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# Healthier outcomes with ozone

*NDLA Summit, January 2024*

**NDSU** NORTH DAKOTA  
STATE UNIVERSITY

univox



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# UniVox and Pathogen Eradication

Started formation in 2021, JV formalized early 2022

Initially worked with upper room Ultraviolet Germicidal Irradiation (UVGI) technology

Berkshire Hathaway contacted us in early 2023 about being a reseller/integrator for their new start-up CerroZone

CerroZone is part of the 80-year-old Marmon Holdings Group under BH.

Production has been transitioning from Marmon facilities to an FDA-certified plant in St. Louis. Production is now online at the CerroZone plant.



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# In-room air purification

## *Ceiling mounted and mobile air cleaning systems*

UniVox is the sole SDVOSB/WOSB distributor for CerroZone

Breakthrough ozonation technology to remove bacteria, viruses, fungi and gaseous compounds from the air

Army testing showed ozone effective against nerve agents

FDA Class II medical devices manufactured in FDA-certified facilities

In independent laboratory tests, CerroZone units remove 99.99+% of Covid-19, RNA and MS2 viruses in a single pass in 1.2 seconds.

It is similarly effective against black mold and gaseous compounds.

# The Power of Ozone

## WHAT IT IS

Ozone ( $O_3$ ) is a highly reactive oxygen molecule. It forms naturally in the upper atmosphere. Due to its disinfecting power, it works about 3,000x faster than bleach with no residue.

## WHY IT'S SUPERIOR

Ozone is certified by the USDA as an organic disinfectant. Due to its high oxidative properties, it degrades cell walls in seconds. Combined with a proprietary catalyst, it is for the first time able to cleanse the air in a safe and reliable way.

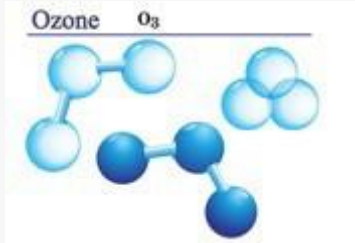
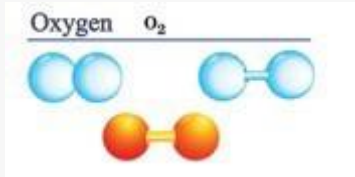
## OTHER POTENTIAL APPLICATIONS

Because of its ability to rapidly break-down pathogens, bacteria, and trace chemicals, Ozone could also be utilized in:

- Poultry Barns – Ammonia & Avian Flu
- Pesticide Residue Removal
- Surface & Sub-Surface Decontamination
- Wildfire smoke mitigation



1. Air Intake - The device pulls in air from the top.
2. UVC Lamps - Ultraviolet light converts the oxygen ( $O_2$ ) in the air into ozone ( $O_3$ ).
3. Mix Chamber - The ozone destroys all microorganisms in the air.
4. Ozone Catalyst - A proprietary catalyst converts the ozone back into oxygen.
5. Air Outlet - Fresh, purified air is returned to the room.



Unit cycles through the air in a room 4 to 12+ times per hour, depending on the size of the unit and the square feet of the room.

