Guidelines on

AIR POLLUTION CONTROL for

Paper Artifacts Burning at Funeral Parlours and Other Places of Worship

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環境保護署
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Environmental Protection Department

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1 INTRODUCTION

Paper artifacts generally refer to Chinese sacrificial offerings made up of paper supported with bamboo or wooden frames. They are relatively large in size as compared with joss paper and appear in various forms such as buildings, vehicles and aircrafts, etc.

Burning paper artifacts is a kind of Chinese ritual activity in Hong Kong for people to worship deities or ancestors. Premises where paper artifacts burning takes place include funeral parlours and other worshipping places such as Chinese temples. It is very common for owners or operators of these premises to provide paper artifacts burning apparatuses for the public to use. However, without proper air pollution control equipment to treat the flue gas generated from burning paper artifacts, smoke and ash flakes emissions may cause nuisance to neighbouring air sensitive receivers such as residential premises, schools, clinics and etc.

This set of guidelines provides guidance to help premises owners and operators understand and implement the best available control measures to minimize nuisance caused by the burning of paper artifacts. These guidelines are also useful for the consultants and contractors responsible for designing, building or installing the paper artifacts furnaces and air pollution control equipment.

2 MAJOR CONSIDERATIONS

In order to minimize potential nuisance, premises owners or operators are strongly recommended to take the following steps:

- They are encouraged to implement green initiatives to stop permitting paper artifacts burning activities within their premises, in particular if their premises are situated in densely populated area. This may be accomplished by exploration and promotion of alternative forms of worshipping without pollution effect (e.g. offering flower, electronic offering, smokeless incense, electric candle and so on).

- If the above step is considered not practicable, they are encouraged to arrange off-site burning as far as practicable by collecting paper artifacts from the worshippers. The facilities for off-site burning should be remote from air sensitive receivers with provision of proper paper artifacts furnaces and effective air pollution control equipment.

- If on-site paper artifacts burning is inevitable, they should provide paper artifacts furnaces and effective air pollution control equipment to achieve no visible emissions and no environmental nuisance to nearby air sensitive receivers. Also, they should operate and maintain the furnace and equipment properly.

Fig.1: Without proper treatment, emissions of smoke and ash flakes from paper artifacts burning may cause nuisance to neighbouring air sensitive receivers.

3 BEST AVAILABLE TECHNOLOGY FOR CONTROL OF AIR EMISSIONS FROM PAPER ARTIFACTS BURNING

In Hong Kong, furnaces provided by premises owners or operators for paper artifacts burning are usually made with metals or brickworks. Typically, internal volume of the furnaces varies from 6m^3 to 8m^3. In some cases, primitive method of flue gas treatment such as water spraying with fixed nozzles is provided for reducing emissions of ash flakes.

Without effective air pollution control equipment, visible emissions (including smoke and ash flakes) carried by high temperature flue gases (can reach over 900^{O}C) can be dispersed to the neighbouring environment through their exhaust outlets and the paper artifacts charging openings, causing potential nuisance. To control emissions from paper artifacts furnaces, suitable control equipment, such as fabric filters, water scrubbers, electrostatic precipitators and etc., should be installed.

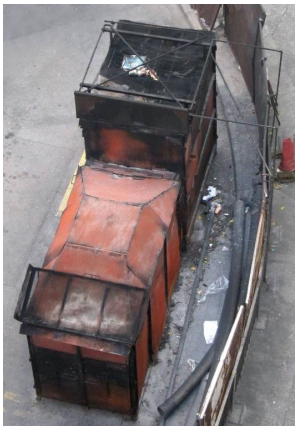

Fig.2: Typical metal paper artifacts furnace with water spraying.

According to practical experience in Hong Kong and elsewhere, electrostatic precipitation coupled with water scrubbing as flue gas pretreatment is proven to be the Best Available Technology (BAT) to give satisfactory performance in removing smoke and ash flakes from paper artifacts burning.

