



## Air Quality Monitoring of Guru Nanak Dev University, Amritsar



**Guru Nanak Dev University  
Amritsar**



राष्ट्रीय मूल्यांकन एवं प्रत्यायन परिषद

विश्वविद्यालय अनुदान आयोग का स्वायत्त संस्थान

**NATIONAL ASSESSMENT AND ACCREDITATION COUNCIL**

*An Autonomous Institution of the University Grants Commission*

# *Certificate of Accreditation*

*The Executive Committee of the  
National Assessment and Accreditation Council  
on the recommendation of the duly appointed  
Peer Team is pleased to declare the  
Guru Nanak Dev University  
Amritsar, Punjab as  
Accredited  
with CGPA of 3.51 on four point scale  
at A grade  
valid up to December 09, 2021*

*Date : December 10, 2014*



*D. Singh*  
Director

Preserve

Protect  
Environment

Save

Er. S.K.Goyal  
M.E. (Env.), FIE (India)  
Sr. Env. Engineer(Retd.)  
Punjab Pollution Control Board(PPCB)



EIA Co-ordinator (QCI)  
Chartered Engineer,PPCB

### Certificate

Certified that a team of faculty members & students, under the leadership of **Prof. Ashwani Luthra, Director IQAC** of Guru Nanak Dev University, Amritsar has conducted a detailed **Environmental Green Audit of various Green Initiatives taken by the university** covering different aspects such as Green Cover, Green Mobility, Air Quality Monitoring, Water and Wastewater Management, Green Energy Initiatives, Solid Waste Management, Bio-Medical Waste Management, and E-Waste Management, for the preservation and protection of environment in its campus. Data and credentials in the report have been scrutinised and are found **Satisfactory**.

Efforts made by the leadership, faculty and students of the University towards environment and sustainability are commendable and worth appreciating.

Dated: NOV.25,2021

  
(Er. Samarjit K. Goyal)  
Chartered Engineer  
Pb Pollution Control Board



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LEAVES  
OF  
IMPORTANT  
SURVIVAL  
TREES  
IN  
INDIA —  
MAHUA,  
KHEJDI,  
ALDER,  
PALMYRA  
AND  
OAK

November 29, 2021

The Coordinator  
Centre for Sustainable Habitat  
Guru Nanak Dev University  
Amritsar

## Subject: Certification for different Audits under Green Campus Initiatives

Dear Sir,

From the past six years, Centre for Science and Environment (CSE) and Guru Nanak Dev University (GNDU) Amritsar have been working together on CSE's Green Campus Initiative and audit programme. Under this engagement, CSE has supervised multiple environmental audits and trained the faculty, staff and students at GNDU as well as other universities and colleges across India. The results and outcomes of this engagement have been published by CSE in multiple reports such as 'A Green Campus Compendium: Incubation, Experimentation and Demonstration of a Green Future' and 'Green Campus Movement'. Appreciation letters have also been shared at the various stages of this programme. CSE appreciates that the faculty at GNDU has prepared the following audit reports:

1. Green Cover of GNDU
2. Green Mobility Initiatives
3. Air Quality Monitoring
4. Liquid Waste Management
5. Green Energy Initiatives
6. Solid Waste Management
7. Bio-Medical Waste Management
8. E-Waste Management

CSE commends GNDU's efforts towards realising Sustainable Development Goals and extends its full support and expertise in its future endeavours.

Yours' cordially,

Rajneesh Sareen  
Programme Director  
Sustainable Buildings and Habitat Programme  
Centre for Science and Environment

## **Preface**

Monitoring the quality of air at Guru Nanak Dev University Campus is being carried on periodic basis so that its contribution to carbon footprints remain lower than the prescribed standards even. The readings noted are compared with the norms set by the Punjab Pollution Control Board. The report on Air Quality Monitoring of the university is prepared for Internal Quality Assurance Cell, GNDU by Dr. Rajinder Kaur Gill, Professor, Botanical and Environmental Sciences Department of the university.

