INDOOR ENVIRONMENTAL MONITORING AT ELEMENTARY SCHOOL "G. RODARI" - ROSSANO VENETO (VI): ABSTRACT

Georeferencing: *UTM/WGS84 32 T 717595.58 m E; 5065083.95 m N*
Rooms affected by the relief: *2 classrooms – 1th level of Elementary School.*
Numbers of people present in each Classroom*: 22 alumni (5-7 years) + 1 teacher*
Flocking time: *8.00-12.30*
Time tracking interval: *2016/12/12 7.00 am – 2016/12/17 7.00 am*

SYNTHETIC NOTE:

1. *HESwall significantly absorbs CO2 indoor*
2. *HESwall reduces CO concentration concentration peaks*
3. *HESwall provides a good thermal insulation capability for low-thickness.*

Objectives of environmental monitoring

In order to understand how HESwall's application contributes to improving air quality in confined environments, an environmental monitoring campaign was conducted at two classrooms of "Istituto Scolastico Comprensivo G. Rodari" of Rossano Veneto (Vicenza-Italy). The two Classrooms, identical to size, orientation, crowding, usage, differ only in the types of interior plaster applied. One has plastered walls with pre-mixed concrete (AULA 2), the other has plastered walls with HESwall (AULA 1).

In accordance with the OMS guidelines, a 6-day statistical area sampling was carried out with continuous monitoring of the following environmental parameters: ambient temperature [°C], indoor relative humidity [%] and CO_2 concentration [ppm]. The instrumentation, or datalogger with appropriate sensors, took measurements every 4 seconds, generating 21,600 daily samples of each parameter for each room.

CO_2 concentration is the paramount parameter for verifying the air quality in confined environments as excessive concentration of this odorless and tasteless gas generates a number of negative effects such as malaise, concentration difficulties, performance down to problems of chronic respiratory tract..

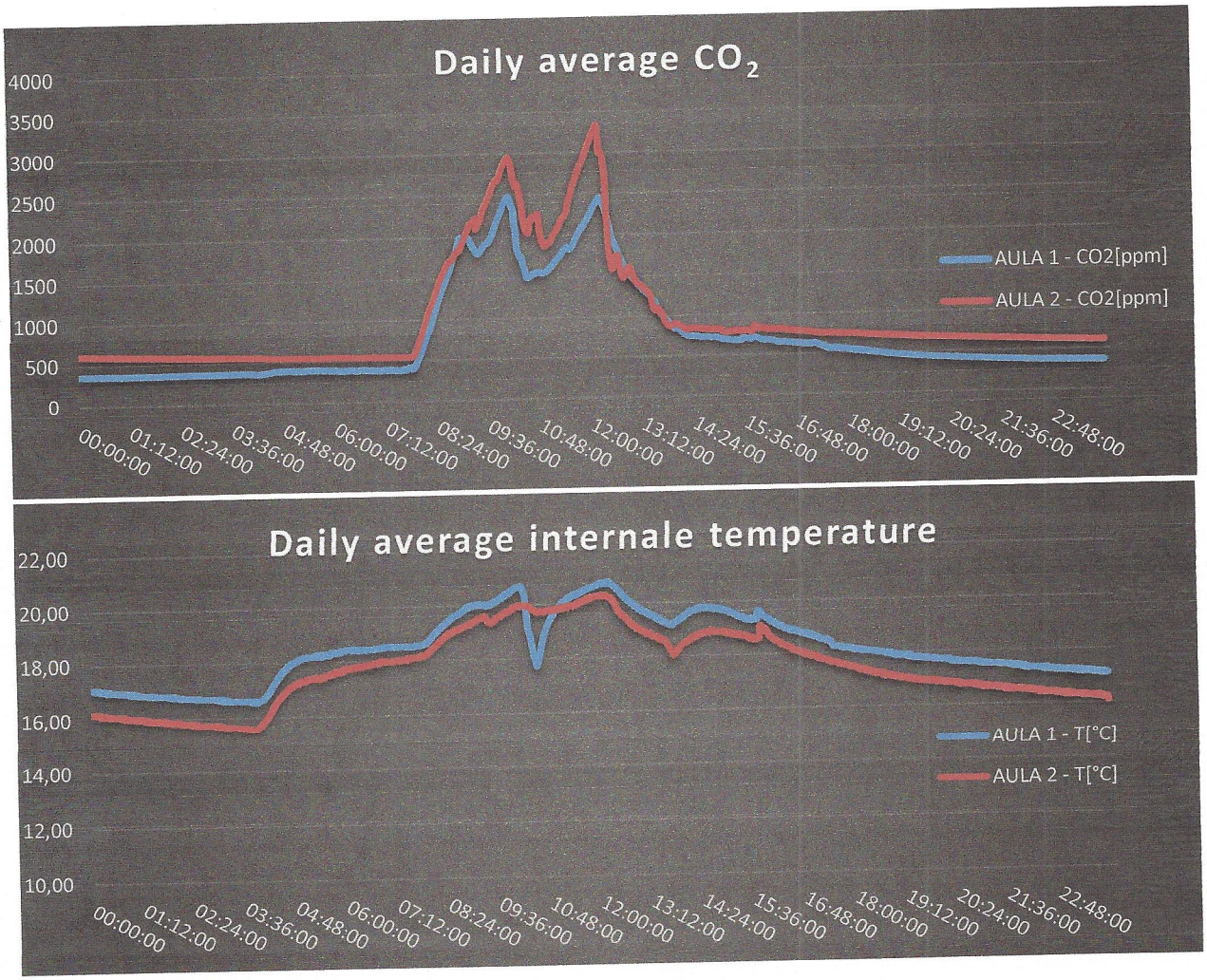
From the literature and from the international sectoral legislation it is shown that the CO_2 concentration threshold level is 1000 ppm. This limitation is based only on its association with body odor and not the effects of carbon dioxide itself on health or indoor comfort. To avoid health problems, concentrations in closed environments should not exceed 3500 ppm (6.3 g / M^3), but at concentrations below 5000 ppm CO_2 is not harmful to humans; concentrations above 10000 ppm (18 g / m^3) cause reversible maladies, while concentrations above 40000 ppm (72 g / m^3) are toxic.

