CASE STUDY ON ABIENT QUALITY OF AIR & NOISE POLLUTION IN JALANDHAR CITY

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Abstract :- Air pollution and Noise pollution have become a serious threat to environment in which we all are living today. The purpose of this project is to measure, calculate, analyse the air and noise pollution in the major parts of Jalandhar City and providing the necessary mitigation techniques for controlling the pollution level in the city. In this research and study, the most important part is to calculate the Particulate Matter (PM) present in air along with Total Volatile Organic Compound (TVOC) and Formaldehyde (CH_2O) also noise level around those areas by using portable air quality meter and dB meter. Apart from this, a survey will be done by reaching out to residents of city of Jalandhar at different areas to find out the problems and diseases/ Illness that they are facing due to current level of pollution of the city. The weather conditions also play an important role in measurement of pollution. The direction and velocity of wind will be under observation as it carries PM from the areas nearby and is not present there daily. A detailed project report will be provided at the end of the work along with graphs and tables. After the complete observations and calculations of seven days data, the concentrations of air pollutants and noise level are concluded as PM2.5 = 84.6µg/m^3, PM10 = 113.08 µg/$m^{3,}$ TVOC = 0.366µg/m^3, HCHO = 0.097µg/m^3 and Noise Level=67.61dB which are beyond the permissible limits as per Central Pollution Control Board (CPCB) standards. The vehicular emission standards and Diwali pollution data is also provided. The survey of people health was done by asking people about the health issues that they are facing due to the increased pollution. About 15%-20% people are suffering from either air pollution problems or noise pollution problems. The different mitigation measures are provided which can help to control Air pollution and Noise pollution in the polluted areas of Jalandhar City.

Keywords **– Particulate Matter (PM), PM 2.5, PM 10, TVOC, CH_2O, CPCB.**

I. INTRODUCTION-

Air pollution: Air pollution have become a serious threat to climate and effects also seen at living and non-living organism. In a study conducted by Lancet Planetary Health found out that IN year 2017 there is 12.4 lakh death in India due to air pollution. THE main constituents of pollution are **Particulate Matter (PM). Particulate matter is** aerosol particles containing various toxic and non- toxic micro molecules of different elements such as ammonia, magnesium, silica, potassium, calcium, sodium chloride, nitrates, sulphates and many more. They are broadly classified as two types.

- **Coarse particles**- They are those particles having size varies from 2.5 to 10 micrometre's. They are generated from industries, wildfires, agriculture fire, woodstoves, and hydronic heaters.
- **Fine particles**- These are particles which have size less than 2.5 micrometre. They are generated from car smoke (especially diesel engine), industrial processes, and chemical reaction of different gases in atmosphere.

In this study we also includes two more components which are deteriorating our atmosphere:-

- **Formaldehyde (CH_2O):-** Formaldehyde is an important chemical mainly used by industry for manufacture of building materials and various house hold products. It is also formed by combustion in engines and various other natural processes. Thus, it may be present in significant concentrations in both indoors and outdoors. Formaldehyde can cause various types of health issues like irritation of the skin, eyes, nose and throat. Exposure to formaldehyde may cause cancer. At room temperature, Formaldehyde is a colourless gas, which has a strong, choking smell.
- **Total volatile organic compounds (TVOC)**:- Total Volatile organic compounds (TVOCs) are emitted as gases from paints, paint strippers, pesticide, building materials and furnishings products. TVOCs include a number of chemicals, some of which may cause several adverse health effects.

Noise Pollution: Noise pollution is a term used to define the sound magnitude that can cause adverse effects in humans or other living organisms. Noise pollution is define by sound pressure in decibels (Db). Noise pollution is one of the major natural worries in India today and unfortunately many are uninformed of the dangers it can cause. Noise pollution is define by term sound pressure.

II. METHODOLOGY- Devices used for gathering data or technique for air pollution:-

2.1 Portable Air Quality Meter:-It is a portable device that is used to monitor the quality of the air of a particular area by collecting the air through certain point. The device shows the pollutant content present in the air and displays the readings of pollutants according to their sizes i.e., PM 2.5, PM 10, CH_2O, TVOC. The device needs to be calibrated first for 180 sec then it is ready for testing. The figures 1.1 and 1.2 shows the device used in this study along with its different parts:

Fig. 1 Portable Air Quality Meter

Fig.2 Device Holes For Air Intake

2.2 Db Meter/ Sound Pressure Meter:- Db meter is a portable device which is used for find the sound pressure level in particular area. When the air pass from microphone then the diaphragm of the microphone responds to changes in air pressure caused by sound waves. This movement of the diaphragm, i.e. the sound pressure deviation is then converted into an electrical signal by which readings are displayed on the screen.

