EMISSIONS MONITORING OF BRICK KILNS

ZIGZAG vs FCBTK

Research direction: Nivit Kumar Yadav

Writer: Parth Kumar and Soujanya Shrivastava

Research support: Ishita Garg and Hetal Modi

Editor: Souparno Banerjee

Cover design: Ajit Bajaj

Cover photo: Parth Kumar

Production: Rakesh Shrivastava and Gundhar Das

We are grateful to Shakti Sustainable Energy Foundation for their support. Shakti Foundation works to strengthen the energy security of India by aiding the design and implementation of policies that support energy efficiency and renewable energy. The views expressed and analyses represented in this document do not necessarily represent those of Shakti. The company accepts no liability for the content of this document, or for the consequences of any actions taken on the basis of the information provided.

Citation: Nivit Kumar Yadav, Parth Kumar and Soujanya Shrivastava, 2019, *Stack Monitoring of Brick Kilns: A CSE Report*, Centre for Science and Environment, New Delhi

Published by
Centre for Science and Environment
41, Tughlakabad Institutional Area
New Delhi 110 062
Phones: 91-11-40616000
Fax: 91-11-29955879
E-mail: cse@cseindia.org
Website: www.cseindia.org

Printed at Multi Colour Services, New Delhi

Contents

List of abbreviations

AIBTMF:	All India Brick and Tiles Manufacturing Federation
CPCB:	Central Pollution Control Board
CSE:	Centre for Science and Environment
DM:	District Magistrate
EPCA:	Environment Pollution (Prevention & Control) Authority
FCBTK:	Fixed Chimney Bull's Trench Kiln
HDK:	High Draught Kiln
MoEF&CC:	Ministry of Environment, Forest and Climate Change
PM:	Particulate Matter
PPM:	Parts Per Million
PS CST:	Punjab State Council for Science and Technology
SPCB:	State Pollution Control Board
UPPCB:	Uttar Pradesh Pollution Control Board
US-EPA:	United States Environment Protection Agency
VSBK:	Vertical Shaft Brick Kiln
VSS1:	Vayubodhan Stack Sampler 1

BACKGROUND

In October 2015, the Union Ministry of Environment, Forest and Climate Change (MoEF&CC) introduced a draft notification for the clay brick manufacturing sector. The step was a result of years of diligent monitoring and deliberation by the Central Pollution Control Board (CPCB) and the Punjab State Council for Science and Technology (PSCST). The draft notification was stringent – it proposed to bring down the emission standard for particulate matter (PM) from 750 mg/Nm^3 to 500 mg/Nm^3 for natural draft kilns, and to 250 mg/Nm^3 for induced draft kilns. The existing emission standard varies from 1,000 mg/Nm^3 for smaller brick kilns to 750 mg/Nm^3 for medium and larger kilns.

The draft notification also proposed that all brick kilns (irrespective of size) must improve their manufacturing process by converting to induced draft kilns to comply with the standards within five years.

In December 2015, the CPCB directed all brick kilns in Delhi-NCR to convert from natural draught to induced draught within 90 days. However, the order made no mention of changes required in brick setting. Brick entrepreneurs presumed – erroneously – that they could comply with the order by simply fitting a fan in their kilns, and did not need to introduce any other changes (such as changes in the brick setting, fuel feeding practices, etc).

In August 2016, the MoEF&CC, after incorporating all comments received from different stakeholders, came up with a modified draft notification which proposed to fix the emission standards for PM at 250 mg/Nm^3 for all kilns. It also stated that the existing kilns should comply with these new standards for PM and convert to zigzag within three years. In the intervening period, the existing brick kilns (except the down draught kilns) would be allowed to comply with the PM standard of 500 mg/Nm^3.

In the same year, another order came from the CPCB: in November 2016, it directed the state pollution control boards (SPCBs) of Uttar Pradesh, Rajasthan and Haryana to shut down those brick kilns which had not converted from natural to induced draught (with rectangular kiln shape and zigzag brick setting) by March 31, 2017. Brick entrepreneurs in the region were confused by the two orders, and intrigued by the multiple terminologies (induced draught, high draught etc).

Following a request from the All India Brick and Tile Manufacturers Federation (AIBTMF), the Environment Pollution (Prevention and Control) Authority (EPCA) stepped in to clear the air. After a series of discussions with all stakeholders, in May 2017, the EPCA ordered all kilns in Delhi-NCR to shift to rectangular zigzag, with entrepreneurs having the option to choose between natural or induced draught. The deadline and schedule of September 30, 2017 as given by different SPCBs remained.

Meanwhile, in June 2017, the CPCB had issued another directive which asked brick kilns across India to convert to zigzag setting with rectangular kiln shape. This directive clearly stated that brick kilns operating without permission and consent from respective SPCBs would be shut down. It also recommended brick paving of the area around brick kilns to prevent fugitive dust emissions. No deadlines were, however, offered.

In October the same year, the EPCA directed that brick kilns which had not converted to zigzag kilns by September 30, 2017, should not be allowed to operate in the winter season (till March 15, 2018). Following an interjection from the AIBTMF, the EPCA agreed to discuss the matter based on the progress reports received from the three SPCBs of Uttar Pradesh, Rajasthan and Haryana on conversion of fixed chimney bulls trench kilns (FCBTKs) to zigzag kilns.

The Association also requested the EPCA to allow brickmakers to operate their FCBTKs for one last season, which would also allow them some time for conversion; the brickmakers offered to provide an undertaking that they will not operate during winter – from October 2017 to February 2018 – and will convert their kilns before they start operations in the next season in 2018. The EPCA allowed brick-kiln owners who had submitted affidavits that said they would convert after July 1, 2018, to operate for one last season from March 1, 2018 to June 30, 2018. The EPCA order clearly mentions that from July 1, 2018, only zigzag kilns will be allowed to operate. The Authority further added that the kilns which had already converted to zigzag, needed to be verified by the SPCBs.

