Alarm Fatigue (Lessons From The Sort Of Real World)

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Avoiding Alarm Fatigue in Food Safety Monitoring

- **Why it matters:** Alarms in food safety systems are essential, but excessive alerts can lead to neglect and risk.
- **Research motivation:** A real-world incident highlighted the need to improve alarm response in food service environments.
- **Study focus:** Our work explores strategies to reduce unnecessary alerts while maintaining rigorous safety standards.

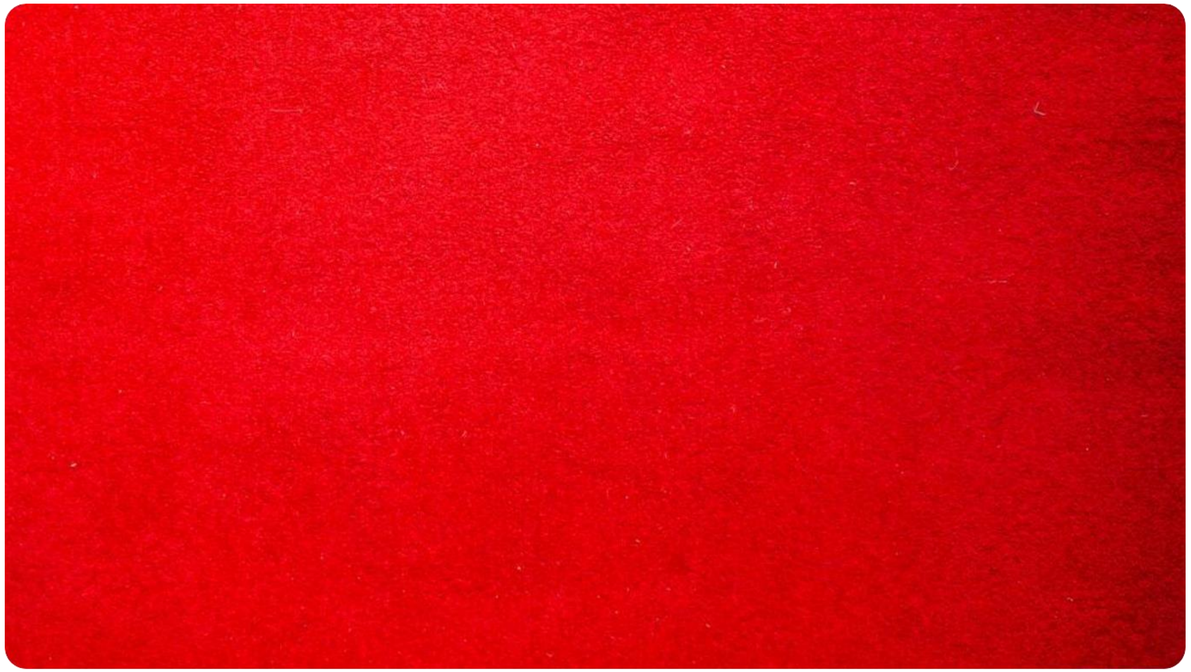

Photo by Jason Dent on Unsplash

A Moment That Stuck With Me

Routine inspection with a surprising insight

- **Unexpected scenario:** A walk-in cooler alarm was sounding, but kitchen staff ignored it entirely.
- **Cultural normalization:** The staff perceived the alarm as background noise due to frequent false triggers.
- **Catalyst for research:** This incident emphasized the critical need to rethink alarm design in food safety systems.

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The Alarm No One Heard

When warnings lose meaning

- **Constant noise:** Repetitive alarms desensitize staff, leading to critical signals being overlooked.
- **False alerts:** Frequent triggers from non-hazardous events reduce alarm credibility.
- **Safety erosion:** Ignored alarms undermine the protective intent of monitoring systems.

Photo by Arabella P on Unsplash

The Problem

Alarm fatigue undermines safety systems

Signal overload
Frequent alerts blur the line between critical warnings and minor issues.

Desensitized response
Users become less reactive, risking missed detection of real hazards.

Systemic breakdown
Alarm fatigue can compromise trust and efficacy in safety protocols.

Our Research Question

Balancing alert reduction with food safety

Key inquiry
Can we reduce unnecessary temperature alerts while maintaining food safety integrity?

Motivating concern
Over-alerting leads to alarm fatigue, which may result in missed real dangers.

Outcome goal
Develop actionable guidelines to differentiate between benign and critical conditions.

Study Design

Evaluating sensor accuracy under controlled conditions

Sensor types
Compared actual product probes, simulated product sensors, and ambient air sensors.

Test environment
Used a commercial reach-in refrigerator to assess temperature behaviors.

Measurement focus
Monitored accuracy and response patterns across sensor types over time.

Products Used

High-risk foods for validation

Food selection
Used diced tomatoes and shredded lettuce—perishable items common in food service.

Risk profile
Chosen for their vulnerability to temperature abuse and pathogen growth.

Storage method
Items were stored in 1/6 pans to simulate standard commercial kitchen practices.

Normal Conditions

Simulated sensors match real food readings

- **Stable results:** Simulated product temperatures closely aligned with actual food readings.
- **Ambient variance:** Ambient air sensors showed higher and more variable temperatures.
- **Validation strength:** Supports simulated sensors as accurate proxies in stable environments.

Photo by Alexander Grey on Unsplash

Stress Test Scenarios

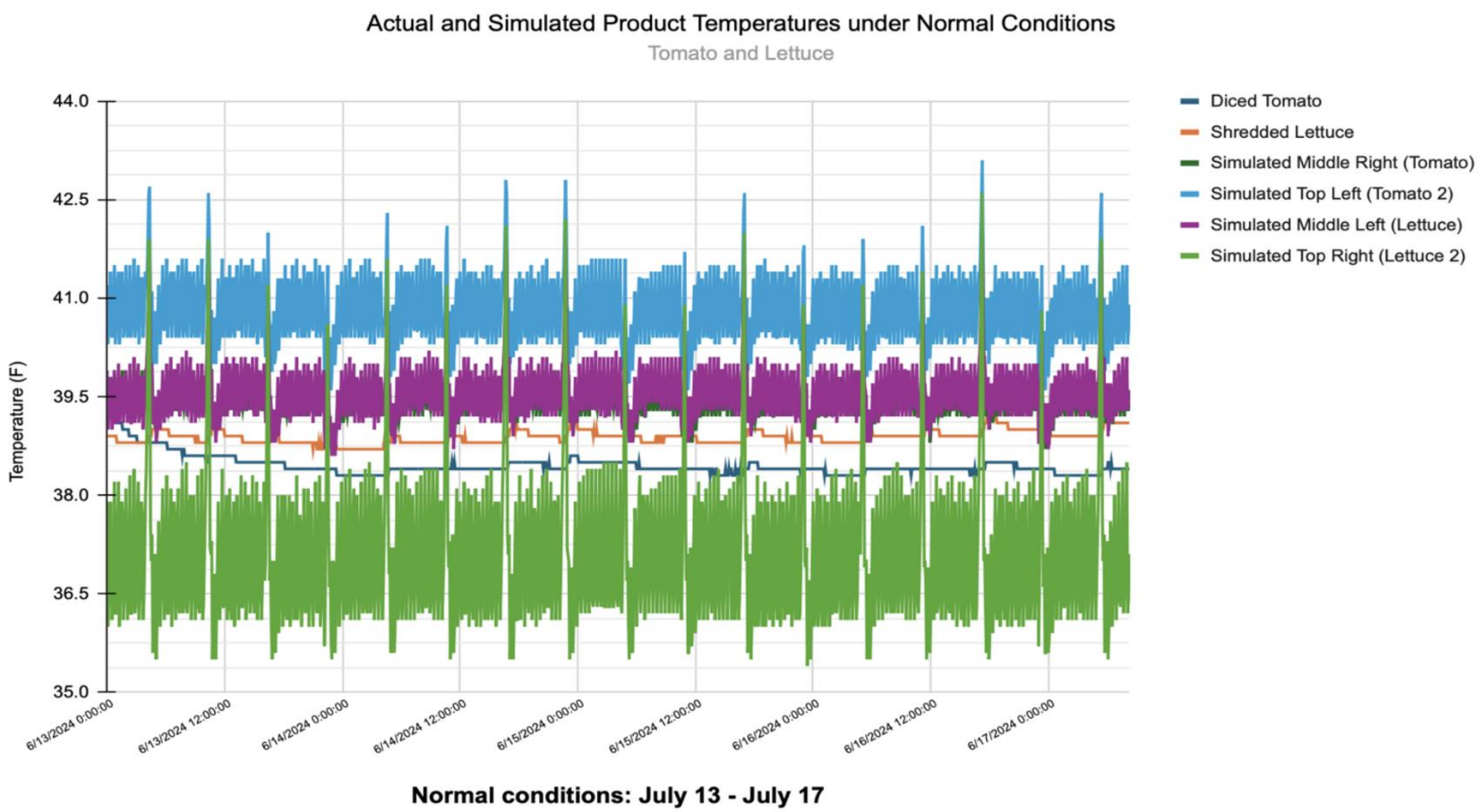
Simulating real-world refrigeration failures

