

Community-driven open-data on Pakistan's air pollution problem



 Air Sensors International Conference

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Session 1D: Community Air Sensor Use

Abid Omar

Pakistan Air Quality Initiative (PAQI پاکی) provides community-driven air quality data and resources to increase social awareness.

abidomar@pakairquality.com

31.48° N, 74.19° E ×

290° @ 7 km/h

152 $\mu\text{g}/\text{m}^3$ Visualization of air quality by Cameron Beccario, site: earth.nullschool.net

earth

Pakistan has some of the worst air pollution in the world.

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vious guid

This global air pollution hotspot has very limited research from the academic community.

Map: Air Quality Life Index by the Energy Policy Institute at the University of Chicago (EPIC).

1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018

Year

2019



01 Nov 2019

AQI 402
"Hazardous"

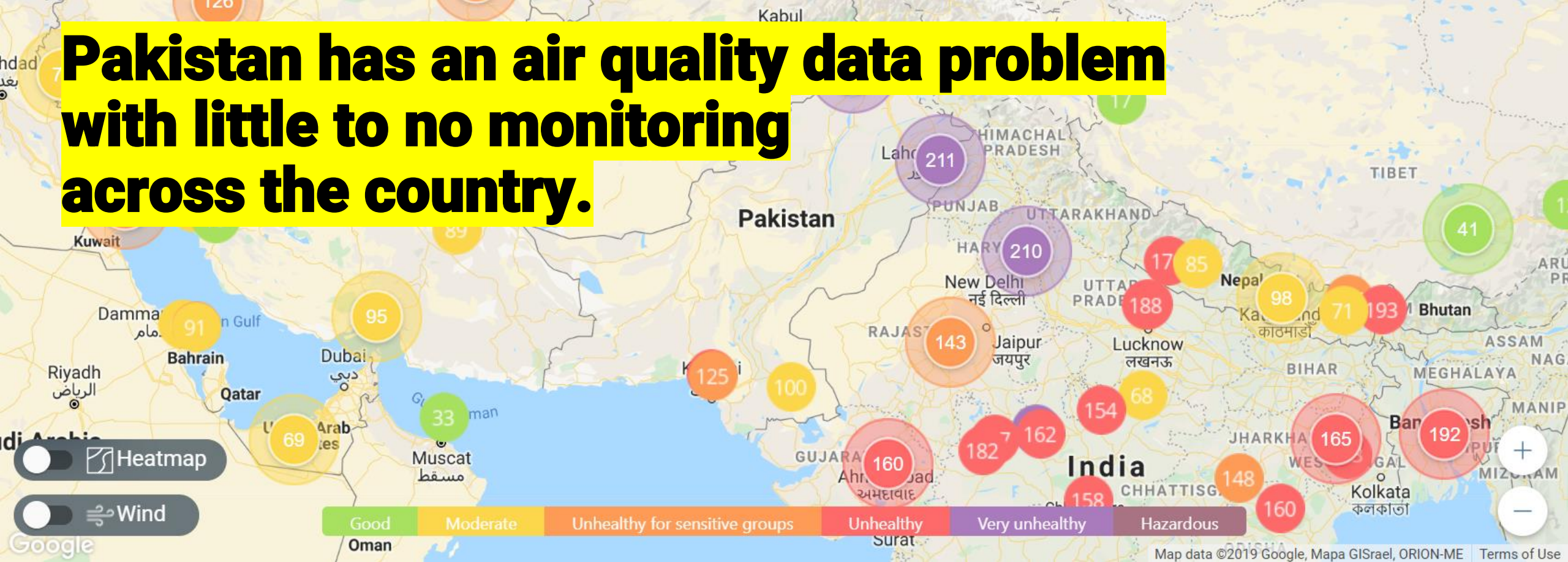
Photo credits: Dawar Hameed Butt (@Lahorewala)

19 April 2020



AQI 44
"Healthy"

Pakistan has an air quality data problem with little to no monitoring across the country.



- **Governments** worldwide are mandated to monitor air quality, not for the sake of data, but for creating and evaluating policy to meet and enforce environmental standards.
- **Monitoring** air pollution is key to reducing its prevalence and health impact.
- **Data in real-time** puts a magnifying glass on air pollution, helping create a cleaner environment when citizens can react to their local air pollution, and also evaluate impact of emission-reduction policy.

How we started: Open Air Quality Data on Twitter

**BeijingAir**  @BeijingAir · Jan 12, 2013

01-12-2013 20:00; PM2.5; 886.0; 755; Beyond Index

 13  122  58 

**BeijingAir**  @BeijingAir · Jan 12, 2013

01-12-2013 03:00; PM2.5; 425.0; 450; Hazardous (at 24-hour exposure at this level)

  2  2 

**BeijingAir**  @BeijingAir · Jan 11, 2013

01-10-2013 12:00 to 01-11-2013 11:59; PM2.5 24hr avg; 379.0; 420; Hazardous

 1  3  

**LahoreAir** @LahoreSmog · Nov 9, 2017

09-11-2017 11:11; PM2.5 conc. 829.6 $\mu\text{g}/\text{m}^3$; 717 Air Quality Index (AQI); Beyond Index

 5  10  5 

**LahoreAir** @LahoreSmog · Nov 10, 2017

10-11-2017 01:11; PM2.5 conc. 279.3 $\mu\text{g}/\text{m}^3$; 329 Air Quality Index (AQI); #Hazardous 🚨

