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Experimental Study of the impact of pollutants on air quality in the Urban city

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Abstract

The main purpose of this experimental study was the effect of the pollutants on air quality in the Arzew city generated by the petrochemical industrial. Sources from the management of environmental Oran, argue that the industrial zone of Arzew, on the hazardous area classification, will be subject to ongoing monitoring of the activities of its production units to reduce its rate of pollution using different techniques or by equipping plants of a refinery to reduce the toxic gas emission levels in the air. In an integrated management approach to the environment and sustainable development of the Industrial Platform, the approach of Sonatrach for the control of air quality and monitoring of air pollution is:

• set up a mobile laboratory to be installed in the perimeter of the study area but outside industrial units.

• This will allow for spot measurements in real time on a wide range of analyzers, quality and quantity of pollutants and dust samples.

Keywords: Air quality, PM10, concentration, industrial zone.

1. Introduction

In this work we treat the control of air pollution and the improving of its quality breathed is mainly on the base of the impact of pollutants on human health and the environment of the industrial area of Arzew in Algeria. In other research, the study investigated the pollutant emissions of filling stations and the impact they cause to the air quality by U. C. Okonkwo and al. [1] and Buntić, N. and al. [2], show the dependence of air pollution levels upon traffic density and seasons. Considering the level of air pollution relative to the regulated, limited and tolerated values, the measured 24-hours concentrations of all studied pollutants did not exceed the limited values and tolerated values. The PM10 standard includes particles with a diameter of 10 micrometers or less. Was used because of their small size, particles PM10 can penetrate the deepest part of the lungs, such as the bronchioles or alveoli. Larger particles are generally filtered in the nose and throat via cilia and mucus, but particulate matter smaller than about 10 micrometers, referred as PM10, can settle in the bronchi and lungs and cause health problems. Major concerns for human health from exposure to PM10 include are: the effects on breathing and respiratory systems, damage to lung tissue, cancer, and premature death Li-Shun Lu et al. [3]. Kayode O. Owoade et al [4] conducted a research to determine the chemical compositions and source identification of PM

2.5 and PM 2.5–10 fractions, airborne particulate matter (PM). To this effect the samples were collected from May, 2011 through April, 2012 at three sites: up and downwind and within a scrap iron and steel smelting industry, Ife–Ibadan highway, southwestern Nigeria. Samples of PM 2.5 (fine) and PM 2.5–10 (coarse) were collected on nuclepore polycarbonate filters using a low volume GENT sampler equipped with a stacked filter unit (SFU). Shaadan, N. and al. [5] found useful for air pollution investigation in this study. The findings of the latter imply that the location and background of station, as well as wind speed, seasonal (monsoon) and weekdays–weekend variations play important role in influencing PM 10 anomalies. Several studies done by controlling the impact of pollutants on air quality in industrial areas as the study of José Antonio Adame et al.[6] Maximum daily of 8 h averages for O_3, daily 90th percentiles for NO, NO_2 and PM_{10} and mean daily values for CO were calculated and used to assess the weekend effect by applying three different metrics: weekly evolution, weekend-weekday differences and the average daily difference between weekends and minus workdays. Particulate Matter (PM) has been recognized as a major factor in determining global climate change. As an important component of air pollution, PM has been linked to various adverse health effects, e.g., Gwynn et al., [7]; Pope et al., [8]; Husain et al., [9]; Khan et al., [10]; Kim et al.,[11]; Alam, K et al., [12] as well as having general environmental effects. One can see how oil has played a major role in the advancement of technology in our time. But, just like every other technology, oil discovery has come with some of its disadvantages. One such disadvantage is its negative impact on the earth's biosphere, releasing pollutants and greenhouse gases into the environment and damaging ecosystem through events such as oil spillage [13], increase in NOx and PM_{10} emission [14, 15].

2. Experimental

The effect of the air quality on the Arzew population health indeed he is more difficult, today, to find in the townships of Arzew and Béthioua a family completely saved by the respiratory illnesses. The clouds black and other toxic steams of the complex of the industrial zone that functioned without worrying too much about the effects on the long-term environment conceal the sky of these two localities and pollute the atmosphere of it. For this reason, we have do a the experimental study. The work is to exploit the experimental data obtained by the team of engineers in the industrial area in order to assess experimental study of the effect of the pollutants on air quality in the Arzew city.