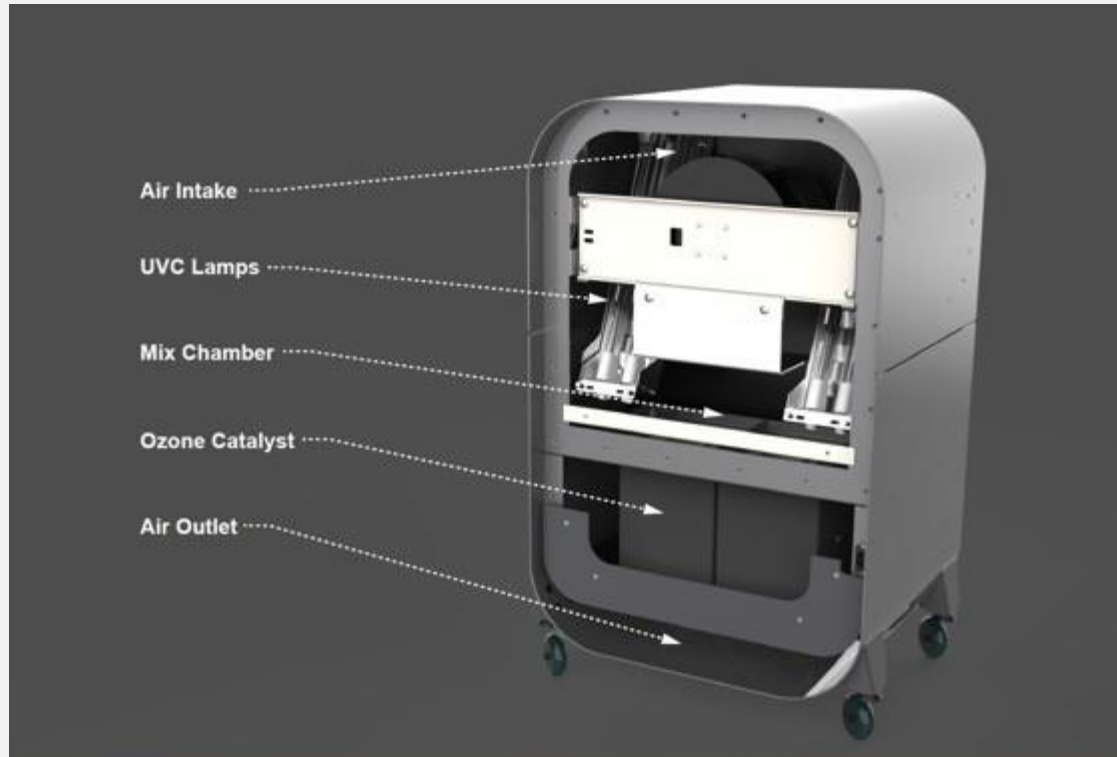
UVC lamps producing 254nm and 185nm wavelengths converts oxygen ( $O_2$ ) in the air to ozone ( $O_3$ ).

The ozone gas oxidizes any pathogens in the air, including SARS-CoV-2, inactivating over 99% of virus particles and bacteria in just a single pass (1.2 seconds) through the machine.

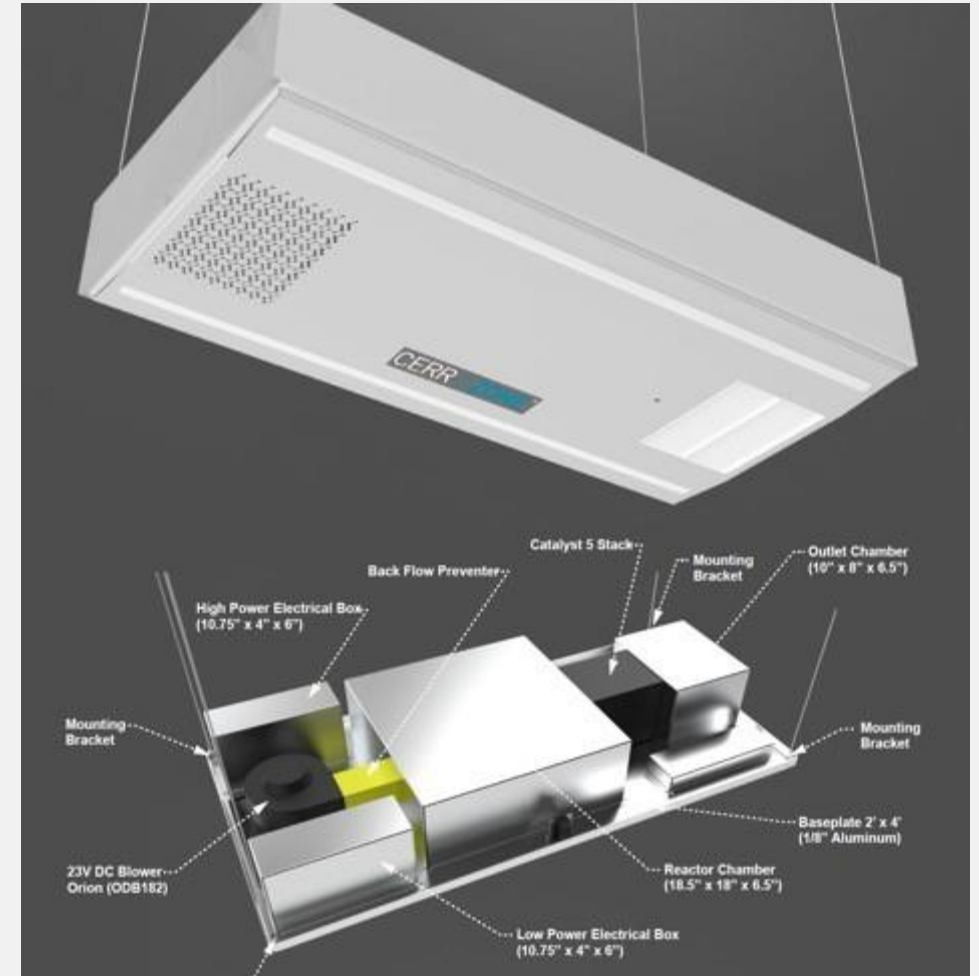
Proprietary catalyst converts the ozone fully back to oxygen (<1 PPB) before it exits the device. For context, the OSHA ambient ozone limit is 50 PPB and the Intertek "Zero Ozone" certification is 5 PPB.