- **Power outages:** Tested both 12-hour and 4-hour outage conditions to assess thermal response.
- **Mechanical faults:** Simulated scenarios with the refrigerator door left ajar for 4 hours.
- **Operational load:** Created frequent door opening events to mimic busy kitchen activity.

Photo by nrd on Unsplash

What We Saw

Sensor responses to stress conditions

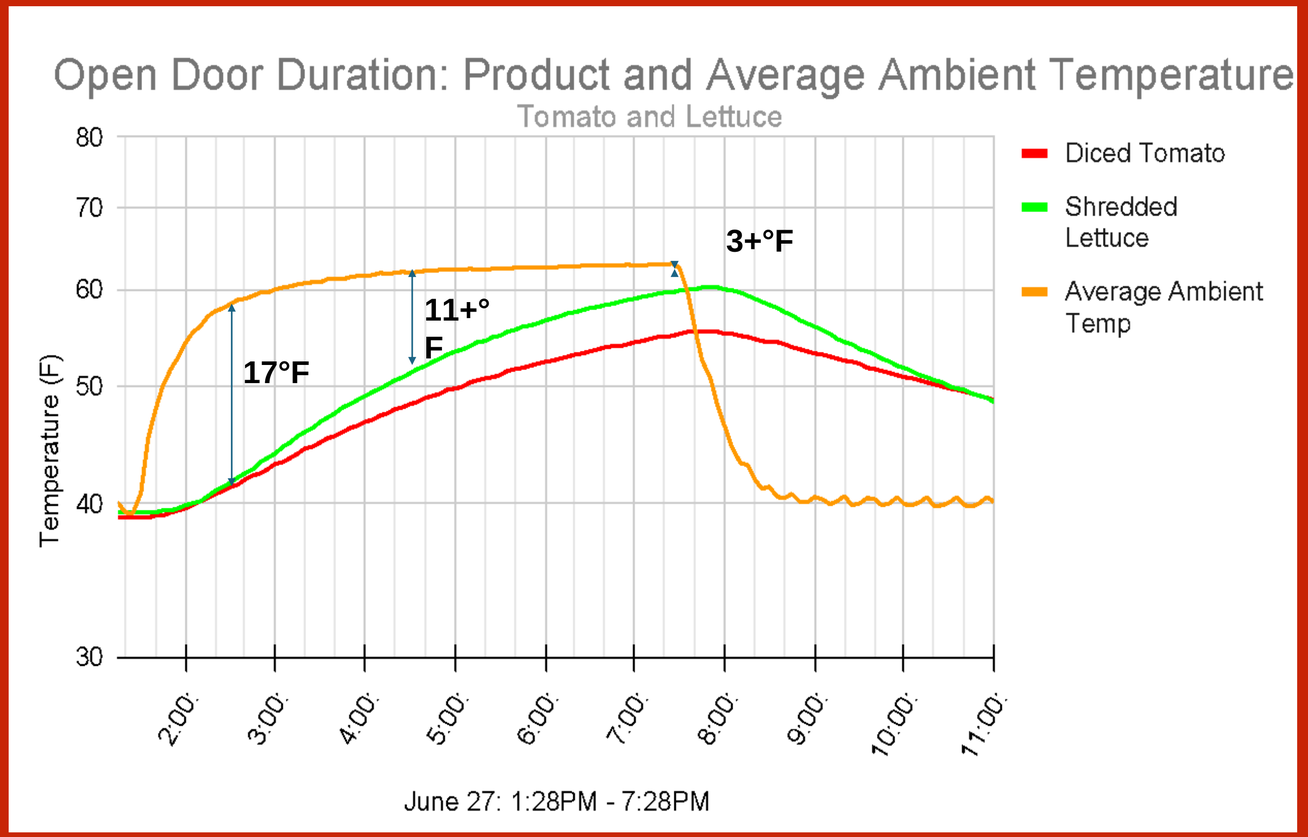


- **Rapid ambient rise:** Ambient temperatures increased sharply during outages and door ajar tests.
- **Delayed food heating:** Simulated and actual food temperatures rose much more slowly.
- **Key insight:** Real-time ambient spikes may misrepresent actual product risk.

DATA REVIEW

Actual Product vs Ambient Temperatures

- Ambient temperatures not representative of actual product temperature
  - Product temps can rise more slowly
    - At 2:30PM
      - Tomato and lettuce are at 41F; air at 58F
    - At 4:30PM
      - Tomato and lettuce are now at 48 and 51; air at 61F
    - At 7:30PM
      - Tomato and lettuce are now 55 and 60; air at 63F



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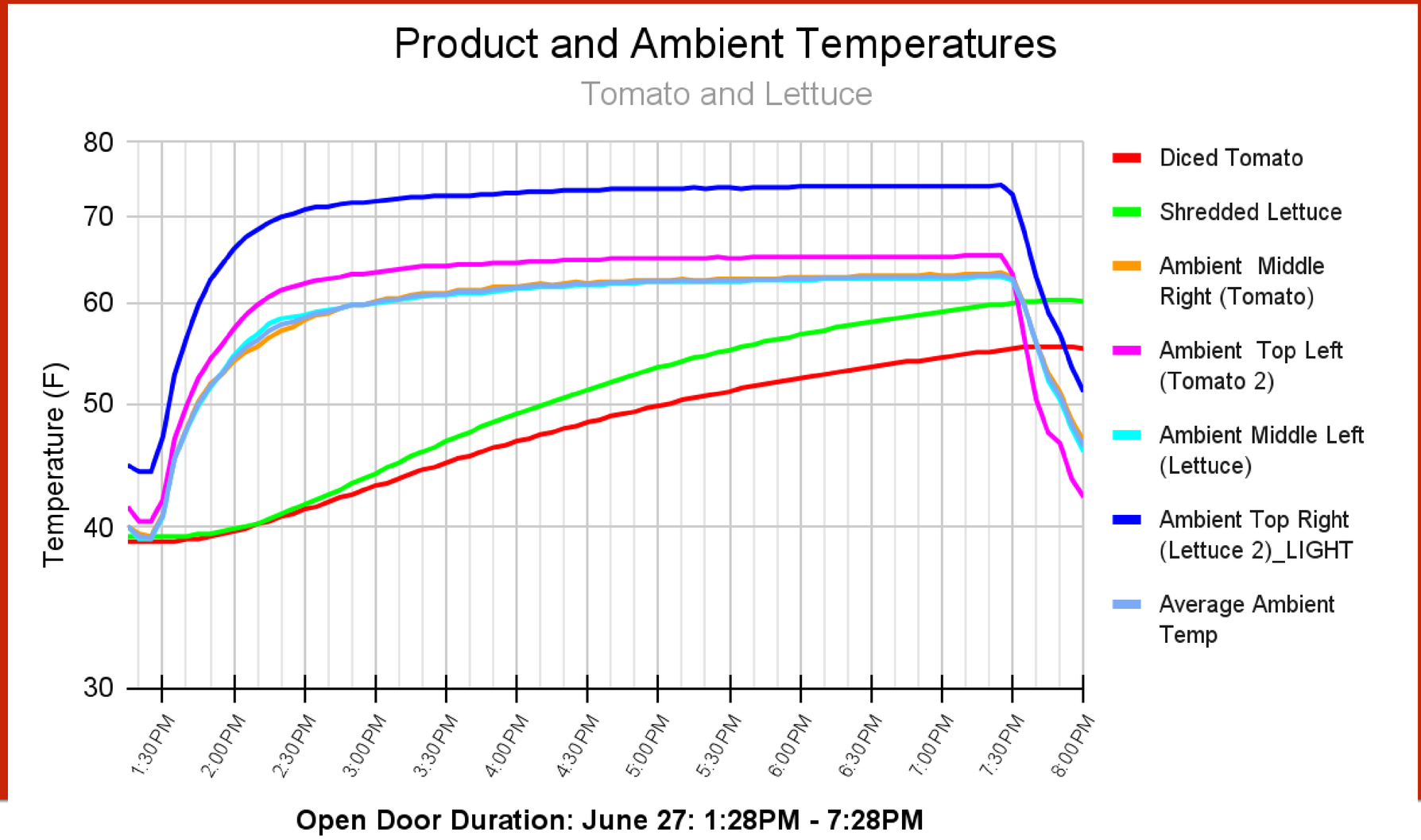

