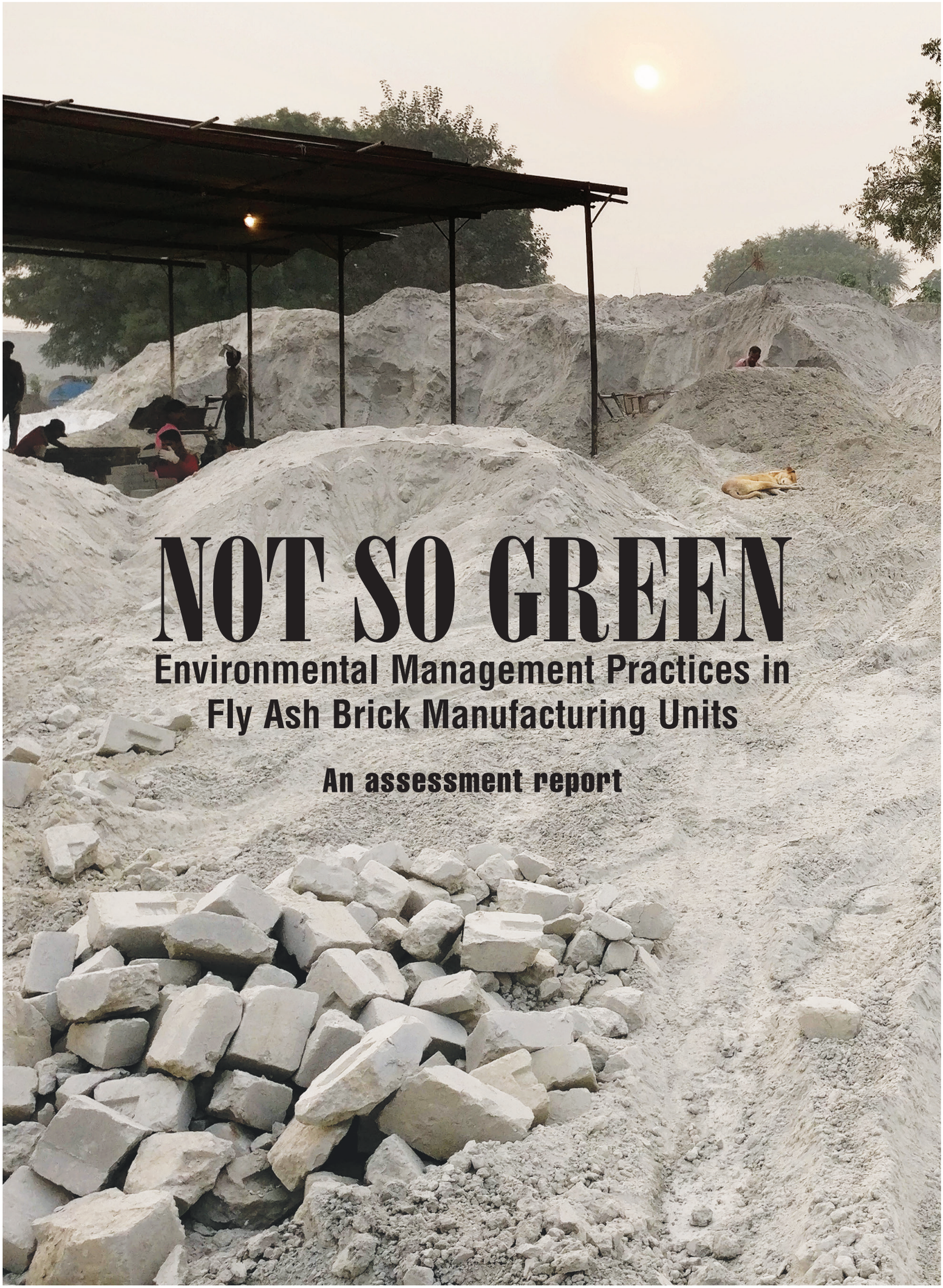

NOT SO GREEN

Environmental Management Practices in Fly Ash Brick Manufacturing Units

An assessment report

NOT SO GREEN

Environmental Management Practices in Fly Ash Brick Manufacturing Units

An assessment report

Centre for Science and Environment

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Introduction

With a rise in population and increase in constructional activities, the demand for building bricks is increasing daily. Fly ash lime building bricks are not only a substitute to clay-burnt building bricks, they are also considered a superior option.

There has been a rise in the use of fly ash bricks over a past few decades, mostly due to government promotion. The Ministry of Environment and Forests issued a notification on 14 September 1999,[1] which mandated mixing of 25 per cent fly ash in bricks prepared within a radius of 100 km from thermal power plants. Additionally, it has also made use of only fly ash-based products mandatory in any construction activity within a 100-km radius of thermal power plants.

Subsequently, in 2016 an amendment[2] in the above notification had increased the radius of the area from thermal power plants—from 100 km to 300 km, thus advancing for greater utilization of fly ash bricks. This led to the mushrooming of small scale fly ash brick manufacturing units all over India. While this transition from pollution-causing red clay bricks to more environmental-friendly fly ash bricks is laudable, there are still certain deficiencies that need to be addressed in this sector before it can be truly called 'green'.