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## **GURU NANAK DEV UNIVERSITY**



With the glorious history of past fifty years, Guru Nanak Dev University was established at Amritsar on November 24, 1969 to mark the Birth Quincentenary of Sri Guru Nanak Dev Ji, the apostle of universal brotherhood, truthfulness, non-violence, compassion, tolerance, harmony, humanity, strict observance of moral & ethical values in daily life, who is also revered as the founder of Sikhism. It won't be an exaggeration to state that His teachings and preaching & His own personal life are perfect examples to be emulated by the entire mankind even after about four and half a centuries and will remain so eternally. Ever since its foundation the endeavour of the university has always been to meet the objectives enshrined in the Guru Nanak Dev University Act 1969, which emphasized that the new University would make provision for imparting education and promoting research in the humanities, learned professions, sciences, especially of applied nature and technology. Studies and research on the life and teachings of Guru Nanak, in addition to working towards the promotion of Punjabi language and spreading education among educationally backward classes and communities are the other commitments. In consonance with these expectations, the university in its eventful history of 50 years has taken long strides in spreading the message of Guru Nanak Dev ji and promoting education in such fields as Science, Arts, Management, Information Technology, Industrial Technology, Environment, Planning and Architecture. To fulfil its commitment, the tuition fee charged from the students of the departments of Guru Nanak Studies and the School of Punjabi Studies has been waived. The UGC conferred this University with status of “University with Potential for Excellence” in 2012. The National Assessment and Accreditation Council (NAAC), Bangalore in November 2014 reaccredited the university in 3<sup>rd</sup> cycle with CGPA of 3.51 out of 4 point scale at “A++” grade, the highest in the region.

Guru Nanak Dev University is a high performing state public university as it has improved its ranking from 80 in 2017 to 51 in 2020 among all Central, Public and Private Universities in the country (NIRF, MHRD, GoI). It is reckoned among top 9% universities of the world and top 10 state public universities of India by Centre for World University Ranking (CWUR), a leading international agency engaged in grading the top ranking universities worldwide since 2012. QS I-GAUGE Rating System has rated the university in the Diamond Category in the field of ‘research, faculty quality and infrastructure’ by the. It was also shortlisted for the University of the Year Award in the 16<sup>th</sup> FICCI Higher Education Summit 2021 organized by FICCI jointly with the Ministry of Education and Ministry of Commerce & Industry, Government of India. High quality research has improved the H-index of the university from 64 to 119 with top 10 percent highly cited papers in Scopus. The university is placed among the top 4 Institutions in Punjab and 10 Institutions in North India by Nature Index,

The University today boasts of 43 teaching departments at the Campus and 149 affiliated colleges, 16 Constituent & University Colleges and 53 Associate Institutes, many of which are located in the rural areas. The university has always strived hard to make the benefits of higher education accessible to the rural masses. More than twenty thousand students, an overwhelming majority of them being women, are enrolled in various Departments at



University Campus and Constituent Colleges. On-line admission, on-line counselling, on-line re-evaluation, introduction of Credit Based Continuous Evaluation Grading System etc. are a few hallmarks of the university. All the results have been computerized and OMR (Optical Magnetic Recognition) system is being used to bring in more efficiency and transparency. This is the first University in the region to have computerized its examination and registration system. The students now have an all-time access to their results through SMS service. It acts as a model higher education institution for digital initiatives like e-office management system, digital library, Wi-Fi enabled campus, high speed online teaching modules, and smart classrooms to name a few.

Academically also, the university has carved a niche for itself in the field of Higher Education in the country. Our University is recognized as one of the leading institutions in North India in the domain of Science and Technology. Many coveted projects from the apex bodies like the DST, CSIR, BARC and other organizations worth crores of rupees have been awarded to our faculty members. One of the four Nodal Calibration Centres established by Bhabha Atomic Research Centre is set up at our campus. The Centre of Emerging Life Sciences equipped with the state-of-the-art scientific instruments worth crores of rupees, well-maintained Botanical Garden, Department of Sports Medicine & Physiotherapy are a few of the jewels in the crown of the university. To more strengthen the university infrastructure and to prepare students for employments, computer lab with the help of TCS is also established. Further, the UGC has granted the University the Centre with Potential for Excellence in Life Sciences and Centre for Advanced Study in Chemistry.

