E2169

BANGLADESH

IMPROVING KILN EFFICIENCY IN THE BRICK MAKING INDUSTRY IN BANGLADESH

[HYBRID HOFFMAN KILN (HHK) PROJECT]

ENVIRONMENTAL MANAGEMENT FRAMEWORK (EMF)

Industrial and Infrastructure Development Finance Company Limited
Chamber Building (6th & 7th Floor), 122-124 Motijeel C/A, Dhaka-1000, Bangladesh.
www.iidfc.com

April 2009.

Table of Contents

I. Objectives 1
II. Background 2
III. HHK Technology 2
IV. Relevant National Environmental Laws and Requirements 4
V. World Bank's Environmental Safeguards 6
VI. General Principles for Sound Environmental Management 7
VII. Environmental Screening 7
VIII. Capacity-Building and Monitoring of Safeguard Framework Implementation ... 8
IX. Consultation and Disclosure 8
X. Environmental Management Plan and Monitoring 8
XI. Occupational Health and Safety 14

Tables

Table 1: Evolution of laws in the brick sector …… 4
Table-2: Mitigation and Enhancement Measures during Construction Phase …… 10
Table-3: Mitigation and Enhancement Measures during Operation Phase …… 13
Table-4: General requirements for Workers Health and Safety ……. 15

Annexure

Annex-A: Location of HHK Plants …… 18
Annex-B: HHK Manufacturing Process …….. 19
Annex –C: Environment Conservation Rules 1997 –
REGULATORY REQUIREMENTS IN THE BRICK SECTOR
…… 21
Annex-D: Ambient Air Quality Standards ……. 22
Annex-E: Checklist-Initial Environmental Evaluation (IEE) ……. 23
Annex-F: Monitoring Format ……. 37

Figure

Figure 1: Flowchart of Brick Making Process for HHKs …….. 20

Abbreviations

BDT	Bangladeshi Taka (Currency)
CEA	Clean Air Alternatives
CER	Certified Emission Reductions
DoE	Department of Environment
EA	Environmental Assessment
ECC	Environmental Clearance Certificates
ECR	Environmental Conservation Rules
EMF	Environmental Management Framework
EIK	Energy Inefficient Kiln
EMP	Environmental Management Plan
FCK	Fixed Chimney Kiln
FDCK	Forced Draft Tunnel Kiln
GDP	Gross Domestic Product
HHK	Hybrid Hoffman Kiln
IEE	Initial Environmental Examination
IIDFC	Industrial Infrastructure Development Finance Company Limited
MCK	Movable Chimney Kiln
MoEF	Ministry of Environment and Forest
MoLGRD&C	Ministry of Local Government, Rural Development & Cooperatives
SME	Small and Medium Enterprise
SPM	Suspended Particulate Matter
UNFCCC	United Nations Framework Convention on Climate Change

BANGLADESH

ENVIRONMENTAL MANAGEMENT FRAMEWORK
for
IMPROVING KILN EFFICIENCY IN THE BRICK MAKING INDUSTRY IN BANGLADESH [HYBRID HOFFMAN KILN (HHK) PROJECT]

I. Objectives

1. The Environmental Management Framework (EMF) provides general policies, guidelines, codes of practice and procedures to be integrated into the implementation of the World Bank-supported Carbon Finance initiative 'Improving kiln efficiency in the brick making industry in Bangladesh [Hybrid Hoffman Kiln (HHK) Project']. The HHK project is designed to promote cleaner technology in brick making and thus improve the environmental sustainability of brick-making sector.

2. The proposed project will support brick-making sector of Bangladesh through purchasing the Certified Emission Reductions (CERs) generated from adoption of energy efficient Hybrid Hoffman Kilns (HHK). The project will reduce estimated 881,000 tonnes of CO_2 during project period (2010-2020). The project activities include implementation of 18-22 doors 18 nos. HHK in 8 different locations. The plants will be located within greater Dhaka district except in one case. A list of project location is attached in Annex-A. The Industrial and Infrastructural Development Finance Company Ltd. (IIDFC) has been identified as the bundling agency. IIDFC, which is a Non Bank Financial Institution, will be lending directly to set up 8 nos. of the HHKs and 2-3 other financial institutions will be lending for the remaining 10 kilns.

3. Projects and programs supported by Carbon Finance Unit of the World Bank need to comply with World Bank Operational Policies. Therefore, the project activities are required to satisfy the World Bank's safeguard policies, in addition to conformity with environmental legislation of the Government of Bangladesh (GoB). The EMF has been developed to ensure compliance with the World Bank's safeguard policies under the current conditions in Bangladesh. The objective of the EMF is to ensure that activities under the proposed operations will address the following issues:

- Minimize environmental degradation as a result of either individual subprojects or their cumulative effects;
- Enhance positive environmental outcomes;
- Protect human health; and
- Ensure compliance with World Bank safeguard policies

II. Background

4. The brick-making industry in Bangladesh is best described as a "footloose" industry. Production is seasonal, confined to the six dry months of the year; technology is outdated; labor productivity low; capitalization non-existent and mostly operating on equity capital; and management is informal. Small and medium enterprises (SMEs) dominate the ownership pattern with little or no cooperatives or large-scale operations. Most brickfields are on leased land with no permanent sites and fixtures. This, along with seasonal nature of production, contributes to footloose nature of the industry. The average brickfield employs about 125 skilled and unskilled workers. Apart from 6 to 10 permanent employees, most are employed for only 6 months during the production season. These seasonal employees, mostly migrant workers from northern Bangladesh, are compelled to seek employment elsewhere during the 'off-season', in agriculture and other casual work. This contributes, on the one hand, to a precarious employment situation for the worker and, on the other, to the existing low labor productivity.

5. Total brick production in Bangladesh is estimated to be about 8.7 billion bricks annually with an estimated sale value of around US$450 million, almost 1% of Bangladesh's GDP. Growth of the brick-making industry is generally tied to the growth of the construction (particularly roads and buildings) industry, which has been growing above national GDP rates. Annual growth rate of the construction sector in Bangladesh has ranged from 8.1% to 8.9% in the last decade; the growth of the brick industry is expected to continue along this trend in the foreseeable future. The Department of Environment (DoE) under the Ministry of Environment and Forests (MOEF) is the primary government agency responsible for the regulation of the brick industry. To enforce regulations, DoE collaborates with the Ministry of Local Government, Rural Development & Cooperatives (MoLGRDC) and the Deputy Commissioners in the districts who provide the required "enforcement" outreach to all communities throughout Bangladesh.

6. Brick making in Bangladesh is a highly energy-intensive and carbon-emitting activity and is one of the largest sources of greenhouse gas emissions in Bangladesh, estimated to be in the order of 3.0 million tons of CO_2 annually. This situation is expected to exacerbate as the pace of urbanization increases and rural incomes rise, creating a growing demand for bricks. Trend data of the last decade show demand for bricks rising steadily at well over 5% annually.

III. HHK Technology

7. The technology of HHK has been selected considering its advantages of energy efficiency over the other technologies and also related low emission. HHK technology combines fuel injection and external firing in highly insulated kilns. This energy efficient Hybrid Hoffman Kiln (HHK) firing process developed in China and is now widely used there. HHK is a hybrid version of the Hoffman Kiln technology that was developed in Germany in the mid-nineteenth century. Since then it has been redesigned to improve heat retention in the kilns and to capture waste heat for recirculation in the drying tunnel.

8. The HHK design combines a highly efficient kiln technology- the Forced Draft Tunnel

Kiln (FDTK) with a unique technique of forming green bricks: granulated coal is injected for internal combustion. This approach results in lower energy usage, higher quality bricks and reduced pollution. Clay is pre- mixed with granulated coal and then extruded to produce green bricks. This unique process is fundamental to energy efficiency. Almost 80% of the total energy required is injected into bricks and only about 20% is fed externally into the firing chamber. Most of the fuel injected into the green bricks, over 95%, is completely burned during firing. This technology improves energy efficiency in two ways: through internal combustion of injected fuel in green bricks and the application of heat optimization techniques in a minimum heat loss chamber in the combustion zone of the kiln. This technology does not require any tall chimney similar to other traditional technologies. The brick making process using HHK technology is described in Annex-B.

9. Bricks of any size, shape and pigmentation can be produced in the proposed system with only minor adjustments and modifications in the process technology. All bricks are expected to be of uniform quality and will meet international standards for strength, quality and appearance, which cannot be achieved with energy inefficient kilns (EIKs).

10. The proposed HHK technology can accommodate different levels of production, depending on the size of the kiln and the number of doors, and the efficiency of the back process. The average capacity is 15 million bricks annually, compared to the traditional tall chimney kiln which produces about 2 million on the average. Assuming each HHK will produce 15 million bricks means that each new HHK plant will replace 7.5 of the older kilns in terms of capacity.