The fly ash brick manufacturing sector in India has been classified as a 'white industry' by the Central Pollution Control Board (CPCB) as it is a non-polluting and waste-utilizing sector. It has been noticed that since fly ash brick manufacturing industry falls in the white category, the government has

Figure 1: A typical fly ash brick manufacturing unit

been very lenient towards it, thus not addressing the issue of environmental concerns arising from improper storage and handling of raw materials by this sector. This laxity allows inappropriate practices that contribute to air pollution. It is pertinent to mention here that this industry was earlier classified in the green category, and thus had to proceed with regulatory procedures by obtaining consent from State Pollution Control Board (SPCB). However, now that it's in the white category only intimation to SPCB is required, which is also not followed by the manufacturers. Currently, the fly ash brick manufacturing sector in India remains unorganized with a lack of clear guidelines.

Fly ash, which is a very important raw material for thesetypes of bricks, is mostly transported in hyva dumpers that are often just partially covered with tarpaulin. This partial covering fails to prevent the fly ash from being dispersed by the wind, causing air pollution. More importantly, fly ash, once transported to the site, is mostly stored in the open, which not only causes fugitive emissions but can also pose health hazards to the workers and visibility issues near the sites.

To understand the issues and concerns from these units deeply, the Centre for Science and Environment (CSE) has conducted a survey in the Delhi-NCR region by visiting various fly ash manufacturing units and assessed the practices being followed. Since NCR is considered the hub of construction, there has always been a huge demand for the construction material. This results in mushrooming of large number of small-scale units in the region and therefore makes it ideal for conducting the study.

Survey area

The CSE survey was performed in Delhi-NCR which covered four states—Uttar Pradesh, Haryana, Rajasthan and Delhi. A total of 46 units were surveyed in areas and districts of Haryana (Jhajjar, Sonipat, Panipat and Gurugram), Uttar Pradesh (Noida, Greater Noida, Dadri, Ghaziabad and Meerut), Delhi (Nangli Sakrawati) and Rajasthan (Bhiwadi) (see *Table 1: Details of units surveyed*).

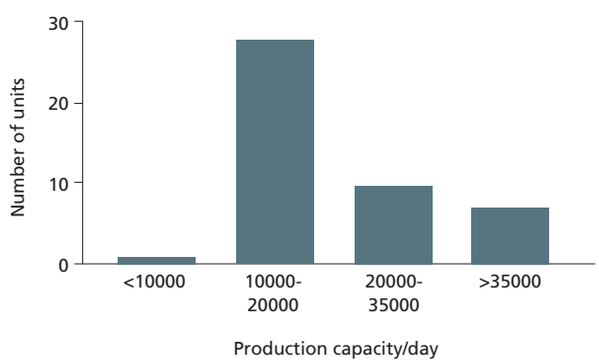
Table 1: Details of units surveyed

S. no	Name of the unit	Area	Production capacity/day
Haryana			
1	Khanak Fly Ash Bricks	Gurugram	20,000
2	Laxmi Chand	Gurugram	20,000
3	Balaji Enterprise	Gurugram	15,000
4	SR Bricks	Gurugram	30,000
5	Centre for Innovative Building Material	Gurugram	80,000
6	Shree Bricks	Panipat	15,000
7	Anttil Bricks	Sonipat	40,000
8	Om Construction	Sonipat	25,000
9	MK Trading	Sonipat	60,000
10	Raj Singh Brick Company	Jhajjar	12,000
11	Shree Balaji Bricks	Jhajjar	32,000
12	Meher Bricks	Jhajjar	10,000
13	JP Tading	Jhajjar	10,000
14	Shristi Fly Ash Bricks	Jhajjar	30,000
Uttar Pradesh			
15	Amit Ashtech	Dadri	15,000
16	Chaman Bricks	Dadri	10,000
17	Mayur Bricks	Dadri	12,000
18	Ashtech	Dadri	12,000,000
19	Stonex Infrastructure	Dadri	15,000
20	A G Bricolage	Greater Noida	15,000
21	Antriksh Enterprises	Greater Noida	13,000
22	Deep Kamal Fly Ash	Greater Noida	15,000
23	D P Fly Ash Bricks	Greater Noida	45,000
24	TSD Enterprise	Meerut	50,000
25	Rajeev Brick Field	Meerut	35,000
26	Ethernal Engineers	Meerut	15,000

S. no	Name of the unit	Area	Production capacity/day
27	Vishwakarma Enterprises	Meerut	15,000
28	R S Enterprise	Ghaziabad	10,000
29	New Company (name not known)	Ghaziabad	15,000
30	Power Bricks Corporation	Ghaziabad	20,000
31	Grey Brick Field	Ghaziabad	15,000
32	Strugligence Bricks	Noida	35,000
Delhi			
33	R K Enterprise	Nangli Sakrawati	15,000
34	Daksh Enterprise	Nangli Sakrawati	25,000
35	Konafsha Bricks	Nangli Sakrawati	10,000
36	Somi Bricks	Nangli Sakrawati	20,000
37	Harish Enterprises	Nangli Sakrawati	15,000
38	V K Enterprise	Nangli Sakrawati	15,000
39	Mann Bricks	Nangli Sakrawati	15,000
40	M B Bricks	Nangli Sakrawati	12,000
41	Surajbhan Bricks	Nangli Sakrawati	12,000
Rajasthan			
42	Mohini Bricks	Bhiwadi	10,000
43	Rohan Traders	Bhiwadi	10,000
44	M K Earthmovers	Bhiwadi	10,000
45	Haridev Traders	Bhiwadi	4,000
46	Eco Bricks	Bhiwadi	15,000

From the survey, it was found that the fly ash sector is dominated by small-scale units having a production capacity between 10,000–20,000 bricks per day. Both medium- and large-scale units—having a production capacity between 20,000–35,000 and greater than 35,000, respectively—have almost equal presence but far less than small-scale units (see *Graph 1:* Scale of operation of the surveyed units).