  2  1 

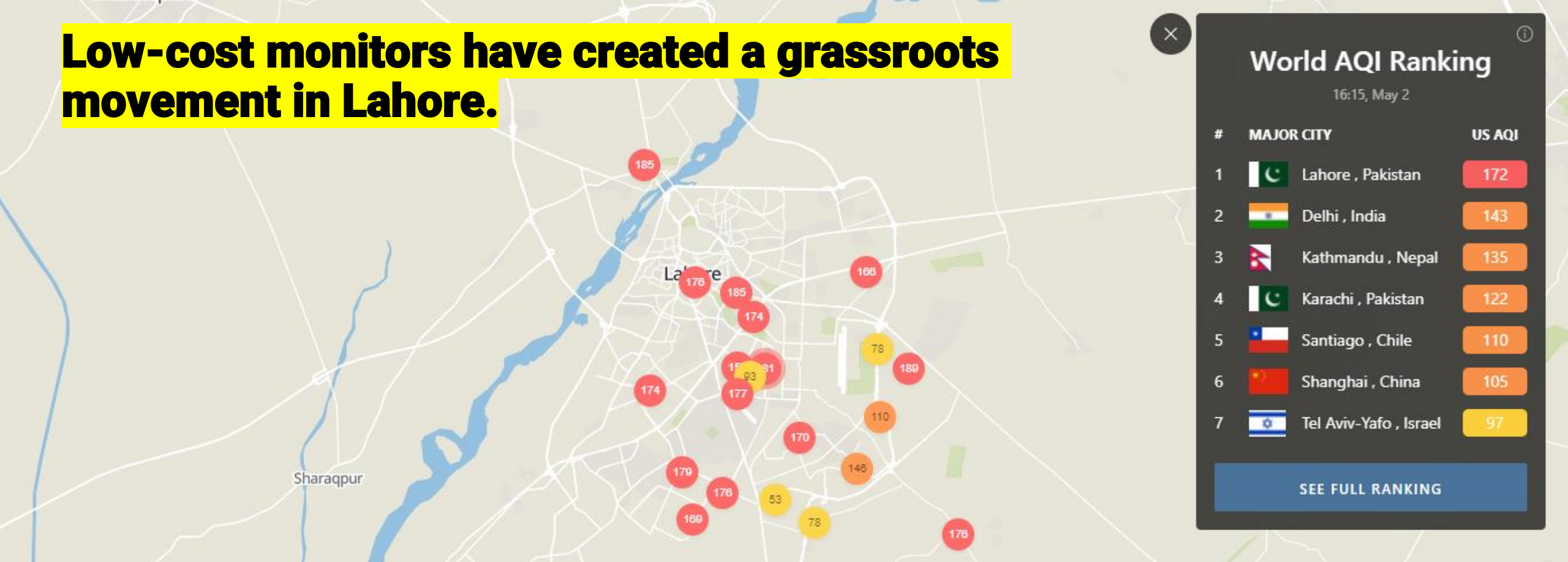
**LahoreAir** @LahoreSmog · Nov 9, 2017

09-11-2017 17:11; PM2.5 conc. 157.9 $\mu\text{g}/\text{m}^3$; 208 Air Quality Index (AQI); Very #Unhealthy 🤔

 1  1  1 

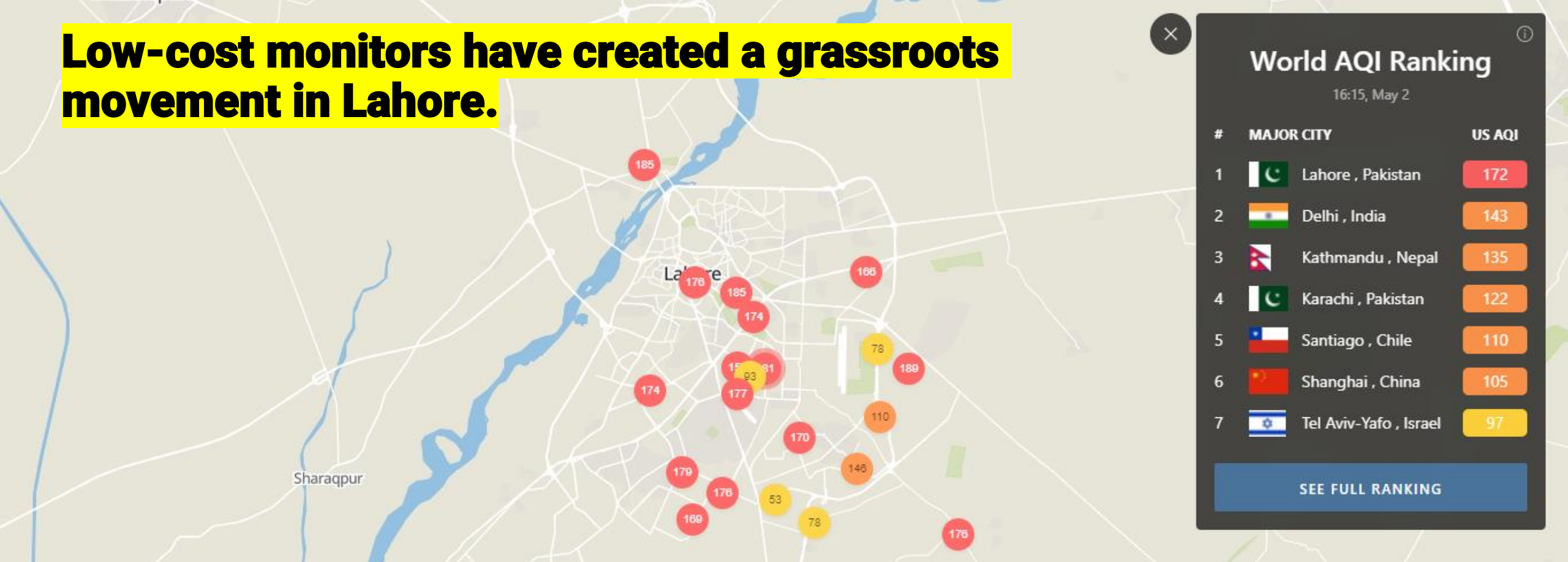
- **PAQI started as a curiosity** to understand more about the air in Pakistan, with the first monitor in 2016 tweeting hourly air quality data (inspired by @BeijingAir).
- **Hourly tweets of PM2.5 values** were initially ignored by the media as 'it's not news until it's breaking news.'
- **First media coverage** by the New York Times when PM2.5 levels reached $1,077 \mu\text{g}/\text{m}^3$ in November 2017, calling smog the 'Fifth Season' in Lahore.

Low-cost monitors have created a grassroots movement in Lahore.



