

Survey on Occupational Safety and Health Conditions of Kitchen Work in Chinese Restaurants

Summary

The Occupational Safety and Health Council conducted a survey on occupational safety and health conditions in Chinese restaurants early 2000 to investigate the occupational safety and health problems faced by kitchen workers and to make suggestions on how the occupational safety and health conditions in the industry can be improved.

In the survey, 471 kitchen workers, including chefs, cooks, assistant cooks, dim sum cooks, grill cooks and material preparation cooks in 159 Chinese restaurants were interviewed. The result shows that 80% of the interviewees have experienced work-related injuries, and over 60% of the kitchen workers have asked for sick leaves because of accidents at work. Musculoskeletal problems, headaches, gastrointestinal disorders as well as cuts, burns and stab wounds caused by fishes or shrimps are the most common health problems for kitchen workers.

During our inspection of working environment in the kitchens, smoke doors kept opening, wet and slippery floor, obstruction of fire exits and passageways, overpiling of materials, improper manual lifting of heavy loads, and lack of proper training were found in many kitchens. All these are possibly the reasons for accidents at work or occupational disease. Meanwhile, the result of occupational hygiene monitoring shows that there is insufficient and uneven lighting in the working areas in the kitchens, and the noise level, temperature and the concentration of carcinogenic substances in the air are high, all of which may seriously endanger the safety and health of the kitchen workers. The result of the survey also indicates that the adoption of practicable measures to improve the health and safety conditions of kitchen work demands immediate attention.

1. Introduction

Hong Kong has always enjoyed the reputation of being the Gourmet's Paradise. There are countless restaurants serving all kinds of cuisine, which

attract many tourists to come with admiration. Many restaurants have devoted a lot of resources and efforts in their interior design so as to provide a comfortable environment for customers. However, few of us notice that the environment in the kitchens which prepare all kinds of delicious food is always poor. Busy kitchen workers always need to work under a hot and wet environment filled with oil fume and traps, which leads to frequent accidents and endangers their health. According to the statistics of the Labour Department¹, catering remains an industry with a high rate of work-related accidents in Hong Kong, second only to the construction industry. In 1999, 58,841 cases of occupational injury and death were recorded in Hong Kong, of which 12,549 cases occurred in the catering industry, representing 21% of the total number. Currently, we have little information about the working environment and occupational safety and health conditions in the catering industry in Hong Kong. The statistics on accidents in the catering industry published annually by Labour Department provide useful information for understanding the occupational safety and health conditions in the industry. However, since these information only provide the number and types of accidents and no detailed analysis in respect of such accidents is conducted, together with the limitations and reporting errors of the accident statistics itself, there is a shortage in comprehensive and systematic information about occupational safety and health conditions in the catering industry.

Nowadays, there are about 28,000 eastern and western style restaurants in Hong Kong. People might ask is there anything wrong with the catering industry with 190,000 practitioners, leading to consistently high occurrence of accidents? What are the most important occupational safety and health problem which the practitioners in the industry are facing? Since 1997, the government's policy on assuring occupational safety and health has been switched from emphasis on legal enforcement to the promotion of safety management. The new strategy encourages employers and employees to manage occupational safety and health by way of self-regulation, and raises the safety awareness through education and training. In such new situation, do the practitioners in the industry understand their responsibilities and are they well-prepared for self-regulation? We need sufficient information to understand the present conditions of occupational safety and health in the industry and to investigate the difficulties and needs of the practitioners. In view of this, the Council decided to conduct a comprehensive and systematic survey on the catering industry. The first stage of the survey mainly focuses on kitchen workers in Chinese restaurants, with an aim to investigate the

environment and conditions of the kitchens in Chinese restaurants and the kitchen workers' knowledge in and attitude towards occupational safety and health, and to work out strategies and plans for the improvement of safety and health conditions in the industry.

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3. Objectives of the survey

The objectives of the survey are:

1. to investigate in a systematic and comprehensive way the major factors endangering the occupational safety and health of the kitchen workers in Chinese restaurants in Hong Kong;
2. to understand the awareness and attitude of the kitchen workers towards occupational safety and health;
3. to examine the occupational safety and health conditions in the working environment of kitchens; and
4. to propose strategic plans to improve the safety and health conditions in the catering industry.

1.

2. Methodology

The survey was conducted in July to November, 1999. It consisted of three parts: questionnaire survey, kitchen inspection and monitoring of occupational hygiene conditions in the working environment.

1. Questionnaire survey

Questionnaire survey aimed at investigating the occupational safety and health problems which the kitchen workers in Chinese restaurants in Hong Kong are facing, such as work-related injuries and illnesses, and their knowledge in, awareness of and attitude towards occupational safety and health. We also listened to their opinions and suggestions for the improvement of working environment. Questionnaire survey was conducted through personal interviews using standardised questionnaires.

3.1.1 Sampling

Subjects being interviewed were kitchen workers in Chinese restaurants, including chefs, dim sum cooks, grill cooks, material preparation cooks, etc. We obtained the

list of Chinese restaurants in Hong Kong and their relevant information, such as the company's name, address and number of employees, from Census and Statistics Department. In order to ensure the representativeness of this survey, samples were chosen equally from Chinese restaurants of various scales. All Chinese restaurants were divided into 3 categories according to their employees size: small Chinese restaurants (20 to 49 employees), medium-sized Chinese restaurants (50 to 99 employees), and large Chinese restaurants (100 employees or more). Assuming the number of kitchen workers represents 10% of the total number of employees in each Chinese restaurant, we can calculate the average number of kitchen workers in each of the three categories of Chinese restaurants. Chinese restaurants with less than 20 employees were not included in the first stage of the survey so as to increase the feasibility and success rate of the survey.

The number of samples needed was determined statistically based on the following formula 2 : $n = z^2 pq/d^2$

$$\begin{aligned} \text{where } n &= \text{number of samples} \\ z &= 1.96 \text{ (at 95\% Confidence Level being 95\%)} \\ p &= 50\% \text{ (p value was chosen as 0.5 such that the largest number of samples was determined under the predetermined Confidence Level and absolute precision)} \\ q &= 1-p \\ d &= \text{deviation rate} = 0.05 \end{aligned}$$

Substituting the above values into the sampling formula, the number of samples n (the number kitchen workers being interviewed) was 385.

The interview subjects were chosen by random sampling method. The target Chinese restaurants included 538 small Chinese restaurants, 388 medium-sized Chinese restaurants and 239 large Chinese restaurants, each of which was assigned a number. A computer software (Microsoft Excel) was then used to produce random numbers in order to decide the subjects for questionnaire survey. With the estimation of number of kitchen workers in each Chinese restaurant of the three categories, the expected number of samples was found (Table 3.1).

Table 3.1

	Small Chinese Restaurants (no. of employees = 20-49)	Medium-sized Chinese Restaurants (no. of employees = 50-99)	Large Chinese Restaurants (no. of employees = 100 or more)
No. of Chinese Restaurants	538	388	239 (222 of which with number of employees between 100 and 199; 16 of which with number of employees between 200 and 299; and 1 has 400 employees)
Average no. of kitchen workers in each Chinese restaurant	$(20+49)*0.1/2$ » 4	$(50+99)*0.1/2$ » 8	$(150*222+250*16+400*1)*0.1/239$ » 16
Estimated no. of kitchen workers	$4*538 = 2152$	$8*388 = 3104$	$16*239 = 3824$
Expected no. of samples	$2152/9080*385$ » 92	$3104/9080*385$ » 132	$3824/9080*385$ » 163

2. Questionnaire design

The questionnaire was designed to be as simple and brief as possible, consisting mainly of multiple choice questions with expression of opinions and suggestions. All interviews were conducted anonymously. The content of the questionnaire included personal particulars and job information of the interviewees, such as sex, age, education level, smoking and drinking habits, job nature, working experience and working hours, as well as whether the interviewees had experienced work injuries or had taken any leaves because of work injuries, whether they had suffered from any work-related health problems during the past year and the reasons thereof. Another focus of the questionnaire was to investigate the interviewees' perception of occupational safety and health, such as their

understanding of occupational safety and health regulations and the responsibilities of employers, employees and the government in respect of occupational safety and health, as well as to gather their opinions on their concerns about occupational safety and health, whether they were willing to share their views with others on occupational safety and health issues, the ways to seek help while encountering occupational safety and health problems, matters to the immediate concern of kitchen workers and the safety and health problems most worried about, etc.

