Workshop Proceedings

Cleaner Brick Production Technologies -
Supporting Bihar's Initiative Towards a Low Carbon Economy

Bihar State Pollution Control Board
in Association With
Development Alternatives, New Delhi and
Shakti Sustainable Energy Foundation.
6 December 2012

2012

1. INTRODUCTION

A day long Workshop on Cleaner Brick Production Technologies- Supporting Bihar's Initiative Towards a Low Carbon Economy was organised by Bihar State Pollution Control Board and Development Alternatives in association with Shakti Sustainable Energy Foundation on the 6th of December 2012 at Hotel Patliputra Ashok. The main objective of the workshop was to create awareness about various cleaner brick production technologies among entrepreneurs. The workshop brought together various stakeholders to deliberate on the various issues of entrepreneurs so that they are able to **practice and preach** cleaner brick technologies.

The workshop was attended by over 170 entrepreneurs, service providers and various government officials of BSPCB, Dept. of Environment and Forests, Dept. of Mining and Geology, NTPC, BSEB etc. Shri. Sushil Kumar Modi, Hon'ble Deputy Chief Minister, Bihar graced the occasion as Chief Guest. The inaugural session presented an overview of the status of brick industry in Bihar. In subsequent session, service providers focussed on the viable technologies that can be adopted in the state. This was followed by a panel discussion in which all the issues raised by entrepreneurs were discussed in detail.

2. WORKSHOP BACKGROUND

The brick industry of Bihar is growing at the rate of 9%. However, it is still besieged with age old Bull's Trench Kiln technology. Presently there are around 4210 registered brick producing units producing around 10,525 million bricks per year. In an average in Bihar around 45 million tonnes of agricultural top soil is lost every year for producing bricks. Moreover the brick industry with the present production consumes around 2 million tonnes of coal thereby releasing around 4-6 million tonnes of CO_2 each and every year. The amount of suspended particulate matter (SPM) and particulate matter less than 10 microns (PM_{10}) resulting from the same are also beyond tolerable limits higher than WHO guidelines. Use of low quality imported coal from North East India e.g. Assam, Meghalaya etc. (>1% Sulphur content) leads to high CO_2 and SO_2 emissions contributing to anthropogenic climate change. Particulate matters and SO_2 cause serious health problems, predominantly in the respiratory system.

The brick industry is important for the rural economy of Bihar. It's a major source of employment providing employment to labourers. They are mostly migrant in nature, with no work during the rainy season, as a result of which workers are forced to look for other jobs or return to native villages. Many of the workers belong to the poorest sections of society. The workers are highly vulnerable to manipulation by contractors bypassing basic labour regulations and rights. The industry also has high incidence of child labour which is unpaid and exploited.

3. PROCEEDINGS

a. Inaugural Session

Welcome and opening remarks, Chairman BSPCB

In his welcome address, Chairman BSPCB stated that bricks play an extremely important role in the construction sector. However it is ignored and does not get the attention like the

Address highlights:

- Traditional brick making technologies contribute to carbon emissions
- Agriculture top soil is being wasted due to brick making
- New technologies should look at using local resources
- Policy support and awareness generation is crucial to adoption of new technologies

cement or steel industries. Currently bricks are made by traditional technologies adding to carbon emissions. Bihar uses around 22,000 tonnes of coal to make bricks. Most of the bricks are made by soil thereby destroying the agriculture top soil in this process. It was suggested that any alternatives for the state should be based on the kind of wastes and resources available. In order to conserve the natural resources by adopting new technologies, policy support from the government in essential. Similarly, awareness generation among entrepreneurs and consumers is important. Accelerated service delivery system and infrastructure like electricity etc. are also required to take this forward.