# Current configurations

## Mobile/Mobile Mini



## Ceiling Tile



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# A single device with multiple applications



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- The air we breathe is eight times more contaminated than surfaces.
  - CerroZone provides continuous active disinfection that **does not require any human intervention** or create any harmful by-products or waste
  - **Pathogen agnostic:** effective against viruses, bacteria, molds, and gaseous compounds
  - Will have significant application in agriculture, emergency management, building management, healthcare, education, government and public recreation.

# Safety

- Intertek testing certifies that the unit converts ozone back into oxygen **surpassing [OSHA](#), [EPA](#), and [CARB](#) standards.**
- **Successfully cleared all Intertek safety tests.**
- **Redundancy of ozone sensors** (1 internal, 2 external) as well as a physical back-flow preventer keeps ozone from leaving the device even in the case of a sudden power outage.

Organization/Third Party	Test	Results
FDA	510(k) Class II Medical Device Clearance	✓
Intertek	UL 867	✓
Intertek	CSA C22.2	✓
Intertek	UL 2998 (“Zero Ozone” designation)	✓
Intertek	IEC 60601-1-2	✓
Intertek	AIM 7351731	✓
Intertek	AHAM AC-2 Sound Testing	50 Decibels (dB), 4.64 Sones
CARB	Clearance to sell air cleaning device	✓

# ASHRAE Standard 241

	Lecture Hall	Food & Beverage Facility	Gym	Medical Waiting Room
CFM Per Person Required for IRMM**	50	90	80	90
Room Occupancy	72	200	150	40
Total Required CFM in IRMM	3,600	18,000	12,000	3,600

Unit Operating CFM	# Units Required in IRMM based on Occupancy and Required CFM Per Person			
50	72.00	360.00	240.00	72.00
110	32.73	163.64	109.09	32.73
220	16.36	81.82	54.55	16.36
400	9.00	45.00	30.00	9.00
800	4.50	22.50	15.00	4.50
1000	3.60	18.00	12.00	3.60

- Clean Airflow requirements in ASHRAE 241

- Requirements For Filtration And Air Cleaning Technology
- Infection Risk Management Mode (IRMM)
- Planning And Commissioning
- Testing Standards And Reporting
- Also adopted by the CDC
- Other air purification devices don't have the air handling capacity to meet this standard.



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Pg 11, Table 7-1: MERV 11+ removal efficiency

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Pg 17, 9.1.7: Efficacy per fan speed

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Pg 23, A1.2.1: Testing shall be completed by a third-party independent laboratory

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Pg 23, A1.2.2 a: Chamber volume shall be at least 800 cubic feet

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Pg 24, A1.3.2: Test with non-enveloped MS2

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Pg 27, Table A-1: Formaldehyde safety

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Pg 27, Table A-1: Ozone safety

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Pg 27, Table A-1: Particulate matter count concentration safety

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# **CerroZone proven to meet and exceed ASHRAE 241 Clean Airflow requirements**

Testing completed in August 2023 at ARE Labs in Olathe, KS

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# **Use of HVAC alone to meet ASHRAE 241 Clean Airflow requirements**

**Increase in Electric Usage and Higher  
Maintenance Costs**

**Use of HEPA Filters May 'Choke' HVAC  
Equipment Creating Unwanted  
Mechanical Failures**

**Restricted Air Flow Caused by HEPA  
Filters can Lead to Pressure Changes  
and Air Balance Problems**

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# Third-Party Testing

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**Bacteriophage MS2** (1/4 the size of SARS-CoV-2) – over 99.998% per pass, 99.9999% removal in a room. Testing conducted at Aerosol Research and Engineering “ARE” Laboratories (Olathe, KS).