2.1. *Measurement area*

The industrial zone in the area of Arzew, Oran, Algeria extends over 12 km along the Bay of Arzew, more than 3500 ha (see figure 1). They are a total of 15 industrial complexes located in this area added to the service units. Cocktail Heavy metals pollution Arzew, NO, NO2, PM10, CO2, sulfates, acids, oxides ammoniated, hydrocarbons ....; "Some nights the flames of the torches are very high and black smoke clouds cover the entire region, particularly on our side of Bethouia city. The yellow fumes of ASMIDAL factory are also identifiable. Sometimes it's really hard to breathe, throat and eyes sting you ... and it's always like that; olds, childrens ... are all affected "Ali works as a technician in the area and lives near the area of company housing, he will tell us!" For years they talk about measures to limit the discharge of flue gases, we are still waiting, but we have no choice, we must continue to work "A testimony that it continues to meet and says a lot about the stresses experienced by the inhabitants. However, no reliable and comprehensive study on this is available or has been released to quantify the problem and to determine the quantities of pollutants discharged and released by international standards. In an integrated management approach to the environment and sustainable development of the Industrial Platform, the approach of Sonatrach for the control of air quality and monitoring of air pollution is:

• Set up a mobile laboratory to be installed on the perimeter of the study area but outside industrial units.
• This will allow for spot measurements in real time on a wide range of analyzers, quality and quantity of pollutants and dust samples.

2.2 *The cabin mobile DRIZ*

The DRIZ set up a booth for monitoring the quality of ambient air in the platform of the ARZEW industrial area to measure in real time the quantity and quality of air pollutants emitted by industrial activity. This approach

aims to restore a database on the quality of the air we breathe directed by six-line analyzers that measure the concentration of gaseous pollutants and particulate thirteen in ambient air samples (NO, NO2, NOX, NH3, PM10, CO, CO2 ... .. and dust <10 microns). The precision and the choose of the PM10 sensor :
- Mass minimum detectable surface:: 6 µg/cm²s on one period of 2h.
- Range of measure: 0-100, 0-200, 0-500, 0-1000, 0-2000, 0-5000, 0-10000 µg/m^3s.

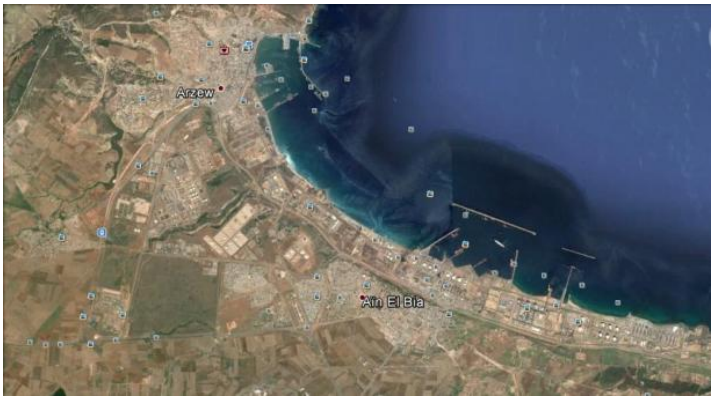

Figure 1: The industrial zone Arzew (Source: Google Earth).

The measurement of the air quality at the Arzew industrial zone will be from measurement conducted by mobile companion cabin. The devices used are automatic analyzers (MP10M, AC32M + CNH3, CO12M, HC51M and VOC 71M) see figure 2 left.