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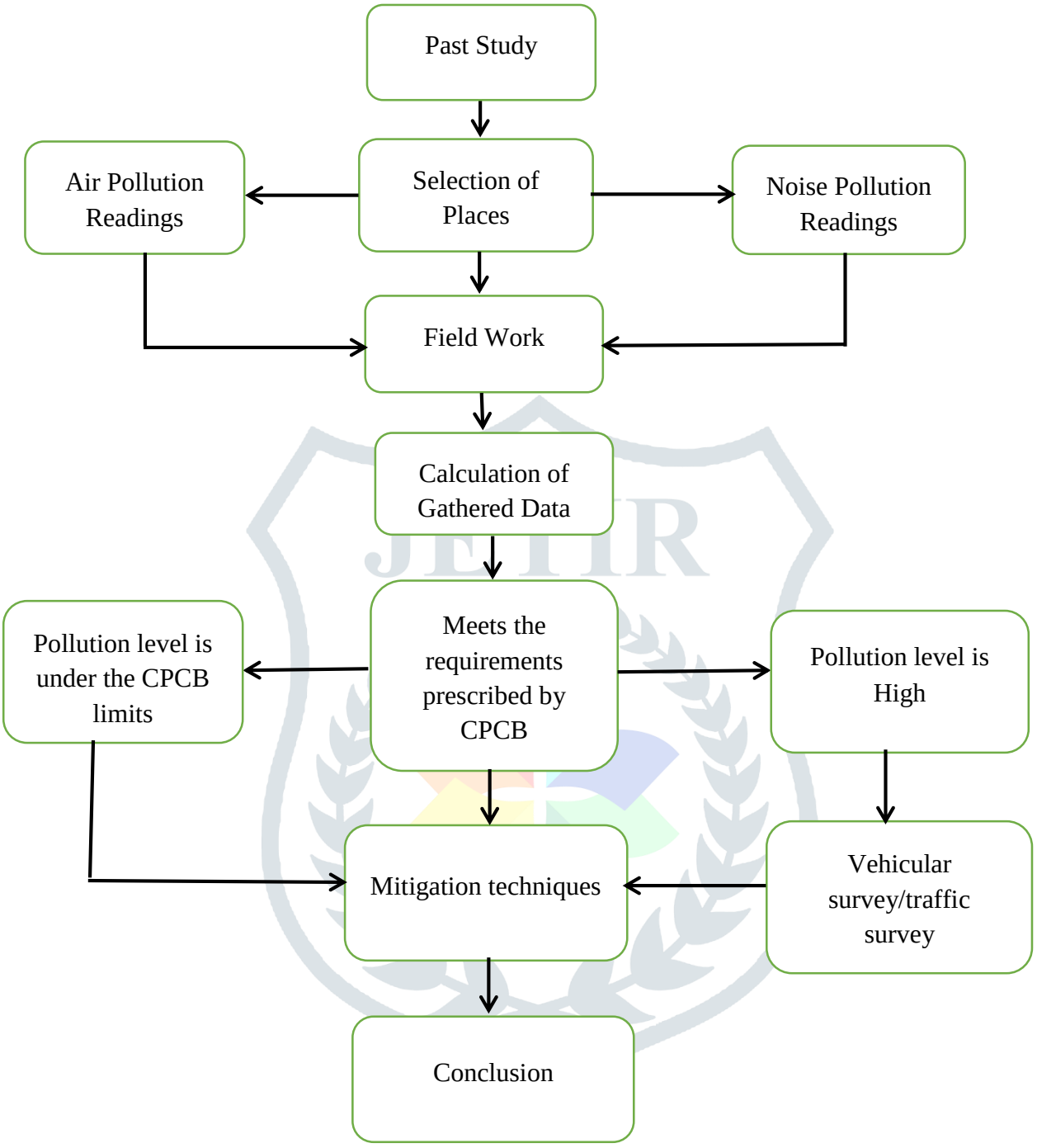
Fig.3 Db Meter/ Sound Pressure Meter

