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Occupational safety and health performance of the manufacturing sector in Jeddah Industrial Estate, Saudi Arabia: A 20-years follow-up study

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ABSTRACT

The objective of the current paper is the evaluation of the progress of occupational safety and health in the manufacturing sector in Jeddah Industrial Estate (JIE), Saudi Arabia over a 20-years period. A study was conducted on 2010 for the appraisal of occupational safety and health performance in JIE and the results are compared to a similar study conducted in 1990. The 1990 study had been based on a sample of 52 plants employing 5830 workers, while that of 2010 was conducted on 135 plants employing 18351 workers. In both studies, evaluation was performed by walk-thorough survey and using detailed survey forms. Comparing the results of both studies reveals that there are considerable improvements in some issues such as exposure to physical and chemical factors, applying engineering controls, and occupational medical services. However, these improvements are much less than what is anticipated or required after two-decade period. On the other hand, a considerable decline in the performance as related to many safety elements and fire protection is observed. Interpretation of these changes and some recommendations are presented.

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1. Introduction

The manufacturing sector in the Kingdom of Saudi Arabia (KSA) has made remarkable progress during the last two decades. For example, both the number of manufacturing plants and the workforce in Jeddah Industrial Estate (JIE), one of the largest industrial zones in KSA, have almost tripled during the last two decades, according to the data of the Ministry of Commerce and Industry. Such progress has its impact on the development and practice of occupational safety and health in the manufacturing industries, mainly due to the introduction of new technologies, usage of potentially toxic chemicals, more exposure to occupational hazards and exposure to physical and psychological stresses, which requires more stringent assessment of the work environment and workers' health. Also, a better knowledge about high risk sectors is needed for developing interventions at the workplace and setting priorities for prevention of occupational factors (Heran-Le Roy et al., 1999).

Occupational health and safety performance of the Saudi manufacturing sector has not been yet adequately studied. There are some studies in the literature addressing occupational health and safety issues in KSA industry based on assessment of either one type of industry or one type of hazard (Al-Jiffry et al., 1990; Noweir et al., 1991; Ahmed et al., 2001; Noweir and Jamil, 2003). However, only a few, yet outdated cross-sectional surveys evaluating occupational health and safety in KSA are found. For example, Noweir (1987) proposed an occupational health and safety program after a preliminary assessment of the status of the available services in the KSA. In another study, Alidrisi et al. (1988) studied stress factors in JIE including heat, illumination, noise and a few aerosols; however, no trial was made to investigate other industrial hazards or appraise the safety performance there. In a third study, Noweir et al. (1991) tentatively appraised the safety performance and work environment in 52 plants in JIE. They referred that most workers were exposed to high environmental levels of heat, noise, non-ionizing radiation, and deficient illumination, particularly in the small and medium-size (SM) industries, where required engineering controls did not exist, or were not operating properly, and no safety facilities existed. Meanwhile, a detailed report of the study, including an executive summary and recommendations for improving the status of occupational safety and health in JIE, was presented to JIE authority and to other pertinent officials as well.

In the fourth trial Noweir (1994) appraised the safety and hygiene requirements of KSA and re-oriented the Saudi National Safety Program, that had been previously proposed (Noweir et al., 1991), reviewing and discussing its executional status, and the involved problems and suitable solutions. He viewed that what seems to be urgently needed is an appraisal of the actual work haz-

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ard and safety performance in industry, delineation of functions of required service, coordination, and concentrated process of development of manpower, equipment and programs.

Since the time of those studies no other trials have been made to evaluate the progress of occupational health and safety in the manufacturing sector in KSA. We found the study conducted in 1990 by Noweir et al. (1991) a suitable baseline for comparison with a recent similar, yet wider, study conducted for establishing profiles of occupational hazards, appraising safety and health performance in JIE plants as a model for the prevailing conditions in KSA. Therefore, the objective of the current study has been the evaluation of the progress of occupational health and safety in the manufacturing sector in KSA after 20 years of the previous study, and following-up the impact of applying the recommendation of the 1990 study on the improvement of the occupational safety and health in JIE plants.

2. Methods

2.1. Selection of the samples

JIE was selected for the study because it is one of the most important industrial zones in KSA. It represents a model of the prevailing conditions in KSA industries.