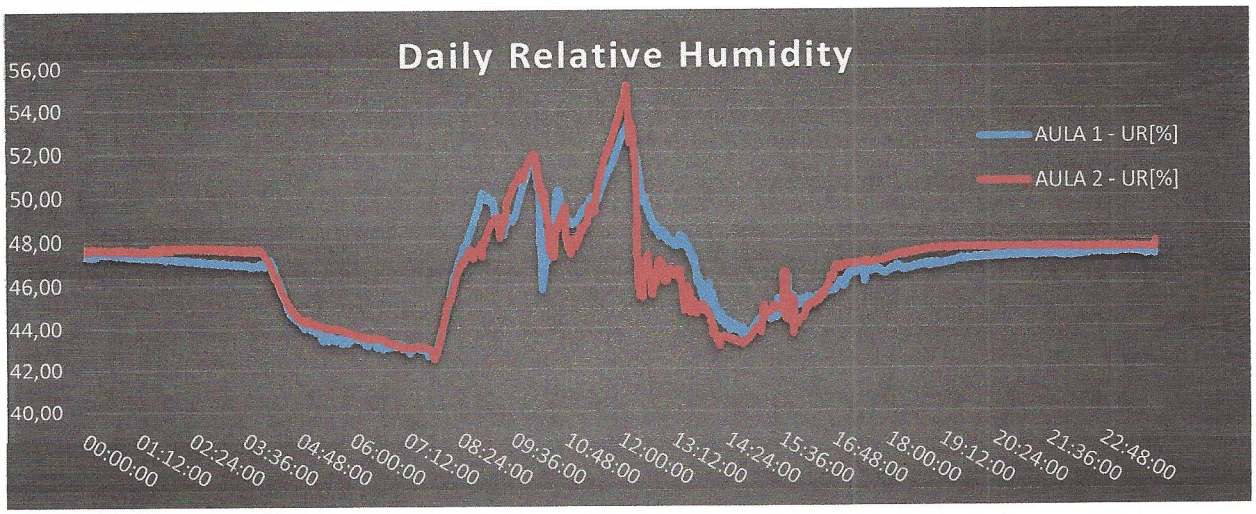
Monitoring results

Following a preliminary assessment made on a statistical basis, the CO_2 concentration forecast, by virtue of the occupancy rate of the single classroom and of the activities carried out therein, is 3219 ppm.

Since the data from the data loggers is reflected, a daily trend of indoor temperature, humidity, and CO_2 concentration is apparent with slight variations on a weekly basis, moreover with similar peak values; This situation justifies the use of an average analysis of the environmental parameters in question, the graphs of which are shown below.

The peak CO_2 concentration conditions detected in CLASSROOM 2 are comparable to the calculated concentration forecast (3219 ppm) based on the degree of crowding and the type of users present in the sites being analyzed. It is anticipated that by comparing between the relative humidity levels recorded in the two AULAs, a completely overlapping behavior between the two instances appeared, so no further analysis and observations were necessary.





Final Remarks

Following the analysis, the following comments are made:

- ***<u>CO_2 Peak Concentration: AULA 1 shows a lower peak CO_2 concentration of 27%</u>*** compared to the control sample represented by AULA 2, with a reduced CO_2 concentration of about 1000 ppm. q
  It is also noted that all peak measurements detected in AULA 1 (from a minimum of 2369 ppm to a maximum of 3100 ppm) *are in any case lower than the predicted CO_2 concentration calculated as a result of the crowding of the classrooms.* Considering the same ventilation modes in both classrooms, it can be stated beyond any reasonable doubt that ***<u>HESwall plaster absorbs environmental CO_2</u>***
- ***<u>CO_2 concentration in the absence of occupants</u>***: Classroom occupation is daily limited to 8.00-12.30. This allows the CO_2 concentration to be measured in the two environments concerned, that is to say, in the absence of pollutants.
  Analyzing the data monitored in the time range of 19:00 to 7:30, ***it appears that the background CO_2 content in AULA 1 is considerably lower than that found in AULA 2, in the order of 34%,*** with concentration values in order of 350 ppm, comparable to the average CO_2 concentration in outdoor environments not subject to critical and unfavorable environmental and climatic conditions.
  Obviously, this figure is significant because in the above-mentioned time interval there are no external factors that alter the equilibrium of the two systems.
- ***<u>On the temperature gradient between the two classrooms</u>***: From the temperature monitoring curves of the two environments, it is apparent that the AULA 1 is warmer than the AULA 2 average of about 0.75 ° C, with a trend almost constant throughout the duration of the monitoring. It is as important as this thermal delta is greater during the non-occupancy of the rooms, standing at about 1°C while it tends to shrink during crowding hours (where other heaters are accessed!) Until reaching the average value of 0.56 ° C. The result is extremely interesting because of the low applied HESwall

thickness (1.5cm) which amplifies the heat insulator characteristics of the HES patent blend.