USD 348
INDOOR AIR QUALITY REPORT

Prior to being hired at USD 348, I had done research for my previous employer (Harper County Commissioners) concerning the improvement of the indoor air quality of our County Jail, which included adding Ultra Violet Lights or Ionizers to the HVAC systems. The HVAC system in the Jail consisted of air-handler units that were heated by a boiler loop and cooled by a chilled-loop system. There was no outside air pumped into the building and one air handler served two cells. Basically, the prisoners and staff were trapped in a box breathing recirculated air and all the contaminants in the air. During my research, I started to learn more about different HVAC systems and the studies of using outside air to improve the indoor air quality of larger commercial buildings.

The District's HVAC systems use outside air and are scheduled to purge the buildings four hours every morning and two hours every afternoon. This is accomplished by pumping an increased amount of outside air into the building and exhausting the inside air to the outside environment. On a normal day when a space, or room, is not calling for heating or cooling, the air in that room is turned over, or changed, two to three times per hour. When a space is calling for heat, the air in that space is changed five to six times per hour, and when cooling is called for in a space, the air is changed up to eight times an hour. Furthermore, there are dampers letting outside air in throughout the day and these are governed by settings in the control systems according to C02 levels and barometric pressure. This influx of outdoor air and air movement is a valuable tool to ensure that we have the cleanest air possible for our students and staff.

The NPBPI, Needle Point Bi-Polar Ionizers, were installed to enhance the air filtration system we have in place. The science behind the ionizers is that contaminants in the air are positively charged, the ionizers produce negatively charged ions that attract and attach themselves to the airborne contaminants, forming little clusters. The clusters gather more contaminants until they are heavy enough to fall out of the air or get swept into the duct work to be filtered out of the air stream through the filtration system. This sequence of events allows smaller contaminants to be filtered without using more restrictive air filters. These systems are in use in other school districts, hospitals, and city building across the U.S.

With any purchase of this importance, the District wanted to make sure it was getting a quality product that was safe for students and staff and was capable of cleaning the air. Most products we use on a daily basis are certified by United Laboratories. We trust these products to perform the way the manufacturers designed them and to keep us safe. The NPBPI that the District purchased from Global Plasma Solutions has two UL Certifications, UL 867 and UL 2998. The CDC recommends *if you are considering the acquisition of bi-polar ionization equipment, you will want to be sure that the equipment meets UL 2998 standard certification (Environment Claim Validation Procedure (ECVP) for Zero Ozone Emissions from Air Cleaners) which is intended to validate that no harmful levels or ozone are produced.*

The District had the ionizers installed in the Fall of 2020, and used them through May of 2021. Around that time GPS, or Global Plasma Solutions, the manufacturer of our NPBPI systems, was named in a lawsuit claiming the ionizers did not function as intended and actually were producing harmful VOC's as a bi-product of the ionization. At that time the District, out of an abundance of caution, made the decision to turn the ionizers off until further testing could be done. Wildan Engineering Group, who oversaw the ionizer project, volunteered to take readings of the air inside one of our buildings and report its findings. The high school was chosen as the building to be tested and the tests were conducted in July of 2021, with the results presented to the Board at the following BOE meeting. It

was emphasized at the meeting that although VOC's (Volatile Organic Compounds) and Ozone were not present in any of the rooms tested, Formaldehyde was present in the library. A decision was made at that meeting that an independent third party should test the same school and rooms that Wildan had tested.

Ecosafe of Kansas City, Missouri was chosen to perform the second set of tests. Just as Wildan's test were conducted, Ecosafe's tests took place on two different days of the week. The first day the samples were retrieved with the ionizers off. A few days later, when students were not present in the building, the second set of samples were retrieved with the ionizers turned on. The results were very encouraging for the District, as you can see from the attached report. VOC's, PM (Particulate Matter, a mixture of solid particles and liquid droplets in the air), and Formaldehyde concentrations were all lower with ionizers turned on. During the tests, readings were also done on miscellaneous gases, such as Carbon Monoxide, Hydrogen Sulfide, Oxygen, and Ozone. None of these gases registered except for ozone, which was a little elevated on the day the ionizers were turned on. Even though the ozone was a little elevated, it was not a constant reading and the ambient outside ozone concentrations were the in the same range as what was being registered inside. Also, the limits were well below the EPA and OSHA Ozone guidelines.