Graph 1: Scale of operation of the surveyed units



Source: CSE

Assesment and observations

CSE perfomed the survey in Delhi-NCR and covered four states. A total of 46 units were studied and assessed on the following parameters:

- Facility for fly ash storage
- Facility for lime storage
- Boundary wall around the unit
- Road for vehicular movement
- Provision of water sprinkling
- Use of Personal Protective Equipment (PPE)
- Proximity to human settlement
- Housekeeping
- Transportation of fly ash
- Provision of tyre washing system

Facility for fly ash storage

Fly ash, being very light and fine gets easily dispersed in the air and causes air pollution, respiratory problems and decreased visibility in the vicinity. The dry fly ash from electrostatic precipitator (ESP) needs to be stored in silos through an adequate pneumatic system. Bottom ash and pond ash being a little moist in nature is difficult to store in silos and therefore needs to be stored under closed sheds to avoid any fugitive emissions.

During the survey, it was found that 99.8 per cent of the units were following the practice of open fly ash storage. Although, these units use bottom/pond ash for brick making but it does not give them the liberty to store ash in open under the pretence of wet component. This moisture gets evaporated in a day or two leaving bottom ash dry and fugitive in nature. Most of the entrepreneurs defended not having proper storage facility because the fly ash gets consumed the same day; however, during the survey it was observed that manufacturers have more than sufficient stock of fly ash that can be used for a few days. Lack of covered storage or even basic coverage is the main issue observed during the survey. This practice of open storage is followed in all types of plants irrespective of their production capacity. Even the fully automatic plants have no provision to store the fly ash in a closed and a contained environment (see *Figure 2: Fly ash storage facility at various units*).

In Delhi, Nangli Sakrawati and Najafgarh areas are called the hub of small scale fly ash units. There are various clusters of such industries and the practice of storing and handling fly ash at these clusters is very poor. Huge amounts of fugitive and dust emissions were observed due to the current practices, and the same also contributes in degrading the air quality of the surrounding area. Apart from Delhi, the other three states also follow the same suit.

Figure 2: Fly ash storage facility at various units

Huge stock of open fly ash at a unit in Greater Noida

Ultra fine dry fly ash stored in open at a unit in Jhajjar

Open fly ash storage at Najafgarh

Half-hearted efforts to cover flyash at a unit in Nangli Sakrawati

A facility to store raw material under a covered shed at a unit in Ghaziabad

A make-shift storage facility in Delhi

THE CORRECT WAY

At the time of the survey, CSE could not find a single unit with proper storage facility in Delhi-NCR; however, two such units were identified outside Delhi, namely Gian Nirman Pvt Ltd at Karnal, Haryana and Paras Construction at Fatehgarh Sahib, Punjab. Both the units use ESP ash for making bricks. Instead of silos, these units have complete closed facility for storage of ESP ash and an inlet is provided at front wall which gets connected to the bulkers and ash is transferred through pneumatic pressure in the storage faciltiy

Details of M/s Paras Construction:
The unit is located at viilage Saidpura, Tehsil & district Fategarh sahib, Punjab. The total area of the unit is approximately 2 acres and have a production capacity of 10,000-20,000 bricks per day. The bricks are produced in rotary hydraulic machine by mixing fly ash, lime, POP, sand and cement. The unit uses ESP ash for brick making which is sourced from Nabha Power Limited at Rajpura.

A well defined, covered facility with a capacity of 500 tons is dedicated on site for storage of ESP ash. The storage facility has a front wall of 30 feet width and 24 feet height, back wall with same width but a height of 20 feet, resulting in slanting rooftop. The sidewalls are 50 feet wide and 24 feet high towards front and 20 feet high at the back. The area is covered with a shed at the top. A gate is provided on the side wall to withdraw fly ash for manufacturing process. This facility reduces the fugitive emissions from fly ash to a great extent.

A separate covered area is designed for storage of lime and gypsum; bags of both are stacked properly in the room. Separate lime ponds are also provided for hydration of lime before usage. Roads within the premises are paved with slag which reduces dust emissions due to vehicular movement.

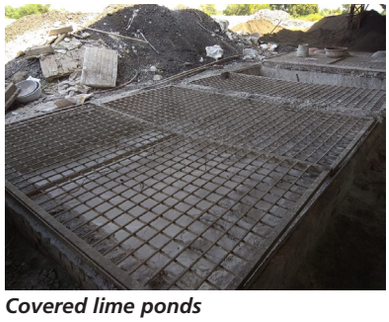
Inlet pipe at the front wall to connect to the bulkers

Side wall of the fly ash storage facility with a gate.

Second sidewall of the facility

Inside of flyash storage facility

Stacked bags of lime and gypsum in covered room



Covered lime ponds

Facility for lime Storage

The lime used in brick making is either quicklime (supplied in bags) or sludge lime (supplied in trolleys). Quicklime is unstable and reacts, often very rapidly, with water to form calcium hydroxide. When exposed to the atmosphere, this calcium hydroxide can react again by absorbing carbon dioxide from the atmosphere to form calcium carbonate. This lime then does not react completely with fly ash, thereby, resulting in a poor quality of bricks. Therefore, the lime should be hydrated only before use and be kept otherwise in closed area. Sludge lime is supplied in a wet condition and should be used immediately as the lime content—compared to quicklime—is less and would further reduce if left in the open.