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**SARS-CoV-2** (original and Delta strains) – over 99.998% per pass, 99.9999% removal in a room. Testing conducted at the University of Missouri Laboratory for Infectious Disease Research (Columbia, MO), MRIGlobal (Kansas City, MO), and Innovative Bioanalysis (Costa Mesa, CA).

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**Gram-Positive** (Staphylococcus) and **Gram-Negative** (Pseudomonas) **bacteria** -- over 99% removal per/pass with both. Testing conducted at ARE Labs (Olathe, KS).

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**Aspergillus brasiliensis** (Black mold) - 99.99+% removal in a room. Testing conducted at ARE Labs (Olathe, KS).

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**Ammonia** (NH<sub>4</sub>) – 100% removal (hit limits of detection) per/pass. No by-products detected. Testing conducted at ARE Labs (Olathe, KS).

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**Hydrogen Sulfide** (H<sub>2</sub>S) – 100% removal (hit limits of detection) per/pass. No by-products detected. Testing conducted at ARE Labs (Olathe, KS).

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**Ozone** (O<sub>3</sub>) – The "Zero Ozone" testing at Intertek has a 5 PPB (parts per billion) max threshold. The testing on CerroZone units showed less than 1 PPB and went down to the detection limit of the sensors since the catalyst was removing background ozone from the room.

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**FDA** – 510(k) Class II device clearance approved on July 1<sup>st</sup> of 2022.

PROS	CerroZone Mobile	NEW CerroZone Mini	Shielded UVC (254 – 280 nm)	Unshielded UVC (Upper Room / 222 nm)	HEPA Filter	PCO / PECO	Ionization / Plasma	Activated Carbon	Traditional Ozone Based Devices
99.99%+ (4 LOG) reduction of viruses and 99.9%+ (3 LOG) reduction of bacteria reviewed and approved by the FDA	✓	Pending	Some		Some	Some			
99.99%+ (4 LOG) virus reduction in room-sized chamber testing (not a shoebox) by an Independent/Accredited Laboratory	✓	✓	Some	Some	Some	Some	Some		
99.99% (4 LOG) reduction on actual aerosolized SARS-CoV-2 (COVID-19) and variants by an Independent/Accredited Laboratory	✓	✓	Some	Some	Some	Some			
FDA 510(k) Class II medical device	✓	Pending	Some		Some	Some			
Certification to "Zero Ozone" standard by accredited 3rd party lab (Intertek or UL) – UL 2998	✓	✓			✓			✓	
Recontamination reduction	✓	✓	✓	Some		Some	Some		✓
Reduces PM 2.5 particles or smaller	✓	✓	Some		✓	Some	Some	Some	
Quickly removes ambient ozone resulting from outdoor smog and indoor pollutants	✓	✓						Some	
Quiet with an acceptable noise level of 55 dBa or lower	✓	✓	✓	✓	Some	Some	✓	✓	✓
Made in USA	✓	✓	✓	Some	Some	Some	Some	Some	✓
Destroys gaseous pollutants and VOCs	✓	✓				Some	Some	Some	✓
Proven to produce no harmful by-products as a result of purification method by Independent Laboratory	✓	✓	✓	✓	✓			✓	

**CERR****ZONE**<sup>TM</sup>  
**More than an air purifier.**<sup>TM</sup>

# CerroZone and Gaseous Compounds

HEPA filters are not effective at removing gaseous pollutants. UV light is transparent to nitrogen in the air and has a limited effect on eliminating gases.

In contrast, ozone is a powerful oxidizer and has demonstrated effectiveness across 3<sup>rd</sup> party testing <sup>(a)</sup>, issued patents <sup>(b)</sup>, and academic research <sup>(c)</sup> on the following gaseous pollutants:)

- **Ammonia** (NH<sub>4</sub>) -- Causes immediate burning of the eyes, nose, throat and respiratory tract and can result in blindness, lung damage or death. Inhalation of lower concentrations can cause coughing, and nose and throat irritation. <sup>1</sup>
- **Hydrogen Sulfide** (H<sub>2</sub>S) -- Colorless gas with a strong odor of rotten eggs. Exposure to hydrogen sulfide may cause irritation to the eyes and respiratory system. It can also cause apnea, coma, convulsions; dizziness, headache, weakness, irritability, insomnia. <sup>2</sup>
- **Pesticides** -- Ozone treatment can be used for the degradation of a broad spectrum of pesticide residues, including several major categories, such as organophosphorus pesticides, organochlorine pesticides, pyrethroids pesticides, carbamates pesticides, etc. <sup>3</sup>
- **Nerve Agents / Blister Agents** – US Department of Army received a patent issued in 1987 (now expired) that described how ozone is “effective for deactivating/decontaminating nerve agents and blister agents generally. Examples of nerve agents include Sarin, Soman and VX. A typical formula for a nerve agent (VX) is as follows, viz **STR1** Examples of blister agents include mustard (HD) and Lewisite (L).” <sup>4</sup>