In the field of culture and sports also, the achievements of the university are noteworthy. The university has been national Champion for 10 times & the winner of the North-Zone-Inter-Varsity Cultural Championship for 13 times. The winning of the coveted Maulana Abul Kalam Azad Trophy, the highest sports award for a university in the country, for a record number of 23 times, speaks volumes about its supremacy in the field of sports. An Astro Turf for hockey, a swimming pool of international standards, a velodrome, a Gymnasium hall, shooting range & many other state-of-the art sports facilities are the prized possessions of the university. The Lifelong Learning Department of the university is successfully catering to the female folk of the region to make them self-dependent by offering various skill development programmes. The Track record of employment of our students by big business Houses and Multi-National Companies has been very satisfactory. Our students of engineering, management and commerce field are employed by companies in India and abroad. They are all contributing to the creditworthiness of the University by their hard work and diligence. In the last year alone, almost all our engineering and management students were recruited by various companies through campus placements. It goes without saying that all these achievements would not have been achieved, but for the heart and soul put in by the students, faculty members, and administration of the university. Undoubtedly, the university remains committed to achieve the lofty goals, for which it was founded after the name of Sri Guru Nanak Dev Ji.

The university is known for its GREEN CAMPUS initiatives in the field of energy, water, solid waste management, micro mobility and health and hygiene. Some of the key initiatives of the university are energy efficient buildings, rooftop solar energy plant, solar water heaters, sensor based urinals, toilets and wash basins, maintenance of lawns as water recharge systems, rooftop rainwater harvesting, on campus sewerage water treatment plant, organic waste management through bio-gas plant and vermi-compositing, natural processing to convert agro-waste into compost, involvement in recycling and reuse of paper, plastic, metal and other waste, efficient medical waste management, regular thickening of tree cover by planting tree each year, making the campus car free, facilitating the students, staff and the visitors by free of charge e-vehicle facility for micro mobility within the campus, developing lush green covered footpaths, regular sweeping of the roads and buildings at least twice a day and regular disinfectant spray to help the university bag the second cleanest State University in India awarded by the Ministry of Human Resource Development, Government of India under Swachh Campus Ranking for the last two years continuously.



## 1. INTRODUCTION

Awareness of daily levels of air pollution is very important for people especially that suffer from illnesses caused by air pollution. The concept of air quality index (AQI) is widely used for air quality description in many countries. The main objective of an AQI is to quickly disseminate air quality information (almost in real-time). Guru Nanak Dev University is having team of scientists that monitor quality of air in university campus on regular basis by using various sophisticated instruments as discussed in the report.

## 2. PM 2.5 MONITORING USING AMBIENT AIR QUALITY SAMPLER

In June 2021, PPCB has installed one additional manual ambient air quality monitoring station in the Department of Botanical & Environmental Sciences (figure 1). The sampling of air was done in the university campus (Department of Botanical and Environmental Sciences) on October 19, 2021 with Respirable Dust Sampler (make Envirotech APM 460 DXNL) using standard methods of Central Pollution Control Board (CPCB Volume I, Guidelines for the Measurements of Ambient Air Pollutants; National Ambient Air Quality Series: NAAQMS/36/2012-13). The value of PM 2.5 on sampling date ranged from 297 to 391.15 ( $\mu\text{g}/\text{m}^3$ ), 0.97 to 1.35  $\text{SO}_2$  ( $\mu\text{g}/\text{m}^3$ ) and 5.485 to 8.65  $\text{NO}_2$  ( $\mu\text{g}/\text{m}^3$ ). Results are given in Table 1. The results revealed higher value of PM 2.5 than the permissible limit of CPCB, while concentration of  $\text{SO}_2$  and  $\text{NO}_2$  were found much lesser than the max. permissible limits.

