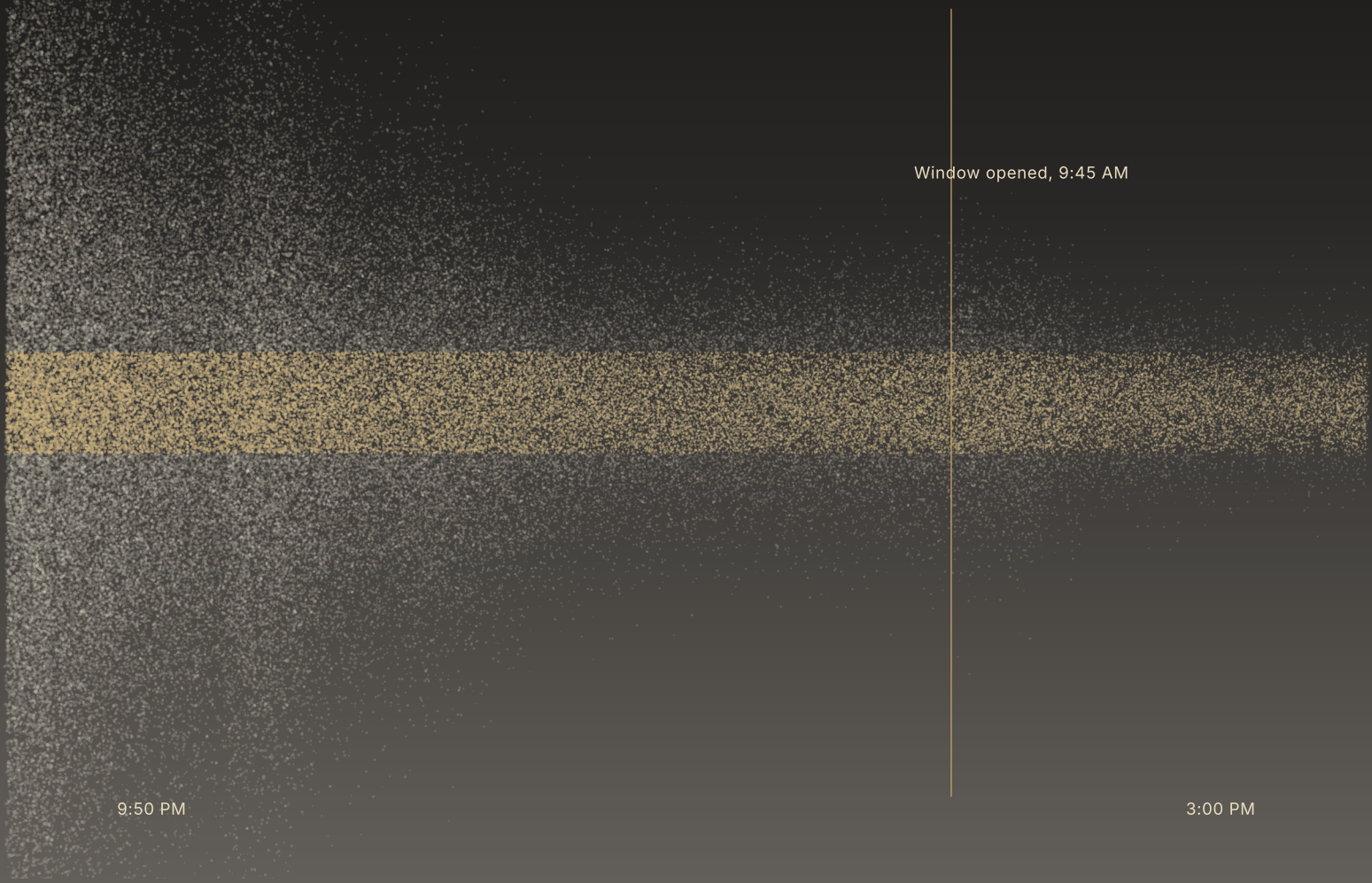
SentioAir.

NOTE 01 / INDOOR AIR ON DIWALI NIGHT / WHITE PAPER BASED ON INTERNAL MEASUREMENT

Diwali night, indoors: 17 hours of PM2.5 in a sealed home

4,112 READINGS AT 15-SECOND RESOLUTION FROM A FIRST-GENERATION SENTIOAIR PROTOTYPE
RAHATANI, PIMPRI-CHINCHWAD / 8 TO 9 NOVEMBER 2026



Cover: every dot is drawn from the PM2.5 readings in this study. Density follows concentration, from 9:50 PM (left) to 3:00 PM (right).

STUDY OVERVIEW

Abstract

Background: Firecrackers on Diwali night drive some of the year's highest particle pollution in Indian cities. Closing windows is the most common household response, yet little has been published on what PM2.5 inside a closed home does through the night and the morning after. We measured it.

Methods: A first-generation SentioAir prototype recorded PM2.5 every 15 seconds in a closed room of an apartment in Rahatani, Pimpri-Chinchwad, from 9:50 PM on 8 November 2026 (Lakshmi Puja night) to 3:00 PM on 9 November. Windows were shut before recording began and stayed shut until about 9:45 AM, then stayed open. No air purifier, air conditioner or exhaust fan was used. We computed PM2.5 sub-indices on the Central Pollution Control Board (CPCB) National Air Quality Index scale, fitted exponential decay models to the sealed period, and compared the results with outdoor figures reported for Pune.