During the survey, it was observed that 99 per cent of the units follow the practice of storing lime bags in the open. Torn bags of lime due to hydration were observed at the surveyed sites (see *Figure 3: Lime storage practices at different units*). The remaining manufacturers—1 per cent of the total—have constructed separate pits for lime in which the required quantity (of lime) is added for hydration. The remaining lime bags are stored under a shed.

Figure 3: Lime storage practices at different units

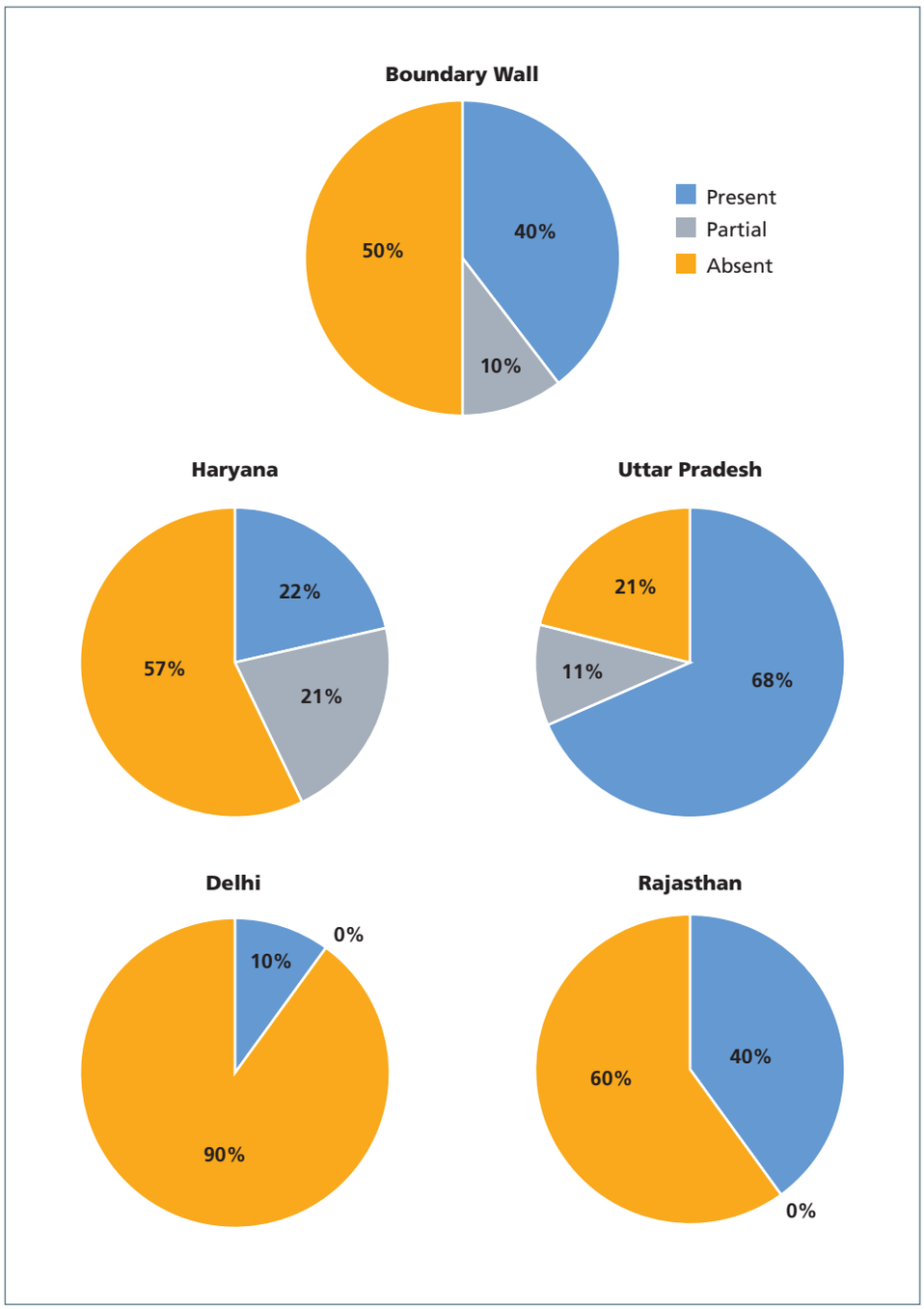
Pit designed for lime hydration in a unit at Gurugram

Torn lime bags due to hydration at a cluster in Nangli Sakrawati, Delhi

Boundary wall around the unit

All fly ash units should have a boundary wall of an adequate height around its periphery to limit dust emissions within the premises. Trees should also be planted along the boundary wall to act as a natural barrier for dust emissions. However, during the survey, it was observed that 50 per cent of the units did not have the boundary wall for their units. These units can be easily located as fly ash mounds and littered adjacent roads can be seen from a distance (see Figure 4: Fly ash exposed due to the absence of boundary wall). While only 40 per cent of the units have a proper boundary wall with an entrance gate, there are approximately 10 per cent units which have partial walls—either of inadequate height or not on all sides of the unit. Remaining 50 per cent of the units do not have boundary walls on their site. Uttar Pradesh has a good percentage of units having adequate boundary walls; whereas, Delhi falls last in this practice. (See *Graph 2: Overall and state-wise boundary conditions in* Delhi-NCR).