**Table 1. Concentration of PM 2.5,  $\text{SO}_2$  and  $\text{NO}_2$  Monitored on Sampling Site.**

S. No.	Parameters	Site (Department of Botanical and Environmental Sciences)	Date and Time of Sampling October 19-2020, 2021	Concentration ( $\mu\text{g}/\text{m}^3$ )	Max. Permissible limit of NAAQS of CPCB (24 hourly) ( $\mu\text{g}/\text{m}^3$ )
1.	PM 2.5 ( $\mu\text{g}/\text{m}^3$ )	Night	10:30 PM – 6:30 AM	391.15	60
		Morning	6:45 AM- 2:45 PM	297	
2.	$\text{SO}_2$ ( $\mu\text{g}/\text{m}^3$ )	Night	10:30 PM – 6:30 AM	1.35 $\pm$ 0.01	80
		Morning	6:45 AM- 2:45 PM	0.97 $\pm$ 0.02	
3.	$\text{NO}_2$ ( $\mu\text{g}/\text{m}^3$ )	Night	10:30 PM – 6:30 AM	8.65 $\pm$ 0.26	80
		Morning	6:45 AM- 2:45 PM	5.485 $\pm$ 0.28	

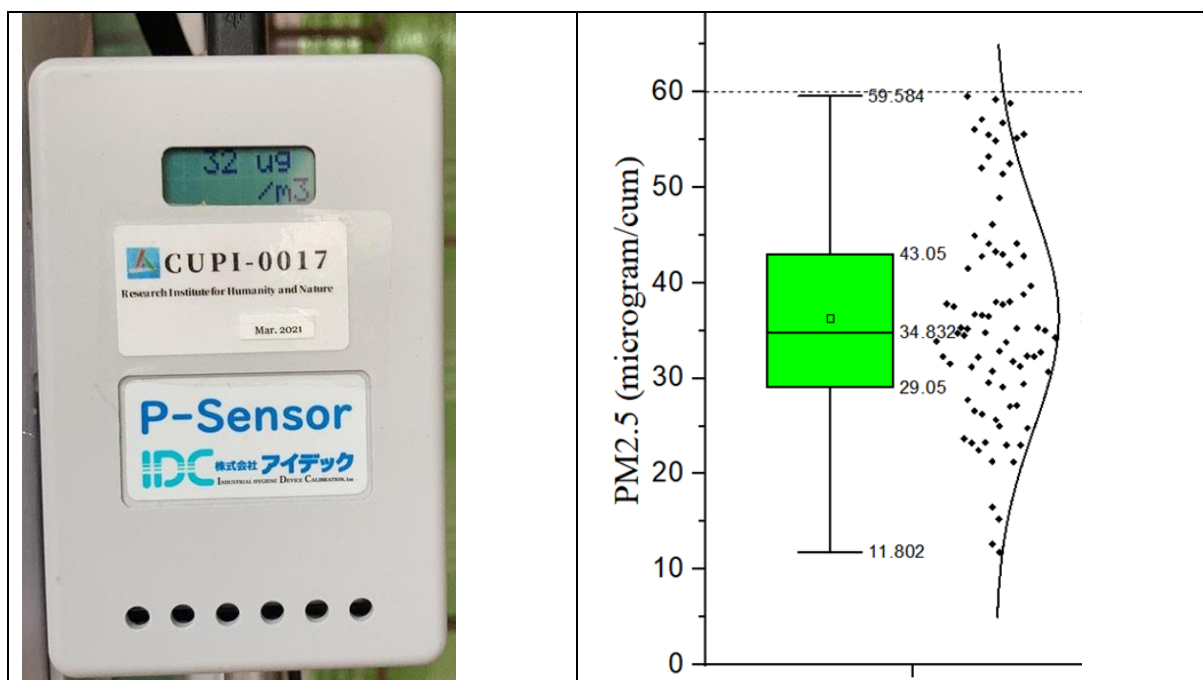


**Figure 1: Respirable Dust Sampler for Sampling of PM 2.5, SO<sub>2</sub> and NO<sub>2</sub>**

### 3. PORTABLE PM<sub>2.5</sub> SENSOR-BASED MONITORING:

GNDU in collaboration with the Research Institute of Humanity & Nature (RIHN), Kyoto, Japan in the year 2020 on Stubble burning in North India and its effects on air pollution (figure 2). The monitoring of PM 2.5 based on sensor was found within the permissible limit of NAAQS of CPCB in the month of June –July 2021.

