INTRODUCTION
The atmosphere is a complex mixture of natural gaseous system that is essential to support life on the planet Earth. Air pollution is the introduction of particulates, biological molecules or other harmful materials on Earth’s atmosphere causing diseases, death in humans and damage to other living organisms such as animals and food crops (Dahmann et al., 2008). A pollutant can be of natural origin or man-made. Primary pollutants are usually produced from a process, such as CO from the vehicles exhaust or the SO2 released from factories. Secondary pollutants are not emitted directly rather they form in the air when primary pollutants react or interact to form O3, PAN, acid rain etc. (Panda et al., 2010). In India ambient air quality have progressively deteriorated due to anthropogenic sources like rapid urbanization, industrialization, uncontrolled increase of vehicles, garbage burning, domestic cooking etc. It has become an important environmental risk factor for lung cancer and cardiopulmonary disturbances (Ghose and Majee., 2001). According to the World Health Organization (WHO), urban air pollution is responsible for approximately 800,000 deaths annually around the globe (Maji et al., 2010). Plants are also affected by various air pollutants. Excessive SO2 make the cell inactive and finally are killed. SO2 with water produces sulphuric acids that are extremely corrosive. Different metals such as iron, aluminium, copper are corroded when exposed to contaminated air. Air Act has been enacted in 1981 to take necessary step to reduce the air pollution and Central Pollution Control Board has enhanced its power and function under this act (Chaulya, 1999; Chen et.al., 2010; Analitis et al., 2006; Gawai et al., 2014; Mohapatra, 2006).

Mining is a vital industry for economic growth of any country. With increase in industrialization, urbanization and other developmental activities in the urban areas, there is a greater need of extraction of minerals. Air pollution in the opencast mining are caused by drilling, blasting, overburden loading and unloading, road transport, material handling plants, exposed pits and workshops. All these operations generates mostly particulate matter and is reported that by applying Heavy Earth Moving Machinery on haul roads of mechanized opencast mines could contribute 80% of the dust emitted (Chakraborty et al., 2002; Ghose & Majee, 2001; Panda et al., 2010; Barman et al., 2010).
Ambient air quality monitoring is the systematic, long term assessment of pollutants levels by measuring the quantity and types of certain pollutants in the surrounding (Alam et al., 1999) and comply with Indian Standards, evaluate the control technologies and prevent respirable diseases caused by pollutants (Stein & Corn, 1975). Air quality Index is the number used by the agencies to communicate to the public that how polluted the air is or how polluted it will become (Maji et al., 2010). For an effective ambient air quality monitoring, meteorological data of an area should also be recorded. Some of the similar study in the field of ambient air quality monitoring and AQI study are Sahu et.al., 2015, Dash and Dash, 2015 a and b; Parida et.al., 2015. Dash et.al., (2016) and Dash and Patra (2016) have also studied the soil quality and floristic composition respectively in the mining areas of the study district.

The present investigation was carried out to measure the concentration of five ambient air pollutants (PM10, PM2.5, SO2, NOX, NH3), air quality index and health impact of air pollution in all the four villages i.e. Jaroli, Jalahari, Jadibahal, Bandhuabeda of Joda, Keonjhar from October, 2015 to March, 2016.

MATERIALS AND METHODS

Study Area
Keonjhar district is covered with an geographical area of 8240 km². It is surrounded by the Singhbhum district of Jharkhand in the North, Jajpur in the South, Dhenkanal, Angul and Sundergarh in the West and Mayurbhanj and Bhadrak in the East. The study area is located near Joda which is about 80 km North-West of Keonjhar. The important minerals available in the area are Iron-ore, Manganese and Chromites. Mining and allied activities in the area generates different types of environmental pollutants.

