

Investigating the concentration of dust and fume in the air of an industrial company in Ahvaz city

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Abstract

Background: High concentrations of welding dust and fumes in workers' breathing air are among the most important environmental factors affecting health of workers, working in the industry. Considering the central role of workforce health in sustainable development, this study was performed with the aim of evaluating the amount of fume and dust in the ambient air of an industrial company in Ahvaz city.

Methods : In this cross-sectional study, the concentration of dust and fume in the breathing air of the workers and the ambient air of the workshop was evaluated. An individual sampler pump was used for pollutant sampling and pollutant concentration was determined using the weight method. Finally, the results were compared with the reference standards.

Results: In 4 stations, the pollutant concentration were higher than the standard. The average amount of dust and fume in the measurement stations were equal to 5.84 (mg/m³) and 2.55 (Mg/m³) respectively.

Conclusion: According to the findings of the current research, the amount of exposure to fume and dust in some stations was more than permissible. so, intervention actions such as Engineering and managerial control should be taken to reduce the exposure.

Keywords: Occupational health, Worker health, Welding fume, Ahwaz.

Introduction:

Among the environmental factors affecting efficiency and health of workers, can be pointed out to much concentration of dust and fume that is allowed in the workers' breathing air. Dust is a collection of suspended particles in the air, and their aerodynamic diameter is less than 100 micrometers. Due to the potential of creating disease, dust is divided into two main groups: ineffective and fibrogenic(1). From the occupational point of view, one of the main factors for worker's health, is fume produced during welding. Fumes are solid particle that are produced by the condensation of gases after sublimation from molten materials. The main element of fume produced during welding is iron oxide. Other important metals found in welding fumes are Manganese, Chrome, Nickle, lead, Copper, molybdenum, Cobalt, Cadmium, Zink and Aluminum. With the emergence of new welding methods and their use and replacement, the number of workers exposed to welding fumes is continuously increasing. Approximately 11 million people in worldwide work as welders and 110 million of people are exposed to welding fumes(2). The results of Gol Babaei and Faizullah's studies in Iran and Abelman in America, showed that the risk rating of welding workers is high. On the other hand, studies of Sjogren in Canada and Yoon in Korea, have confirmed that the increased risk of lung cancer in welders is due to fume exposure(3,4,5,6).

Materials and methods: In this cross-sectional study, the concentration of dust and fume in the breathing air of the workers and the ambient air of the workshop was evaluated. An individual sampler pump was used for pollutant sampling and pollutant concentration was determined using the weight method. Finally, the results were compared with reference standards. OHSAS 18001:2007 and Limits of occupational contact of pathogenic agents of the Ministry of Health of Iran were the references. Before sampling, the filters were placed in a desiccator for 24 hours and dried. Then, they were weighed by a sensitive scale. Before connecting the individual sampling pump to the worker, calibration was done with a soap bubble flowmeter. Sampling was done continuously and during one work shift, and at the end of sampling, the filters were placed in a cassette and sent to the reference laboratory for analysis. It should be noted that in order to ensure the accuracy of sampling, the flow of the pumps and the sampling conditions were regularly controlled. The necessary information for the evaluation of the samples, such as the characteristics of the sampling location, the weight of the sample, the pump flow, the temperature, the pressure and the volume of the air sampled after correction based on the standard temperature and pressure, were recorded in forms(2).

Results: The results, are presented in the following tables.

Table No 1. Dust measurement result

Row	Location	Exposure Time(hr)	Sampling Type	Sampling Method	Measured Value(mg /m3)	Standard (mg/m3)	Pump Flow(L/M)	Result
1	Production Hall 1- point 1	8	Environmental	Gravimetry	2.8	10	2	OK
2	Production Hall 1- point 2	8	Environmental	Gravimetry	4.0	10	2	OK
3	Production Hall 2- point 1	8	Environmental	Gravimetry	5.8	10	2	OK
4	Production Hall 2- point 2	8	Environmental	Gravimetry	0.5	10	2	OK
5	Production Hall 3- point 1	8	Environmental	Gravimetry	0.9	10	2	OK
6	Production Hall 3- point 2	8	Environmental	Gravimetry	12	10	2	Not OK

7	Operator	8	Environmental	Gravimetry	13.6	10	2	Not OK
8	Store	8	Environmental	Gravimetry	15.9	10	2	Not OK
9	Outside area	8	Environmental	Gravimetry	15.5	10	2	Not OK
Allowed amount of AOE-TWA= 10 (mg/m3)								

Table No 2. Fume measurement result

Row	Location	Sampling purpose	Chemical Analyte	Exposure Time (min)	Pump Flow (L/M)	Sampling Time (min)	Sampling Air volume (Lit)	Measured Value (Mg/m ³)	Analysis method	Unit of measurement	TLV	Result
											TWAPPM	
1	Hall 1- Welder1	Personal	Fume	800	2	20	40	3.4	GRAV	(Mg/m ³)	5	OK
2	Hall 1	Environmental	Fume	800	2	20	40	2.0	GRAV	(Mg/m ³)	5	OK
3	Hall 2- Welder2	Personal	Fume	800	2	20	40	3.1	GRAV	(Mg/m ³)	5	OK
4	Hall 2	Environmental	Fume	800	2	20	40	1.7	GRAV	(Mg/m ³)	5	OK
Allowed amount of AOE-TWA= 5 (Mg/m3)												

Discussion and Conclusion:

According to the findings of the current research, the amount of exposure to the dust in some stations were more than permissible. So, intervention actions should be taken to reduce the exposure. But, in all measurement points, the amount of welding fume exposure was below the standard limit. In research conducted in Taiwan, people exposed to dust with a concentration of 24.1 mg/m³ were divided into the group of people with high exposure(7). In another study conducted in Malaysia, workers in the cement industry were exposed to 10 mg/m³ of total dust(8). In order to reduce exposure to dust and fume, actions such as, replacing more modern and automatic devices with old ones, eliminating unnecessary presence of people in the place, reducing of working hours, using of mask, using of local ventilation to absorb and transfer fumes and using a fan to remove fumes from the worker's breathing area is recommended.

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