



01/21/2025

Ritchie Bowling
Maypearl ISD
PO Box 40 / 309 Main St.
Maypearl, TX 76064

Dear Mr. Bowling,

In the HVAC industry, carbon dioxide, CO₂, is often used as a primary indicator of indoor air quality (IAQ) because its concentration directly reflects the level of ventilation in an occupied space - high levels of CO₂ generally signify poor ventilation in a space. However, in most buildings concentrations almost never rise to the level that would pose a health risk (i.e. greater than 5,000 ppm for more than 8 hours¹). For most school and office buildings, a CO₂ concentration rate of about 700 ppm above the outdoor air levels², provides an optimal dilution rate of odors from the human body to satisfy a substantial majority of space occupants. Outdoor CO₂ concentrations are typically in the 300-500 ppm range, thus indoor CO₂ concentrations of 1000-1200 ppm in a space housing sedentary people is an indicator that a substantial majority of occupants will be satisfied with the diffusion of body odors. CO₂ is not a good indicator of the concentration and occupant acceptance of other indoor contaminants, such as volatile organic compounds off gassing from furnishings and other building materials, and bacteria, virus, mold, and fungi concentrations. Proper air changes per hour in a space are used to ensure these concentrations are maintained at occupant acceptable levels by bringing in fresh outside air and exhausting an equivalent amount of air.

Below is a list of regulations concerning CO₂ concentrations:

Agency	Level	Note:
TDSHS	700 ppm above outdoor level	IAQ Voluntary Guidelines – Recommended levels to incite response action
ASHRAE (Strd. 62-1989) ²	1,000 ppm	Recommended levels that should incite response action
OSHA (29CFR 1910.1033) ¹	5,000 ppm	Time Weighted Average – 8 hours
OSHA (29CFR 1910.1033)	800 ppm	Proposed level that should incite response action
OSHA	50,000 ppm	IDLH (Immediately Dangerous to life & health)
ACGIH	5,000 ppm	TLFV (Threshold limit value)
ACGIH	30,000 ppm	STEL (Short term exposure limit)
NIOSH	5,000 ppm	REL (Recommended exposure limit)
NIOSH	30,000 ppm	STEL

From TASB Facilities report dated 12/6/2024

TASB completed a limited indoor air quality inspection on the main building of the Primary School on November 15th, 2024. The follow-up report to the onsite inspection denoted elevated CO₂ levels in the main hallway, the hallway to the gym, and in classroom #7. Based on these findings, the report recommended that Maypearl ISD have an HVAC professional complete an evaluation of the equipment serving the building to identify the cause of the elevated CO₂ levels in the spaces observed.





Below are the results from TASB's inspection:

<i>Environmental Indicator Results</i>						
Primary Campus						
Sample Location	Time of Reading	Carbon Dioxide (PPM)	Temperature-Fahrenheit	Relative Humidity %	Carbon Monoxide (PPM)	Total Spore Count
Main bldg. Main Hallway	11:56 AM	1660	70.0	51.3	0	1410
Classroom #7	12:27 PM	1710	73.0	54.5	0	1530
Hallway connecting Main bldg. and Gym	12:48 PM	1668	70.0	54.2	0	620
Gym	1:00 PM	1008	70.0	52.6	0	880
Library	1:16 PM	518	70.0	35.9	0	370
Outside of Main bldg. and portable bldgs.	1:40 PM	387	73.4	24.2	0	13590
Quad bldg. portable Rm 22	1:55 PM	1342	70.3	46.3	0	1530
Motor skills portable / Motor skills room	2:07 PM	556	71.8	45.2	0	1250

From TASB Facilities report dated 12/6/2024

The district then reached out to E3 to evaluate the equipment in the Primary School main building and E3 performed an indoor air quality inspection on the morning of January 14th, 2025. During the inspection space temperatures, relative humidity, and CO₂ levels in several spaces throughout the building were measured along with a review of the heating, ventilation, and air conditioning (HVAC) serving the building.