Introduction to Workshop, Senior Scientist, BSPCB

Initiatives by State Government:

- Policy Workshop in January
- Formation of Task Force to fast track adoption of cleaner technologies
- Workshop on use of Fly Ash Technology by NTPC
- Clean Brick Technology Workshop suitable for Bihar conditions

Giving an introduction to the Workshop Dr. Naveen Kumar, BSPCB said that Govt. of Bihar is focusing on improvement of the brick sector in terms of reducing pollution and use of top soil presently. The various initiatives taken by the state was highlighted. To sustain this initiative, an Inter Departmental Task Force was set up in the month of June in collaboration with all relevant State Government Departments related to the brick sector. One of the key decisions taken by the Task Force was to mobilise brick entrepreneurs to understand their

issues. As a beginning a Policy Workshop was held at BSPCB in January 2012 to understand the various policies related to brick sector. Decision was taken to hold various workshops for awareness generation on cleaner technologies. As a follow up, the second workshop was held at Kahalgaon on 30th November by NTPC. The 2nd Task Force meeting is to be held on 7th. of December where the issues raised at this workshop will be addressed.

Status of Brick Sector in Bihar: Opportunities and Challenges
Dr. Soumen Maity, Development Alternatives, New Delhi

Challenges and Opportunities in Bihar brick sector:

- **Need to look at alternatives using less coal to reduce production costs**
- **Scope of use of fly ash and other industrial wastes enhancing resource efficiency**
- **Scope of alternate technologies e.g. Fly ash, Zig Zag, VSBK, Internal fuel**
- **Main focus in the future should be on fly ash technologies**
- **Good opportunities of mechanization to solve skilled labour issues**

Dr. Soumen Maity, Development Alternatives focussed on the status of brick sector in Bihar. The various issues and opportunities in the brick sector of Bihar were highlighted. Traditionally the major raw materials used for brick making in Bihar is soil and coal. No waste materials are being used in brick making unlike other states. 90% of the soil used is from agricultural land with 10% from river banks and bed. Large scope exists in alternate technologies like Fly Ash, Vertical Shaft Brick Kiln (VSBK), Zig-Zag kilns, Hybrid Hoffman kilns and the use of industrial wastes as internal fuel. Large opportunities exist for mechanization which will improve the brick quality and also create unskilled local jobs. Brick making in Bihar is energy intensive consuming more than 20-24 tonnes per lakh of fired bricks. Such high coal consumption is bound to create problems since coal prices will be increasing in near future. However there are ways to reduce production costs by adopting new technologies with an additional benefit of reducing pollution. Apart from adopting new technologies, entrepreneurs can also make modifications in existing FCBTK to reduce energy costs. While focussing on fly ash technology, the use of power plant waste (5,500 MW) is enough to meet the entire brick demand of the state. The role of BSPCB and Mining Dept. was commendable unlike other states in the brick sector. One of the major issues for adoption of cleaner technologies is the lack of awareness among the entrepreneurs on alternative solutions. It was concluded that if new practices and technologies are adopted, Bihar has the potential to become a 'Carbon Neutral State' in the future only through the brick sector earning substantially from sale of carbon credits.

Address by Pritpal Singh, Punjab State Council for Science and Technology

Initiatives by PSCST:

- **Designed improved fixed chimney in 1997**
- **Formulated revised national emission standards**
- **Technology available with PSCST to improve existing fixed chimney operation to reduce energy consumption and emission**

Shri. Pritpal Singh, highlighted the work done by PSCST in the field of brick sector. Fixed chimneys were designed by PSCST in 1997 when Central Pollution Control Board approached the institution to develop an alternative for movable chimneys. This technology was made with two objectives; better design and improved practices through increased airflow. As a result, this technology was adopted widely. Mechanisation is a big issue as it requires heavy power requirements and electricity is not available in these areas. PSCST was also instrumental in revising national emission standards after studying 50 kilns. These standards need to be stricter in order to reduce the smoke. Leakages from brick kilns should be stopped and proper combustion should be ensured. In case of fly ash, mixing technique is important since manual mixing cannot work.

Address by Dr. Sameer Maithel, Greentech Knowledge Solutions Pvt. Ltd.

New initiatives:

- **Zig-Zag firing technology with natural draught**
- **Use of hollow bricks to improve resource efficiency**
- **Training Academy on improved brick technologies**

Dr. Sameer Maithel, expressed his satisfaction that the Bihar government is giving due importance to this sector. He discussed about Zig-Zag kilns and how they can save upto 20% coal. He gave the example of Mr. O.P. Badlani who has adopted this technique. The issue of adoption of hollow bricks was also presented to improve the resource efficiency. The establishment of Next Gen Training Academy was also highlighted to train entrepreneurs and workers on Zig-Zag brick firing technology. He advised entrepreneurs to attend the programme in January and get the benefits.

