

## **Investigation of Noise Pollution Levels in Some Beet Sugar Factories in Egypt**

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### **Abstract**

There are twelfth sources noise pollutants that have been resulting from sugar beet factories such as an including beet lab reception, beet washing and slicers, vacuum pump area, centrifugal mixer station ,power station ,boiler house ,boiler water treatment ,boiler house (soot blower ),cooling tower pump station ,pulp dryer station ,lime kiln area ,air compressor area . The evaluation depends on measuring of sound pressure level released from these sources. Data of sound pressure level are collected through seasons 2017 and 2018.This study research aims to evaluate the noise pollution problems resulting from sugar beet industry. Also, to establish noise pollution control methods. Sound Pressure Levels (SPL) of the sources are measured according to ISO recommendation, while noise exposure levels are carried out using equivalent noise level. The results proved that sound pressure level exceeded the national limits assigned by Egyptian Environmental Law No 4/94. The maximum SPL and the minimum values of SPL at boiler soot blower and cooling tower pump station 110 dBA and 78 dBA respectively . In the old Belqase sugar factory, it has been found that the maximum SPL reached to 112 dBA at boiler soot blower and the minimum value was 83 dBA in the air composer. In the Nile sugar factory, the maximum and minimum values of SPL at power station, processing levels and products storage 86 dBA and 60.1dBA respectively. In the Alexandria sugar factory, the maximum and minimum values of SPL at air compressors and lime kiln area 88.7and 74.2dBA respectively. Noise exposure also is assessed to protect the employees in the old and new Sugar plants. As the working shift is 12 hours in our investigated plant, a model is used to estimate the equivalent noise dose according to 8 hours exposure. The results presented that the workers in the old Sugar plant are suffering from the high emitted noise

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levels. Control measures are essential to reduce the noise especially from the old sugar plant.

**Keywords:** *Sugar Industry, Exposure Limits, Noise Sources, Noise Exposure.*

## **1. Introduction**

Noise is an unwanted sound that we constantly exposed to it. It is a mixture of sounds that spread in environmental work in a long run causes progressive hearing loss or may be full *deafness*<sup>16</sup>. Noise causes a lot of diseases for workers as difficulty of communication, narrow and nervous, lack of ability to perform mental and muscular work, imbalances causing dizziness, nausea, and imbalance and vomiting. The noise control act of **1972** spells out federal plans to keep noise at *tolerable levels*<sup>7,8</sup>. The federal laws are directed to emissions, but provide technical assistance to states establishing performance laws. The situation is also complicated by an overlapping of authority of the environmental protection agency and the occupational safety and health administration. This study has been applied on Belqase sugar factories and Nile sugar factory; Also Alexandria sugar factory. The first factory of Belqase sugar has been holding in **1992** and the second factory Belqase sugar has been holding in 2011 but the Nile sugar company has been hold in **2011** and Alexandria Sugar Company has been hold *in 2014*<sup>25</sup>.

As battle development over the acceptability of 85 or 90 dBA (decibel is a unit of sound pressure level based on practical scale of 0-140 dBA) as the safe sound level for worker, it became evident that the U.S. Occupational Safety and Health Agency (**OSHA**) has direct responsibility for worker safety while environment protection agency (EPA) must protect the worker as a plant employee and also as a citizen. Madbuli el **2003** concluded that the problem of industrial noise had been aggravated by the use of high speed, high production machines in textile mills and other industries. The causal relationship between work place noise and hearing loss has been observed for centuries (*Franks, 1988*). Lately, there have been many trials for assessing the magnitude of the problem of noise