Sampling Method
In the present study, sampling of PM10 was done by Respirable Dust Sampler (RDS) APM 460NL, sampling of PM2.5 by RDS APM 550 and sampling of gaseous pollutants is done by APM 411 TE of Envirotech, Delhi. The sampler was placed at a height of 3-10m in the downwind direction. During sampling of PM10 air was drawn into the cyclonic chamber where the heavier particles size of 100µ-10µ are settled at the bottom and the lighter particles size less than 10µ are trapped on 8” X 10” Micro Glass Fiber (MGF) filter paper. Flow rate was maintained at 1.2 m³/min. During sampling of PM2.5, air was drawn into the Wein’s impactor where the heavier particles size 10µ to 2.5µ are stick to the silica gel and the lighter particles size less than 2.5µ are trapped on the 46.7 mm Poly Tetra Fluro Ethylene(PTFE) filter paper with a flow rate of 1000m³/hr. For the gaseous sampling, SO2 was collected through 30ml of absorbing reagent of Potassium Tetra Chloro Mercurate (TCM), NOX was collected through 30 ml of the absorbing reagent of Sodium Hydroxide (NaOH) and NH3 was absorbed by Sulphuric acid (H2SO4) of 10 ml of solution at a flow rate of 1 liter/min.

Analysis procedure
Cyclonic flow technique and impactor based technique was followed for measurement of concentration of PM10 and PM2.5 respectively. Improved West and Gaek (1956) method was followed for laboratory estimation of SO2. Modified Jacob and Hochheiser (1958) method was followed for laboratory estimation of NO2. They are finally expressed as weight of particulates collected per cubic meter of air sampled (µg/m³). Indophenol method was used for the analysis of NH3.

Air Quality Index
Air quality index is an environmental index that describes the overall ambient air status and trends of a particular place based on specific standard. It is a measure of the ratio of the pollutants concentration to the status of ambient air in the places. The following computation was used to derive the air quality index values of the monitoring sites under consideration. The higher the AQI value, greater is the level of air pollution and greater the damage to health. The AQI scale was divided into five categories that describe the range of air quality and associated potential health.

\[ \text{AQI} = \frac{1}{3} (\text{IPM}_{10}/\text{SPM}_{10} + \text{IPM}_{2.5}/\text{SPM}_{2.5} + \text{ISO}_{2}/\text{SSO}_{2} + \text{INO}_{2}/\text{SNO}_{2}) \times 100 \]

Where;

\[ \text{IPM}_{10}, \text{IPM}_{2.5}, \text{ISO}_{2} \text{and INO}_{2} \text{are the individual values of PM}_{10}, \text{PM}_{2.5}, \text{SO}_{2} \text{and NO}_{2} \text{respectively obtained during sampling, SPM}_{10}, \text{SPM}_{2.5}, \text{SSO}_{2}, \text{SNO}_{2} \text{are the standards of ambient air quality prescribed by Central Pollution Control Board}. \]
RESULTS AND DISCUSSION

In village Jaroli the average concentration of PM$_{10}$, PM$_{2.5}$, SO$_2$, NO$_X$ and NH$_3$ was 94 µg/m$^3$, 50 µg/m$^3$, 7 µg/m$^3$, 16 µg/m$^3$ and 26 µg/m$^3$ respectively and AQI was 51. In village Jalalahri the average concentration of PM$_{10}$, PM$_{2.5}$, SO$_2$, NO$_X$ and NH$_3$ are 65 µg/m$^3$, 26 µg/m$^3$, 4 µg/m$^3$, 11 µg/m$^3$ and 20 µg/m$^3$ respectively and AQI was 29. Near Jadibahal, the average concentration of PM$_{10}$, PM$_{2.5}$, SO$_2$, NO$_X$ and NH$_3$ was 73 µg/m$^3$, 32 µg/m$^3$, 5 µg/m$^3$, 13 µg/m$^3$ and 22 µg/m$^3$ respectively and AQI was 37. Similarly near Bandhuhbeda the average concentration of PM$_{10}$, PM$_{2.5}$, SO$_2$, NO$_X$ and NH$_3$ was 78 µg/m$^3$, 34 µg/m$^3$, 5 µg/m$^3$, 14 µg/m$^3$ and 29 µg/m$^3$ respectively and the AQI was 39. Out of the four sampling stations, highest concentrations of different air pollutants was recorded at Jaroli and the lowest was recorded at Jalalahri. Further, the Air Quality Index (AQI) was also calculated for these sampling locations. The AQI of Village Jaroli comes under moderate air pollution and for the rest villages i.e. Jalalahri, Jadibahal and Bandhuhbeda comes under light air pollution category. Table 1 and Figure 1 shows the average concentration of pollutants, air quality index and along with the standards prescribed by CPCB. Further, with respect to the health effect due to ambient air pollution in the area, it was noticed that, the village Jaroli is comparatively more affected and the Village Bandhuhbeda is least affected. The particulate and gaseous pollutants affect the people lives in the study area from asthma, chronic obstructive pulmonary diseases (COPD) and cystic fibrosis. Asthma has been observed in many children.

