An Integrated Occupational Hygiene Consultation Model for the Catering Industry

YI-KUEI LIN* and LIEN-HSIUNG LEE

Department of Industrial Management, National Taiwan University of Science and Technology, Taiwan, R.O.C

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Vegetable oil used in food processing, during high-temperature exposure, will generate particulate matter (PM) and polycyclic aromatic hydrocarbons (PAHs), which are carcinogenic chemical compounds, with the potential to cause lung disease for restaurant kitchen staff. This study’s design includes a three-stage consultation process with eight major consultation items, in order to build an integrated consultation model for occupational hygiene. This model combines inspection and consultation, targeting Chinese restaurants in the catering industry. Characteristics of the integrated consultation model include cooperation between different government departments and collaboration with nongovernmental, professional consulting organizations. An additional benefit of the model is the building of a good partnership relationship with the Catering Trade Association. The consultation model helps Chinese restaurants attain improvements in their work environments with minimal investment. Postconsultation, results show a 63.35% and 61.98% (P < 0.001) decrease in the mean time-weighted concentration of exposure to PM and PAHs, respectively. The overall regulation compliance rate of Chinese restaurants significantly increased from 34.3% to 89.6%. These results show that the integrated consultation model for occupational hygiene not only helps small and medium enterprises reduce exposure concentrations in the workplace but also has specific potential for successful implementation in Taiwan.

Keywords: catering industry; consultation model; cooking oil fumes; occupational hygiene; small and medium enterprises

INTRODUCTION

When vegetable oil is used to deep-fry, stir-fry, or roast food at a high temperature, large quantities of cooking oil fumes (COFs) are produced and released into the environment (Tung et al., 2001; Reinik et al., 2007). During high-temperature treatment, food can generate harmful degradation products (Kiel, 1986; Kiel and Andersen, 1988; Vainiotalo and Matveinen, 1993), such as particulate matter (PM) and polycyclic aromatic hydrocarbons (PAHs) (Svendsen et al., 2002). It has already been confirmed that COFs contain numerous mutagenic and carcinogenic chemical compounds (Kiel, 1986; Kiel and Andersen, 1988; Vainiotalo and Matveinen, 1993). Epidemiological studies have also confirmed that Chinese women who are exposed to COFs at home are at a high risk of contracting respiratory disease (Svendsen et al., 2003), lung cancer (Wu-Williams et al., 1990; Ko et al., 2000; Lee et al., 2001a; Yu et al., 2006), bladder cancer, and cervical cancer (Chiang et al., 1999). Early statistical figures from Norway have indicated a relatively high lethality rate among hotel and restaurant kitchen staff with respiratory disease such as asthma and pulmonary emphysema (Borgan and Kristoffersen, 1986). In a survey by the Taiwan Institute of Occupational Safety and Health (IOSH; 2001) on pulmonary disease among restaurant kitchen staff found that 16.7% of chefs showed signs of pulmonary calcification. These
findings indicated that there is an urgent need to reduce COF exposure at cooking sites in restaurants.

In November 1994, Taiwan implemented the Occupational Safety and Health Management System, based on the Voluntary Protection Program (VPP) from America’s Occupational Safety and Health Administration (OSHA). In order to have worksites granted certification, the government implemented an occupational hygiene consultation model (Su et al., 2005). The voluntary protection system was enforced until 2005, and a total of 986 businesses received consultation, of which 77.9% were large businesses and 22.1% small and medium enterprises (SMEs). These firms acquired certification of voluntary protection. Relatively few SMEs passed inspection. The reasons for this include: (i) insufficient funding for equipment to improve the work environment; (ii) poor implementation of engineering improvement techniques, fear of failing even after attempting improvements, and not being able to meet the regulatory standards; (iii) shortage of full-time staff to manage efforts, e.g. most businesses outsource environmental monitoring and physical examinations to nongovernment consulting firms. This practice makes it difficult to pass on experience and skills within a specific business, and lastly, (iv) lack of establishing a Plan-Do-Check-Action (P-D-C-A) management cycle, leading to inability to fulfill self-regulation. In relation to occupational hygiene, SMEs generally lack human resources and/or equipment to meet regulations (Mizoue et al., 1996), so government agencies in advanced countries are seeking ways to assist SMEs to pay more attention to occupational hygiene problems. For example, in 1998, America’s OSHA implemented the Strategic Partnership Program consultation model for SMEs, especially for businesses whose occupational hygiene performances did not reach established standards. The advantage of this model is that the partnerships were established between OSHA and SMEs in collective actions. Besides, the governmental departments and consulting institutes were mainly in charge of stipulating performance indicators and inspecting results. If SMEs needed various actual improvements, they contacted the occupational hygiene technicians, located within practice and consulting institutes. The ‘Dandelion’ consultation model, established by the Japanese government in 1999, is an effort to support safety and health activities of SMEs and was authorized by the Japanese Ministry of Health, Labor and Welfare to provide guidance and assistance to SMEs who registered as manufacturers. The consultations were specifically directed to the issues which SMEs applied for, therefore, exactly fit the needs of SMEs. The advantage of the model is that a consulting team was set up in each SMEs to carry out professional guidance and suggestions.