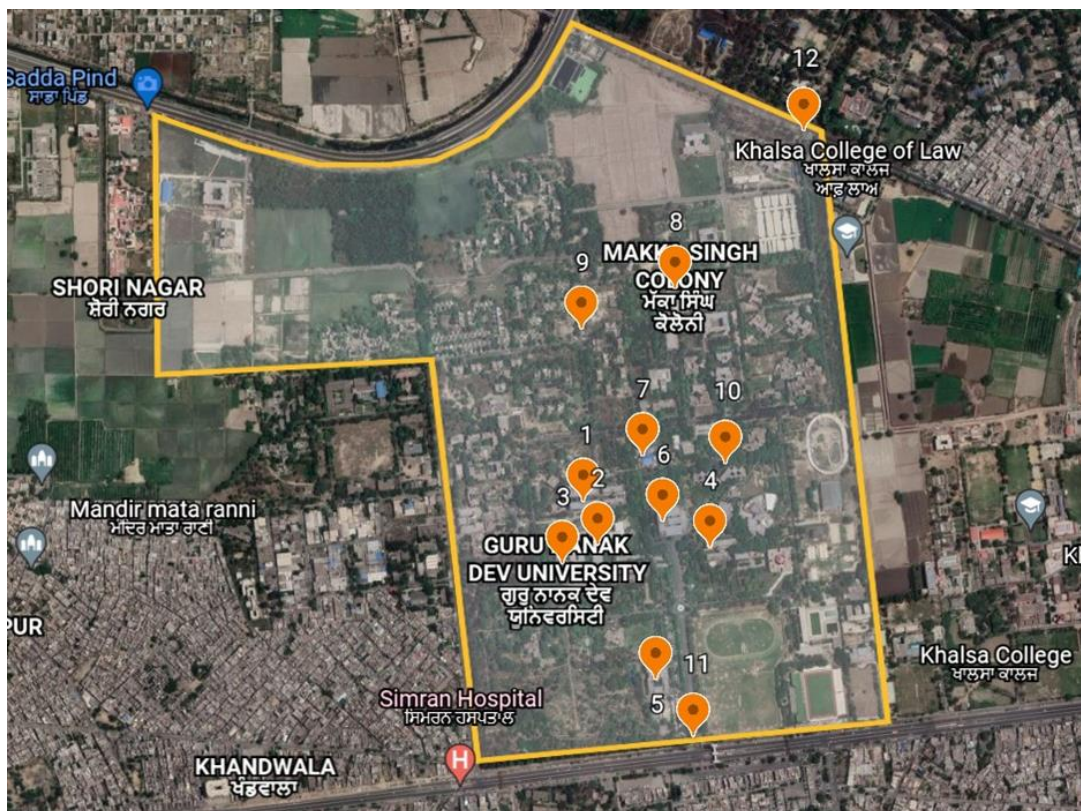
[https://www.chikyu.ac.jp/rihn\\_e/project/2020-01.html](https://www.chikyu.ac.jp/rihn_e/project/2020-01.html)



**Figure 2: (A) Portable PM 2.5 Sensor (B) Box-plot of PM 2.5 in GNDU during June-July, 2021**

#### 4. OZONE MONITORING

Ozone is the second most dangerous parameter as it aggravates lung diseases such as asthma, emphysema, and chronic bronchitis. Monitoring of ozone was done on October 19, 2021 at various sites Figure 3 of Guru Nanak Dev University using portable Ozone Air Monitor



**Figure 3: Sampling Sites shown on Map Downloaded from Google Earth** (Make Eltech Engineers Private limited). The average concentration of ozone was observed to be 0-11 ppb which is within the permissible limit of NAAQS of CPCB (table 2; figure 4).