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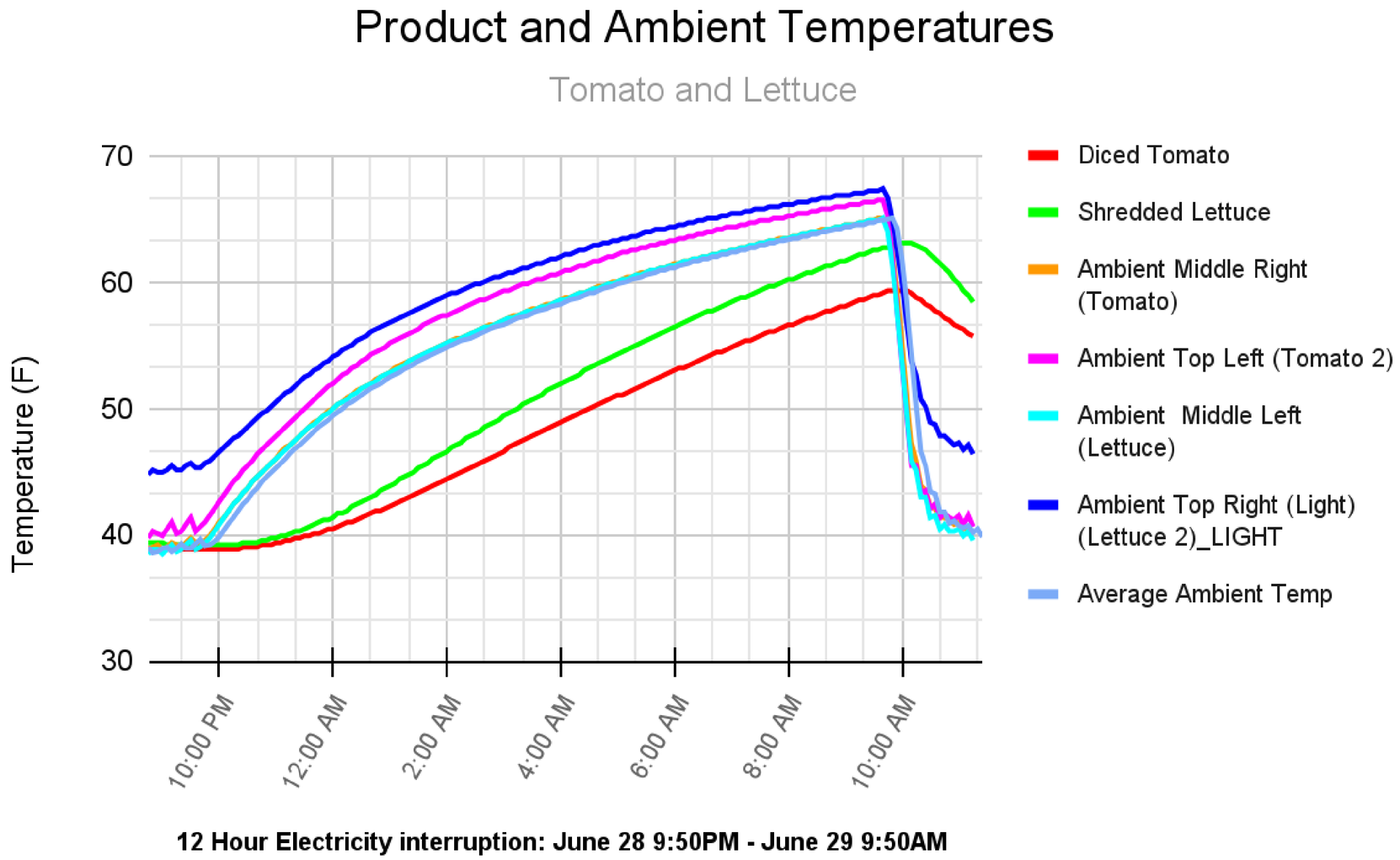
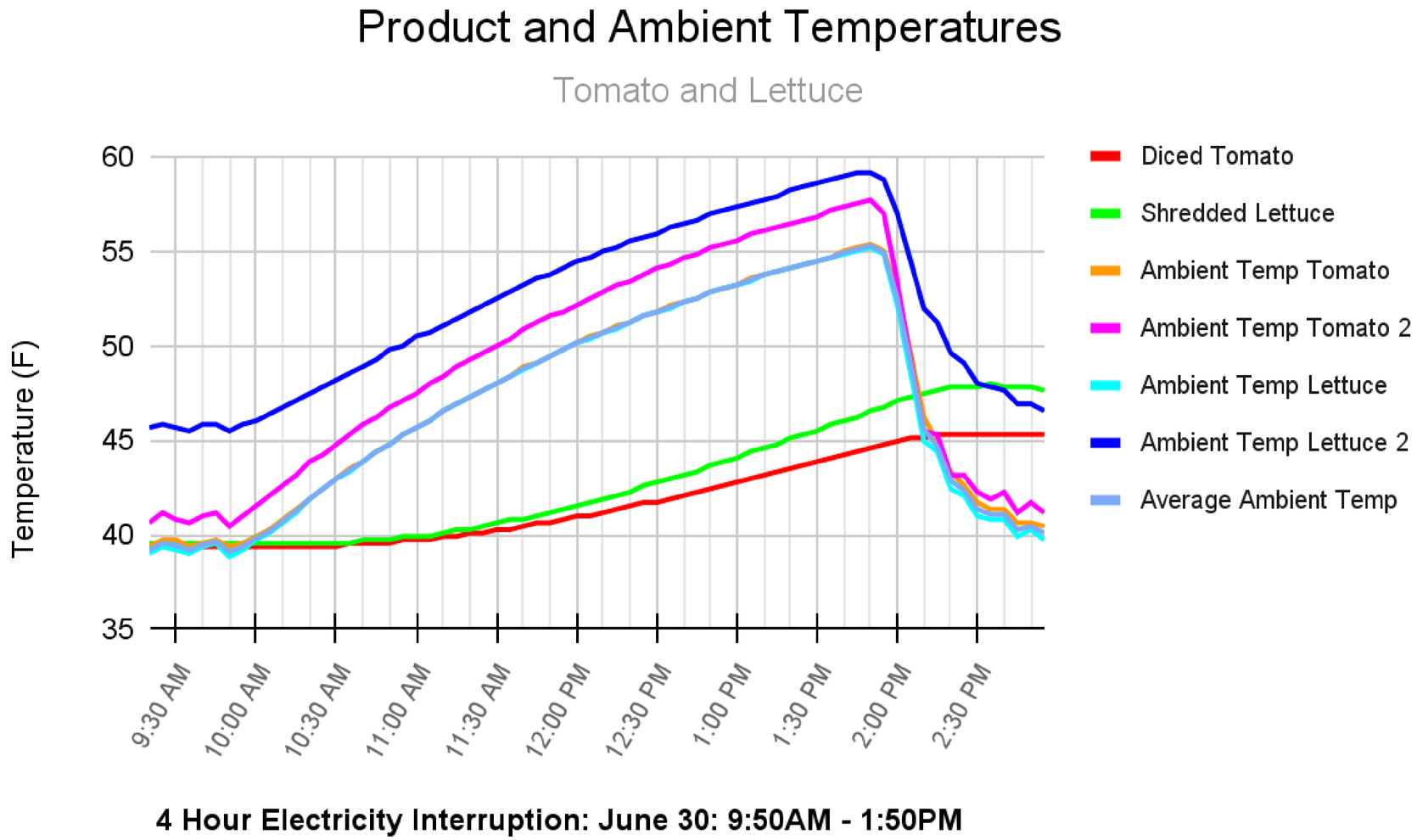