The proprietary Micron Pure catalyst within the CerroZone units further removes any ground-level ozone gas as it passes through the system:

- **Ozone** (O<sub>3</sub>) -- Breathing ground-level ozone can trigger a variety of health problems including chest pain, coughing, throat irritation, and congestion. It can worsen bronchitis, emphysema, and asthma. Ozone also can reduce lung function and inflame the lining of the lungs. <sup>5</sup>

Sources:

1 (a) [https://www.health.ny.gov/environmental/emergency/chemical\\_terrorism/ammonia\\_general](https://www.health.ny.gov/environmental/emergency/chemical_terrorism/ammonia_general)

2 (a) <https://www.cdc.gov/niosh/topics/hydrogensulfide/>

3 (c) <https://ifst.onlinelibrary.wiley.com/doi/abs/10.1111/ijfs.13938#>

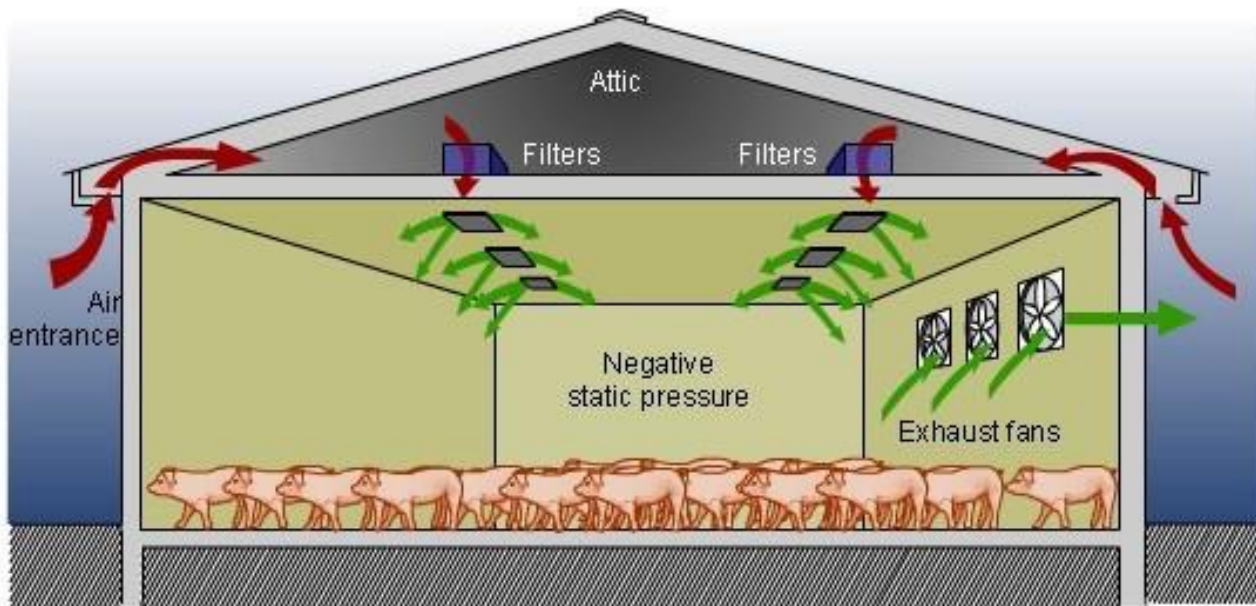
4 (b) <https://patents.google.com/patent/US4784699A/en>

5 (a) <https://www.iowadnr.gov/Environmental-Protection/Air-Quality/Air-Pollutants/Effects-Ozone>

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# CerroZone and Swine Health

Status quo:



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Offers a drop-in technology that addresses multiple contaminants impacting swine production

Address challenges to maintaining indoor air quality in swine barns in cold weather conditions

Eliminate bacterial and viral pathogens instantly.