The awareness and the attitude of kitchen workers towards safety and health were reflected through a series of questions, such as the interviewee's response when there was a fire or leakage of fuel gas in the kitchen, whether personal protection equipment were used in the ordinary course of work, and the precaution measures taken against work injuries and occupational disease.

3. Quality control and data processing

In order to ensure the reliability, accuracy and precision of the survey, all surveyors had been trained before conducting the questionnaire survey. The questions in the questionnaire were carefully designed and undergone prior testing to avoid misunderstanding and confusion.

All information obtained in the survey was input into a computer software (SPSS) for data processing and statistics compilation. All data were randomly checked to ensure their accuracy.

1. Kitchen inspection

Surveyors underwent on-site inspection of kitchens with the help of a safety inspection checklist, the content of which included whether the floor was wet and slippery, the loading of goods, fire exits and passageways, the placement of knives and labelling of chemicals, etc. These criteria were rated as "Poor", "Fair" or "Good" with reference to the marking scheme for Safety Award Scheme for Catering Industry 1999. "Good" was defined as most (over 70%) of the kitchen work environment, facilities, tools, etc. were kept in good conditions; "Fair"

was those about half (40-60%) of the kitchen work environment, facilities, tools, etc. were kept in good conditions; while “Poor” was those restaurants with small portion (less than 40%) of the kitchen work environment, facilities, tools, etc. were kept in good conditions

2. Occupational hygiene monitoring

The endangering factors which kitchen workers face at work were investigated through monitoring the conditions of working environment in the kitchens of Chinese restaurants. The scope of monitoring included lighting, noise, heat stress and indoor air quality. Over 30 restaurants were randomly selected out of the 159 Chinese restaurants participating in the questionnaire survey, and the occupational hygiene monitoring was conducted in those Chinese restaurants in July to October, 1999.

We used TOPCON (IM-2D) digital illuminance meter to measure the lighting in the working area and the surroundings in the kitchens³. Through the calculation of uniformity of illuminance by dividing the minimum illuminance value by the average value, we could determine the occurrence of patchy lighting.

The measurement of noise was conducted according to the requirement of Factories and Industrial Undertakings (Noise at Work) Regulation⁴. The instruments used included Bruel & Kjaer 2236 A-009 Precision integrating Sound Level Meter and Bruel & Kjaer 4231 Acoustical Calibrator.

The measurement of heat stress was conducted using Metrosonics Inc. (Hs-3700) portable heat stress monitor with reference to the guidelines of American Conference of Governmental Industrial Hygienists (ACGIH)⁵. In the process of measurement, we paid specific attention to locate the heat sources such as stoves and steam boilers.

As for air quality, the measurement focused on the volatile organic compounds^{6,7,8,9} in the air, which included formaldehyde, acrolein, benzene, 1,3-butadiene, oil mist and a series of polycyclic aromatic hydrocarbons (PAH)¹⁰. The sampling and measurement were conducted according to the analytical guides issued by the National Institute for Occupational Safety and Health (NIOSH) and the United States Environmental Protection Administration (USEPA). The air samples were collected from the breathing zone of kitchen workers, while background air samples were also collected from other areas away from wok cooking in the kitchens which served as bases for reference. Each sample was processed and measured by UV-Vis spectrophotometer and high precision Gas Chromatograph-Mass Spectrometer. All analytical results would be checked against the occupational exposure limit-time-weighted average

(OEL-TWA) and the occupational exposure limit-ceiling (OEL-C) adopted by the Labour Department. The threshold limit value (TLV-TWA) by ACGIH as well as ES-TWA and CEL-TWA established by the European countries would also be referred so as to assess if kitchen workers were over-exposed to the airborne chemicals found in the workplaces. According to the results of questionnaire survey, most of the kitchen workers have to work 12 hours a day with 6 days a week which come up to 72 working hours a week. Hence, the OEL reduction factor of 0.42 was determined by the Brief and Scala model.

In order to ensure normal functioning of all the instruments and the accuracy and reliability of the monitoring data, all instruments had been calibrated by accredited laboratories through standard procedures.

1. Findings

471 kitchen workers from 159 Chinese restaurants were interviewed, in which 34.8% of them came from large restaurants whereas 40.6% and 24.6% came from medium-sized and small restaurants respectively.

Questionnaire survey

4.1 Personal particulars

The majority of interviewees were male (98.9%) and females only accounted for 1.1%. Most of them were of middle age and those at the age between 31 and 50 accounted for 71% of the total number of interviewees. Those in the age range of 21 to 30 accounted for 19.9% while those aged above 50 and below 21 accounted for 6.1% and 2.4% respectively.

Table 4.1: The number of interviewees by age group and by sex

	Male	Female
	Number (percentage %)	Number (percentage %)
Below 21	11 (2.4)	0
21 – 30	90 (19.7)	1 (0.2)
31 – 40	165 (36.1)	1 (0.2)
41 – 50	158 (34.6)	3 (0.7)

Above 50	28 (6.1)	0
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64.5% of the kitchen workers interviewed had secondary education; 30.7% had completed primary education; 4% were uneducated or had very little education; and only a very small minority (0.9%) received matriculation education or above. All kitchen workers surveyed held different posts in the Chinese restaurants, including chefs (26.1%), cooks (14%), assistant cooks (28.9%), *dim sum* masters (13.8%), cured meat masters (10%) and material matching, mixing and chopping cooks (7.2%). The majority of them (74.3%) had over 10 years working experience in kitchen; 16.6% had 4 to 10 years experience; 7.2% had 1 to 3 years experience; only 9 kitchen workers (1.9%) had less than one year of working experience.

Table 4.2: Particulars of interviewees

	Number (percentage)
Education:	
Uneducated	5 (1.1)
Little formal education	13 (2.9)
Primary level	140 (30.7)
Form 1 – Form 5	290 (63.6)
Form 6 – Form 7	4 (0.9)
Matriculation or above	4 (0.9)
Posts:	
Chef	123 (26.1)
Cook	66 (14.0)
Assistant cook	136 (28.9)
<i>Dim sum</i> cook	65 (13.8)
Grill cook	47 (10.0)
Chopping cook	34 (7.2)
Working experience in kitchen:	
Less than 1 year	9 (1.9)
1-3 years	34 (7.2)
4-10 years	78 (16.6)
More than 10 years	350 (74.3)

Approximately 48.5% of the interviewees were smokers, among them some (4.2%) even smoking at work; 16.3% were drinkers, among whom 3 interviewees (0.7% of the total number) said that they were used to drinking at work.

Table 4.3: Smoking and drinking habit

	Smoking	Drinking
	Number (percentage)	Number (percentage)
Yes (on duty)	19 (4.2)	3 (0.7)
Yes (off duty)	202 (44.3)	71 (15.6)
No	235 (51.5)	382 (83.8)

The majority of kitchen workers (95.3%) had rather long working hours of between 9 and 12 hours per day; a small number (1.7%) even worked for more than 12 hours per day. Almost all kitchen workers (97.9%) worked 6 to 7 days a week. Most of them said that they worked up to 54 to 84 hours a week.

Table 4.4: Working hours

Working hours per day	3 to 5 working days a week	6 to 7 working days a week
5-8 hours	1 (0.2)	13 (2.8)
9-12 hours	9 (1.9)	440 (93.4)
More than 12 hours	0	8 (1.7)

2. Work-related injuries and health problems

More than 80% of kitchen workers had suffered from injuries when engaging in the catering industry; over 60% had taken sick leave due to occupational injuries.

In the past twelve months, cuts (62.4%) and scalding (61.1%) were the two most common types of occupational injuries occurring in kitchens.

Injuries by animals such as fish, shrimps, crabs and the like as well as striking against stationary objects accounted for 29.5% and 20.2% respectively. Occupational injuries by slipping (13.0%) and manual handling operations (9.8%) were also prevalent in kitchens. Others included injuries by striking against or being struck by moving objects (5.3%), falls from height (4.2%), being struck by falling objects (2.8%), electric shock (1.9%) and machinery in operation (1.9%).

As shown in Table 4.5, injuries of kitchen workers were directly related to their job nature. There were high injury rate for material preparation cooks in terms of cuts and scald (94.1% and 52.9% respectively) as the cooks always use knife and contact with sea food. Besides, injury rate as a result of cuts and scald for main chefs, cooks, assistant cooks, dim sum cooks or grilling cooks were also high (up to 50-60%). Even the experiences chefs and cooks could be hurt by animals unavoidably. The injury rate was 30% in their respective work population. Due to the kitchen space limitation as well as rush work nature, 20% of the population of material preparation cooks, assistant cooks, dim sum cooks and grilling cooks had been injured by striking against stationary objects.