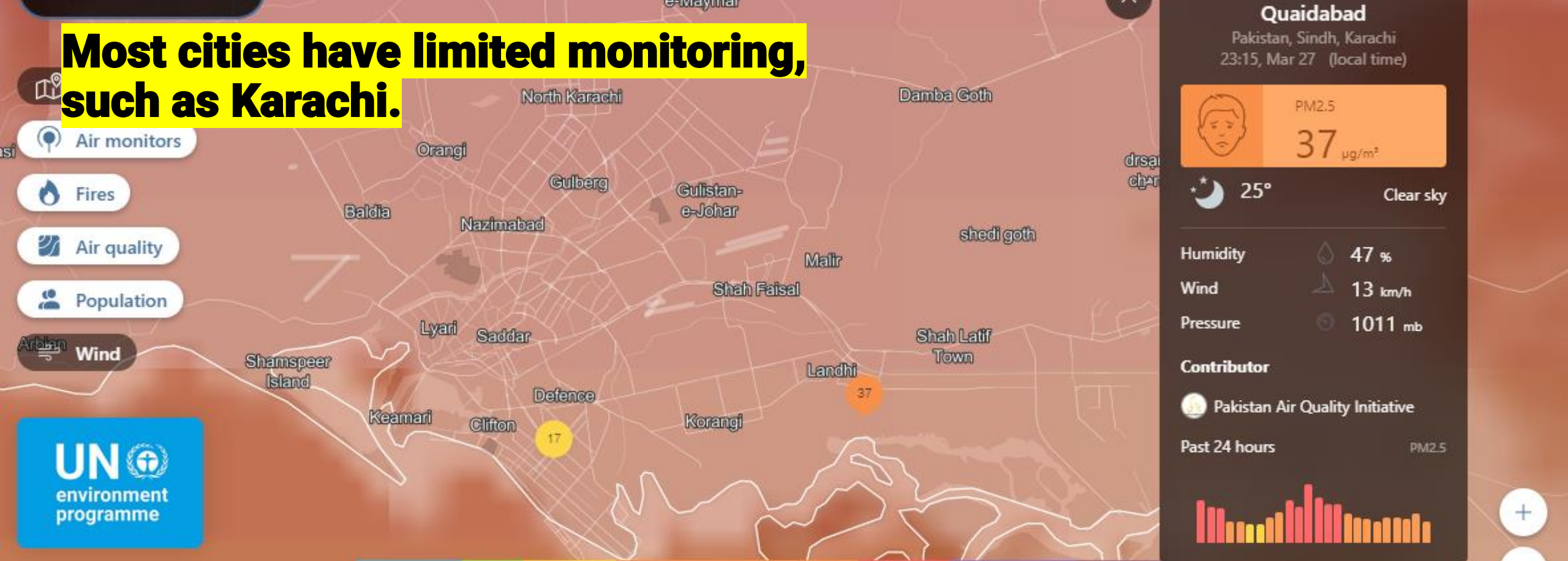
- **Availability of real-time data** through the IQAir/UNEP AirVisual website and app has helped create a grassroots citizen movement. Initial monitors were self-funded by the Pakistan Air Quality Initiative, and the rest are funded and hosted by concerned citizens and corporations.
- **More low-cost monitors** are required to achieve coverage density, enabling empowered public to fight air pollution, enabling researchers and policy-makers to further the fight on air pollution.
- **Reference-standard and multi-pollutant monitoring** is required to take this to the next steps.

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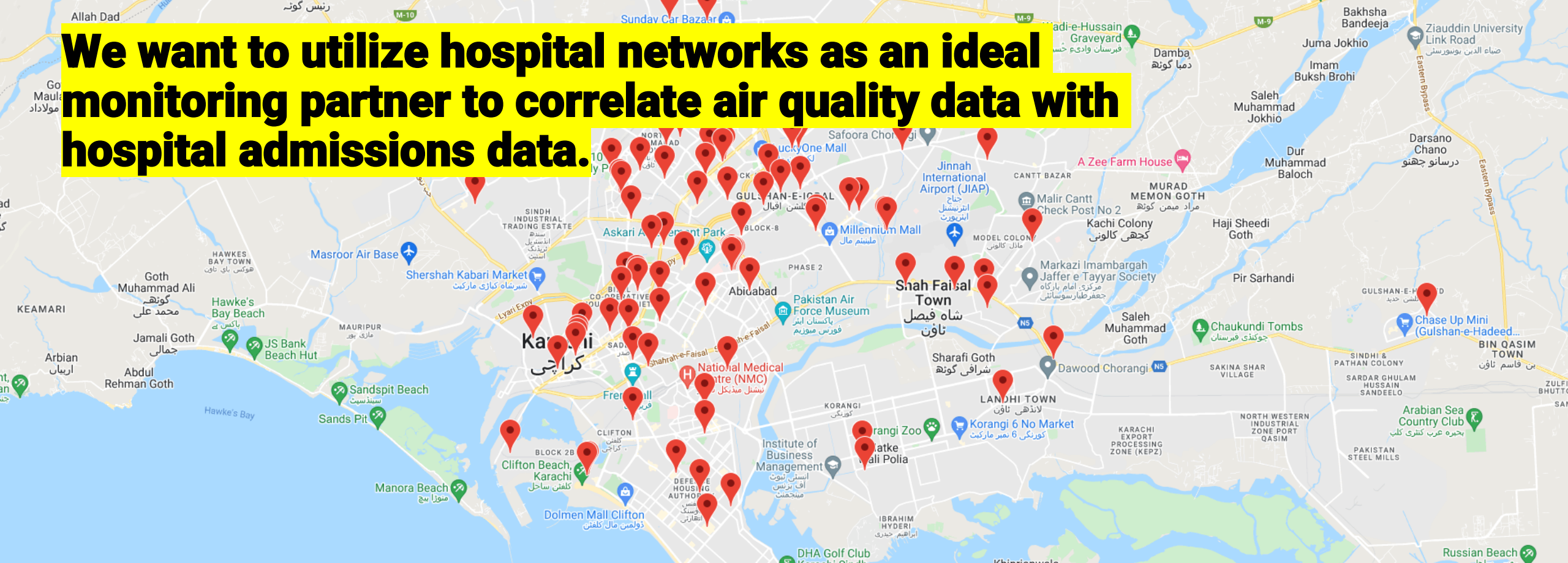
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Most cities have limited monitoring, such as Karachi.