11. Since the technology is new in Bangladesh, an Independent Consultant has been engaged to review energy and environment performance of a typical HHK in Bangladesh through detailed monitoring of the first demonstration kiln. The results show that HHK requires 14 tonnes of coal per 100,000 brick production whereas the figure for Fixed Chimney Kiln is 24 to 26 tonnes. In another way, specific fuel consumption of HHK is 1.379 MJ/kg. The average value of specific fuel consumption for FCK is 2.00 MJ/kg brick. The HHK measurement was carried out during the kiln stabilization period and it is expected that coal requirement will decrease with further stabilization of the kiln. The maximum observed stack emission (suspended particulate matter) was 26.9 mg/m^3 and average stack emission was 20.3 mg/m^3. Both the value was much below the maximum allowable limit of Bangladesh (1,000 mg/m^3). The calculated mass emission load of SPM emission per 1,000 brick production was 0.879 kg compared to emission load for FCK is 1.71 kg/1,000 bricks. The result also shows that the HHK operation does not increase significantly Ambient PM_{10}, $PM_{2.5}$ and CO concentrations near the gate of the Kiln site about 100 m from the stack. The study provides a basis to understand the performance of HHK although the monitoring was carried out only in one kiln for limited time-frame. The study concluded that HHK technology can be promoted as one of the cleaner technologies for brick making. According to Bangladesh standard, 120 feet tall chimney is mandatory for FCK technology. Since the stack emission of HHK is far below the Bangladesh standard, requirement of tall chimney can be waived for initial plants and the standard can be reviewed based on further monitoring results of HHK plants.

IV. Relevant National Environmental Laws and Requirements

Brick Burning Act

12. Till 1988, brick making was an unregulated industry in Bangladesh. The government has introduced some measures of control by legislating the "Brick Burning (Control) Act 1989 (Act #8 of 1989) on February 12, 1989. The main goal of the Act was to eliminate the unrestricted and rampant use of wood fuel in brick kilns. As a first step, it was necessary to bring brick kilns within the purview of the law and greater scrutiny. This was done by introducing registration and permitting requirements. The Act was amended in 1992 and again in 2001. Each amendment sought to tighten the regulations and introduce a greater measure of emissions restrictions. The Act forbade establishing a kiln within 3 km from an upazila headquarter (smallest administrative unit) boundary limit or clusters of homesteads numbering more than 50 homes or fruit garden having 50 trees. The Table 1 provides chronological evolution over the last two decades.

Table 1: Evolution of laws in the brick sector

Year	Description
1989	Brick Burning Act, 1989 - without brick burning license none can burn bricks.
1992	Amendment of Brick Burning Act- banning of wood burning in brick kiln, licensing authority to District Commissioner instead of Upazila Chairman, inspection authority without prior notice, banning of bricks and firewood (if firewood used), BDT. 50,000 fine instead of BDT. 10,000.
1999	Circular regarding postponement of license for brick kiln due to huge sulfur deposition from coal burning in brick kilns.
2001	Amendment of Brick Burning Act-defines inspection committee, expands definition of firewood, brick kiln location (no brick kiln within 3km range from the periphery of Upazila main town, forest (area having at least 50 trees), city town, municipality, residential area).
2002	Circular- Mandatory requirement of 37 meter (120 feet) high chimney in brick field
2004	Circular- Banned the operation of Bull's Trench Kilns (BTK) and Moveable Chimney Kiln (MCK)
2006	Circular- After December 31, 2010 renewal of clearance of existing FCK will be stopped – owners are requested to switch over other clean technology

13. According to the act, the Deputy Commissioner is responsible for issuing a license for brick burning after receiving a local committee (Additional Deputy Commissioner, Upazilla Health Administrator, Environment/Forest Official and Union Parishad Chairman) report. The license is issued for three years and the Deputy Commissioner can cancel a license if any violation of act is noticed. However, the brick owner is given opportunity to justify his/her position. This act provides authority to the Deputy Commissioner or his/her representative to inspect the brick fields without prior notice and seize all bricks, equipments etc. if the brickfield uses firewood or operates without license. The act also has provision of imprisonment up to one year, or with a fine up to BDT. 50,000, or with both punishments.

14. All the brick entrepreneurs requires license from the Deputy Commissioner for setting-up and continuing brick production and have to ensure there is no use of firewood in brick burning. Old technologies like BTK and FCK can not be used any more and there is an urgency to move towards cleaner technologies.

Bangladesh Environmental Conservation Act (ECA), 1995

15. The Environmental Conservation Act (ECA) of 1995 is the main legislative framework document relating to environmental protection in Bangladesh. This umbrella Act includes laws for conservation of the environment, improvement of environmental standards, and control and mitigation of environmental pollution. This Act established the Department of Environment, and empowers its Director General to take measures as he considers necessary which includes conducting inquiries, preventing probable accidents, advising the Government, coordinating with other authorities or agencies, and collecting & publishing information about environmental pollution. According to this act, no industrial unit or project shall be established or undertaken without obtaining, in a manner prescribed by the accompanying Rules, an Environmental Clearance Certificate from the Director General. This procedural requirement needs to be followed.

Bangladesh Environmental Conservation Rules (ECR), 1997

16. The Environment Conservation Rules, 1997 were issued by the Government of Bangladesh in exercise of the power conferred under the Environment Conservation Act, 1995. Under these Rules, the following aspects, among others, are covered:

(i) Declaration of ecologically critical areas;
(ii) Classification of industries and projects into 4 categories.
(iii) Procedures for issuing the Environmental Clearance Certificate,
(iv) Procedures for issuing the Pollution-Under-Control Certificate
(v) Determination of environmental standards.

17. The Environmental Conservation Rules (ECR) contains the procedures for obtaining Environmental Clearance Certificates (ECC) from the Department of Environment for different types of proposed projects. As per Schedule-I of ECR 1997, brick making projects have been classified as Amber–B category and require Initial Environmental Examination (IEE). ECR also explains the environmental clearance process.

18. The implementing enterprise needs to submit an application along with other documents (Annex-C), and to obtain the Clearance Certificate. In addition, as per Schedule II of ECR 1997, Standards for Gaseous emission from industries or projects, 1000 mg/Nm^3 is prescribed for the kiln soot and dust in the brick sector. New technologies and practices that do not meet this minimum requirement should not be selected. Ambient air and noise standards are also applicable (Annex-D).

Issue related to National Environmental Laws and HHK Technology

19. HHK technology is in compliance with the National Environmental Laws and will significantly contribute to reduce pollution from the brick-making industry in Bangladesh. However, the only issue related to National Environmental Laws and HHK is the chimney height. According to a circular in 2002 related to Brick Burning Act, 37 meter (120 feet) chimney became mandatory for all brick kilns in Bangladesh. This was done based on studies conducted for existing technology Fixed Chimney Kiln (FCK). Since the stack emission of HHK is much lower, tall chimney was not considered in the main design of HHK in China and also in Bangladesh. The clause of the Brick Burning Act should be relaxed for HHK for the initial years during pilot demonstration. The emission of HHK will be monitored and if required the GoB Brick Advisory Committee (to be facilitated under Clean Air and Sustainable Environment Project) will recommend necessary design changes for the chimney height.

V. World Bank's Environmental Safeguards

OP 4.01 Environmental Assessment

20. The Bank requires environmental assessment (EA) of projects proposed for Bank support to ensure that they are environmentally sound and sustainable, and thus to improve decision making. EA is a process whose breadth, depth, and type of analysis depend on the nature, scale, and potential environmental impact of the proposed project. EA evaluates a project's potential environmental risks and impacts in its area of influence; examines project alternatives; identifies ways of improving project selection, siting, planning, design, and implementation by preventing, minimizing, mitigating, or compensating for adverse environmental impacts and enhancing positive impacts; and includes the process of mitigating and managing adverse environmental impacts throughout project implementation.

OP 4.04 on Natural Habitats

21. The conservation of natural habitats, like other measures that protect and enhance the environment, is essential for long-term sustainable development. The Bank therefore supports the protection, maintenance, and rehabilitation of natural habitats and their functions in its economic and sector work, project financing, and policy dialogue. The Bank supports, and expects borrowers to apply, a precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development. The Bank promotes and supports natural habitat conservation and improved land use by financing projects designed to integrate into national and regional development the conservation of natural habitats and the maintenance of ecological functions. Furthermore, the Bank promotes the rehabilitation of degraded natural habitats. The Bank does not support projects that involve the significant conversion or degradation of critical natural habitats.

22. Of the two environmental safeguard policies that are relevant to this project, only OP 4.01 on Environmental Assessment is triggered. From the initial assessment, it has been confirmed that kiln will be set-up around peri-urban areas, which will not involve any impact on critical natural habitats.