Table 4.5: Type of occupational injuries occurring in the past twelve months

	Number (percentage in each of the job population)						
	Chefs	Cooks	Assistant cooks	Dim sum cooks	Grill cooks	Material preparation cooks	Total (%)
Cuts	76 (61.8)	36 (54.5)	84 (61.8)	39 (60.0)	27 (57.4)	32 (94.1)	294 (62.4)
Scalding	78 (63.4)	39 (59.1)	89 (65.4)	37 (56.9)	30 (63.8)	15 (44.1)	288 (61.1)
Slipping	12 (9.8)	10 (15.2)	23 (16.9)	9 (13.8)	3 (6.4)	4 (11.8)	61 (13.0)
Fall from height	2 (1.6)	5 (7.6)	8 (5.9)	3 (4.6)	1 (2.1)	1 (2.9)	20 (4.2)
Injured by falling object	1 (0.8)	2 (3.0)	6 (4.4)	1 (1.5)	2 (4.3)	1 (2.9)	13 (2.8)
Electric shock	2 (1.6)	2 (3.0)	2 (1.5)	1 (1.5)	2 (4.3)	0 (0)	9 (1.9)
Striking against stationary	16 (13.0)	12 (18.2)	31 (22.8)	17 (26.2)	10 (21.3)	9 (26.5)	95 (20.2)

object							
Struck by moving object	7 (5.7)	5 (7.6)	6 (4.4)	5 (7.7)	1 (2.1)	1 (2.9)	25 (5.3)
Injured by manual handling operations	15 (12.2)	6 (9.1)	12 (8.8)	9 (13.8)	4 (8.5)	0 (0)	46 (9.8)
Injured by machinery in operation	3 (2.4)	2 (3.0)	1 (0.7)	2 (3.1)	1 (2.1)	0 (0)	9 (1.90)
Injured by animal	40 (32.5)	23 (34.8)	38 (27.9)	6 (9.2)	14 (29.8)	18 (52.9)	139 (29.5)

In the questionnaires, we have examined the common work-related diseases and health problems among kitchen workers in the past twelve months. As shown in Table 4.6, the two most common work-related diseases were musculoskeletal diseases (41.2%) and headachy symptoms(37.6%). Digestive system diseases like stomach ache, gasteremphraxis and dyspepsia accounted for 20.2% while respiratory system diseases such as coughs, nasal obstruction and accumulation of phlegm were not uncommon (15.1%). 12% of kitchen workers suffered from skin diseases, and the rest included otopathy (6.6%), oculopathy (4%) and heatstroke (2.5%).

Based on the ill health problems of staff recorded in different work positions, more than 50% of chefs, cooks and dim sum cooks had ever suffered from musculoskeletal diseases in the past 12 months. Over 40% of chefs and cooks had also claimed of being suffered from headachy symptoms. Relatively high population of chefs and cooks had also been suffered from respiratory diseases and gastrointestinal disorders which may be due to their frequent exposure to oil fumes and work stress. On the other hand, about 15% of the food preparation cooks had been suffered from skin problems which could be the result of wet hand and frequent contact with saucing and food.

Table 4.6: Work-related diseases or health problems in the past twelve months

	Number (percentage in each of the job population)						
	Chefs	Cooks	Assistant cooks	Dim sum cooks	Grill cooks	Material preparation cooks	Total (%)
Musculoskeletal diseases	63 (51.2)	33 (50.0)	44 (32.4)	23 (35.4)	24 (51.1)	7 (25.9)	194 (41.2)
Skin diseases	17 (13.8)	7 (10.6)	17 (12.5)	7 (10.8)	3 (6.4)	5 (14.7)	56 (11.9)
Respiratory system diseases	22 (17.9)	14 (21.2)	21 (15.4)	7 (10.8)	4 (8.5)	3 (8.8)	71 (15.1)
Digestive system diseases	32 (26.0)	15 (22.7)	24 (17.6)	9 (13.8)	8 (17.0)	7 (20.6)	95 (20.2)
Oculopathy	8 (6.5)	3 (4.5)	5 (3.7)	2 (3.1)	1 (2.1)	0 (0)	19 (4.0)
Otopathy	13 (10.6)	3 (4.5)	5 (3.7)	3 (4.6)	6 (12.8)	1 (2.9)	31 (6.6)
Heatstroke	4 (3.3)	5 (7.6)	2 (1.5)	0 (0)	1 (2.1)	0 (0)	12 (2.5)
Headachy symptoms caused by work pressure	52 (42.3)	27 (40.9)	48 (35.2)	19 (29.2)	20 (42.6)	11 (32.3)	177 (37.6)

3. Awareness and concerns about occupational safety and health

Occupational Safety and Health Ordinance has come into effect since May 1997. Almost 70% of kitchen workers surveyed said that they had heard of the Ordinance, among whom 47.7% were even aware of the clause “general duties”. It is interesting that nearly 50% of kitchen workers admitted that employees should bear most responsibility for occupational injuries, accidents and diseases, followed by employers (39.5%) and government (13%).

Table 4.7: Responsibility for occupational safety and health problem

	Number (percentage)
Employers	183 (39.5)
Employees	220 (47.5)
Government	60 (13.0)

Many kitchen workers (69.7%) had discussed with their colleagues about occupational safety and health issues. When they encountered occupational safety and health problem, most of them asked for assistance from their supervisors and colleagues, accounting for 66.1% and 10.8% respectively. Those who sought assistance from the Labour Department and the Occupational Safety and Health Council accounted for 11.6%, then insurance agents (5.2%), doctors (3.9%) and trade unions (1.1%).

Table 4.8: The targets of seeking assistance when encountering occupational safety and health problem

	Number (percentage)
Supervisors	306 (66.1)
Colleagues	50 (10.8)
Trade Unions	5 (1.1)
Labour Department/Occupational Safety and Health Council	54 (11.6)
Insurance agents	24 (5.2)
Doctors	18 (3.9)
Others	6 (1.3)

Approximately 60% of the interviewees knew where to get occupational safety and health information. Most of them selected the Labour Department (45.2%) as their source of information, followed by the Occupational Safety and Health Council (44.8%).

Table 4.9: Sources of occupational safety and health information

	Number (percentage)
Labour Department	213 (45.2)
Occupational Safety and Health Council	211 (44.8)
Vocational Training Council	19 (4.0)
Company	16 (3.4)

Others	12 (2.5)
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Table 4.10 shows that the prime concern of kitchen workers about their employment was stable income (46.5%), followed by safe and healthy working environment (34.1%) and job security (12.7%), while approximately 5% thought that job satisfaction was most important. There is a great discrepancy on the results of the present study and a previous study on the construction industry undertaken by the Council¹¹. A higher degree of concern on occupational safety and health issue had been shown by construction workers. According to the point of view of most kitchen workers, stable income would be far more important than a safe and healthy work environment.

Table 4.10: The prime concern of kitchen workers about their employment

	Number (percentage)	
	kitchen workers	construction workers ¹¹
Stable income	216 (46.5)	10946 (13.0)
Safe and healthy working environment	158 (34.1)	63297 (75.1)
Job security satisfaction	59 (12.7)	6847 (8.1)
Job satisfaction	22 (4.7)	—
Others	9 (1.9)	3190 (3.7)

With regard to safety and health problems, the primary concern of kitchen workers was industrial accidents and occupational diseases (30.6%), followed by cancer (20.6%) and poor air quality (19.3%). Approximately 10% worried about traffic accident and heart disease.

Industrial accidents and occupational diseases are the utmost concern by kitchen workers. However, with reference to a previous survey conducted by the council, the utmost concern of safety & health issue by the general public was air quality. The degree of concern on Occupational Safety and Health problem by the general public was

rated 5 in a total of 7 safety & health issue. This indicates the different attitude on safety & health concern by the general public and the employed population.