Initiatives taken by Govt. of Bihar for Promotion of Cleaner Brick Technologies
Shri. Dipak Kumar Singh, Secretary, Dept. of Environment and Forests

Shri. Dipak Kumar Singh, illustrated that the main objective of changing the brick sector is to make them more efficient, reduce coal use, economize on production costs and reducing

pollution while increasing the strength and quality of bricks. Through this Clean Brick Production Technology Initiative, BSPCB and DoEF are focussing on three main aspects:

Focus of Govt. of Bihar:

- **To improve the brick sector and reduce pollution**
- **Promote new technologies which economize on production costs and improve quality**
- **Use of fly ash in brick making**
- **Use of industrial wastes in brick making**
- **Vertical use of soil for brick making and reuse land for pisciculture**
- **Encourage entrepreneurs and workers for knowledge and skill development initiative**

1) How can we bring about a change in existing technologies without compromising the quality of bricks? What are the new techniques that can reduce resource use? Apart from the above, in the future emission standards of the brick sector will be stricter. Thus time has come to consider thinking about all these issues and preparing for a change.
2) What are the alternative technologies we can employ? For instance fly ash use will be relevant around thermal power plants. Use of other industrial wastes is also possible.
3) We currently use top-soil for brick production and ruin agricultural land. This will impact agricultural productivity in the state. Entrepreneurs should consider digging deeper for soil rather than taking only top soil and moving horizontally. When the soil is completely uses and the land abandoned, farmers can practice farming or start fisheries.

He reiterated that the Task Force meeting will discuss the issues that comes up in the workshop and will take policy decisions related to mining royalty rates, Schedule of Rates, etc. He hoped that the participants will find the deliverables by resource persons interesting and adoptable. Similarly the Training Academy is a great initiative and all entrepreneurs should take the benefit of these.

Address by Chief Guest, Shri Sushil Kumar Modi, Hon'ble Deputy Chief Minister, Bihar

Welcoming all the guests, Shri Sushil Kumar Modi, Hon'ble Deputy Chief Minister appreciated the focus on the brick sector and thanked for the detailed documentation on the status of brick sector in Bihar and the opportunities associated.

Bihar is progressing rapidly with a growth rate of 11%. Construction industry has and will continue to play an important role in this growth. This industry or sector also provides employment to large population of the state. It was stated that there is a huge demand of bricks in the Indira Awas Yojna to build around 8 lakh houses. He reiterated that the main objective of cleaner brick production technologies should be to use less coal, less top soil and look at opportunities of low pollution. Presence of highly qualified experts from across the country in the workshop was also encouraging; which should be utilized. It was also directed that such a Workshop be organised on a bigger scale and invite atleast 10 entrepreneurs from each district. The venue of Rabindra Bhavan in Patna was also offered by the State Govt. for the same.

It was emphasized that there is a need for policies and incentives related to this sector. Special focus should be given to the incentives that can be given to the entrepreneur for adopting new technologies. It may be modelled on the food processing industry in Bihar. He urged the experts to document the best practices and incentives offered to brick sector in other States so that Bihar can consider in adopting the same. Similarly new policies should also be considered for introduction towards improving the brick sector.

Future directions on improving the brick sector:

- **Look at meeting the demand of 8 lakh houses under the IAY**
- **Cleaner brick production technologies should look at using less coal, soil and minimizing pollution**
- **Use of experts to disseminate low carbon technologies**
- **Organize Brick Sammelan at Rabindra Bhavan and call selected entrepreneurs from all districts**
- **Need to provide incentives for adopting cleaner brick technologies**
- **Document best practices and incentives in other states for replication in Bihar**
- **Govt. to consider new policies for improving the brick sector**
- **Need for mechanism to ensure utilization of fly ash**
- **To implement fly ash notification of the Central Government.**
- **NTPC to encourage setting up fly ash enterprises in their own campus**
- **Urgent need to remove misconceptions about fly ash bricks**
- **Modified schedule of rates to look at fly ash and other eco-friendly technologies**
- **Task Force to become more effective in bringing a change in the Bihar Brick Sector in the next 3 years.**