The purpose of this inspection was to observe the indoor conditions at the time of the on-site visit to understand if there are any areas of concern and identify the sources of the problem and potential solutions for the district. Readings were taken in the same rooms that TASB identified with elevated CO₂ levels along with several other spaces throughout the building. During E3's onsite inspection, many of the spaces observed had a CO₂ differential greater than 1000ppm compared to the outside. The table below outlines the readings taken:



**Maypearl ISD - Primary School**

1/14/2024

Location	CO ₂ Meter Reading (PPM)	CO ₂ Differential from Outside (PPM)	Temperature (°F)	Relative Humidity	Was the space unoccupied during the measurement? Y/N	Approximate Duration of the space being Unoccupied
Outside Conditions - Front of Building	396	-	59	24%	-	-
Classroom 1	2073	1677	66	54%	Y	35 Mins
Classroom 2	1877	1481	68	47%	Y	35 Mins
Classroom 3	2100	1704	68	50%	Y	35 Mins
Classroom 5	1920	1524	71	46%	Y	25 Mins
Classroom 7	1685	1289	69	50%	N	-
Classroom 7	1600	1204	69	50%	Y	10 Mins
Classroom 13	1880	1484	70	46%	N	-
Main Hallway	1241	845	68	48%	-	-
Hallway Connecting Main Hallway & Gym	1611	1215	68	49%	-	-
Library	1217	821	69	32%	N	-
Admin Office	1366	970	68	49%	N	-

Reading with a CO₂ differential >1000ppm between the space and outside

In addition to taking readings, the E3 team also interviewed the district's staff who were walking us around and visually inspected the HVAC equipment in the building. Based on these interviews and inspections the following observations were noted:

- The district has seen a growth in attendance this academic year, adding approximately 40 students to the campus along with several additional teachers causing a higher density of people in the building. Adding additional people in the building increased the rate of indoor CO₂ being produced while the HVAC equipment design and operation remained the same.
- The building exhaust system is currently inadequate. The only exhaust in the building is in the restrooms along the main hallway and the exhaust fans currently installed in those spaces are undersized while the restrooms by the gymnasium and library do not have any exhaust fans. No other exhaust systems were identified in the main building.
- Most of the units on the campus do have outside air ducted to the return side of the unit. In the classroom area, the outside air is ducted from the outside in a main trunk line that then branches off over the hall and goes to each individual unit. Every unit that had outside air





ducted to the fan coil unit was observed to have an actuated outside air damper that was interlocked to open when the fan coil unit fan was energized and close with a spring return when the fan turned off. Many of the outside air duct runs are very long (>50 ft), especially in the classroom wing and have no fan forcing air to the space's fan coil units. Therefore, the space fan coil unit is the only method for drawing fresh air to the space. The only unit that was identified without ducted outside air was the library packaged unit located on the ground outside the library.

- For adequate fresh air to be brought into the building, the exhaust air rate should be slightly less than fresh air rate. This allows the building to remain positively pressured so that untreated fresh air is not pulled in through air gaps in the building envelope. Since the building currently has negligible exhaust air, the existing fan coil units are pulling air from the path of least resistance which is return air from the spaces they serve due to the far shorter return air duct compared to the long outside air duct runs. This lack of fresh air changes is leading to a buildup of CO₂ and other indoor contaminants in the space.

The CO₂ levels observed during the site visit, although not optimal, are well within a safe threshold and a substantial majority of occupants will be satisfied in the building. However, the facilities HVAC system is not installed to current standards and could be improved. These improvements could lead to improved IAQ and perceived occupant comfort.

Based on these findings, E3 recommends any or all the following actions to improve the indoor air quality in the building. Each of these recommendations come with first and ongoing maintenance costs and could be implemented immediately or at the end of the useful life of the existing equipment. E3 recommends hiring a qualified professional to assist in selecting the best solution for Maypearl ISD:

- 1) Add additional exhaust to the building by increasing the amount of exhaust in the restrooms to meet code requirements and adding additional general exhaust that pulls any remaining exhaust air required to make the exhaust air be slightly less than the amount of outside air required by the building.
- 2) Add a needlepoint bipolar ionizer to each HVAC unit in the building. Ionizers assist with mitigating odors, reducing VOCs, and deactivating bacteria, viruses, mold and fungi in the building. In addition, ionizers increase the efficiency of filtration by clumping small particles together.
- 3) For the classroom units with common outside air ductwork, add a variable speed fan to each main trunk line with a pressure sensor to adjust the amount of air provided as units turn on and off in the building.
- 4) As an alternative to adding fresh air fans, the existing outside air ductwork could be shortened and run through the roof near each unit to allow for a shorter path for the air to get to the fan coil unit serving the space.
- 5) Add in-room air cleaning devices such as a stand-alone fan/filter or fan/air cleaner.

Sincerely,

Daniel Meyer, P.E.