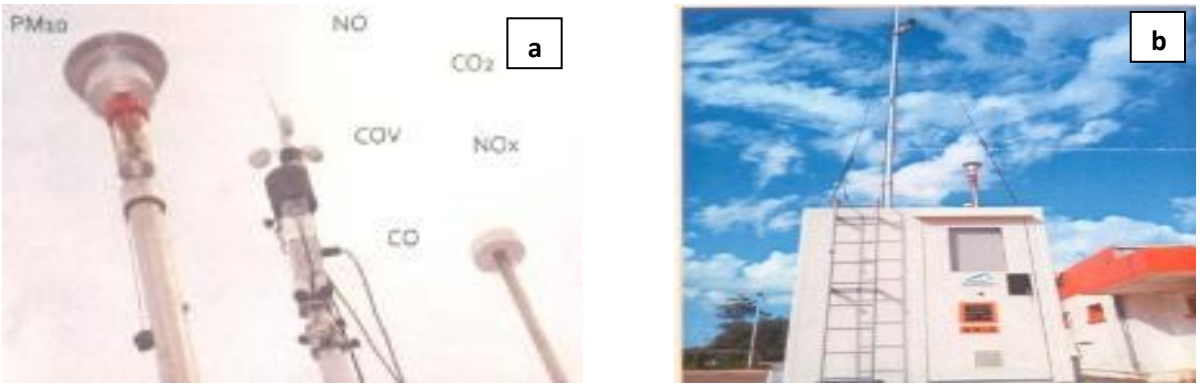

Figure 2: Mobile station (a), sampling heads and meteorological mast (b).

These sampler devices, ambient air to the outside by means of sampling heads (see figure 02 on the right), analyze internally using measurement technology-specific pollutant and provide results according to different formats. The results used are generally average values. The mobile station has been installed in the industrial area of Arzew Sonatrach in the complex.

2.3 *The effects and influence of Settings Meteorology*
If the air quality depends mainly on the emission of pollutants from various sources (transport and industry), it also depends on weather conditions. The topography of a site, climatology (wind speed, wind direction, temperature and humidity) influence the transport, transformation and dispersion of pollutants.

- Speed and wind direction: Turbulence and stability winds effects on transport, dilution and dispersion of pollutants.

- Temperature: alters the chemistry of pollutants: Cold reduces the volatility of some gas while the summer heat is in favor of photochemical ozone. The temperature has an effect on the movement speed and response of the molecules.
- Humidity: Is often a determining factor in the effect of pollutants on the property, vegetation and health. (See table 1)

Table 1: Settings Meteorology of daily means the period of 02 to 13 November 2013

Settings Meteorology				
Date	**Wind speed (m/s)**	**Wind Direction deg**	**Humidity %**	**Temperature °C**
Moy:02/11/2013	**1,9**	**269**	**58**	**16,5**
Moy:03/11/2013	**2,7**	**264**	**62**	**18,8**
Moy:04/11/2013	**28,3**	**263**	**61**	**18,9**
Moy:05/11/2013	**32,5**	**271**	**67**	**19,4**
Moy:07/11/2013	**3,4**	**219**	**71**	**19,4**
Moy:11/11/2013	**8,5**	**219**	**94**	**35,3**
Moy:12/11/2013	**6,0**	**184**	**67**	**29,1**
Moy:13/11/2013	**11,9**	**166**	**155**	**54,0**
Moy:16/11/2013	**7,6**	**220**	**106**	**38,3**
Moy:17/11/2013	**10,9**	**224**	**150**	**57,7**

3. The standards for PM 10 particles in air quality

Table 02 below shows the relatives (2013) and (2014) standards for PM10 particles. Due to a short period of action (3 months), the comparison is only possible for short-term regulatory values as the daily limit value and information thresholds and recommendations and alert. The standardss for PM 10 in air quality:

Table 2: The relatives2013 standards for PM10 and 2014 (Source: Decree No. 2010-1250 of 21 October 2010 on air quality).

Pollutant	**Airborne dust (PM10)**
Value limit	Annual average: 40 µg / m^3 Daily average: 50 µg / m^3 not to be exceeded more 35 days / year
Quality Objective / Long-term goal	Annual average: 30 µg / m^3
Threshold information and recommendation	Averaging over 24 hours slippery: 50 µg / m^3
Alert threshold	Averaging over 24 hours slippery: 80 µg / m^3

4. Results and discussion

In this article, the measurements of the mobile station are compared to the DRIZ concentrations observed in the industrial Arzew zone. The comparative analysis of average daily profiles (Figure 03 and 08) measured between November 2013 and January 2014 month on the mobile station's DRIZ. Commuter's peaks are, however, somewhat more marked on the Arzew industrial site. The collection of data from the mobile station The DRIZ started from the months November 2013 and the month in January 2014, because it is more often this season than those brief and intense peaks occur, often also the night, so in conditions contrary to the photochemical formation.

