

China's Factory Floors: An Industrial Hygienist's View

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Determinants of workplace health and safety in China, including work organization, composition of the workforce, production regimens, lack of independent worker representation, and the status of government regulatory enforcement, are described and analyzed. The findings of reports of nongovernmental organizations and media articles are summarized. Key markers of working conditions in export-sector factories, i.e., accident and safety program compliance rates, chemical and noise exposures, and machine guarding issues, are analyzed. Four factors for improving workplace health and safety are proposed: 1) employer commitment and implementation of effective health and safety programs on a plant level; 2) Chinese government enforcement of regulations; 3) meaningful involvement of workers in plant health and safety programs; and 4) continued involvement of international professionals and "civil society" both to pressure multinational corporations and the Chinese government and to provide technical assistance and resources for building the capacity of employers, workers, and government agencies to improve factory working conditions in the world's fastest growing economy. *Key words:* China; factories; workplace health and safety.

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Our labor relations are going back in time, back to the early days of the industrial revolution in 19th-century Europe. Many of the enterprises set up with investment from Asian companies, along with privately-owned Chinese enterprises, have reduced working conditions to a situation comparable to the initial period of capital accumulation that accompanied the appearance of capitalism. Forcing workers to labor long hours for very low wages and even workers signing "life and death" contracts with employers. The problem is particularly serious in the southwest coastal regions and in Taiwanese and South Korean-owned factories." —HAN ZHILI, director of a citizens rights center, interviewed by an official newspaper of China's Department of Labor and Social Security in 2001.¹

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China's booming economy, based on low wages, long hours, and a stable, controlled political climate, is widely predicted to become the primary "factory floor of the global economy" in the coming decade. A clear understanding of what actual conditions on those factory floors are, especially in the area of occupational safety and health, is only just beginning to emerge. Nonetheless, the reports currently available contain a wealth of information and insights as to the physical conditions, work practices, and management policies that shape workplace health and safety in China, despite the lack of an academically rigorous method.

Traditionally, four key elements are viewed as the backbone of the industrial hygiene profession: the anticipation, recognition, evaluation, and control of workplace hazards that result in injury and illness to workers. At present, an industrial hygienist's view of China's factory floors is largely limited to the first two principles—anticipation and recognition of workplace hazards.

Industrial hygiene is not currently recognized as an academic discipline or as a distinct profession in China. Economy-wide, there has been little or no monitoring of airborne chemical contaminants, noise, or non-ionizing radiation exposures; ergonomic risk factors and heat stress have not been investigated; and there are few audits of employee training programs and OSH management systems such as those typical of industrial hygiene evaluations of workplaces elsewhere in the industrial world.

Lack of hazard evaluation, which extends to safety issues such as machine guarding, electrical safety, and fire prevention, has logically resulted in limited efforts to control workplace risks to life and limb. Most such efforts have occurred only after catastrophic accidents resulting in multiple worker deaths and substantial property losses. But even in the mining sector, where as many as 10,000 miners are killed a year, scandal-generated efforts by government mine safety agencies to enforce existing regulations have failed to significantly reduce the well-known causes of explosions, roof falls, and floods.²⁻⁶

Over the last 20 years, the Chinese government has conducted safety program evaluations and limited industrial hygiene monitoring, but the information available in English-language journals is limited, and the surveys reported are often more than a decade



Half of the fifth floor of a sports shoe production building in Dongguan City factory complex with 30,000 workers. In two identical buildings, some 3,000 women workers sit behind sewing machines on the fifth floor assembling the "uppers" of sports shoes to be glued together with the soles of the shoes on other floors of the building. (Photo by Garrett Brown)

old.⁷⁻¹⁵ In the last decade, transnational corporations operating in China have conducted industrial hygiene monitoring and surveys of their facilities, but that information is not publicly available.

The information about actual working conditions in China that is available consists primarily of reports by nongovernmental organizations (NGOs) and articles in the mass media in the West, both based on interviews of workers outside their workplaces by individuals without professional training in occupational safety and health. There are also a few articles in peer-reviewed professional journals, and summaries of conditions by NGO analysts.

The present article is based on a review of key NGO factory reports, mass media articles, and NGO summary analyses (see Appendixes A–C), as well as personal observations from many visits in 2001 and 2002 to three Taiwanese and Hong Kong–operated sports shoe factories in Guangzhou Province employing 51,000 workers. This article's focus is on conditions in manufacturing facilities in China, although many issues are also applicable to agriculture, construction, and mining.