Graph 2: Overall and state-wise boundary conditions in Delhi-NCR



Source: CSE

Figure 4: Fly ash exposed due to the absence of boundary wall

Inadequate height of a boundary wall at a unit in Gurugram

Fly ash littered on road due to the absence of boundary wall at plant in Gurugram

Road Infrastructure for vehicular movement

According to CPCB's Guidelines,[3] roads in the premises of a power plant and a fly ash user agency shall be paved along with an adequate width of tree plantation on both sides. Of all units surveyed, only Ashtech in Dadri had suitable road pavings and tree plantations. All other units had no road infrastructure and the vehicular movement was causing high degree of dust emissions within the premises (see *Figure 5: Road infrastructure at fly ash units*).

Figure 5: Road infrastructure at fly ash units

Paved road and tree plantation on both sides of the road at Ashtech, Dadri

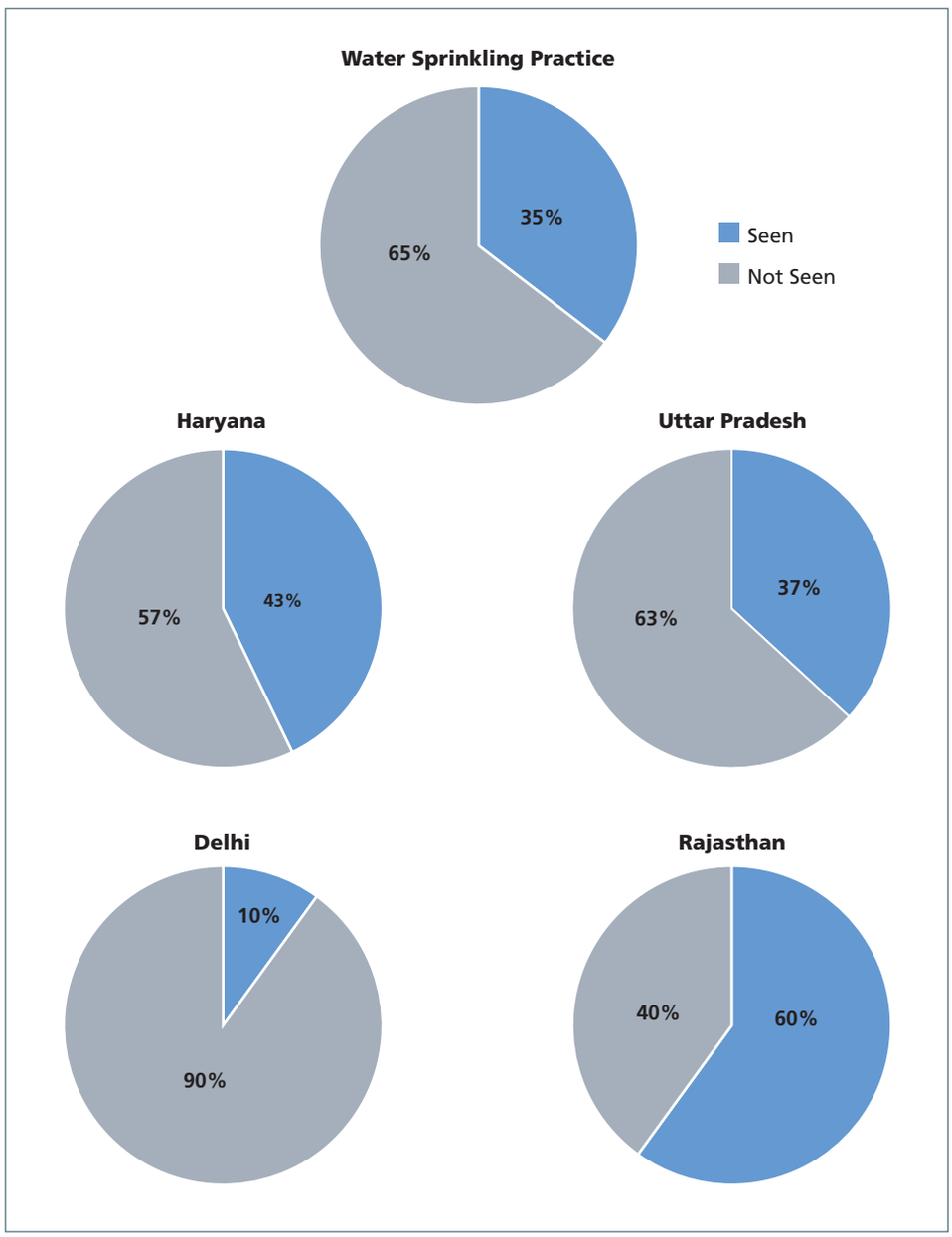
Unpaved passage for trucks to the storage area at a plant in Jhajjar

Provision of water sprinkling

Boundary wall and tree plantation are required to prevent dust emissions dispersing outside the premises. However, to suppress such emissions within the premises, water sprinkling is mandatory. The sprinkling should be performed at regular intervals on fly ash mounds, roads and other areas that may cause emissions.

Of the units surveyed, only 35 per cent were found following this practice (see *Figure 6: Water sprinkling practice in fly ash units*). In this aspect, Rajasthan has the maximum percentage of such unit folllowed by Haryana while Delhi again falls last (see *Graph 3: Status of water sprinkling practice in Delhi-NCR*).

Graph 3: Status of water sprinkling practice in Delhi-NCR



Source: CSE

Figure 6: Water sprinkling practice in fly ash units

A unit at Dadri

Unit at Nangli Sakrawati

Use of Personal Protective Equipment (PPE)

Though fly ash has been shifted to a non-hazardous category, it may still cause respiratory issues, if inhaled for a longer duration. The other raw material used in this industry may also cause health problems if exposed to for a longer duration without appropriate PPEs. Therefore, it is always recommended to use hand gloves, gum boots and nose masks while working in this industry. During the survey, it was observed that workers do not use nose masks at any of the units, the use of gum boots was found at a few units; however, usage of gloves was relatively higher (see *Figure 7: Provision of PPEs at fly ash brick manufacturing units*).