The most recent draft notification by the MoEF&CC came on March 16, 2018. This draft notification followed the 2016 notification by leaving the PM emission standard at 250 mg/Nm^3; but it allowed one year for conversion to zigzag in the case of kilns located near non-attainment cities, and two years for other kilns. It also said that in cases where various pollution regulatory bodies (such as the CPCB or SPCBs) have separately laid down timelines for conversion, such orders shall prevail.

At this stage, brick kiln entrepreneurs who were using agricultural waste in FCBTKs as fuel claimed that PM emissions from their kilns were lower – in some cases, even lower than the emissions from brick kilns which were using the cleaner zigzag technology! Some brick kiln entrepreneurs also shared the stack monitoring reports from monitoring surveys conducted by the CPCB during winter in Sriganganagar, Rajasthan and Greater Noida, UP, according to which emissions from zigzag kilns were shown to be higher than that from FCBTKs using agricultural waste. Post the sharing of this report by brick kiln entrepreneurs, we came across a request letter written by CPCB to MoEF&CC advocating to allow FCBTK with agricultural waste to operate. This request letter seems to have a lot of flaws on various grounds which CSE has tried to address through a point-wise analysis in the table shown in the annexure of this report.

From October 2015 to March 2018, as is evident from this backgrounder, regulatory intervention in the clay brick manufacturing sector has not proceeded as desired. As an organisation working in the public interest, therefore, Centre for Science and Environment (CSE) decided to conduct independent stack monitoring of brick kilns across northern India. Fortunately, some brick kiln entrepreneurs allowed CSE's team to conduct the monitoring exercises. This report is based on CSE's stack monitoring of brick kilns.

METHODOLOGY

The selection of the kilns to be monitored was done carefully, to ensure coverage of different locations and their various practices in different areas across the Indo-Gangetic plains. A primary criterion for selection of kilns was the technology being used (FCBTK / zigzag-natural draught / zigzag-high draught etc) and the type of fuel being used in them. Based on all this, nine kilns were shortlisted and monitored (*see Table 1: Kilns visited for air pollution monitoring*).

Parameters measured

The aim of the monitoring exercise was to get credible readings of essential parameters which are key to understand the emissions from brick kilns. Although a number of parameters were looked into during the process of monitoring, some were measured to use them for calculating the following final parameters:

1. Percentage of oxygen
2. Percentage of carbon dioxide
3. Carbon monoxide in PPM (Parts Per Million)
4. Dust concentration or Particulate Matter (PM) in mg/Nm^3

Instruments used

To measure the parameters mentioned above, two instruments were used primarily:

1. **Stack Sampler VSS1:** This is an instrument used for pollution monitoring of flue gas emanating from chimneys of large- and small-scale industries (including the brick industry). In this monitoring exercise, this instrument was used for three purposes:
   i. For measurement of the stack and ambient temperature
   ii. For measurement of the air pressure inside the chimney
   iii. For collection of PM in the thimble

This instrument is approved by the CPCB for PM monitoring.

Table 1: Kilns visited for air pollution monitoring

S. No.	Kiln Type	Location	Date of Monitoring
1	Zigzag (Natural Draught)	Varanasi, Uttar Pradesh	19-Feb-19
2	FCBTK	Kanpur, Uttar Pradesh	21-Feb-19
3	FCBTK	Kanpur, Uttar Pradesh	22-Feb-19
4	Zigzag (Natural Draught)	Minakhan, West Bengal	7-Mar-19
5	FCBTK	Minakhan, West Bengal	7-Mar-19
6	Zigzag (High Draught)	Howrah, West Bengal	8-Mar-19
7	Zigzag (High Draught)	Hooghly, West Bengal	9-Mar-19
8	FCBTK	Kanpur, Uttar Pradesh	28-Mar-19
9	FCBTK	Kanpur, Uttar Pradesh	29-Mar-19

Source: Centre for Science and Environment, 2019

2. **TESTO Gas Analyzer:** This is a sensor based instrument used for measurement of percentages of O_2 and CO_2 and the CO concentration (ppm) in flue gas. This instrument is approved by United States Environmental Protection Agency (US-EPA) and European Union environmental agencies for the monitoring of the gases in the kiln.

Protocol followed for PM measurement from stack

The monitoring protocol that was followed for the measurement of PM in this study was in strict adherence to the CPCB guidelines for stack monitoring. Recommendations for the process mentioned in the government notifications for brick kilns were also considered. The steps followed in the monitoring process were:

1. Measurement of initial weight of the thimble after putting it in the oven, followed by desiccation for an hour each (in a certified laboratory)
2. Molecular weight determination of stack gas
3. Static pressure determination
4. Stack gas velocity determination
5. Calculation of stack gas volumetric flow rate
6. Conversion of stack gas velocity flow rate to litre/min
7. Measurement of sampling time
8. Sampling using air sampler VSS1
9. Calculation of final weight of the thimble after putting it in the oven, followed by desiccation for an hour each (in the same certified laboratory)
10. Calculation of corrected flow rate
11. Calculation of dust concentration (in mg/Nm^3)
12. Correction of the result at 17 per cent O_2

MONITORING RESULTS AND ANALYSIS

The monitored brick kilns were grouped into the following six categories based on kiln type and fuel used:

1. Zigzag (natural draught with coal and sawdust as fuel)
2. Zigzag (high draught with only coal as fuel)
3. FCBTK with only coal as fuel
4. FCBTK with coal, agricultural waste (crop residue of *Chironji (Buchanania lanzan)*) and wood as fuel
5. FCBTK with coal and agricultural waste (*tudi*) as fuel
6. FCBTK with only agricultural waste (*tudi*) as fuel

PM emissions

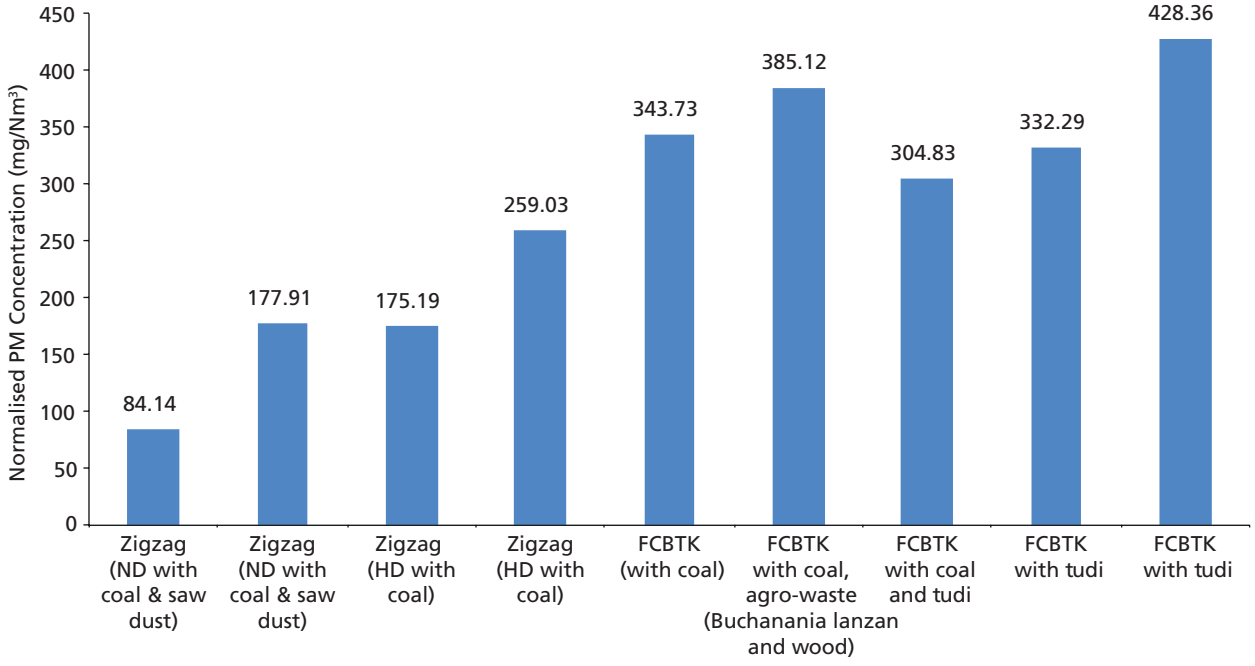
Many factors may be responsible for the variation in PM concentrations in the same type of kilns, but the key reason is the frequency of firing and the change in dosage of fuel via manual feeding, which depends on the individual judgment of the firing man. The monitoring found that the CO_2 values varied from 4.36 per cent to 7.67 per cent, and the O_2 values ranged between 14.19 per cent and 17.33 per cent. These values confirm the variation in air flow, which affects the concentrations of PM. Hence, normalisation of measured values at a fixed percentage of CO_2 or O_2 is necessary – therefore, the PM values in this

Table 2: Monitoring results from nine brick kilns in Uttar Pradesh and West Bengal

S. No	Kiln Type	O_2%	CO_2%	CO (ppm)	PM	PM (O_2 correction at 17%)
1	Zigzag (ND with Coal & Saw Dust)	15.46	5.92	1712.80	116.45	84.14
2	Zigzag (ND with Coal & Saw Dust)	16.94	4.92	349.53	180.41	177.91
3	Zigzag (HD with Coal)	15.61	6.15	2623.76	235.96	175.19
4	Zigzag (HD with Coal)	17.33	4.36	705.19	237.59	259.03
5	FCBTK (with Coal)	17.08	4.53	988.46	343.16	343.73
6	FCBTK with Coal, agro-waste (Buchanania lanzan) and Wood	16.13	5.27	588.30	469.34	385.12
7	FCBTK with Coal and Tudi	17.22	4.62	1882.24	288.13	304.83
8	FCBTK with Tudi	14.19	7.67	3501.41	566.11	332.29
9	FCBTK with Tudi	14.27	7.33	3342.70	720.96	428.36

Source: Centre for Science and Environment, 2019

Figure 1: Calculated PM concentrations (with O_2 correction at 17%) from emissions at sample kilns



ND: Natural Draught; HD: High Draught

Source: Centre for Science and Environment, 2019

report have been normalised or corrected at 17 per cent O_2. The corrected/normalised values of PM can be seen in Figure 1.

