DESIGN OF BLAST CELLS IN SANTA MARIA

1. Overview

The design of the blast cells in Santa Maria is based on the large cells in Building 3 of the Oxnard facility. Such a design results in extreme variation in air temperature and velocity at various locations in the cell, and thus inconsistently freeze the product. The ultimate result is a longer cycle time necessary to completely freeze the product and/or an incomplete freezing of the product.

John Dittrick, Ken Evans, Jim Romine, Chris Kennedy and Elliott Wolf all agree that the design must be changed to one similar to those used in materially every other blasting warehouse owned by Lineage. Below we provide an explanation of why the current design is flawed and the necessary changes. The cells will have to be completely redesigned, but can still fit into the 24’ × 44’ footprint in the existing blueprints.

2. Existing Design

The current design for Santa Maria calls for 9 blast cells arranged in one row on the east side of the facility, directly adjacent to the conveyor through which Titan will pass product. Each cell is 24’ wide by 44’ deep, with a 27’ opening for the door.

2.1. Airflow. In the Santa Maria cells, as in Oxnard, air is blown over a coil in the top, rear corner of the cell towards the front of the cell, through an airspace at the top. The air then “turns” 90 degrees downward and travels into an airspace between the front of the racking and the door. It is then sucked through the product by fans on the rear wall, then sucked up to the coil in the top and the cycle repeats.

FSI Architects’ elevation of the blast cell design is as follows, with arrows indicating the direction of airflow:
MOUNT OVERHEAD DOOR TRACK AS CLOSE TO ROOF FRAMING AS PRACTICAL

EVAPORATOR UNDER DEFERRED REFRIGERATION SUBMITTAL

METAL DECKING ATTACHED TO TOP OF RACKING

PENDENT MOUNTED LIGHT FIXTURE

DRIVE IN RACKING UNDER DEFERRED SUBMITTAL

REcirculation Fans- Balancing to Eliminate Dead Air in Corners

ACCESS LADDER TO MAINTENANCE CAT WALK
ONE AT SOUTH END AND ONE AT NORTH END OF CELL BANK.
OPENING ONLY FOR MAINTENANCE ACCESS BETWEEN CELLS.
The perspective from above:

2.2. **Capacity.** The current design envisions racking that is 5 pallets-high, 5-wide and 7-deep, for a total of 175 pallet positions in each cell and 1,575 across all 9 cells. At a nominal blast cycle length of 72 hours,\(^1\) the facility will able to blast 525 pallets per day.\(^2\)

The blasting capacity is more than sufficient for the needs of Titan, even once it ramps up. Titan has indicated a maximum throughput of 400,000 lbs per day at the height of the strawberry season. Approximately 30% of this output will be IQF cases and thus not need to be blast frozen. Even if Titan produces 400,000 lbs of drums in a day, at 1,600 lbs per pallet, the facility will only need to blast 250 pallets per day.

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\(^1\)As discovered in Oxnard, we have no idea of the “proper” blast cycle length, particularly for a 400-lb drum. 72 hours is the upper end of the SOP provided by Smucker for Oxnard, but it does not account for the variability in airflow and air temperature encountered in different areas of a blast cell of this design. Rigorous testing is necessary to determine the appropriate cycle length and temperature distribution in a cell of this design; we have begun specing out the necessary sensors, data collection equipment and procedures, but doing so will take weeks and likely need to be done during strawberry season with live product.

\(^2\)Titan was unable to provide precise estimates on scheduling throughout each production day. The calculation above represents an upper bound, as simply 1575 pallet positions / 72 hours \(\times\) 24 hours / 1 day.
3. **Necessary Changes**

Based on our experience on the east coast and at Oxnard, the blast cells at Santa Maria must be redesigned in order to increase their efficiency, decrease cycle length, and ensure consistency in the freezing process.

3.1. **Airflow Direction.**

3.1.1. *Flawed Premise of Current Design.* The racking is $5 \times 5 \times 7$ deep and oriented such that the air flows through 7 pallets. Fisher and Terminal management’s stated reason for such a design is to “pull the hottest air possible.” By making the air circulate through the longest dimension in the blast cell, it removes the most heat in each revolution around the cell.

While correct that this design “pulls the hottest air,” our objective is not merely to remove as much heat as possible. Our objective is to make sure all of the product reaches the temperature specified by the customer. The Oxnard/Santa Maria design makes this difficult in that it maximizes the variation in air temperature and in air velocity within a cell. Air heats up as it goes through each successive pallet. In cells of a similar design as here, in the middle of the cycle, the air temperature is approximately 18 degrees higher in the back of the cell than at the front.\(^3\) We do not have airflow figures for the front and the back of the cell, but they are likely to be comparably variable, as each pallet serves to shield the successive pallets from the oncoming air.