Results: PM2.5 peaked at 465 µg/m³ (Severe) at 9:51 PM. With windows shut, it decayed exponentially with a half-life of 3.1 to 3.5 hours (R^2 0.95 to 0.97), interrupted by a rebound from 243 to 296 µg/m³ around midnight. From 6:00 AM to 9:45 AM it stopped falling and held at a mean of 81 µg/m³ (Moderate). The unit registered the window opening at 9:44:51 AM as a step change in its humidity reading. PM2.5 first rose 13% as outdoor air entered, then fell; the one-hour mean dropped below India's 24-hour standard of 60 µg/m³ at 11:52 AM. Over 17 hours 9 minutes the room averaged 142 µg/m³, 2.4 times the Indian standard and 9.5 times the WHO guideline, a PM2.5 sub-index of 318 (Very poor). This was higher than every outdoor AQI reported for Pune and Pimpri-Chinchwad over the same night. The prototype captured 99.9% of expected readings.

Conclusion: A sealed room held firecracker smoke for hours and could not clean itself below the level set by the air leaking in. Opening a window once outdoor air improved finished the job. On Diwali night, when windows are closed and opened matters as much as whether they are.

STUDY OVERVIEW

At a glance

465 µg/m³

Peak PM2.5 at 9:51 PM, Severe band, inside a closed room

3.1 to 3.5 h

Half-life of PM2.5 in the sealed room overnight

81 µg/m³

Where the sealed room stalled, 6:00 to 9:45 AM (Moderate)

2 h 7 min

From opening the window to a one-hour mean below 60 µg/m³

318 AQI

17-hour PM2.5 sub-index (Very poor), vs 242 reported for Pune city

99.9 %

Data coverage at 15-second resolution from a first-generation prototype

Key takeaways:

- **Smoke that gets in stays in.** Firecracker smoke entered before the windows were closed. The sealed room read 465 µg/m³ at 9:51 PM and stayed in the Severe band for about four hours.
- **A sealed room clears slowly.** With no purifier or fan running, indoor PM2.5 halved roughly every 3 to 3.5 hours overnight.
- **Then it stops clearing.** From 6:00 AM to 9:45 AM the room held at about 81 µg/m³ (Moderate), close to the level of the outdoor air leaking in.
- **Opening the window, at the right time, finished the job.** After the window opened at 9:45 AM and outdoor air cleared, the one-hour mean fell below 60 µg/m³ within about two hours and averaged 41 µg/m³ from noon to 3:00 PM.
- **Indoors was worse than the city.** The room's 17-hour PM2.5 sub-index of 318 (Very poor) was higher than every outdoor AQI reported for Pune and Pimpri-Chinchwad that night, including 242 for Pune city.
- **High-resolution data shows what daily averages hide.** At 15-second resolution the prototype captured a midnight rebound, a morning plateau and the window opening, to within a minute of the occupant's log.

01 / CONTEXT

1. Introduction

Diwali is the one night of the year when much of urban India lights firecrackers at the same time. Measurements in Indian cities have repeatedly recorded sharp rises in particle pollution on Diwali night [1]. In New Delhi, ambient PM2.5 rose to about 16 times its pre-firework level during Diwali, and fireworks accounted for about 95% of the elemental fraction of PM2.5 [2]. Close to the source, exposure is far higher: a study in Pune measured breathing-zone PM2.5 peaks of 4,860 to 64,500 µg/m³ from single firecrackers [3].

Most of that exposure plays out indoors. People spend the large majority of their time inside buildings [4], and on Diwali night most are at home. The usual advice during smoke events is to keep windows and doors closed. Outdoor particles still reach indoor air through gaps in the building, and once inside they are removed slowly, by air exchange and by settling on surfaces [5, 6]. How long a closed home holds a sudden load of firecracker smoke, and what happens when the windows are opened the next morning, is rarely measured at high time resolution.

India's official air quality figures come from outdoor monitoring stations and are summarized on the CPCB National Air Quality Index, which is built on 24-hour averages [7]. Those figures describe the street, not the bedroom. Low-cost optical particle sensors make continuous indoor measurement practical, with known limits that call for careful interpretation [8].

This white paper reports a continuous indoor record across Diwali night 2026, taken by a first-generation SentioAir prototype, designed and built in Pune by EmergeSphere Technologies, an Indian deep-tech startup. We describe what the measurements show, how fast a sealed room cleared, what changed when a window was opened, and how indoor exposure compared with the outdoor figures reported for the city.

02 / METHODS

2. Methods

2.1 Setting

Measurements were taken in a closed room of an apartment in Rahatani, Pimpri-Chinchwad, Pune, across Lakshmi Puja night, the main night of Diwali. The occupant kept a log of ventilation and room conditions (Table 1).

Table 1. Setting and room conditions

Item	Detail
Location	Rahatani, Pimpri-Chinchwad, Pune, Maharashtra, India
Space	One closed room in an apartment
Date	8 to 9 November 2026 (Lakshmi Puja night)
Recording	9:50 PM on 8 November to 3:00 PM on 9 November (17 h 9 min)
Windows	Closed before 9:50 PM; opened at about 9:45 AM and left open until 3:00 PM
Interior door	Closed overnight
Air cleaning	None: no air purifier, air conditioner or exhaust fan
Main smoke source	Firecracker smoke from outside, which entered before the windows were closed (occupant report)

All times are Indian Standard Time (IST, UTC+5:30).