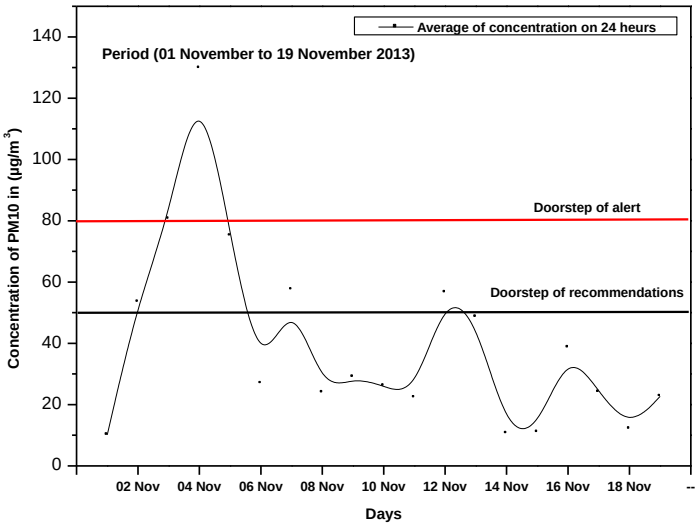

Figure 3: PM10- exceedance of the information threshold and alert threshold and recommendation on the mobile station (averages 24 hours of months in November 2013).

PM10 peaks due to photochemistry are fairly characteristic, as can be seen in figure 4, 6 and figure 09. These peaks are broad: a period of several hours, the increase in concentration takes place in the morning since it takes enough sunlight, and the decay is very slow. Often, though, when there has been a significant spike, we do not quickly find low. The lowest levels are in the late night, around 6:00 am. The level of concentration of pollutants in the atmosphere above which a short exposure presents a risk to human health from which emergency measures must be taken. The results obtained using the mobile station The DRIZ in the industrial zone of Arzew, will be compared to time standards (information and alert thresholds) because the three measurement periods, only the station DRIZ exceeds the information threshold, warning and recommendations set at 80 µg m^{-3} and has an offset with higher concentrations of the station several hours (Figure 4, 6 and 9). In the mobile station measures the daily limit value set at 50 µg m^{-3} was exceeded in three periods:

The first case observed in the following dates: (November 2, 2013 around 11 hours with a maximum of 117.8 µg m^{-3}, 03 November 2013 to 10 hours with a maximum of 225 µg m^{-3}, 04 November 2013 to 14 hours with a maximum of 273 µg m^{-3}, November 5, 2013 to 16 hours with a maximum of 137 µg m^{-3} and 07 November to 10 hours with a maximum of 102 µg m^{-3}, see figure 05) concerned only simultaneous peak PM10. The only industrial plant in the area being a boiler room (which was run at full speed at this time of year). The second case observed in the following dates: (November 11, 2013 to 12 hours with a maximum of 41 µg m^{-3}, 12 November 2013 to 10 hours with a maximum of 148 µg m^{-3}, 13 November, 2013 around 11 hours with a maximum of 100.5 µg m^{-3}, 16 November 2013 to 14 hours with a maximum of 148 µg m^{-3} and 17 November 2013 to 02 hours with a maximum of 148 µg m^{-3}, see figure 07) involved only a peak of PM10 pollutant. And

the third case observed in the following dates: (January 7, 2014 to 12 hours with a maximum of 126 µg m^{-3}, 08 January 2014 to 12 hours with a maximum of 69 µg m^{-3}, 09 January, 2014 to 10 hours with a maximum 115 µg m^{-3}, January 11, 2014 to 12 hours with a maximum of 90 µg m^{-3} and 13 January 2014 to 20 hours with a maximum of 71 µg m^{-3}, see figure 10) involved only a peak of pollutant PM10.
Finally, the results of seasonal variation in 24-hour concentration of PM10, indicating higher values in winter, could be explained by air pollution from emission sources industrial. The higher values of PM10 concentration in the summer period were probably consequential to the growing number of my resuspended particles due to dry weather and wildfires in this area Toth I. and al. [16-18].