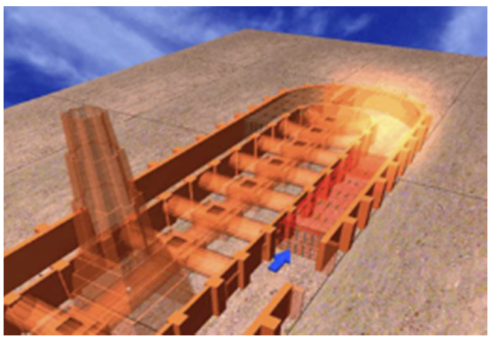
Fly ash notification is not being followed properly. This can be seen from the fact that 20% fly ash is not being given free of cost to the entrepreneurs. There needs to be a mechanism to ensure that the fly ash is utilised. Apart from the rules, the issues being faced by entrepreneurs in order to utilize the fly ash also need to be known. It was advised to ensure

the implementation of this notification. Transportation and storage of fly ash is a problem. It was stressed that few highly mechanised fly-ash units can be set up in the NTPC campus itself. Fly ash utilisation should be the States prime focus due to its high generation and disposal problems. He along with BIA officials had visited a fly ash unit and was happy to see such initiatives in the state. Misconceptions about fly ash bricks should be removed from the minds of people. In addition to promotion of fly ash there is a need to relook the strategy of the brick sector. Schedule of Rates should include Fly Ash and other eco-friendly technologies. He applauded the efforts of the Task Force and hoped to see a difference in this sector in the next 3 years.

b. Awareness Session 1: Improvement of Existing Brick Production Technologies in Bihar

Improvement of existing FCK – Better Feeding and Firing Practices
(Shri. Pritpal Singh, Punjab State Council of Science and Technology, Chandigarh)

Technology description



Improvement of existing FCK is through following better feeding and firing practices. These are very minor changes in the kiln structure or daily operational practices. The kiln needs to be repaired every season by applying non-shrinkable mud plaster on walls to avoid leakages. Use of optimal quantity of rubbish/keri over brick setting and insulated tawa reduces heat loss. Combustion is improved through the use of shunt system. Feeding interval also plays a major role in improving energy efficiency. Right mix of coal sizes needs to be used with reduced feeding interval. Mixing of two types of fuel e.g. coal/husk should be avoided. As possible dry bricks should be used since moisture content bricks uses up more energy in driving off the moisture. Use of instrumentation should also be encouraged to understand the health and performance of the kiln. Apart from changes in kiln, improved energy efficiencies can also be attained by using hollow bricks.

Advantages

- Pollution control through energy conservation
- Around 10-15% of coal saving
- Increased production capacity by around 10-15%
- Improved product quality

Improvement efficiencies of existing brick production technologies
(Dr. Soumen Maity, Development Alternatives, New Delhi)

Technology description

The technology of improvement of existing technologies is through the use of internal fuel in green brick making. This technology is independent of any firing kiln. Internal fuel in the

form of industrial wastes can be used. However in Bihar since carbonaceous internal fuel is not available, thus coal can be used also as an internal fuel. The coal used as an external fuel needs to be grinded into a powder form (less than 2 mm) and sieved to get the coarser particles out. While the finer particles are used as internal fuel, th e coarser will be used as an external fuel. The fine particles of coal are mixed with soil to make green bricks. The most important issue in this case is the mixing technique. Mixing of two different entities can only be made through mechanized means. Since use of pugmill is popular in Bihar thus mixing will not be an issue. Before determining the proportion of addition both the coal and soil needs to be tested for optimum mix design with desired benefits. In this technology the investment is around Rs. 200,000 with a payback period of only 1 year.

Advantages

- Reduction in total coal consumption by around 25-30%.
- Scope of reduction in environmental emissions by more than 70-80% depending on the mix design
- Better quality product
- Higher yield from reduction of class 2 and 3 bricks
- Reduction in firing labour due to use of lesser coal during operation

Retrofitting FCK to natural draught Zig Zag brick firing
(Shri O.P. Badlani, Prayag Kiln Technologies, Varanasi)

Technology description

Prayag Bricks have played a key role in transforming/retrofitting existing FCBTK's to natural draught zig zag kilns. The basic theory of this technology is to improve the draught of the firing process. The technology can be implemented in existing FCBTK's. For the same the height and the volume of chimney needs to be increased. The length of the kiln is also decreased with increase in height. From an ellipsoidal structure the kiln is modified to a rectangular structure. Brick setting in the kiln are chamber wise instead of line wise. Smaller sizes of coal are fed through insulated feed holes at a regular manner. This improves the efficiency of the firing procedure with improved quality.