A paper artifacts furnace system adopting BAT for emission control basically comprises the following components:

- A properly designed paper artifacts furnace;
- A water scrubber or other suitable devices for flue gas cooling and removal of ash flakes and large dust particles;
- A mist elimination device to reduce the emissions of visible water mists due to excessive evaporation of water by hot flue gas;
- An adequately sized and effective electrostatic precipitator for removal of fine dust particles from the flue gas; and
- An exhaust fan for assisting the inflow of air and extraction of flue gas.

Fig.3: An example of paper artifacts furnace adopting BAT for emission control.

Premises owners or operators should appoint competent and experienced professionals to design and install paper artifacts furnaces adopting BAT for effective emission control.

Guidelines on the design and installation of paper artifacts furnaces and associated air pollution control equipment are given as follows:

(a) Paper Artifacts Furnace

(i) The paper artifacts furnace and its charging opening should be properly sited such that they are away from neighbouring air sensitive receivers to minimize potential nuisance.

(ii) Sufficient space surrounding the paper artifacts furnace should be allowed for operation and maintenance of the furnace.

(iii) The burning chamber of the furnace should be made of suitable materials and internally lined with heat-resistant materials to reduce the surface temperature of the furnace during operation.

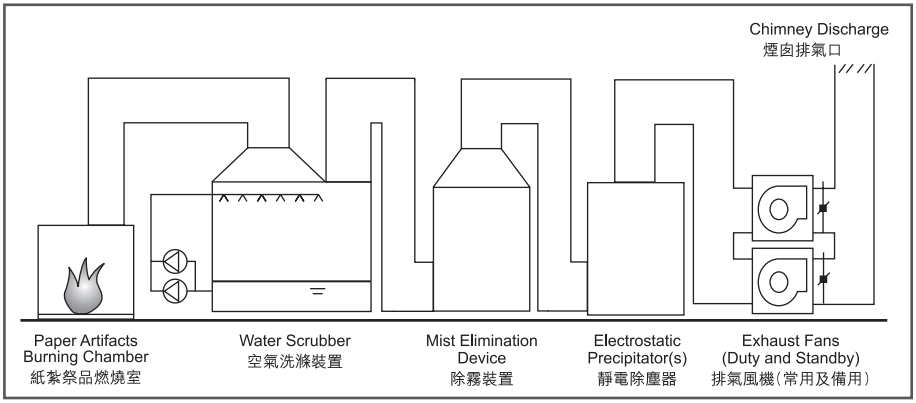

Fig.4: Typical Configuration of Paper Artifacts Furnace adopting BAT for Emission Control.

(iv) The design of the furnace including the size of the burning chamber and the charging opening should be commensurate with the paper artifacts burning capacity of the furnace in order to avoid overloading of the furnace resulting in generation of excessive emissions.

(v) Adequate air flow should be supplied to the furnace to support complete combustion of paper artifacts inside the furnace.

(vi) Ash containers, water spray hoses and etc. should be provided to facilitate bottom ash clearing.

(b) Air Pollution Control Equipment

The air pollution control equipment should be designed with due consideration of the large volume of flue gas, high temperature due to spontaneous burning of paper artifacts, high humidity of flue gas, and potential heat hazard to operators and equipment components. The following is a list of major points to be taken into consideration in the design of the air pollution control equipment:

(i) Air pollution control equipment should basically comprise a water scrubber (or other suitable devices), a mist elimination device, an electrostatic precipitator and an exhaust fan connected in series. To increase system reliability, another standby fan should be installed to allow changeover in case the duty fan breaks down.

(ii) The overall smoke removal performance of the air pollution control equipment should be targeted to achieve no visible emissions at discharge. The selection of a proper electrostatic precipitator is critical to the overall performance of the air pollution control equipment. As the performance of an electrostatic precipitator would be greatly affected by the variations in actual applications, such as particle size distribution and concentration of inlet gas etc., particular attention should be paid taking into account of those relevant factors in selecting a proper electrostatic precipitator.

