

## Assessing the Ultraviolet Exposure Level in Welding Workers of Sar-Cheshmeh Copper Complex

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Article information	Abstract
<p>Article history: Received: 11 Aug 2011 Accepted: 13 Oct 2011 Available online: 5 Nov 2012 ZJRMS 2013; 15(4): 76-77</p> <p>Keywords: Welding Ultraviolet radiation Eye diseases Skin diseases</p> <p>*Corresponding author at: Department of Biostatistics, Faculty of Medicine, Qom University of Medical Sciences, Qom, Iran. E-mail: mehdi_r_d@yahoo.com</p>	<p><b>Background:</b> Because of being exposed to a wide range of ultraviolet radiations, welders are prone to eye and skin diseases. This study aims at determining the ultraviolet exposure level in welding workers of Sar-Cheshmeh Copper Complex.</p> <p><b>Materials and Methods:</b> This cross-sectional study was conducted in 2010 on all welding workers of the complex using Hagner UV digital radiometer.</p> <p><b>Results:</b> The mean value for the received ultraviolet radiation level was <math>0.09 \pm 0.045 \text{ j}^2/\text{cm}^2</math>. The level of UV exposure was significantly different (<math>p=0.001</math>) for the welders working in different units of the complex. The mineworkers received the highest level of radiation (<math>0.14 \text{ j}^2/\text{cm}^2</math>).</p> <p><b>Conclusion:</b> In this study, the ultraviolet exposure of welding workers is below the allowable threshold limit for UV radiation.</p>

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### Introduction

Electromagnetic rays with a wavelength between 100 nm and 400 nm are referred to as ultraviolet (UV) rays [1]. Sun is the most important natural source of UV rays and among the artificial resources of such rays, various types of UV lamps and the welding industry may be pointed out [2]. Premature aging is one of the long-term complications caused by UV exposure [2, 3].

Farmers and workers who work in outdoor environments and under direct light of the sun may suffer from various types of skin cancer [2, 4]. Unlike other forms of the cancer, skin cancer outbreak has been increased drastically in recent years [5]. Antonini did not find any relationship between damage to the internal layers of cornea in welders exposed to UV [6].

In another study, the measured UV radiation in aluminum welders has caused several skin and eye problems [7]. Recent studies suggest that being exposed to UV radiation with  $10 \text{ j}^2/\text{cm}^2$  energy density causes acute skin reactions such as cutaneous erythema [3, 4, 5, 8]. Peng et al. found numerous relations between exposure to welding radiation and transformations in skin [9]. Birt shows that welders not only are exposed to the UV radiation but also they suffer chronically and acutely from welding fumes which they, in turn, may result in various diseases such as airways irritation, bronchitis, changes in pulmonary function and lung cancer [10]. Because of being exposed to a wide range of ultraviolet radiations, welders are prone to eye and skin diseases.

The purpose of present study is to determine the ultraviolet exposure level in welding workers of Sar-Cheshmeh Copper Complex

### Materials and Methods

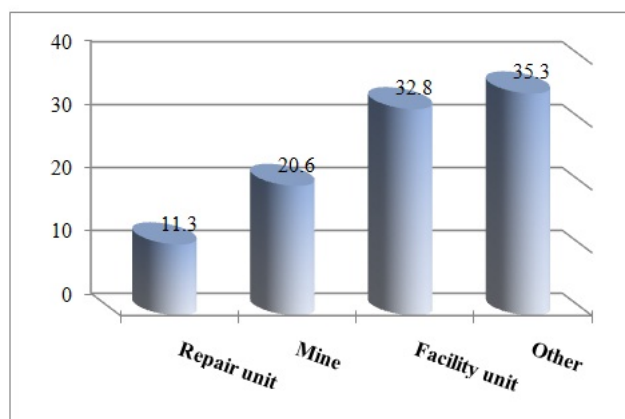
This study was of a descriptive-analytical type carried out based on the cross-section method. In July 2010, all welders (34 people) working in Kerman, Sar-Cheshmeh Copper industry were examined. In order to measure UV radiation, the Hagner UV digital radiometer was used. Hagner UV digital radiometer is a direct-reading instrument which indicates the results immediately after measurement.

The exposure levels were measured in a distance of 1 meter from the welding point, almost near the welder's face and body [1]. After recording the results in a form prepared for welders and entering the data in SPSS-13 software, the results were described and analyzed using mean and SD indicators, quantity and percentage, confidence interval (95%), Kruskal-Wallis one-way analysis and Pearson's correlation coefficient. A significance level of 0.05 was also used for all tests.

### Results

The Estimated average age of workers was  $34.56 \pm 6.83$  years (23-54 years old) and their average working experience was  $11.09 \pm 6.39$  years (3-30 years). Fifty-three percent (18 people) working in the welding industry were illiterate, 44.1% (15 people) had finished the middle

school and only 2.4% (1 person) had the high school diploma. The workers who had no specific workplace and were active in all parts of the industry and the welders working in the Repair Unit constituted, respectively, the most and the least percent of welders in Sar-Cheshmeh Copper Complex (Fig. 1).



**Figure 1.** Distribution of workers in different units of Sar-Cheshmeh Copper Complex

**Table 1.** Ultraviolet levels in different parts of the Sar-Cheshmeh Copper Complex

Ultraviolet exposure Type of job	Mean±SD	p-Value
Repair unit	0.1±0.005	0.001
Mine	0.14±0.52	
Facility unit	0.08±0.02	
Other	0.05±0.03	
Total	0.09±0.04	

The allowable threshold limit for UV radiation suggested by the Iran Occupational Health Committee is  $1 \text{ j}^2/\text{cm}^2$  while in this study the average amount of UV radiation received by welders was  $0.09 \pm 0.045$ . A 95% confidence interval was obtained for the average UV radiation of 0.074-0.106 which is less than 1.

Results showed that increasing the diameter of welding electrodes increases the voltage rate ( $r=0.66$ ,  $p=0.01$ ) following which the amount of UV radiation received by

welders increases as well ( $r=0.49$ ,  $p=0.003$ ). Likewise, there was a significant difference ( $p=0.001$ ) between the average level of UV radiation received by the different units' workers as the welders working in Mine unite received the highest level of UV radiation.

## Discussion

The level of UV radiation received by the welders of Sar-Cheshmeh Copper Industry is less than the allowable threshold and can cause no disease or health problem in the welders. The recommended standard level for exposure to the radiation is 1000 seconds and less than  $1 \text{ j}^2/\text{cm}^2$  which is a confirmation for the Chiung's study results. On the other hand, the level of UV radiation received by the workers in cutting unit is more than what is received by the welders. It was also evident that electrodes with 3 mm and 5 mm diameters generate more UV radiation than other electrodes that is fully consistent with the results of Antonini's study. Also, Pearson's correlation test showed a direct relationship between the voltage and the level of received radiation; in other words, as the welding machine's voltage increases, the received UV level increases as well which is approved by Emil and Kim. With regard to this study, we recommend the investigations on the level of UV exposure and disease occurrence caused by which in farmers and other industries' workers

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## Authors' Contributions

All authors had equal role in design, work, statistical analysis and manuscript writing.

## Conflict of Interest

The authors declare no conflict of interest.

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