In Taiwan, an SME is defined as a legal entity that has a capital of <NT$80 million and <200 employees. According to statistical data of the Small and Medium Enterprise Administration–Ministry of Economic Affairs of 2007, 97.6% of enterprises in Taiwan consist of SMEs that employ 77.1% of all workers. Within the catering industry, 99.8% of all businesses are SMEs. The 2007 annual statistical labor report showed that 284 000 enterprises and 5 160 000 workers fell under the Labor Safety and Health Laws. However, the Labor Inspection Offices (LIO) had only 309 labor inspectors for all business safety and health inspections. The result was an annual inspection rate of business of ~10% (Su et al., 2005), which was not effective in motivating businesses to improve occupational hygiene. To resolve this problem, the government attempted to modify the implementation model to include occupational health consultation through third-party nongovernmental sources. Under such an approach, selected nongovernment professional consulting organizations would perform inspections and make improvements. Moreover, the government collaborated with the human resources divisions of the Catering Trade Association’s (CTA) to follow up on inspections and offer network platform services to affiliated members. In the past, consultation services in developed countries were directed at the manufacturing industry. Based on observations of this approach, the current study presents an innovative integrated occupational health consultation model that emphasizes inspection and consultation. Validity of the proposed model is demonstrated by using the Taiwan catering industry as an illustrative example.

**METHODS**

**Consultation model**

The integrated occupational health consultation team (Fig. 1) comprises the following three governmental departments and two other institutions. First, IOSH is the only governmental organization charged with occupational safety and health research. Using scientific techniques, hazardous factors in working environments are investigated and analyzed and strategies for protecting the safety and health of workers are recommended. Second, LIO helps enterprises establish an occupational safety and health management mechanism to supervise the
implementation of labor safety and health inspections and to prevent occupational injuries and disease. Third, the Department of Health (DOH) is responsible for inspecting the management of public hygiene and assisting to improve the working environment. Additional participants include nongovernmental professional consultants from nonprofit occupational health organizations. Trade associations establish partnerships with the government and become the communication platforms of governmental departments and their affiliated members. Within governmental departments, the integrated occupational health consultation model emphasizes cross-departmental cooperation; IOSH holds one working group meeting per quarter in every fiscal year. On the other hand, LIO performs a catering industry inspection while DOH negotiates with publicly owned banks to provide low-interest loans to those Chinese restaurants that require funds for improvements to their work environments. Non-governmental professional consulting organizations, whose members consist of retired occupational health inspectors, scholars from universities’ occupational health departments, and professionals who possess engineering backgrounds, coach businesses to establish self-regulation systems and provide concrete and feasible improvement tactics. In Taiwan, the president of a trade association is normally the head of the leading enterprise of the industry. Therefore, the leading enterprise combined with the catering industry and its members hold a demonstration workshop to increase firms’ technical application skills through demonstrations and exercises. The current research’s integrated occupational health consultation model used SMEs as the consultation objects to assist SMEs in improving on-site occupational health standards.

