Targeted Ventilation

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Michigan Potato Industry Commission
Winter Potato Conference 2023

Techmark, Inc. History

- Founded in 1987 in Lansing MI
- Our Mission is to serve high value agricultural producers, striving to make the best producers better.
- One of our corporate goals is:
  - "To develop complete, technology-based solutions to producer defined opportunities."
- Fruit and Vegetable Post Harvest Handling and Storage.
- Large Scale mushroom cultivation

Techmark, Inc. Storage Solutions

- Ventilation System Design, Sales, Installation and Support
- Potato Laboratory Services for Sugar levels in Chip and French Fry Potatoes
- Impact Recording Device manufacturer- Bruise detection for produce harvest and handling systems
- Consulting on Storage Operations for maximum quality return

Josh Brood - Storage Division Manager

- Engineer at Techmark since 2003
- Design of ventilation systems
  - Sugar Beets, Potatoes, Carrot, Vegetable Cold Storage
- Work with growers and producers to determine how our ventilation systems will benefit their operation
- Mechanical and Electrical team lead and scheduling
- Set-up and start-up of ventilation systems and training of managers and operators

Goal of a Potato Storage

- To keep potatoes viable between the time of harvest and processing.
  - Short term (1 week to 1 month)
  - Long term (1 month to 12 months)
- Not a hospital - Poor quality potatoes can not be changed to good quality, simply by placing them into storage
- In northern climates like Michigan, we can use outside air to keep potatoes at a temperature profile where pathogens can be minimized
- Supplemental Cooling in a controlled environment to keep this same temperature profile

Goal of a Potato Storage

- Humidity added to keep environment surrounding the potato at a high level (98 -99% RH) so weight loss is not seen at processing time
- Heat added to keep temperature profile in line, as to not freeze or alter sugar levels
- Control of CO2 levels to maintain good chip and fry colors

Problems with Potatoes in Storage

- In traditional ventilation systems, when a rot problem is discovered by smell or visual leak (trench, pipe or ducts) the first mode of action is to turn off the humidification system
- If the problem area is large enough, decisions are made to remove good potatoes to gain access to the bad potatoes in the storage
- Both of these options involve long term implications that will affect the value of the stored potatoes
  - Weight loss of potatoes with out proper humidity in first scenario
  - Moving potatoes outside of intended shipment periods and possible quality hits

Problems with Potatoes in Storage

- The best way to deal with rot is high volume, dry air.
- How do you tr eat the potatoes that are rotting, without compromising the potatoes that still have good integrity?
  - Targeted Ventilation
  - A system within a system
  - Prescriptive Ventilation as we call it!

Prescriptive Ventilation

Prescriptive Ventilation - What is it?

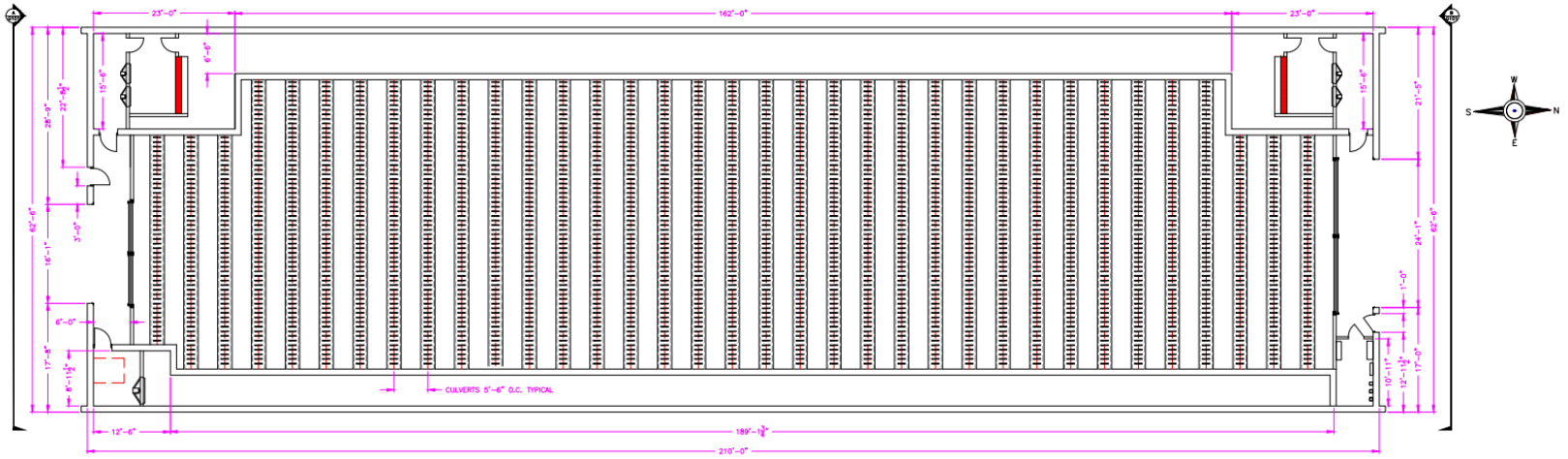
- Definition of "Prescription":
  - **In the medical field:** a written direction for a therapeutic or **corrective agent**
- *specifically* : one for the preparation and use of a medicine.

- Definition of "Prescribed":
  - **a:** to lay down as a guide, direction, or rule of action
- In our case- Using a "prescribed" amount of dry, high-volume air to aid in rot problems within a traditional potato storage system.