The study of pollution level in Jalandhar City was divided into different phases. In first phase of project, the study of research papers was done. These research papers gave the ideas about the different aspects of the project related details. According to the information provided in the research papers, the selection of places for project was done. The places which were selected had high traffic intensity and volume. The total 22 places were selected for the study which are located at different areas of the City. These areas include like Bus Stand, Industrial Areas, Railway Stations, and different roundabouts (chownks). After selecting places for study, the field work was done. The field work, the collection of pollution data was done with the help of portable devices i.e.; Portable air Quality Meter and Db Meter. At each selected place was under 10 minute's observation. The data was collected two times in a day for a particular place. The readings were noted down. The acquired Air pollution and Noise pollution readings the calculation of the data was done. Different tables were made for better understanding of data. The results of the acquired data were then compared with the standards of the CPCB (Central Pollution Control Board). The comparison off data was analysed and different tables were made with respect to pollutant. The places where there is high level pollution, study will be carried out to find reason. The places which are having pollution content more than standard limit is provided with some mitigation techniques that will reduce the level of pollution of the area. The mitigation techniques were provided by keeping the economy as low as possible along with the area required to install any required thing. Conclusion of the data was done in last which summarised all the information and data collected to provide a overview of the results and analysis done in the project.

Flow Chart of Case Study-



III. RESULTS AND DISCUSSION

In the below table standard values or limiting values are given as per C.P.C.B (Central Pollution Control Board, New Delhi) for the following pollutant's:- Particulate matter (PM), Formaldehyde (HCHO), Total Volatile Organic Compound (T.V.O.C), Sound Pressure.

Table 1: Standard values

Pollutant's	$PM_{2.5}$	PM_{10}	SOUND PRESSURE (DAY TIME)	HCHO	TVOC
Standard Limit	60µg/m^3	100µg/m^3	75Db	0.1mg/m^3	1mg/m^3

The average weekly amount of particulate matter, TVOC, CH_2O and sound pressure present in the environment of different areas of Jalandhar City are depicted in form of tables. The case study is done between 12-March-2018 to 29-April-2018.

Table 2: PM 2.5 average reading

PLACE	PM 2.5 (µg/m^3)						
	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5	WEEK 6	WEEK 7
Urban Estate	65.5	70	76	70.5	67	60	73
Pathankot By-pass	113.5	104.5	96.5	103	97	120.5	100.5
Transport Nagar	78	81.5	90	90	88.5	90	89.5
Maqsuda	63	76.5	81.5	74	72.5	68	67
D.A.V College	97.5	88.5	82	93.5	87.5	85	81
Railway Station	82	99	104.5	102.5	100	99	93
Mai Hera Gate	79.5	88	97	79.5	87.5	94	82
Dolphin Hotel	93	91	91.5	74	85.5	105.5	91.5
Alaska Chownk	62.5	77	76	83.5	83.5	67	75.5
P.A.P Chownk	115.5	124	123	135	125.5	125	116
Guru Ravidas Chownk	83.5	87.5	91	89.5	85.5	85	86.5
Nakodar Chownk	99.5	107	95.5	93.5	102.5	104	95
Dr. B.R. Ambedkar Chownk	73.5	86.5	72	89	83.5	80.5	83.5
B.M.C Chownk	69	83.5	84.5	85	75	69	75
Guru Nanak Mission Chownk	64	69	67	66.5	62.5	57.5	73
Bus Stand	79	87.5	78.5	85.5	82.5	84	88.5
Jyoti Chownk	94	78.5	97	98.5	88	99.5	90
Luv-Kush Chownk	78	84	88.5	94	85	84	73.5
Rama Mandi	75.5	88.5	84	104.5	91.5	84	84.5
Kapurthala Chownk	83.5	86	86.5	89.5	84	80.5	80.5
Football Chownk	87.5	73	67.5	78.5	67.5	92	82
Cantt	40	60.5	54	62.5	52	55.5	47