HAZARDS ASSOCIATED WITH THE ORGANIZATION OF WORK

As in any workplace, the composition of the workforce, size and age of the facility, hours and pace of work, and type of management and its commitment to safety have

decisive impacts on workplace conditions. In China, the work-organization factors at play include the type of enterprise, the composition of the workforce, the scale of the workplaces, the hours of work, the lack of independent union representation, and the status of government regulations and enforcement.

OWNERSHIP AND MANAGEMENT

Ownership and management of enterprises in China fall into four general categories. Each type has its own distinct characteristics and set of health and safety problems. The public sector consists of state-owned enterprises (SOEs), while the private sector includes private, individually owned enterprises (PIEs), foreign-invested enterprises (FIEs), and township and village enterprises (TVEs).¹⁶

Since 1980 there has been a dramatic shift in production and employment from the public sector to the private sectors. In 1980 SOEs, both rural agricultural and urban non-agricultural, numbered more than 80 million entities and represented 99% of employment and production.^{7,17} By 2002 SOEs accounted for only a third of the 400 million non-agricultural workers.¹⁶

Township and village enterprises, both agricultural and non-agricultural and in both rural and urban areas, had grown to over 22 million entities with 128 million workers in 2000, accounting for 50% of total production and 40% of total goods exported from

China in 1999.^{13,17} Over 100 million TVE workers are in rural areas, although their employment may be in industrial settings.¹³

The FIEs grew from a handful in the early 1980s to 84,000 enterprises and 10 million workers in 1992.⁸ Growth in this sector has also exploded since 1992, with 28,455 enterprises and 6.4 million workers in FIEs in Guangdong Province alone in 2000.¹⁸ For example, in Shenzhen County there were only 224 small industrial factories in 1979, which grew to 3,051 plants with one million workers in 1991, and these figures at least doubled in the following decade.¹⁹

In general, the size and ownership of an enterprise have important impacts on working conditions. Large public and private-sector facilities (over 3,000 workers) have more financial and technical resources available to purchase new equipment, institute new technologies, establish and maintain effective workplace safety staff and programs; and a higher profile generally brings more stringent official oversight.¹⁶

In theory, the SOEs should enjoy better conditions with the resources of the state, long-term, stable workforces and managers, and direct involvement of and access to state agencies and trade unions. In fact, many SOEs have professionally trained occupational health and safety personnel, formal H&S departments, and dedicated resources, which simply do not exist in small and medium-sized enterprises in any category.⁸

However, competitive pressures within the privatizing economy, which are sure to intensify with the entry of increased foreign investment, have undercut SOE health and safety performance.⁷ One NGO analyst reported “it is not a rosy picture at the SOEs. Numerous non-implementation, negligence and outright violation of regulations still plague their H&S records. Refusal to provide legally-required and adequate compensation to victims of industrial injuries is very common. Underinvestment and lack of resources also account for poor H&S provisions and training in the SOEs.”¹⁶

Most private-sector operations are small and medium-sized enterprises and are located in villages, towns, and suburban areas. Small enterprises, especially the rural TVEs, often are using outdated equipment and production processes, and have little experience with or resources available for workplace safety programs. A Ministry of Health survey of the 20-million-plus TVEs in 2002 found that 60% of these workplaces had “minimal industrial safety measures.”^{13,20}

In 2000, *Workers' Daily*, the newspaper of the official All-China Federation of Trade Unions (ACFTU), described small-scale plants: “in some newly established, labor intensive firms, work conditions are abominable, workshops are small, low and damp, dust and noise seriously exceeds standards, and toxic and hazardous tasks are not effectively regulated. After working in these abominable conditions for a long time, workers' health is utterly devastated.”²¹

The FIEs, again in theory, should offer better health and safety conditions. These enterprises enjoy access to substantial financial and technical resources from foreign investors and the experience of implementing health and safety programs in transnational operations. Many multinational corporations now claim to have “one global standard” of health and safety programs, to be implemented in the same way in each and every one of its facilities around the world. Nonetheless, some of these corporations operating in China have been the target of international campaigns to end “sweatshop conditions” in factories producing for the global consumer market.²²⁻²⁹

In fact, many FIEs have invested in new equipment and technologies and have initiated efforts to establish systematic occupational safety and health management systems and ongoing activities, especially in large plants producing for internationally-recognized brands.^{18,24,30-32} However, the core of China's export-processing sector remains TVEs, PIEs, and FIEs based on Asian capital (Korean, Taiwanese, and Hong Kong) that are out of the public spotlight and largely unmonitored by their ultimate retailers.