Advantages

- Increased energy efficiency with reduced coal consumption (from 18 Tons to 13 Tons per lakh of fired bricks)
- Very low levels of environmental emissions

- Improved yield of Class 1 bricks (from 55-60% to 80-85%)
- Capital cost of around Rs. 10-15 lakhs only with a productivity of 50 lakhs bricks per year
- Customized support from Prayag Bricks in the field of site visits, design and layout, construction supervision, operation and training.

c. Awareness Session 2:
Introduction of New Brick Production Technologies for Bihar

Zig Zag brick firing technology
(Dr. Sameer Maithel, Greentech Knowledge Solutions Pvt. Ltd., New Delhi)

Technology description

The basic concept of Zig Zag firing technology is to allow more airflow in the kiln. In this technology air follows a zig-zag path which gives it more time to raise its temperature. Due to increased travel time induced suction is mad e through use of high capacity fans. This is not used in normal natural draught FCBTK. In Zig Zag firing technology turbulence in air is created by impact of air striking the walls. It promotes better mixing of air and fuel. Feeding is done through smaller spoons which can hold 300-400 gm of coal at a time. This improves combustion also. In this technology SPM concentration is reduced to around 70-80%. During proper operation black smoke is not visible.

Advantages

- Increase Class I bricks
- Reduces coal consumption
- Reduces pollution
- Smaller foot print area

The Vertical Shaft Brick Kiln technology
(Shri Ayan Kumar Keora, Development Alternatives, New Delhi)

Technology description

The vertical shaft brick kiln technology is the world's most energy efficient and environment friendly technology certified in many countries. It is box like structure having multiple shafts with refractory insulation. Chimneys are provided for exhaust of gases and regulate draught of air for efficient combustion. Green bricks are loaded from the top and fired bricks are taken out from the bottom. The kiln is a continuous firing system with unloading at specified intervals throughout the day. Unloading devices are provided at each shaft which is manual or mechanized. Use of internal fuel is a necessity to improve energy efficiencies. The technology is versatile with production based on number of shafts. A scientific firing pattern is followed with temperature measured through instrumentation. More than 120 kilns are

operating in India with technology transferred to South Asia, Africa and South American countries.

Advantages

- Diverse scale of production
- Flexibility of production from 5000 to 500,000 bricks per day
- High energy efficiency (coal consumption around 6-8 tons per lakh of fired bricks)
- Use of industrial waste materials
- 80% reduction in environmental emissions
- Increased profitability
- Utilization of local unskilled workers
- 365 days of production

The Fly Ash Brick Making Technology
(Shri Anamoy Ranjan, TARA Machines and Tech Services Pvt. Ltd., New Delhi)

Technology description

Fly ash brick making technology is a relatively new technology in Bihar. There are only some sporadic instances of fly ash enterprises in and around NTPC, Kahalgaon. Fly ash bricks are uniform cement colour which is pleasing to eyes. They are even and uniform in shape resulting in less consumption of cement. The technology uses fly ash and coarse sand with either cement or lime/gypsum as an additive. Raw materials are mixed in pan mixers and shaped in hydraulic presses. They are then cured t o give required strength. TARA Machines and Tech Services have developed fly ash technologies and provide turnkey solution to utilization of waste materials. Waste materials are tested and suitable customized solutions made through lab scale R&D. To get the optimum productivity based on market demand, appropriate machines are suggested. After required machine delivery, they are installed and commissioned with training of workers to produce the right quality. TARA Machines does not only sell a machine but a service of making a successful entrepreneur.