12 Hour Electricity interruption: June 28 9:50PM - June 29 9:50AM

DATA REVIEW

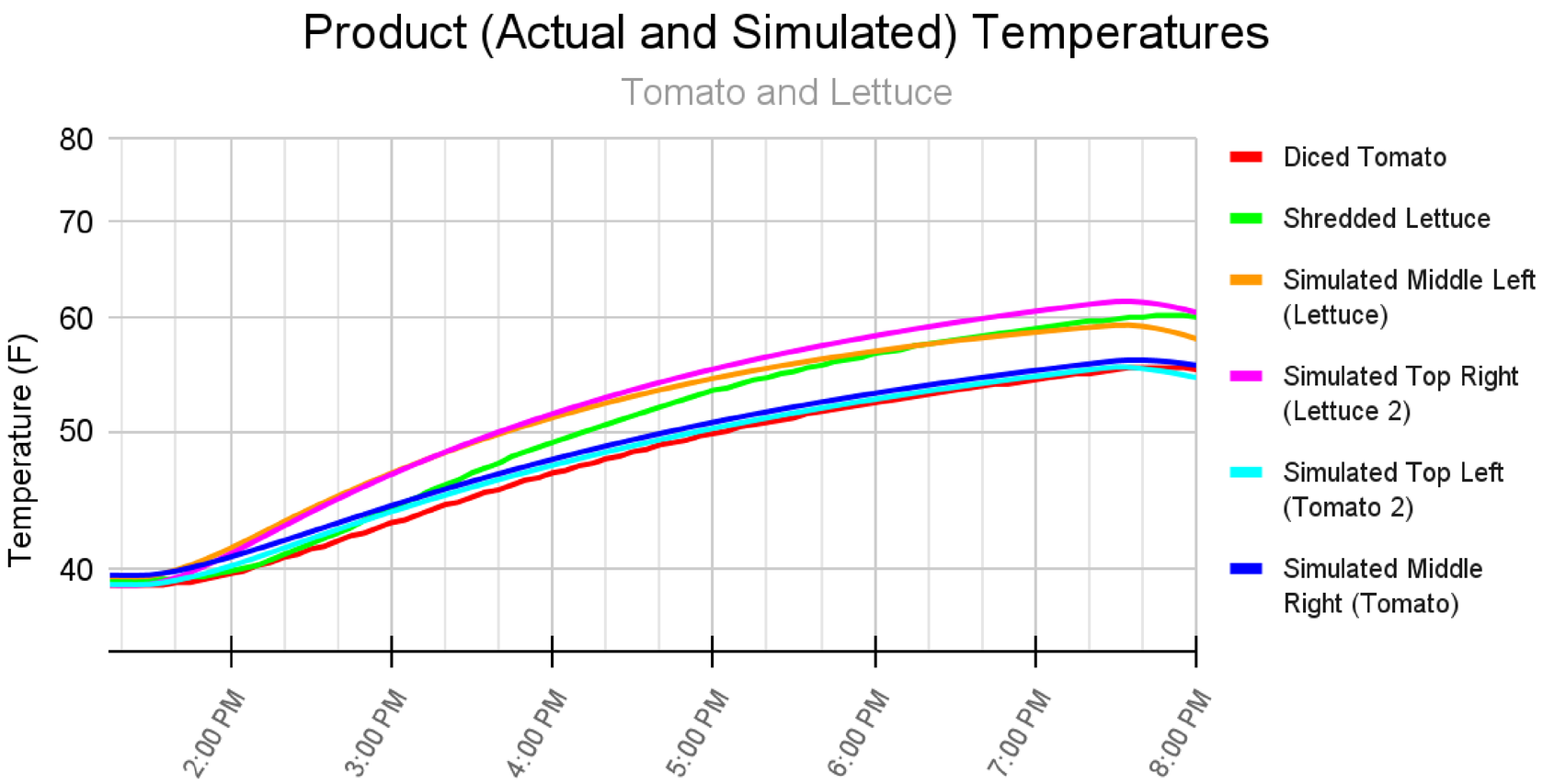
Actual Product vs Ambient Temperatures



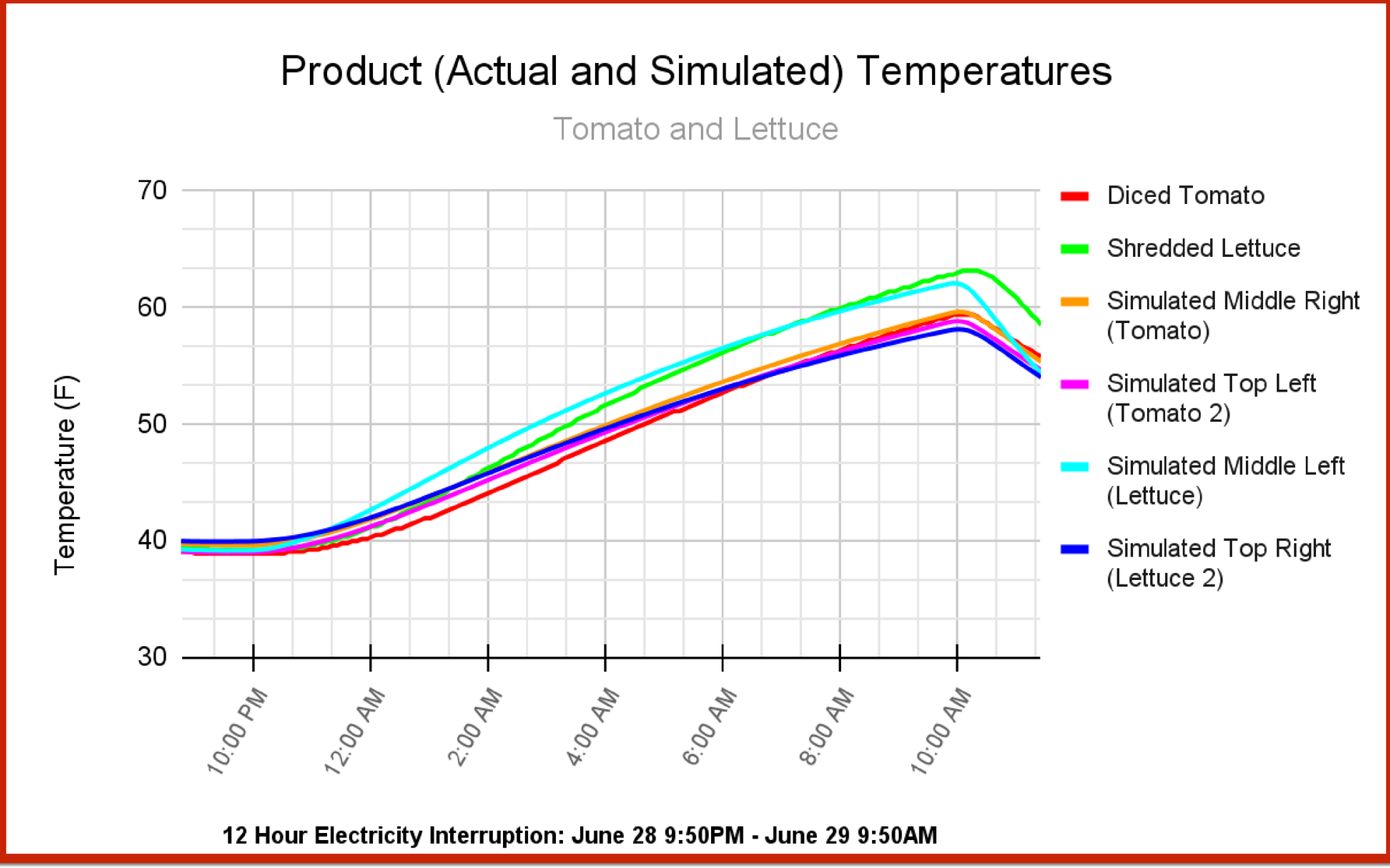
4 Hour Electricity Interruption: June 30: 9:50AM - 1:50PM