COMPOSITION OF THE WORKFORCE

The workforces of many enterprises, especially in the booming FIEs and TVEs, consist of rural, young, overwhelmingly female workers with limited education and often no urban or industrial experience. In the “shoe city” section of Dongguan City (Guangdong Province), only 22.4% of sports shoe workers were migrant workers in 1986, while in 1990 this figure had increased to 87.4%.⁷ In nearby Shenzhen County, migrant workers now number 1.8 million and account for 70% of the local population.³³ It is estimated in the last decade that more than 80 million Chinese workers left rural areas to seek work in urban and suburban areas.¹⁷

These migrant workers face multiple obstacles that work against their abilities to protect themselves against workplace hazards. The workers have little education and lack experience with industrial settings. They are required to obtain expensive permits to live and work in urban areas, so the workers, or their families, have large debts that must be repaid, limiting the workers' ability to leave hazardous jobs. The workers from rural, western areas may not speak the local languages of places where the plants are located.

In addition, migrant workers in China, especially in the FIEs on the eastern coast, face many of the same problems—precarious residential status, cultural and language barriers, lack of training, concentration in more hazardous or demanding entry-level jobs—that generate higher injury rates for immigrant workers in advanced economies as well.³⁴⁻⁴¹

Moreover, migrant workers, and women in general, have second-class status in Chinese society.^{16,41-51}

The work organization in many factories using migrant workers creates a situation with a “forced labor” character. Factory rules prohibit workers from talking during work hours; workers live on-site in controlled dormitories; employers often hold workers’ travel documents and permits; employers frequently require “deposits” or withhold part of workers’ wages until the end of the yearly contract period; and heavy fines are often issued for violations of factory rules. All these aspects make it difficult for workers to discuss, let alone organize to improve, conditions; or even to simply leave an unsafe facility.⁵²

Whether working in their home areas or as migrants, young workers in China face the same obstacles—lack of job experience and training—that have resulted in elevated injury rates for young workers in advanced economies such as that of the United States.⁵³⁻⁵⁶ In China, a survey of construction-site fatalities in two areas over the 1991–97 period found that 53% of fatalities in the East Pujian New Area occurred in workers who were under 35 years of age, while 62% of fatalities in Shunde City were those of workers under 29 years of age.¹²

While most PIEs and TVEs are small and medium-sized, many of the SOEs and FIEs are huge facilities having 5,000 to 30,000 workers in a single factory complex. Although such giant workplaces may have more resources available for health and safety programs, the implementation of effective health and safety programs, such as worker training in a FIE of 18,000 migrant workers speaking a variety of different dialects, poses serious challenges.^{18,31}

HOURS OF WORK

The extremely long hours of work common in all types of Chinese enterprises pose several hazards. Workdays of 10–16 hours, six days a week, are quite common, and workdays of up to 18 hours and seven-day work weeks are frequently reported (see reports in Appendix A).

In the toy industry, short order-delivery times during the peak season of July to October have even led to work hours of 20 hours a day, seven days a week, for several weeks at a time.⁵⁷⁻⁵⁹ Even in FIEs in the sports shoe industry, where international campaigns around “corporate codes of conduct” have been strongest, the shortest work week publicly reported is 55 hours over six days.³¹

There are several important hazards related to long hours of work. First, such long hours of work raise the probability of industrial accidents resulting in serious injuries such as amputations. Since many manufacturing workers in China are paid on a piece-rate or incentive basis, the intensity of work is also elevated and extends over many hours of work. The relationships between long work hours and increased fatality and accident rates, increased work-related illnesses, and declining general health, have been increasingly recognized and studied in other industrial countries.⁶⁰⁻⁶⁸

Second, worker exposure limits to airborne contaminants, noise, and non-ionizing radiation, both governmental regulatory limits and guidelines such as the Threshold Limit Values (TLV) of the American Conference of Governmental Industrial Hygienists, are all based on a norm of eight-hour days in a 40-hour work week. Although adjustments have been made for 10–12-hour daily schedules, the exposure limits are still based on work weeks averaging 40 hours.⁶⁹⁻⁷³

Routine exposures to airborne chemicals, particulates, or noise that last 60–80 hours a week far exceed any regulatory limits or guidelines. Such long exposure times render meaningless the “health protective” purpose of regulatory limits. The lack of adequate “recovery time” for body metabolisms to excrete contaminants, which is the basis for setting permissible exposure levels, as well as the impact of cumulative and synergistic effects, means that adverse health effects from such lengthy exposure times are highly probable.