2.2 Device

The SentioAir prototype is a first-generation home air monitor designed and built by EmergeSphere Technologies in Pune. It measures fine particles with an optical particle sensor and reports PM2.5 every 15 seconds, together with temperature, relative humidity and several gas channels, to the SentioAir cloud platform, from which the data for this study were exported. PM2.5 values are the unit's corrected output. The unit used here (SA-A8D3D4) ran the same firmware throughout. Only the streams listed as used in Table 2 enter the analysis.

Table 2. Data streams and their use in this study

Stream	Interval	Use	Note
PM2.5	**15 seconds**	**Primary outcome**	**All readings retained**
Relative humidity	15 seconds	Event detection only	Sensor sits inside the housing and reads drier than the room; only changes were used
Temperature	15 seconds	Not used	Raised by heat from the unit's own electronics
Gas channels	15 seconds	Not used	Calibration in progress on this prototype

2.3 Timeline

The record divides into four phases set by the ventilation log (Fig. 1): the sealed evening and night, when the smoke decayed; a sealed morning plateau; the first hour after the window was opened; and the open-window late morning and afternoon.

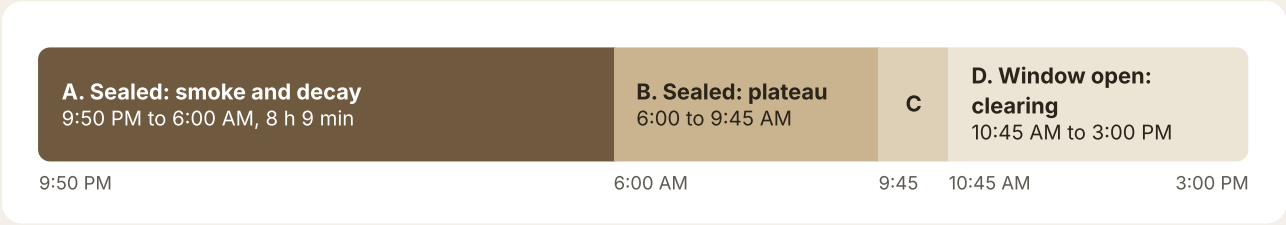


Figure 1. Study timeline, drawn to scale. Phase C (9:45 to 10:45 AM) is the first hour after the window was opened, when outdoor and indoor air mixed. Windows were closed in phases A and B and open in C and D. No air cleaning was used at any point.

2.4 Data processing

Timestamps were converted to IST. Readings were averaged into 1-minute, 2-minute, 10-minute and 1-hour means for analysis and display. No readings were removed. Time spent in each AQI band was counted from the individual 15-second readings. Data coverage was assessed against the 15-second schedule.

02 / METHODS

2.5 Air quality index

PM2.5 concentrations were converted to sub-index values with the CPCB National AQI breakpoints [7], by linear interpolation within each band (Table 3). CPCB defines the official AQI on 24-hour averages, with at least 16 hours of data and at least three pollutants, one of which must be PM2.5 or PM10 [7]. The 17-hour record meets the 16-hour minimum for a PM2.5 sub-index; hourly values are indicative only. We also compare concentrations with India's 24-hour standard for PM2.5 of 60 µg/m³ [9] and the WHO 2021 24-hour guideline of 15 µg/m³ [10].

Table 3. CPCB National AQI bands for PM2.5

Band	PM2.5, µg/m³	AQI	Possible health impact (CPCB)
Good	0 to 30	0 to 50	Minimal impact
Satisfactory	31 to 60	51 to 100	Minor breathing discomfort to sensitive people
Moderate	61 to 90	101 to 200	Breathing discomfort to people with lung disease such as asthma, and discomfort to people with heart disease, children and older adults
Poor	91 to 120	201 to 300	Breathing discomfort to people on prolonged exposure, and discomfort to people with heart disease
Very poor	121 to 250	301 to 400	Respiratory illness on prolonged exposure; stronger effect in people with lung and heart disease
Severe	above 250	401 to 500	Respiratory effects even in healthy people; serious impact on people with lung or heart disease

2.6 Decay model

For the sealed period, the room was treated as a single well-mixed space that loses particles at a constant total rate λ, the sum of air exchange and deposition on surfaces, toward a background level C_b sustained by outdoor air leaking in [5, 6]:

$$C(t) = C_b + (C_0 - C_b)\, e^{-\lambda t}$$

Here C_0 is the concentration at the start of the fit and t is time in hours. The half-life of the excess above C_b is ln 2 / λ. We fitted this model by nonlinear least squares to 1-minute means over three windows. We also fitted a simple log-linear model, with C_b fixed at zero, to 2-minute means from 10:20 PM to 6:00 AM. R^2 is reported for each fit; for the log-linear model it is computed on the log scale.

02 / METHODS

2.7 Event detection

The window opening was identified in the humidity stream as the first sustained change after a stable morning baseline, and compared with the occupant's log. PM2.5 before and after the opening was compared over two 30-minute windows, 9:15 to 9:44 AM and 9:46 to 10:16 AM.

2.8 Outdoor comparison

No outdoor monitor was placed at the building. Outdoor figures for the same night were taken from news reports that cite CPCB bulletins and the Air Quality Early Warning System of the Indian Institute of Tropical Meteorology (IITM) [11, 12]. Station AQI values combine several pollutants and are mostly 24-hour averages, city values average across stations, and the IITM figures are forecasts. The comparison is therefore directional, not a like-for-like measurement.

2.9 Software

Analysis was done in Python with pandas, NumPy and SciPy; figures were drawn with Matplotlib.