Table 3 : PM10 average reading

PLACE	PM 10 (µg/m^3)						
	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5	WEEK 6	WEEK 7
Urban Estate	89.5	85.5	85	89	83	81	91
Pathankot By-pass	129.5	149.5	154	149	142	142.5	151.5
Transport Nagar	105	120.5	114	121	120.5	105	112.5
Maqsuda	82	93	94	113.5	103.5	88	88
D.A.V College	112.5	113	115.5	120.5	116	121	110.5
Railway Station	94	125	126	123	122	117.5	122
Mai Hera Gate	101	114	138.5	130	113	114.5	129
Dolphin Hotel	138.5	117	118	122	140.5	116.5	138.5
Alaska Chownk	97	118	102	114.5	90	107.5	96
P.A.P Chownk	147	136.5	140.5	119.5	142.5	142.5	146
Guru Ravidas Chownk	95.5	121.5	115	116	105	111	112
Nakodar Chownk	128	114.5	124	128	138	122.5	129.5
Dr. B.R. Ambedkar Chownk	93	105	101	105	105.5	98.5	100.5
B.M.C Chownk	97	123	112	104.5	116.5	110	100.5
Guru Nanak Mission Chownk	85	109	111	107	111.5	104	87
Bus Stand	82.5	137	143.5	132.5	130	128.5	112
Jyoti Chownk	127	133.5	125	135.5	136.5	122.5	144.5
Luv-Kush Chownk	86	108	109	100	106	102	100
Rama Mandi	104	125	131.5	116.5	133	123.5	110.5
Kapurthala Chownk	100	117	125.5	118	111.5	116.5	106
Football Chownk	90	103.5	100	148	117.5	98.5	102.5
Cantt	67	68.5	77	73.5	70	75	80

Table 4: Formaldehyde (ch_2o) average reading

PLACE	HCHO (mg/m^3)						
	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5	WEEK 6	WEEK 7
Urban Estate	0.0325	0.045	0.041	0.0385	0.04	0.0365	0.1105
Pathankot By-pass	0.1805	0.203	0.172	0.1645	0.1545	0.1575	0.1535
Transport Nagar	0.173	0.07	0.0475	0.0645	0.058	0.055	0.0545
Maqsuda	0.017	0.0385	0.046	0.0825	0.064	0.0485	0.0235
D.A.V College	0.0375	0.021	0.024	0.02	0.0195	0.018	0.0445
Railway Station	0.0955	0.0655	0.0755	0.076	0.077	0.0685	0.08
Mai Hera Gate	0.0835	0.0655	0.0585	0.0555	0.057	0.0565	0.075
Dolphin Hotel	0.1825	0.2485	0.1635	0.1815	0.172	0.1675	0.1925
Alaska Chownk	0.0405	0.0475	0.018	0.024	0.022	0.0185	0.021
P.A.P Chownk	0.1775	0.2705	0.2435	0.2615	0.2425	0.2625	0.1775
Guru Ravidas Chownk	0.1635	0.093	0.086	0.0785	0.0825	0.089	0.056
Nakodar Chownk	0.103	0.075	0.0935	0.097	0.0935	0.09	0.1
Dr. B.R. Ambedkar Chownk	0.085	0.0495	0.062	0.051	0.0605	0.051	0.064
B.M.C Chownk	0.021	0.0355	0.029	0.032	0.031	0.026	0.0285
Guru Nanak Mission Chownk	0.0935	0.0695	0.0435	0.0565	0.0595	0.049	0.0945
Bus Stand	0.0795	0.2115	0.1685	0.178	0.2085	0.157	0.114
Jyoti Chownk	0.064	0.164	0.051	0.0705	0.0595	0.0585	0.072
Luv-Kush Chownk	0.1835	0.179	0.159	0.155	0.167	0.151	0.1145
Rama Mandi	0.304	0.148	0.2245	0.223	0.203	0.1905	0.0455
Kapurthala Chownk	0.106	0.0895	0.04	0.0515	0.052	0.037	0.067
Football Chownk	0.16	0.0975	0.155	0.167	0.1985	0.143	0.075
Cantt	0.024	0.0515	0.035	0.037	0.0365	0.037	0.0235

Table 5: Total Volatile Organic Compound (TVOC)