Services provided

- Testing of raw materials (fly ash, sand, lime, gypsum)
- Optimum raw mix design for desired brick strength
- Project report submission through well-known consultants
- Supply of equipments through a TARA Machines Fly Ash Technology Package
- Site layout based on site specifications for optimum utilization of manpower
- Machines installations and commissioning with on-the-job training
- Annual maintenance contract for machines and services

Fly Ash Bricks and its Advantages
(Shri Girish Kumar, Eco-Powers and Bricks Pvt. Ltd., Patna)

Technology description

Details of the technology have already been given. However there are some specific issues raised about the fly ash brick industry in Bihar. Over the past couple of years numbers of units were established. However over 90% of the units have closed down. Most of the remaining units are operating in a marginalized scale producing paver blocks only and not any products using fly ash. Due to the failure of these units, new initiatives are finding it difficult to get finance from banks.

Issues raised

- No working incentive for the fledging fly ash industry at present
- Business unfriendly conditions since have to compete with clay bricks without any market support
- Availability of raw materials only in and around Kahalgaon despite Barauni and Muzaffarpur thermal power plants.
- 5% VAT on fly ash bricks compared to 1% on burnt clay bricks produced from polluting technologies
- Present production cost in and around Patna is Rs. 5.35. Thus have to be sold at Rs. 6-7 which is high than burnt clay bricks
- An increase in demand will help to reduce some of the "fixed overheads" and reduce costs. This will encourage more investment
- Marketing costs are high since it is a new product and acceptability is low
- MOEF Gazette notification dated 14th September 1999, and modified twice since then, recommends government agencies and private sector to use bricks containing at least 25% Fly Ash within 100 km of Thermal Power Station. However the same is not followed in principle by the state
- Unfavorable Schedule of Rate dated 16th July 2012. Fly ash bricks at Rs. 4,305 compared to Grade A bricks at Rs. 5,636 per thousand

4. ISSUES RAISED BY ENTREPRENEURS

The panel discussion on the issues raised by entrepreneurs for adopting cleaner brick production technologies was chaired by Shri Dipak Kumar Singh, Secretary, DoEF. Some of the key concerns raised by the entrepreneurs in the workshop are mentioned below:

a) Quality of bricks in Zig-Zag kilns

Issue: Quality in terms of strength and colour of red bricks.

Suggestions: Entrepreneurs were assured that there is no change in the quality of red bricks.

b) Exemption of fly ash bricks from VAT

Issue*:* Entrepreneurs need to pay VAT similar to that of red bricks. This results in losses to the entrepreneur.

Suggestions: It was clarified that this aspect will be discussed in the Task Force before being taken up with appropriate authorities.

c) Process of procurement of fly ash

Issue: There is lack of awareness among the entrepreneurs about the process of procurement of fly ash from NTPC which makes successful operation of an enterprise difficult.

Suggestions*:* After clarifying the process of procurement, it was stated that AGM, NTPC Kahalgaon has been appointed as a nodal person for fly ash availability. In case of any issues he may be contacted directly. His contact details will be put up on the website of DoEF, BSPCB and EcoBrick. A manual eliciting the procurement process will also be prepared by NTPC towards creating transparency in fly ash availability.

d) Revision of rate of fly ash bricks in the Schedule of Rates

Issue*:* The price of fly ash bricks in the Bihar Schedule of Rates is very low in comparison with burnt bricks. This discourages the entrepreneurs from starting a fly ash enterprise.

Suggestions: The issue would be taken up in the Task Force meeting on 7th December 2012 and discussed with all the relevant departments.

e) Application for NOC in case of expansion

Issue*:* Entrepreneurs have to apply for a fresh NOC for the expansion of an existing fly ash unit. This causes delay in the procurement of raw materials.

Suggestions: NOC is given on the basis of the pollution load of a plant and not its production capacity. In the case of a fly ash unit, the rules can be revised after discussions. To be taken up in the Task Force Meeting on the 7th.

f) Nodal Officer

***Issue*:** Entrepreneurs requested the appointment of a nodal officer in the government for clarification of any issues.

Suggestions: Member Secretary, BSPCB was appointed as the Nodal Officer for all the queries of entrepreneurs.

