using environmentally sound ways of dismantling. Dismantling and segregation are relatively safe processes and can be continued at household levels. However, more people can come together to carry out metal recovery and extraction, which would involve costs. The interventions from SPCBs and the state government would be required for building linkages between them and formal recyclers. Even after a formal chain is set up, chances are that the collected and dismantled products are routed to a third party that gives higher prices rather than the formal recycling agency. To prevent such leakages, an NGO or government authorities must be involved to support the informal sector in every step or for handholding.

The cost for the formalization and setting up of dismantling and recycling agencies can be borne by CSR funds of manufacturers of electrical and electronic appliances.

Set up cooperatives and give them the status of micro or small enterprises to carry out metal extraction or channelize them as formal e-waste recyclers

People involved in e-waste dismantling and metal extraction in Moradabad can be organized in cooperatives recognized by the district administration. There have been successful initiatives to integrate actors in the informal economy, responsible for 95 per cent e-waste recycling in India, into the formal economy. In New Delhi, for example, the NGO Chintan Environmental Research and Action Group is engaged in an initiative to help e-waste workers formalize. Safai Sena, an active organization of 12,000 members that has worked on the collection of recyclables for more than a decade, is a group that Chintan helped organize. Organizing e-waste workers in Moradabad would allow workers to strengthen their trade and remain in business. Also, organized e-waste workers can advocate for the integration and formalization of informal actors in the formal economy and could serve as a good example to government authorities that supporting an organized network of collectors and dismantlers could be socially, economically and environmentally more beneficial than shutting down operations. Some formal recyclers from neighbouring cities and towns (such as Noida, Faridabad and Gurgaon) can also support this by building the capacity of informal sector associations as well as jointly developing norms for trade of material between the two sectors.

Ban and enforce open burning and acid bath

A strict ban on open burning and acid bath of PCBs have to be enforced by authorities in Moradabad. Bans have been imposed in the past but locals involved in the business find a way out by working in the early hours of morning or very late in the night. The Uttar Pradesh Pollution Control Board together with the police can carry out stringent monitoring and take punitive action against the people engaged in these activities. Heavy fines and imprisonment will deter people from engaging in open burning and acid bath.

Project Moradabad as an e-waste dismantling/recycling and brass works hub

Moradabad can serve as a hub for formal e-waste dismantling and recycling of Uttar Pradesh. The cooperatives in Moradabad can cater to the incoming e-waste from Uttar Pradesh, NCR, New Delhi etc. During a conversation with SPCB officials, the CSE team found out that an area for SEZ is demarcated in Moradabad; however, not many industries have come up there. That area can be utilized for e-waste management activities.

There are more than 2,000 registered brass units in operation in Moradabad. In the absence of any legal binding, there is a no-control situation that has bred hazardous working conditions as well as rampant child labour in the industry. The SPCB has suggested shifting the fuel in brass industries to CNG to reduce the emissions from the coal-fired furnaces that operate in every household in the middle of the city.

The declaration of an industrial area for brass works, with a safe working environment, needs to be ensured by the government. Authorities should give Moradabad recognition for its brass works and revive the market so that people can shift back from illegal e-waste handling.

V. Snapshots of e-waste dismantling and recycling in Moradabad and Bhojpur



A worker using blow torch/flame to loosen the soldering of a PCB, Bhojpur



A worker using blow torch/flame to loosen the soldering of a PCB, Bhojpur



Children segregating components from PCBs, Bhojpur



Streets littered with PCB waste, Bhojpur



Containers with acid kept in a household for metal recovery, Nawabpura, Moradabad



Ball mill in operation at Nawabpura, Moradabad. The area was very smoky, hence the picture quality



Workers washing the ash to recover fragments of metals on the banks of the Ramganga, Moradabad

