

# Measurement and analysis of noise pollution in Al-shaheed Copper and Brass factories, Iraq.

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## ABSTRACT

Industry workers suffer psychological and physical stress as well as hearing loss due to industrial noise. Although noise source control can be profound process sometimes, it would be the most effective way to eliminate noise level on source. Therefore, identifying dominant source of noise shall be the first step to overcome the noise problem in industry. This paper presents the noise pollution in Al-shaheed Copper and Brass factories in Iraq at 33°06'04" longitude and 43°48'50" altitude. The factories are staffed by 1700 workers for 12 hours a day, 7 days a week. This study depended on the maximum permissible occupational noise exposure limit of International Standards Organization (ISO) and Occupational Safety Health Act (OSHA) as a comparison reference. And proved that the half of the work sites in factories where unacceptable noise levels and all sites of comfort workers exceeded the limit of acceptable noise and the study also proved that the administration building factories sites within the levels of the noise surveys and administrative staff in safety from the impact of noise in factories. Also the Noise pollution has no effect on residential areas near the factories.

## Introduction

Workers have been aware of the connection between noise and hearing loss. Hearing loss is not the only adverse effect of occupational noise, but also effects on mental and physical health and disturbance of daily activities [1-4].

Concern over the impact of noise in the workplace led to limit exposure to high level occupational noise, International Standards Organization (ISO) suggests the maximum permissible occupational noise exposure limit of 85-90 dB(A) [5]. United Kingdom [6], France, Germany and Belgium[7].

Denmark [8], Irish Republic [9], Italy, Canada and Australia [10,11] allows 90 dB(A), Japan [12], Sweden and Norway [9,10] allow 85 dB(A) . These limits had been allowed with halving rates of 3 dB(A) and working schedules of 8 h/day and five days a week, i.e. 40 h/week. Occupational Safety Health Act (USA) allows 85 dB(A) for 40 h/week with halving rate of 5 dB(A) [13].

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It can be seen in Table (1) that for halving rate of 3 dB(A), the acceptable time for each value of noise levels, for ISO and OSHA limit of 90 and 85 dB(A) and seen in Table (2) the Acceptable Equivalent Sound Level at some common location.

In Iraq there are no regulatory laws to limit high level occupational noise and due to general unawareness about the ill-Effects of high level noise. Therefore, there is a growing need to set occupational noise exposure limits.

Table 1: Maximum permissible occupational noise exposure duration per week allowed under the limits of 90 and 85 dB(A) with halving rate of 3 dB(A) [5,13].

Noise level dB(A)	Occupational noise exposure duration/week					
	90 dB(A)			85 dB(A)		
	hrs	Min	sec	hrs	min	sec
85				40	00	00
86				30	00	00
87				25	00	00
88				20	00	00
89				15	00	00
90	40	00	00	12	30	00
91	30	00	00	10	00	00
92	25	00	00	7	30	00
93	20	00	00	6	15	00

94	15	00	00	5	00	00
95	12	30	00	3	45	00
96	10	00	00	3	07	30
97	7	30	00	2	30	00
98	6	15	00	1	52	30
99	5	00	00	1	33	45
100	3	45	00	1	15	00
101	3	07	30	0	56	15
102	2	30	00	0	46	53
103	1	52	30	0	37	30
104	1	33	45	0	28	08
105	1	15	00	0	23	27
106	0	56	15	0	18	45
107	0	46	53	0	14	04
108	0	37	30	0	11	43
109	0	28	08	0	9	23
110	0	23	27	0	7	02
111	0	18	45	0	5	52
112	0	14	04	0	4	42
113	0	11	43	0	3	31
114	0	9	23	0	2	56
115	0	7	02	0	2	21

Note: Greater than 115 dB(A) is not acceptable.

### Method of study

#### area of study

Al-shaheed factories are located in the region of Western Sahara within the administrative borders of Anbar province in Iraq at 33°06'04" longitude

#### Objectives of study.

**Table 2: Acceptable Equivalent Sound Level at some common locations [14].**

Location	Effects	dB(A)	Time hrs.	Time of day
Bedroom	sleep disturbance, annoyance	> 30	8	night
Living area	annoyance, speech interference	> 50	16	day
Outdoor living area	moderate annoyance	> 50	16	day
Outdoor living area	serious annoyance	> 55	16	day
Outdoor living area	sleep disturbance, with open windows	> 45	8	night

The objectives of this study were to assess noise levels of Al-shaheed Copper and Brass factories environment and to evaluate the degree of potential hearing loss due to ISO and OSHA occupational noise exposure limits, thereby prevent innocent workers from potential noise-induced hearing losses and providing some useful data for hearing conservation purposes which may contribute to help industrial

hygienists set the groundwork for governmental regulations on Iraq. and 43°48'50" altitude. They are produce Copper and Brass alloys.Noise pollution has no effect on residential areas near the factories to the fact that the nearest residential area about 15 km away, but it has impact of the workers in the factories, who numbered 1700 workers Distributors 2 Hevcat and they works continuously 12 hours / day for 7 days a week without interruption.