VI. General Principles for Sound Environmental Management

23. The proposed HHK Project will support the sustainable growth of the brick sector in Bangladesh. The project activities will be limited only in the brick plant sites and can be considered as environmental friendly projects in comparison to the existing technologies. Considering the extent and nature of the project and magnitude of potential environmental impacts, HHK efficiency project has been assigned an Environmental Category of "B" on overall basis. In view of the EMF objectives and assessment of the nature, the project will be based on the following principles:

- The World Bank acting as Trustee of various carbon funds will only purchase the Certified Emission Reductions (CERs) from the adoption of HHK technology and will not finance any physical intervention of the project.

- IIDFC will monitor the environmental safeguard compliance with the support of the individual entrepreneurs. The environmental safeguard will be integral part of the contract agreement between IIDFC and individual entrepreneur.

- IIDFC will use the carbon revenues for overall monitoring and emission measurement. The enterprises will ensure the implementation of agreed mitigation activities with their own funding. In case of any reported noncompliance, IIDFC will deduct the carbon revenue from the entrepreneurs and will ensure proper implementation of mitigation activities through this fund.

- No HHK plants will be set-up in disputed lands and areas restricted for development works.

- Due diligence will be ensured in site selection to protect natural habitats.

- The entrepreneurs will assess new environmental concerns (if any) due to operations of HHK plants during the project period and take necessary mitigation measures.

- All the entrepreneurs will follow the related government rules for environmental clearance, licensing and labor act for occupational health and safety.

VII. Environmental Screening

24. In compliance with the above principles, environmental screening of individual sub-project will consist of an examination of the scope of the land-based works and the associated environmental social impacts, as well as the mitigation requirements. The entrepreneur will use the government approved IEE check-list format for environment screening. The un-official English version of IEE checklist is attached in Annex-E. The enterprises should have the necessary approvals/permissions/consents from government and local government authorities in place before the subproject initiation and also need to renew/update the license/clearance as required by government procedures. In addition, the enterprises should agree to continue to be in

full legal compliance and also be prepared to adhere to the environmental management requirements that form a part of the agreement. If that is not the case, the enterprise should NOT be selected for the benefits of carbon finance.

VIII. Physical Description of Brick Sites

25. Sixteen of the 18 HHKs will be set up at different locations in Dhaka, Narayanganj and Gazipur (Greater Dhaka) districts and the other 2 in Natore in north-western Bangladesh. The Greater Dhaka has a tropical climate with three main seasons - the hot and humid summer, the rainy season and the mild and relatively dry winter. More than 85% rainfall occurs during May to October. The climate exhibits pronounced seasonal variability associated with monsoon winds - predominantly from the southwest during summer, from the northeast during winter and light and variable during spring and autumn. Natore has similar climatic condition, however generally prolonged dry period. It is also the low water table area of Bangladesh.

26. Sites for all HHKs have been selected, and the plants are either at different stages of construction or in operation. In general, the plants will be built either on new sites, or on existing ones replacing the traditional kilns. No plant will be constructed in filling the wetlands. The sites of HHKs in greater Dhaka are located at distances of about 30 km to 70 km from the Dhaka city. Location of the individual plants varies somewhat in terms of topography and extent of other developments in the surrounding areas. Three of the plants, Universal Bricks in Dhaka and SSL Bricks and Haair Bricks in Gazipur districts, are located in rural areas with no other non-agricultural developments in the surrounding area. Diamond Bricks and Sunflower Bricks which have been set up in contiguous sites in Narayanganj, are located in an area that already has some manufacturing establishments, including traditional brick kilns.

27. *Universal Bricks* in Dhamrai, Dhaka, has been built on a 7.5-acre parcel of leased private land, by replacing an existing kiln that used traditional technology. The plant is located on a somewhat higher non-irrigable land. The project is surrounded by agricultural land on three sides (north, south and west) and few families are living on east side of the project. The lands are mostly one-crop agricultural with some homesteads in the vicinity. *SSL Bricks* is located in the Gazipur village of Gazipur district, at a distance of some 70 km from the Dhaka city. The site is a 4-acre parcel bought directly from the landowners on a “willing buyer-seller” basis. The land was not used for any agricultural or commercial purposes earlier. The general area is higher and reported never to have been flooded during the monsoon when most of the country does. Land around the site is irrigated agricultural and generally produce two crops a year. There are a few homesteads in the vicinity of the kiln. *Haair Bricks* in the Sreepur Upazila of Gazipur district is a 3.14-acre parcel also purchased from private landowners on a “willing buyer-seller” basis. At a distance of more than 50 km from Dhaka, the site is located on high ground in an area with low rolling hills and some agricultural lands. There are no human settlements in the vicinity of the plant.

28. The other two HHKs, *Diamond* and *Sunflower*, are located in contiguous sites at Sawaghat in Narayanganj, some 30 km from Dhaka, and about 0.25 km from the main road. The site for the two plants together consists of 8 acres of private land purchased directly from the

owners on a “willing buyer-seller” basis. These lands were previously used as clay quarries for other brick manufacturing plants in the area, which still use the traditional technology. Land has been developed to build these plants. The surrounding is generally open with two factories, a small steel mill and a board manufacturing plant, about 0.50 km from the site. Land around the site, which is prone to inundation during the monsoon, is generally one-crop agricultural. Adjacent to the site, by the entry road to the kiln, there is a small community cemetery that was previously difficult to access during the rainy and flood season. Access to the cemetery has now been made easy by the new entry road to the kiln site.

29. The locations and physical characteristics of other HHKs in the Dhaka Division are quite similar to the ones described above. The northern regions of the country, where a few of the HHKs are going to be located are even less densely populated.

IX. Capacity-Building and Monitoring of Safeguard Framework Implementation

30. The bundler IIDFC has hired the services of the consulting firm ‘Clean Energy Alternatives (CEA)’ to support the design of the Carbon Finance Project and also to assist the implementation support and auditing. As part of the capacity-building to be provided for implementation of the proposed operations, As a service provider CEA will also provide required capacity building support to the entrepreneur to ensure environment safeguard compliance. During supervision of these operations, the World Bank will assess the implementation of the EMF, and recommend additional strengthening, if required.

X. Consultation and Disclosure

31. The EMF will be shared by IIDFC and entrepreneurs with concerned nongovernmental organizations, civil society and potential affectees. It will be disclosed in English and Bangla by IIDFC and it will also be made available at the World Bank’s InfoShop. If the sub-project requires updating of the generalized EMP, it will be available to IIDFC website and to be sent to the World Bank.

XI. Environmental Management Plan and Monitoring

32. This project can be considered as environmental friendly project since it will promote cleaner technology and will significantly reduce the emissions comparing to the existing technology. The nature of the sub-projects is same since all are using the same Hybrid Hoffman Kiln (HHK) technology for manufacturing clay bricks. A generalized Environmental Management Plan (EMP) has been developed, which can be applied for all HHK plants. However, EMP may require updating considering the local environment settings or technological modifications during operation phase. The primary objective of the environmental management and monitoring is to record environmental impact resulting from the project activities and to ensure implementation of the ‘mitigation measure’ identified earlier in order to reduce adverse impacts and enhance positive impacts from specific project activities. Besides, it would also

address any unexpected or unforeseen environmental impacts that may arise during construction and operation phases of the project.

33. The environmental management program will be carried out as an integrated part of the project planning and execution. It must not be seen merely as an activity limited to monitoring and regulating activities against a pre-determined checklist of required actions. Rather it must interact dynamically as project implementation proceeds, dealing flexibility with environmental impacts, both expected and unexpected. As the bundler of the project, IIDFC will monitor the implementation of environmental management framework. IIDFC with the assistance of CEA will ensure proper monitoring and to take appropriate measures to mitigate any adverse impact and to enhance beneficial impacts, resulting from the project activities.

Mitigation Measures of Project Impacts during Construction Phase

34. The environmental management during the construction phase will be primarily focused on addressing the possible negative impacts arising from activities:

Land development- HHK technology requires around 2.5 to 3 acres of land for one 18-22 doors kiln. The land development activities include excavation of earth, cleaning of vegetation, filling some low lands. These activities may have impact on ecological parameters such as homestead vegetation, bushes and trees, aquatic species etc.

Transport of equipments and materials- Traffic flow to and from the project site is likely to increase during the construction phase due to increased movements of vehicles carrying construction materials and equipments. This increased vehicle movement possibly result higher noise level. The negative impact of the increased traffic flow would be mostly concentrated mainly around the project sites, affecting neighboring residential areas (if any).

Construction activities- The volume of construction debris and wastes to be generated during the construction phase will not be significant unless the plant is constructed on site by replacing an existing technology. Indiscriminate storage and disposal of these construction debris and wastes could create local water logging and ponding by blocking the natural drainage lines and would be aesthetically displeasing. Also some noise is expected to be produced from plant construction activities. However, the construction work will be limited to during the day-time.

35. Table 2 summarizes the potentially significant environmental impacts during construction phase, the measures needed to eliminate or offset adverse impacts and enhance positive impacts. The project will also focus on enhancing the possible beneficial impacts from employment of local workforce for construction works.