**Table 2 Concentration of Ozone, VOC and AQI monitored on various sampling site.**

Site No.	Site Name	Ozone Concentration (ppb)	VOC (ppm)	Air Quality Index
1	Department of Botanical and Environmental Sciences	6	0.037	207
2	Department of Computer Science	2	0.7	207
3	Department of Pharmaceutical Science	4	1.6	220
4	Department of Chemistry	2	2.3	229
	Administrative Block	5	0.9	216
5	Bhi Gurdas Library	0	0.4	213
6	Deshmesh Auditorium	4	0.3	201
7	Health Centre	2	0.4	208
8	Residential Area	3	0.9	219
9	Canteen near Arts Block	11	4.4	219
10	Outside Front Gate (outside GNDU campus)	9	2.0	218
11	Outside Back Gate (outside GNDU campus)	11	7.8	219



**Figure 4: Portable Ozone Air Monitor Reading near Health Centre, GNDU, Campus**



## 5. TOTAL VOC MONITORING

Volatile organic compounds (VOCs) are emitted as gases from various solids or liquids. VOCs include a variety of chemicals, some of which may have short- and long-term adverse health effects. Concentrations of many VOCs are consistently higher indoors (up to ten times higher) than outdoors examples are paints, solvents, wood preservatives, aerosol sprays, cleansers and disinfectants, air fresheners, office equipment such as copiers and printers, glues and adhesives, permanent markers etc. Health effects of VOC include eye, nose and throat irritation, headaches, loss of coordination and nausea, damage to liver, kidney and central nervous system etc at higher concentration.

Total VOC content (indoor) was monitored in various departments of the university using Portable VOC Monitor (Make: Honeywell Mini RAE Lite). The total VOC content in the university campus ranged from 0.037 to 7.8 (Table 2, Figure 5).



Figure 5: Portable VOC Reading in Bhai Gurdas Library, GNDU, Campus

## 6. MONITORING OF AIR QUALITY INDEX

Air quality index was recorded at various sites of Guru Nanak Dev University, using Portable Air Quality Monitor (Make Huma-i HI-150 with advanced temperature, humidity, CO<sub>2</sub>, Volatile Organic Compounds (VOC), and Particulate Matter ((PM2.5 & PM10) sensors (Figure 6).

As per CPCB's (Central Pollution Control Board) air quality standards, AQI is categorised into six parts. AQI between 0-50 is considered 'good', 51-100 'satisfactory', 101-200 'moderate', 201-300 'poor', 301-400 'very poor', and between 401-500 'severe'. As the AQI value increases, health impacts become serious. Under satisfactory AQI, sensitive people might witness minor breathing discomfort, while severe AQI may cause respiratory impact even on



Figure 6: Portable Air Quality Monitor Reading of PM 1 and AQI at Bhai Gurdas Library, GNDU, Campus.

healthy people, and can serious health issue in people with existing respiratory issues. The AQI in university campus ranged from 201 to 229 which fall under POOR category on sampling date (table 2 and 3).