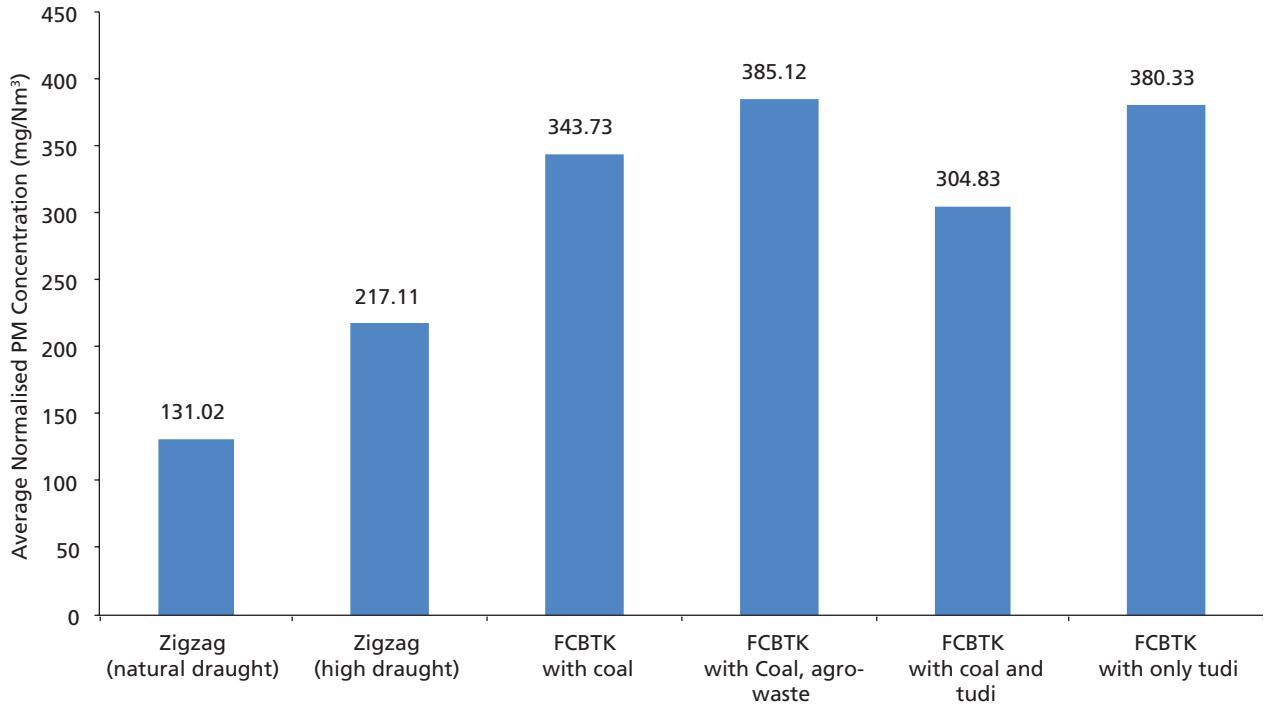
It can be inferred from the monitoring results that brick kilns with zigzag-natural draught technology have the lowest PM concentrations in their emissions. The two such kilns had corrected PM concentrations at 84.14 and 177.91 mg/Nm^3, respectively. These concentrations are well below the limit of 250 mg/Nm^3 as prescribed by the CPCB norms. It is important to note that in both the zigzag kilns with natural draught, coal with sawdust was being used as fuel.

In zigzag kilns with high draught, where only coal was used as fuel, the measured PM concentrations were found to be 175.19 and 259.03 mg/Nm^3. The normalised values from both the kilns showed some difference. If we consider the average of both the values, which comes to approximately 217 mg/Nm^3, it is well below the CPCB limit of 250 mg/Nm^3.

On the contrary, the PM concentrations from all the FCBTKs that were monitored were found to be well above the limit – the values ranged from 304.83 to 428.36 mg/Nm^3, depending on the type/mix of fuel used. The corrected/normalised values of PM can be seen in Figure 1.

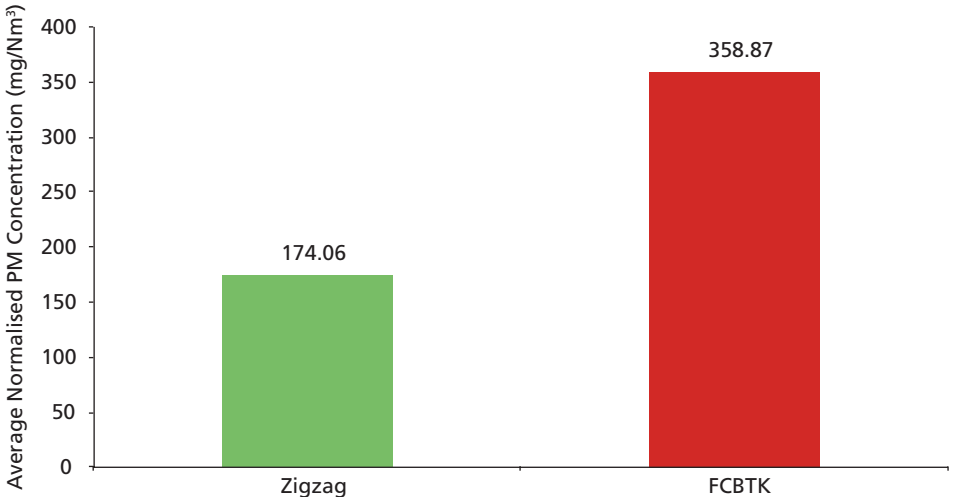
Figure 2 shows the average corrected PM concentrations of the six types of brick kilns covered in this study. It shows that the overall average of the PM concentrations of both types of zigzag kilns is well below the standard of 250 mg/Nm^3, whereas the average values of all types of FCBTKs are unable to meet the standard.