DATA REVIEW

Product and Simulated Product Temperatures

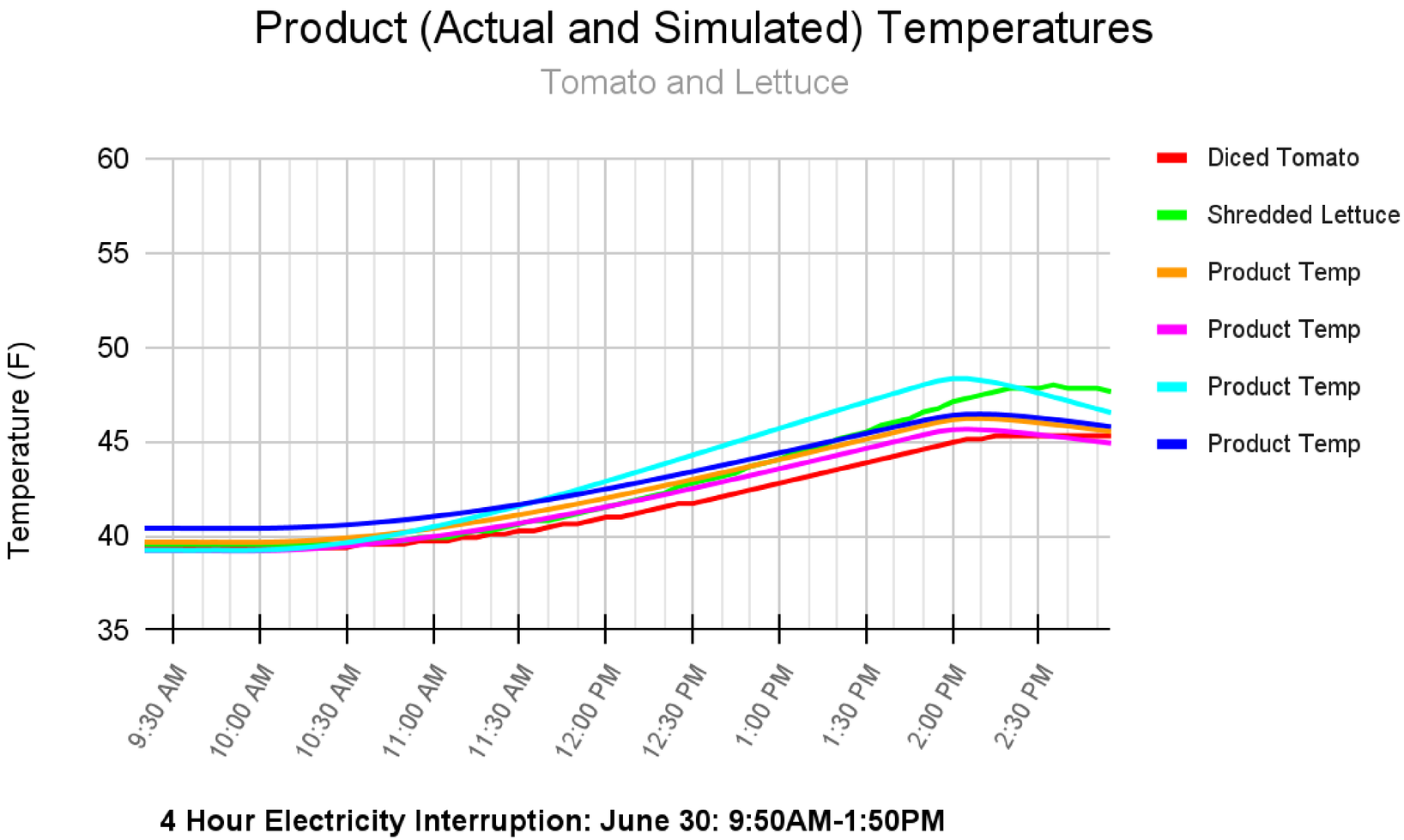


DATA REVIEW


Product (Actual and Simulated) Temperatures
Tomato and Lettuce
Temperature (F)
70
60
50
40
30
10:00 PM
12:00 AM
2:00 AM
4:00 AM
6:00 AM
8:00 AM
10:00 AM
Diced Tomato
Shredded Lettuce
Simulated Middle Right (Tomato)
Simulated Top Left (Tomato 2)
Simulated Middle Left (Lettuce)
Simulated Top Right (Lettuce 2)
12 Hour Electricity Interruption: June 28 9:50PM - June 29 9:50AM