Even if the Chinese chemical exposure limits, also based on 40-hour weekly exposures, were applicable to actual exposures, there are widely-used chemicals, such as methyl ethyl ketone, n-hexane, and methylene chloride, without any regulatory limits in China.⁷

WORKER REPRESENTATION

Although virtually all the SOEs have local branches of the official trade union federations, the ACFTU, the vast majority of workers in the fastest-growing sectors (FIEs and TVEs) do not have any union representation on the job. The federation recently reported a membership of 103 million workers with a full-time staff of 526,000. Approximately 50% of the urban workforce is unionized, with over 95% membership of workers in SOEs but less than 20% of workers in the private sector.⁷⁴

As has been widely noted, the ACFTU itself is part of the government apparatus and does not play an independent role in most circumstances. There have been examples where ACFTU bodies have actively participated in decisions promoting health and safety issues at an enterprise level, particularly in the SOEs, but these are exceptions to the general rule.^{5,16,75-78}

Interestingly, the one sector where there has been some movement toward member-selected and -controlled unions are the FIE plants. In January 2003, Guo Wencai, director of the ACFTU’s Elementary Construction Department, reported that there had been direct elections of union chairs in FIEs in Guangdong, Fujian, Zhejiang, and Shandong provinces.⁷⁹ One of these elections occurred at a plant producing sports shoes for Reebok, and two of the elected union leadership committee members also serve on the plant’s health and safety committee, which has given the health and safety committee more influence and impact in the plant.¹⁸



Worker uses a hand-operated buffing tool to clean excessive material from finished sports shoes in a Dongguan City plant. The work is done inside a box intended to capture airborne dust and noise. Noise levels at the operator's station were still above 90 decibels (A scale), however, and other hazards included constant forceful gripping to operate the pneumatic buffing tool and non-adjustable stools without back support. Note the bent necks and hunched shoulders of the workers. (Photo by Garrett Brown)



Worker in the "hot press" department of a sports shoe plant in Dongguan City. The workers place shoe sole-shaped pieces of rubber in heavy (15–40 pounds) metal molds which are compressed and heated. Poor design of this work station requires the workers to constantly bend over to place or remove pieces of rubber in the molds. The metal plates are hot and a skin burn hazard, and the molds also pose a foot crush hazard if they fall off the work table. (Photo by Garrett Brown)



The difficulties of retro-fitting older equipment is evident in this sports shoe plant in Dongguan City. The blue shear cutting polyethylene sheets has been fitted with an orange guard to prevent amputations by the cutting blade. The guard, however, catches the cut materials so workers have to place their hands inside the guard in order to clear jammed polyethylene. (Photo by Garrett Brown)



Worker in a sports shoe plant in Dongguan City spraying "hot melt" glue onto shoe parts in preparation for combining cloth parts of the "uppers." This relatively new technology and glue materials create exposures to airborne chemicals that had not been measured or controlled as of March 2002. Several manufacturers of the "hot melt" adhesive do not provide information about the actual components of the mixture so as to "protect proprietary information." (Photo by Garrett Brown)



Worker operating a punch press and riveting machine making the holes for shoe laces in sports shoe "uppers" in a Dongguan City plant. The noise levels generated by the machines exceeded 90 decibels (A scale) and required manual placement of metal punches. The workers in this facility used personal hearing protection, but had not received audiograms or training about the hazards of noise-induced hearing loss. (Photo by Garrett Brown)



Worker placing shoe parts covered with chemicals in a drying booth in a Dongguan City sports shoe factory. The local exhaust ventilation system had never been tested, as of March 2002, to verify flow rates and capture efficiency. The worker is wearing a "respirator" commonly used in China, which simply consists of a gauze mask with a center section of activated charcoal. This mask does not have an airtight seal and provides no protection to the worker. (Photo by Garrett Brown)



Worker manually applying adhesive to the soles of sports shoes in a Dongguan City factory. The glue is cured by ultraviolet light in the shelves in front of the workers. Hazardous exposures include airborne chemicals, repetitive hand motions, and ultraviolet radiation. As of March 2002, none of the workers had received "hazard communication" training describing the characteristics and hazards of the chemicals they were using or the non-ionizing radiation used to cure the adhesive. (Photo by Garrett Brown)



Workers using their thumbs and fingers to insert parts of sports shoes in a Dongguan City plant. Workers are required to elevate their elbows and hunch their shoulders to force parts into place. They also sit on non-adjustable tools without back support. (Photo by Garrett Brown)