Figure 7: Provision of PPE's at fly ash brick manufacturing units

Workers without any personal protective equipment at a unit in Najafgarh

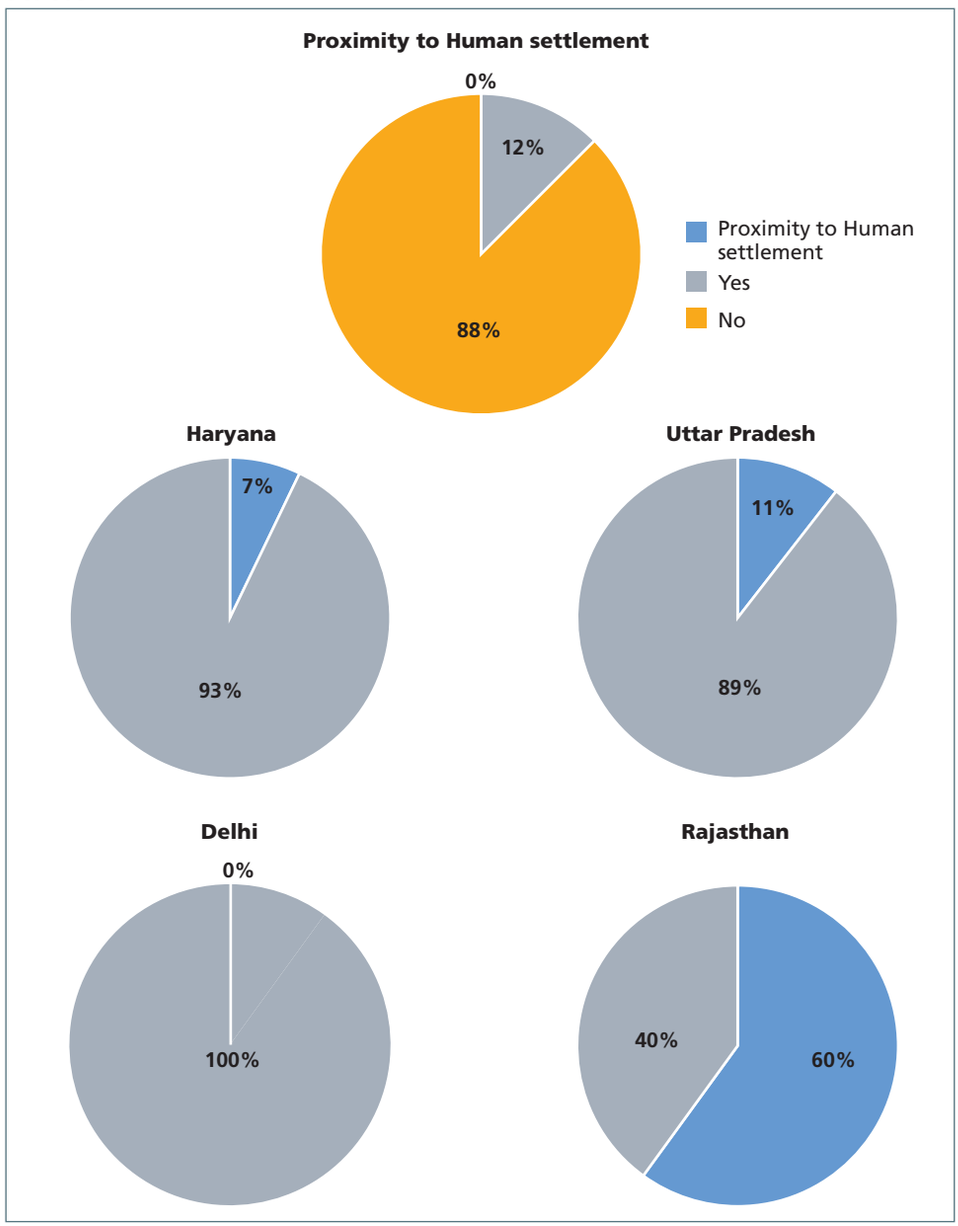
A worker with a pair of gum boots at TSD Enterprises, Meerut

Workers using gloves at Deep Kamal Fly Ash, Greater Noida

Proximity to human settlement

Although, the fly ash industry has been categorized under the white category, it is still not recommended to set up such unit amidst human settlements due to its dust and fugitive emissions causing activities. Of the 46 units surveyed, it was good to observe that only five units were built near residential areas. All other units were either situated in agricultural areas or industrial areas (see *Figure 8: Proximity of units to human settlements*). In this aspect, Delhi tops the list as none of the units are situated next to human settlement; followed by Haryana, whereas, Rajasthan has the maximum percentage of such units (see *Graph 4: Proximity of fly ash units to human settlements in different states*) However, it is important to mention here that the route followed by trucks/ trolleys carrying raw material for almost all the units passes through human settlements.

Graph 4: Proximity of fly ash units to human settlement in different states



Source: CSE

Figure 8: Proximity of units to human settlements

A fly ash unit next to a residential area in Dadri

Another fly ash unit near a residential area in Bhiwadi

Housekeeping

Housekeeping includes proper storage of raw material at a designated area, regular water sprinkling, cleaning of roads etc. However, it was observed that most units do not pay attention to this factor; therefore, resulting in a soiled working area (see *Figure 9: Soiled working area at fly ash units*).