Table 4.11: Safety and health problems that kitchen workers showed primary concern

	Number (percentage)
Industrial accident and occupational disease	141 (30.6)
Cancer	95 (20.6)
Poor air quality	89 (19.3)
Traffic accident	33 (7.2)
Heart disease	19 (4.1)
Others	58 (12.6)
Nil	26 (5.6)

4. Awareness of and attitude towards occupational safety and health problems

In the questionnaire, a number of hypothetical questions were raised to test kitchen workers' awareness of and attitude towards occupational safety and health problems. The majority of interviewees could respond correctly to emergency warning signals. If the fire alarm rang, 70% of interviewees would shut off the main gas supply and leave the premise promptly; 14.6% would immediately leave the premise without any consideration. However, 12.6% would leave only upon order by their supervisor, while approximately 3% would turn a deaf ear to the fire alarm and continue their work.

Table 4.12: Response upon hearing fire alarm

	Number (percentage)
Leave immediately	68 (14.6)
Leave promptly after shutting off all gas supplies	327 (70.0)
Leave only upon order by supervisor	59 (12.6)

Utterly ignore	13 (2.8)
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In case of gas or liquefied petroleum gas leakage, 90% of kitchen workers would shut off the main gas supply and open all windows to let the gas out; almost 50% would turn off all electrical appliances and put out all stove fire; 57.3% of interviewees would take active actions by reporting to the police and evacuating all customers and kitchen workers. Nevertheless, 3.6% of kitchen workers would ignore the gas leakage and said that the gas would soon dissipate, thereby incurring no danger.

Table 4.13: Response to gas leakage in kitchen*

	Number (percentage)
Completely ignore and say that the gas will soon dissipate	17 (3.6)
Shut off the main gas supply and open all windows to let the gas out	421 (90.0)
Turn off all electrical appliances and put out stove fire	224 (47.9)
Report to the police and evacuate all customers and kitchen workers	268 (57.3)

* Kitchen workers might choose one or more option(s)

Most of the interviewees (68.3%) thought that personal protective equipment (PPE) were required for kitchen work. According to them, the most common PPE used in kitchen was apron (54.5%), followed by gloves including plastic gloves (37.9%), heat-protective gloves (25.6%), cotton and yarn gloves (21.4%) and cut-resistant gloves (3.8%). Plastic boots (21.9%) were another commonly-used personal protective equipment. Others included safety shoes (17.8%), boiler suits (15.0%) and sleevelets (8.3%). Occupational injuries by knives, cutting and scalding were among others prevalent in kitchen work. Though almost 70% of interviewees understood the importance of wearing PPE, the number of users was relatively few, reflecting that

more emphasis should be placed on improving the attitude of kitchen workers towards work safety.

Table 4.14: The use of personal protective equipment in routine work

	Number (percentage)
Apron	255 (54.5)
Plastic gloves	177 (37.9)
Heat-protective gloves	120 (25.6)
Plastic boots	102 (21.9)
Cotton gloves	100 (21.4)
Safety shoes	83 (17.8)
Working uniform	70 (15.0)
Sleevelets	39 (8.3)
Cut-resistant gloves	18 (3.8)

Although the rate of occupational injuries in the catering sector is comparatively high, the majority of kitchen workers (89.3%) thought that kitchen work was safe, supporting our findings that kitchen workers interviewed did not have sufficient sense of crisis to the dangers hidden in kitchen to occupational safety and health. Nearly 80% of interviewees thought that kitchen workers would be more careful at work and if there was a safer and healthier working environment, at least 50% of occupational injuries could be avoided. However, there was still a number of interviewees (5.6%) who thought that occupational injuries were unavoidable.

Table 4.15: The view that accidents are avoidable

The percentage of accidents considered to be avoidable	Number (percentage)
100%	56 (12.1)
Above 50%	197 (42.5)
Approximately 50%	115 (24.8)
Below 50%	44 (9.5)

Unavoidable	26 (5.6)
Uncertain	26 (5.6)

Regarding how to solve occupational safety and health problems in the catering sector, a considerable number of kitchen workers raised some well-intented and constructive suggestions, including the engagement of experienced kitchen workers as safety training instructors to raise the occupational safety and health awareness of workers in the trade; appropriate arrangement of rest during working hours; improvement of ventilation; and equipping with suitable personal protective equipment. They also thought that supervisors should play a leading and guiding role in promoting work safety; regularly checking cooking equipment and promptly repairing those which could not function properly. Ultimately, it is hoped that the government should further enforce safety legislations to ensure occupational safety of kitchen workers and protect their health.

5. Training

In order to increase kitchen workers' knowledge of occupational safety and health aspects, correct their safety behaviour and attitude, and strengthen their alertness to and ability of identifying hidden dangers in working environment, proper education and training, the most important elements of the safety management system, are indispensable. The Occupational Safety and Health Ordinance stipulates clearly that employers should provide all their staff with all necessary training and information. According to the survey conducted in the form of questionnaires, over 60% of the Chinese restaurants where interviewees worked did not provide any general safety training which should include orientation training, refresher training as well as job specific training, like fire prevention knowledge, machinery safety, manual handling operations and the use of chemicals. 30% only provided some of the above training programmes, while 75% did not even practise periodic fire drills to cope with contingent emergencies.

Table 4.16: Safety training and fire drills

	Number of Chinese restaurants (%)
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	Nil	Some	Yes
Provision of general safety training	72 (60.0)	31 (25.8)	17 (14.2)
Provision of job specific training	76 (62.3)	24 (19.7)	22 (18.0)
Arrangement of regular fire drills	89 (74.2)	10 (8.3)	21 (17.5)

Table 4.17: Statistics about provision of safety training

	Number (%)		
	Large Chinese restaurants	Medium Chinese restaurants	Small Chinese restaurants
General safety training	10 (58.8)	3 (17.6)	4 (23.5)
Job specific training	12 (54.5)	3 (13.6)	7 (31.8)
Regular fire drills	8 (38.1)	7 (33.3)	6 (28.6)

According to the results of the survey, large Chinese restaurants represent the majority (over 50%) among those providing training programmes, and also the majority (38.1%) among those practising periodic fire drills. This may be due to the fact that large restaurants or restaurant chains possessed comparatively more resources so that they could perform more actively in occupational safety and health management.

Kitchen inspection

6. Working environment and conditions of kitchens in Chinese restaurants

An investigation team carried out site inspections of the kitchens in more than 150 Chinese restaurants to assess their working environment and conditions. The inspections are very important to us as we can have a comprehensive and systematic understanding of safety conditions of the kitchens of Chinese restaurants in Hong Kong. The results show that almost 80% of kitchens (77.4%) did not have adequate instructions of emergency exit route; approximately

three-fourths of restaurants (72.0%) did not keep smoke doors closed for the sake of working convenience. A considerable number of kitchens' drainage facilities were in poor condition (54.0%), while most of their floors were oil-stained (70.4%). In some of the kitchens surveyed, emergency exits were blocked (43.5%) while materials were piled up (36.3%). In addition, some kitchen workers did not undertake their manual handling work properly (35.8%) while others placed sharp knives in unsafe positions (31.5%). A number of kitchens (27.2%) did not carry maintenance on ventilation system while some kitchens recorded unsafe use of electrical appliances and equipment (17.9%).

Since large Chinese restaurants are generally superior to their smaller counterparts in resources, manpower, equipment and workplace area, the kitchens of large restaurants have more favourable working environment and conditions, including putting all equipment in good and systematic order, keeping all exits and passageways clear and unblocked, pasting maps clearly showing fire escape routes and emergency measures, providing auxiliary devices for delivery to minimize the needs of manual labour handling operations, as well as pasting relevant safety notices in kitchens. All these are important elements of enhancing safety performance in the catering sector.