The positive impact on workplace health and safety of active involvement of workers in independent trade unions has been increasingly recognized and researched. The benefits to workplace safety come from an informed, organized, and empowered workforce able to identify hazards and initiate joint actions with management to control or eliminate the hazards. The lack of independent, member-controlled unions in Chinese workplaces represents an obstacle to establishing and implementing effective health and safety programs.⁸⁰⁻⁹⁷

Although Chinese labor law has provided for the establishment of enterprise health and safety committees with worker involvement, few enterprises in either the public or the private sector have created such committees. Those that do exist usually do not include non-managerial employees and have had very limited roles and levels of activity.^{5,51}

Frank Renshaw, of the U.S.-based Rohm and Haas Company, which operates several major chemical facilities in China, noted "in China, the history of the social system and how it transfers to the workplace does not support a culture of employee involvement and personal responsibility for health and safety. China does not have a long history of people being empowered. Supervision is difficult to hold accountable. Leadership is lacking. Punishment, or the threat of it, is still a major deterrent to people accepting added responsibilities. The prevailing attitude toward health, safety and the environment does not encourage participation and proactiveness."⁹⁸

GOVERNMENT ACTIVITY

Last, the framework of government regulation and enforcement has an important impact of health and safety in China, as it does in other countries. China recently approved the Occupational Disease Prevention Law and the Safe Production Law, both of which went into effect in 2002. These laws complement and bring together the key workplace regulations passed over the last 20 years, and give China regulations roughly equivalent to those of many other industrial countries.

As of 1999, China had issued 276 workplace health standards, including 205 for chemicals, 53 for particulates and dusts, 12 for physical agents, and four related to safety management. China also has published in the last several years technical manuals of industrial hygiene procedures for monitoring of airborne contaminants, as well as protocols for biological monitoring.⁹⁹

In terms of international standards, China has adopted several of the International Labor Organization's key health and safety conventions, including Convention 170 (Chemicals, 1990) and Convention 167 (Health and Safety in Construction, 1988). However, China has not adopted such key conventions as 184 (Safety and Health in Agriculture, 2001), 176

(Safety and Health in Mines, 1995), 162 (Asbestos, 1986), 161 (Occupational Health Services, 1985), and 155 (Occupational Safety and Health, 1981).¹⁰⁰

However, the most significant aspect of this regulatory framework is not the laws' content, but rather the lack of meaningful enforcement of them in China. There is widespread personal and institutional corruption and collusion between employers (both domestic and foreign) and local authorities. Regulations requiring employee training, chemical exposure limits, and machine guarding, among other key safety requirements, are simply not enforced.^{7,16}

Local authorities have been quoted in the Chinese media as explaining that regulations would not be implemented for fear that foreign and domestic investors would simply relocate their facilities to other sites in China where regulations were known to be unenforced. With the explosive growth of village and township enterprises, local authorities also have a direct financial stake—taxes, fees and illegal bribes—in the enterprises that they are supposed to be regulating.^{7,101}

In 2002, the national government decreed that local governments must now survive solely on their tax incomes, cutting them off from dividends previously collected from local SOEs.¹⁰² This means that any policies that "discourage foreign investment"—such as regulatory enforcement—are economic suicide and political impossibilities for local governments.³⁰

Even if government authorities had the political will to enforce China's regulations, they would still face daunting shortages of trained personnel, equipment, and technical resources. A Ministry of Public Health and Agriculture survey of 29,246 enterprises in 30 counties in 15 provinces in 1990–91 found that there were only 235 persons with responsibilities for occupational health services, and only 153 of these were full-time. In 1989, the survey noted, the average length of experience of occupational health personnel was 78 days. Moreover, the average availability of 13 specific pieces of equipment used for workplace monitoring and physical examinations was only 24% in 28 of the 30 counties studied.^{8,11,13}

A 2002 study of occupational health services in China concluded: "China has a long way to go in training sufficient personnel qualified in occupational health and safety."⁸

REPORTS OF ACTUAL WORKING CONDITIONS

The most comprehensive reports of actual conditions publicly available are those from NGOs based in Hong Kong and media reports from journalists based throughout China. Both sets of authors usually have limited or no training in occupational health and safety, and their information comes primarily from worker interviews outside the workplace, but there is a

solid consistency and corroboration of information between the 20 NGO reports listed in Appendix A and the 26 major media articles listed in Appendix B.