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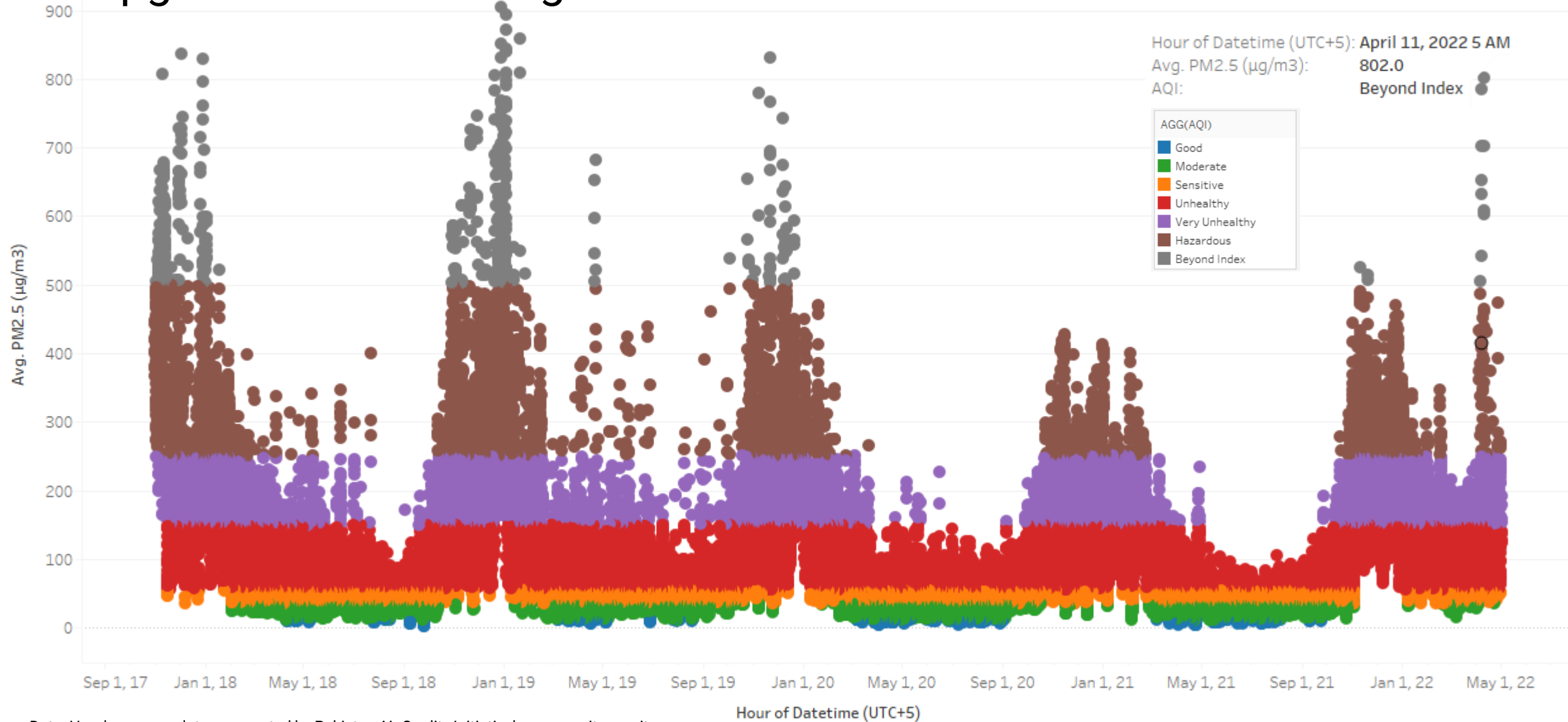
We want to utilize hospital networks as an ideal monitoring partner to correlate air quality data with hospital admissions data.



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- **Potential project partners in the healthcare sector** to correlate air quality data with hospital admissions data:
 - SINA Health, Education and Welfare Trust, 30 potential locations
 - The Aga Khan University Hospitals, Medical Centers and Clinical Laboratories, 100 potential locations

Open-data on Lahore's air pollution problem

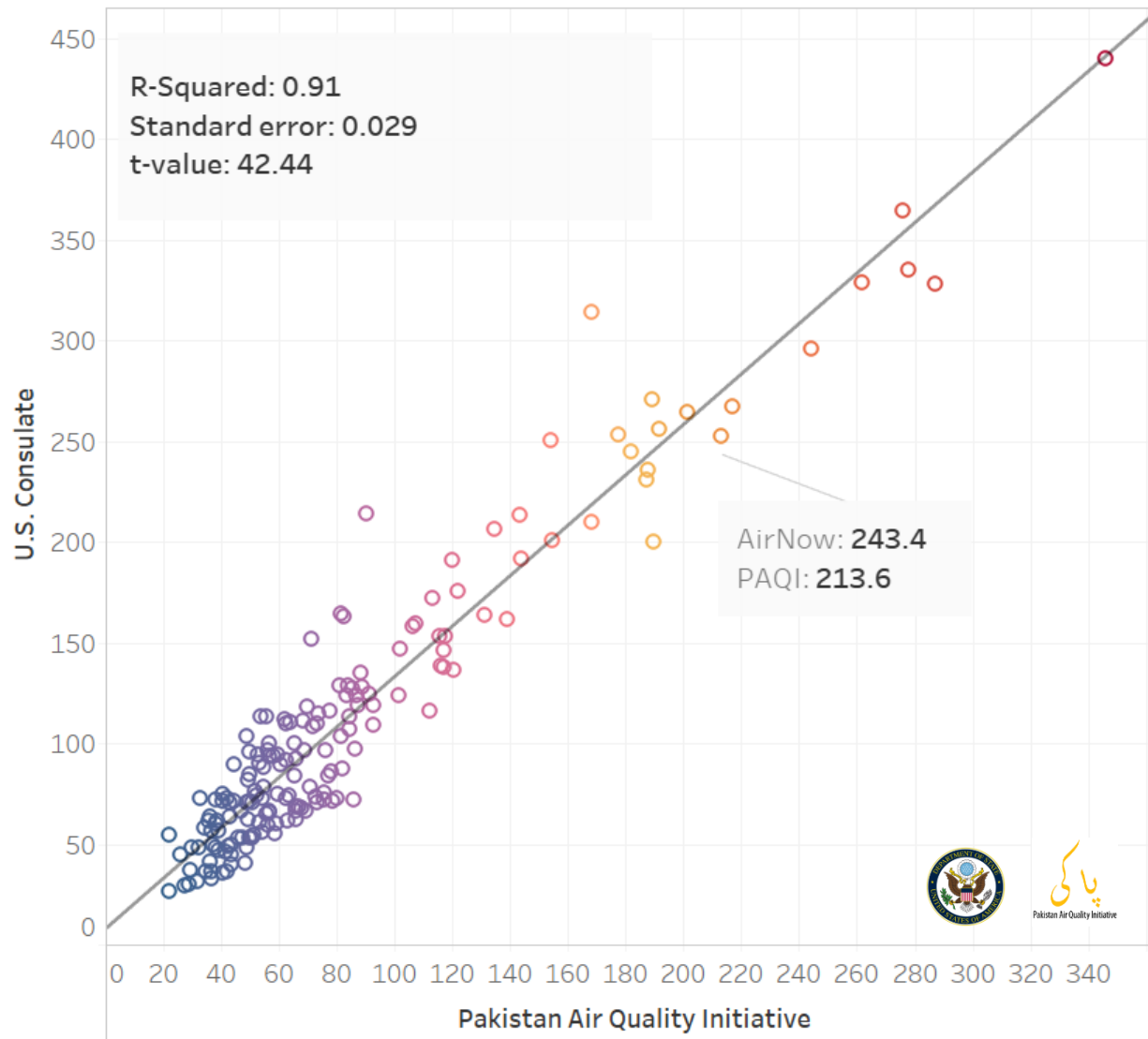
105 $\mu\text{g}/\text{m}^3$ annual average PM2.5 in 2021



