

CASE STUDY

**EnviroKlenz in Primary School -
Carlow, Ireland**



INDUSTRY OVERVIEW

Safety protocols for returning to the classroom are a crucial focus for all educational institutions, as they affect the rate of airborne transmission and the performance of students. Recent guidelines from the Department of Education have brought greater attention to air quality in primary and secondary schools. Schools are beginning to invest in air quality monitors to gauge the level of pollution in classrooms, specifically for particulate matter and carbon dioxide, and comparing this to the World Health Organization's (WHO) new standards of adequate internal air quality.

School buildings often rely on natural ventilation systems, where the main exchange of air comes from open windows and doors. This has limitations during colder months when it is not as feasible to keep windows open, presenting issues like lack of ventilation and greater accumulation of particulate matter indoors. There is also the negative consequence of increased outdoor air pollution making its way indoors. Higher levels of carbon dioxide within classrooms has shown to affect performance of students, and high levels of air pollution in work and school atmospheres are deemed as inadequate for the health of all occupants.

Recommended short-term exposure to fine particulate matter:

15 $\mu\text{g}/\text{m}^3$
of PM_{2.5}

according to WHO short-term air quality guidelines

Air Ventilation Recommendations:

- Increase outdoor air ventilation, when possible, to increase indoor air flow
- Utilize air quality monitors to measure and manage indoor pollution
- Implement additional air cleaning methods to supplement natural ventilation
- Maintain particulate matter below WHO standard of 15 $\mu\text{g}/\text{m}^3$ for PM_{2.5}

STUDY BACKGROUND

- ▶ The EnviroKlenz Air System Plus was deployed and operational alongside air quality meters that measure and record particulate matter, stationing the EnviroKlenz Air System Plus in a classroom of a primary school in Carlow, Ireland. The EnviroKlenz Air System utilizes a patented adsorptive neutralization process of capturing and removing toxic and noxious odors, chemicals, and pathogens. This is done through multi-stage decontamination, consisting of primary filtration and neutralization through the EnviroKlenz Air Cartridge, followed by UVC and HEPA filtration. The air quality monitor provides real-time measurements of particulate matter concentrations (PM1, PM2.5, PM10) and particle size distribution using a combination of multiple light scattering-based particle sensors.
- ▶ The EnviroKlenz Air System Plus and air quality monitor operated in the classroom as daily schedules were carried out as usual. Air quality readings compared data collected when the EnviroKlenz Air System Plus was turned off versus when it was turned on to gauge its impact on particulate reduction. This particularly highlights on the addition of an air purifier to a space with no existing filtration system in place.
- ▶ The results from this case study are compared to particulate matter data from the World Health Organization (WHO). Updated in 2021, the WHO has developed new air quality guidelines through research on air quality trends and exposure risks for PM2.5 pollution. These fine inhalable particulates, with diameters of 2.5 micrometers and smaller, are the common size relative to airborne illness carriers. In the case study, a broad range of particles were monitored, all with similar trends. For illustration purposes, the collected data is measured and recorded in PM2.5. It is then plotted in comparison to the WHO's air quality guidelines for PM2.5, representing a recommended short-term exposure level of 15 ug/m³ and a recommended annual average mean of 5 ug/m³.

TEST DETAILS

Testing Period:

27/09/21 - 08/10/21

Setting:

A classroom within the primary school

Equipment Used:

(1) EnviroKlenz Air System Plus and (1) commercial-grade air quality monitor per operational location. Readings were captured in the ranges of PM10, PM2.5, and PM1 (sub-micron sized).

Monitor Status:

The air quality monitor was running between 27/10/21 and 08/10/21; the air quality monitor was turned on several days prior to turning on the EnviroKlenz Air System Plus to establish base-line air quality readings.

Running Time:

The EnviroKlenz Air System Plus was operational in the classroom between 04/10/21 and 08/10/21; data is pulled from this date range and compared with the collected base-line air quality readings.

OBSERVATIONS

Classroom

Without EnviroKlenz Air System Plus



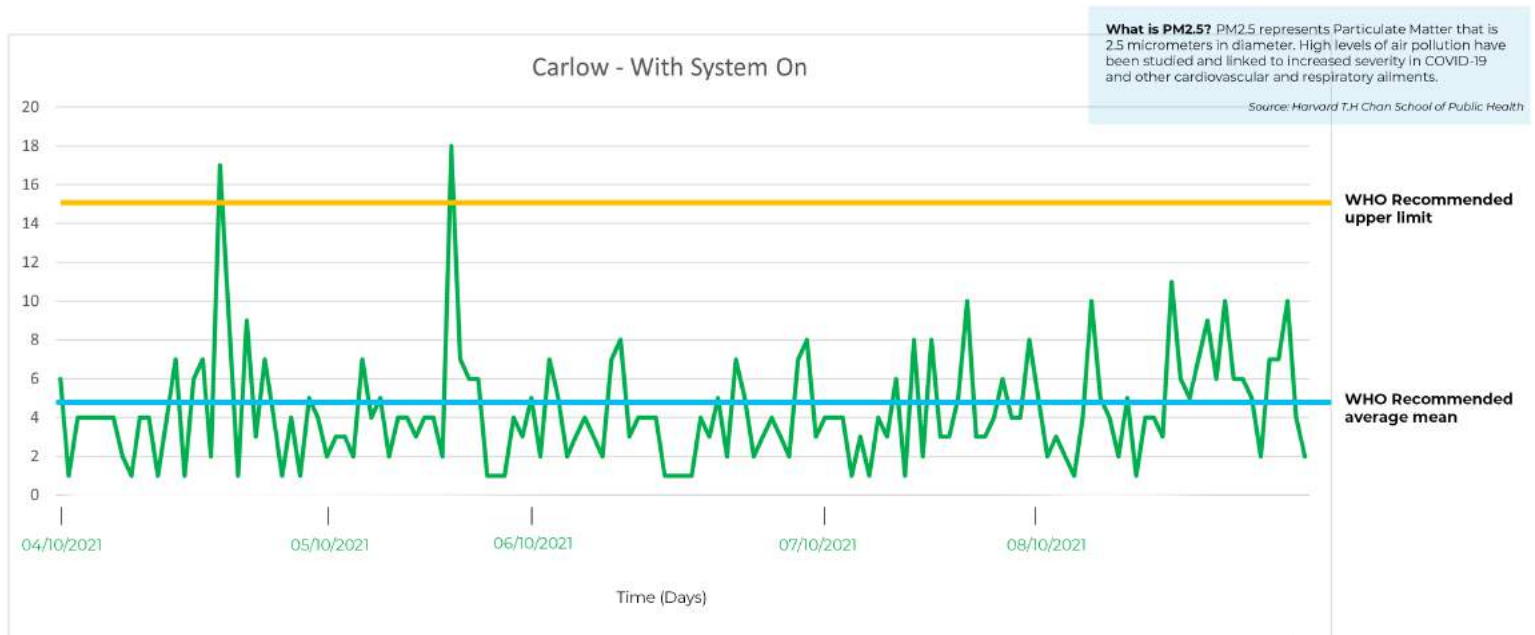
The above data is depicting air quality readings taken between 27/09/21 and 02/10/21, collecting base-line PM2.5 readings with the EnviroKlenz Air System Plus turned off.