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exposure in manufacturing industries. The U.S. Occupational Safety and Health Agency (*OSHA*), *in 1981*, estimated that more than 6 million workers (active and retired) had noise exposure levels greater than 85 dBA *in U.S.A (OSHA, 1981)*. However, *Frank (1988)* used data of two OSHA conducted U.S. industry-wide noise surveys estimated that some 4.7 million workers were exposed *in 1985* to average daily noise levels of 85 dBA or greater. Meanwhile, a National Occupational Hazard (NIOSH) Survey revealed that the top seven industries with the greatest percentage of workers exposed to 85 dBA or greater were lumber and wood, textiles, petroleum, utilities, metals, printing, and paper production industries (*NIOSH-NOHS 1974, 1977 and 1978*). Similar findings were reported by the two OSHA contracted noise surveys (*Bolt, et. 1976; Booz et., 1983*). In U.K., noise pollution was reported *in 1985* as the biggest hazard in factories, since 700 000 workers were being still exposed to noise levels exceeding the government's Recommended limit of 85 dBA (*Pearce, 1985*). This study aims to evaluate the noise pollution problems which results from sugar beet industry. Also, to establish noise pollution control methods.

## **2. Materials and Methods**

### **2.1. Site description**

This study has been applied on plants of both Dakhliya Sugar Company and the Nile sugar company, also Alexandria Sugar Company. The sites of the factories are shown in Fig (1) & Fig (2). the dakhliya sugar plants are carried out in Belkas, AbuMady area while the Nile Sugar plant in the km 45 in the road of Alexandria. Cairo desert and the Alexandria sugar plant in the km 54 in the road



## of Alexandria . Cairo Desert



**Fig.1. Site of Dakhliya Sugar Manufacturing & Refining plants**



**Fig.2. Sites of both the Nile Sugar and Alexandria Sugar Companies**

## 2.2. Noise Measurement and Analysis

For each sugar plant (Old and new), noise measurements were carried out at strategic locations depending on the type, number and layout of machineries. The noise measurements



included Maximum and Minimum SPLs at the individual octave bands. Other relevant data such as the operation, type and number of machinery, construction materials for roofs, floors, walls and ceilings etc. were also recorded. Noise was measured at each location using the Sound Level Meter SL – 4010 as shown in fig. (3) were statistically analysed using Excel. For each factory, frequency Tables for Max and Min SPL levels were constructed.



**Fig.3. The sound level meter instrument**

### **3. Results and Discussion**

The dBA is the unit used to measure the intensity of sound. Both Max (SPL) and Min (SPL) of the surveyed factories are given in Table (1&2&3) and graphically shown in figures (4&5),(6&7). The results proved that sound pressure level exceeded the national limits assigned by Egyptian Environmental Law No (4/94) in several sites. The maximum SPL was (110) dBA at boiler soot blower and the minimum value of SPL was (78) dBA in the cooling tower of pump station at the old sugar plant. In the new Belqase sugar factory, it has been found that the maximum SPL reached to (112) dBA at boiler soot blower and the minimum value was (83) dBA in the air composer. In the Nile sugar factory, the maximum and minimum values of SPL at power station, processing levels and



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products storage 86 dBA and 60.1dBA respectively. In the Alexandria sugar factory, the maximum and minimum values of SPL at air compressors and lime kiln area 88.7and 74.2dBA respectively.

Noise exposure also is assessed to protect the employees in the old and new Sugar plants. As the working shift is (12 hours) in Dakahlia Sugar plants ,but in the Nile Sugar and Alexandria Sugar plants working shift (8) as a model used to estimate the equivalent noise dose according to (8 hours) *exposure*<sup>10, 14</sup>. The results presented that the workers in the old Sugar plant are suffering from the high emitted noise levels.