Data: Hourly-average data aggregated by Pakistan Air Quality Initiative's community monitors.

Open-data on Lahore's air pollution problem

PAQI low-cost sensor data show excellent correlation



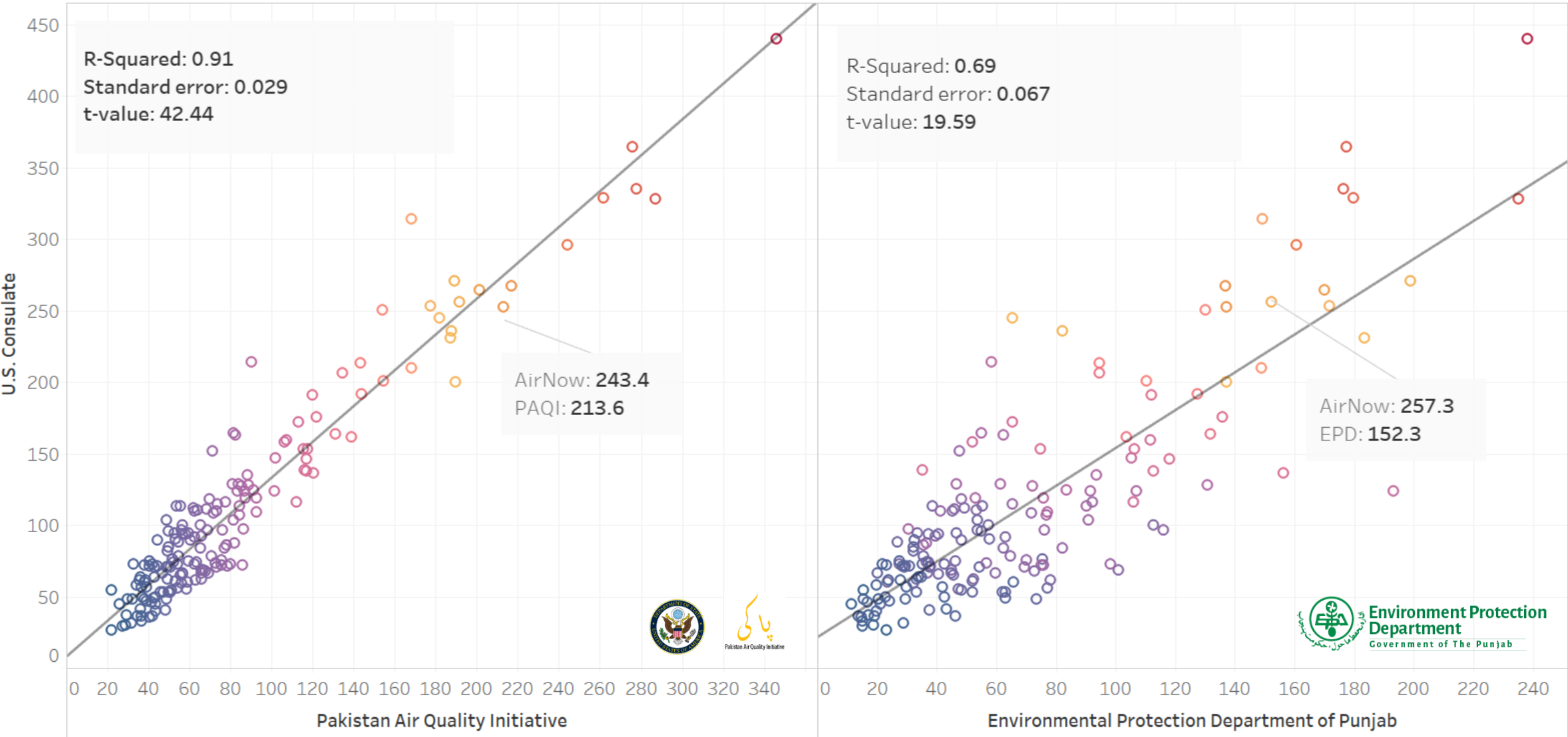
PAQI low-cost sensor data show excellent correlation with U.S. Consulate's reference-standard PM2.5 monitors for the 24-hour city average from May-November 2019:

- **R-Squared: 0.91**
- **Standard error: 0.029**
- **t-value: 42.44**

Data source: Pakistan Air Quality Initiative (PAQI), the Environmental Protection Department, Government of Punjab (EPD), and U.S Environmental Protection Agency (EPA) AirNow, reported as concentration of particulate matter of 2.5 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$).