Table-2: Mitigation and Enhancement Measures during Construction Phase

Activity/Issues	*Potentially Significant Impacts*	*Proposed Mitigation and Enhancement Measures*	*Responsible Parties*
Land development	• Change in land use • Soil erosion and sedimentation • Soil stability and compactness	• Site specific environmental investigation prior all design and construction work • appropriate engineering of slopes to prevent slumping, slippage and erosion • restoration of disturbed soil to its original use or to an approved use • re-vegetation of barren surfaces • adopting erosion control and soil stabilization measures	Consultant (CEA) and entrepreneurs (Monitoring by IIDFC)
	•		
		•	
Transportation of equipment and materials	• Increased traffic/navigation • Generation of noise especially affecting residential areas	• In case of any objection from the local communities regarding noise disturbance due to construction activities, scheduling of transportation may be done in consultation with local communities. • Speed reduction provision in critical areas and road turns • Use of safety road symbols if required	Entrepreneur (Monitoring by IIDFC/CEA)
	• Wind –blown dust from material (e.g., fine aggregate) storage areas	• Watering unpaved/dusty roads • Sprinkling and covering stockpiles • Covering top of trucks carrying construction debris away from the site	

Activity/Issues	*Potentially Significant Impacts*	*Proposed Mitigation and Enhancement Measures*	*Responsible Parties*
Construction activities, including operation of construction equipment	• Generation of noise from construction activities (general plant and access road construction), especially affection the nearby school and residential areas	• Avoiding as much as possible, construction equipment producing excessive noise during school hours and also at night • Maintaining equipment in good working condition and where appropriate using noise suppressors, mufflers and acoustic hoods • Creation a buffer zone between the school/residential areas and construction site to reduce disturbance to normal schooling/residential activities, if there is close school/residence.	Entrepreneur (Monitoring by IIDFC/CEA)
	• Generation of construction waste (specially in old brick field)	• Hauling of construction debris away from the site and their appropriate disposal in a sanitary landfill	
	• Accidents	• Regular inspection and maintenance of equipment • Environmental health and safety briefing • Provision of protective gear	
	• Loss of work opportunity due to converting agricultural land in brick kiln	• Employment of local people in construction related works as much as possible	

Mitigation Measures of Project Impacts during Construction Phase

36. Most of the environmental parameters will experience beneficial effects during the operation phase of the HHK operation in comparison to the Bangladesh Standard and existing FCK technology. Efforts should be made to enhance these beneficial impacts for overall sustainable development in brick making sector. The following the activities, which may cause environmental concern:

Raw Materials for Green Bricks- Clay is the major raw material used in traditional green brick making in Bangladesh. It is mainly obtained from different farmlands, which causes depletion of top soil and arable land. In addition, the plant area is subjected to high temperature during brick burning. This may result in making the land unsuitable for cultivation even after years of site abandoned. However, HHK technology requires less land compared to FCK (in terms of brick production/plant area).This may be noted here

that the production capacity of one 18-22 door HHK is around 7.5 times of one typical FCK. Moreover, HHK project will promote sourcing of clay from river bed, canal bed and beds of other water bodies without disturbing any major changes in river morphology or other water bodies. Thus this technology is also reducing the agricultural land degradation by preventing the use of top soil of cultivable land in the green brick production. In addition, HHK brick making process uses coal as internal fuel, which also reduces the demand for clay as raw materials for green brick making.

Brick making also consumes considerable amount of water. Many brick fields are located close to the river to utilize surface water. However, majority draws water from groundwater reservoirs (depth varies depending on hydro-geologic condition) and may cause lowering of groundwater especially during dry season for irrigation purposes.

Plant Operation- Emissions from brick manufacturing facilities include SPM, PM_{10}, $PM_{2.5}$, SO_2, NOx, CO, CO_2 and many more hazardous air pollutants. Factors that may affect emissions include raw material composition and moisture content, kiln fuel type, kiln operating parameters, and plant design. As mentioned earlier, the monitoring of the first HHK indicates the stack emission is far below the Bangladesh standard. The CO at factory gate was also below the Bangladesh Standard. Although PM_{10} and $PM_{2.5}$ at factory gate were higher than the standard, these values were higher even during non-operation period. However, inadequate or inappropriate operation of kiln may increase emission levels. Higher emissions are also expected during stabilization period after start-up in new season. Use of coal with more ash and sulphur content also leads to higher emissions. In the project, the entrepreneurs will use coals having higher calorific values (with low sulphur and ash content) which will be monitored on regular basis as part of Certified Emission Reductions (CERs).

The brick making process generates significant amount of fly ash from burning of coals. HHK requires around 50% less coal compared to FCK and accordingly fly ash production in HHK is much less than FCK. Fly ash is also used as insulating materials in the process. Direct exposure to dust, coal particles and fly ash may cause health hazards to workers and nearby non-worker community.

No model simulation study is carried out to identify the noise level during the plant operation. However, HHK operation does not involve heavy machineries and equipments or any heavy rotary machine or engines that would create substantial noise disturbance. Hence the noise level is likely to be within the Bangladesh standard 75dBA during plant operation.

Transport of bricks- Traffic flow will be increased significantly during the operational phase for delivering the produced bricks. This increased vehicle movement will lead to higher noise level. The negative impact of the increased traffic flow would be mostly concentrated mainly around the project sites, affecting neighboring areas.

37. Table 3 summarizes the potentially significant environmental impacts during operation

phase, the measures needed to eliminate or offset adverse impacts and enhance positive impacts. The project will also focus on enhancing the possible beneficial impacts from employment of local workforce for construction works.

Table-3: Mitigation and Enhancement Measures during Operation Phase

Activity/Issues	***Potentially Significant Impacts***	***Proposed Mitigation and Enhancement Measures***	***Responsible Parties***
Raw Materials for Green Bricks	• Depletion of top soils and farmland	• Promote use of clay from non-agricultural land • Use optimal amount of coal as internal fuel • Explore options for use of alternative materials • Planting of indigenous trees around the project site, especially along the boundary of the school and residential areas located close to the project site	Entrepreneur (Monitoring by IIDFC/CEA)
	• Lowering of groundwater during dry seasons (possibility in few locations)	• Encourage recycling and reuse of water where possible • Monitoring of groundwater level during dry season	
Plant Operations	• Emission of particulate materials and flue gases	• Optimal use of high-grade coal • Regular maintenance of plant • Capacity building of master mason and other workers • Monitoring emission of particulate materials and flue gases of first 4 kiln once in the first year and second 4 kiln once in the second year with project cost • Adjustment of design (increase of chimney height etc.) if required.	Entrepreneur (Monitoring by IIDFC/CEA)
	• Exposure of dust, fly ash and coal particles	• Mandatory use of masks where necessary and other safety provision for workers • Provision of sufficient covering of storage materials • Watering of bare areas • Proper disposal of unused fly ash from the site • Ensuring proper house keeping	

Activity/Issues	*Potentially Significant Impacts*	*Proposed Mitigation and Enhancement Measures*	*Responsible Parties*
	• Generation of sewage, solid waste and others	• Construction of sanitary latrine and septic tank system • Erecting no litter sign, provision of waste bins/cans, where appropriate • Waste minimization, recycle and reuse • Proper disposal of solid waste • If the rejected bricks are not reused, disposal of such bricks should be in an appropriate manner	
	• Generation of noise from plant operation	• Maintaining equipment in good working condition and where appropriate using noise suppressors, mufflers and acoustic hoods	
Transport of Bricks	• Generation of noise from transportation of bricks	• In case of any objection from the local communities regarding the noise pollution during transportation of bricks, scheduling of brick deliveries may be done in consultation with local communities • Speed reduction provision in critical areas and road turns • Use of safety road symbols if required • Encourage voluntary indigenous tree plantation around road side to make a buffer zone with local residence	Entrepreneur (Monitoring by IIDFC/CEA)

38. IIDFC/CEA will use a reporting format to collect information related to environmental and occupational health & safety issues in HHK operation twice in a year (Annex-F). In addition, the project will conduct regular monitoring of the following parameters as part of UNFCCC monitoring requirement for this carbon finance project. This information will be publicly available. The parameters are:

i) Quantity of coal consumed per year for brick making
ii) Calorific value of coal consumed for brick making
iii) Total number of bricks produced per year
iv) Weights of bricks
v) Specific fuel consumption per brick
vi) Number of operational days of the kiln in a year

XI. Occupational Health and Safety

39. The project will ensure occupational health and safety practices in both construction and operation phase to minimize accidents and work related ill health. Improved health and safety management can bring significant benefits to the business. It reduces individual and human costs of accidents and ill health, direct and indirect cost to the business, improves customer perception and company profile and workers' morale.

General Requirements

40. In Bangladesh the main law related to occupational health and safety is Labor Law 2006. The law has provisions on occupational hygiene, occupational diseases, industrial accidents, protection of women and young persons in dangerous occupation. The key salient features of the general requirements for the workers' health and safety stated in this law is presented in Table-4.