Priorities for Task Force:

- Focus on specific cleaner technologies based on raw material availability. This is needed since all technologies will not be applicable for all areas
- Adoption of fly ash technologies to be accelerated in specific areas like Muzaffarpur, Nabinagar, Barh, and Bhagalpur once quality raw materials are available. This is to be tested by Development Alternatives
- R&D on soil quality and fly ash brick production to produce good quality bricks at an economical price
- Tap into entrepreneurship training schemes of World Bank to build capacity of young entrepreneurs in adopting cleaner brick production technologies
- Introduce diploma courses on brick making to create a pool of trained manpower
- Look at considering waiver of VAT on fly ash bricks which is much higher than burnt clay bricks. This will encourage adoption of cleaner brick production technologies
- Mining royalty to be based on technology and not on amount of brick production
- Pollution NOC for fly ash based on technology and not on bricks produced
- Fast track clearance for fly ash from NTPC

5. LIST OF ATTENDEES

Government Officials

1)	Dinesh Kumar	Pollution Control Board	9431074043
2)	S.K. Pathak	PRO to Deputy CM	9431017530
3)	Sanjay Krishna	OSD, Rural Development Dept.	9431818239
4)	Surendra Prasad	Building Construction Dept.	9430888805
5)	Shailendra Kumar	Pollution Control Board	9304658599
6)	L.N. Roy	BSEB	8757929568
7)	R.S.P Gupta	NTPC	9431602068
8)	S. Nand Kumar	Pollution Control Board	9431071744
9)	S. N. Thakur	Pollution Control Board	9431348234
10)	D. K. Gupta	NTPC Kahalgaon	9473196766
11)	Surendra	Mines and Geology Dept	9431289921
12)	Anil Kumar	Pollution Control Board	9430511414
13)	S. K. Karn	Advisor, DoEF	9431814901
14)	A. P. Sinha	Mines and Geology Dept	9973206763
15)	JKP Singh	Pollution Control Board	9430287177
16)	Ruby	Road Construction Dept	9430469967
17)	Dilip Kumar	Building Construction Dept	9431620143
18)	Kumar Sarwar	Urban Development & Housing	9431878535
19)	Ramesh Pandey	District Mining Office	9934627557
20)	S. N. Jayaswal	Pollution Control Board	9431425750
21)	V.K. Sinha	NTPC Barh	9431019891

Entrepreneurs

1)	Vikas Kumar	Buddha Pavers and Tiles Ltd	9431818239
2)	D. Kumar	Ara	9304893021
3)	Govind	Sangam Int	9576754339
4)	Sanjay Gupta	Sangam int	9576093962
5)	Narayan	Bhojpur	9430817263
6)	Nagendra Nath	Chetan Int Udyog	9931391605
7)	S. N. Singh	Kisan Bricks	9431011124
8)	Mukesh	Kumar Int Udyog	9835655383
9)	Dharmendra	Dharm Int Udyog	9771292029
10)	K.K. Singh		9939073331
11)	Dharmendra	SKG Int Udyog	9955426066
12)	Ravindra Prasad	SKG Int Udyog	8294333633
13)	Shashi bhusan	Devi Int Udyog	8507173539
14)	Abhimanyu Kr	Om Sai Bricks	9934060188
15)		Sri Ram Bricks	9546170585
16)	Arun Kumar	Bharat Bricks	9334294345
17)	Pankaj Kumar		9308292080
18)	Shanak		9308292080
19)	Mr Singh	Krish Bricks	9576453078
20)		R.S.M Bricks	9430002052
21)	Satyananad	Maa Int Udyog	9431488615
22)	Sikand	Patna	9334393942
23)	Vijay Krishna	Satya Bricks	7488366998

