

HOTEL KITCHEN FIRE

H.H. Wu and W.K. Chow

Department of Building Services Engineering, The Hong Kong Polytechnic University, Hong Kong, China

ABSTRACT

Kitchen engineering is a very complex application of MVAC systems and building services systems. Engineering systems include basically the detailed design on air-conditioning, fire safety, ventilation, building pressurization, refrigeration, air distribution and kitchen equipment. Preliminary Studies concerning fire safety in hotel kitchens are reported. Problems of kitchen fires and various fire services installations were discussed. Training desired for chef and issues related to the building services systems in kitchen are outlined. In particular, operations and maintenance management related to fire safety are of particular concern.

1. INTRODUCTION

Fire in kitchen might happen in a hotel which is difficult to prevent. The combination of flammable grease and particulates in the kitchen MVAC system and the potential of kitchen equipment to be an ignitions sources create a higher hazard level than other hotel locations. Some fires were quite small (example: grease or spilled oil burning) but some might be quite big by spreading to other parts of the hotel (example: fire in exhaust duct or fire due to gas leaking/explosion), causing death or injury. There may be many possibilities to starting fires (e.g. [1,2]) in hotels and kitchens. There are special risks, particularly at night of fires in kitchen where most of the staff are not aware of. Most of the fire incidents are problems arising from, and relating to kitchen staff and building services installation. Kitchen staff are professional in various cooking but may not get used to handle particular type of accident, such as fire outbreak.

Firstly, there are the kitchen staff and other hotel employers who, in the event of fire, are taken by surprise, particularly if the outbreak is at night when the kitchen operation is only at cleaning mode with minimum staff present. The fire will cause significant damage as the combustile content in the kitchen is high. The languages of the kitchen staff might be varied; especially those staff staying are of preferential accents.

Secondly, there are the kitchen staffs who are supposed to be well trained, aware of their surroundings and with the opportunity of knowing the hotel kitchens perfectly. They are members of a team responsible to their superiors and should know what to do in emergency, e.g. in five star hotels. However, some kitchen staff might be of temporary appointment, particularly during the peak business season, e.g. Christmas, New Year Eve and Easter, etc. For hotels with high and frequent turnover rates of kitchen staff might have more problems. Some staff are not always familiar with the language

of the country. Furthermore, the complexity of kitchen building services installation might lead to big fire hazard, such as electrical/gas kitchen equipment, storage/use of gas and dangerous goods for cooking, huge exhaust/fresh air system and environmental cleaning systems used in kitchens.

2. KITCHEN FIRE PROTECTION SYSTEM

Building services systems in kitchen have a lot of impacts on kitchen fire safety [3]: -

- Electrical System – Overloading & short-circuiting are main contributing factor. Hence, electrical safety is very critical in kitchen fire safety.
- Cleaning Equipment For Steward – Overheat of motors in dishwashing and glasswashing machine. Hence, regular maintenance & cleaning are crucial.
- Kitchen Equipment – Regular maintenance & cleaning on equipment to remove oil & debris.
- Air-conditioning System [4] – Maintenance & cleaning of equipment to remove dusts, damper/filter maintenance & proper selection of insulation.
- Dumbwaiter & food conveyors – Proper maintenance of equipment on electrical safety & dust removal are important. Shaft & bottom void are critical for fire safety.
- Utilities – Electricity, gas, solid fuel, LPG will properly be used and the safety measures should be properly observed.
- Fire Protection System – Of course, this must be properly maintained.

2.1 BTM System and FM200

They are used more in cooking wok range and

Japanese Teppanyaki cookers. Gas supply will be isolated in case fire alarm is activated.

2.2 Detectors & Manual Pull Stations

A fire warning system consists of detectors and manual call points (break glass units) are licensed required for kitchens per licensing requirements [5]. Depending on the fire warning system installed, information will be displayed at the control panel. In the case of conventional systems “zone” indication will be given. In the case of addressable systems the location of the actuated detector or break glass point will be given as an automatic liquid crystal display (LCD) at the control panel. This may also be provided as a hard copy by connecting a printer to the system.

Due to the lack of response to smoke, heat detectors are not suitable for most areas in an hotel and are only installed in areas where smoke detectors could give unwanted alarms e.g. kitchens.

In the event of a false alarm [6], it is important that the cause and extent of the problem is determined as quickly as possible in the kitchen. This is especially important where there is disruption to the fire warning system resulting in a substandard level of protection.

Common causes of false alarms in kitchen include the following:

- mechanical and electrical faults, often resulting from the effects of vibration, impact or corrosion;
- ambient conditions such as heat, smoke or flame from cooking or work processes, fumes from engine exhausts.
- work being carried out in a protected area without knowledge of, or in neglect of, the necessary precautions;
- electrical transients or radio interference;
- inadequate servicing;
- the building up of dust or dirt within a detector in the kitchen, or the entry of insects;
- accidental or malicious operation of manual call points or detectors, delivery of trucks and cabinets.