Figure 2: Average corrected PM concentrations from different types of zigzag brick kilns and FCBTKs



Source: Centre for Science and Environment, 2019

Figure 3: Overall average corrected PM concentrations in zigzag brick kilns and FCBTKs



Source: Centre for Science and Environment, 2019

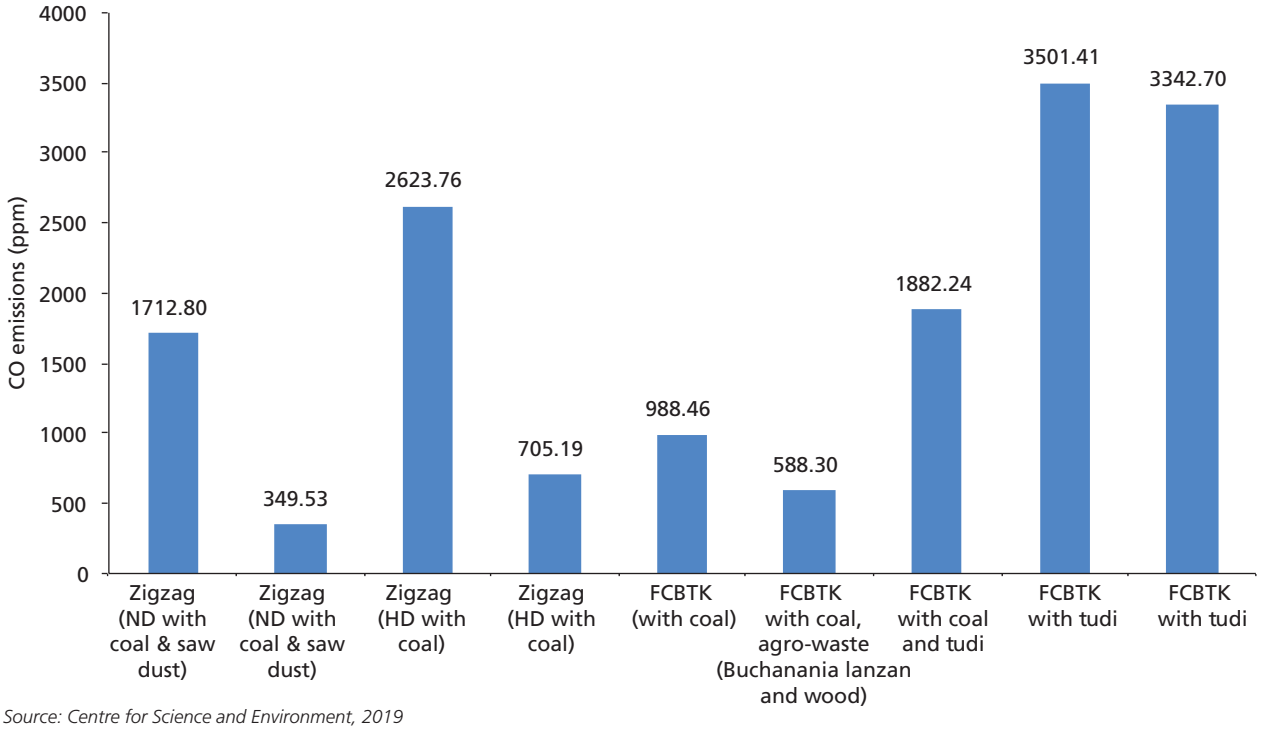
All the zigzag kilns that were monitored had lesser PM concentrations in their emissions than the FCBTKs, irrespective of their type and fuel used (*see Figure 3*).

Overall, the average corrected PM concentrations of zigzag kilns and FCBTKs indicate that brick kilns with zigzag technology (all types) have much lesser average PM concentrations than FCBTKs (*see Figure 3*).

Carbon monoxide emissions

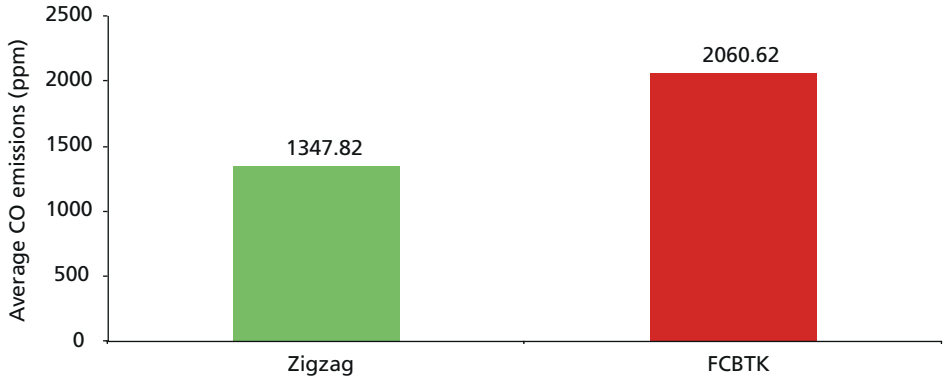
Unlike PM concentrations, there were no regular patterns observed for carbon monoxide (CO) emissions in the monitored kilns. Low as well as high CO emissions were observed for both zigzag brick kilns and FCBTKs, ranging from 349.53 ppm to 3,501.41 ppm on an average (*see Figure 4*). The CO concentrations measured in FCBTKs running with only agricultural waste (*tudi)* as fuel were very high (3,501.41 and 3,342.7 ppm) compared to other brick kilns that were monitored. Even the physical observation of FCBTKs that were using only agricultural waste (*tudi*) revealed high density of black smoke from the chimneys; the smoke was much more dense and black in color compared to the other FCBTKs and zigzag brick kilns.

Figure 4: Carbon Monoxide emissions in zigzag brick kilns and FCBTKs



Source: Centre for Science and Environment, 2019

Figure 5: Average CO emissions from FCBTKs and zigzag brick kilns



Source: Centre for Science and Environment, 2019

The overall average CO emissions from zigzag brick kilns were calculated to be considerably lesser than that of FCBTKs (*see Figure 5*).