Figure 9: Soiled working area at fly ash units

Poor housekeeping at units in a cluster at Nangli Sakrawati

Fly ash littering within the premises of a unit at Dadri

Dust emissions at a unit in Greater Noida

Transportation of fly ash

As stated in the CPCB guidelines, both dry and wet fly ash should be transported either in tankers/bulkers or mechanically-designed covered trucks. 'Tractor trolleys with a box-type covering on the top and hydraulic unloading system need to be deployed for transportation of fly ash while traversing through habilitated areas. Tractor trolleys suitably covered with good quality tarpaulin (made of HDPE) could be allowed to transport fly ash for distances upto 10 km.' Although, during the survey CSE could not witness the transportation of fly ash at every unit, it was found that all units using bottom ash receive the material in hyva dumpers covered with tarpaulin. (See *Figure 10: transportation of fly ash*)

Figure 10: Transportation of fly ash

Fugitive emissions from Bulker carrying fly ash

Hyva's covered with tarpaulin used to transport bottom/pond ash.

Unloading of fly ash at a unit in Ghaziabad

Provision for tyre washing

Thermal power plants and fly ash user agencies should make arrangements for tyre washing of the vehicles (bulkers/trucks) that transport raw material and product, before they leave the premises (according to CPCB guidelines). None of the units, except one, had the facility for tyre washing. Power Bricks Corporation in Ghaziabad was found to be practicing tyre washing, but failed to complete the process successfully because the washed vehicles had to pass through a passage that was littered with fly ash—resulting in futile efforts.

Environmental management

Fly ash brick manufacturing industry is one of the growing industries in the upcoming years and has the potential to grow to the limits that it can utilize all the fly ash that is being produced by thermal power plants in India. But these units, although under white category industry since 2016, still have a tremendous potential for fugitive and dust generation from storage and handling of fly ash, bottom ash and gypsum. These plants handle tonnes of fine and dry material every day, despite the fact that there have hardly been any attempts at improving material handling and management. The main reason for this is the cost factor coupled with an absence of regulatory intervention.

During the survey, it was found that the storage and handling practices for fly ash was compromised in all units irrespective of their scale of production. The fly ash was seen scattered all over the place and dispersed in air contributing to air pollution. An absence of a boundary wall around the units makes the situation worse by spreading fly ash all along the roads. The trucks/trolleys carrying raw material and final products do not follow tyre washing protocol and thus carry fly ash to longer distances. In addition to this, inadequate housekeeping and non-use of PPEs make the workers vulnerable to health-related risks.

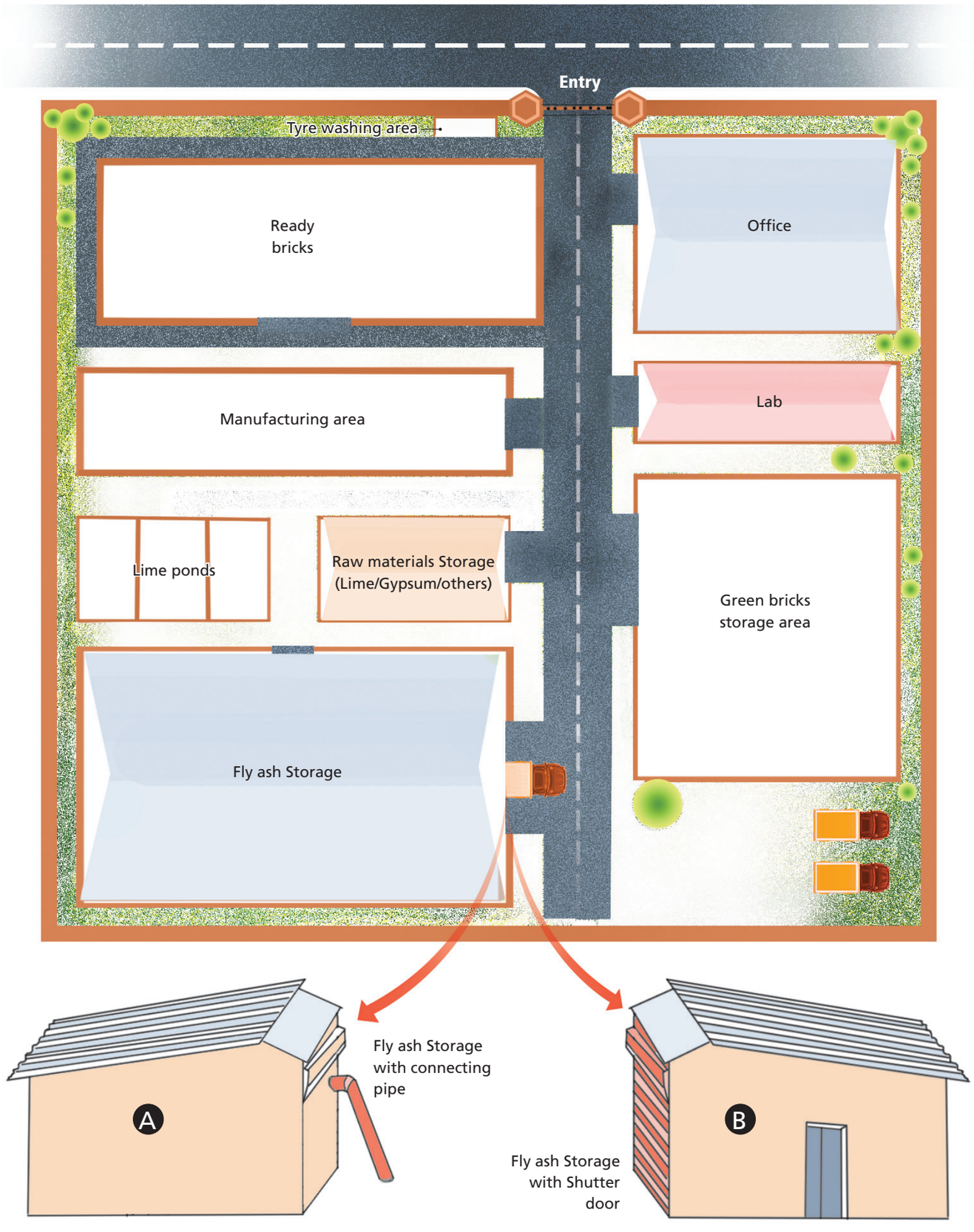
These parameters are openly challenged since there are no guidelines or norms for the fly ash industry. The government has been lenient to this sector but their negligence on the issue may become a major environmental concern in the future. In view of this, CSE has come up with some minimum requirements that should be made mandatory in order to make this sector essentially sustainable and environment-friendly. In addition to this, regulatory and policy intervention is also required to strengthen this industry.