While it is true that without reliable injury and illness reporting, comprehensive industrial hygiene monitoring, and workplace-inspection audit reports, it is difficult to draw definitive conclusions about China's current status of occupational health and safety, it is possible to gain an accurate picture of the general outlines of workplace conditions in several sectors of the Chinese economy from the sources listed in Appendixes A–C. In addition, in 2001 Australian National University researcher Anita Chan published a book based on primary research that confirms the evidence of the NGO reports and media articles.⁷⁸

The key hazards, which appear throughout both NGO and media reports of SOEs, TVEs, and FIEs, and which were evident in the site visits of the author in China, include:

- Lack of management commitment, organizational structures and programs, and dedicated resources to workplace safety
- Lack of worker knowledge of hazards and lack of participation in identifying and correcting recognized hazards
- High rates of accidents, injury, and illness
- Unmeasured and uncontrolled exposures to chemicals
- Unmeasured and uncontrolled exposures to high noise levels
- Unrecognized, unmeasured, and uncontrolled ergonomic hazards
- Unrecognized, unmeasured, and uncontrolled non-ionizing radiation hazards, both ultraviolet and radiofrequency
- Unrecognized, unmeasured, and uncontrolled heat-stress hazards (high temperatures, inadequate supplies of water, inadequate sanitation facilities and access)
- Uncontrolled safety hazards such as unguarded machinery, electrical shocks, working at heights without fall protection
- Life-safety hazards, including uncontrolled fire hazards and inadequate evacuation, rescue, and medical treatment programs

Naturally, not each and every factory in China has every one of the characteristics listed above. However, the NGO reports and media articles describe scores of facilities that have many of these attributes, in all four of the basic ownership categories.

Even the FIEs producing for export, subject to international publicity campaigns and with considerable resources at their disposal, were characterized by one leading NGO in Hong Kong, based on its research, in the following fashion:

Such factories form the backbone of the export-processing industries; many serve as sub-contractors and suppliers to the major MNCs (multinational corporations) around the world. The plants are set up with maximum planning and investment, for the pursuit of maximized, short-term returns. Nearly all the workers are employed on short-term contracts; many of them are very young migrants from nearby or from the remote countryside. An extremely exploitative and repressive, often illegal, labour regime is imposed on the workforce. Workers commonly suffer from long working hours, forced overtime, deprivation of rest days and sick leave, low wages (nearly always on piece-rate), arbitrary penalties and dismissals, and denial of collective bargaining rights. H&S features very low in the investment and management priorities of these enterprises, if at all. The local law enforcement officials are usually willing to turn a blind eye to the situation, either because they are bought off or because they see it in their interests to keep the entrepreneurs and investors happy.¹⁶

Markers of the actual safety performance of China's workplaces can be seen in three areas: accident and safety program compliance rates; chemical and noise exposures; and machine guarding.

Accident and Safety Program Compliance Rates

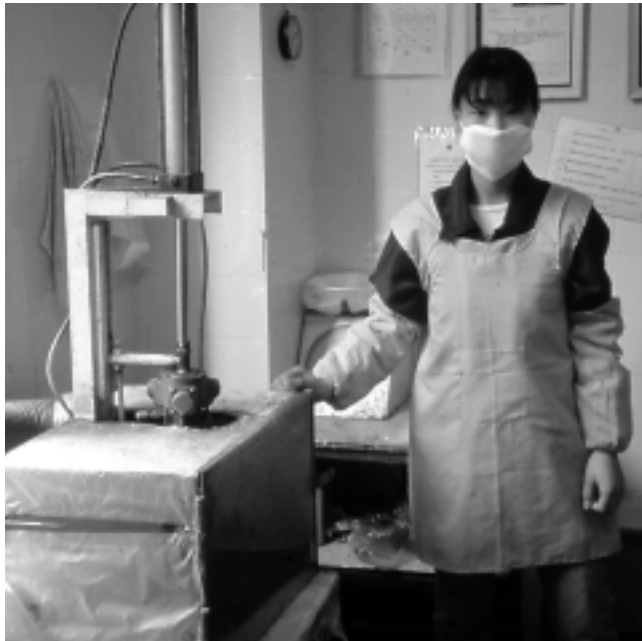
The ILO estimated that the annual workplace fatality rate for 2001 in China was 11.1 per 100,000 workers, compared with a rate of 4.4 per 100,000 workers in the United States. China's official records indicate that industrial accidents rose 27% from 2000 to 2001, and cases of occupational disease rose 13% in 2001 over 2000. The official statistics are widely considered to underestimate the actual data.¹⁶

The 1990–91 survey of construction fatalities near Shanghai found the fatality rate in the East Pujian New Area (9.1 per 100,000 workers) to be 94% higher than the U.S. rate in 1997 (4.7 per 100,000 workers). If highway accidents and intentional injuries are excluded from the U.S. statistics, then the adjusted U.S. rate becomes 2.8 per 100,000, or 225% lower than the East Pujian New Area rate.¹²

In terms of enterprise safety compliance, only limited number of surveys have been reported in the English-language literature.