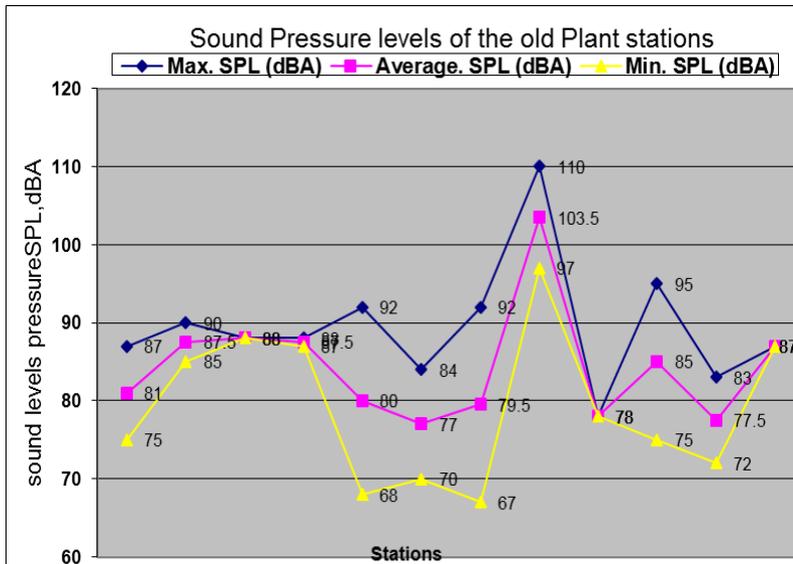
Control measures are essential to reduce the noise especially from the old sugar plant. The results proved that sound pressure level In the Nile sugar plant and Alex. Sugar are not exceeded the national limits assigned by Egyptian Environmental Law No (4/94) in several sites.

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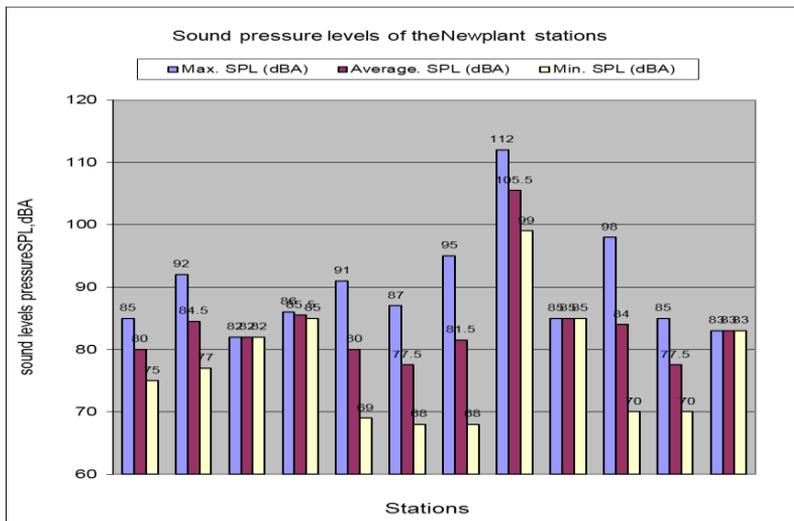


**Table (1). Production season 2017 for Dakhlia sugar and refining old and new plants.**

Station	Max. SPL (dBA)Old	Max. SPL (dBA)New	Average. SPL (dBA)Old	Average. SPL (dBA)New	Min. SPL (dBA)Old	Min. SPL (dBA)New
Beat Lab reception	87	85	81	80	75	75
Beet washing and Slicers	90	92	87.5	84.5	85	77
Vacuum Pump area	88	82	88	82	88	82
Centrifugal mixer station	88	86	87.5	85.5	87	85
Power station	92	91	80	80	68	69
Boiler water treatment	84	87	77	77.5	70	68
Boilers house	92	95	79.5	81.5	67	68
Boiler house (soot house)	110	112	103.5	105.5	97	99
Cooling tower pump station	78	85	78	85	78	85
Pulp dryer station	95	98	85	84	75	70
Lime kiln area	83	85	77.5	77.5	72	70
Air compressor area	87	83	87	83	87	83