03 / RESULTS

3. Results

3.1 Overview

The prototype logged 4,112 PM2.5 readings over 17 hours 9 minutes, 99.9% of the 4,118 expected at its 15-second interval (section 3.8). Concentrations ranged from 11 to 465 µg/m³, with a mean of 142.2 µg/m³ and a median of 91 µg/m³ (Table 4). The sealed night averaged 226.8 µg/m³; the open-window afternoon from noon to 3:00 PM averaged 40.6 µg/m³, 82% lower.

Table 4. PM2.5 by phase (µg/m³)

Phase	Time	Readings	Mean	Median	Range	Band of mean
A. Sealed: smoke and decay	9:50 PM to 6:00 AM	1,952	226.8	210	70 to 465	Very poor
B. Sealed: plateau	6:00 to 9:45 AM	900	81.2	81	56 to 148*	Moderate
C. Window open: mixing	9:45 to 10:45 AM	240	89.2	89.5	66 to 110	Moderate
D. Window open: clearing	10:45 AM to 3:00 PM	1,020	46.5	44	11 to 107	Satisfactory
Full record	**9:50 PM to 3:00 PM**	**4,112**	**142.2**	**91**	**11 to 465**	**Very poor**

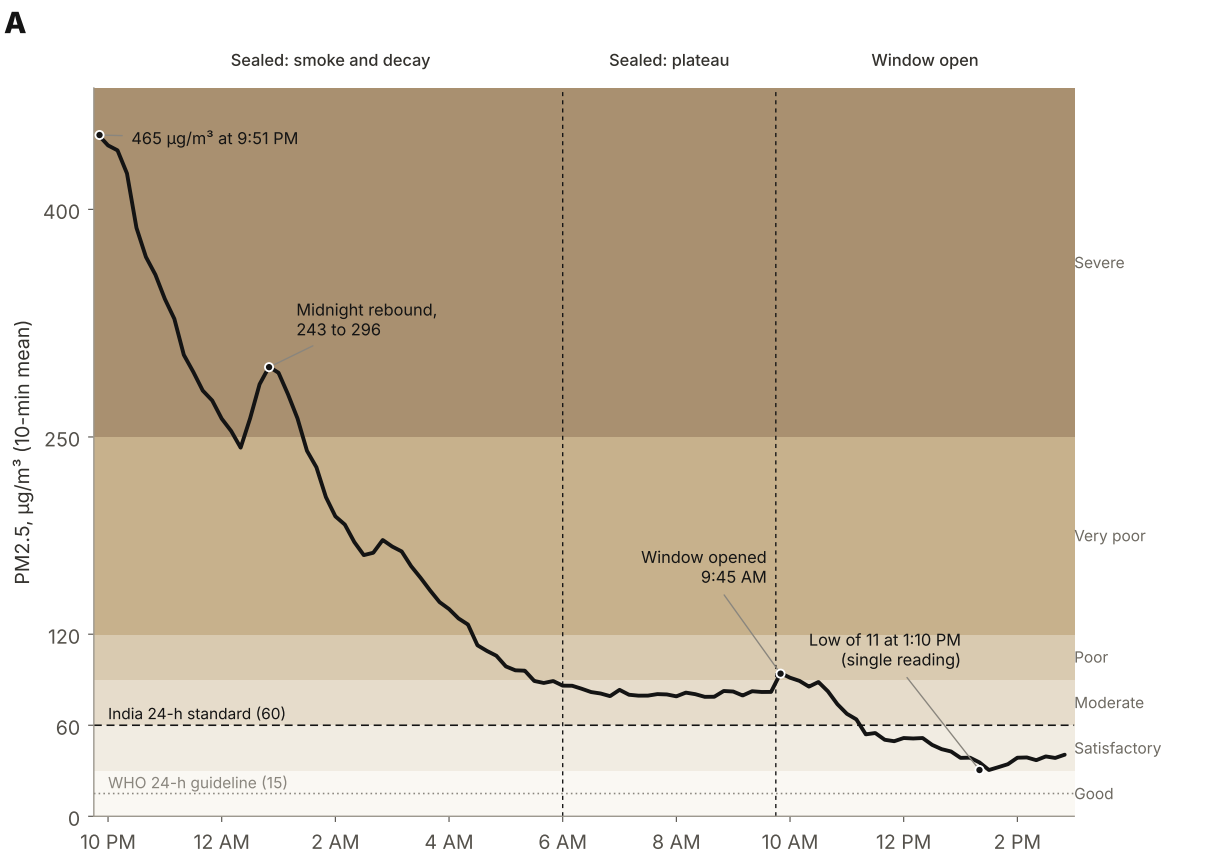
*The 148 µg/m³ maximum in phase B is a single 15-second reading at 9:30 AM. Band of mean uses CPCB PM2.5 breakpoints (Table 3).

Figure 2 shows the full record. Phase A carries almost all of the exposure: the room spent its first four hours in the Severe band and most of the rest of the night in Very poor. The plateau in phase B is visible as a flat line in the Moderate band, and the drop in phase D brings the room to Satisfactory for the afternoon.

3.2 The evening: Severe for four hours

Recording began at 9:50 PM with readings already above 430 µg/m³, and PM2.5 peaked at 465 µg/m³ at 9:51 PM. Hourly sub-indices stayed in the Severe band through the 1 AM hour (Fig. 2B). Around midnight the decline reversed: the 10-minute mean rose from 243 µg/m³ at 12:20 AM to 296 µg/m³ at 12:50 AM before falling again. With windows and door shut and no reported indoor source, this rebound is consistent with fresh smoke from late-night firecrackers leaking in through the building shell [5]. Across the whole record, 19.9% of readings were above 250 µg/m³, the Severe threshold.