Table-4: General requirements for Workers Health and Safety

Issues	***Requirements***
Health and Hygiene	• Cleanliness • Proper ventilation and temperature • Protection against dust and fumes • Disposal of wastes and effluents • Proper illumination • Provision of adequate latrines and urinals • Sufficient spittoons and dustbins
Safety	• Safety for building and equipment • Precautions in case of fire • Fencing of machinery • Floor, stair and passage way • Precautions during work on or near machinery in motion • Monitoring against carrying of excessive weights
Compensation for accidents at work	• Owner's responsibility for compensation • Amount of compensation • Report on fatal accident and treatment • Compensation on contract and contract registration • Scope for appeal
Dust and Fumes	• For any dust or fumes or other impurities likely to be injurious to the workers, effective measures shall be taken to prevent its accumulation and its inhalation by workers
Overcrowding	• No work room in any factory shall be overcrowded • Minimum space requirement for every worker employed in a work room

Issues	*Requirements*
Latrines and urinals	• Sufficient latrines and urinals shall be provided • Shall be maintained in clean and sanitary condition • Shall be adequately lighted and ventilated
Precautions in case of fire	• Shall be provided with means of escape in case of fire • Effective measures shall be taken to ensure that all the workers are familiar with the means of escape • Fire fighting apparatus should be provided and maintained
First aid	• First aid facility should be provided and maintained. • Ensure one first aid box for every one hundred and fifty workers • Shall be kept with a responsible trained person who shall be available during the working hours
Disposal of wastes and effluents	• Provide with proper disposal system for solid waste and effluents. • In case of a factory where no public sewerage system exists, prior approval of the arrangements should be made for the disposal of wastes and effluents
Compensation	• If personal injury is caused to workmen by accident arising in the course of employment, employer shall be liable to pay compensation • Monthly payment as compensation for temporary disablement are – Compensation should be paid for the period of disablement or for one year whichever period is shorter – Such compensation shall be paid at the rate of full monthly wages for the first two months – Two thirds of the monthly wages for the next two months and at the rate of the half of the monthly wages for the subsequent months – In case of chronic occupational diseases, half of the monthly wages during the period of disablement for a maximum period of two years shall be paid

Health Hazards

41. The HHK construction and operation is not expected to cause any major health impacts. Handling the coal, dust and fly ash can cause eye and respiratory irritation and in some cases allergic reactions. The inhalation of exhaust gases from kiln and transport vehicles are also harmful for health. Excessive and continuous noise contributes to loss of hearing and triggers physiological and psychological body changes. Stress can be caused by working in shifts, high

work load, poor living condition of workers etc. A quantification of the measure of severity in health hazards is not well defined. They are slow acting and cumulative, their effects may not be visible for years. The project will encourage the entrepreneurs to adopt the following measures to minimize the hazards arising from the activities at different phases of HHK construction and operation:

- Informing the workers about the potential health impacts
- Arranging proper medical examination prior to and during employment, as well as tests and analyses necessary for the detection of diseases
- Providing adequate protective gear to the workers exposed to large amounts of dust, fly ash and coal
- Frequent spraying of water to minimize dust pollution
- Providing access to amenities for welfare and personal hygiene needs such as sanitary toilets, potable drinking water, washing facilities, and shelter sheds etc.
- Provision of proper disposal of waste and sludge
- Providing hygiene education to the workers

42. Wastewater, in the form of human wastes, will be generated mainly in the temporary labor sheds during the construction phase. This could be a source of local pollution if not properly disposed. Use of unsanitary latrines and improper disposal of human waste would create environmental pollution and adversely affect health and well being of the people at the construction site by increasing the risk of disease transmission. In addition, there would be solid waste of domestic nature would be generated from the temporary labor sheds. The volume is not expected to be significant. But, indiscriminate disposal of such solid waste would create environmental pollution and unhealthy situation at the project site. Similar to the construction phase, wastewater will be generated from workers living in labor sheds. Since HHK will be operated round the year, the entrepreneurs have agreed to provide sanitary latrine with septic tanks for the workers under community benefit plan. Adequate hygiene practices will also be promoted among the workers.

Safety

43. Safety implies the reduction of risk of accidents at the work site. Accident prevention is more valuable than any compensatory measures. This may be achieved through strict rules and procedures for the execution of specific tasks, enforcement of the rules, discipline amongst workers, maintenance of machineries used and by providing all necessary gear or equipment that may enhance the safety of the workers. The following guidelines should be followed to maintain the safety of the workers:

- Orientation of workers about the safety procedures related to their respective jobs
- Ensuring sufficient lighting in the area where a person performs construction work or may be required to pass through, including access ways and emergency exit or passage without risk to health and safety
- Providing safe access at construction site to and egress from all places where they

may be required to work or pass through. This includes the provision of emergency access and egress route that must be free from obstructions

- Installing adequate perimeter fencing on the site before construction work commences and that should be maintained during the construction work and operation period
- Ensuring all electrical equipments are properly designed, installed, insulated (as required) used, maintained and tested to eliminate the risk of electrical shock, burns, fire or explosion
- Keeping HHK site orderly and tidy
- Maintaining access ways clear of materials and debris and also in a non-slippery condition
- Storing materials in an orderly manner so that it does not pose any risk to the health or safety of any person
- Storing hazardous materials in different places with proper shelter against rain and any form of water
- Limiting access to hazardous storage place and making the area as hazardous material storing place
- Making of first aid facility accessible when construction and operation works are being undertaken.

Annex-A

Location of HHK Plants

HHK kilns 18 door	*Location*	*Reported status of Implementation*	*Construction Start*	*Commissioning Earliest*	*Financier*
Universal (2)	**Area:** Amtoli, Dhamrai, Savar **Latitude:** 23°58'52.00"N **Longitude:** 90°11'28.00"E	2 Commissioned	June 2006 and October 2007	January 2008	Equity Financed
Diamond (2)	**Area:** Rupganj, Narayanganj **Latitude:** 23°48'00" N **Longitude:** 90°34'50"E	Initial Firing is done. Need several firing to be stabilized	March 2008	November 2008	IIDFC
Haair Bricks(2)	**Area:** Gazipur **Latitude:** 23°56'11.00"N **Longitude:** 90°14'5.00"E	Land purchased Machinery imported	April 2009	September 2009	IIDFC
Sunflower (2)	**Area:** Rupganj, Narayanganj **Latitude:** 23°53'5.00"N **Longitude:** 90° 8'58.00"E	Land purchased and the project site is ready for starting construction. L/C will be reopened in April 2009	April 2009	September 2009	IIDFC
SSL (2)	**Area:** Gazipur **Latitude:** 24°10'51.00"N **Longitude:** 90°23'19.00"E	Equipment shipped and will arrive within 1 month 40% of the Kiln Construction is done, dryer and green brick section is still not started.	January 2009	May 2009	Bank Asia Ltd.
Banalata (2)	**Area:** Natore **Latitude:** 24°48'17.00"N **Longitude:** 88°57'14.00"E	Land purchased	May 2009	November 2009	Janata Bank
Kapita (2)	**Area:** Dhamrai, Savar **Latitude:** $23^0 55' 11.00"$ N **Longitude:** $90^0 7' 47''$ E 90°11'28.00"E	Land purchased. Construction will start by April, 2009	April 2009	September 2009	Agrani Bank
Eeta and Tiles Ltd. (4)	**Area:** Gazipur **Latitude:** **Longitude:**	Land purchased	April 2009 and October 2009	September 2009 and March 2010	Mutual Trust Bank

As on January 06, 2009.

Annex-B

HHK Manufacturing Process

Clay Extraction, Transportation and Preparation: The clay is excavated by hydraulic excavator or by hand from nearby riverbeds or surface clay mined from open pit and transported to plant stacking yard by trucks. The clay is crushed by means of roller mills and then by double shaft mixer where water and granulated coal is added in such a manner as to ensure moisture content of 15%.

Coal Crushing and Pulverizing: Coal is crushed using steel sieve type crushing machine to pulverize the coal.

Brick Shaping: The tempered material is fed into vacuum extruder for continuous column production. The column is then cut by Clay bar cutting machine. The green bricks are set on wood planks that are manually loaded on the drying cars for drying.

Brick Drying: The green brick is then manually loaded on to the drying car, which is then transported into the drying tunnel by means of hydraulic pusher. Hot air for drying is funneled into the tunnel from the annular kiln. The drying cycle is about 24 hours.