Table 4.18: Working environment and conditions of Chinese restaurants

	Number of Chinese restaurants (%)		
	Poor	Fair	Good
Housekeeping	14 (11.2)	55 (44.0)	56 (44.8)
Drainage facilities	67 (54.0)	45 (36.3)	12 (9.7)
Electric safety	22 (17.9)	59 (48.0)	42 (34.1)
Unblocked exits	54 (43.5)	41 (33.1)	29 (23.4)
Smoke doors keeping closed	90 (72.0)	14 (11.2)	21 (16.8)
Exit signs	43 (34.7)	27 (21.8)	54 (43.5)
Emergency route indication	96 (77.4)	2 (1.6)	26 (21.0)

Smooth and undamaged floor	10 (8.0)	24 (19.2)	91 (72.8)
Floor covered with antiskid materials	10 (8.0)	24 (19.2)	91 (72.8)
Floor without oil stain	88 (70.4)	26 (20.8)	11 (8.8)
Classified storage of materials	8 (6.5)	33 (26.6)	83 (66.9)
Stockpiling of materials	45 (36.3)	44 (35.5)	35 (28.2)
Separate storage of chemicals and food	11 (8.9)	24 (19.5)	88 (71.6)
Manual handling operations	43 (35.8)	11 (9.2)	66 (55.0)
Conditions of knife tools	3 (2.4)	20 (16.0)	102 (81.6)
The placement of knife tools	39 (31.5)	35 (28.2)	50 (40.3)
Labelling of chemicals	9 (7.3)	13 (10.6)	101 (82.1)
The storage of chemicals far away from fire sources	8 (6.5)	9 (7.3)	107 (86.3)
Well-established ventilation equipment	10 (8.0)	38 (30.4)	77 (61.6)
Stoves with ventilation installation	7 (6.0)	9 (7.7)	101 (86.3)
Cleanliness of ventilation system	34 (27.2)	42 (33.6)	49 (39.2)
Safety promotion - poster & notice	76 (62.3)	24 (19.7)	22 (18.0)

In comparison, the safety performance of small Chinese restaurants is relatively inferior. Such undesirable working environment and conditions as poor drainage facilities which lead to wet floor, blockage of emergency exit and escape, smoke doors not kept closed, no proper repair of defective exit indicating board with lighting, lack of indication of fire escape route and emergency procedures, floor with

oil stain, unsafe piling up to material, lack of mechanical aid for manual handling, unsafe placement of knife tools, inactive promotion work to enhance the health and safety awareness of workers are all factors of serious accidents at the workplace.

Table 4.19: Safety conditions of kitchens of Chinese restaurants of difference sizes

	Number (%)		
	Large Chinese restaurants	Medium Chinese restaurants	Small Chinese restaurants
Poor drainage facilities	16 (23.9)	23 (34.4)	28 (41.8)
Blockage of emergency exit	11 (20.4)	13 (24.1)	30 (55.6)
Smoke doors kept opening	22 (24.4)	28 (31.1)	40 (44.4)
Defective exit signs	8 (18.6)	11 (25.6)	24 (55.8)
lack of indication of fire escape route and emergency procedures	19 (19.8)	30 (31.3)	47 (49.0)
Floor with oil stain	21 (23.9)	28 (31.8)	39 (44.3)
Over-piling of material	11 (24.4)	15 (33.3)	19 (42.2)
Improper manual handling operation	5 (11.6)	11 (25.6)	27 (62.8)
Unsafe placement of knife	8 (20.5)	14 (35.9)	17 (43.6)
Lack of health and safety promotion	12 (16.7)	25 (34.7)	35 (48.6)

Occupational sanitation monitoring

A total of approximately 40 large, medium-sized and small Chinese restaurants were selected in this survey to examine the environmental conditions of their kitchens such as lighting, noise, heat stress and air quality, thereby obtaining first-hand information concerning the

working environment and conditions of kitchens of Chinese restaurants in Hong Kong.

7. Lighting

Table 4.20 shows the average illuminance value and lighting uniformity of the workplace in kitchens, clearly reflecting that kitchen workers worked under different illumination conditions, ranging from 110 to 995 luxes. Illumination Engineering Society of the United States (IES)¹² has suggested that indoor illumination level of kitchens for commercial use should be 750 lux. Apparently, the majority of Chinese restaurants (92%) from this sample survey did not provide sufficient illumination for their kitchen workers.

Table 4.20: Assessment of illuminance in kitchens of Chinese restaurants (the number of Chinese restaurants surveyed: 37)

Illuminance (lux)			Uniformity ratio		
Range	Mean± Standard deviation	Illuminance suggested by IES (lux)	Range	Mean± Standard deviation	The minimum standard ratio
110-995	480±192	750	0.11-0.96	0.48±0.21	0.8

In addition, the illumination uniformity in kitchens was also examined. According to the results of the survey, the uniformity ratio ranged from 0.11 to 0.96, while the mean was 0.48. However, most of the surveyed data (92%) were lower than the minimum standard ratio of 0.8, showing clearly that the prevalence of uneven distribution of illumination in kitchens was very serious.

8. Noise

In this survey, the noise impact on kitchen workers at work was also measured.

According to Table 4.21, the daily personal noise exposure ($L_{EP,d}$) to kitchen workers surveyed ranged between 69 dB(A) and 95 dB(A), with the mean at 85 dB(A) which had reached the first action level.

When the peak sound pressure level ranged from 96 dB to 121 dB, the mean was 109 dB.

As it is generally known that exposure to excessive noise will impair one's hearing, a short-time exposure to high noise level, such as the sound of explosion, is enough to split the ear membrane and cause deafness at once. Similarly, frequent long-time exposure to high noise level will lead to irreversible impairment of auditory nerve cells of the inner ear, ultimately resulting in permanent hearing loss.

The three noise action levels defined in the Factories and Industries Undertakings (Noise at Work) Regulation⁴ are (i) 'first action level', meaning a daily personal noise exposure of 85 dB(A); (ii) 'second action level', meaning a daily personal noise exposure of 90 dB(A); and (iii) 'peak action level', meaning noise reaching a peak sound pressure level of 140 dB(A).

Table 4.21: Noise assessment of kitchens in Chinese restaurants (the number of Chinese restaurants surveyed: 37)

Daily personal noise exposure			Peak sound pressure level		
dB(A)			dB		
Range	Mean \pm Standard deviation	First action level/dB(A)	Range	Mean \pm Standard deviation	Peak action level/dB
69-95	85 \pm 5	85	96-121	109 \pm 5	140

Among the 37 Chinese restaurants surveyed, daily personal noise exposure to kitchen workers of 15 Chinese restaurants (41%) exceeded that specified in 'first action level'. Besides, the daily personal noise exposure to kitchen workers of 9 Chinese restaurants (24.3%) reached 90 dB(A) or above, exceeding the noise level specified in 'second action level' under the Regulation. All these show that most kitchen workers of Chinese restaurants were under the threat of noise hazards at their workplace. According to the records of site inspection, the high noise level originated from the motor functioning sound of steam boilers and exhaust installation, gas stoves, the impact of cooking utensils, and the sound of chopping meats and bones.

9. Heat Stress

Since measuring the body temperature of kitchen workers is not feasible for determining their thermal load, measuring the most relevant environmental factors which influencing physiological reaction of people is the primary approach of heat stress monitoring. At present, Web Bulb Globe Temperature Index (WBGT) is one of the simplest and most suitable methods of measuring high-temperature environment⁵. This Index is the appropriate measurement officially approved by American Conference of Governmental Industrial Hygienists (ACGIH) and National Institute for Occupational Safety and Health (NIOSH) of the United States.

The team monitored the WBGT of 35 Chinese restaurants. Measurement was made in the areas where kitchen workers carried out their routine work, including the immediate vicinity of stoves and ovens, and relevant working surfaces. Measurement parameters comprised the dry-Bulb temperature, the Natural Web-Bulb Temperature and Global Temperature while indoor WBGT Index is computed by the heat stress monitor with accounting for the above parameters.

Table 4.22: Monitoring of heat stress in kitchens of Chinese restaurants

WBGT Index (°C)		
Range	Mean ± Standard deviation	Permissible heat exposure threshold limit value (°C)
21.2-37.3	28.2±3.2	26.7

According to ACGIH's guidelines⁵, assuming that kitchen workers are required to work continuously for 8 hours in moderate workloads, the insulation value of clothing (Clo Value) of their boiler suits will be 0.6 and the permissible heat threshold limit value (TLV) will be 26.7°C. The TLV refers to heat stress conditions under which it is believed that nearly all workers may be repeatedly exposed without adverse health effects. In fact, the TLV is based on the assumption that nearly all authorized, fully clothed workers with adequate water and salt intake

should be able to function effectively under the given working conditions without exceeding a deep body temperature of 38°C.

Table 4.22 shows that the WBGT of Chinese restaurants' kitchens surveyed ranged from 21.2°C to 37.3°C. Since some Chinese restaurants have installed air-conditioning system in their kitchens as observed on site, the environmental temperature could be maintained within a certain range. Nevertheless, there were still a number of kitchens where no effective ventilation system was installed, and WBGT reached as high as 37.3°C in some kitchens. 68.6% of the Chinese restaurants surveyed recorded WBGT exceeding the heat stress threshold limit value. The use of gas in grilling and deep frying are the main heat sources. High-temperature working environment may lead to severe illnesses like heat stroke, thereby seriously impairing one's health. Other health problems diseases include heat exhaustion and heat cramps, while excessively long exposure to high-temperature environment may result in heat disorder, leading to electrolyte unbalance, dehydration, skin rash, oedema, and even loss of working ability.