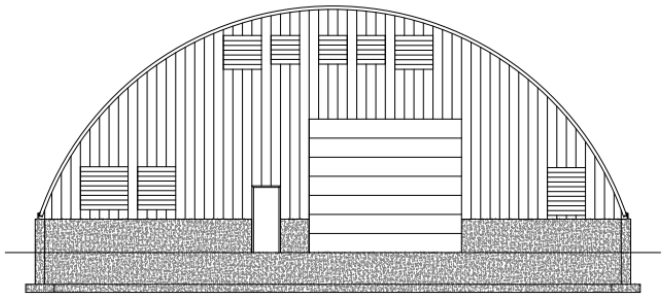
Prescriptive Ventilation

- Suitable for northern climate storages:
  - This will only work when outside air temperature is below the potato temperature and therefore suitable for drying the potatoes
- How To: Watch the Plenum Temp and the Pile Temp sensor in the PV system to determine the evaporative cooling that is taking place as the decaying potatoes are dried.
  - Once these are within 1 degree of one another, the Above Pile RH sensor should begin to read a value below 95%.
  - When the Plenum Temp and the Pile Temp sensor are within 1 degree of one another and the Above Pile RH is below 95% for 3 consecutive days, then the pile has been dried.

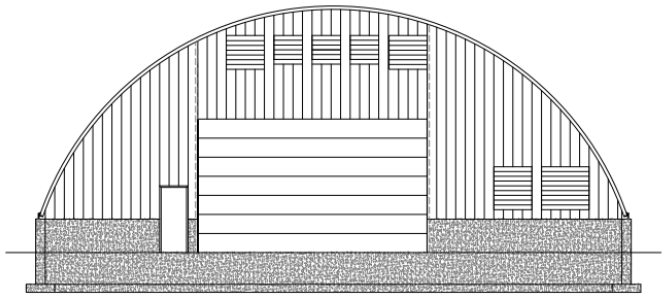
Prescriptive Ventilation: Design



PLAN
SCALE: 1/8"=1'-0"



SECTION A G101
SCALE: 3/16"=1'-0"



SECTION B G101
SCALE: 3/16"=1'-0"

Prescriptive Ventilation

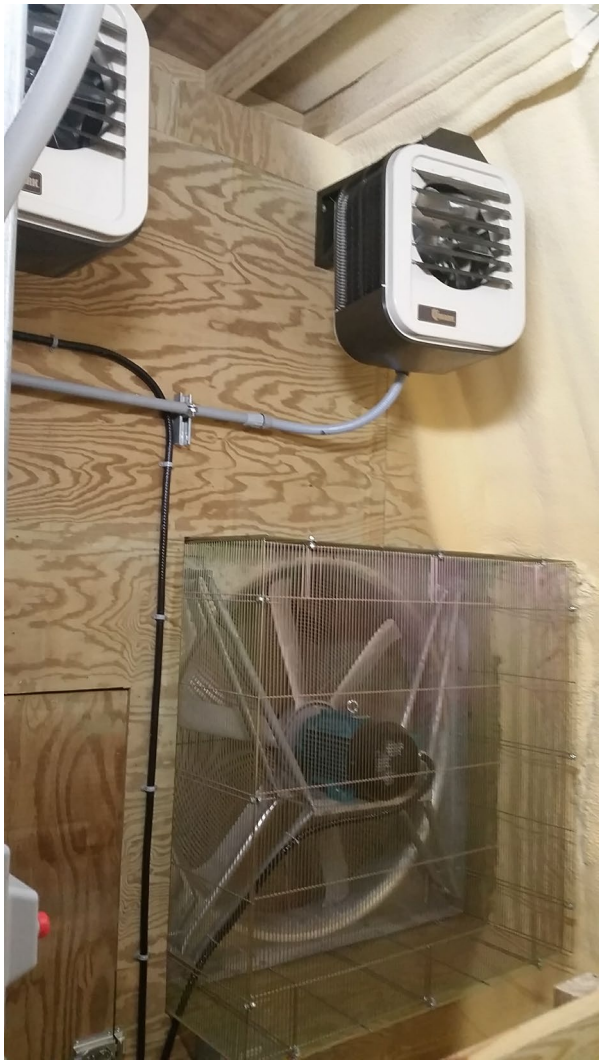
Left Side - Main System

Right Side - PV

Prescriptive Ventilation: Equipment

Fresh Air Inlet- Usually 1 Inlet Door

Pressure Fan- Sized depending on cwt treated at min of 2 cfm/cwt



Prescriptive Ventilation - Equipment

Heat is required - electric heat or vented gas heaters

Prescriptive Ventilation - Equipment

- Pile temperature sensor in treated area
- Return air humidity and temperature sensor above the treated area
- Plenum humidity and temperature sensor

Prescriptive Ventilation - Equipment

Air Volume Sensor - Determine cfm/cwt

Prescriptive Ventilation

Prescriptive Ventilation

Some of the first systems used a plywood chamber to target the dry air in the main system chamber.

This took time to implement and was more difficult to have multiple areas of treatment.

Prescriptive Ventilation - Charge wall entry

Prescriptive Ventilation - Large System: Fresh Air Door, Heaters and Fan

Prescriptive Ventilation: Trailer System

Other methods of Targeted Ventilation

- Closing off ducts on a daily or hourly basis.
- Keep humidity turned on and ducts open for good potatoes for a time duration
- **Then Flip Flop and air system**
- Turn off humidity and close ducts to good potatoes and open ducts to potatoes with an issue
  - CFM is increased because there are fewer ducts open to the entire ventilation system
  - Increase your system CFM with additional fan

Supplemental Cooling - Refrigeration System

- Fixed in place or mobile options
- Allows for greater harvest window
- Extend storage season into spring and summer
- On board controls for remote troubleshooting

Thank you for your time and attention.
For further discussion, please contact myself or any of Techmark's team members.

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