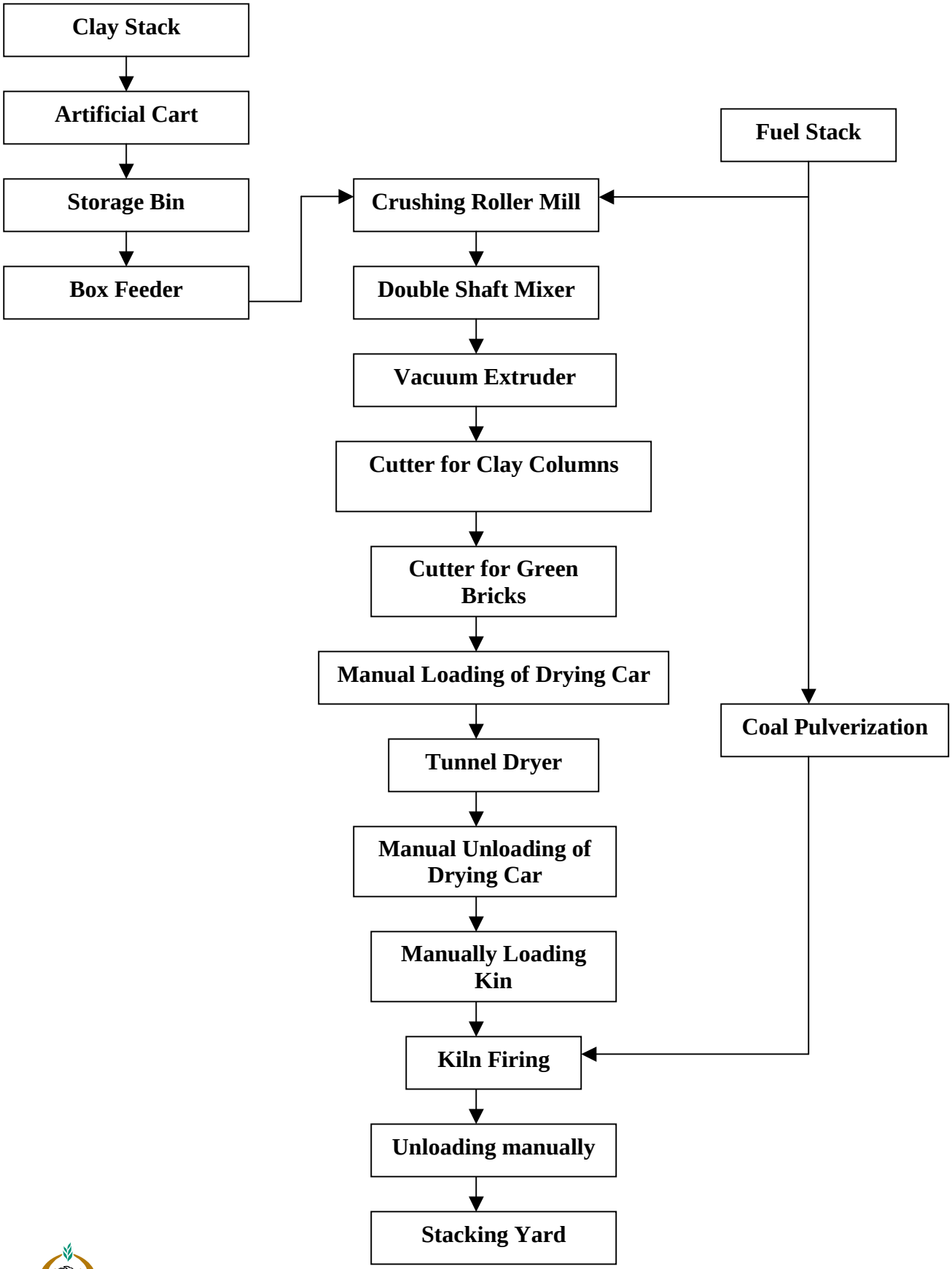
Brick Firing: The dried green bricks are unloaded manually into the annular HHK (Hybrid Hoffman kiln). The speed of firing is 1.25 m/h at a sintering temperature of about 950-1050^{0}C. The fired brick are unloaded and conveyed manually in carts to stacking yard.

Main technical data includes:

Clay Particle size after roll mill:	< 2mm
Brick Moisture content for shaping:	18%–20%
Dry chamber temperature	120 ^{o} C
Sintering temperature:	950 ^{o}C –1050 ^{o}C

The schematic diagram for the brick making process using HHK is shown in Figure-1.

Figure 1: Flowchart of Brick Making Process for HHKs



Annex-C

ENVIRONMENT CONSERVATION RULES 1997 – REGULATORY REQUIREMENTS IN THE BRICK SECTOR

Category of the brick sector

As per Schedule - 1, bricks / tiles have been classified as Orange-B Category. For the purpose of issuance of the Environmental Clearance Certificate, the industrial units and projects shall - in consideration of their site and impact on the environment - are classified four categories: (a) Green, (b) Orange - A, (c) Orange - B and (d) Red.

Procedure for applying for the Environment Clearance Certificate

As bricks/tiles have been classified as Orange-B Category, the following documents shall be submitted along with the application for the Environmental Clearance Certificate:

(i) Report on the feasibility of the industrial unit or project

(ii) Report on the Initial Environmental Examination of the industrial unit or project, and also the process flow diagram, Layout Plan (showing location of ETRP), design of the ETP of the unit or project,

(iii) Report on the Environmental Management Plan (EMP) for the industrial unit or project, and also the Process Flow Diagram, Layout Plan, design of the ETP and information about the effectiveness of the ETP of the unit or project.

(iv) No objection certificate from the local authority

(v) Emergency plan relating adverse environmental impact and plan for mitigation of the effect of pollution

(vi) Outline of the relocation, rehabilitation plan (where applicable)

(vii) Other necessary information (To be provided time to time).

Standards for gaseous emissions

As per Schedule II, Standards for Gaseous emission from industries or projects, 1000 mg/Nm^3 is prescribed for the kiln soot and dust in the brick sector.

Annex-D

Ambient Air Quality Standards

Pollutant	***Standards***	***Average Time***
Carbon Monoxide (CO)	10 mg/m^3 (9 ppm) (Ka)	8-hour
	40 mg/m^3 (35 ppm) (Ka)	1-hour
Lead (Pb)	0.5 µg/m^3	Annual
Oxides of Nitrogen (NO_X)	100 µg/m^3 (0.053 ppm)	Annual
Suspended Particulate Matter (SPM)	200 µg/m^3	8-hour
PM_{10}	50 µg/m^3 (Kha)	Annual
	150 µg/m^3 (Ga)	24-hour
$PM_{2.5}$	15 µg/m^3	Annual
	65 µg/m^3	24-hour
Ozone (O_3)	235 µg/m^3 (0.12 ppm) (Gha)	1-hour
	157 µg/m^3 (0.08 ppm)	8-hour
Sulphur Dioxide (SO_2)	80 µg/m^3 (0.03 ppm)	Annual
	365 µg/m^3 (0.14 ppm) (Ka)	24-hour

Source: Ministry of Environment and Forests, Notification related to Environment Conservation Rules 1997 - Schedule 2, 16 July 2005

Abbreviation:

ppm: Parts Per Million

(Ka) Not to be exceeded more than once per year

(Kha) Annual average value will be less than or equal to 50 microgram/cubic meter

(Ga) Average value of 24 hours will be less or equal to 150 microgram/cubic meter for one day each year.

(Gha) Maximum average value for every one hour each year will be equal or less than 0.12 ppm.

Annex-E

Initial Environmental Evaluation (IEE)

Orange-B and Red Classified Industrial Project IEE checklist

Put necessary information in the blank space/put tick sign (🗹) and provide necessary information with attachment as applicable,

1.1 General Information

1.1 Name of Company : _____

a) Sponsor/Sponsors' name : _____

b) Contact Address : _____

_____

1.2 Name of Industrial Project : _____

a) Location of Project ::
_____

_____

b) Present Address of the Office : _____

_____

c) Telephone/Fax : _____

d) E-mail : _____

(Attach a general map of the area showing roads, khal, beel, river, forest and other important establishments. Attach the general map marked as Attachment-1)

2.0 Description of the proposed project

2.1 Total Amount of Investment in the project: _____

2.2 Description Project Land

a) Total Amount of Land in the project : _____ sq. meter

b) Amount of Land for Development : _____ sq. meter

c) Amount of covered land by establishment: _____ sq. meter

(Layout plan of the project: Attachment-2A, Map of the project area showing distance: Attachment-2B and Picture of the Project Site Attachment=2C – to be attached)

2.3 Land use of the proposed project site

2.3.1 Current use of the land: _____

2.3.2 Current use of land within 1.0 kilo meter radius area: _____

2.3.3 Width of the project nearest mail road: _____ meter

2.3.4 What are located in the 1.0 kilo meter distance of the project?

✒Wetland ✒Natural Waterways ✒Flood Control Water Reservoir

✒Forestry ✒Residential Areas ✒Park/Play Ground

✒Hill/Tila ✒Others

2.3.5 What are situated within 500 meters of the project?

✒Historical site ✒Military establishment ✒Specified area

✒ Hospital/Clinic ✒Key point installation ✒ Restricted area

✒Educational Institution ✒Ecologically critical area ✒Residential Areas

✒Industries polluting air quality ✒Food silos ✒Others

2.3.6 Boundary of the project

North: _____

South: _____

East: _____

West: _____

2.4 Description of Project Phases

2.4.1 Construction Phase

2.4.1.1 Buildings for the Industrial Project

◘ Will be constructed ◘ Will be taken on rent

Use of different floors of the building	Number of floor	Area of floor (sq. meter)
◘ Administration/Office	_____	_____

- Factory/Production Activities _____ _____
- Raw materials storage _____ _____
- Rest House/Day Care _____ _____
- Canteen _____ _____
- Toilet facilities _____ _____
- Waste Treatment Plant _____ _____
- Water purifier _____ _____
- Generator _____ _____
- Dangerous Waste Storage _____ _____
- Solid Waste Storage _____ _____
- Others _____ _____

2.4.1.2 Services for Construction of Buildings

a) Water

Source: _____ Daily consumption: _____ Cubic meter

b) Electricity

Source: _____ Daily consumption: _____ KWH

2.4.2 Factory Operation Phase

2.4.2.1 Description of production activities/processes (If necessary please use additional paper and enclose a flow-diagram: Attachment-2D).