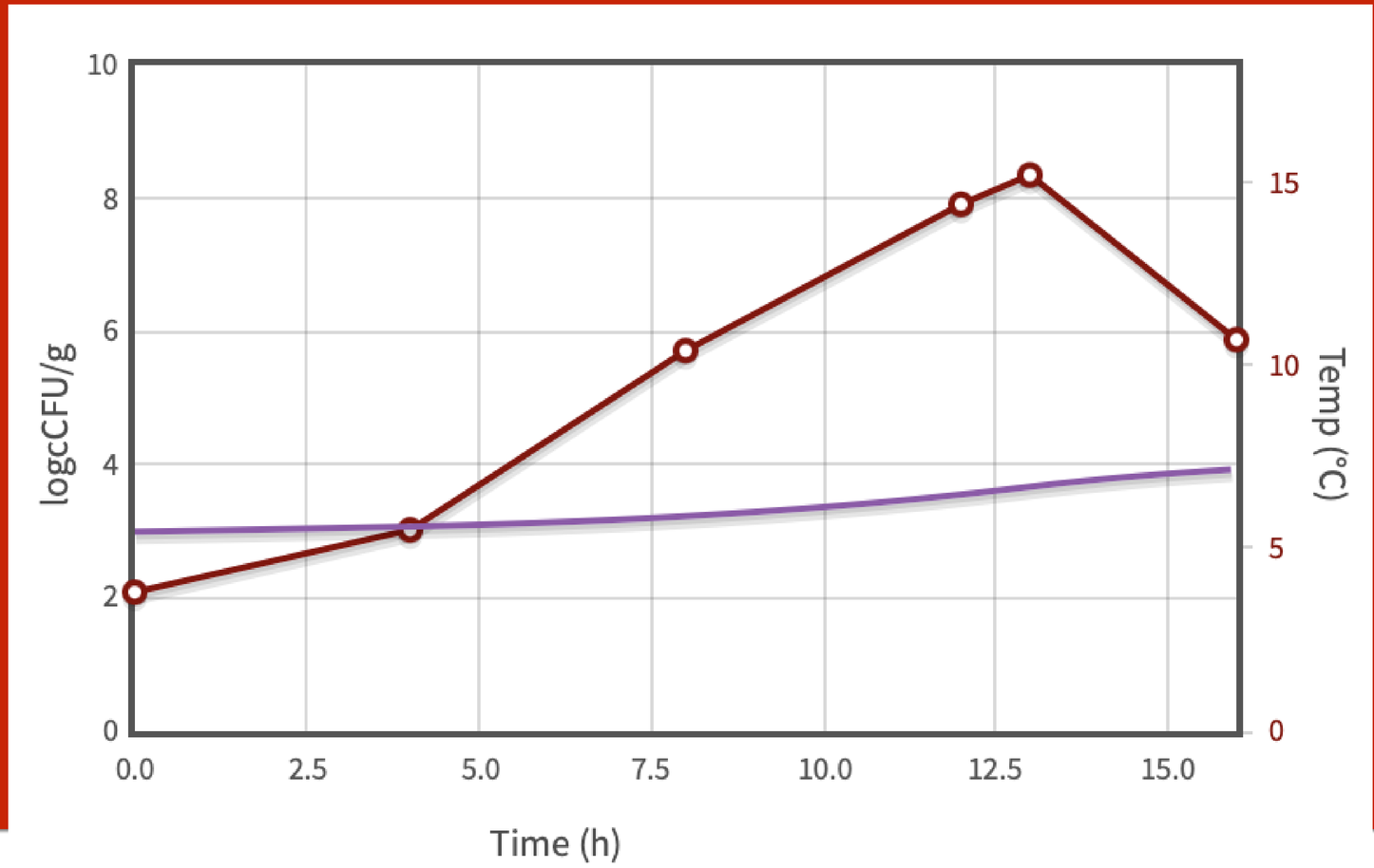
DATA REVIEW

Product and Simulated Product Temperatures



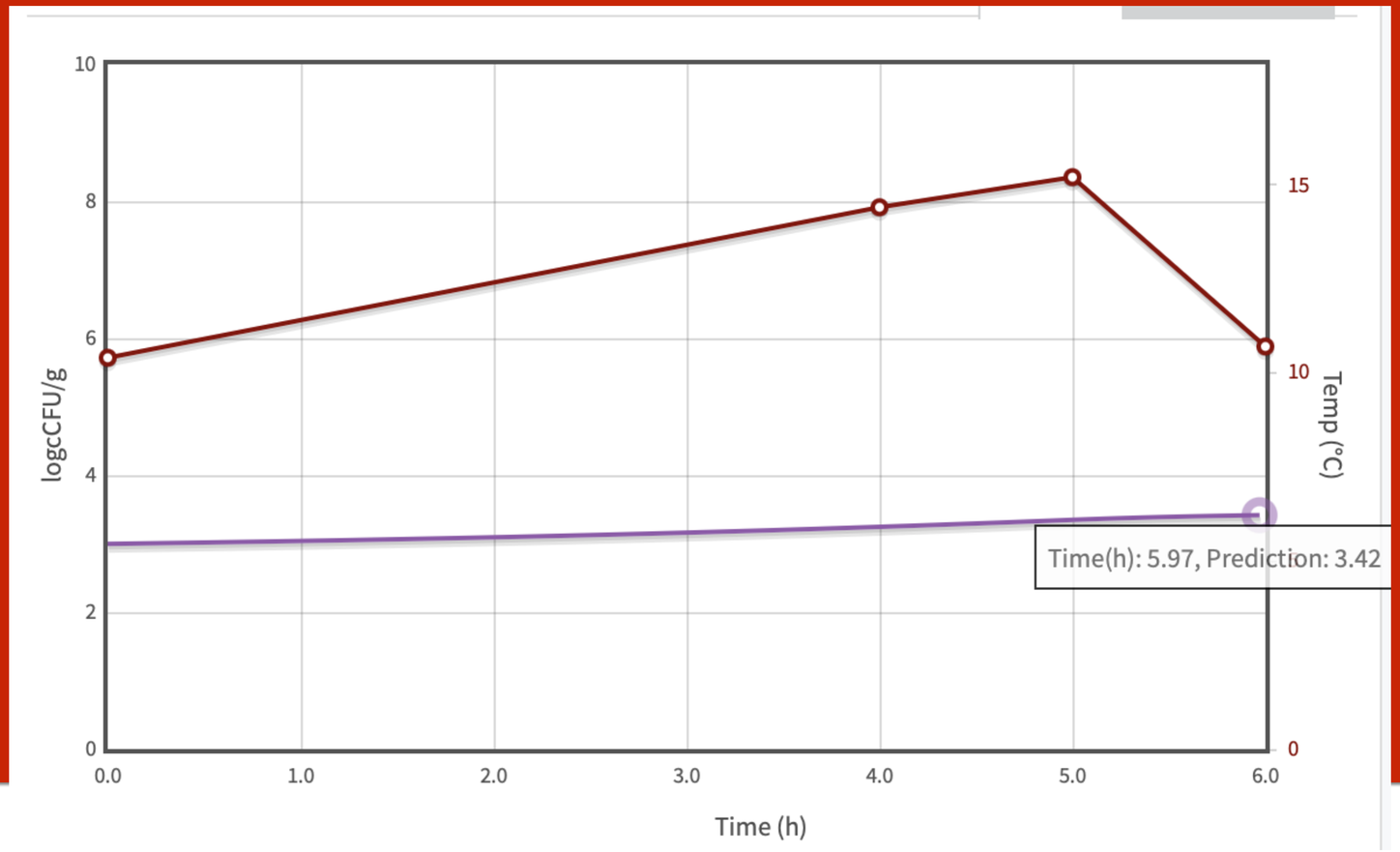
MICROBIAL RISK MODELING

Model Lm growth based on tomato product temperature



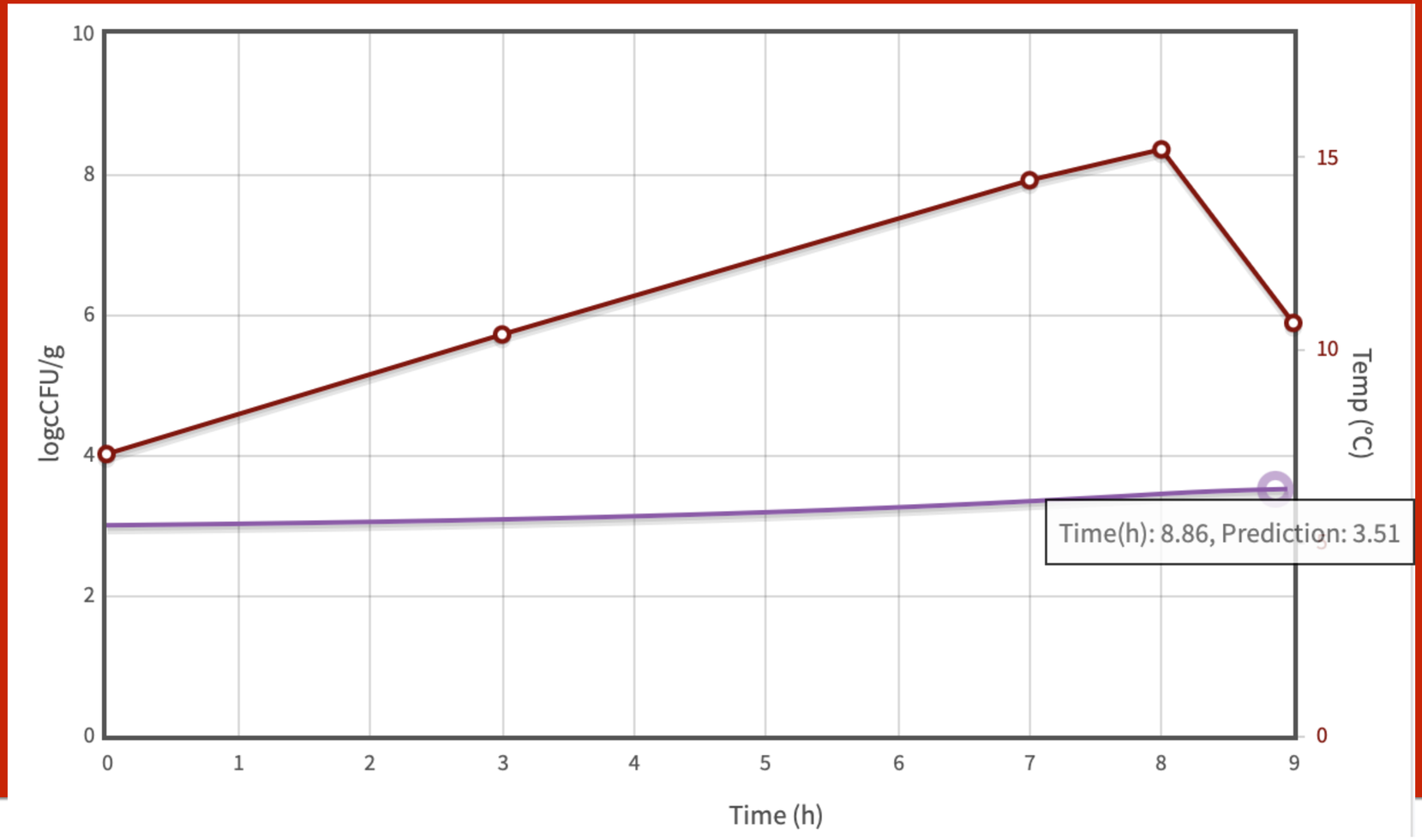
MICROBIAL RISK MODELING

Model *E. coli* growth based on tomato product temperature +8hrs (total represented here is 14hrs, Combase limitaton)