In both studies (1990 and 2010) profiles of the plants and workforce in JIE were prepared using official records and categorized according to type of industrial activity, such as those published by Alidrisi et al. (1992). The enterprises have been classified according to size of industry into small: <50 workers, medium: 50–199 workers, and large: $\geqslant$200 workers (WHO, 1982).

Based on the total number of JIE manufacturing plants in 1990 and 2010, the formula discussed in Inman and Conover (1982) was used to calculate the required sample size. In the 1990 study, a 90% confidence level was used, whereas a confidence level of 95% was used in the 2010 study. The type and size of industries in the sample were distributed as similar as possible to the population. Accordingly, in the 1990 study a sample of 52 plants (15 large, 20 medium and 17 small), and in the 2010 study a sample of 135 plants (24 large, 67 medium and 44 small) were studied.

2.2. The walk-through survey

Each of the selected plants was surveyed in a walk-through survey using a special study from. The design of the form was based on the forms used by the National Institute for Occupational Safety and Health (NIOSH) in the U.S. National Hazard Survey (NIOSH, 1974, 1977); however, subjected to some modifications in the interview procedures in order to convene with the conditions of a previous similar study in Egypt (Noweir, 1991), as well as with the conditions in Saudi Arabia. Self-reporting questionnaire was excluded to avoid the disadvantage mentioned by Kongtip et al. (2008). One of these disadvantages is that only plants interested in occupational safety and health tend to respond.

The survey form was designed, and field-tested, mainly to collect information on:

1. Basic information, including ownership, type of industrial activity, shift system and description of working force, including adults and youngsters, gender, ethnicity, type of employment, production workers and administrative employees.
2. Evaluation of environmental conditions in all plant departments, including data on industrial operations and processes, exposure to physical, chemical, and biological hazards, available engineering controls, available personal protection, and available industrial health services.
3. Evaluation of industrial safety in all plant departments, such as plant housekeeping and layout, machinery and tools, electric power circuits and equipment, pressure equipment and containers, and material handling.
4. Evaluation of fire prevention items, such as fire fighting, alarm system, exit facilities, safe storage of flammable materials, construction material, and smoking prohibition.
5. Evaluation of occupational health services, including medical services, pre-employment and periodical medical examinations, safety and health records, training, and health and safety specialists.
6. Evaluation of environment sanitation and industrial waste disposal.

It may be noted that the walk-through technique is a direct observation method. The situations are natural because they are real and the skill of the surveyor rests on his ability to observe and record without bias. Therefore, a very high level of skill and experience is required and observations are needed to be recorded in a standardized form so that comparison with other situations is possible. Consequently, the walk-through surveys in all the plants were conducted by one of the authors, in order to avoid any personal bias in the appraisals.

Many plant owners or managers were concerned that the data of the study might be used against them, a problem found, also, in other field studies (Patwary et al., 2012). Discussions with plant owners were made to convince them that the data were to be confidential and used for research purpose. Also, as a motivation, they were told that a copy of the results, including recommendations, were to be given to them. This would provide an opportunity for them to obtain a review of their health and safety management system and that any concerns or queries that they might have would also be dealt with (Walker and Tait, 2004).

After getting acceptance from plant owner or manager to involve the plant in the study, the survey scheme was started by an initial interview with the executive person to gather the basic information of the plant and involved workers and to arrange for the field visit. Then, the field study was conducted through a walk through survey using the above-discussed study form. The surveyor collected the data by direct observation and workers questioning, as appropriate. A plant was studied within a period of 1–3 days, according to its size and complexity of operations.

2.3. Statistical analysis

The data were processed and tabulated, and figures were produced in Microsoft Excel®. The significance, represented by *P*-value, of the difference between 1990-study and 2010-study results was calculated by the test for two proportion using Minitab version 15 software.

3. Results

3.1. Physical and chemical hazards

Fig. 1 shows that heat stress and noise are the main physical hazards in the studied plants in both the 1990 and the 2010 studies. For instance, 53.9% of plants (62.7% of workers) and 48.4% of plants (25.2% of workers) in the two studies, respectively, involved (exposed to) hot working conditions ranging from mild to severe. Also, the percentage of plants involving noise exposure increased in the 2010 study (74.1%), as compared to that of the 1990 study (51.9%) with relatively small reduction in the percentage of exposed workers from 56.1% to 47.5%.

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