_____

_____

_____

_____

_____

_____

_____

2.4.2.2 Operating time of Factory:

Average: _____ Hour/Daily: _____Day/hour

Maximum: _____ Hour/Daily: _____ Day/hour

2.4.2.3 Raw materials and finished products (provide a list of all materials used in the production including the chemicals required in the production and use additional space if required)

Raw Materials	Source of raw materials	Quantity (annual)
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

2.4.2.4 Production Capacity (provide list of all products, if necessary use additional space)

Manufactured products	Quantity (annual)
_____	_____
_____	_____
_____	_____
_____	_____

2.4.2.5 Description of manpower:

Administrative : _____

Production process : _____

Environmental management; _____

Total: _____

2.4.2.6 Description of equipment: (Give list of all necessary machineries, use additional space if necessary)

Equipment	Quantity
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

2.4.2.7 Electricity supply:

Supplier Production Capacity (applicable cases) Demand

- National Grid Line
- Own Generator
- Others

2.4.2.8 Water Supply

Source	Description	Use of water	
		Domestic	Industry
Supplied water	_____	_____	_____
Surface water	_____	_____	_____
Own deep tubewell	_____	_____	_____
Recycled water	_____	_____	_____
Others	_____	_____	_____

2.4.2.9 Supply of Fuel (Gas/Coal/Furnace oil etc.)

Source: _____ Daily use _____ Cubic meter/ton/liter

3.0 List industrial wastage (Identify the waste from the production process)

- Acid waste (such as hydrochloric acid, sulphuric acid, nitric acid etc.)
- Base waste (caustic soda, caustic potash, sodium cleaner etc.)
- Asbestos waste
- Ceramic/mineral wastage
- Polluted pots or containers (containers of chemical materials or paints etc.)
- Chemical fertilizer and insecticide waste
- Glass waste
- Stable waste (solidified, chemically fixed and encapsulated wastage)
- Non-organic chemical waste (such as arsenic, copper, cadmium etc.)
- Tannery waste
- Metallic waste
- Oil (such as waste oil, oil/water mixed)
- Organic sludge
- Organic solution (such as halogenated, aliphatic, aromatic, mixer)
- Color/Ink/Paint waste
- Paper waste
- Pathogenic or hazardous waste
- Pharmaceutical waste
- Plastic waste
- Plating waste
- Perishable waste (such as grease trap wastage, organic wastage)
- Reactive chemical waste (such as explosive, reducing and oxidizing agent)
- Resin/latish/adhesive
- Rubber waste
- Styrofoam waste
- Textile waste
- Others, please mention

4.0 Produced Liquid Wastage: (Identify source of liquid wastage, nature of polluter and probable quantity and use additional space if necessary)

Source of liquid wastage	Probable quantity	Nature of Polluter	
		Poisonous	Ordinary
Production process	_____	☐	☐
Washing/Cleaning	_____	☐	☐
Cooling	_____	☐	☐
Domestic sanitary waste	_____	☐	☐
Recycled water	_____	☐	☐
Others _____	_____	☐	☐

4.1 Process of refining liquid waste:

Source of liquid waste		Process of refining liquid waste	
	Own ETP	Joint ETP	Direct Delivery
◘ Production process	☐	☐	☐
◘ Washing/Cleaning	☐	☐	☐
◘ Cooling	☐	☐	☐
◘ Sanitary waste	☐	☐	☐
◘ Refined water	☐	☐	☐
◘ Others _____	☐	☐	☐

Total Quantity
Final delivery place of liquid waste: _____

4.1.1 Proposed treatment of liquid waste (Enclose the Layout of ETP: Attachment-4A)

Refining capacity of ETP: _____ Cubic meter/daily

Units of ETP:

Infrastructure	◘ screening ◘ Well water separator	◘ Equalizer ◘ Sedimentation	◘ Grit removal ◘ Others, _____
Chemical	◘ Adsorption ◘ Flocculation/Coagulation	◘ Disinfection ◘ Chemical Oxidation	◘ pH correction ◘ Others, _____
Organic	◘ Sequencing Batch Reactor ◘ Biological conductor ◘ Stabilization pond	◘ Activated sludge ◘ Trickling filter ◘ Anaerobic digestion	◘ Aerated lagoon ◘ Others, _____
Sludge Treatment	◘ Thickening ◘ Digestion	◘ Heat dried ◘ dewatering	◘ Kiln burnt ◘ Others, _____
Others	◘ Ion exchange ◘ Activated carbon absorption	◘ Membrane filtration ◘ Septic tank and soak well	◘ Reverse Osmosis

4.1.2 Removal of Sanitary wastage/Treatment System (Enclose layout plan of Sanitary Wastage Refinery Plant ; Attachment-4B)

Capacity: _____

- ◘ Outlet through the prevalent sewerage line
- ◘ Own sewerage treatment plant
- ◘ Own septic tank and soak well
- ◘ Others

4.1.3 Water treatment system

- ✔ Chlorination
- ✔ Deionization
- ✔ Reverse osmosis
- ✔ Others

5.0 Drainage System (Enclose Drainage layout plan; Attachment-5)

Nature ◘ Open Drain ◘ Covered/under-drainage

Where the drainage will be connected?

◘ Public drainage ◘ Canal/river ◘ Others, _____

6.0 Particulate and Gasoline outlet (Mention the gasoline waste source and nature of pollution and use additional space if necessary)

	Source	Nature of particulate and gasoline discharge					
		Particulate	Acid smoke	Sulphur dioxide	Nitrogen Oxide	carbon & dust	Others

- ◘ Power plant
- ◘ Own Generator
- ◘ Furnace
- ◘ Woven
- ◘ Varnish Cattle
- ◘ Paint booth
- ◘ Boiler
- ◘ Incinerator
- ◘ Rotary kiln
- ◘ Others

6.1 Gas outlet control system (Put tick sign to the following which will be established)

◘ Chimney ◘ Dust collector ◘ Scrubber ◘ Exhaust fan

◘ Toxic gas filtration ◘ Gas absorption ◘ Cyclone (with duct, ID fan & Stack)

◘ Electrostatic precipitator (ESP) ◘ Bag houses/Fabric Filtration ◘ Others, _____

7. Sound pollution control system

- Insulator
- Muffler
- Silencer
- Thick wall
- Gas wool
- Canopy
- Others

8. Actions necessary to be taken for maintaining occupational health (Put tick sign on the following which will be established)

- Musk
- Safety spectacles
- Gloves
- Strong boot
- Helmet
- Ear plug
- Others

9. Affect identification and mitigation

Legend: D- Direct affect In- Indirect affect
L- Long term affect S - Short term affect
R- Reversible I - Irreversible

9.1 Construction Phase

Probable Affect	Impact of affect			Mitigation/enhancement measures
	D/In	L/S	R/I	
Dust from the cleaning of area, construction work and earth work				▫ Regularly spray water in the earth road/open earthen area ▫ Remove earth/mud from the truck before leaving the project area ▫ Carrying goods with covered triple in the truck ▫ Provide temporary fencing around the construction area ▫ Others
Removal of earth from the surface of the land after construction of earth work, connecting road etc.				▫ Stock the surface earth in a safe place and create a lair on the tope of the filled in area ▫ Planting in the construction area as soon as possible
Evolution of earth from the open space because of removal of earth				▫ Carry out construction work during the dry season

Probable Affect	Impact of affect			Mitigation/enhancement measures
	D/In	L/S	R/I	
and digging of the area				◘ Establishment of barrier net
Siltation of the drain or water sheds from the open land piles				◘ To present siltation, temporary silt trap to be established/dig up pond ◘ Pile up the spoiled earth away from the drain in a plain land ◘ To use the spoiled land in filling up the low land
Pollution of the nearby water sheds because of the removal of the construction waste				◘ Construction of temporary shed for waste within the construction area and removal of solid waste properly ◘ Arrange for sufficient toilets ◘ Arrange to properly abide by construction rules for removal of waste and sanitation by the contractors and labors
Employment generation				◘ Preference should be given to the local labors when employed
Increase the rate of accidents				◘ Arrange for strict observance of the safety measures at the time construction