Emissions from zigzag kilns significantly less than from FCBTK

Report by Punjab State Council for Science and Technology (PSCT) submitted to CPCB

The PSCT conducted a study sponsored by the Central Pollution Control Board to fix new emission standards for brick kilns in the country. The Council monitored 59 brick kilns throughout the country using different fuels and technologies. Kilns using either coal or biomass were monitored in north, central and west zones of the country, while kilns using only coal were monitored in the east and south zones. FCBTK, zigzag, high draught, VSBK, down draught and Hoffman kilns were monitored.

The key observations following the monitoring were:

- FCBTKs/HDKs: PM level observed was as high as 1,375 mg/Nm^3 for kilns using coal as fuel.
- FCBTKs/HDKs: High CO level observed in kilns using biomass as fuel.
- PM emission factor range
  - Coal-fired FCBTK kilns: 0.79 to 1.85 g/kg of fired brick
  - FCBTK using biomass: 0.78 to 1.19 g/kg of fired bricks
  - Zigzag natural: 0.37 g/kg of fired bricks,
  - High draught kiln: 0.24 to 0.28 g/kg, except for one kiln in Kolkata where it was 1.12 g/kg

The above values show that emissions from zigzag/HDKs are almost half of the emissions from FCBTKs using biomass and one third of the emissions from FCBTKs using coal as fuel.

Source: Presentation by J.S. Kamyotra, Brick Kilns in India. Anil Agarwal Dialogue, March 11, 2015. https://cdn.cseindia.org/docs/aad2015/11.03.2015%20Brick%20Presentation.pdf (accessed on March 28, 2019)

Surface emissions

An important observation which has been by far completely ignored is the issue of surface emissions during the feeding of the fuel in the kilns. This issue is much more severe in kilns which use agricultural waste in loose form as a fuel compared to the ones which are using coal. It can also be extremely harmful for the health of the workers in the kilns – especially workers responsible for feeding the fuel.

Surface emissions from an FCBTK during feeding of agricultural waste (tudi).

PARTH KUMAR, CSE

The economics of fuel in FCBTK

Different kinds of fuels are being used in FCBT kilns around the country. The most common fuels being used are agricultural waste in loose form and coal. Use of agricultural waste as a fuel is much more than coal due to its local availability and cheaper rates. Some FCBTKs run entirely on agricultural waste, while there are others which run on coal. Interestingly, there are a few which use both the fuels together in a ratio of about 70:30, where 70 per cent is agricultural waste.

Kiln owners say they use both the fuels together because bricks made in kilns that run completely on agricultural waste do not have the required strength and color. This could be due to the lack of sustenance of heat by burning agricultural waste which has lower calorific value than coal – the bricks, therefore, are not adequately baked. Despite this, a majority of FCBTKs are running completely on agricultural waste, which is a matter of concern with respect to the quality of bricks being produced. One of the biggest drives for use of agricultural waste is its low cost (compared to coal). The average price of mustard husk for a kiln owner in Kanpur is Rs 3,500 per tonne, whereas the average coal price ranges around Rs 13,500 per tonne.

Since the calorific value of mustard husk is lower than coal, a larger quantity of husk is required to bake the same amount of bricks -- to bake one lakh bricks, 14 tonnes of coal will be required; around 22 tonnes of mustard husk does the job for the same amount of bricks. Therefore, the comparative cost for baking one lakh bricks is Rs 189,000 for coal and Rs 77,000 for mustard husk: the huge difference explains the kiln owners' preference for agricultural waste as a fuel.

CONCLUSIONS OF THE STACK MONITORING STUDY

Based on the monitoring results and analysis, the following major conclusions have been drawn:

a. The PM concentrations in the emissions from all types of FCBTKs were higher than that from all types of zigzag brick kilns that were monitored.
b. The average PM concentrations in the emissions from all types of zigzag kilns were less than 250 mg/Nm^3 while the same from all types of FCBTKs exceeded the limit.
c. High amounts of surface emissions were also observed in all the kilns that used agricultural waste in loose form as a fuel.
d. Carbon monoxide emissions from FCBTKs using agricultural waste as fuel was very high.
e. The overall emissions performance of the monitored zigzag kilns was better than that of the monitored FCBTKs in this study.

RECOMMENDATIONS

In context to the background of this report, any directive from CPCB that allows FCBTKs that use agricultural waste will have serious repercussions. In case CPCB gives such a directive which allows the brick kiln entrepreneurs to use agricultural waste in loose form, a possibilty may arise that all the brick kiln owners who have not converted their kilns to cleaner technology would file an affidavit to use agricultural waste. In such a scenario, it will be very difficult for SPCBs with their limited manpower to monitor fifty thousand odd kilns across the country to understand the impact of such a step.

Based on the conclusions and the observations made on ground during monitoring and surveying of the brick kilns in various regions, there are certain recommendations which could be made to help the clay brick industry to move towards cleaner and environment-friendly technologies and practices. Some of the key recommendations are as follows:

Technical:

- Use of agricultural waste in the form of pellet/briquette as fuel in FCBTKs.
- Quality control of pellet/briquette: Sometimes, kiln owners mix soil which reduces the calorific value of briquettes. A quality control procedure is required for manufacturers of pellets/briquettes to avoid such issues.
- Monitoring to understand emissions from FCBTKs run with briquettes should be conducted by CPCB to formulate further policy regarding the same.
- In case the CPCB or the MoEF&CC wants to promote agricultural waste in loose form, then proper feeding practices such as using a funnel which feeds directly into the kiln will help in eliminating surface emissions. The impact on stack emissions has to be monitored.