#### measurement process

The measurement of noise levels was used Sound level meter model AR824 at (A) frequency weighting in 40 locations inside and outside the factories as shown in figures (1 and 3). 25% of the reality of measurement is located in the room's comfort of workers, engineers, and boardrooms.

The measurement process was repeated 5 times continually for each location at a various machine work time stages, that for containment of noise changeability. It was at a certain distance 1m from the machines and at an altitude of 2 m from the land of the factory and at a distance of 1 m from the walls and 2 m from the entrances , corners and intersections to thirsty without being influenced by sound waves reflected from these surfaces. Were also measured wind speed, temperature and humidity at each location to calculate the effect of atmosphere on the transmission of sound waves.

#### Results and Discussion

In the workplaces

The determination of permissible and impermissible occupational noise exposure limits depends mainly on two factors: the noise level measured and the duration of exposure to noise, and the effect of these factors on the safety of workers.In this study, for reasons mentioned earlier we will rely on the limits defined by the ISO and OSHA as a comparison reference, i.e. as shown in the table (1) The highest acceptable level of noise is 90-85 dB(A) and working schedules of 8 h/day and five days a week, i.e. 40 h/week, And that working hours would be reduced if the level of noise was above the acceptable level Down to the highest permitted noise level at 115 dB(A).

A 30-site is the number of sites measured in the workplace, which represents more than 75% of the total number of sites that included all workplaces in factories as shown in figure (1). 17- site which

exceeded the permissible limits of OSHA and 12 of them exceeded the permissible limits to the ISO, of 57% and 40% respectively, this meaning that the half of workplaces in factories where unacceptable noise levels. The highest of these levels exceeded the highest permitted noise level reached of 120 dB(A) at the hard shear machine as shown in Table 3 and figure (2). While, The 13 or 18 sites remaining are located within the permissible limits and the best workplaces is a store peaked at 55 dB(A) and the most forestry workplaces was at Acid exchange tank reached of 84 dB(A).

The duration of exposure to noise for workers (not managers) was exceed the permissible limits for acceptable levels of noise, they demonstrate at 12 hour / day, 7 days / week this means that the workers are working 44 hour/week outside the acceptable limits. It's also does not change as it should with increasing noise levels to unacceptable levels.

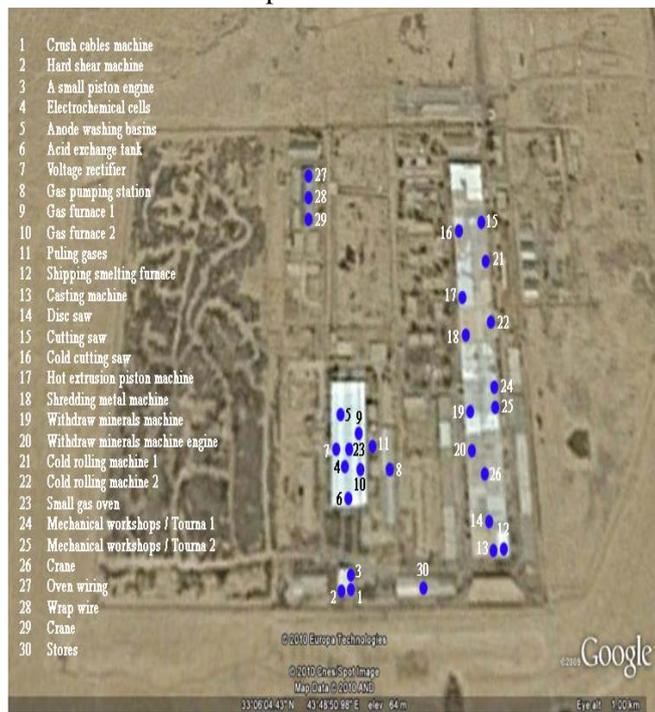


Figure (1): shows the sites of measured noise levels at the workplace.