EPA Standards for ozone exposure during an eight hour day is 0.070 ppm.

OSHA Standards for ozone exposure during an eight hour day:

0.10 ppm performing lite work for eight hours
0.08 ppm performing medium work for eight hours
0.05 ppm performing heavy work for eight hours

Knowing this might cause some concern, I did research on why slightly elevated ozone levels were present on the second day of testing. I found an associate professor at Wichita State University, Dr. Yang-Soen Kim, who has a strong expertise in building energy modeling, indoor air quality, and the occupants' perception and impact on building energy and environment. She has years of experience in the building science research field. I had a lengthy zoom meeting with her and several emails. I asked if she could review both air quality reports and give me any opinion she might have. After reviewing the reports, she asked if there were any measurements taken of the outside ozone levels on the day that the elevated levels were taken. Her studies through the years have shown that with the increase in ventilation with modern buildings and HVAC systems, more outside air is present inside the buildings. Most harmful PMs are filtered out of the air before they enter the building via the HVAC air filters. But most smaller PMs and gases are too small to be filtered out and eventually enter the building. Also, most buildings are not air tight and outside air can enter through gaps and cracks in the walls or when doors open and close. She was not familiar with the particular ionizers that we use, but she knew of the technology and stated they shouldn't be producing any ozone.

During our conversations, I started researching the outdoor air quality in our area and found the EPA monitors the air quality and the ozone in the area was elevated also. I then purchased an ozone meter to run my own tests. The samples I collected at the HS on 11/24/21 were with the ionizers turned on and I collected samples from four different locations, the Commons, Room 107, the Library, and Outside. The Commons registered very slight Ozone levels ranging from 0.000-0.007 ppm, way below all standards. The other areas inside did not register any ozone. The outside readings were 0.016-0.045 ppm. During the Christmas break I took readings in the Industrial Arts building with the ionizers on and with them off. With the ionizers off I did not register any ozone inside the building, my readings for ozone outside were 0.003-0.009 ppm. The next day, with the ionizers

on, my first reading was 0.003 ppm, four minutes later it was 0.001 ppm, and starting four minutes later the rest of the readings were 0.000 ppm. Even placing the meter inches from the ionizer in each air handler at the Industrial Arts building I did not register any ozone. Outside ozone levels were 0.006-0.008 ppm.

Ground level ozone, the ozone we breath almost everyday thrives on sunlight to survive, that is why ozone levels are higher in the Summer months and less prevalent during the Winter months. Inside, ozone has a half life of approximately seven-ten minutes before it decomposes into oxygen. Ozone is used in Hotels, Office Buildings, and passenger Air Planes to rid them of odors and to disinfect them. The ozone is produced by Ozone Generators, and the space has a distinct smell when you enter a room or space that has been disinfected with one. You can even hang one in your deer blind or tree stand you hunting out of to "get rid of your scent" to help you bag that monster buck. These Generators are very different, with different technology, than the NPBPI that the district has installed.

People study indoor air quality for years and do not have definitive answers on how to have pure clean air inside our buildings. Most of the materials that go into the structures we build put off VOCs, including formaldehyde. The paint, cleaning products, sanitizing products, and even personal hygiene products put off VOCs. The office equipment like printers produce low levels of ozone. These gasses, VOCs, and Particulate Matter are all around us, inside our home and businesses, and outside in the great outdoors. What I feel we need to do is to look at the steps that have been taken to make the quality of our indoor air as safe as we can to help the students, staff and patrons of USD 348. Do we want increased pollutants in our air space inside our schools? According to the EcoSafe report, VOC's were reduced with the ionizers on, PM's were reduced with the ionizers turned on, and formaldehyde, the VOC that was found in the Library that prompted the second report, was reduced with the ionizers on. I feel turning on the ionizers is one piece to a puzzle for having the best air quality in our buildings that we can. Another piece is to monitor the ozone, formaldehyde, and VOCs in our buildings to ensure levels are below Government standards and to ensure our students, staff, and patrons are safe inside our buildings.

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