

Evaluation and improvement in design for clamp kilns for brick manufacturing (cleaner production), good practices, practicable energy conservation measures, and environmental standards, thereof

Executive summary

TERI has been entrusted by CPCB (Central Pollution Control Board), New Delhi for monitoring the performance of predominant types of clamp kilns operating in peninsular India and implement better design and good operating practices for improving their environmental and energy performance. The study was initiated in February 2010.

The objectives of the study included the following:

- Study/evaluate the existing firing practices, emission levels of predominant seven different types of clamp brick kilns namely Conical clamp, Covered clamp, Open clamp, Scotch clamp, Scove clamp, Chulha type clamp, and clamp with two side walls covering proper geographic representation and different fuel consumption;
- Prepare inventory of clamp brick kilns of the country;
- Monitor emission in stack/fugitive emission and ambient air of select clamp kilns;
- Recommend cost-effective modification in existing design and firing practices and its demonstration in different types of clamp kilns prevailing and considered under study in the country to prevent, abate, and control air pollution;
- Prepare specimen standard drawings for various production ranges/types for clamps and detailed specifications for recommended design/type of clamps;
- Evolve emission standards for different types of clamp kilns and recommended emission factors;
- Recommend pollution abatement options and citing criteria; and
- Make recommendations on good practices and better housekeeping.

During the field study of the clamp kilns, a wide variation in the design of clamps, types of brick setting, clay preparation processes, construction of insulation walls, fuel type and firing methods have been observed. The variation in the design differs from state to state which depends on the awareness/knowledge base of the local workers operating these clamps. During the clamp kiln operation, high emission levels have been observed during the first two days of the start of fire and particularly during the initial firing when external fuel is fired to ignite the stacked fuel between the stacked bricks. The Specific Energy Consumption (SEC) in the clamps with single layer of coal at the bottom or using coal as main fuel was found to be very high. The detailed study of all the designs of clamps monitored in different parts of the country reveals the following facts:

- The SEC and overall performance of clamps using internal fuel is better;
- Placement of fuel in multi-layers results in lesser ambient emissions and comparatively low SEC; and
- Kilns having permanent walls reported lower energy losses as well as emission levels;



Based on the detailed monitoring of existing clamp kilns and discussions with the stakeholders during the workshop on August 13, 2013 at CPCB and also considering practical aspects of clamp kiln operation, the following recommendations were made for operation of clamp kilns in the country.

Recommended criteria for obtaining approval to construct and operate clamp kiln

- An application for establishment of brick clamp to pollution control board/industries department shall be accompanied by a no objection/license from the local body (Gram Panchayat, Zila Parishad, Municipality or Municipal Corporation).

Recommended stack height

- Minimum stack height for batch size up to 75,000 bricks: 12 m.
- Minimum stack height for batch size from 75,000 bricks to 150,000 bricks: 15 m.

Recommended citing criteria

- Any two clamp kilns should be at a radial distance of 500 m from each other.
- The minimum distance for construction and operation of clamp kiln from a village should be 500 meters.

Recommended operating practices

- Use of internal fuel during green brickmaking results in savings in fuel consumption, reduced emissions, and better quality of bricks. The type and quantity of internal fuel may be decided based on the characteristic of the locally available fuel.
- Plastering of temporary brick walls being used for loading and unloading of bricks in the clamp kiln.
- Placement of fuel in multi-layers during the green brick stacking to reduce emissions and produce better quality bricks.
- Paving the passage around the brick clamp within the premises with broken bricks to reduce the generation of particulate matter during the activities such as clay preparation and transportation of bricks.

Recommended clamp kiln design

- The option for increasing the efficiency of the clamp kiln and containing its emissions is to enclose the clamp within three permanently constructed walls and roofs. The fourth side could be used for loading and unloading of bricks which should be closed by raising a temporary brick wall and plastering it. The exhaust gases from the clamp should be channelled through a chimney/stack that will help in better dispersion of emissions. The permanent walls should be made wider at the base, tapering towards the top and buttressed on the outside for greater strength. The method of loading of bricks should be similar to the conventional brick clamps.

It is further recommended that all the clamp kilns with batch size more than 150,000 should switch over to energy efficient and environment-friendly technologies, such as continuous kilns, which are already in vogue in various parts of the country.