- Initial base-line measurements were taken when the EnviroKlenz Air System Plus was turned off. During this period, spikes in PM2.5 are measures at two to three times greater than WHO recommended annual average mean of 5 ug/m³ of nPM2.5. The highest spike reached 18 ug/m³.
- The classroom only utilizes natural ventilation through open doors and windows, which does not demonstrate particulate reduction during peak hours of occupancy, as shown by the spikes; this is when PM2.5 levels are dangerous and the classroom is more vulnerable to airborne illness transmission and airborne pollution exposure.
- Further, the natural ventilation does not demonstrate consistency in its ability to exchange the air supply, as there is no constant maintenance of PM2.5 within the WHO's recommended annual average mean of 5 ug/m³.

OBSERVATIONS

Classroom

With EnviroKlenz Air System Plus



The above data is depicting air quality readings taken between 04/10/21 and 08/10/21, collecting PM2.5 readings with the EnviroKlenz Air System Plus turned on.

- With the EnviroKlenz Air System Plus turned on, PM2.5 levels are more consistently held within the WHO's recommended upper limit of 15 ug/m³, with majority of the readings showing levels within the recommended annual average mean of 5 ug/m³.
- There are a few minor spikes in air quality levels, which could indicate an influx of traffic or activity within the classroom, however these are quickly brought down to the recommended average mean for air quality.
- This demonstrates reduction in PM2.5 due to the added filtration of the EnviroKlenz Air System Plus in the environment. This validates its efficiency at capturing and retaining particulates in a given enclosed space.

DATA SUMMARY

High-Level Analysis

- ▶ The air quality measurements from the case study reveal significant spikes in PM2.5 throughout the day within the classroom, showing the inconsistency and inadequacy of current ventilation means. As shown by the data collected while the EnviroKlenz Air System Plus was turned off, spikes throughout the day measure particulate matter at levels two to three times greater than the recommended annual average mean from the WHO's air quality guidelines, representing 5 ug/m³ of PM2.5.
- ▶ This data indicates that the current use of natural ventilation did not demonstrate control or reduction of these influxes of dangerous air pollution during operational hours within the classroom. This increases the school's overall vulnerability to illnesses and transmission, as well as health risks associated with short and long-term exposure to indoor air pollution.
- ▶ Comparing these base-line readings to the data collected when the EnviroKlenz Air System Plus was turned on shows how the additional filtration and added air exchanges provide more consistent control of particulate matter within the WHO's recommended air quality guidelines. Spikes primarily remain under the upper limit for air quality, and they were quickly remediated to below the recommended annual average mean of 5 ug/m³. The EnviroKlenz Air System Plus was able to capture and retain particulate matter during all hours of the day, providing greater reliability in PM2.5 reduction than the existing use of natural ventilation.



EnviroKlenz

Timilon Corporation | 24301 Walden Center Drive Suite 101
Bonita Springs, Florida 34134 | +44 2031 481800 | cstahl@timilon.com

DATA SUMMARY

Expert Recommendation

- ▶ Based on the findings, it is shown that the indoor air quality is improved with the additional filtration of the EnviroKlenz Air System Plus. In order to comply with the updated WHO air quality guidelines and address concerns with inadequate indoor air quality, EnviroKlenz recommends the addition of its air purifiers within classrooms and offices throughout the primary school.
- ▶ This additional filtration will enhance the level of ventilation and particulate reduction that is currently achieved by natural means, as well as reduce outdoor air pollution that could be affecting indoor air quality. This is also an improvement that is highly applicable to the upcoming winter months, where natural ventilation is less attainable due to colder weather. When windows cannot be kept open, the EnviroKlenz Air System Plus can provide additional air exchanges, filtration, and ventilation to reduce particulate matter and other sources of airborne pollution or illness. This allows for on-demand control of ventilation and filtration when it is most needed to replace the lack of natural air exchanges.
- ▶ Benefits of implementing the EnviroKlenz Air System Plus throughout classrooms in a school setting can include:
 - On-demand control and adjustability of added filtration
 - Cost-effective solution to address inadequate air quality
 - Added air exchanges for greater particulate removal and retention
 - Greater consistency in overall air quality
 - Reduction of outdoor air pollution that comes from natural ventilation