Compliance rates for workplace hazard standards in SOEs were reported to be 51.4–63% between 1986 and 1989 and 65.6–68.3% between 1991 and 1995. Rates of environmental monitoring and health surveillance in TVEs during this period were reported to be only 1.4–2.7%.⁸

The 1990–91 survey of 9,246 enterprises in 30 counties found that only 9% of TVEs inspected had established any kind of organization to address occupational health issues on site.¹¹



Chemical mixing room in a sports shoe factory in Dongguan City. An enclosed system with local exhaust ventilation was in use for this room. However, the ventilation system had never been tested, as of March 2002, to verify flow rates and capture efficiency. The worker assigned to the room is wearing a "respirator" commonly used in China, which simply consists of a gauze mask with a center section of activated charcoal. This mask does not have an air-tight seal and provides no protection to the worker. (Photo by Garrett Brown)

In 1994, the Occupational Health Control Station of the Shenzhen Labor Bureau surveyed 10,942 industrial enterprises with 2.3 million employees. The survey found that 43% of the facilities were handling hazardous materials. But 53% of the worksites had no "protective facilities," 43% had inappropriate or "unqualified protective facilities," and only 3% had "approved protective facilities" such as local exhaust ventilation and chemical-handling procedures. The same survey found that 84% of these facilities did not provide personal protective equipment.¹⁹

A 2002 survey of 19,527 enterprises in 28 provinces and municipalities found low levels of regulatory compliance, especially in the growing private sector. Exhaust ventilation to control chemical exposures was present in 82% of surveyed SOEs, 67% of urban collective enterprises, 70% of FIEs, and 55% of private-sector enterprises. Personal protective equipment had been provided in 78% of SOEs, 72% of urban collective enterprises, and 50% of private-sector enterprises. Periodic health examinations, required for employees exposed to "toxic chemicals," had occurred in 57% of surveyed SOEs, 2.7% of FIEs, and only 1.9% of private-sector enterprises.¹⁰³

In July 2002, the *Guangzhou City Evening Post* reported the local government had inspected 59,091 workshops

in 8,410 enterprises and found that 96% of the workshops were in violation of health and safety regulations.⁵⁰

Chemical and Noise Exposures

Chemical exposures leading to industrial poisoning have been a longstanding problem in Chinese industry. Studies going back to 1979 document severe benzene poisoning in China's shoe-making industry, resulting in widespread aplastic anemia, leukemia, and related health problems.⁷ More recent studies indicate industrial poisoning continues to be a serious problem.

In the 1990–91 survey of 30 county enterprises where monitoring had been conducted, the results indicated 40% of worker exposures measured were ten times China's regulatory limits. Moreover, it was reported that only 42% of these facilities had any type of ventilation equipment.¹¹

Official statistics indicate 3,906 acute occupation-related chemical accidents during 1991–95, with 28,901 cases of chronic industrial poisoning between 1984 and 1993 and 10,923 cases during 1991–95.⁸ A survey of acute intoxication incidents in FIEs and TVEs indicated an increase of 43.8% in the number of accidents between 1999 and 2000.¹⁹ In December 2002, the official Xinhua News Agency reported that officials in the State Administration of Work Safety (SAWS), enforcing the newly enacted safety and health laws, had closed 681 companies and suspended operations in more than 11,000 others for workplace violations involving the use of hazardous chemicals.¹⁰⁴

Renshaw, of Rohm and Haas Co., reported that "our experience in chemical manufacturing in China is that the basics in hazardous chemical handling and in the fundamentals of good industrial hygiene practice are not in place."⁹⁸ He noted that hazard controls in China, especially in small enterprises, can be characterized as:

- Manual process control with little instrumentation is common.
- Many hazardous operations that were designed as open systems and many designed as closed systems have been overridden by poor work practices or failure of equipment integrity.
- Construction materials and equipment design are at a low standard.
- Local exhaust ventilation is universally poor, dilution ventilation systems are very basic, and air-cleaning equipment is often not in working order.
- Work practices are casual and often major contributors to exposure.
- Locally manufactured personnel protection equipment does not meet modern design and performance standards; e.g., gauze face masks with a charcoal center section.
- Work clothing, often workers' own street clothing, and personal hygiene facilities are often not main-

tained in a sanitary condition. In larger firms, uniforms and hot meals are standard.⁹⁸

The author's experience in inspecting three FIEs with 51,000 workers in Guangdong Province in 2001 and 2002 also matched that described in the NGO and media reports. A wide range of toxic chemicals, including isocyanates, were in heavy use, but no worker exposure monitoring had been performed; ventilation systems were ineffective, when present; no or inadequate personal protective equipment (gloves and respirators) was in use; and no hazard communication training had been conducted with exposed workers.^{18,31}

The impact of uncontrolled chemical exposures in Chinese plants was described in several particularly poignant articles in the media: Philip Pan's May 13 and August 4, 2002, *Washington Post* articles; and Erik Eckholm's June 6, 2000, *New York Times* article (see Appendix B).