03 / RESULTS



B Hourly PM2.5 sub-index (top) and mean PM2.5, µg/m³ (bottom)

9:50 PM	10 PM	11 PM	12 AM	1 AM	2 AM	3 AM	4 AM	5 AM	6 AM	7 AM	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM
480	462	422	408	402	349	332	301	210	177	169	168	179	184	95	81	59	65
449	403	303	267	252	183	161	120	93	83	81	80	84	85	57	48	35	39

Severe · Very poor · Poor · Moderate · Satisfactory · Good · Darker = worse

Figure 2. The full 17-hour record. (A) 10-minute mean PM2.5 against CPCB bands (shading, darker = worse), India's 24-hour standard and the WHO guideline; dashed vertical lines mark the phase boundaries at 6:00 AM and 9:45 AM. (B) Hourly PM2.5 sub-index and mean concentration; the first cell covers 9:50 to 10:00 PM only. Hourly sub-indices are indicative; CPCB defines the AQI on 24-hour averages.

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3.3 Overnight decay

Between the evening peak and the morning, PM2.5 fell along a close-to-exponential curve (Fig. 3A). The log-linear model gave a half-life of 3.5 hours (R^2 0.95). The model with a background term, fitted to the whole sealed period, gave a half-life of 3.1 to 3.3 hours, a total loss rate of 0.21 to 0.22 per hour and R^2 of 0.96 to 0.97 (Table 5). Fitted only from 1:15 AM, after the midnight rebound, the decay was faster, with a half-life of 1.7 hours, toward a higher background of 67 µg/m³, approaching the plateau that followed. Across the four fits, the room took roughly 3 to 3.5 hours to halve its PM2.5 for most of the night, with no purifier or fan running.

Table 5. Decay model fits for the sealed period

Fit	Window	Model	C_b, µg/m³	λ, per hour	Half-life	R^2
1	**10:20 PM to 6:00 AM**	**Log-linear, 2-min means**	**0 (fixed)**	**0.20**	**3.5 h**	**0.95**
2	9:50 PM to 9:44 AM	With background, 1-min means	32	0.22	3.1 h	0.97
3	10:20 PM to 9:44 AM	With background, 1-min means	27	0.21	3.3 h	0.96
4	1:15 AM to 9:44 AM	With background, 1-min means	67	0.42	1.7 h	0.97

λ is the total loss rate (air exchange plus deposition). Half-life is ln 2 / λ. For fit 1, R^2 is computed on the log scale.

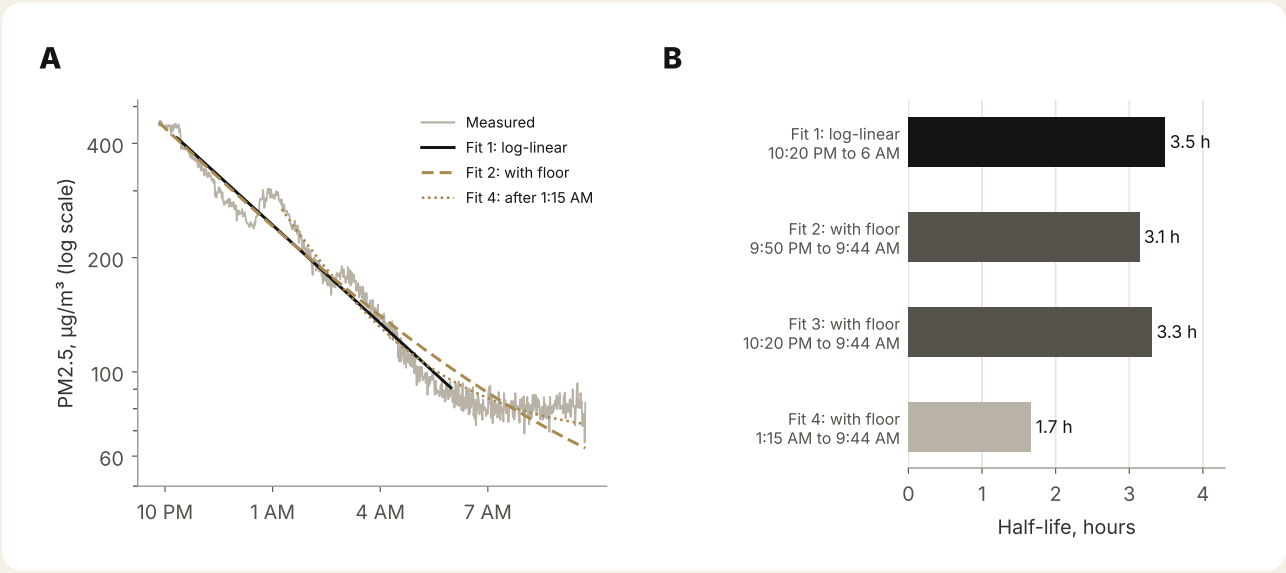


Figure 3. Overnight decay in the sealed room. (A) 1-minute mean PM2.5 on a log scale, with fits 1, 2 and 4 from Table 5. A straight line on this scale means exponential decay; the bump around midnight is the rebound described in section 3.2. (B) Half-life from each fit.

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3.4 The morning plateau

From 6:00 AM to 9:45 AM the room stopped clearing. PM2.5 averaged 81.2 µg/m³ (median 81; 10th to 90th percentile, 70 to 92), with a trend of −0.9 µg/m³ per hour, effectively flat. The room spent this whole period in the Moderate band. A plateau of this kind is expected once indoor levels fall to the level sustained by outdoor air leaking in [5]. The next phase supports this reading: when the window was opened, indoor PM2.5 rose rather than fell, showing that the outdoor air at that hour was still dirtier than the air inside.