Open-data on Lahore's air pollution problem

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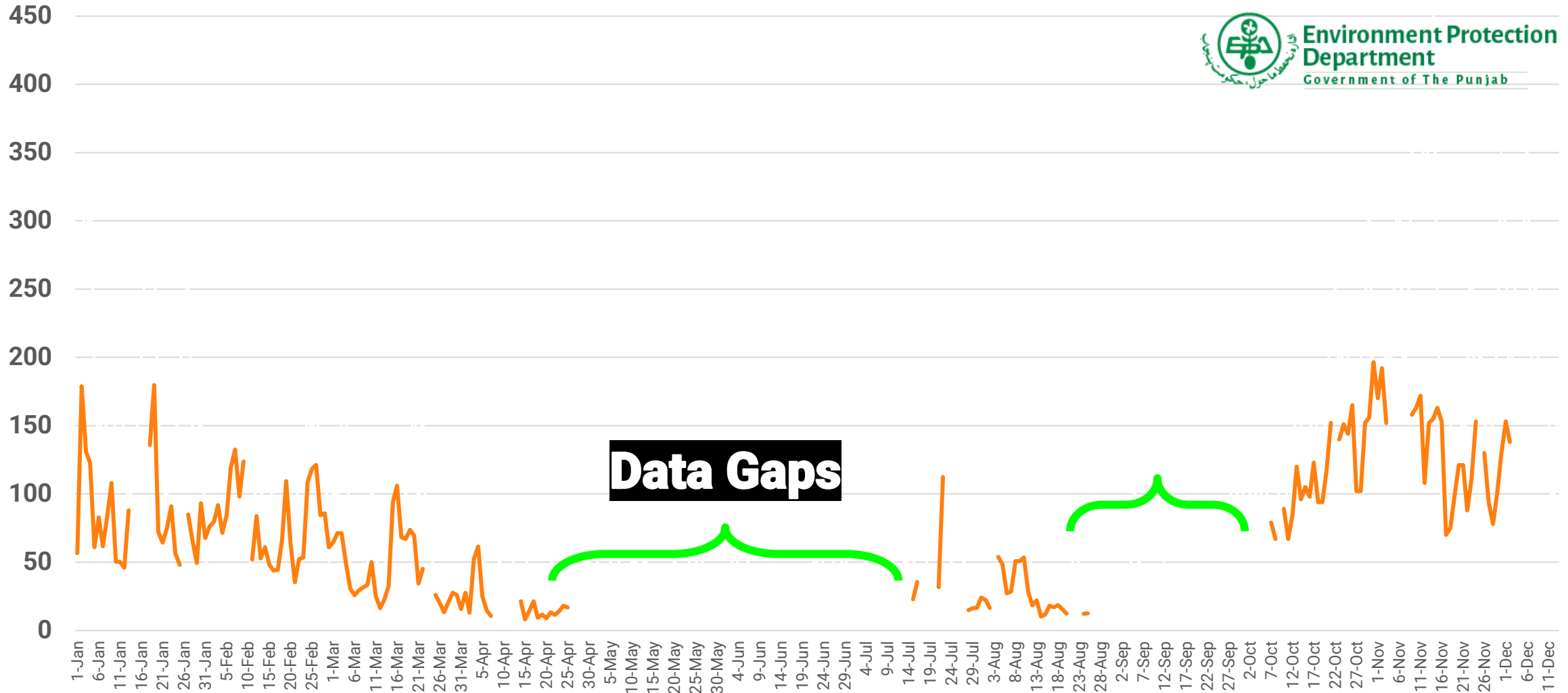


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Open-data on Lahore's air pollution problem

EPD reports 70 $\mu\text{g}/\text{m}^3$ of fine particulate matter

14 times above WHO safe limits!



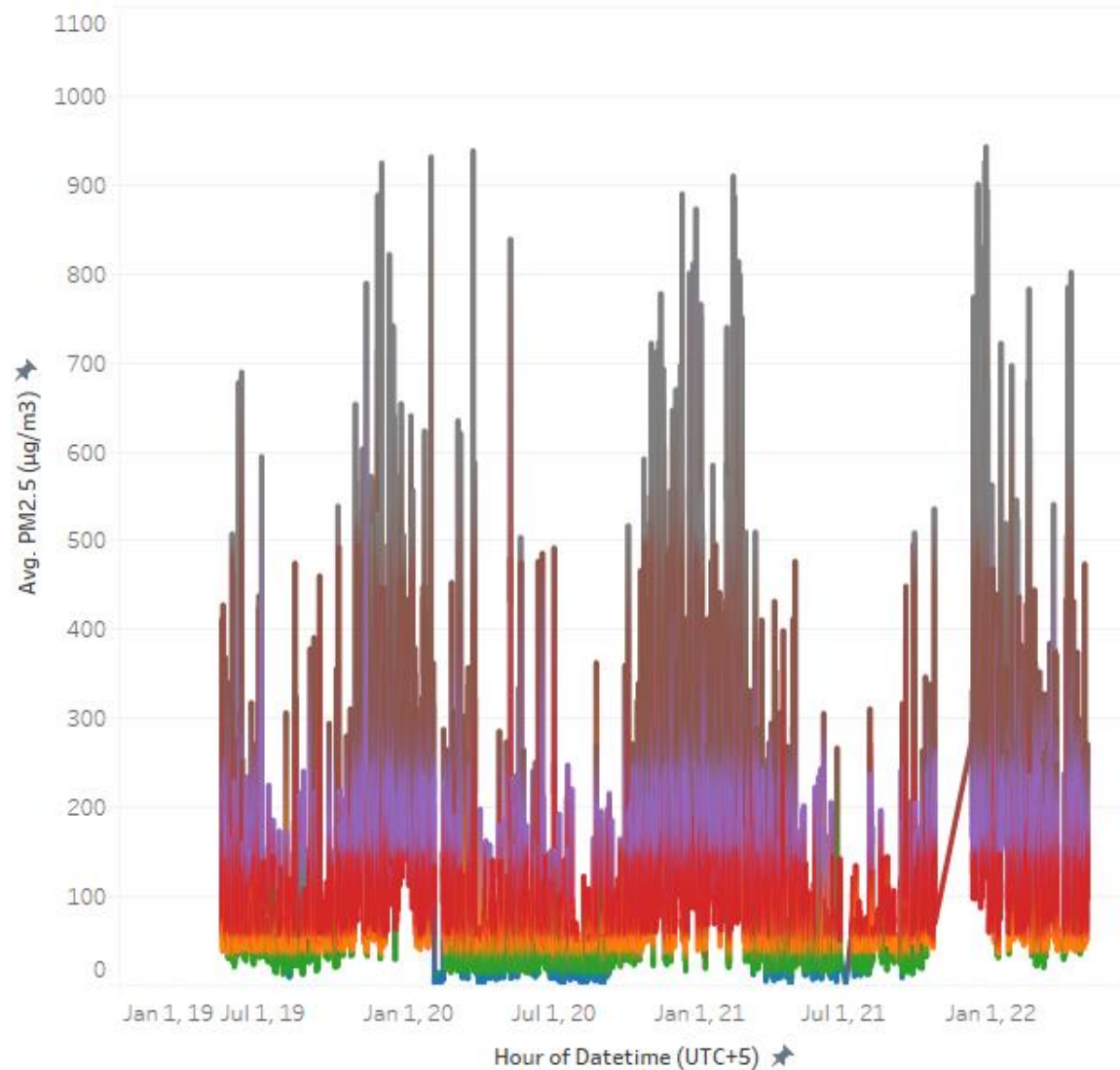
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Lahore is more polluted than New Delhi!