9.2 Operation and Maintenance Phase

Probable Affect	Impact of affect			Mitigation/enhancement measures
	D/In	L/S	R/I	
Problem to nearby community or to their properties				◘ Arrange for sufficient buffer zone ◘ Tree plantation in the buffer zone area ◘ Raise boundary wall around the project area ◘ Others
Air pollution for the dust, smoke etc.				◘ Adapting air pollution control measures ◘ Others
Pollution of surface and underground water due to domestic waste				◘ Construct effective safety tank and soak pit ◘ Construction of appropriate wastage treatment plant for sewerage wastage ◘ Others
Pollution of surface and				◘ Construction of appropriate

Probable Affect	Impact of affect			Mitigation/enhancement measures
	D/In	L/S	R/I	
underground water because of industrial liquid wastage				sewerage treatment plan caused for the industrial liquid wastage ◘ Others
Pollution of the environment and work place because of hazardous waste				◘ Treatment of hazardous waste ◘ Burning in an inclinator ◘ Maintained properly ◘ Others, _____
Sound pollution				◘ Take necessary action to control sound pollution (such as insulator, muffler, silencer) ◘ Others, _____
Odor				◘ Arrange for sealed container, masking agent etc. ◘ Others, _____
Vibration created for machine run				◘ Adequate measures for controlling vibration (such as shock absorber, damper/isolator, spring isolator) ◘ Others _____
Problems created out of solid Waste				◘ Adequate facilities for waste separation/storage ◘ Training of workers on waste management ◘ Collect wastage regularly in an environment friendly manner ◘ Returning lead acid battery only to the specified dealers ◘ Deposition of solid waste to specific dump site or sanitary land fill ◘ Others, _____

10. Environment management and monitoring planning (EMP)

Project Activities	***Place of monitoring***	***Monitoring parameter***	***Monitoring frequency***	***Responsible person/unit for monitoring***
Construction Example: Solid Waste Collection	Construction Area	Disposed goods	Weekly/Daily	
Operation Example:				

Project Activities	*Place of monitoring*	*Monitoring parameter*	*Monitoring frequency*	*Responsible person/unit for monitoring*
Solid Waste production	Production/Packaging/ Storage area	Weigh of Packing goods/scraper	Daily	
Industrial liquid waste outlet	Solid waster storage area Liquid waste refinery	pH, BOD, COD, Temp, TSS. TDS, SS etc.	Quarterly	
Air polluter discharge	Mention place(s) of emissions	SMP/PM, NOx, SOx,	Quarterly	
Disposal of hazardous waste	Production area	Quantity, Storage, Leveling	Daily	
	Hazardous waste storage area	Quantity, Storage, Leveling	Daily	
Work environment	Production area	Light, air, humidity, sound, temperature	Quarterly	

11. Emergency Management

11.1 Probable calamity situation

- Fire
- Explosion
- Death of labor for dangerous work or serious injury
- Discharge/leakage of poisonous gas
- Discharge of harmful products for environment
- Others

11.2 Arrangement to be made to prevent or face dangerous situation

Dangerous situation	*Preventive measures*	*To Face/Control measures*
Fire	◘ Fire exit ◘ Keep water in the water pot ◘ Fire hydrant ◘ Emergency light/indicator ◘ Organize regular fire drill ◘ Others, _____	◘ Safe rescue of workers ◘ Health services at safe places ◘ Communicate with hospital/Civil Defense ◘ Fire extinguishing using fire extinguisher ◘ Others, _____
Explosion	◘ Checking plant equipment	◘ Quickly closing plant operation

Dangerous situation	*Preventive measures*	*To Face/Control measures*
	regularly ◘ Setting alarm creating equipment ◘ Manual preparation and training on safety issues of plant operations ◘ Arrangement of safe places for transferring during emergency situation ◘ Arranging primary treatment ◘ Others, _____	◘ Safe rescue of workers ◘ Health services at safe places ◘ Communicate with hospital/Civil Defense ◘ Others, _____
Discharge of hazardous products and poisonous gases	◘ Checking plant equipment regularly ◘ Setting alarm creating equipment and automatic shut-down of plant during discharge of hazardous products and poisonous gases ◘ Manual preparation and training on safety issues of plant operations ◘ Provision of required medicine to tackle hazardous products and poisonous gases ◘ Others, _____	◘ Quickly closing plant operation ◘ Quickly safe rescue of workers ◘ Health services at safe places ◘ Communicate with hospital/Civil Defense ◘ Others, _____
Discharge of liquid/gaseous products harmful to environment	◘ Regular inspection of discharge line of liquid and gaseous products ◘ Regular checking and maintenance of liquid waste treatment plants ◘ Regular checking and maintenance of equipment setting for air quality control ◘ Provision of required chemical products, spare parts and alternative electric supply ◘ Others, _____	◘ Quickly closing plant operation ◘ Informing Department of Environment ◘ Informing local authorities ◘ Providing required compensation ◘ Taking pollution control measures in consultation with Department of Environment ◘ Others, _____
Death or injury of labor	◘ Automation of risky works which may cause injury or death of labor ◘ Manual preparation and training on occupational health risk reduction ◘ Others, _____	◘ Providing primary health care ◘ Transferring quickly to hospital ◘ Compensation as per legal requirement ◘ Others, _____
Others	◘	◘

12. Public Consultation

12.1 Consultation with local communities about project activities?

☐ Yes ☐ No

12.2 If consultation held, then opinion of with local communities *(attach name of the attendants, address and meeting minutes).*

☐ Positive ☐ Negative ☐ Others, _____

I am certifying that all information provided in IEE is correct and no information is kept hide or distorted.

(Name and Address of Entrepreneurs)

Attachments Checklist.

Annex-F

Monitoring Format

Reporting Form
for HHK Entrepreneurs

Please refer to the **Note** (attached with the form) for explanation

Date ☐☐☐☐☐☐☐☐
D D M M Y Y Y Y

I. General details

1. Type of HHK:
   Community owned ☐ Entrepreneur owned ☐
2. Name of the owner: ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐
3. Telephone number: ☐☐☐☐☐☐☐☐☐☐☐
4. Geographical location:
   Name of the Place: ☐☐☐☐☐☐☐☐
   District: ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐
   Type of area:
   Urban ☐ Peri-urban ☐ Rural ☐ Remote ☐
5. Year of kiln commissioning ☐☐☐☐
6. Number of workers Full Time ☐☐ Part Time ☐☐
7. No. of months of operation per year ☐

II. Risk minimization for averting penalty

8. Clearance from DOE received Yes ☐ No ☐
9. NOC from Chairman Union Council Yes ☐ No ☐
10. NOC from DC's Office Yes ☐ No ☐
11. VAT Registration Yes ☐ No ☐

12. Whether SPM level measured Yes ☐ No ☐

13. Utilization of fly ash % by weight ☐ Yes ☐ No ☐

14. Is topsoil used in brick making? Yes ☐ No ☐

15. Proper toilet facility on premises Yes ☐ No ☐

16. Provision of shower room Yes ☐ No ☐

17. First aid box available on site Yes ☐ No ☐

III. Utilization of Industrial Waste

18. Type of waste utilized (List)

IV. Maximize productivity by skill development, worker benefits and retention

19. Any efforts to improve productivity and reduce drudgery through selective mechanisation Yes ☐ No ☐

Machine	**For full capacity of Kiln**	**For partial capacity of Kiln**
Pug mill		
Extruder		
Clay carrying carts		
Loading trolleys		
Transportation trolley		
Unloading trolleys		
Conveyor belt		

20. Efforts to develop skill and ensure safety through training of workers

Category of workers	**Number of Trainings**		**Ratio of workers trained: total**	**Type of Training**
	Suggested	**Allowed by Owner**		
Fire masters				
Firemen				
Operators				
Loaders				
Un loaders				

Dryer operators				
Supervisors				
Management persons				

21. Workers retention percentage ☐☐

22. Are cooperative type group interest programs encouraged? Yes ☐ No ☐

23. Number of workers' children in school % Yes ☐ No ☐

V. Worker health and safety

24. Is clay transported on carts? Yes ☐ No ☐

25. Are green bricks transported on carts? Yes ☐ No ☐

26. Are dried bricks transported on carts? Yes ☐ No ☐

27. Are burnt bricks transported on carts? Yes ☐ No ☐

28. Is the maximum weight carried by adult s without trolleys less than 40 kg. Yes ☐ No ☐

29. Is a water source present near the kiln for fire fighting Yes ☐ No ☐

30. Clean drinking water in premises Yes ☐ No ☐

31. Are trouble shooting posters displayed Yes ☐ No ☐

32. Plantation around HHK (for dust suppression, shade and carbon sequestration) Yes ☐ No ☐