The variation is highly problematic because the blast cycle is not complete until the hottest product in the cell is below the temperature specified by the customer. In a design such as in Santa Maria, achieving the required temperature in all of the product will require cooling product in some parts of the cell to a temperature well below the specification, reducing capacity and wasting energy. Even worse, workers could conclude that because some of the product meets specification all of the product meets specification, and pull product prematurely.\(^4\)

3.1.2. *Alternative Design.* Elsewhere in Lineage, we nearly universally use a different design. In Vernon and in the east coast warehouses warehouses, the fans are oriented to send air through the smallest number of pallets—usually from left to right—as opposed to the largest. Although each cycle of air pulls less heat off of the product than with the existing Santa Maria design, there is a (far) less extreme variation in temperature and airflow between the intake and the return side, and thus within the cell.

\(^3\)Per discussion with Pat Stimpert in early November. Do we have an alternative source that we could get more detailed figures from?

\(^4\)This is especially likely with a design as deep as these cells. The hottest part of the cell will be towards the rear; but taking temperatures of product towards the rear will require unloading almost all of the cell. It seems unlikely that we could take such temperatures consistently.
Converting the Santa Maria cells to the traditional design while maintaining the same footprint would require rotating the airflow 90 degrees and eliminating two columns of pallets on each side to provide airspaces:

### 3.1.3. Implications for Capacity.

All else equal, rotating the airflow and providing airspaces on the left and right would reduce the capacity of each cell from $5 \times 5 \times 7 = 175$ to $3 \times 5 \times 7 = 105$. Across all 9 cells, there would be 945 blast positions. This is still sufficient to service Titan’s needs, assuming a 72-hour cycle length.

Rotating the airflow to left-to-right obviates the need for the air plenum in the rear necessitated by the current design. We must confirm with the architect, but the horizontal dimension of the airspace seems greater than the length of two pallets, allowing a configuration of $3 \times 5 \times 9 = 135$, compared to the original $5 \times 5 \times 7 = 175$.

Despite the decreased pallet positions, the new design would lower the cycle length, thereby increase blast capacity on the margin.\(^5\)

\(^5\)We do not have enough data to quantify precisely how much. We are prioritizing collecting it in Oxnard, but need to wait until the sensors are ready and the strawberry season starts.
Notwithstanding the dimensions and capacities described here, we need data from Vernon and the east coast facilities to determine the optimal configuration. For now, we advance only the general principle of left-right airflow through the shortest dimension, as opposed to a specific racking configuration.

3.1.4. **Blasting Partially Empty.** The left-right airflow configuration also improves the performance of a blast cell if it is not completely full.

Ideally, a cell would operate only if it was completely full. Gaps in product allow air to “short-cycle” around the product instead of through it. Further, differences in the thermal mass of the product in the cell from cycle-to-cycle cause inconsistencies in the optimum cycle length.

Under any of the above-discussed racking configurations, it is very likely that these cells would run much of the time without being completely filled. Although Titan’s extremely large lot sizes may completely fill these cells when it fully ramps up production, in the early years and during slow parts of the season it will produce far less than 140 pallets per day. Even if it does not, there could be “residual” pallets that must be frozen.

According to Chris Kennedy of RCS Smithfield/Tar Heel, the left-right airflow makes the cell easier to manage if not completely filled:

I think the best reason for the left to right air flow is an operational issue. It makes it easier to load the cell if you are not going to fill it completely or if you have product that has a longer freeze time than others that are going in to the same blast.

The goal is to build a wall of product that the air is forced to flow through whether by sucking it or pushing it through. When the air goes from the side you can place the product that is harder to freeze on the discharge side or if you are only filling a portion of the cell you can create that wall more efficiently you can also utilize baffles more effectively to direct the air flow. That was one of the biggest things that I saw in the pictures was a large empty space in the cell that would allow the air to go around the product.

If there is an issue with the racks or numerous other reasons that the cell is not loaded evenly in the front to back style it does not leave you many options for restricting the air flow through the product. I have used both styles in the past and found operationally the left to right gives you more flexibility. It is also easier to train the staff that the more difficult product to freeze goes on the left rather than being the last thing that is loaded.

For instance, with the barrels being made out of different materials, we would instruct our blast loaders to place them on the discharge side and to plan his blast loading accordingly. We would load the left and the middle with the plastic barrels and would load all of the metal barrels on the right.
We do that now with the hot offal product and the product that has high fat content making sure that is loaded on the discharge side.

3.2. **Consistency of Dimensions.** The roof of the facility is sloped such that the side to the north of the blast cells is 7 feet lower than the side on the southern end of the blast cells. With the current design, Cell 9 is approximately 4 feet taller than Cell 1. The height of the racking and metal decking separating the airspace on the top of the cell is the same across all cells, leaving a variation in the height of the top airspace across the cells:

![Diagram showing blast cells with varying heights]

We do not know the precise impact of this inconsistency, but increasing the vertical dimension of the airspace means that a larger air mass is in the cell cycling around the product. Moving a larger mass with comparably sized fans would result in lower airspeeds. Precisely how much lower is something that we would have to test or simulate—an exercise for which we have insufficient time.

Given the experience at Oxnard, however, we should blast as consistently as possible. Each cell should have identical dimensions. Achieving this would require moving them to an orientation perpendicular to the slope of the roof or building a deck at the same height in each cell to make the size top airspace consistent.