24) Prem Kumar	R. K. Kumar	9334201299
25) Arun Kumar	Danapur	9334447262
26) Roshan Kumar	Makan Int Udyog	8002666143
27) Nirbhay	Kajal Int Bhatta	9835853260
28) Anil Kumar	Devi Bricks	9431043128
29) Jeetendra	Sunderpur, Patna	8083096805
30) Lakshman Singh	RBM	9546328291
31)	Namaskar Int Udyog	
32) Sudhir Kumar		9339325102
33) Anjani Kumar		9204207309
34) Shashi Singh		9204207309
35) Indra Yadav		9771047167
36) Pankaj Prasad	Devi Int Udyog	9334616180
37) Ajay Kumar Kant	Hans Brick Udyog	9852481022
38) Subodh Ranjan		9308294006
39) Pappu Kumar	Tata Int Udyog	
40) Bipin Kumar	S.B. Enterprises	9939896901
41) Amrendra Kumar	Chetan Bricks	9832084701
42) Prem Kumar	Sudha Int Udyog	9263906901
43) Mahesh	Devi Int Udyog	9931004851
44) Mohan	Satya Enterprises	9546170483
45) Jai Kumar Jha		9234426702
46) Satish Kumar	Juli Bricks	8002585997
47) Mantu Singh	Rahul Bricks	9334086862
48) Rahul Sinha	Amprapali Cement	9304923514
49) Girish Kumar	Eco-Pavers	8651185618
50) Ashok Kumar	M.K.S Bricks	9931293739
51) Ramesh Singh	M.K.S Bricks	9801293766
52) Pramod Kumar	M.K.S Bricks	9162667299
53) Jai Kumar	Sharad Bricks	9334086201
54) Vijay Kumar		9204124387
55) Ashok Kumar		9204256500
56) Chandra Bhushan		9334120002
57) Devendra		9955534841
58) Arun Kumar	Hari Om Int Udyog	9852906328
59) Sanjay Kumar	Gopal Int Udyog	9420606694
60) Dharmendra	Ma Durga	954668117
61) Sadan Singh	Durga Int Udyog	9801184100
62) Arvind Kumar		9661763847
63) Mukul Anand	Bihita Om Sai Enterprises	9334149410
64) Jitendra Kumar	Soni Enterprises	9097879381
65) Sushil Kumar	Muzzafarpur	9939640608
66) Swetanjan	Muzzarfarpur	9576727508
67) Uttam Kumar	Home Bricks	9431009201
68) Prem Kumar	Harsh Bricks	9308416965
69) Rajnesh Kant	MKS Bricks	9608098119
70) Satyendra Sinha	Hero Bricks	9334160080
71) Sanjay Bricks	Prince Bricks	9334160080
72) Dhirendra Kr	Prakash Bricks	9304823470

73)	Sanjay Kumar	Shiva Bricks	9334416266
74)	Jai Narayan	JBC Bricks	9572704467
75)	Gopal	Maruti Udyog	9572704467
76)	M. Shamshad	Tata Int	9801070705
77)	Rajendra Prasad	Sona Int Udyog	9939462223
78)	Mamta Srivastava		9431494192
79)	Binod Kumar		9431079713
80)	Sunil Kumar	SBM Bricks	9835229912
81)	Prahalad Kumar	Jai Ma Bricks	9386948947
82)	Harish Kumar		9771750877

There were another 20 entrepreneurs whose names or contact details have not been recorded or entered in the List.

Media

1)	Dhirendra K	Sadha News	9473447645
2)	Kaushik Ranjan	Hindustan	9771403488
3)	R.P. Singh	Sandhya Prabhat Khabar	9386927553
4)	Awanesh Kumar	Darsh News	9771902877
5)	Avinash	ETV news	9431602748
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7)	S. Haider	Aradhna News	9031066894
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10)	Aamir Ali	Qaumi Tazveer	9546500272
11)		Taara TV	8986042099
12)	Amalendu M	Aaj	8002147573
13)	S.K. Rajiv	Kashish News	9431288046
14)	Prem Kumar	The Vigil	9334044931
15)	Vikash Ranjan	Doordarshan	9308960910
16)	Rohit Narayan	Dawn Bhaskar	9304032464
17)	Mrityunjay	Dainak Jagran	9304951909
18)	Ishwar Chand	Punjab Kesari	8936073199
19)	Ajit Kumar	Dainik Jagran	9835061888
20)	Anwar Sayeed	PTI	9431095279
21)	Chandan	D.D. News	9308562198
22)	Brajesh	Prabhat Khabar	9472481428
23)	Deepak	Sahara Samay	9431019173

Resource Persons

1)	Pritpal Singh	PSCST	9814104784
2)	Kunal Sharma	Shakti Foundation	9843338721
3)	Dheeraj	Greentech Knowledge Soln.	9717456132
4)	Sameer Maithel	Greentech Knowledge Soln.	9811392256
5)	O.P. Badlani	Prayag Kiln Technology	9935111095
6)	Sandeep Ahuja	Prayag Kiln Technology	9935005554