10. Air quality monitoring

Monitoring of air quality was conducted in 30 Chinese restaurants surveyed, aiming to better understand whether the composition of volatile organic compounds in the air (including the concentration of carcinogen) within the working environment of kitchens has reached an overly high level and whether the occupational health of kitchen workers would be endangered. The test was conducted in the area close to the stoves where cooks worked and breathed, as well as other areas of the kitchens. Air samples in the above assigned places were taken and sent to an accredited chemical laboratory for precise chemical analysis. The results were recorded and shown in Table 4.23.

Table 4.23: Air quality of kitchens in Chinese restaurants (the number of Chinese restaurants surveyed: 30)

Air pollutant	Occupational exposure limit	Air sample taken from the breathing zone of cooks	Air sample from the kitchen setting	Detection limit
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		Range	Mean ± Standard deviation	Range	Mean ± Standard deviation	
Formadldehyde (ppm)	0.3 (OEL-C)	<0.03-0.63	0.20±0.20	0.03-0.14	0.07±0.04	0.03
Acrolie (ppb)	100 (OEL-C)	Below the detection limit	-	Below the detection limit	-	10
Benzene (ppb)	210 (OEL-TWA)	Below the detection limit	-	Below the detection limit	-	10
1,3-Butadiene [1,3] (ppb)	840 (OEL-TWA)	Below the detection limit	-	Below the detection limit	-	200
Oil mist (mg/m ³)	2.1 (OEL-TWA)	<0.5-7.10	1.32±1.88	Below the detection limit	-	0.5
Polycyclic Aromatic Hydrocarbon						
Naphthalene (mg/m ³)	21.8 (OEL-TWA)	<0.5-58	6.87±13.20	<0.5-1.4	0.20±0.53	0.5
Acenaphthylene (mg/m ³)	4200 (TLV-TWA)	Below the detection limit	-	Below the detection limit	-	1.0
Acenaphthene (mg/m ³)	4200 (TLV-TWA)	Below the detection limit	-	Below the detection limit	-	1.0
Fluorene (mg/m ³)	4200 (TLV-TWA)	Below the detection limit	-	Below the detection limit	-	1.0
Phenanthrene (mg/m ³)	4200 (TLV-TWA)	Below the detection limit	-	Below the detection limit	-	1.0
Anthracene (mg/m ³)	84 (TLV-TWA)	Below the detection limit	-	Below the detection limit	-	1.0

		limit		limit		
Fluoranthene (m g/m3)	4200 (TLV-TWA)	Below the detection limit	-	Below the detection limit	-	1.0
Pyrene (m g/m3)	4200 (TLV-TWA)	Below the detection limit	-	Below the detection limit	-	1.0
Chrysene (m g/m3)	4200 (TLV-TWA)	Below the detection limit	-	Below the detection limit	-	1.0
Benz (a) anthracene (m g/m3)	4200 (TLV-TWA)	Below the detection limit	-	Below the detection limit	-	1.0
Benzo (b&k) fluroanthene (m g/m3)	4200 (TLV-TWA)	<1.0-1.2	0.04±0.22	Below the detection limit	-	1.0
Benzo (a) pyrene 3,4 (ug/m3)	2.1 (CEL-TWA)	,1.0-1.0	0.03±0.18	Below the detection limit	-	1.0
Dibenz (ah) anthracene 1,2,5,6 (m g/m3)	4200 (ES-TWA)	Below the detection limit	-	Below the detection limit	-	1.0
Indano (1,2,3-cd) pyrene (m g/m3)	4200 (TLV-TWA)	Below the detection limit	-	Below the detection limit	-	1.0
Benzo (ghi) perylene (m g/m3)	4200 (TLV-TWA)	Below the detection limit	0.27±1.26	Below the detection limit	-	1.0
Remarks:	ppm	Parts per million in terms of volume by volume				
	ppb	Parts per billion in terms of volume by volume				
	mg/m3	Milligrams per cubic metre of air				
	µg/m3	Micrograms per cubic metre of air				

Formaldehyde is a chemical compound of volatile substance in edible oil¹³.

Long-term scientific experimentation and epidemiological studies have concluded that

formaldehyde may cause cancer. Both NOHSC of Australia and ACGIH have classified it as a suspected human carcinogen. In 1998, the Labour Department¹⁴ formulated 'A Reference Note on Occupational Exposure Limits for chemical substances in the Work Environment', suggesting formaldehyde occupational exposure limit-ceiling (OEL-C) to be 0.3ppm. As shown in Table 4.23, the concentration of formaldehyde in the oil fumes released from stir-frying by hot woks ranged from <0.03ppm to 0.63ppm, and the mean was 0.20ppm. The concentration of formaldehyde in the air of 28.5% of Chinese restaurants' kitchens exceeded the above OEL-C. It is noteworthy that a small amount of formaldehyde was measured out (ranging between 0.03ppm and 0.14ppm) inside the kitchens in areas far away from the stoves, reflecting that formaldehyde may be released from other sources (like cigarette smoking, furniture, carpet, etc.), but the main pollution source is still the process of stir-frying process.

The Chinese put much emphasis on 'hot wok cooking', particularly in the cooking method of frying food in shallow and deep oil. Cooking food with high-temperature oil releases oil fumes, among which there may exist some substances changing human genes and causing cancers. In fact, oil fumes released from stir-frying are the main air pollutants in kitchens. According to the monitoring results, the concentration of oil mist exposed to cooks ranged from <0.5mg/m³ to 7.10mg/m³, and the mean was 1.32 mg/m³. The revised OEL-TWA by Brief and Scala Model was 2.1 mg/m³. The concentration of oil mist in the air of 23.3% of Chinese restaurants' kitchens exceeded that limit. No oil fumes was measured out in the background air samples, furnishing an abundant proof that the ventilation system installed in the Chinese restaurants' kitchens in general could effectively clear greasy dirt off the air. However, since cooks have to be in close contact with oil fumes for long hours, their health may be seriously impaired.

Chemical analysis of polycyclic aromatic hydrocarbons (PAH) in the sample air aimed to examine whether oil fumes released from stir-frying contained carcinogen, which endangered the health of kitchen workers. The analysis results show that such volatile chemical compounds as Naphthalene, Benzo (b&k) fluoranthene, Benzo (a) pyrene, and Benzo (hgi) perylene were measured out in the breathing zone of cooks when stir-frying. Meanwhile, the concentration of Naphthalene in 13.3% of Chinese restaurants' kitchens exceeded occupational exposure limit of 21.8 mg/m³, some reaching as high as 58 mg/m³. Though the concentration of 3 other kinds of PAH was not significantly higher, both Benzo (b) fluoranthene and Benzo (a) pyrene, like formaldehyde, were defined by ACGIH as suspected human carcinogens, and the concentration of Benzo (a) pyrene in a few kitchen even reached 1.0 mg/m³, close to

CEL-TWA of 2.1 mg/m^3 , the severity of which should not be overlooked. Our air monitoring results show that high concentrations of formaldehyde, PAH and even oil mist are probably the main causes for the fair chance of kitchen workers of Chinese restaurants to suffer from cancers of respiratory system.

5. Discussion

This is the first comprehensive and systematic survey of occupational safety and health conditions in kitchens of Chinese restaurants in Hong Kong. It was conducted very successfully, not only inquiring into the occupational safety and health issues faced by kitchen workers of Chinese restaurants in Hong Kong and understanding their awareness and requests in this respect; but also providing first-hand information on enhancing the catering trade's safety and health standard through on-site inspections and occupational hygiene monitoring work.

To obtain typical samples and reduce sampling errors, we have chosen more random samples to ensure sufficient number of samples. As samples are obtained from Chinese restaurants of different sizes and kitchen workers in different positions, the result is fully representative of the trade.

The survey was conducted in personal interviews. Many studies prove that personal interviews can collect more ample and comprehensive information than telephone interviews. However, a personal interview has its own disadvantages, e.g. errors would be made due to the interviewer's aptitude or prompts in questioning and recording. To avoid such deviation during the interview, our questionnaire was written in spoken language as far as possible and all interviewers received proper training prior to the survey. The survey was conducted without putting down the interviewee's name, so that it was more likely in getting genuine answers.