**Fig. 4. Measured noise level in Dakhlia Sugar and Refining old plant**

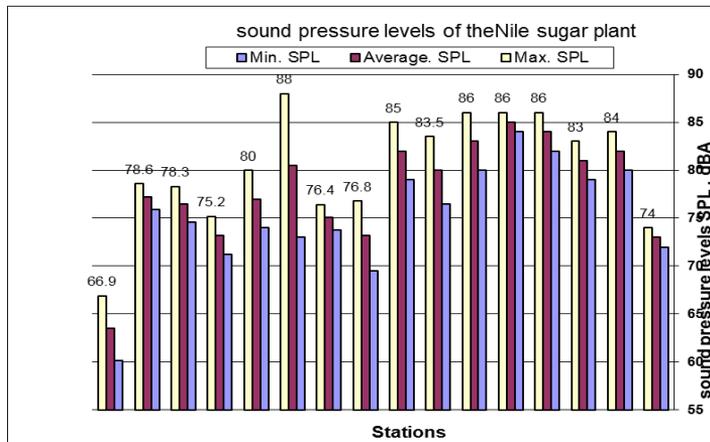


**Fig. 5. Measured noise levels in Dakhlia Sugar and Refining new plant**



**Table (2). Production season 2018 for the Nile sugar plant**

Station	Max. SPL (dBA)	Average. SPL (dBA)	Min. SPL (dBA)
Beat Lab reception	74	73	72
Processing operations (level 0)	84	82	80
Processing operations (level 5.25)	83	81	79
Processing operations (level 10.25)	86	84	82
Processing operations (level 17.25) (9(111111111110110.25))	86	85	84
Power station	86	83	80
waste water treatment plant	83.5	80	76.5
Boilers house	85	82	79
pallets	76.8	73.15	69.5
Pulp pressing	76.4	75.1	73.8
Pulp dryer station	88	80.5	73
Lime kiln area	80	77	74
Sugar raw storage	75.2	73.2	71.2
The workshop cars	78.3	76.45	74.6
The mechanical workshop	78.6	77.25	75.9
Products storage	66.9	63.5	60.1

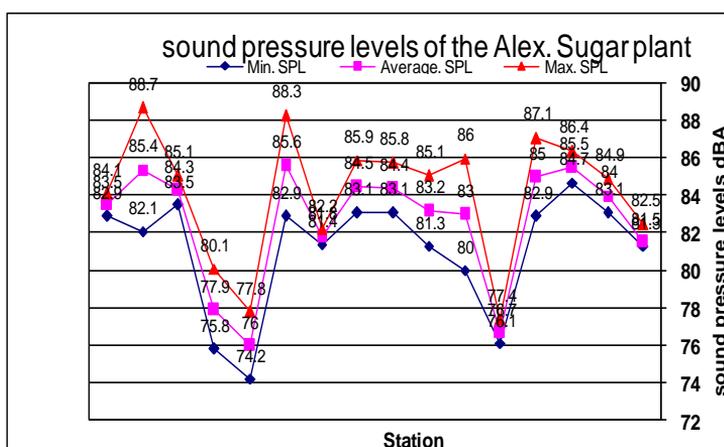


**Fig. 6. Production season 2018 for the Nile sugar plant.**



**Table (3).Production season 2018 for the Alexandria sugar plant**

Station	Max. SPL (dBA)	Average. SPL (dBA)	Min. SPL (dBA)
Beat Lab reception	82.5	81.5	81.3
Beet washing	<u>84.9</u>	84	83.1
Processing building	86.4	85.5	84.7
pallets	87.1	85	82.9
Weighting bridges	77.4	76.7	76.1
Power station	86	83	80
waste water treatment plant	85.1	83.2	81.3
Boilers house	85.8	84.4	83.1
Raw water treatment	85.9	84.5	83.1
Pulp pressing	82.2	81.8	81.4
Pulp dryer station	88.3	85.6	82.9
Lime kiln area	77.8	76	74.2
Sugar storage	80.1	77.9	75.8
workshop	85.1	84.3	83.5
Air compressors	88.7	85.4	82.1
Firefighting pump	84.1	83.5	82.9



**Fig.7. Production season 2018 for the Alexandria sugar plant**



**Table (4). Workers noise diseases in Dakhlia sugar and refining company**

Dakhlia Sugar and refining company	Operation Date	Worker Exposure /12 hrs.	Workers Noise Diseases
Old plant	1995	323	6
New plant	2011	323	0

**Table (5). Workers noise diseases in Nile sugar and Alexandria sugar plants**

Company	Operation Date	Worker Exposure /8 hrs.	Workers Noise Diseases
The Nile plant	2011	650	0
The Nile plant	2014	700	0