3.5 The window opening

The unit's humidity reading, steady at 27% for the preceding half hour, shifted at 9:44:51 AM and fell to 23% by 9:57 AM (Fig. 4B), matching the occupant's log of the window being opened at about 9:45 AM. PM2.5 rose from a mean of 80.8 µg/m³ in the 30 minutes before to 91.6 µg/m³ in the 30 minutes after (+13%), with a maximum of 110 µg/m³ at 9:52 AM (Fig. 4A). It held near 90 µg/m³ until about 10:45 AM, then fell steadily as outdoor air cleared through the late morning. The 10-minute mean was below 60 µg/m³ from 11:20 AM, and the one-hour mean crossed below 60 µg/m³ at 11:52 AM, 2 hours 7 minutes after the window was opened. From noon to 3:00 PM the room averaged 40.6 µg/m³ (Satisfactory). The lowest single reading, 11 µg/m³, came at 1:10 PM.

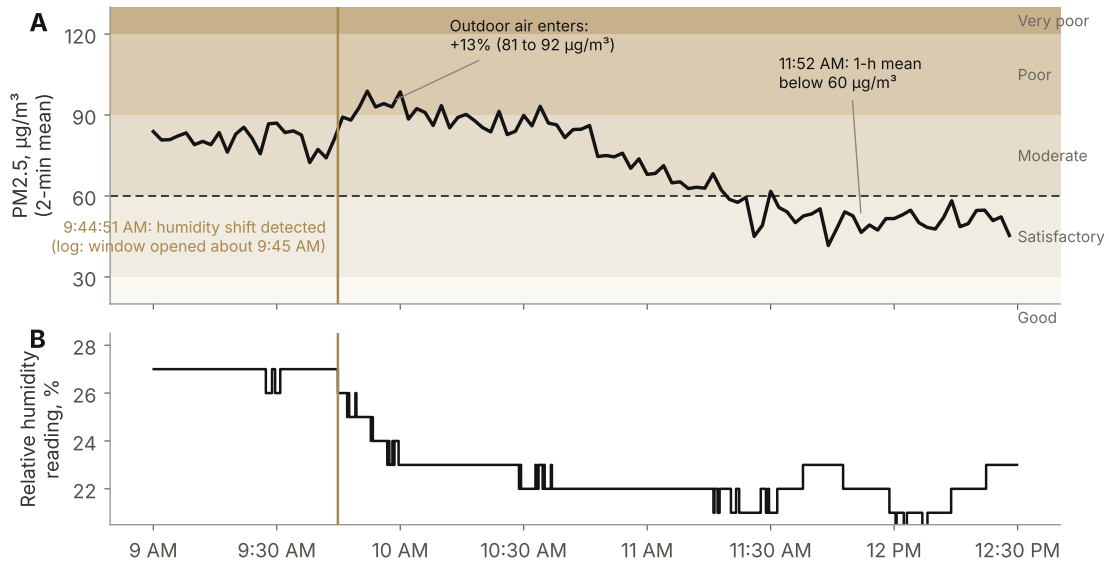


Figure 4. The window opening, 9:00 AM to 12:30 PM. (A) 2-minute mean PM2.5 against CPCB bands, with India's 24-hour standard (dashed). (B) The unit's relative humidity reading, which changes in 1% steps. The gold line marks 9:44:51 AM, when the humidity reading first shifted. The humidity sensor sits inside the housing and reads drier than the room, so only its change is used.

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3.6 Exposure against standards

The room spent 6 hours 38 minutes in the Very poor or Severe bands, and another 4 hours 49 minutes in Moderate (Fig. 5A). 79.0% of all readings were above India's 24-hour standard of 60 µg/m³, and 99.9% were above the WHO guideline of 15 µg/m³; only six readings, all in the early afternoon, were at or below it.

The 17-hour mean of 142.2 µg/m³ corresponds to a PM2.5 sub-index of 318 (Very poor), 2.4 times the Indian standard and 9.5 times the WHO guideline (Fig. 5B). The sealed night alone averaged 226.8 µg/m³, 3.8 times the Indian standard. The two sealed phases, A and B, account for 11 hours 54 minutes of the record; the room met India's 24-hour standard only after the window was opened and outdoor air improved.