Another limitation is that the survey was conducted within the workers' working premises so that the interviewees had to seek their employers' consent. In addition, much information such as injury or disease suffered on the job was all furnished by the kitchen workers, rather than certified by medical diagnosis or other documents (e.g. sick leave certificates). Hence, it is very important to obtain sufficient samples to reduce deviation. On the other hand, collection of personal samples in the course of occupational hygiene monitoring called for kitchen workers' full cooperation, but the request for interview was declined from time to time, particularly during the busy hours of the restaurants. Nevertheless, with much effort, the surveying officers have eventually obtained adequate samples to get a better picture of occupational safety and health conditions in the kitchen work.

The 471 workers taking part in the survey come from different posts in the kitchen. They are mainly male workers of middle age, mostly with secondary education, half of them are smokers, but less than 20% having the habit of drinking. Some of the kitchen workers said that they would smoke during work. This may deteriorate the air quality within the working premises. Over 70% of the interviewees have 10 years or longer working experience in kitchen. The experienced kitchen workers do their familiar job with ease, thus helping to enhance their working efficiency. However, with inadequate awareness of work safety and poor safety work system, plus long working hours in kitchen and lack of rest, the kitchen workers may suffer injury on the job due to fatigue, absent-mindedness and work pressure.

It was found in the survey that 80% of the interviewees had suffered injury on the job; while over 60% of them had to take sick leave due to such injury. The most common injuries during the past year were cutting and scalding (both over 60%). These figures show the frequency and seriousness of industrial accidents in the catering trade. In the past twelve months, the occupational diseases suffered by kitchen workers were mainly musculoskeletal diseases, followed by symptoms caused by work pressure, such as headache and indigestion, which should draw the attention of the management. Cuts, scalding and stab wounds caused by animals (such as by fish fin or crab) are most common injuries in the kitchen. People hurt by collision with stationary objects could be due to narrow space or rush work. Other important reasons for injury are fall on slippery floor and poor housekeeping. It is also easy to get injured when manual lifting or carrying heavy loads. Apparently, these injuries can be considerably eliminated through straightening up the kitchen and on the job training.

Musculoskeletal diseases are common health problems suffered by workers in the catering trade. It is often seen that a cook in a Chinese restaurant often holds a big wok weighing over ten pounds and tosses it over the stove from time to time; the food in the wok is thrown in mid air and the cook's waist twists when placing the food on dish. These gestures are quite graceful but would lead to sprain on his wrist, elbow, upper arm, waist and back.

On the other hand, the grill cooks are required to bend over to pickle and roast the meats; the dim sum cooks are required to put in or take out the dim sum for steaming to or from the steamer installed at high position. Furthermore, manual lifting a full bucket of hot soup or a huge bag of rice, flour, sugar or oil in improper gesture is a principal factor leading to musculoskeletal injuries.

This survey also shows that many kitchen workers are aware of the Occupational Safety and Health Ordinance and consider that they should take responsibility to prevent accidents while working. They are willing to discuss the problems with others and seek assistance or obtain more information about occupational safety and health. Like the findings in other safety awareness surveys conducted for other trades, most kitchen workers are mostly concerned with their stable income though they know a safe and healthy environment is important.

Most kitchen workers can react properly in emergency, but there is still a few people who treat the emergency lightly, therefore education and drill on emergency should be strengthened. Most interviewed kitchen workers said they are willing to use personal protection equipment and aware of it's importance in prevention of kitchen accidents. However, the actual use rate of protection equipment is far from satisfactory, with considering the high accident rate of cuts, scalding and fall on slippery floor. Employers should allocate more resources to provide suitable personal protection equipment and strengthen training for the kitchen workers, who in return should cooperate with their employer to reach the safety standard. In fact, most interviewees believe that many industrial accidents in kitchens can be avoided if the kitchen workers adopt a more cautious working attitude.

The above findings seem to show that the kitchen workers are aware of safety and health in the workplace, they understand the requirements of the ordinance and know the serious consequences caused by industrial accidents and that these accidents can be prevented, but why is that the accident rate of the catering trade still so high? One of the explanations is that the kitchen workers lack the sense of crisis. Most interviewed cooks (89%) consider their job as "safe" which actually is not the case. Judging from our inspection results, the working environment of most kitchens we visited is neither safe nor healthy.

The inspections on site show that the actual working environments and conditions of many kitchens are unsatisfactory. Puddle on the ground, blockage in safety exits, lack of sign for emergency exits, slippery floor, unstable piling up of materials, improper manual handling, unsafe use of knives, poor ventilation and lack of safety awareness promotion work may possibly constitute serious hazards for kitchen workers.

In addition, the lighting in kitchens of most Chinese restaurants is far from adequate in comparison with the proposed illumination standard, worse still, the brightness of lighting is uneven. The poor vision caused by dim lights is likely to cause hazards

during work. Improper lighting would reduce working efficiency, endanger employees' health and increase chance of accident. In addition to inadequate and uneven lighting, other poor illumination effects are also found in the kitchen environment, such as over brightness in some areas, glare effect, contrast light, shadow, reflective light and dazzling light. These are the main factors causing visual troubles and may lead to kitchen workers' eye fatigue and frequent headache at work. The survey further verifies that the noise level in many kitchens exceed those of "first action level" and "second action level" set out in "Factories and Industrial Undertakings (Noise at Work) Regulation".

The findings also indicate that the kitchen workers are facing the problem of heat stress. The WBGT Index in some kitchens is as high as 37°C, far exceeding the threshold value limit of permissible heat exposure of 26.7°C. The hot and damp working environment is a serious problem to kitchen workers. Other undesirable working conditions together with numerous heat sources (such as stoves and roasters) may impair the health of kitchen workers, especially in summers.

It is worth noting that when cooking with hot oil, the kitchen workers' breathing zone contains highly concentrated air pollutants, including formaldehyde, oilmist and polycyclic aromatic hydrocarbons. It is believed that these harmful substances could be derived from the transformation process on heating unsaturated oil and fat in meat during hot cooking. In fact, the findings prove that some kitchen environments are full of carcinogenic substances. It is hard to imagine that the cooks who prepare delicious food for us may possibly suffer from cancer just because they inhale the oily smoke arising from cooking. It is more worrying that both employers and employees in the trade do not realize the existence of such a hazard.

According to a survey conducted by the Chinese University of Hong Kong in 1998¹⁵, the rate of kitchen workers dying of lung cancer is 15% higher than the general public; if compared against the waiters, the kitchen workers' rate is also 15% higher. The proportion of smokers among kitchen workers is similar to that of waiters, approximately 40% to 50%. Therefore the findings have made the deduction that lung cancer suffered by kitchen workers is related to long contact with oil fumes. In addition, studies carried out in Taiwan and China in recent years point out that women who accumulatively inhale kitchen oily smoke containing carcinogenic substances would be more vulnerable to lung cancer apart from chronic bronchitis and worsening of asthma. According to a report on epidemic of lung cancer in Taiwan issued by Public Health College, Taiwan University in March this year, the rate of lung cancer

suffered by women using ventilators in kitchens is 30% lower than women of the same age but not using ventilators.

Chinese often use edible oil to cook by frying, stir-frying and deep-frying. Many carcinogenic substances are evaporated from the boiling oil. According to documentary information¹⁶, 1,3-Butadiene, Benzene, Acrolein and Formaldehyde of high concentration are detected from the oil fumes released from rapeseed oil when cooking; while less concentrated organic substances are also found in peanut oil fumes. With the rise of temperature during cooking, the contents of 1,3-Butadiene and Benzene in the oil fumes increase considerably, even exceeding by 12 to 22 times. Some study information indicates that the cooking oil repeatedly used by the Chinese restaurants, commonly known as “Ten thousand years’ oil”, contains a variety of carcinogenic substances. We had attempted to test the “Ten thousand years’ oil”, but most visited restaurants declared that “Ten thousand years’ oil” is no longer used in the Chinese restaurants in Hong Kong. As a result, no test was conducted on “Ten thousand years’ oil”. Literature review¹⁷ also indicates that some carcinogenic substances including Benzo (b) fluoranthene, Benzo (k) fluoranthene and Benzo (a) pyrene could be detected in high grade mineral oil. This finding is very closed to our air quality monitoring results obtained from the Chinese restaurants, further confirms that oil fumes constitute a serious threat to kitchen workers.