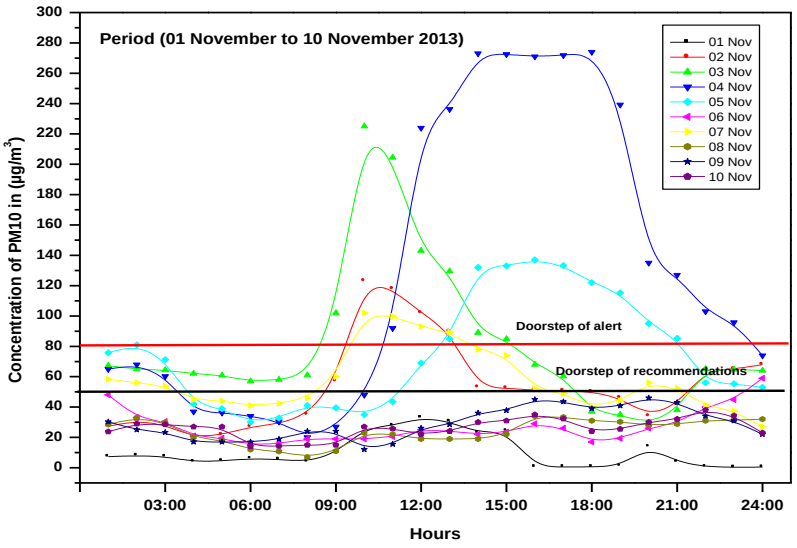

Figure 4: Evolution of daily profiles means the period of 01 to 10 November 2013 PM10 in Arzew.

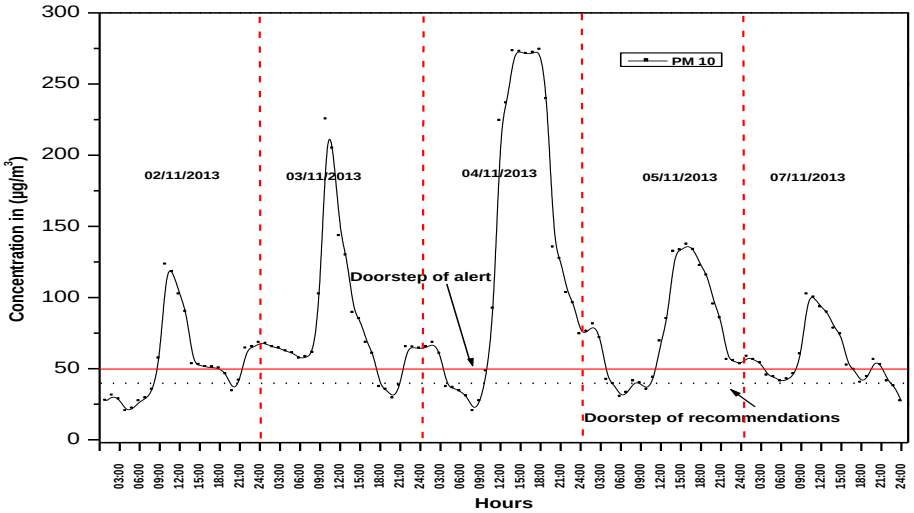

Figure 5: PM10 Arzew peak period of 2 to 7 November 2013.