Due to the large number of Chinese restaurants, and in order to have an efficient use of consultation resources, IOSH designed a three-stage occupational health consultation process (Fig. 2). The first stage mainly involved the use of an integrated occupational health consultation team to address the features of Chinese restaurants that are hazardous to occupational health through technologies, such as ventilation, whose engineering is improved through research and development by IOSH. The nongovernmental professional consulting organizations then advised the Chinese restaurants, on the basis of actual kitchen practice, how to comply with the standards of the relevant occupational health legislation. The second stage involved in promoting the technology established at the first stage to new Chinese restaurants while adapting to each restaurant’s specific practices. The efforts included to generate various knowhow, such as manuals of ventilation technology and manuals of environmental sampling and analytical methods. At this stage,
for the first time, a good partnership relationship is built with the CTA. The third stage involved two major tasks. The first task is a follow-up on results: periodic follow-up inspections of Chinese restaurants that had undergone consultation about improvements. The second task involved enhanced inspection, by the LIO, of Chinese restaurants that had not undergone consultation or did not wish to make improvements. Implementation of the integrated occupational health consultation model involved bringing together specialization skills of occupational health staff, formation of the consulting team, and SMEs obtaining a diagnosis and ideas from experts without consultation fees. Analysis software is developed that combined the work environment monitoring database and health evaluation database. This software is used to perform statistical measurements and analysis, helping to track exposure levels. The consultation team employed engineering technology and good management practices to improve the occupational health environments of participating Chinese restaurants minimum investment.

Occupational hygiene consultation is a continuous and long-term undertaking. The consultation process is usually divided into periods of 3 years. To ensure continued compliance and prevent exposure levels rising after the consultation team has left, the second stage of the consultation model establishes a partnership with the CTA to help SMEs improve the workplace and maintain compliance with regulations, as well as introduce the custom-developed consultation tools and technical handbook to association members. During Stage 3, association members are trained in follow-up and monitoring techniques. After the consultation team has left, the association will thus retain a method for providing follow-up performance consultations with restaurants implementing a self-regulation system.

<table>
<thead>
<tr>
<th>Stage</th>
<th>1</th>
<th>2</th>
<th>3</th>
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<tbody>
<tr>
<td>Step</td>
<td>Establish improved technology</td>
<td>Expand consultation</td>
<td>Follow-up of results</td>
</tr>
</tbody>
</table>

**Execution Procedure**

- LIO
- SMEs
- Investigation of current occupational hygiene
- Establish improvement strategy
- Technical manual
- Expand consultation
- Establish partnership relationship with CTA
- Establish follow-up mechanism
- Reinforce inspection

*Fig. 2. The three stages of occupational hygiene consultation process.*
In order to comply with Taiwan’s Labor Safety and Health Law regulations, occupational hygiene consultations include eight major items: setup and operation of a ventilation system, execution of a work environment monitoring system, improvement of workplace tidiness, implementation of worker education and training, management of physical examinations, a general hazard communication program, establishment of a self-regulation system, and management of personal protective equipment. One development is design of ventilation engineering techniques, such as an air-curtain exhaust ventilation system (Fig. 3). We stipulated active and passive performance indicators according to the catering industry’s occupational hygiene information on their cooking Web site. Consultation on administrative management is undertaken and included the following—(i) environment monitoring: an environmental monitoring plan is drafted and environmental monitoring reports are analyzed and archived; (ii) workplace tidiness: the 5S ['Seiri' (tidiness), 'Seiton' (orderliness), 'Seiso' (cleanliness), 'Seiketsu' (standardization), and 'Shitsuke' (discipline)] borrowed from Japan were introduced; (iii) education and training: interactive digital teaching materials were compiled and worker training conducted; (iv) physical examinations: offering to undertake the government-designated physical examinations of the work locations and analyzing and recording results; (v) hazard communication: promoting a Globally Harmonized System of classification and labeling of chemicals to align chemical management with international standards; (vi) self-regulation: setting up various types of self-checking forms and stipulating standard operation procedures; (vii) protective equipment: plans for individual protective equipment management and the correct use of the equipment.

In the current study, we cooperated with the consultation team and the CTA. Depending on the features of each Chinese restaurant, we selected 30 participants from Taipei City, with an average of 63 employees each. During the consultation period, assessment of COF levels is carried out in each restaurant kitchen. All the restaurants operated normally while assessment is performed.

Assessment indicators

One of the major goals of the consultation was to decrease exposure concentrations within the working environment. Thus, the reduction of exposure concentration of PM and PAHs was set as the passive indicator for the program. Measurement of PM exposure levels focused on inhalable PM10, PM2.5, and PM1.0 (Lee et al., 2001b; Siegmann and Sattler, 1996), while measures of PAHs focused...
on five hazardous substances, namely, pyrene, benzo[k]fluoranthene (BkF), benzo[a]pyrene (BaP), benzo[ghi]perylene (BghiP), and dibenzo[a,e]pyrene (DBaeP) (Josephson, 1984; Menzie et al., 1992). We performed environmental monitoring and analysis of PM and PAHs at the same locations where exposure is likely, both pre- and postconsultation. SPSS 12.0 was used for statistical analysis. The Mann–Whitney U test was used to evaluate differences between exposure levels of PM and PAHs pre- and postconsultation.