2.3 Portable Fire Fighting Equipment

In Hong Kong, it is a legal obligation to provide a means of fighting fire and ensure adequate maintenance. This requirement may be supported by a condition of insurance imposed by the insurance company. Fire extinguisher and fire blanket are key element with the following points to note in kitchen: -

Before deciding on the numbers and type of fire extinguishers that are required for a particular risk, reference should be made to local legislation and advice should also be sought from the fire service department.

Fire blankets should be provided in high or special risk areas, i.e. all kitchens and workshops.

Extinguishers are made in a number of sizes; the heaviest that can be considered portable weights 23kg. The physical ability of those persons who are most likely to use them must, therefore, be considered. If the allocation of water extinguishers is to be based on the criterion floor area, then one 9 litre extinguisher should be provided for every 200m² of floor area.

2.4 Hose Reels

Hose reels are strongly recommended particularly where the attendance of the local fire brigade is doubtful and where floor areas are in excess of 800m². They are the most effective extinguisher, depending on the class of fire. Once they are in action a substantial volume of water can be provided, which will be equivalent to using several extinguishers at the same time. The water supply may also be controlled.

2.5 Water Systems

Water can be used for protecting cooking ranges, griddles and grease exhaust systems. However, the rating of the sprinklers must be carefully selected to avoid accidental bursting of sprinkler needs.

Sprinklers are comprised of a system of pipework, pumps, control valves and heat sensitive valves in the sprinkler heads which release water onto the seat of a fire. The rate at which the water is released will depend on the severity of the fire, given the nature of any combustible materials present. It is the flow of water which actuates any connected alarm systems. Water mist system can also be used to protect cooking equipment. They suppress fire by suffocation and steaming effect to reduce the fire site temperature.

2.6 Emergency Lighting & Back-Up

This is a license requirement for kitchen [5].

When the electricity supply to the normal lighting fails, emergency lighting is required to fulfill the following functions:

- to indicate early and unambiguously the escape routes and associated exit signs;

- to provide illumination along such routes allowing safe movement towards and through the exits provided;
- to ensure that fire alarm call points and fire fighting equipment provided along escape routes [6] can be readily located;
- to ensure that changes of direction and levels are identified.

Emergency lighting is required not only on complete failure of the normal power supply but also on a localized failure if such a failure would present a hazards, e.g. failure of a single sub-circuit on stairways.

Any new emergency lighting system should conform with the provisions of territorial legislation. The normal standards require that emergency lighting should maintain an adequate level of illumination for three hours, although in small kitchen, e.g. those lower than three storeys, one hour is sufficient.

2.7 Dry and Wet Chemical System

Dry or wet chemical system to be installed in hoods and exhaust system to suppress fire. These systems extinguish a fire by reacting with grease and their products to saporify, or form foam layer to isolate oxygen from the hot surface.

3. TOTAL FIRE SAFETY IN HOTEL KITCHENS AND STAFF TRAINING

Total fire safety in hotel kitchen should be provided and we need to consider the followings: -

- Risk factor, such as fire load density (FLD) and occupancy load factor (OLF)
- Fire service installation (FSI)
- Passive building construction (PBD)
- Fire safety management (FSM)

We will discuss the above four key elements of total fire safety in hotel kitchen in the following sections.

3.1 Risk Factor

The fire load density (FLD) is viewed as a critical factor as it would affect the fire. The calculation of fire load in a hotel kitchen of a given geometry is important and related to the relative values of the fire resistance period (FRP) and the fire severity. Whether the hazard level is structural endangering or not can be determined. In the standard licensing conditions issued by the Home Affairs Department (5), no storage of dangerous goods in excess of exempted quantity is permitted without statutory approval. Moreover, no storage of any description, combustible furniture or portable heaters are to be

allowed within any part of the escape routes. These must be kept clear for evacuation. There is also control on the use of furniture foam materials, such as BS7176 [7]. FLD is very important in the local codes with an upper limit of 1135 MJm^{-2} [8,9].

Another important risk factor is the occupancy load factor (ODF) in a hotel kitchen. There is various fire precaution and evacuation procedures that the hotel may take in order to minimize the evacuation chaos. This is particular obvious and effective in hotels staff with efficient fire safety management practiced. The hotel kitchen is usually not crowded, governed by the licensing regulations. However, the additional fire risk due to the kitchens at basements or high rise buildings and different race and may need more detailed consideration on fire safety. The occupancy load in the kitchen area is usually limited under the means of escape (MOE) code. Generally speaking, the occupancy load factor is not a critical factor to be considered in kitchen fire safety.

3.2 Fire Service Installation

This has been discussed in the above section 2.