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# CerroZone and NDSU

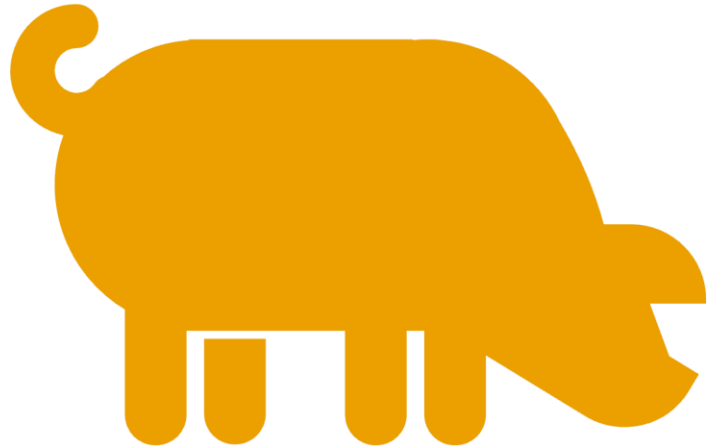
UniVox has partnered with NDSU's Animal Sciences Department on a study to test CerroZone's efficacy in improving air quality in swine barns.

The study will address both particulate matter (like ammonia) and bacteria.

The study will follow 32 litters of piglets through the farrowing and nursery phases.

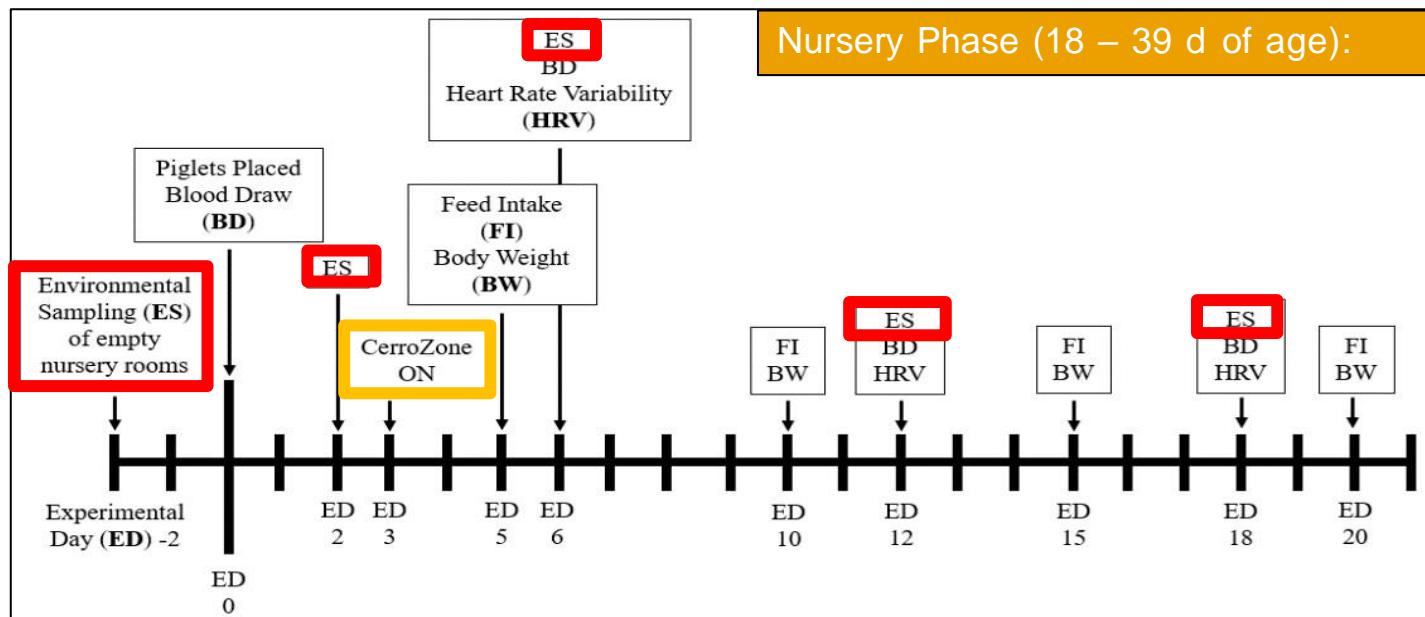
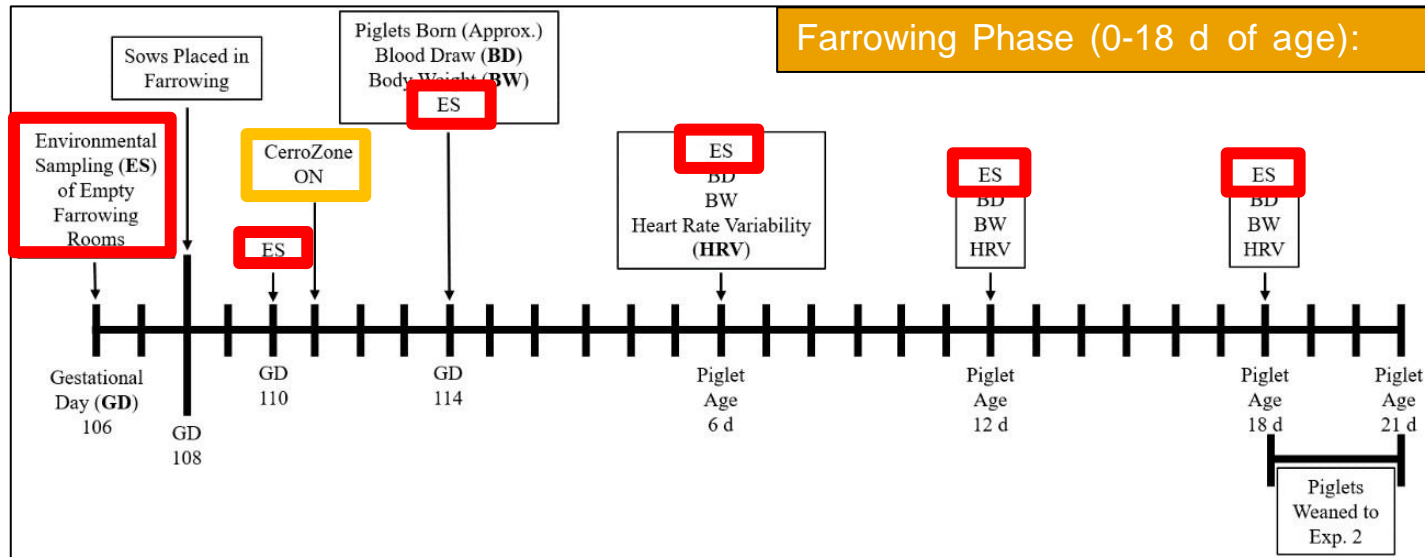
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# Study purpose