Active indicators included percentage of compliance with the Labor Safety and Health Laws, labeling rate of hazardous materials, conformance rate of hazard perceptions, rate of correct usage of personal protective equipment, rate of proper maintenance of personal protective equipment, number of companies with improvement tactics, number of factories establishing a self-regulation system, number of workers receiving training, and number of companies who implemented monitoring. The values of active indicators are set by the consultation teams in the January meeting of each year, with achievement ratios checked annually in December.

Environmental monitoring

In the 3-year period from 2006, when the consultation study began, environmental monitoring was conducted every half-year to collect the results in a total of six measurement frames. Comparisons were made between pre- and postconsultation levels of PM and PAHs every half-year, in order to inspect the efficiency of consultation. During this consultation period, the consultation team continually proposed ideas for ventilation engineering improvements as well as suggesting administrative and management measures, such as changes to the ventilation hood and filter device cleaning. Daily area monitoring of particulate PAHs was done in the kitchens area of all 30 Chinese restaurants over two consecutive workdays. Particulate PAHs in the workplace were sampled using the Institute of Occupational Medicine samplers with glass fiber filters (diameter of 25 mm, pore size of 0.7 µm) at a flow rate of 2.0 l min⁻¹. The samplers used in area monitoring were set at a height that was close to that of the breathing zone. Duplicate samples were obtained at each sampling location. Airborne particulate PAHs were monitored in the kitchen area on two consecutive workdays. Five different locations’ samples were taken each day per restaurant and the sampling time for each sample was 10 h (from 11:00 AM to 9:00 PM), every restaurant having 10 samples. Five different PAHs congeners were subjected to quantitative analysis using high-performance liquid chromatography.

Continuous monitoring of PM₁₀, PM₂.₅, and PM₁.₀ was performed in the kitchens of each restaurant, using a laser dust monitor with a mass measuring range of 0–100 mg m⁻³ (Grimm Model 1.108; Grimm Labortechnik). This device produces data every minute, thus obtaining continuous data of mass concentration and temperature. The dust monitors were placed near the PAH samplers in the workplace. The sampling duration and schedule for monitoring PM were the same as those for PAHs.

RESULTS

Consultations are performed with the kitchen workers of 30 Chinese restaurants. In 18 of these, the ventilation systems are improved and air-curtains used to improve exhaust design. In six of the locations, air-curtains are installed to improve exhaust design and changes made to the shape of the ventilation hood. In three of the locations, a blocking board is installed next to the ventilation hood and the amount of ventilation thus increased. In another three locations, the kitchen fan is turned off, and its filter device periodically changed or cleaned. Table 1 shows PM and PAHs levels of 30 Chinese restaurants pre- and postconsultations. After consultation, a statistically significant improvement is found in median concentrations of PM₁₀, PM₂.₅, PM₁.₀, pyrene, BkF, BaP, BghiP, and DBaeP. The median of the total PAHs concentration decreased from 6.59 to 2.66 ng m⁻³, while the geometric mean PAH concentration declined from 6.81 to 2.58 ng m⁻³ (P < 0.001), indicating a positive effect from consultation.

The various items in Table 2 show that after consultation, the time-weighted mean exposure level of PM₁₀ dropped from 90.46 to 24.95 µg m⁻³, a mean reduction of 72.47%. The time-weighted mean exposure level of BkF dropped from 0.72 to 0.20 ng m⁻³, a mean reduction of 72.22%. Therefore, in both cases a significant difference is obtained. Overall, mean PM levels dropped 63.26%, and mean PAHs levels 61.98%, illustrating the positive effects from consultation.

The consultation team performed according to the preset active and passive indicators, using standards that aligned with or surpassed regulatory standards for coaching. The result is a compliance increase of 34.3% in 2005 to 89.6% in 2007. Businesses who received consultation conformed to the overall
ratio of occupational hygiene regulations (Fig. 4). From radar graph analysis, eight major consultation items complied with regulatory standards, with an average of >80%. Among these following were especially successful: effects of hazard communication (accordance rate 100%), education and training (accordance rate 97%), and personal protective equipment (accordance rate 96%) are significant.