(iii) The treatment capacity of the air pollution control equipment for the furnace should meet the peak load operation conditions, i.e. the worst case scenario.

(iv) Where necessary, additional control equipment (such as cyclone) should be added as integral components of the air pollution control equipment to further reduce the emissions.

Fig.5: Exhaust outlet should be properly located away from air sensitive receivers.

(v) A valid licence under the Water Pollution Control Ordinance (WPCO) should be obtained from the EPD, and proper discharge of wastewater generated from the operation and maintenance of the air pollution control equipment of the furnace according to the WPCO licence conditions should be provided.

(vi) Exhaust outlet for final discharge of treated flue gas from the furnace should be located at a place where ventilation is good and any emissions can be adequately dispersed to the atmosphere without hindrance. Sufficient separation distance from any air sensitive receivers in the vicinity should be provided such that any emissions will not cause nuisance to the public.

(vii) Emissions from the exhaust system of the furnace should be directed vertically upwards, unless it can be demonstrated that other direction is more advantageous in preventing the emissions from causing potential nuisance.

(viii) Low-noise fans should be used as far as practicable as they are both energy efficient and less noisy.

(ix) Where circumstances permit, consideration should be given to install variable speed fans and pumps to cater for different burning load conditions. This measure saves energy, prolongs operating life of equipment, and reduces noise level at low burning rate.

4 OPERATION AND MAINTENANCE

It is important that the paper artifacts furnace with air pollution control equipment should be properly operated and maintained all the time. The following practices should be fully adopted:

(a) Good Operational Practices and Administrative Measures

(i) Before burning paper artifacts, the operator should make sure that the air pollution control equipment has been turned on and running normally. Paper artifacts burning should never be carried out without operation of the air pollution control equipment.

(ii) The operator should ensure only offerings made with paper, bamboo or wooden materials are burnt in the furnace. Other wrapping materials, in particular plastic materials, should be removed.

⚠ 警告

1) 化寶前，請確保除煙機已啟動並正常運作。

2) 化寶爐只可焚燒紙類祭品，請勿投放其他物料。

3) 除煙機處理工作量上限為每小時 XX 公斤，焚燒過量會造成空氣污染及機件損耗。

4) 若發現除煙機有可見的污染物排出，應適當地減低燃燒速度或啟動清洗程序，若情況持續，應停止化寶，並聯絡維修人員檢查除煙機。

Fig.6: A sample instruction notice provided adjacent to paper artifacts furnace with clear instructions on the use of furnace.

(iii) It is essential to employ trained operators to control the feeding rate of paper artifacts to the furnaces. In case visible emissions are observed at the flue gas discharge, the feeding rate should be reduced as appropriate, and if visible emissions persist, the operator should immediately stop the burning activities and call for maintenance of the air pollution control equipment if necessary.

(iv) Whenever there is any sign of deterioration in performance of the electrostatic precipitator, the operator should arrange cleaning of the electrostatic precipitator. For those electrostatic precipitators with automatic self-cleaning function, the operator should ensure self-cleanings are carried out at frequencies recommended by manufacturers.

(v) The operator should regularly clean the burning chamber and clear away ash remains inside the burning chamber, preferably at least once a day. To prevent emissions during ash clearing process, the ash should be wetted sufficiently by water spraying.

(b) Good Maintenance Practices

(i) Maintenance and repair of air pollution control equipment should only be carried out by competent personnel with sufficient training and relevant skills in accordance with manufacturer's recommendations.

(ii) Air pollution control equipment should be maintained regularly to ensure optimum performance. All components should also be inspected, cleaned and serviced regularly.

(iii) Any defective parts of the air pollution control equipment should be replaced as soon as possible. To facilitate immediate replacement, sufficient stock of spare parts should be kept on-site.

(iv) Operators should keep a copy of the operation and maintenance manual and should maintain a proper log of maintenance records on-site to facilitate maintenance of the equipment.

5 ENQUIRIES

For further information,
please contact EPD's Hotline at 2838 3111 or
send email to enquiry@epd.gov.hk.

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