Funnel feeding system in a Hoffman's Kiln

GREENTECH KNOWLEDGE SOLUTIONS PVT LTD, NEW DELHI

GREENTECH KNOWLEDGE SOLUTIONS PVT LTD, NEW DELHI

General:

- In case the CPCB or the MoEF&CC wants to promote agricultural waste in loose form, a closed storage yard for agricultural waste should be arranged at every kiln which uses such waste to avoid any mishap due to fire. Fire extinguishers should also be made available at the kilns.
- Portholes, platforms and safe staircases should be built in all kilns; a majority of the kilns do not have adequate facilities for monitoring.
- Proper storage yards should be built for pellet/briquette to avoid moisture arrest.
- Due to the fluctuation in the demand sector of briquettes there is a continuous fluctuation in their rates, therefore a price control mechanism for pellet/briquettes in every state is required.
- Laborers cannot be allowed to work in such hazardous conditions where surface emissions are so high, especially in kilns which use agricultural waste as fuel in loose form.

Annexure

CSE'S RESPONSE TO THE CPCB REQUEST LETTER TO MOEF&CC

Reference	Points by CPCB	Response by CSE
3rd Paragraph on Page No. 2	The emission monitoring carried out during February-June, 2012 by Punjab State Council for Science and Technology, Chandigarh for CPCB for revision of emission standards, corroborate the claim that PM emissions from kilns using agricultural residue is less (Table 1 and 2)	This is not correct. There are several issues associated with the results of the monitoring exercise carried out by PSCST. Firstly, the complete report is not available in the public domain. Secondly, the values are not normalised as per the CPCB's draft notification. Lastly, the PSCST has reported PM emission values of some kilns that were using agricultural waste to be over 250 mg/Nm^3 but have not been taken into account by CPCB in its response.
3rd Paragraph on Page No. 2	Based on the study carried out, CPCB has proposed a common revised PM limit of 250 mg/Nm3 to MoEF&CC which can be achieved by good operation/firing practices, which is yet to be finalised.	CPCB report submitted to MoEFCC does not spell out what are the good operation/firing practices. It is also important to understand how many units adopting such good operation/firing practices exist. Until and unless, such practices are documented, it cannot be assumed that brick kiln units will adopt it in their practices after standards are revised.
4rd Paragraph on Page No. 2	In view of the above representations, CPCB has carried out further emission monitoring in brick kilns using agriculture residue during November,2018 &February, 2019 and observed that PM emission during these studies was lower than the proposed standard of 250 mg/Nm^3 in most of the cases ranging from 8 mg/Nm^3 to 390 mg/Nm^3. Some of the low values during the latest monitoring in February, 2019 are expected because of brick kilns being extra cautious in applying good firing practices.	It is practically impossible to achieve 8mg/Nm^3 in a brick kiln. CPCB conducted monitoring at four kilns out of which three kilns were using agricultural waste as fuel. The results obtained were 390,117 and 296 mg/Nm^3. At one of the kiln, the normalized SPM value is measured as 117 mg/Nm^3, however the %O_2 for that kiln is 19.29 which indicates that air entering the kiln is going out of stack without any combustion which is due to low fuel feeding. The CO values from burning of agricultural waste are normally high. For example CO value measured by CSE for brick kilns using agricultural waste are above 3000 ppm. The low value from kilns monitored by CPCB cannot be attributed to good practice but to the fact that monitoring was done during non-feeding time or with negligible feeding. The normalised values shown in the CPCB report on stack monitoring conducted last year are incorrect as they are not normalised as per the stack monitoring guidelines by CPCB.
1st Paragraph on Page No. 3	The main argument for providing exemption from conversion to zigzag modification that exclusively used agricultural residue cannot be fed in zig-zig type kilns due to zig- zag arrangement of bricks in the kiln was also examined and found true. It was further noticed that dried mustard/cotton plant residues are also not fit for size reduction through cutting/ shredding due to its nature as substantial quantity will turn into dust if cutting/shredding is resorted to. It is also realised that large scale utilisation of abundantly available resource is pro-environment.	The conclusion by the CPCB is incorrect. Only a small variation has to be done in the fuel feeding hole of zigzag kilns to enable them to accept agricultural waste as fuel. The CPCB can inspect the following zigzag kilns that use agricultural waste: 1. Jindal Brick Fields Owner: Jagdeesh Prasad Contact No: +91 9414025623 Kiln type: Zigzag with agricultural waste (tudi) Location: NH-21 (Bharatpur-Jaipur Highway), near Arauda village, Dist Bharatpur, Rajasthan.