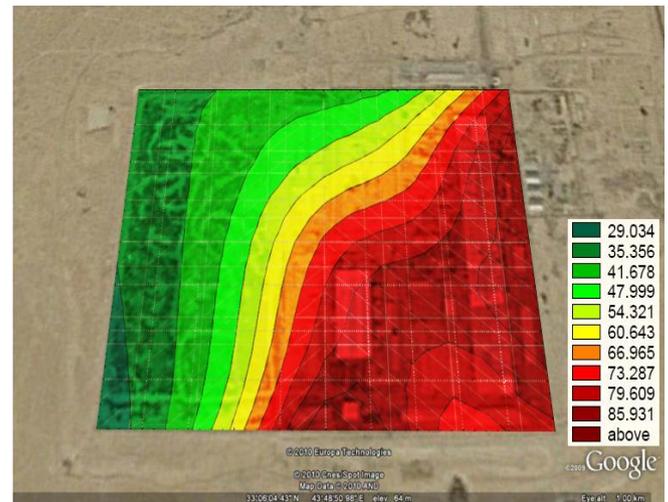


Figure (2): shows the measured noise levels at Al-shaheed factories.

Table 3: noise levels measured in the workplace.

Source points	Noise levels dB(A)				
	1	2	3	4	5
1 Crush cables machine	91	93	114	102	89
2 Hard shear machine	104	114	120	117	106
3 A small piston engine	78	80	90	76	75
4 Electrochemical cells	77	76	76	76	77
5 Anode washing basins	70	73	74	74	73
6 Acid exchange tank	84	84	86	85	84
7 Voltage rectifier	76	76	77	77	76
8 Gas pumping station	97	97	102	99	97
9 Gas furnace 1	86	92	92	89	88
10 Gas furnace 2	99	100	102	100	98
11 Puling gases	107	107	108	107	106
12 Shipping smelting furnace	86	94	105	95	88
13 Casting machine	83	87	98	97	86
14 Disc saw	83	106	108	83	76
15 Cutting saw	76	76	76	76	76
16 Cold cutting saw	89	94	99	98	92
17 Hot extrusion piston machine	83	87	94	91	85
18 Shredding metal machine	79	84	86	85	81
19 Withdraw minerals machine	75	88	105	83	80
20 Withdraw minerals machine engine	78	82	101	88	81
21 Cold rolling machine 1	85	90	100	92	89
22 Cold rolling machine 2	82	84	86	84	83
23 Small gas oven	82	82	83	82	81
24 Mechanical workshops / Tourna 1	93	101	102	102	101

<b>25</b>	<b>Mechanical workshops / Tourna 2</b>	<b>96</b>	<b>97</b>	<b>97</b>	<b>96</b>	<b>96</b>
<b>26</b>	<b>Crane</b>	<b>87</b>	<b>90</b>	<b>92</b>	<b>91</b>	<b>86</b>
<b>27</b>	<b>Oven wiring</b>	<b>70</b>	<b>73</b>	<b>75</b>	<b>74</b>	<b>72</b>
<b>28</b>	<b>Wrap wire</b>	<b>65</b>	<b>66</b>	<b>67</b>	<b>67</b>	<b>65</b>
<b>29</b>	<b>Crane</b>	<b>80</b>	<b>83</b>	<b>86</b>	<b>84</b>	<b>82</b>
<b>30</b>	<b>Stores</b>	<b>55</b>	<b>62</b>	<b>66</b>	<b>60</b>	<b>59</b>

<b>4</b>	<b>rooms</b>	<b>74</b>	<b>74</b>	<b>74</b>	<b>74</b>	<b>74</b>
<b>5</b>		<b>62</b>	<b>62</b>	<b>66</b>	<b>67</b>	<b>62</b>
<b>6</b>		<b>90</b>	<b>96</b>	<b>10</b>	<b>94</b>	<b>84</b>
<b>7</b>		<b>59</b>	<b>60</b>	<b>64</b>	<b>61</b>	<b>60</b>
<b>8</b>		<b>55</b>	<b>56</b>	<b>56</b>	<b>55</b>	<b>55</b>
<b>9</b>		<b>71</b>	<b>75</b>	<b>87</b>	<b>70</b>	<b>66</b>
<b>10</b>		<b>57</b>	<b>61</b>	<b>72</b>	<b>65</b>	<b>58</b>

**in the resting places**

It's difficult to determine the highest acceptable noise level in workers comfort places because several types of workers activity, they could be bedrooms or dining rooms or communications rooms, and We do not know exactly the number of hours spent by workers inside this rooms. So after we see the noise level appropriate for all these activities as shown in the table (2) we will assume that 50 dB (A) is the highest acceptable level of noise in workers comfort places. The number of sites measured in workers comfort places was 10 sites which constitute 25% of the total number of sites which include the most workers comfort places in the factories (8 sites) and some of the positions in the administration building factories (2 sites) as shown in figure (3).

