Welcome!

Environmental Control for Food Safety & Quality

Presented by

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Air Management Technologies, Inc.
Building Energy & Environmental Services

Environmental Control Wholesale Bakery

Occupants

- Heat stress
- Air exchange
- Air movement

Food Quality & Safety

- Space temperature
- Humidity
- Mold / Particulates

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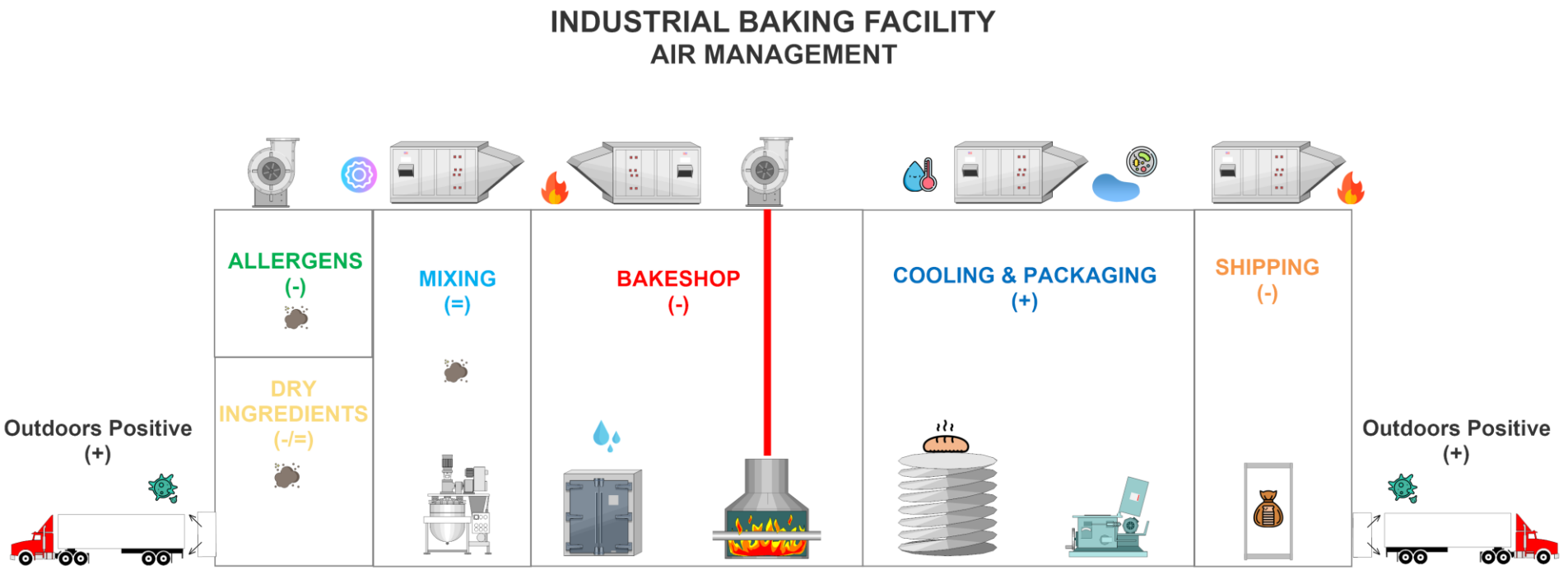
Bakery Overview – Environment