As mentioned above, the high accident rate in the catering trade is related to unsafe working environment in kitchens and inadequate crisis awareness among the workers. Why is the kitchen workers’ crisis awareness so low? One of the reasons is the insufficiency of education and training on occupational safety and health. This survey has further proved such a deduction. According to the survey, 60% of the Chinese restaurants do not provide general safety training for their staff; 65% do not provide special training on the job; 75% do not conduct regular fire drills. Nearly 30% of the restaurants only provide limited safety training.

Although insufficient education and training on occupational safety and health as well as inadequate crisis awareness among the workers are causes of low safety and health standard in the trade, we have, after further analysis and inquiry, found a factor that could not be ignored, i.e. the workers’ attitude and behaviour on safety. After many years’ promotion by the government and Occupational Safety and Health Council, most workers recognize the importance of safety at work and know the requirements by the law, but they “know but not taking action”. For example, they realize the

wearing of personal protection equipment can prevent industrial accidents, but they are unwilling to use it. During the work, they refuse to observe safety rules and want to complete the job as soon as possible by taking a shortcut. We should pay attention to such a phenomenon.

Of course, improving the safety behaviour and attitude is not the whole of promoting work safety and health. To enhance the work safety and health standard in the catering trade, we should start with system, environment, equipment and people. First of all, an administrative system for work safety and health should be set up to improve working environment, remove the hazardous factors and upgrade or replace unsuitable or damaged equipment. In this survey, we have found that, except for a few big restaurants and catering groups, most restaurants we visited have not set up their safety committees, not to mention any safety policy and safety structure.

Some large scale catering groups have provided systematic on-the-job training for the staff, including safety courses. Restaurants of small-and-medium scale can join together to set up a central training centre or make use of the Council's safety training courses provided for the catering trade or their internal safety training courses, in order to achieve the objectives of training the staff with highest cost-effectiveness. Employers can set their training target and design appropriate training method according to job analysis and crisis assessment. Of course, proper improvements should be made to respond to the workers' feedback to the training programme, helping them apply the knowledge and skill learned from the training courses to their daily work.

To improve the kitchen's lighting condition, we should conduct regular examination and maintenance on all lighting facilities. For example, damaged lightings should be replaced immediately; old shades of fluorescent lamps which may reduce illumination should be replaced; local lighting should be improved in areas requiring stronger illumination; lighting facilities (including artificial lighting and natural light) should be properly arranged to provide comfortable and even lighting. In fact, adequate and suitable lighting in the working premises is extremely important. It may enhance the cooks' working efficiency and alleviate their fatigue and unease in eyes. Most importantly, accidents may be prevented by improving their visual response.

The survey shows that most cooks in Hong Kong are disturbed by noises at work. To implement an effective hearing protection scheme, the priority is to control the source of noise. Machines should be properly maintained to minimize their noise during operation. The working process and machine generating too much noise should be

rearranged and repaired or replaced as far as possible. The cook's working shifts should be properly arranged so as to reduce the hours at work with disturbing noise. It is also necessary to wear suitable hearing protectors such as earplugs or earmuffs if the above control measures fail to get the desired result. As for thermal pressure, installment of an effective exhaust device at the source of hot air or fumes can effectively dispel the heat. Ventilators should be installed in all stoves and roasters to reduce the heat in kitchens. A complete ventilation system at working area may promote the circulation of fresh air, thus helping to reduce the temperature.

The findings of the study also prove the existence of airborne carcinogens in the kitchen. An effective ventilation system should be installed to cope with the oil fumes evaporated from heated cooking, especially in a limited space such as a small kitchen. In fact, ventilation is the most common environmental control measure to deal with air pollution because it can rapidly dispel combustible and poisonous substances.

To solve the problem of oil fumes in the catering premises, some Chinese restaurants have installed water spray hoods, or hydro-vents, in their kitchens to discharge the oil fumes¹⁸. These ventilation systems considerably reduce the hazard of kitchen workers' exposure to oil fumes, but constitute jeopardy to the residents in the neighbourhood. The residents living near the restaurants discharging the untreated oil fumes may be more vulnerable to lung cancer, especially the children and elderly.

Actually, there is a variety of equipment to handle oil fumes, such as air washer, scrubber and electrostatic precipitator. Unfortunately, the above oil fume removing equipment, except for the last one, cannot effectively remove the organic chemical substances in the oil fumes. An electrostatic precipitator uses electromagnetism to attract most passing-through organic chemical compounds and retain them in the device. The oil fumes finally discharged almost does not contain the said pollutants. If such kind of ventilation is widely adopted to replace "hydro-vent", the health threat constituted by oil fumes to kitchen workers and the general public will be reduced to a great extent.

To improve the conditions of working premises and enhance the health and safety standard of the catering trade, the employers should set up a safety working system; provide information, guidance and training for the staff and conduct supervision; properly repair and maintain the working premises; provide and upkeep the facilities of access to the working premises; as well as ensure the safety in the working environment without prejudice to health.

Good management of working premises is an easy way to improve kitchen environment. It may not only build up a clean, tidy and orderly working environment to minimize the occurrence of accidents, but also considerably enhance kitchen workers' efficiency and reduce the breakdowns of equipment and tools. The managerial officers in frontline should take the lead to conduct regular safety inspections and rectify unsafe phenomena and behaviours in a timely manner.

Without the effort and coordination of kitchen workers, even an effective safety system cannot give full play to its desirable role. To ensure the health and safety at work, employees should sincerely cooperate with employers by performing their own duties. It is hoped that through the efforts of all parties, industrial accidents and occupational diseases in kitchens will be effectively reduced.

6. Conclusion

Through this survey, we have not only kept abreast of the information of workers in the catering trade and their awareness and attitude towards occupational safety and health, but also had a better understanding of the kitchen's working environment. It is found that most kitchen workers know the requirements in law and consider that they have duty to prevent industrial accidents and occupational diseases, but why is the accident rate of catering trade still so high? Here we try to examine the reasons.

Firstly, the kitchen workers' crisis awareness is low. Most interviewed cooks consider their job as "safe", but our investigation on site shows that the working environment in the kitchen is not safe: wet and slippery floor, blocked-up fire access, excessive piling of materials, inadequate and uneven lighting, high temperature in the working environment, poor indoor air quality. All these constitute serious threat to the safety and health of kitchen workers.

Secondly, this survey further proves that the low crisis awareness of the kitchen workers is due to inadequate education and training on occupational safety and health. Most Chinese restaurants do not provide general safety training for their staff, even the training of work-related skill is far from enough.

Thirdly, this survey discloses the problems in the workers' attitude and behaviour on safety. After many years' promotion by the government and the Council, most workers recognize the importance of safety at work, but they "know but not taking action". During the work, they refuse to observe safety rules and want to complete the

job as soon as possible by taking a shortcut. Therefore, it is important to strengthen the culture of caring about safety in the catering trade.

Fourthly, changing the safety behaviour and attitude is of course not the whole of promoting work safety and health. We consider that to enhance work safety, we should start with system, environment, equipment and people. First of all, an administrative system for work safety and health should be set up to provide sufficient safety training, improve working environment, remove the hazardous factors and upgrade or replace unsuitable or damaged equipment.

The survey also indicates that the working environment of Chinese restaurants of small-and-medium scale is relatively poor and their safety performance inferior. Worse still, the safety training provided by such restaurants are not enough and the employees' crisis awareness is too low. In view of the above, the Council has launched a "OSH Assistance Plan" for small-and-medium scale enterprises in the catering trade since October 2000 to encourage the restaurants to carry out occupational safety and health improvement plans, reduce occurrence of industrial accidents, enhance productivity and strengthen competitiveness. The plan is aimed at the catering undertakings employing fewer than 50 staff. By providing OSH professional services including advisory service, safety and health inspection, OSH training for staff, we will assist the restaurants in building up a safe and healthy working area, so that the staff can work safely and also meeting the legal requirements.

In addition, the Council and Labour Department jointly organized a territory-wide "Award Scheme for Good Housekeeping in the Catering Trade" last year to promote the awareness of the catering trade of safety management in working area. Well supported and participated by the trade people, the scheme has aroused their concern on safety management. This year an "Award Scheme for Safety in the Catering Trade" was launched to further enhance the safety awareness and performance in the catering trade. Through a variety of activities, such as prized quiz on occupational safety and healthy in the catering trade in newspapers, the message on safety has been brought to all workers and their families in the trade.

As long as both the employers and employees cooperate closely to build up a self-regulated safety management system, the catering trade's safety culture will certainly be enhanced and the industrial accidents in the trade will be further reduced.

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