From Tables (4) & (5) as the working shift is (12 hrs.) in our investigated plant, a model is used to estimate the equivalent noise dose according to (8 hrs) Exposure as Unified Labor Law (*No. 12 of 2003*). It is found that the length of exposure time of the workers to the noise gives higher levels of noise than allowed in Egyptians labor law and environment. It is found that 6 workers have been got noise diseases in old plant as a result of long periods of noise pollution. This is due to not following the safety and occupation health instructions in the factory and the poor overall maintenance of the equipment and machinery. The results presented that the workers in the old Sugar plant are suffering from the high emitted noise levels.

#### **4. Conclusion and Recommendations**

The results of this study indicated that the workers at the two factories of Dakhlia Sugar & Refining Company were exposed to higher noise levels than the worker of Nile Sugar and Alexandria Sugar companies. This is due to many reasons, including the exposure period to 12 hours per shift compared to 8 hours for other two companies. The sound pressure level measured in the old plant is higher than the new plant; due to the old machines and the poor



maintenance. In Dakhliya Sugar & Refining Company, it was designed steel cover in boiler soot blower which absorbs the sound pressure levels but it has not been implemented yet.

Several control measures are suggested to decrease the noise levels such as designing, fabricating and using quieter machines to replace the noisy ones. Also, proper lubrication, better maintenance of machines, installing sound proof chambers in noisy machines, guarding the parts with sound-absorbing materials are also effective methods of noise control. Reducing the noise produced from a vibrating machine can be achieved by vibration damping i.e. making a layer of damping material (rubber). Using silencers is also effective methods to control noise from automobiles, ducts, exhausts etc. and convey systems with ends opening into the atmosphere and using glass wool or mineral wool covered with a sheet of perforated metal for the purpose of mechanical protection.

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## المخلص العربي

# التحكم في التلوث الضوضائي الناتج من مصانع سكر البنجر وكيفية الحد منه

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يهدف هذا البحث الى التحكم فى التلوث الضوضائى الناتج عن صناعة بنجر السكر واستحداث طرق للحد منه و كذلك عمل حماية للعاملين فى مصانع سكر البنجر حيث تم اجراء قياسات ميدانية لأربعة مصانع هى مصنعى شركة الدقهلية لصناعة وتكرير السكر ومصنع شركة النيل للسكر ومصنع شركة الإسكندرية للسكر. أجريت الدراسة خلال موسم 2017 وموسم 2018م. حيث تم قياس مستويات ضغط الصوت ( SPL ) للمصادرة مستوى الضوضاء المكافئ وفقاً لتوصية ISO.

وأظهرت النتائج أن مستوى الضغط الصوتي تجاوز الحدود الوطنية المنصوص عليها فى قانون البيئة المصري رقم 94/4. كان الحد الأقصى ل SPL110 ديسيبل عند منافخ سوانل المرجل وكانت القيمة الدنيا ل SPL78 ديسيبل. فى مصنع السكر القديم فى بلقاس ، وجد أن الحد الأقصى ل SPL يصل إلى 112 ديسيبل عند منافخ السخام ، وكان الحد الأدنى للقيمة 83 ديسيبل فى الملحن الهوائى. بينما فى مصانع الاسكندرية للسكر والنيل للسكر تكون القياسات فى الحدود المسموح بها ويرجع ذلك لتطبيق تلك المصانع لساعات العمل 8 ساعات للوردية الواحدة واما الدقهلية للسكر فتبلغ ساعات العمل 12 ساعة بمصانع سكر بلقاس وهو ما يفسر عدم وجود حالات ضعف السمع فى شركتى الاسكندرية والنيل للسكر بينما تبلغ بينما تبلغ 6 حالات فى مصنع سكر بلقاس القديم. أظهرت النتائج أن العاملين فى مصنع السكر القديم يعانون من مستويات عالية من الضوضاء الصادرة ولا بد من وجود تدابير ضرورية للحد من الضوضاء وخاصة المصانع القديمة.