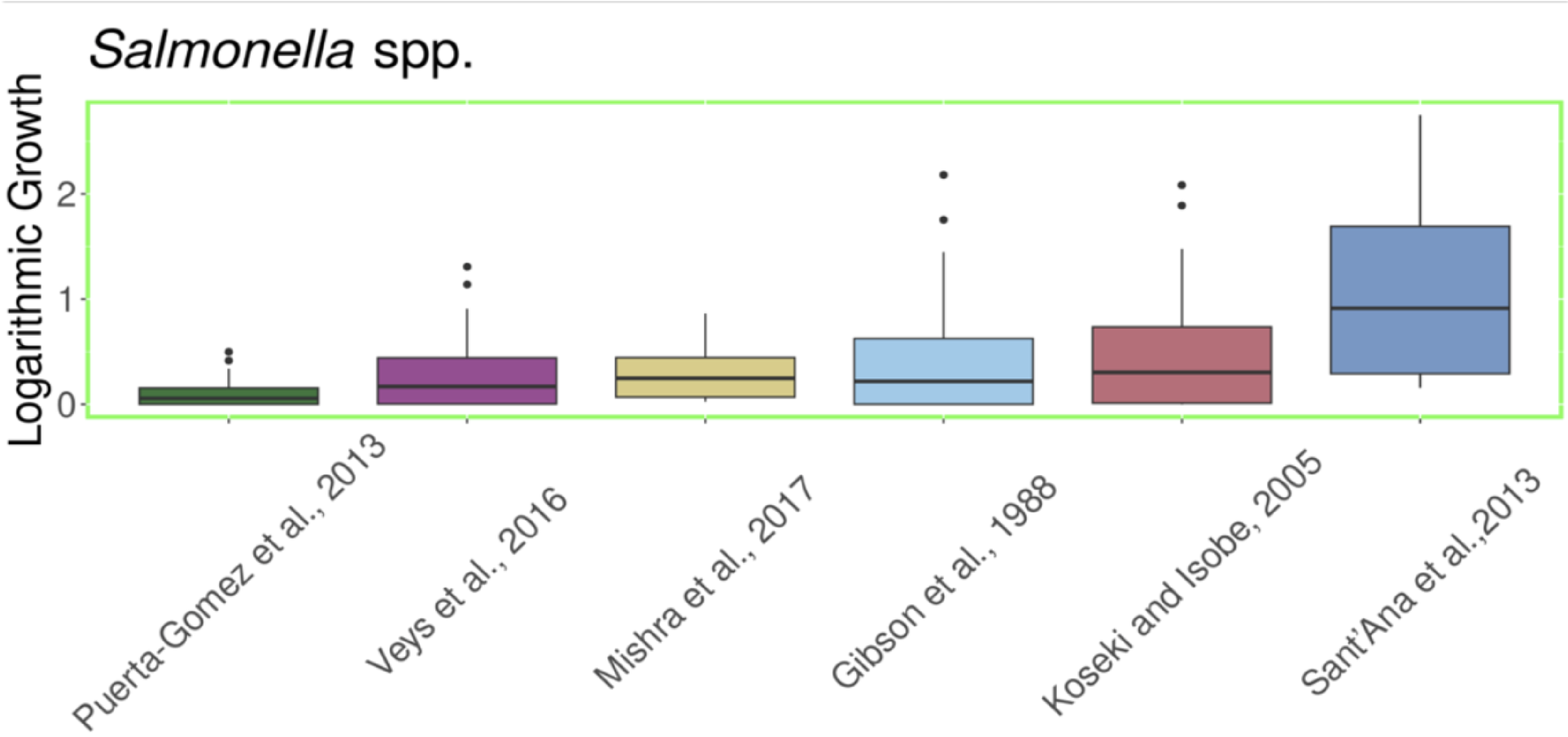


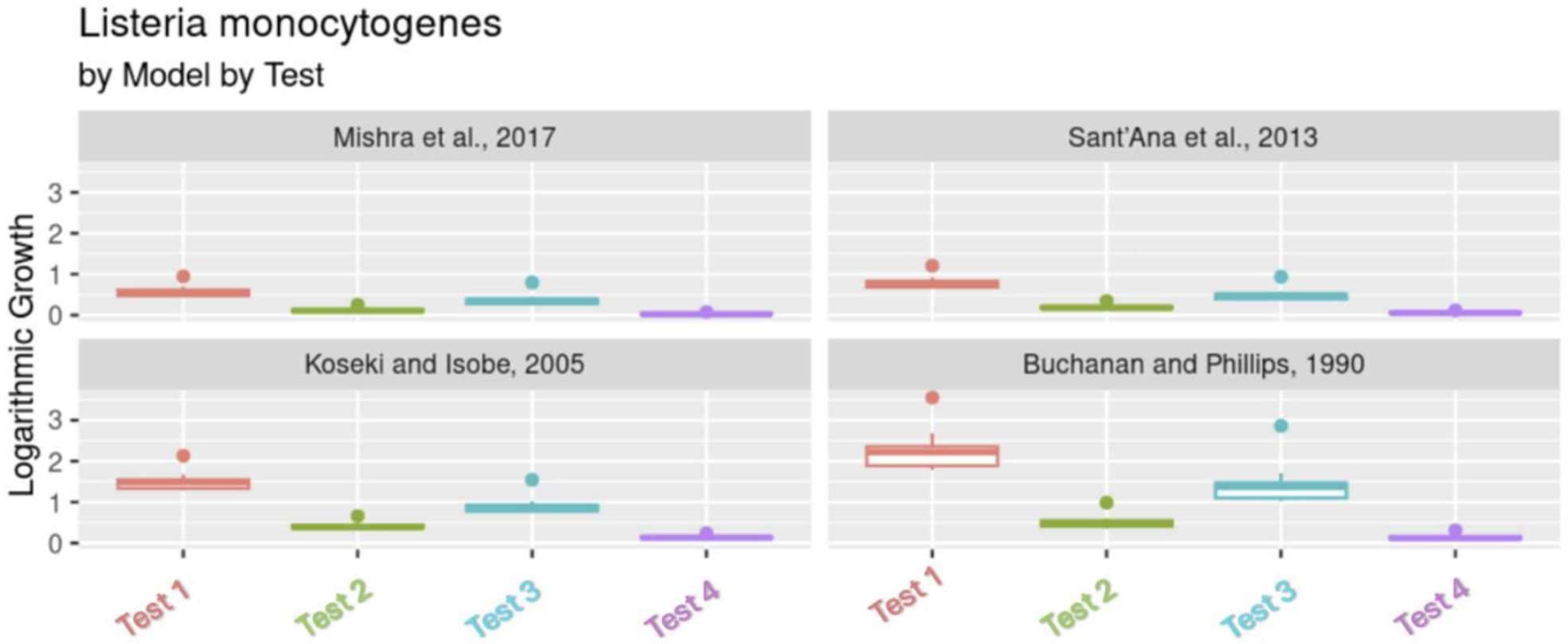
MICROBIAL RISK MODELING

Model *Salmonella* growth based on tomato product temperature +5hrs (total represented here is 14hrs, Combase limitation)



12 Hrs


Salmonella spp.
Logarithmic Growth
0
1
2
Puerta-Gomez et al., 2013
Veys et al., 2016
Mishra et al., 2017
Gibson et al., 1988
Koseki and Isobe, 2005
Sant'Ana et al.,2013


Listeria monocytogenes
by Model by Test
Mishra et al., 2017
Sant'Ana et al., 2013
Koseki and Isobe, 2005
Buchanan and Phillips, 1990
Logarithmic Growth
0
1
2
3
Test 1
Test 2
Test 3
Test 4

Findings

Pathogen growth remained minimal

Growth constraint
Even under 12-hour outages, pathogens showed limited growth.

Listeria lead
Listeria exhibited the highest increase but remained below 1 log CFU.