PLACE	TVOC (mg/m3)						
	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5	WEEK 6	WEEK 7
Urban Estate	0.1705	0.1685	0.1765	0.187	0.1665	0.1675	0.2165
Pathankot By-pass	0.6285	0.767	0.9015	0.8195	0.8795	0.871	0.678
Transport Nagar	0.2065	0.3905	0.2015	0.2295	0.2315	0.1885	0.1955
Maqsuda	0.241	0.2135	0.26	0.292	0.301	0.2635	0.1315
D.A.V College	0.323	0.3225	0.321	0.3225	0.2685	0.298	0.284
Railway Station	0.3865	0.36	0.6935	0.595	0.5915	0.607	0.4645
Mai Hera Gate	0.2075	0.2625	0.479	0.4495	0.4915	0.448	0.265
Dolphin Hotel	0.582	0.589	0.766	0.839	0.8205	0.8595	0.607
Alaska Chownk	0.224	0.222	0.1835	0.2185	0.2045	0.189	0.284
P.A.P Chownk	0.36	0.3945	1.0975	0.945	0.96	0.9975	0.307
Guru Ravidas Chownk	0.2985	0.1775	0.588	0.579	0.5745	0.555	0.198
Nakodar Chownk	0.167	0.1795	0.2275	0.2375	0.1995	0.1895	0.1715
Dr. B.R. Ambedkar Chownk	0.377	0.378	0.4035	0.3895	0.3945	0.3875	0.3585
B.M.C Chownk	0.1455	0.2065	0.2255	0.276	0.214	0.2175	0.1625
Guru Nanak Mission Chownk	0.325	0.292	0.248	0.259	0.259	0.242	0.3785
Bus Stand	0.3625	0.2825	0.4405	0.4905	0.4735	0.43	0.151
Jyoti Chownk	0.547	0.499	0.5605	0.556	0.462	0.543	0.255
Luv-Kush Chownk	0.315	0.36	0.489	0.4515	0.3795	0.471	0.222
Rama Mandi	0.416	0.2025	0.303	0.281	0.3365	0.2975	0.1525
Kapurthala Chownk	0.332	0.241	0.3825	0.345	0.3805	0.361	0.285
Football Chownk	0.2065	0.252	0.22	0.225	0.226	0.208	0.1685
Cantt	0.1275	0.132	0.164	0.166	0.1785	0.152	0.135

Table 6: average Sound level

PLACE	SOUND LEVEL (Db)						
	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5	WEEK 6	WEEK 7
Urban Estate	64.6	63.35	63.2	64.1	62.55	64.35	64.45
Pathankot By-pass	72.35	73.8	73.3	73.6	73.45	76.6	77.65
Transport Nagar	67.8	68.35	69.05	68.9	68.4	72.15	71.95
Maqsuda	57.4	59.3	59.75	60.65	58.65	64.5	63.9
D.A.V College	65.8	66.75	68	66.65	68.65	66.4	67.5
Railway Station	68.8	67.45	67.15	69.6	66.25	67.2	66
Mai Hera Gate	72.15	71	69.85	70.8	72.65	68.35	69.8
Dolphin Hotel	74.25	73.35	71.85	71.8	71.95	73.15	72.65
Alaska Chownk	71.65	68.9	69.35	70.5	71.35	67.4	71.4
P.A.P Chownk	73.55	71.75	75.05	73.45	73.3	75.5	75.65
Guru Ravidas Chownk	64.8	64.1	65.3	65.05	65.45	67.05	68.2
Nakodar Chownk	61.1	62.1	63.6	64.3	63.3	66.75	66.2
Dr. B.R. Ambedkar Chownk	64.1	61.85	65.15	62.45	65.2	68.05	68.1
B.M.C Chownk	58.5	60.6	58.35	57.95	60.3	62.1	63.45
Guru Nanak Mission Chownk	59.95	60.1	60.2	60.05	60.45	62.85	63.9
Bus Stand	71.6	70.9	70.95	71.55	72.4	73.3	73.85
Jyoti Chownk	71.9	71.6	71	71.25	71.5	72.95	73.75
Luv-Kush Chownk	71.5	71.5	69.85	72.35	71.15	71.75	71.05
Rama Mandi	64.25	65.55	65	66.7	65.3	67.65	67.55
Kapurthala Chownk	67.9	67.95	67.95	68.7	68.2	70.25	70.8
Football Chownk	69.1	69.85	69.05	69.55	69.45	71.1	71.75
Cantt	56.7	56.1	56.15	57	57.6	61.3	61.4

Vehicular survey data of areas having high pollution- Result gives average value of vehicular pollutants and Standard Values (S.V) in brackets. Standard values are as per C.M.V Rules 1989 (rule 115).