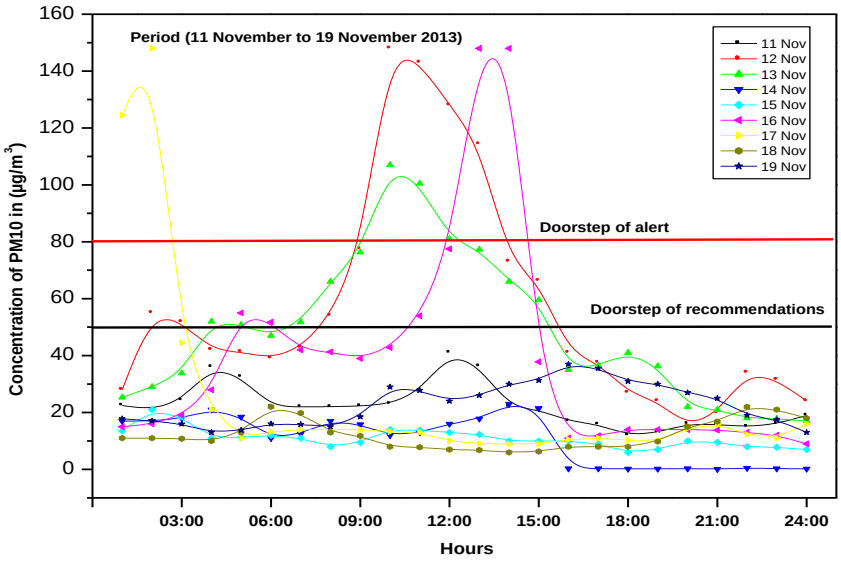

Figure 6: Evolution of daily profiles means PM10 period of 11 to 19 November 2013.

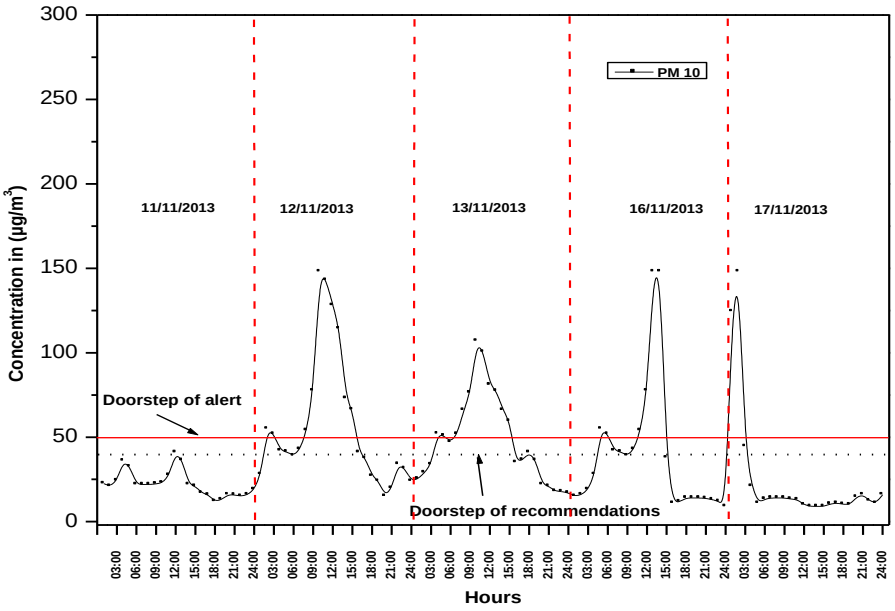

Figure 7: PM10 peak Arzew period of 11 to 17 November 2013.

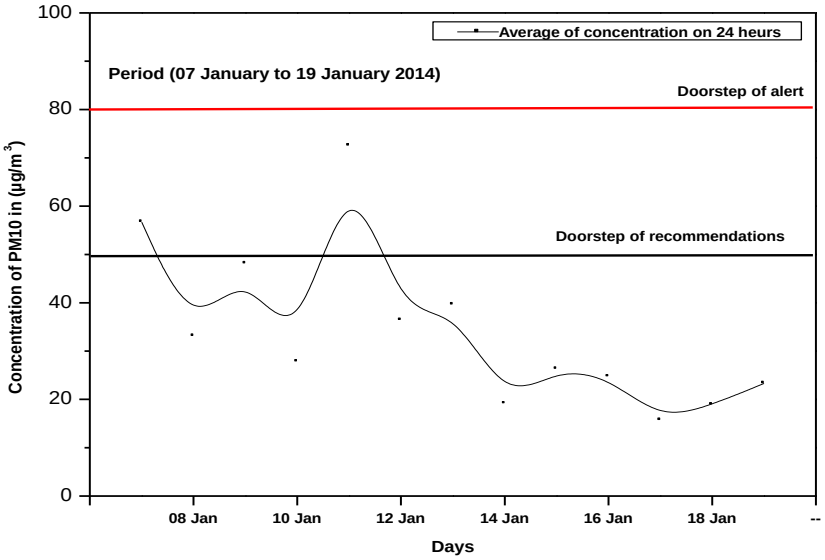

Figure 8: PM10- exceedance of the information threshold and alert threshold and recommendation on the mobile station (averages 24 hours of month January 2014).