Measurements in the factories management building was proved that it's located within the levels of surveys and administrative staff in safety from the noise impact from workplaces. But The Measurements in all workers comfort places had exceeded the acceptable limit of noise. The most dangerous workers comfort places was at the hard shear machine and crush cables machine of 101 dB(A) and the lowest workers comfort places was near the site of the crane reached of 55 dB(A) and varied in other sites between these two levels, as shown in table (4).



Figure (3): shows the sites of measured noise levels in the workers comfort places and in the factories management building.

Table (4): noise levels measured in the workers comfort places and in the factories management building.

Source points	Noise levels dB(A)				
	1	2	3	4	5
<b>1</b>	<b>46</b>	<b>46</b>	<b>46</b>	<b>46</b>	<b>45</b>
<b>2</b>	<b>49</b>	<b>48</b>			
<b>3</b>	<b>65</b>	<b>66</b>	<b>69</b>	<b>65</b>	<b>66</b>

**Conclusions**

Results of study showed that:

- About Half of workplaces in factories where unacceptable noise levels, The highest of these levels 120 dB(A) at the hard shear machine which was exceeded the highest permitted noise level of ISO and OSHA, the best workplaces is a store 55 dB(A) and the most forestry workplaces was at Acid exchange tank 84 dB(A).
- The workers are working 44 hour/week outside the acceptable limits. It's also does not change with increasing noise levels to unacceptable levels.
- The administration building factories sites within the levels of the noise surveys and administrative staff in safety from the impact of noise in factories.
- The Measurements in all workers comfort places had exceeded the acceptable limit of noise. The most dangerous workers comfort places was at the hard shear machine and crush cables machine of 101 dB(A) and the lowest workers comfort places was near the site of the crane reached of 55 dB(A).
- The Noise pollution has no effect on residential areas near the factories.

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## قياس وتحليل تلوث الضوضاء في مصانع الشهيد للنحاس والبراص , العراق.

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### الخلاصة

عمال المصانع يعانون إجهاداً نفسياً وجسدياً بسبب الضوضاء الصناعية التي قد تؤدي بهم الى الإصابة بفقدان السمع. التحكم بمصادر الضوضاء بالرغم من كونه عملية عميقة أحياناً إلا إنه الطريق الأكثر فاعلية لإزالة الضوضاء من مصادرها, وإن تمييز مصدر من مصادر الضوضاء سيكون الخطوة الأولى للتغلب على مشكلة الضوضاء في الصناعة. هذه الدراسة تبيّن تلوث الضوضاء في مصانع الشهيد للنحاس والبراص الواقعة عند خط طول  $33^{\circ}06'04''$  وخط عرض  $43^{\circ}48'50''$  والتي يعمل فيها 1700 عامل لمدة 12 ساعة يومياً ولسبعة ايام في الإِسبوع. وإن هذه الدراسة إعتمدت على الحدود العليا المسموح بها مهنياً لمنظمة التقييس الدولية (ISO) وقانون الصحة والسلامة المهنية (OSHA) كمرجع مقارنة, حيث يعتمد تحديد مستويات الضوضاء المقبولة وغير المقبولة مهنياً بشكل أساس على عاملين أساسيين هما مستوى الضوضاء المقاس ومدّة التعرض للضوضاء وتأثير هذين العاملين على سلامة العاملين. وأثبتت هذه الدراسة أن نصف أماكن العمل في المصانع فيها مستويات غير مقبولة من الضوضاء, وإن جميع أماكن راحة العمال تجاوزت الضوضاء فيها الحدود المسموح بها. كما أثبتت القراءات المقاسة في مبنى إدارة المصانع أنها تقع ضمن الحدود المسموح بها وإن الإداريون في مامن من تأثير الضوضاء في المصانع. وأثبتت أن العمال يعملون 44 ساعة خارج الحدود المقبولة في كل إسبوع, وإن ساعات العمل لا تتغير كما يجب بزيادة مستويات الضوضاء الى الحدود غير المقبولة. كما ليس للتلوث الضوضائي في المصانع أي تأثير على المناطق السكنية المحيطة.