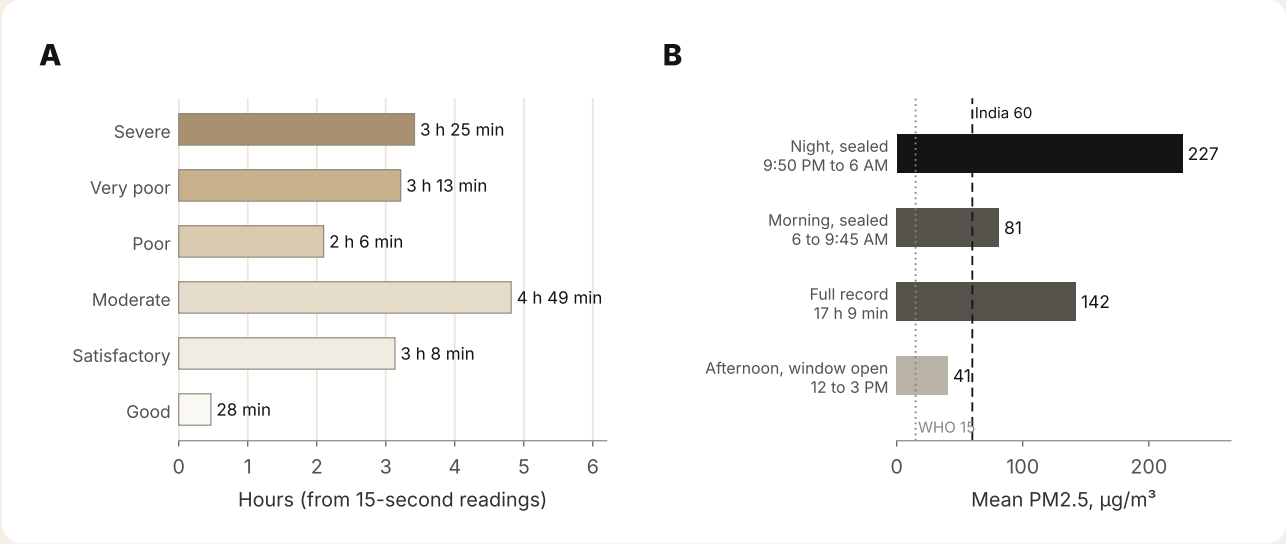


Figure 5. Exposure. (A) Time spent in each CPCB band, counted from individual 15-second readings; total 17 h 9 min. (B) Mean PM2.5 for each part of the record against India's 24-hour standard (60 µg/m³, dashed) and the WHO 2021 24-hour guideline (15 µg/m³, dotted).

Table 6. Indoor PM2.5 against standards

Period	Mean, µg/m³	× India standard (60)	× WHO guideline (15)	Band
Night, sealed (9:50 PM to 6:00 AM)	226.8	3.8	15.1	Very poor
Morning, sealed (6:00 to 9:45 AM)	81.2	1.4	5.4	Moderate
Afternoon, window open (12:00 to 3:00 PM)	40.6	0.7	2.7	Satisfactory
Full record (17 h 9 min)	**142.2**	**2.4**	**9.5**	**Very poor (318)**

03 / RESULTS

3.7 Comparison with outdoor figures

The room's 17-hour PM2.5 sub-index of 318 was higher than every outdoor AQI reported for Pune and Pimpri-Chinchwad over the same night (Fig. 6; Table 7). Two caveats apply: station AQI values combine several pollutants and are mostly 24-hour averages, and city figures average across stations that may sit far from where fireworks were lit.

The pattern over time is more telling than the totals. In the 10 PM hour, indoor PM2.5 averaged 403 µg/m³, well above the roughly 250 µg/m³ that IITM expected outdoors that evening. This is consistent with a dense local plume entering before the windows were closed. Between 2 AM and 5 AM, when IITM forecast outdoor PM2.5 above 300 µg/m³, the sealed room averaged 120 to 183 µg/m³. Closing the windows protected the room from the late-night peak outside, but not from the smoke already inside.

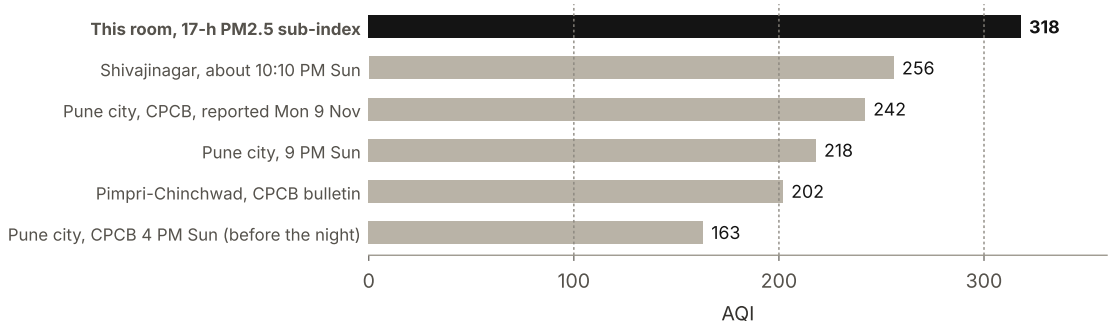


Figure 6. Indoor PM2.5 sub-index for this study (black) against outdoor AQI values reported for Pune and Pimpri-Chinchwad (gray). Dashed lines mark CPCB band boundaries at 100, 200 and 300. Outdoor values are as reported in [11] and [12].

Table 7. Outdoor figures reported for the same night

Location	Time	Metric	Value	Source
This study, indoor	**9:50 PM to 3:00 PM**	**PM2.5 sub-index, 17-h mean**	**318**	**SentioAir**
Pune city	Sun 8 Nov, 4 PM bulletin	AQI, 24-h	163	CPCB, via [11]
Pune city	Sun 8 Nov, 9 PM	AQI	218	Official, via [11]
Shivajinagar	Sun 8 Nov, about 10:10 PM	AQI	256	Via [11]
Pimpri-Chinchwad	CPCB bulletin, as reported	AQI	202	CPCB, via [11]
Pune city	Mon 9 Nov, as reported	AQI	242	CPCB, via [12]
Pune	Sun 8 Nov, evening	Hourly PM2.5, forecast	about 250 µg/m³	IITM, via [11]
Pune	Mon 9 Nov, 2 to 5 AM	Hourly PM2.5, forecast	above 300 µg/m³	IITM, via [11]

03 / RESULTS

3.8 Data completeness and resolution

The prototype recorded 4,112 of 4,118 expected readings (99.9%). Every full hour from 1 AM to 2 PM had all 240 expected readings (Fig. 7). The few missing readings fell in the first three hours, when the unit restarted five times during warm-up; the longest gap between readings was 52 seconds.