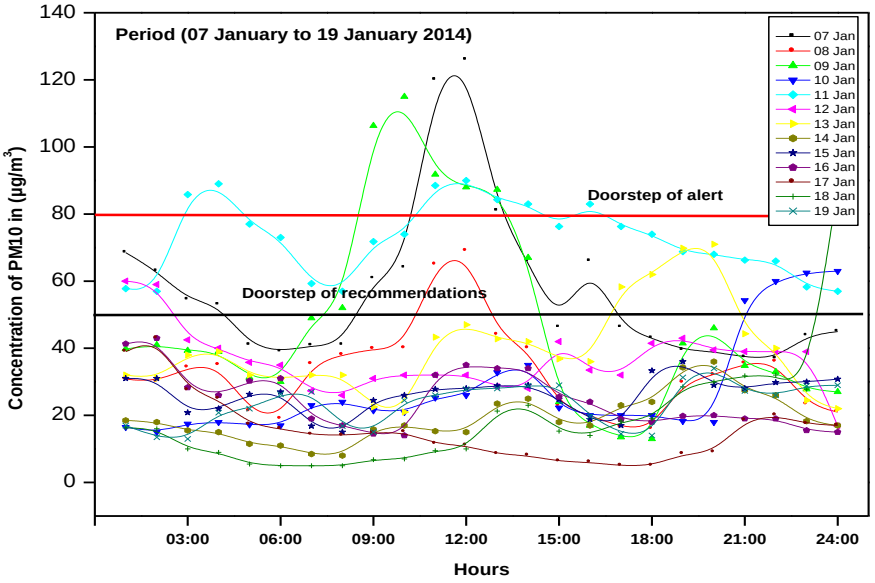

Figure 9: Evolution of daily profiles means PM10 period of 7 to 19 January 2014.

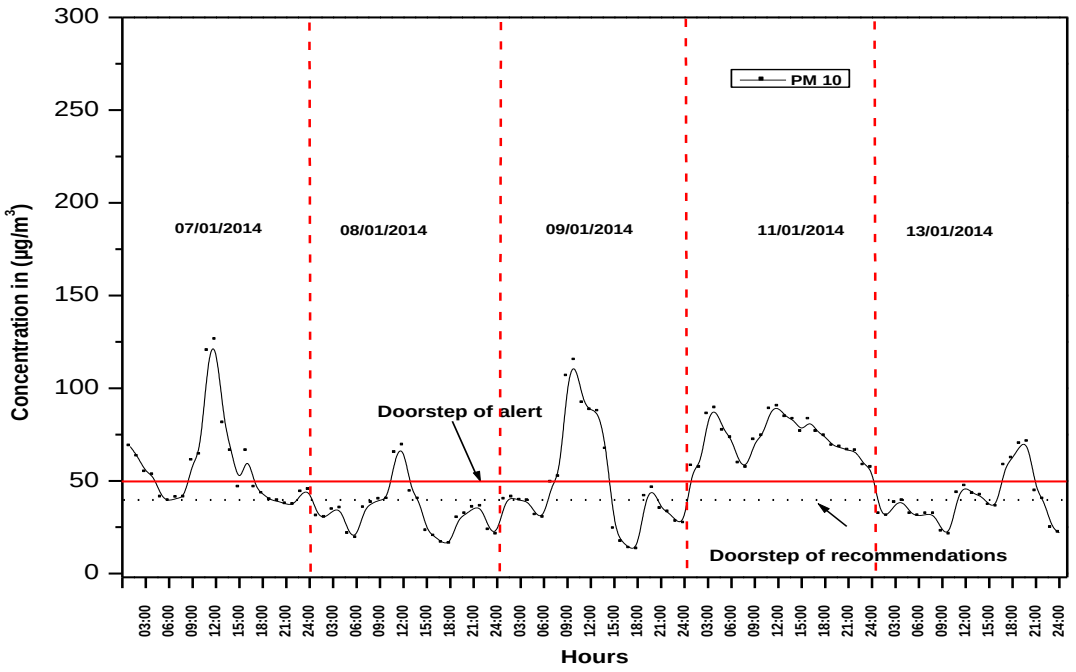

Figure 10: PM10 in Arzew peak period from 7 to 13 January 2014.