Table 7: Vehicular data of areas having high pollution

s.no	Class of 2-wheeler	No. of vehicle units	Hc (n-hexane equivalent)(S.V:-4500 ppm)	Co%(S.V:-3.5%)
1	Scooter (gear)	140	2503	1.9
2	Scooter (non-gear)	100	2124	1.6
3	Motor cycle	100	3009	2.4

Table 8: Survey for four-wheeler petrol

S.no	Class of vehicle	No. of vehicle units	HC (n- hexane equivalent)(S.V:-750 ppm)	Co % (S.V:-0.5)
1	BS II four-wheeler (petrol)	160	398	0.281

Table 9: Survey for four-wheeler diesel (smoke density)

S.no	Class of vehicle	No. of vehicle units	HSU(S.V:- 65%)	K (S.V2.45 1/m)
1	Diesel	150	33.45 %	1.1

IV. MITIGATION MEASURES

4.1 AIR POLLUTION MITIGATION:-

- Industrial area of Jalandhar, this area have factories which have absolute incinerators which are used to burn industrial waste these incinerators have less efficiency by which solid waste convert into gaseous pollution. Apart from this there are many factories which are not using any type of air filters for chimney. So changing of old machinery and installation of new equipment's will reduce toxic gases emission to environment.
  Cost of incinerator which can burn 8kg to 250kg waste is approximately ₹1, 00,000.
- Industrial area is situated at North direction of Jalandhar city and also come under main territory of city, wind direction flow toward north east majority of time and after noon direction shift little bit from north east to North west due to which whole air pollution came toward city. This scenario will automatically rectified if installation of machines are done.
- The area's inside city, having high pollution is due to traffic congestion, whether it is dolphin hotel or pathankot By-pass. These are the area's where frequent traffic jams can be seen or phase of movement of traffic is of low speed. This case will be sort out by providing proper flow to vehicles which can be achieved by widening of roads, diverting other cities traffic and early completion of road construction projects which are going on at NH 44.
- Bharat Stage IV (B.S 4) vehicles are in used in India and in 2020 Bharat Stage VI are going to implement on whole country but pollution certificates which are given to vehicles are of Bharat Stage II which was implemented in 2003, so certificates should be issue as per new norms which will reduce mobility of high emission vehicles.
- The nearby area of Jalandhar city is farmland due to which agricultural activities like burning paddy residual causing extreme air pollution during seasons so, legal action should be taken against farmer who violate National Green Tribunal Act.
- Use Natural Gas Instead of carbon product.

4.2 NOISE POLLUTION MITIGATIONS:-

- Use of noise barriers on roadway
- Limitation of vehicle speeds.
- In Jalandhar many vehicles have aftermarket exhaust and horn's produced high level of noise especially at residential areas. These types of vehicles should be bound and selling of these aftermarket accessories prohibited.
- Planting green trees and shrubs along roads, hospitals, educational institutions will help in noise reduction and air pollution to a considerable extent.

V. CONCLUSION

- There are number of pollutants present in air of Jalandhar City and all these pollutants have different chemical and physical properties.
- The past studies done on air and noise pollution gives the enough information about the changing environment to consider it a problem.
- The study done in this project provides the data about the concentration and level of pollution in Jalandhar City.
- After analysing and calculating the data of two months the concentration and level of $PM_{2.5}$=84.6µg/m^3, PM_{10}=113.08µg/m^3, TVOC=0.366µg/m^3, HCHO=0.097µg/m^3 and Noise Level=67.61dB.
- The level of pollutants in higher than the prescribed limits of CPCB as well as WHO.
- The main pollution causing agents are factories and vehicular traffic.
- The main area's which have high air pollution are Pathankot By-pass, P.A.P Chownk, Jyoti Chownk and the lowest area is Jalandhar army cantonment.
- The area's where Sound pressure exceed limits are Pathankot By-pass, P.A.P Chownk and Jalandhar Bus stand and Jalandhar military area have least amount of noise pollution.
- In this study it is found out that, majority of vehicular emission are as per norms but due to congestion and traffic jams in the central area of city cause air and noise pollution simultaneously.
- Wind speed and direction is also one of the main factor behind air pollution dispersion in city.

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