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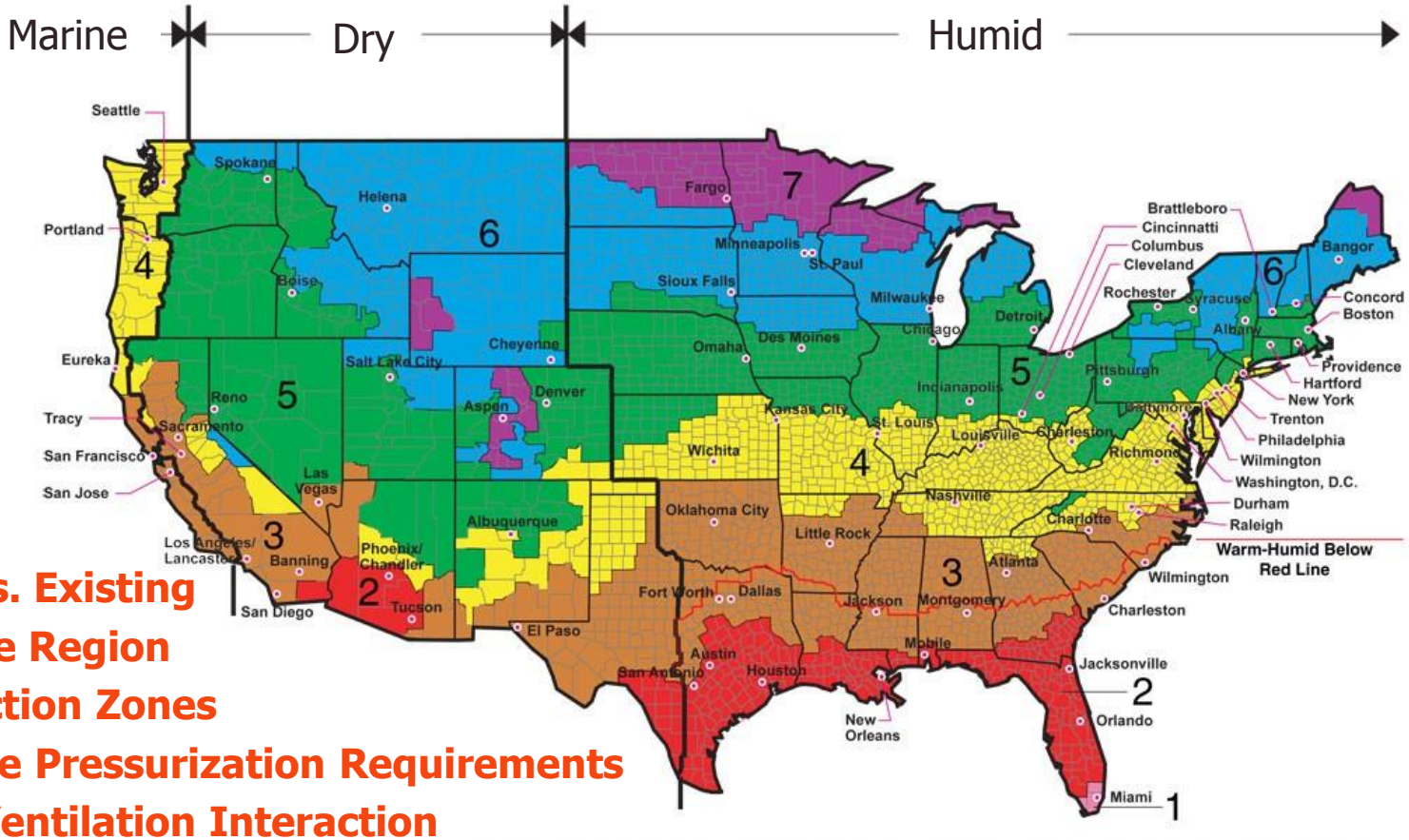
Facility Considerations



- ✓ New vs. Existing
- ✓ Climate Region
- ✓ Production Zones
- ✓ Positive Pressurization Requirements
- ✓ Zone Ventilation Interaction
- ✓ Air Filtration

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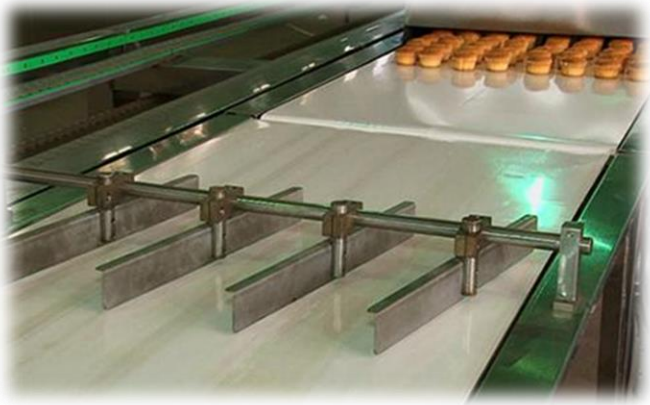
Cleanrooms

- Enclosures
- Exposure Impact Factor
- ISO Specifications
- Zones
- Compressed Air Filtration
- Product Temperatures