Conclusions

The purpose of this work is to take stock of the industrial zone of Arzew in Algeria on city air pollution and health risk, through the results of studies or audits conducted at national level or international. Described successively pollution caused by industries. The results presented in this article provide a first estimate of the impact of pollution on air quality in the Arzew city and the surroundings. A daily concentration of three periods, well beyond the standards. Although these air quality standards have been established for urban pollution. Larger particles are retained by the upper respiratory tract. They are therefore less harmful to health than the finer particles (<10 microns in diameter) which penetrate deeper into the body; then they irritate the lower airways and impair lung function overall. Finally, during the winter, the highest 24-hour air concentrations were recorded for the PM10 pollutant. Lower ozone concentrations were generally observed in winter and during early morning hours, while high ozone levels were typically found in summer and in the afternoon. In the urban area in the City of Arzew the air quality is relatively is not acceptable with occasionally higher concentration of ozone in the summer time, which exceeded the limit and tolerated values.

Acknowledgments-Experimental measurements were performed on the mobile station's DRIZ set up a cabin for monitoring the quality of ambient air in the platform of the ARZEW industrial area to measure in real time the quantity and quality of air pollutants issued by industrial activity.

References

1. Okonkwo U.C., Ijioma I.N., Onwuamaezea I.P., *International Journal of Engineering Transactions C: Aspects*, 28, No. 6, (2015) 949-955.
2. Buntić N., Kraljević T., Talić, S., *Journal of Bulletin of the Chemists and Technologists of Bosnia and Herzegovina* 39 (2012) 7-10.
3. Li-Shun L., Bo-Huei L., Tin-Chi W., *Interactive Qualifying Project, IQP E-project-*, (2006) 050206-144504.
4. Kayode O. O., Philip K. H., Felix S.O., Lasun T. O., Olusegun G. F., Bamidele H. O., Olugbemiga O. J., Muritala A. A., Muniru I. B., *Atmospheric Pollution Research* 06, (2015) 107-119.
5. Shaadan, N., Abdulaziz J.,Mohd T. L., Sayang M. D., *Atmospheric Pollution Research (APR)* 06 (2015) 365-375.
6. Adame J. A., Hernández-Ceballos M. Á. , Sorribas M. , Lozano A. , De la Morena B. A., *Aerosol and Air Quality Research*, 14 (2014) 1862–1874.
7. Gwynn R.C., Burnett R.T., Thurston G.D., *Environ. Health Perspect*. 108 (2000) 125–133.
8. Pope C. A., Burnett R.T., Thun M. J., Calle E. E., Krewski D., Ito K., Thurston G.D., .*Air Pollution*. J. Am. Med. Assoc. 287 (2002) 1132–1141.
9. Husain, L., Dutkiewicz V.A., Khan A.J., Ghauri B. M., *Atmos. Environ*. Vol 41, (2007) 6872–6883.
10. Khan, M.F., Hirano, K., Masunaga, S., *Atmos. Environ*. 44 (2010) 2646–2657.
11. Kim N.K., Kim Y.P., Kang C.H., *Atmos. Environ*. 45 (2011) 6107–6115.
12. Alam K., Mukhtar A. , Shahid I. , Blaschke T. , Majid H. , Rahman S. , Khan R. , Rahman N., *Aerosol and Air Quality Research*, 14 (2014) 1851–1861.
13. Timothy P.M., *USEPA Publications*, (2006) 23-25.
14. Tabejamaat S., *International Journal of Engineering Transactions B: Application*, 16, No.3 (2003) 301-310.
15. Pirouzpanah V., Sami S. M., Ajabshirchy Y., *International Journal of Engineering Transactions B: Application*, 14 No. 3 (2001) 263-272.
16. Toth I., Hercog P., Peternel R., Vojnikovi B., *Coll. Antropol*. 35 Suppl. 2, (2011) 25–30.
17. Medjahed B. Bouzit M., *International Journal of Applied Engineering Research*.11 (2016) 3192-3198.
18. Medjahed B., Naili S., Bouzit M., *Journal of Materials and Environmental Science*. 7 (2016) 4767-4777.