3.3 Passive Building Construction

Usually, fire door, smoke lobbies & hatches with damper/fusible link are adopted. This is governed by the various statutory regulations, mainly from fire service department, building department and the Home Affairs department [5]. In hotel kitchen, the fire compartment is enclosed by fire barriers on all sides, including concrete walls, door and shutter etc. The fire resistance period (FRP) of the building construction material should be big enough to limit fire spread, restrict fire severity by limiting the available oxygen amount and let the kitchen staff to have enough time to arrive at the escape route safety.

3.4 Fire Safety Management

Fire safety management was pointed out systematically years ago by Malhotra in 1987 [10]. The means of escape maintenance, doors/passage/staircases maintenance and concern on the external facilities which might become unsafe due to external exposures were all discussed.

Recently, topics including management responsibilities, staff training emergency procedures, fire safety manual and routine precautions are also discussed in BS5588: Part II on "Code of Practice" for design office, industrial, storage and other similar building in 1997 [11]. Developing and implementing an effective fire safety management progress is published in the fire safety management handbook by the American Society of Safety Engineer [12].

As related by Malhotra [10], the main objectives of fire safety management are to ensure that in case of a fire: -

- all the fire safety measures provided will be available
- occupants will be able to use the fire safety measures
- occupants will be assisted to escape to a safe place

It is necessary to develop a fire safety plan, particularly in a hotel and even kitchen [10]. It consists of:

- Normal mode of hotel operation including:
 - maintenance plan of all the passive building construction and fire service installation in a kitchen. Good housekeeping practice and detailed preventive maintenance schedule are needed;
 - staff training plan which will be discussed in detail;
 - fire prevention plan. This would need the care of electrical equipment and proper maintenance and housekeeping [13]. This is a very important plan in hotel kitchen.
- Emergency mode of hotel operation:
 - fire action plan and relation with the local fire Brigade.

Kitchen staff training and procedures are usually offered by hotel management all over the world. It is vital that adequate provision is made to ensure all full and part time kitchen employees and shift workers on shift duties are trained. They should know what to do in case of fire so that quick and safe evacuation can be achieved properly of themselves and guests.

In order to ensure the continuity and effectiveness of the training programme, which should be based upon written instructions and notices, it is important that records are kept of all training.

The kitchen staff should be well trained concerning actions on discovery a fire [14]. Raise the alarm at once by the appropriate operation of the nearest fire alarm system call point. Notify reception/switchboard of the fire location.

If the fire is considered small enough to be easily and safely extinguished, e.g. a such grease fire at the griddle, attempt to do so with the nearest correct type of fire extinguisher and fire blanket, but do not take personal risks and always call for assistance.

Never attempt to fight fires alone.

If the fire is considered too large, or if it should get out of control, or if the escape route is threatened, leave the kitchen quickly and calmly by the nearest available escape route. Do not stop to collect personal belongings and do not use the lifts.

Report to the fire assembly area.

Fire Evacuation drills, which should not involve guests, are recommended to take place at least once a year and preferably once every six months.

Evacuation training should form part of the fire precautions training discussed previously and should include; knowledge of the fire alarm signal, knowledge of the nearest escape routes and fire exits, the knowledge to help disabled persons, including an understanding of different disabilities, i.e. physical, mental, hearing, sight disabilities and possible reactions in the event of a fire, the location of the fire assembly area, the importance of ensuring attendance at the roll call, and if necessary reporting any persons missing or known to be still in the kitchen, work shift identification, extent of drill, optimum evacuation time, date, total evacuation time, approximate number of participants, date of next drill.

4. MAINTENANCE MANAGEMENT IN KITCHEN

Preventive maintenance schedules on all fire protection and building services systems in kitchen [15] are crucial. This is the most effective maintenance in order to maximize the equipment performance and least shutdown.

All sorts of short-term and long-term checking on electrical, MVAC system & fire protection systems are required to ensure its efficiency [16,17] and safety. In the kitchen, cleaning of all kitchen equipment and grease removal are vital and usually neglected in kitchen due to cost concern or negligence. Fire always breaks out due to this kind of negligence. We also need to check all the filters, water scrubber, electronic precipitator and vent wash system, etc. to ensure their operations in order to remove the fire risk.

All ventilation and exhaust system [18] must be carefully checked and cleaned so that all the grease is removed. The control of all the damper and sensors cleaning should also be taken care of.

5. CONCLUSION

To achieve total fire safety in a kitchen, fire safety management cannot be neglected. Usually, due to cost constraint and staff manning reduction

nowadays, fire safety management in hotel kitchen will be at risk. This is not sensible and basically affects the reputation of the hotel group if fire really occurs. Although there is a lot of regulation and rules governed the fire safety in hotel kitchen, it is necessary to review again the current fire safety system. Bringing in engineering performance based code into the design, construction and management of fire safety in kitchen [19-22]. Possibly, in next steps, we would like to develop fire safety ranking [23] in hotel kitchens so that hotel owners, executive and employees will have a proper guidance and procedures in all fire safety management matters. Study on measurement of heat release rate (HRR) from cooking foodstuff with exhaust system set up in hotel kitchen is important.

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