In addition to helping the staff of every enterprise implement occupational health education and training, the consultation model designed digital teaching materials. The training course for hazard recognition helped workers realize the dangers of COFs. A total of 196 employees took the tests for hazard recognition before the consultation and then again 1 year after the consultation. The average test score is 61 ± 21.8 before the consultation (total score of 100), increasing to 85 ± 8.3 after the consultation. A paired t-test showed a statistically significant difference ($P < 0.05$) between these scores.

**DISCUSSION**

**Improvements of administrative controls**

The model developed a technical handbook for engineering improvement of the ventilation systems while creating self-evaluation software for occupational health management. These systems resources could then be used within the catering industry in the form of a checklist. The list, generated by the software, can be used to diagnose the extent of legal compliance and understand the current occupational health status of the company. In order to achieve self-regulation management of SMEs, businesses

### Table 1. Comparisons of PM and PAH levels pre- and postconsultation in 30 Chinese restaurants

<table>
<thead>
<tr>
<th></th>
<th>2006/3 Preconsultation (n = 300)</th>
<th>2008/9 Postconsultation (n = 300)</th>
<th>$P^*$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Median</td>
<td>Geometric mean (geometric SD)</td>
<td>Geometric mean (geometric SD)</td>
</tr>
<tr>
<td>PM$_{10}$ (µg m$^{-3}$)</td>
<td>65.9</td>
<td>62.95 (2.21)</td>
<td>16.87</td>
</tr>
<tr>
<td>PM$_{2.5}$ (µg m$^{-3}$)</td>
<td>45.4</td>
<td>40.87 (2.15)</td>
<td>14.5</td>
</tr>
<tr>
<td>PM$_{1.0}$ (µg m$^{-3}$)</td>
<td>28.8</td>
<td>28.52 (2.11)</td>
<td>13.02</td>
</tr>
<tr>
<td>Pyrene (ng m$^{-3}$)</td>
<td>0.93</td>
<td>0.66 (3.64)</td>
<td>0.29</td>
</tr>
<tr>
<td>BkF (ng m$^{-3}$)</td>
<td>0.44</td>
<td>0.38 (3.09)</td>
<td>0.14</td>
</tr>
<tr>
<td>BaP (ng m$^{-3}$)</td>
<td>2.00</td>
<td>1.96 (2.24)</td>
<td>0.79</td>
</tr>
<tr>
<td>BghiP (ng m$^{-3}$)</td>
<td>1.81</td>
<td>1.79 (2.60)</td>
<td>0.68</td>
</tr>
<tr>
<td>DBaeP (ng m$^{-3}$)</td>
<td>0.68</td>
<td>0.61 (1.90)</td>
<td>0.24</td>
</tr>
<tr>
<td>Summed PAHs (ng m$^{-3}$)</td>
<td>6.59</td>
<td>6.81 (2.21)</td>
<td>2.66</td>
</tr>
</tbody>
</table>

Summed PAHs: sum of pyrene, BkF, BaP, BghiP, and DBaeP.

$^*$Mann–Whitney U tests.

### Table 2. PM and PAH levels of exposure pre- and postconsultation

<table>
<thead>
<tr>
<th></th>
<th>2006/3 Preconsultation (n = 300)</th>
<th>2008/9 Postconsultation (n = 300)</th>
<th>Concentration improvement (reduction,%)$^*$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Minimum</td>
<td>Maximum</td>
</tr>
<tr>
<td>PM$_{10}$ (µg m$^{-3}$)</td>
<td>90.64</td>
<td>17.21</td>
<td>562.7</td>
</tr>
<tr>
<td>PM$_{2.5}$ (µg m$^{-3}$)</td>
<td>55.93</td>
<td>8.52</td>
<td>302</td>
</tr>
<tr>
<td>PM$_{1.0}$ (µg m$^{-3}$)</td>
<td>37.59</td>
<td>5.21</td>
<td>179.1</td>
</tr>
<tr>
<td>Pyrene (ng m$^{-3}$)</td>
<td>1.42</td>
<td>0.04</td>
<td>11.52</td>
</tr>
<tr>
<td>BkF (ng m$^{-3}$)</td>
<td>0.72</td>
<td>0.03</td>
<td>5.49</td>
</tr>
<tr>
<td>BaP (ng m$^{-3}$)</td>
<td>2.66</td>
<td>0.20</td>
<td>8.3</td>
</tr>
<tr>
<td>BghiP (ng m$^{-3}$)</td>
<td>2.51</td>
<td>0.05</td>
<td>7.92</td>
</tr>
<tr>
<td>DBaeP (ng m$^{-3}$)</td>
<td>1.13</td>
<td>0.07</td>
<td>5.54</td>
</tr>
<tr>
<td>Summed PAHs (ng m$^{-3}$)</td>
<td>8.39</td>
<td>1.43</td>
<td>28.81</td>
</tr>
</tbody>
</table>