The 15-second interval resolved three events that a daily average would not show: the midnight rebound, the morning plateau and the window opening, which the unit registered within a minute of the occupant's logged time (Table 8).



Figure 7. Readings received per clock hour. The first bar covers 9:50 to 10:00 PM only. The gold line marks the 240 readings expected in a full hour at a 15-second interval.

Table 8. Events resolved by the 15-second record

Event	When	What the record shows
Evening peak	9:51 PM	465 µg/m³, one minute after recording began
Midnight rebound	12:20 to 12:50 AM	10-minute mean rose from 243 to 296 µg/m³ with windows shut
Sealed plateau	6:00 to 9:45 AM	Flat at 81 µg/m³ (trend −0.9 µg/m³ per hour)
Window opened	**9:44:51 AM (log: about 9:45 AM)**	**Humidity reading stepped down; PM2.5 rose 13% as outdoor air entered**
Below India's standard	11:52 AM	One-hour mean crossed below 60 µg/m³, 2 h 7 min after opening
Lowest reading	1:10 PM	11 µg/m³

04 / INTERPRETATION

4. Discussion

On Diwali night 2026, a closed room in Rahatani held PM2.5 in the Severe band for about four hours and in Very poor for most of the rest of the night. The smoke had entered before the windows were closed, and no purifier, air conditioner or fan was used. Under those conditions the room behaved like a slowly leaking box: concentrations halved roughly every 3 to 3.5 hours, then settled at about 81 µg/m³, the level the outdoor air could sustain.

Two practical points follow. First, timing matters as much as the act of closing windows. Closing a room after smoke has entered traps it; closing it before the firecrackers start keeps most of it out. Second, a sealed room does not clean itself to a healthy level. In this record it could not get below Moderate until the window was opened and outdoor air improved. Air cleaning, which was not used here, is the usual way to speed up removal indoors.

The morning record shows why ventilation decisions benefit from measurement. Opening the window at 9:45 AM first raised indoor PM2.5, because outdoor air was still worse than indoor air at that hour. About an hour later, as outdoor air cleared, the open window brought the room down quickly. Opening earlier would likely have added exposure; opening later would have extended the plateau. Without readings, the right moment is a guess.

Finally, the study shows what continuous indoor measurement adds to official data. Outdoor stations and city averages placed Pune in the Poor band that night. The room in this study averaged Very poor, and its worst hours were Severe. A first-generation SentioAir prototype captured that record at 15-second resolution with 99.9% data coverage, and registered a change in ventilation within a minute of the occupant's log.

What households can do on Diwali night

1. **Close up before the firecrackers start,** not after the smoke arrives.
2. **If smoke has already entered, clean the air.** A sealed room alone halves its smoke only every 3 hours or so; an air purifier sized for the room speeds this up.
3. **Protect the people most at risk.** Children, older adults and people with asthma or heart disease should stay in the cleanest closed room.
4. **Open up when outdoor air is cleaner than indoor air,** which on this morning was after about 10:45 AM, not at first light.
5. **Measure indoor air,** so these decisions follow data rather than guesswork.

04 / INTERPRETATION

Limitations

This is a single-room, single-night observation with one device. No reference-grade monitor was placed alongside it, so absolute concentrations carry the uncertainty typical of optical particle sensors, which can read high in humid air and vary with particle type [8]; firework smoke differs from the particles such sensors are usually tuned on. The timing and shape of the curves are more robust than the absolute values. The prototype's humidity sensor sits inside the housing and reads drier than the room, so only its changes were used. Recording began at 9:50 PM, after the smoke had entered, so the true evening peak is unknown. Room volume, air-tightness and outdoor concentrations at the building were not measured, and the occupant log gives the window time to the nearest few minutes. Outdoor comparisons rely on media reports of CPCB and IITM figures and are directional. A multi-day study placing SentioAir units alongside other monitors is planned.

Conclusions

In a sealed home on Diwali night 2026, firecracker smoke that entered before the windows were closed kept indoor PM2.5 in the Severe band for about four hours. Without ventilation or air cleaning, the room halved its PM2.5 roughly every 3 to 3.5 hours and then stalled at about 81 µg/m³. Opening a window once outdoor air improved brought it below India's 24-hour standard within about two hours. Over 17 hours, indoor exposure (PM2.5 sub-index 318, Very poor) exceeded every outdoor AQI reported for the city. These findings apply to this room on this night. They point to a simple rule: seal early, clean the air you are sealed in with, and open up when the air outside is cleaner.

Declarations

This was an observational measurement in a private home, with no participants other than the occupant who kept the ventilation log. EmergeSphere Technologies Pvt. Ltd., which makes SentioAir, funded, ran and analyzed the study. The 15-second data are available from the author on request. Generative AI was used to assist with the analysis and drafting; all analyses and text were reviewed and verified before publication. This paper is for general information and is not medical advice.

05 / SOURCES

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SentioAir.

ABOUT

Air you can see, decisions you can trust.

SentioAir is an AI and IoT air intelligence platform built by EmergeSphere Technologies Pvt. Ltd., an Indian deep-tech startup based in Pune. The SentioAir home monitor reads the air inside your home continuously and turns it into a clear verdict on the CPCB scale, so you know when to close up, when to open up, and when to clean the air.

This white paper was produced with a first-generation SentioAir prototype, designed and built in Pune.

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