Minimum requirements

Figure 11 shows the desired layout of the unit showcasing the minimum requirements mention below and the approximate area breakup of the plant with these facilities is provided in Table 2.

- The units shall have closed facility for storage of fly ash, bottom ash and pond ash. The facility shall be covered with walls on three sides and a shed on the roof top. In case of fly ash, the fourth side (front side) shall also be covered with a wall and an inlet pipe shall be provided at this wall to connect to the bulkers (see part A of Figure 11).
- For storage of bottom/pond ash a "shutter type facility" shall be provided on the front side instead of wall (see part B of Figure 11). The height of the storage area shall be such that it allows hyvas/dumpers to lift up fully for dumping of ash.
- In both the case, a small gate shall be provided on the side wall of facility to withdraw ash for manufacturing (see part B of Figure 11).
- Storage of other raw materials (lime/gypsum/cement/sand) shall also be done under covered areas.
- Lime ponds shall be provided for hydration of lime before use, the remaining lime shall be stored in closed storage area.
- The unit shall have boundary wall of an adequate height all along its periphery with a layer of tree plantation along the boundary wall to restrict any fugitive/dust emissions within the premises.
- The roads for vehicular movement within the premises shall be paved and cleaned regularly.

Figure 11: Desired layout of fly ash units



- Water sprinkling shall be performed regularly within the premises to suppress dust emissions.
- Provision for tyre washing of vehicles shall be provided at the exit gate of units to avoid fly ash scattering along the roads.

Table 2: Area breakup of a fly ash unit plant

S. No	Description	Area (sqm)
1.	Bricks storage area (green bricks and ready bricks)	2000
2.	Manufacturing area	1000
3.	Office area + labour quarters	500
4.	Fly ash storage area (500 tonnes capacity)	250
5.	Lime ponds	100
6.	Other raw material storage area	150
7.	Lab	20
8.	Open area (for vehicular and pellet movement)	600
	Total	**4,620 ~ 4700 sqm (1.16 acre)**

**for production capacity of 10,000-15,000 bricks/day*

The cost involved in fulfilling the minimum requirements can be termed as Environmental management cost. The approximate breakup of the environmental management cost is given in Table 3. This costs shall be included while calculating the total project cost.

Table 3: Area breakup of a fly ash unit plant

S. No	Description	Cost involved (INR)
1	Fly ash storage area	6 lacs (for 500 tonne storage capacity)
2	Storage area for other raw material	2 lacs
3	Lime ponds	1 lacs
4	Lab	3 lacs
	Total	**12 lacs**

Regulatory intervention

In order to implement the said requirements, regulatory intervention is essential. According to the revised criteria of CPCB for categorization of industries,[4] the fly ash brick industry has been categorized as a white industry. However, since the industry causes generation of fugitive emissions of particulate matter, it shall be *re-categorized in the green category*. The minimum requirements mentioned above shall be considered as consent conditions under The Air (Prevention and Control of Pollution) Act, 1981.

Besides the above norms, site selection should also be one of the criterions while granting CTE. The industry shall be granted a 'Consent to Operate (CTO)' only if they comply with the consent conditions. Central Pollution Control Board (CPCB) may develop comprehensive guidelines on environment management in fly ash brick manufacturing units along with capacity building of manufacturers, officials of SPCB and district authorities responsible for licensing process.

Policy intervention

Legislative whip alone cannot solve the problems. In order to ensure the compliance, economic viability is also equally important. Economic viability can be achieved if the scale of operation is enhanced so that the annual turnover can substantiate the annual cost of pollution control norms. Once such scale of operation with respect to the number of bricks per day is fixed, subsequently small-scale units shall be asked to enhance their scale of production. The government may help to ease the soft bank loan and other facilities. Moreover, only consented industries shall be allowed to procure fly ash from power stations or traders.

Without an appropriate policy intervention, the regulatory system cannot function properly. As observed, initiating a regulatory action might lead to closure of such units which is not desirable as it is a resource-utilization and waste-recycling industry.

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Since the fly ash brick manufacturing sector in India has been classified as a 'white industry', the government has been very lenient towards it by not addressing the issue of environmental concerns arising from improper storage and handling of raw materials by the fly ash sector.

CSE has conducted a survey in Delhi-NCR by visiting various fly ash manufacturing units and assessed the practices being followed.

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