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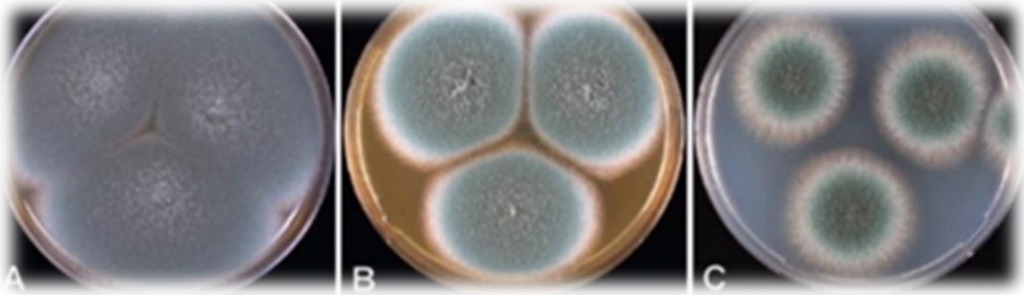
Mold

- Spores Active vs. Dormant
- Darkness / Light
- Moisture and Humidity
- Nutrient
- Temperature 40-100F
- Greenhouse will travel
- Time 24-240 hours



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Space Pressurization

Space Pressurization Water Column "	0.03"	0.05"	0.07"	0.09"
CFM Leakage per Ft2	694	896	1,060	1,201
Electric Cost, Fan	$40	$53	$64	$74
Heating Cost	$646	$834	$986	$1,117
Wind Protection, MPH	7.9	10.2	12	13.6

- **How Pressure and Velocity (MPH) Equate**
- **Importance of Dock Door Maintenance**
- **Motorized vs. Gravity Dampers**

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Air Filtration

Description	MERV-1 Service Roll	MERV-6 Tridim 2-Ply	MERV-8 Tridim 3-Ply	MERV-13 Tri-Cell/Pre
Efficiency 3.0 Microns	<20%	84%	87%	>95%
Pressure Drop @ 500 FPM	0.08	0.31	0.46	0.78
Usage Area	None	Existing Retrofit	Non-Product	Product Zone
Energy Cost MCFM	$4.51	$17.46	$25.92	$43.94

Equipment Air Filtration

1. Minimum Efficiency Rating Value (MERV)
2. Continuous linked filters recommended to prevent air bypass.
3. Antimicrobial coating NOT recommended for "Human Comfort" systems
4. Energy cost based on $0.06 per kWh and 8,000 hours a year operation

- **Existing Equipment retrofits may have negative impacts.**
- **MERV Ratings**
- **Material Type: Synthetic vs. Cardboard and Fabric**

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Sample Plant Results

Outdoor Air Infiltration 919

Plant Condition	Suppy Airflow Filtered	Exposure Product Molds M^3 MERV Rating			
		1	6	8	13
Negative Pressure	90%	1,006	275	240	
Positive Pressure	100%	1,016	203	165	
Spiral Cooler	100%			165	64

Facility Ambient Mold Impact

1. Space pressure inside plant was negative 0.015" WC
2. Sample exhaust taken at Spiral Cooler exhaust discharge

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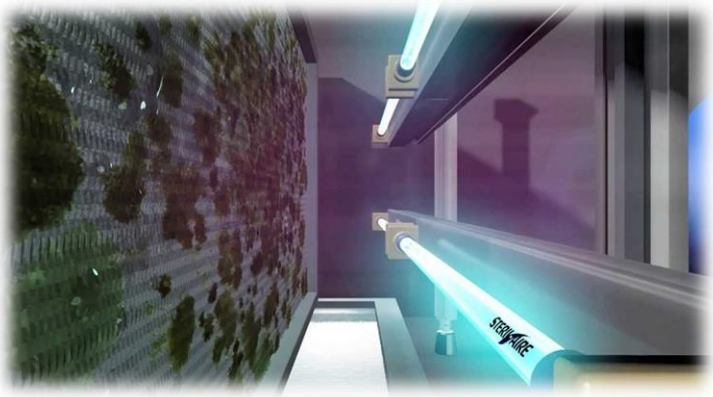
Environmental Control Systems

- Sanitation
- UV Lighting
- Air Filtration
- Outside Air Intakes
- Fabric Curtains
- Up-blast Exhaust Fans
- Location of Air Devices
- Air Distribution Types



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Sample Guaranteed Solutions Comparative Snapshot