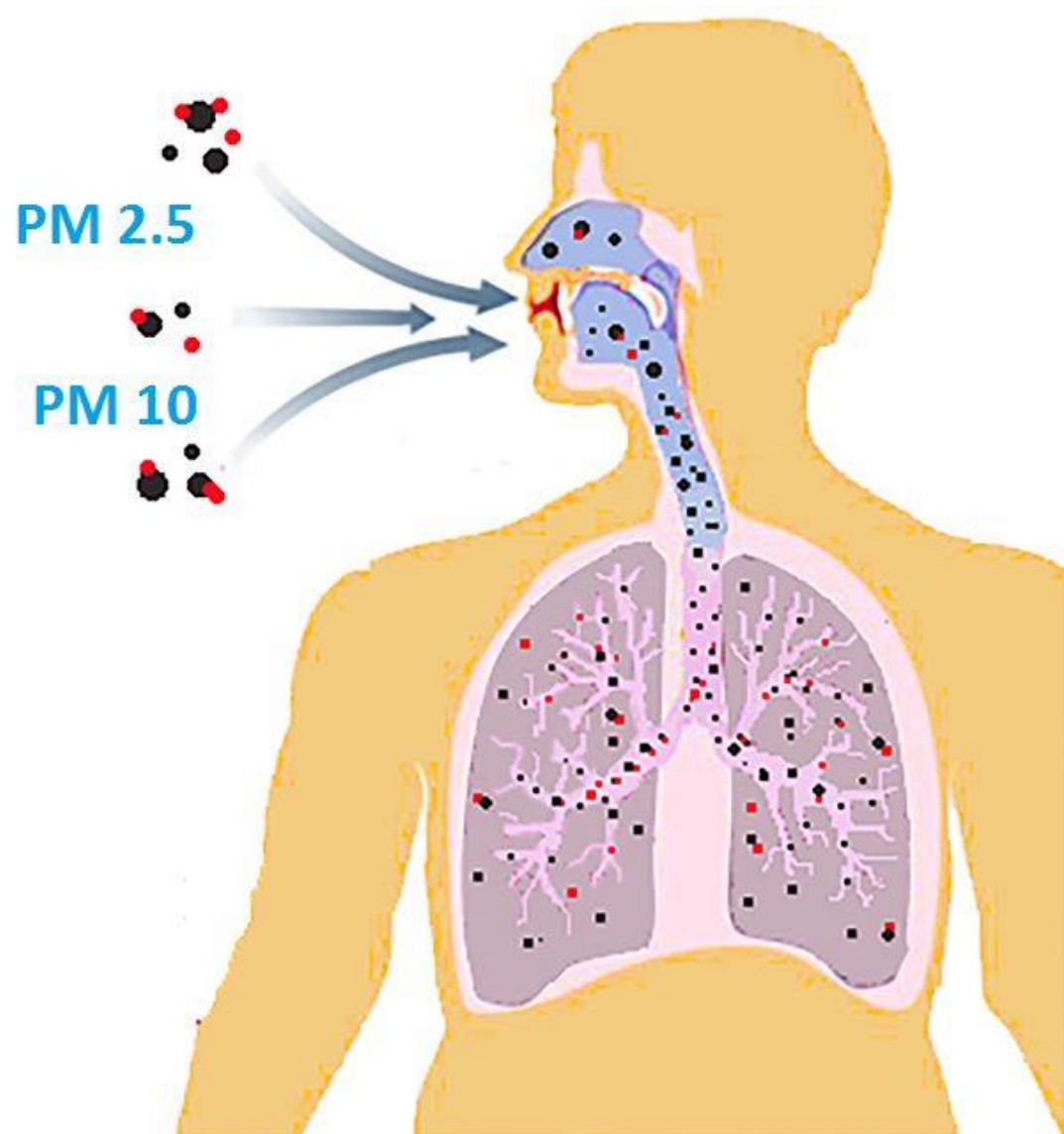


**Table 3: AQI and Possible Health Impacts**

<b>Daily AQI Colour</b>	<b>Values of Index</b>	<b>Levels of Health Concern</b>	<b>Description of Air Quality</b>
Green	0-50	Good	Minimal Impact
Yellow	51-100	Satisfactory	Minor breathing discomfort to sensitive people
Orange	101-200	Moderate	Breathing discomfort to the people with lungs, asthma and heart diseases
Red	201-300	Poor	Breathing discomfort to most people on prolonged exposure
Purple	301-400	Very Poor	Respiratory illness on prolonged exposure
Maroon	401-500	401-500 'severe'	Affects healthy people and seriously impacts those with existing diseases

## **7. CONCLUSION**

The air quality of Guru Nanak Dev University campus varies with season. The quality of air of campus is much better than surrounding as compared to Amritsar city due to large plantation cover. Most of the air quality parameters are within the prescribed limits of NAAQS of CPCB.







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**Prepared by  
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