Table 1 Average concentrations of air pollutants (µg/m$^3$) and AQI in the study area

<table>
<thead>
<tr>
<th>Location</th>
<th>PM$_{10}$</th>
<th>PM$_{2.5}$</th>
<th>SO$_2$</th>
<th>NO$_X$</th>
<th>NH$_3$</th>
<th>AQI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jaroli</td>
<td>94</td>
<td>50</td>
<td>7</td>
<td>16</td>
<td>26</td>
<td>51</td>
</tr>
<tr>
<td>Jalalahri</td>
<td>65</td>
<td>26</td>
<td>4</td>
<td>11</td>
<td>20</td>
<td>29</td>
</tr>
<tr>
<td>Jadibahal</td>
<td>73</td>
<td>32</td>
<td>5</td>
<td>13</td>
<td>22</td>
<td>37</td>
</tr>
<tr>
<td>Bandhuhbeda</td>
<td>78</td>
<td>34</td>
<td>5</td>
<td>14</td>
<td>29</td>
<td>39</td>
</tr>
<tr>
<td>Standard</td>
<td>100</td>
<td>60</td>
<td>80</td>
<td>80</td>
<td>400</td>
<td></td>
</tr>
</tbody>
</table>

Figure-1 Concentration of air pollutants at different stations

Figure 2, 3, 4, 5, 6, 7 shows the wind rose diagrams for the month of October, November, December, January, February and March respectively. Table 2 shows the affected people in study area due to Air Pollution between the age group of 0-6 years and above 6 years with their percentage value.
Figure-2: Wind rose of October

Figure-3: Wind rose of November

Figure -4: Wind rose of December
Table 2: Affected people in study area due to Air Pollution

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Village name</th>
<th>Population</th>
<th>Affected population</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Below 6 yrs</td>
<td>0-6 yrs</td>
<td>Above 6 yrs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>male</td>
<td>female</td>
<td>male</td>
</tr>
<tr>
<td>1</td>
<td>JAROLI</td>
<td>4017</td>
<td>747</td>
<td>368</td>
</tr>
<tr>
<td>2</td>
<td>JALAHARI</td>
<td>3986</td>
<td>414</td>
<td>289</td>
</tr>
<tr>
<td>3</td>
<td>JADIBAHAL</td>
<td>1228</td>
<td>256</td>
<td>144</td>
</tr>
<tr>
<td>4</td>
<td>BANDHUABEDA</td>
<td>573</td>
<td>98</td>
<td>62</td>
</tr>
</tbody>
</table>

Source: Local Health Care Center
CONCLUSION
India and other developing countries have experienced a progressive degradation of air quality due to urbanization, industrialization, number of motor vehicles, lack of awareness among the people, use of fuels with poor environmental performance and ineffective environmental regulations. In this present study, the particulate and gaseous pollutants are below the standards as prescribed by CPCB. Care should be taken to avoid the health hazards caused due to the air pollution in the study area.

REFERENCES
[12] Dash, S.K., Dash, A.K. “Assessment of ambient air quality with reference to particulate matter (PM10 and PM2.5) and gaseous (SO2 and NO2) pollutant near Bileipada, Joda area of Keonjhar, Odisha, India”. Pollution Research. 34(4), 817-824, 2015.