	Cleanroom	Spiral Conditioning	Refrigerated	Ambient
Sustainability Impact				
Emissions GHG/Tons	63	50	50	94
Refrigerant GWP/Tons	171	114	379	0
Stewardship Allowance	$0	$0	$0	$0
Energy Cost				
Fan	$4,770	$3,816	$3,816	$7,156
Cooling	$4,430	$2,954	$56,000	$0
Heating	$0	$0	$0	$2,385
Operating Cost				
Production Efficiency	$0	$0	$0	$0
Sanitation & Maintenance	$10,000	$7,500	$10,000	$5,000
Food Safety & Quality				
Predictiable & Protective	Best	Better	Good-Fair	Fair
Quality-Waste-Value Benefit	0.30%	0.20%	0.10%	0.00%
Financial Impact Annual Benefit	($120,000)	($80,000)	($40,000)	$0
Financial				
Capital Investment	$725,000	$575,000	$525,000	$300,000
Capital Avoidance	$300,000	$300,000	$300,000	$0
Incentives	$0	$0	$0	$0
Capital Comparison	$425,000	$275,000	$225,000	$300,000
Cost Bias				
First Year Investment	$324,201	$209,270	$254,816	$314,541
Annual Operating Cost	($100,799)	($65,730)	$29,816	$14,541
Simple Return on Investment %	31%	31%	-12%	-5%
Life Cycle Years	15	15	15	15
Life Cycle Investment	($1,086,987)	($710,950)	$672,246	$518,115
Investment Impact Cost Lb.	($0.0009)	($0.0006)	$0.0006	$0.0004

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Bakery and Food Processing Solutions

Industrial Ventilation

- Product Cleanrooms
- Space Pressurization
- OSHA Heat Stress
- Particulate Air Filtration
- Make Up Air Systems
- Central Panel Cooling
- New Facility Design
- Cold Storage
- Minor Ingredient HVAC
- Thermal Storage
- Sanitary Design

Oven/Oxidizer Waste Heat

- Oven Exhaust
- Oxidizer Discharge
- Fuel Cell Stack
- Compressed Air
- Hot Thermal Utilities
- Cold Thermal Utilities
- Low Temp Refrigeration
- Industrial Heat Pumps
- Steam Generation
- Hot Water Heating
- Bagel Boiler Pre-Heat

Process Environmental

- Product Coolers
- Blast Freezers
- Hold Freezers
- Proofers
- Retarders
- Kettles & Cookers
- Fermentation Rooms
- IMP Enclosures
- Sanitary Plenums
- UV Lighting
- Humidification

Central Glycol Refrigeration

- Central Chillers
- Glycolic Pumps
- Heat Exchangers
- "Ice" Water Chillers
- Energy Optimization

Chemical, Low Charge Ammonia, and CO2 refrigerants.

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Thank You!

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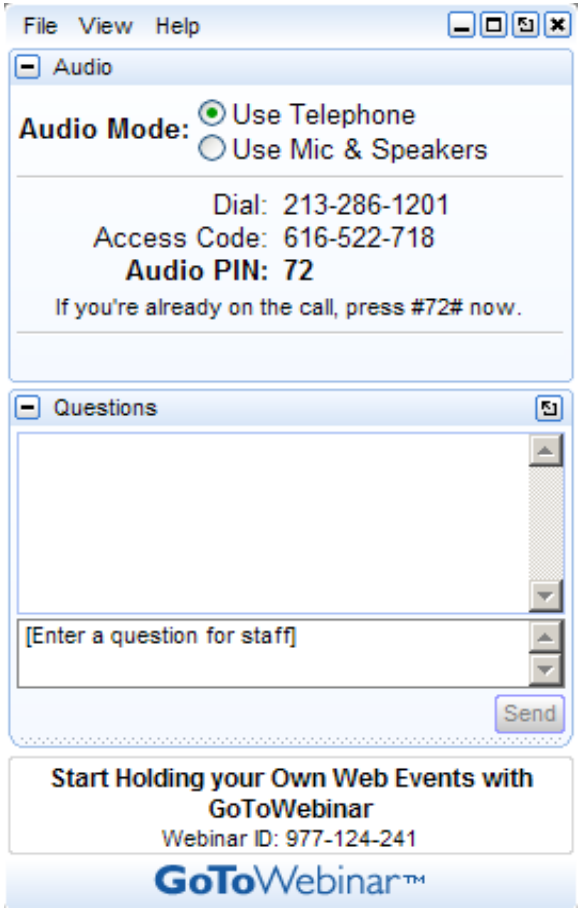
Questions or Comments?



- **Reminder for submitting a question:**
  - Please make sure your attendee panel is open
  - Enter your question in the question box and click send.

Additional Questions?

info@airmangement.com
570-523-4822

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Thank You for Attending

- Follow up email and survey
- More Questions?

American Society of Baking

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