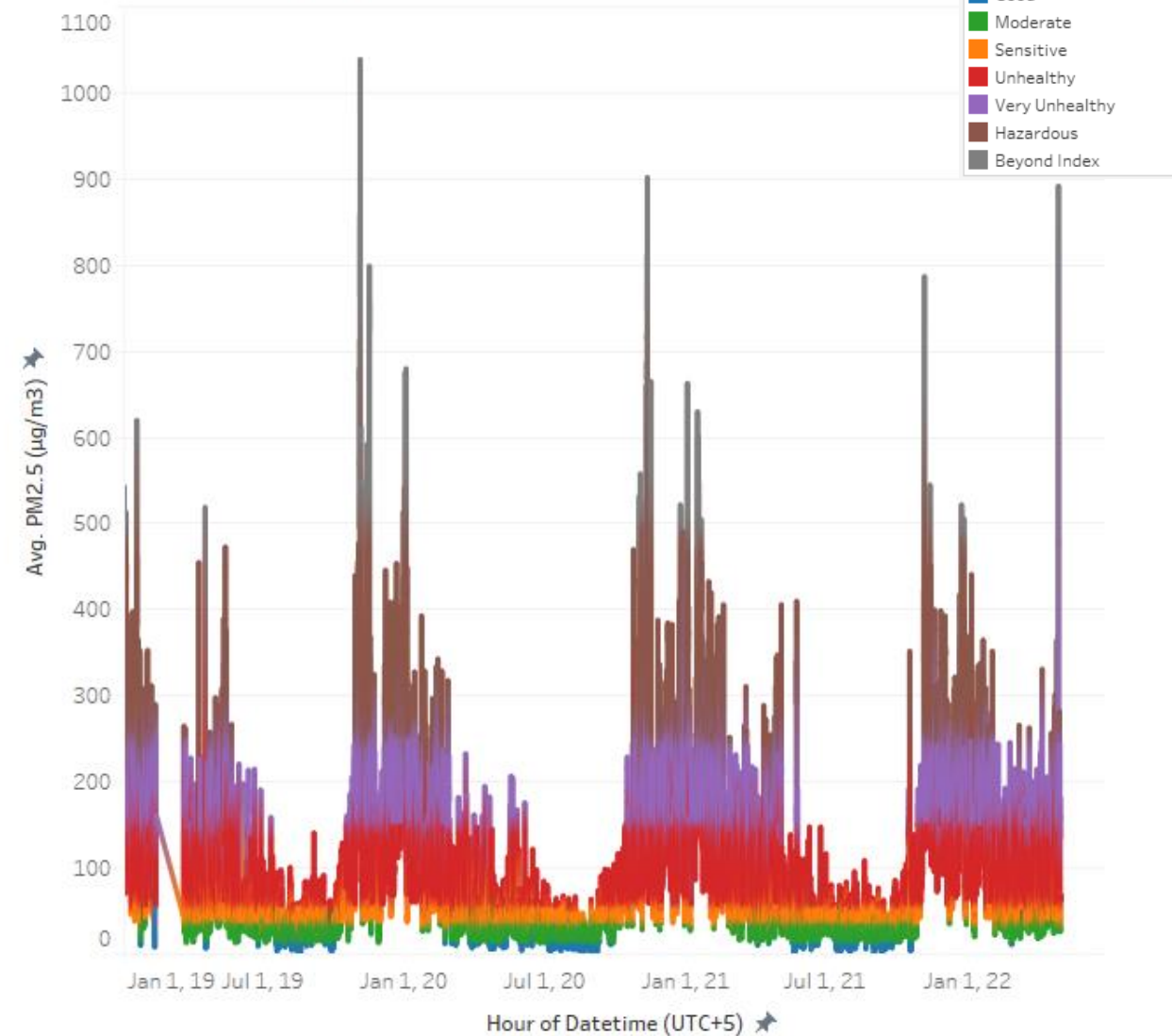
Data from US Consulate's BAM monitors



US Consulate - Lahore



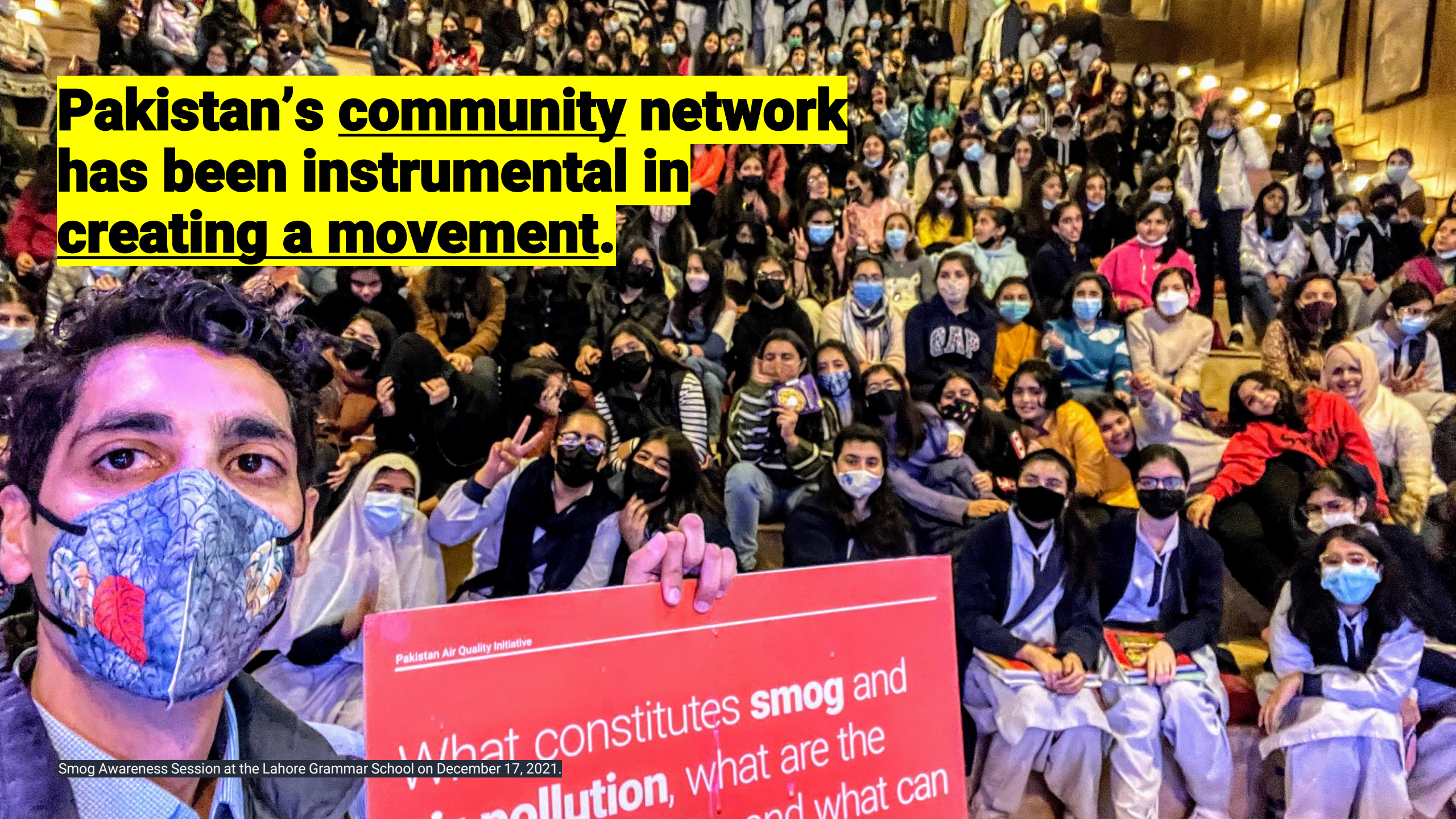
US Consulate - New Delhi



The dense alleys of the Walled City of Lahore has Hazardous air throughout the year.



Near Delhi Gate and Wazir Khan Mosque, Photo credit: Pakistan Air Quality Initiative on April 28, 2019.



■ **Pakistan's community network has been instrumental in creating a movement.**

'Scary Moms' Are Part Of The Citizen War Against Pollution In Pakistan



Volunteer 'Scary Moms' lead awareness sessions at 110 schools across Punjab.

Smog Awareness Session at the Information Technology University (ITU), Lahore on July 30, 2018.
[See the story on NPR.](#)



How to engage and develop a community of citizen scientists to deploy, maintain and manage air quality sensors in a decentralized network.

Social media

- **Post original content!**
Anyone can re-tweet, like or re-post.
- **Primary research**
Citizen scientists add value by creating and spreading new information through open data.
- **Network!**
Connect with fellow citizen scientists and “real” scientists to gain expertise in your area.

Traditional media

- **Engage**
Plan regular outreach and interactions.
- **Validate**
Traditional media is looking for validated and original new stories, it's up to you to convince them that your air inequality story is worth sharing.

Community

- **Meetups!**
Plan regular outreach and interactions, organize meetups, talks, events.
- **Schools & Universities**
Workshops and dialogues at schools and universities help engage new citizen scientists.
- **Government**
The government is your friend... try to find a meaningful engagement with policy-makers to champion your cause.

The elephant in the room for community networks.

Community-driven initiatives which are not organized under a formal institution have limited **access to funds**, and therefore have a limited scale and sustainability.

Urban waste disposal in Karachi, Pakistan. Photo credit: Pakistan Air Quality Initiative

We need you.



We are literally drowning in smog without your help.

Thick Air II, a sculpture by Ali Baba shown at the Smog Show, December 2021.

How can the ASIC community help?

- More **academic research** focused on Pakistan.
- Help us in statistical analysis to **publish our LCS data** in an academic journal to make it more reachable.
- **More low-cost monitors** are required to achieve coverage density, enabling empowered public to fight air pollution, enabling researchers and policy-makers to further the fight on air pollution. Help us expand the network across Pakistan.
