

Guidelines on

**AIR POLLUTION CONTROL** for

**Joss Paper Burning at  
Chinese Temples, Crematoria  
and Similar Places**



香港特別行政區政府  
環境保護署  
HKSAR Government  
Environmental  
Protection Department



# CONTENTS

1 Introduction	2
2 Major Considerations	3
3 Best Available Technology for Control of Air Emissions from Joss Paper Burning	4
4 Operation and Maintenance	9
5 Enquiries	12

# 1 INTRODUCTION

Joss paper generally refers to Chinese sacrificial offerings made up of paper materials. They are relatively small in size and appear commonly in forms of paper notes, clothing and paper folding crafts.

Burning joss paper is a kind of Chinese ritual activity in Hong Kong for people to worship deities or ancestors. Premises where joss paper burning takes place include Chinese temples, crematoria and other worshipping places. It is very common for owners or operators of these premises to provide joss paper burning apparatuses for the public to use. However, without proper air pollution control equipment to treat the flue gas generated from burning joss paper, 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 joss paper. These guidelines are also useful for the consultants and contractors responsible for designing, building or installing the joss paper 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 joss paper 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 joss paper from the worshippers. The facilities for off-site burning should be remote from air sensitive receivers with provision of proper joss paper furnaces and effective air pollution control equipment.
- If on-site joss paper burning is inevitable, they should provide joss paper 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 joss paper burning may cause nuisance to neighbouring air sensitive receivers.*

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

In Hong Kong, furnaces provided by premises owners or operators for joss paper burning are usually made with metals or brickworks. Typically, internal volume of the furnaces varies from 0.2m<sup>3</sup> to 8m<sup>3</sup>.

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



*Fig.2: Typical brickwork and metal joss paper furnaces in Hong Kong.*

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 joss paper burning.

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

- A properly designed joss paper furnace;

- A water scrubber or other suitable devices for flue gas cooling and removal of ash flakes and large dust particles;
- 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 joss paper furnace adopting BAT for emission control.*

Premises owners or operators should appoint competent and experienced professionals to design and install joss paper furnaces adopting BAT for effective emission control. Where circumstances permit, premises owners or operators may resort to “ready-to-use” packaged type furnaces with built-in air pollution control equipment.

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

### **(a) Joss Paper Furnace**

- (i) The joss paper 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 joss paper furnace should be allowed for operation and maintenance of the furnace.

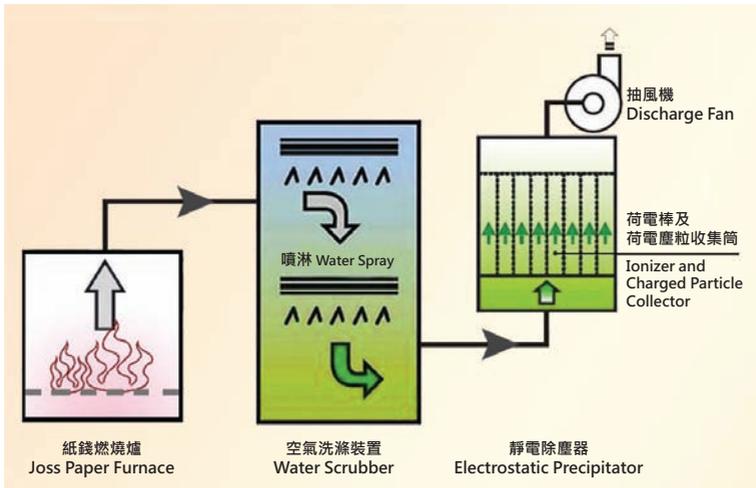


Fig.4: Typical Configuration of Joss Paper Furnace adopting BAT for Emission Control.

- (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.
- (iv) The design of the furnace including the size of the burning chamber and the charging opening should be commensurate with the joss paper 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 joss paper inside the furnace.
- (vi) Ash containers, water spray hoses and etc. should be provided to facilitate clearing bottom ash.

## **(b) Air Pollution Control Equipment**

- (i) Air pollution control equipment should basically comprise a water scrubber (or other suitable devices), 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.
- (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.



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

## 4 OPERATION AND MAINTENANCE

It is important that the joss paper 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 joss paper, the operator should make sure that the air pollution control equipment has been turned on and running normally. Joss paper burning should never be carried out without operation of the air pollution control equipment.
- (ii) The operator should ensure only offerings made with paper materials are burnt in the furnace. Other wrapping materials, in particular plastic materials, should be removed.

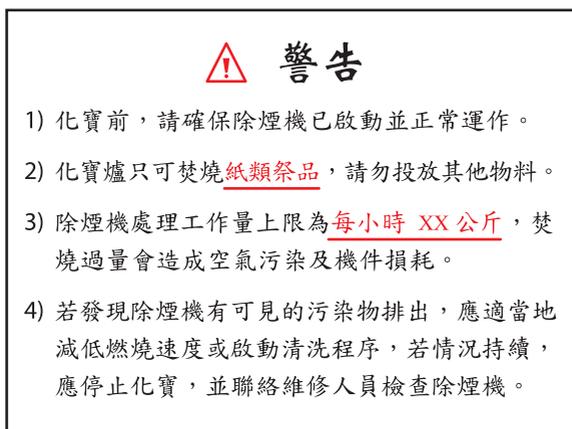


Fig.6: A sample instruction notice provided adjacent to joss paper furnace with clear instruction on the use of furnace.

- (iii) It is essential to employ trained operators to control the feeding rate of joss paper 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.



*Fig.7: It is essential to employ trained operators to control the feeding rate of joss paper to the furnaces, especially during festive days.*

## **(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](mailto:enquiry@epd.gov.hk).*





Printed on recycled paper

9 / 2011