Risk perspective
Short-term spikes did not translate to severe food safety threats.

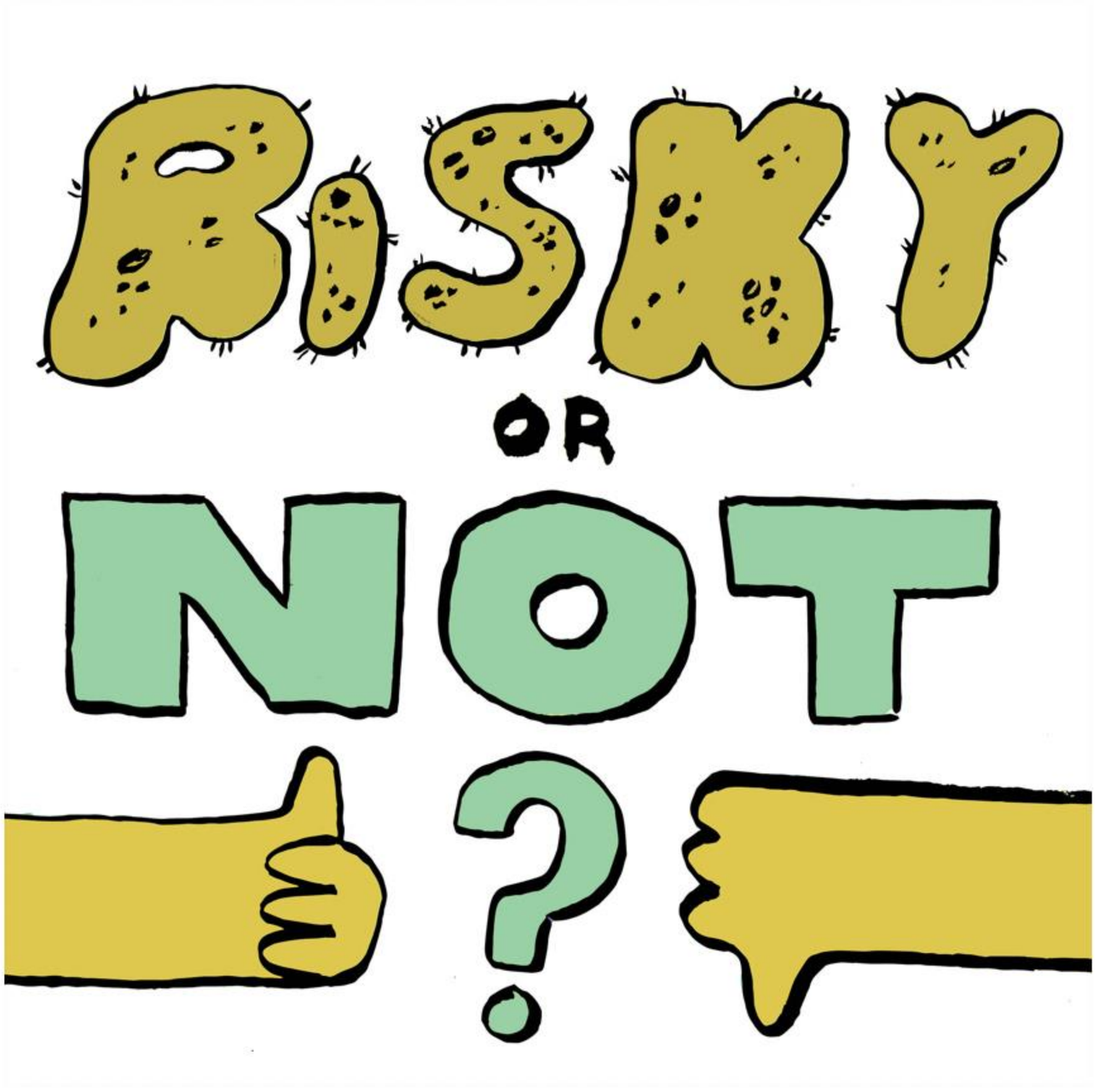
What This Tells Us

Ambient spikes ≠ significant food safety risk

- **Key takeaway:** Short-term ambient increases don’t always mean product danger.
- **Simulated reliability:** Simulated sensors better match true food risk profiles.
- **Policy implication:** Alert systems should consider food temperature kinetics, not just air spikes.

Photo by James Kern on Unsplash

Food Safety Talk


RISKY
OR
NOT
?

Would like to recognize:

Eric Moore, Terrence Gristgau, Robert Prevendar, Dr. Lisa Shelley, Dr. Ellen Shumaker,

Catherine Sander, Jac Merril

And Don Schaffner from Rutgers

Ben Chapman, bjchapma@ncsu.edu, (919) 515-8099

Riskyornot.co

Foodsafetytalk.com

https://cals.ncsu.edu/agricultural-and-human-sciences/

Alarm Fatigue – Yum! Perspective on Restaurant Food Safety Applications

Food Safety Summit, 5/15/25

Robert Prevendar | Chief Food Safety & QA Officer

Yum! KFC Pizza Hut Taco Bell the Habit Burger Grill

Our Collective Responsibility

Trust in every bite™...

Where We Want To Go, Together

- Make food safety important every day – set expectations.
- Train leaders and team members “why” it matters and how to execute.
- Simplify, simplify, simplify.
- Insist on integrity, urgency and corrective action.
- Incentivize the food safety behaviors we want to see.
- Move from “point in time” evaluation of risk, to “real time” leveraging of data to get a more complete view of risk.


Teach Everyone the Big 6 and why they matter
Set expectations to measure the Big 6 in the restaurant every day
(Daily Food Safety Check)
Motivate and measure effective corrective actions every day in Routines
Audit the integrity, and effectiveness of the Daily Food Safety Check
Align accountabilities and recognize the right behaviors
B6
How We Transform Culture

Utilizing Digitized Routines & IOT

In restaurant:

- Simplify & automate
- Suggested CA (AI Tools)
- Document actual CA
- Identify trends to create dynamic routines
- Target interventions

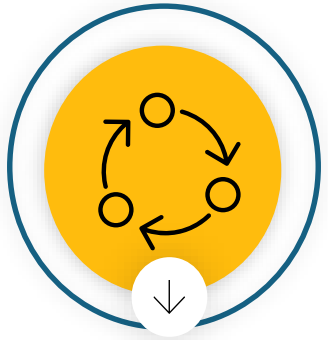
Above restaurant:

- Identify trends
- Design interventions
- Innovate processes
- Evaluate consistency, integrity, effectiveness of CA, and alignment to audit findings
- Feed into dynamic risk rating

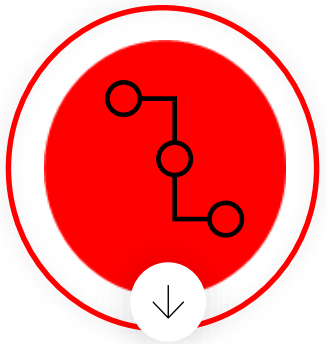
Alarm Fatigue: How to Ensure Out-of-Compliance Alarms Serve Their Purpose and Ensure Food Safety

5/15/25
Matt Jenkins
Director, Food Safety

Why Digitize?



Continuous Improvement



Simplification

Proactive Risk Management

Active Managerial Control

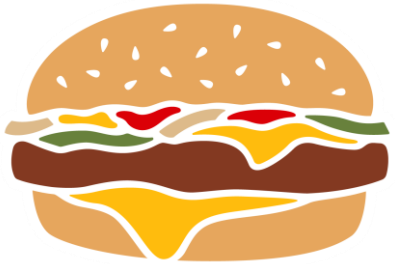
Results Driven

- ***Create a Culture of Accountability***
- ***Share Common Values & Beliefs***
- ***Drive Behavior Modification***

Lessons Learned

Design & Build

- Ambient or Product Mimicking
- Sensors & Gateways for NOW and/or for LATER
- Battery Life
- Quantify an ROI



Alert Setting

- What is Real? Balance Risk & Reality
- Alert Layering & Notification Escalation
- Environment Specific Application
- Define Corrective Actions

Engagement with Ops

- Test, test again & test again
- Listen to feedback from Restaurant Teams
- Balance Risk & Reality
- Deployment& Reporting Considerations