Reference	Points by CPCB	Response by CSE
		2. Periwal Brick Kiln Company Owner: Pradeep Periwal Contact Nos: +91 9876514121, 9417414121, 7986585193 Kiln type: Zigzag with agricultural waste (*tudi*) Location: Village Killiamwala, Dist. Abohar, Punjab. There are more such kilns in Bharatpur, but their owners did not allow CSE to collect data. Many zigzag kiln owners in Baghpat have also reverted to 50 per cent coal and 50 per cent agricultural waste as fuel to reduce the cost of operations. Utilisation of agricultural waste is important, but this must be done in appropriate form. Brick kiln owners can use agricultural waste as fuel but in pellet or briquette forms. There are a few brick kilns in Punjab which do this – the CPCB and MoEF&CC can visit these sites.
Point No.i on Page 3	No brick kiln shall operate in NCR without valid Consent from the concerned State Pollution Control Board. SPCBs shall initially issue provisional Consent for a period of 2 months to brick kilns using agricultural residues, after inspection of the site to satisfy the siting guidelines and existing emission monitoring facilities.	Good initiative but have never got implemented by various SPCBs on ground. For example, few years back UPPCB shared the data that there are around 17,000 brick kilns in UP but only around 6,000 kilns have obtained consent. Rest are operating for years without fulfilling the sitting criteria. Moreover, only few states like UP, Assam, Rajasthan have the sitting guidelines which also have never been implemented on the ground. Such non-compliant brick kilns are operational since years even being in the knowledge of pollution control board.
Point No. i. on Page 3	The kilns will submit affidavits along with Bank Guarantee of 5 lacs with validity of 06 months. The validity of consent shall be extended after submission of the compliance report by the brick kilns. The bank guarantee will be returned based on the compliance report of individual brick kilns and inspection for compliance by SPCBs.	The bank guarantee amount is low as non compliance should be strictly penalized. Therefore, in order to deal strictly with non-compliance the bank guarantee amount should be Rs 50 lakhs. CPCB guideline says bank guarantee will be returned based on compliance report. The pertinent question is who will guarantee that they will not use fuel other than agricultural waste post compliance report.
Point No. ii. on Page 3	The Consent issued by the respective State Pollution Control Board shall clearly specify daily production capacity and also that the brick kiln is permitted to use only agricultural residue as fuel.	The consent issued to all brick kiln should be available on SPCB's website for public as well as should be posted on the gate of the brick kiln. In case of absence of gate, CPCB should make it mandatory and strict enforcement should be ascertained.
Point No. iii. on Page 3	The brick kilns shall submit monthly monitoring reports to SPCBs and SPCBs shall monitor the compliance of 20% of kilns every month and shall take action for closure of those found violating the permitted fuel conditions.	In the history of brick kilns, since the time they have been shifted from moving chimney, they have not been inspected by SPCB except in the case when pressurized by high/supreme court or NGT. It is difficult to understand how SPCB will cross check the compliance of 20% kiln due to their limited manpower and resources.
Point No. iv. on Page 4	District Magistrate shall also ensure surprise physical inspection of brick kilns to check any unauthorized use or storage of unauthorized fuels and shall take action for closure of those found violating the permitted fuel conditions.	It is highly impractical, as DM never inspects brick kilns unless pressurized by higher authority. In Delhi NCR only zigzag kilns are allowed to operate, however all FCBTk's are operating illegally but DM is unable to take any action against them despite submitting frequent status reports to him.

Reference	Points by CPCB	Response by CSE
Point No. vi. on Page 4	The brick kilns will install CCTV cameras and will record the operations continuously. The recorded footage will be submitted to the State authorities on monthly basis.	This direction from CPCB has feasibility issues. It does not specify the number of CCTV cameras to be installed and their locations. The direction can be fulfilled by installing just one camera and that too at the gate. What purpose will that camera serve? CPCB should prepare a clear guideline on installation of CCTV camera specifying following points: 1. Number of cameras to be installed at stack, at the gate and at different locations within the kiln. 2. Location where these cameras should be installed 3. Specification of cameras (high resolution which can capture night view also) 4. Provision for 24 hrs power supply for all cameras. 5. Measures to be adopted by the brick entrepreneurs for safety and proper functioning of the camera. Submitting of footage to SPCB and feasibility of SPCB to watch the footage for 24 x 30 days for dozens of brick kilns is humanly not possible. Therefore, the footage should be available in the public domain.

It is difficult to understand how the CPCB can come up with new guidelines when its earlier orders of October, 2017 and June, 2017 remain unimplemented. Here is what the orders say, and what CSE has found on the ground:

CPCB direction: Brick kilns operating without consent shall close down all their processing operations with immediate effect.
What CSE found: Brick kilns without consent as well as kilns which have not converted into zigzag are operating openly in UP, Haryana and Punjab.

CPCB direction: The brick kilns not having stack monitoring facilities like port holes and platforms as per the CPCB guidelines shall also close down all their processing operations with immediate effect.
What CSE found: This guideline has been, by and large, ignored by most kiln owners. CSE visited various brick kilns and found the facility for monitoring missing or ill-designed for conducting stack monitoring (please see figures 1, 2, 3 and 4 on the facing page). The situation is really poor in Rajasthan and Haryana. It has been adopted only in Baghpat district of UP.

CPCB direction: Brick kilns not converted to zigzag from FCBTK by September 30, 2017 should not be allowed to operate.
What CSE found: Non-converted FCBTKs are still operating illegally in DelhiNCR.

CPCB direction: According to the CPCB direction dated 27th June, 2017, all the moving area around the brick kiln should be paved with the bricks to minimize fugitive dust emissions from the brick kiln operations. This condition should be incorporated in the Consent condition while granting the consent by the respective state boards.
What CSE found: Almost in all the brick kilns in the country the moving areas are not paved resulting in excessive fugitive emissions at the kilns.

PARTH KUMAR, CSE

Figure 1: Ladder provided 6 feet above ground (Bharatpur, Rajasthan; 19-Mar-2019)

PARTH KUMAR, CSE

Figure 2: Monkey ladder without platform. (Kanpur, UP; 21-Feb-2019)

PARTH KUMAR, CSE

Figure 3: No ladder or platform (West Bengal, 09-Mar-2019)

PARTH KUMAR, CSE

Figure 4: Temporary arrangements; difficult to use (Kanpur, UP; 21-Feb-2019)

The clay brick manufacturing sector in India has been identified as a key contributor to air pollution. Since October 2015, the sector has been the target of several official notifications, orders and directives, all issued with the aim of making it environmentally less damaging. However, these regulatory interventions have not served their purpose. To add to it, a plethora of claims, counter-claims and assertions seems to have muddied the field and confused all stakeholders immensely.

To get to the heart of the matter and clear the picture, Centre for Science and Environment (CSE) conducted a monitoring exercise and survey of brick kilns across northern India. This report summarises CSE's findings and provides some recommendations.

Centre for Science and Environment
41, Tughlakabad Institutional Area,
New Delhi 110 062 Phones: 91-11-40616000
Fax: 91-11-29955879 E-mail: cse@cseindia.org
Website: www.cseindia.org