- Collaborate with local institutions for **reference-standard** BAM monitors to help with co-location studies in the three major cities.
- Help us get a few **multi-pollutant monitors** to develop a more comprehensive understanding of air pollution (the SENSIT RAMP is a viable low-cost air quality monitoring platform).
- **Collaborate** with a local research institution in developing emissions inventory and source apportionment studies.



135,000 deaths per year are attributed to ambient air pollution in Pakistan.

135

Source: Cohen et al. (2017) Estimates and 25-year trends of the global burden of disease attributable to ambient air pollution: an analysis of data from the Global Burden of Diseases Study 2015.

The Lancet, 389 (10082) Retrived from
[https://doi.org/10.1016/S0140-6736\(17\)30505-6](https://doi.org/10.1016/S0140-6736(17)30505-6)

Thank you.



Pakistan Air Quality Initiative



 Air Sensors International Conference

Community-driven open-data on Pakistan's air pollution problem. This presentation was shared at the **Air Sensors International Conference 2022 Session 1D: Community Air Sensor Use** on May 11-13, 2022. Please contact Abid Omar of the Pakistan Air Quality Initiative for any questions or comments at abidomar@pakairquality.com.

Pakistan Air Quality Initiative

About us



About our founder

Abid Omar has a social mission: how can I help improve the environment of Pakistan? He sees the air pollution emergency in Pakistan as a silver lining — an opportunity to drive environmental awareness and change that will clean up Pakistan for good.

A key indicator of environmental issues is pollution that affects our daily lives, specifically air pollution. He found but there is no data for this, so he founded the Pakistan Air Quality Initiative to monitor air quality in across major urban areas of Pakistan and to provide awareness for air quality and air pollution issues, and therefore provide impetus for change.

His day job is in the technical textiles and filtration industries.



Pakistan Air Quality Initiative

About the Pakistan Air Quality Initiative

The Pakistan Air Quality Initiative (PAQI پاکسی) provides crowdsourced air quality data for Pakistan. PAQI is a community-driven initiative to set up low-cost, real-time monitors to capture air quality data and thereby increase social awareness. PAQI provides tools and information people need to thrive in polluted environments.

The Pakistan Air Quality Initiative was founded in 2016, and is a grassroots community organization.

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