Summed PAHs: Sum of pyrene, BkF, BaP, BghiP, and DBaeP.

$^*$Concentration improvement = mean postconsultation - mean preconsultation; percentage reduction = $\left[\left(\text{mean postconsultation} - \text{mean preconsultation}\right)/\text{mean preconsultation}\right] \times 100\%$. 
are encouraged to apply P-D-C-A cycle management, resulting in an overall reduction of PM and PAHs concentrations in kitchens.

Controls of worker exposure

Normally, range hoods in restaurant kitchens cannot achieve optimal environmental control. This is because the distance between the updraft local exhaust hood and the stove is too great, and cooking movements break up the exhaust current. As a result, COFs spread. A hood’s ability to collect fumes depends on the size of its opening, its exhaust volume, the relative location of the fume source and exhaust hood, and the degree of external interference with the airflow (Flynn and Ellenbecker, 1986). The design of the air-curtain exhausting ventilation system that we used is based on the existing household kitchen hood, functioning as a suction hood and creating a push–pull effect. This design obtains a maximum reduction in the concentrations of PM and PAHs.

Other findings

High PAH particle concentrations in Chinese restaurants expose kitchen staff to COFs. Since restaurant employees do not use any respiratory protection equipment, during work hours, they constitute a high-risk group for PAH exposure.

The limitations of this study include the lack of PAH exposure data from nonoccupational environments, such as that produced by vehicle traffic. Each day, restaurant staff spends 10 h in the restaurant (including time spent at work and on breaks). Time spent in traffic is <1 h, so it may be assumed that traffic pollution does not have a large impact on PAH exposure for restaurant employees.

In order to ensure successful implementation of the integrated occupational hygiene consultation model, an inducement mechanism must be developed. Therefore, during the consultation period, the LIO temporarily suspends inspections of SMEs. However, SMEs are required to write and submit a proposal for improvement of shortcomings. SMEs are assisted in the application of low-interest bank loans necessary for improvements in the workplace environment. Free consultation on occupational hygiene is provided. Businesses that exhibit good improvement performance are nominated for the annual elections of the best labor units as models for the promotion of safety and hygiene. SMEs that are required to purchase materials for engineering improvements can take advantage of discounts, thanks to collective purchasing. Analysis software that combines an environment monitoring database and health evaluation database is provided free to all participants. Additionally, self-evaluation software that measures occupational hygiene management within the catering industry is supplied. In this study, a total of 30 restaurants received
consultation, and 279 restaurants attended the presentation of accomplishments. Twelve restaurants applied for low-interest bank loans.

**CONCLUSIONS**

In Japan, integrated occupational health consultation models, related to occupational health service, have been suggested as a way to improve SME compliance. The emphasis is on third parties in order to improve the environment for SMEs and to make significant contributions to improvements in their occupational health (Hino et al., 2006). The current study has proposed a feasible model for cooperation between government departments, nongovernmental professional consulting, and the CTA. The proposed consultation model includes a three-stage consultation process and eight major consultation items. Satisfactory results are achieved when this model is implemented in the cooking areas of Chinese restaurants. In line with its incentive-based design, the integrated occupational health consultation model assists SMEs in reducing exposure levels at the workplace, consolidating the industry’s accumulated consultation experience and technology. This approach can be presented to other businesses as a source of reference in order to improve occupational health. The integrated occupational health consultation model has succeeded in assisting SMEs in Taiwan to reduce their exposure levels. This approach can also be proposed as a reference to other countries seeking to improve occupational health among SMEs.

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**REFERENCES**