Like chemical exposures, worker exposures to noise often exceed regulatory limits and are largely uncontrolled by engineering methods or personal protective equipment. In the 1990–91 survey of 24,000 enterprises in 30 counties, 43% of monitored sites had noise levels above 90 decibels (A scale) and 23% were above 95 dBA. Compliance with the regulatory limits of 85 dBA for new facilities and 90 dBA for older installations was only 33%.¹¹

Machine Guarding

One marker of workplace safety program status is control of obvious hazards such as unguarded machinery that result in amputations. One estimate of industrial accidents in China during 2000 indicated more than 50,000 hands, feet, fingers, and limbs were amputated.¹⁰¹

A 1999 investigation by the ACFTU's *Workers' Daily* newspaper of 12,189 accidents in 9,582 factories in Shenzhen reported to seven local hospitals in 1998 found that 15% of the incidents involved loss of limbs or fingers (772 amputations). Every day in 1998 in Shenzhen, 31 workers became temporarily or permanently disabled, and every 4.5 days a worker was killed in an industrial accident.^{19,105}

An indication of the failure of plant safety programs and government enforcement is the experience of lawyer Zhou Litai in Guangdong Province, who has represented scores of injured workers, many of whom have been denied any compensation for amputation injuries.¹⁰⁴ Some of the injured workers have been disabled at factories that have experienced repeated amputations without guarding or replacing the hazardous equipment. For example, between 1992 and 1998, at the Gaobao Plastic and Pattern Producing Co. (a Hong Kong–financed FIE), more than 20 workers lost fingers from the same set of rolling and cutting machines.¹⁹



Workers filing out of the production buildings at the 5,000-worker sports shoe factory in Longguan, heading toward the dormitories, which have cafeterias on the ground floors. (Photo by Garrett Brown)

KEY FACTORS FOR IMPROVING HEALTH AND SAFETY CONDITIONS

From an industrial hygiene viewpoint, there are four key factors to improving workplace health and safety in the present structure of work and conditions in China.

First, employers in China—both domestic and foreign—must recognize and comply with their legal and ethical responsibilities for providing safe and healthy workplaces. This is particularly true of the transnational corporations currently flooding China, which have the financial, human, and technical resources to actually implement the “one global standard” for workplace health and safety that is advertised in their corporate “codes of conduct,” ostensibly implemented by their “corporate social responsibility” departments.

Second, the Chinese government must generate the political will needed to actually enforce the prior and newly-established workplace health and safety regulations, and to devote the financial and human resources necessary to foster compliance with the law. Given the

economic competitiveness of China compared with even other low-cost producers such as Mexico, Central America, and Indonesia, China's government has the capacity to "set the rules of the game" for foreign investors in China, requiring them not only to comply with China's regulations but also to share technical and human resources to further develop the government's own capacity, and to accelerate the development of the occupational health profession in China.

Third, given the size and complexity of China's varied workplaces, effective health and safety programs cannot be implemented and maintained without the active participation of informed and empowered workers. Worker participation and leadership in all aspects of plant safety committees and ongoing inspection and training activities is essential to provide these programs with the scope and impact required to improve conditions.

The positive impact of this worker participation and leadership would be strengthened by increasing the involvement of the ACFTU, especially in those plants where democratic elections are held for union officers, and/or other unions that may develop as China's workers initiate genuinely democratic, member-controlled unions.

Finally, civil society and occupational health professionals both inside and outside China must continue to be involved in governmental and nongovernmental efforts to improve workplace safety. This involvement can take various forms, from "anti-sweatshop" consumer campaigns directed at foreign investors and corporations operating in China to projects providing technical assistance to build the capacity of three key actors in improving workplace safety in China—employers, the government, and workers.

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APPENDIX A

Selected Factory Reports Published by Nongovernmental Organizations

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APPENDIX B

Selected Articles from the Major Media on Occupational Health and Safety Issues in China

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