- (1) Determine the effect of CerroZone air purifying technology on swine barn air quality.
  - (2) Determine the effect of CerroZone air purifying technology on pig health and growth during the farrowing and nursery phases of production.
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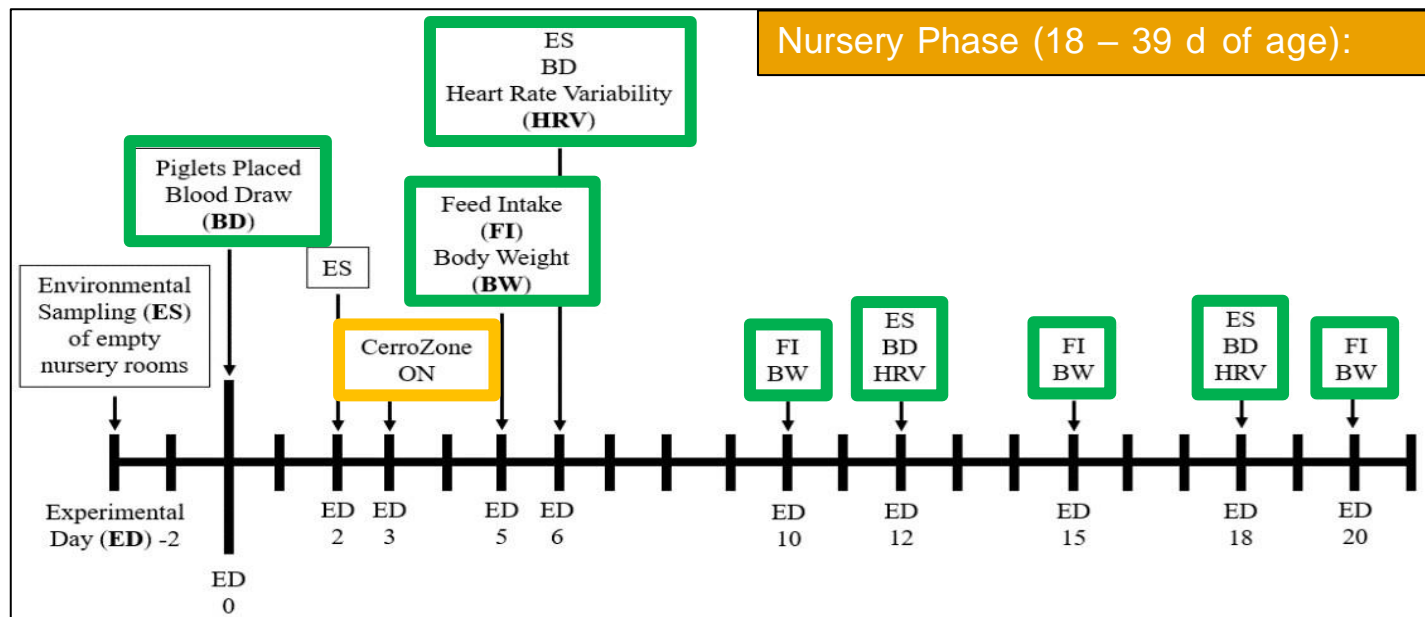
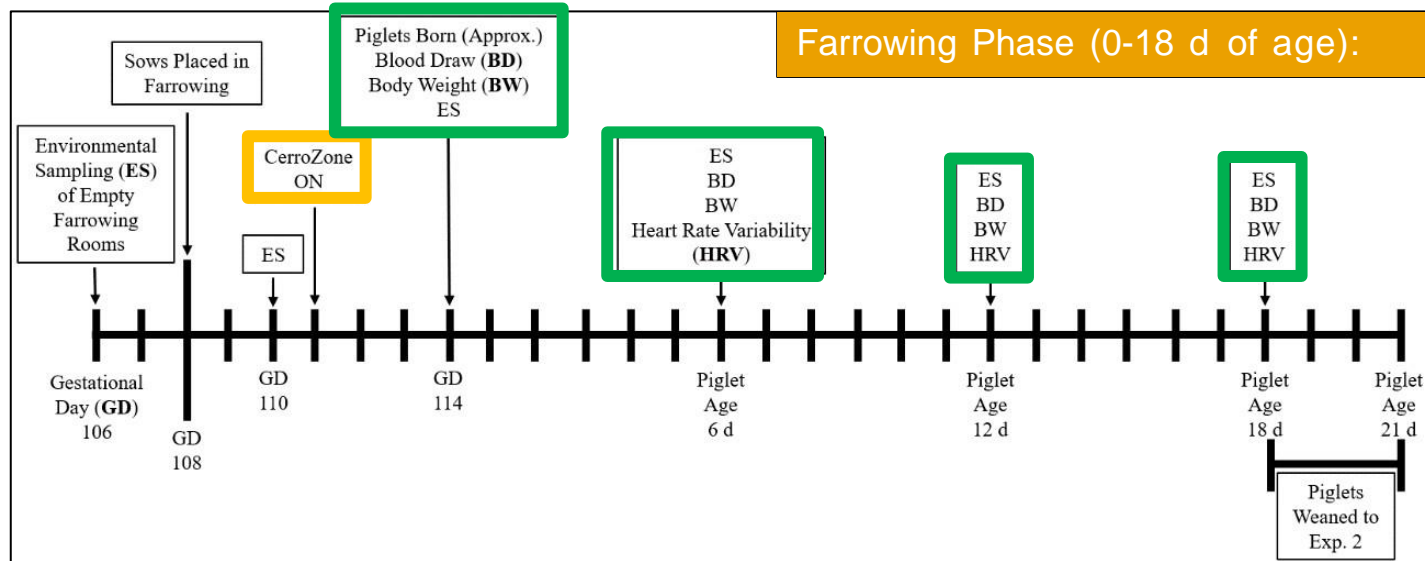


## General Procedures:

- CerroZone turned on 3-d post animal introduction.
- Regular environmental sampling (ES) throughout experimental period.

## Environmental Sampling

- Airborne/Equipment pathogens
- Ammonia



## General Procedures:

- Performance of pigs measured by body weight (BW) and feed intake (FI).
- Heart rate variability (HRV) and behavior of animals measured to detect changes as a result of CerroZone technology.
- Immune function (BD) and nasal microbiota.

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# Contact

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