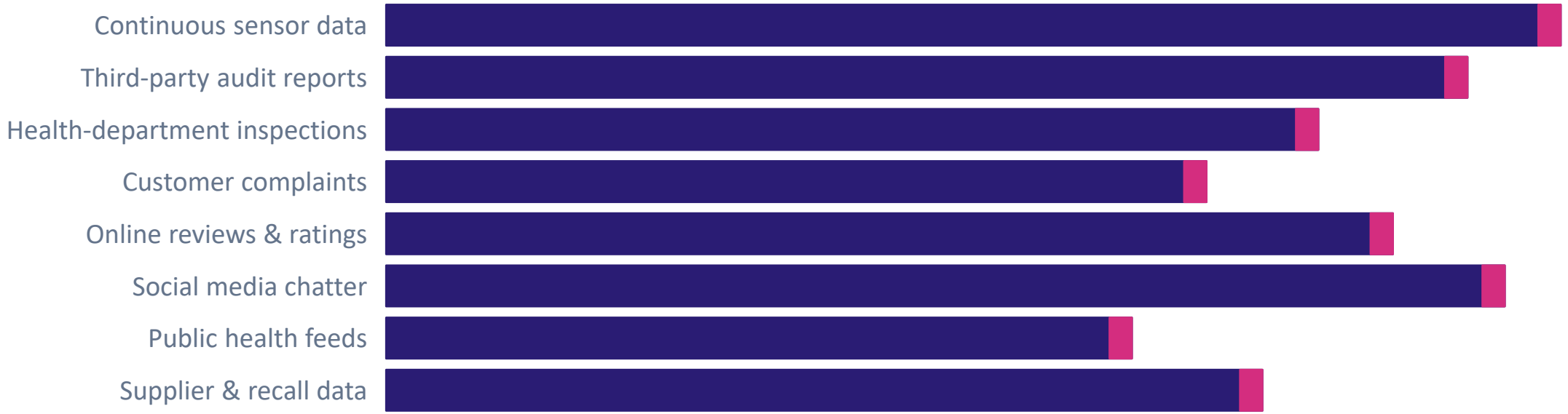
Technology Landscape:
Near-Term AI Developments

Lisa Shelley
Safe Plates Program
North Carolina State University

THE PROBLEM

More data than any team can read



AI's near-term value isn't generating new streams — it's reading the streams we already have.

THE FRAMING

Four streams AI is making useful

Read → filter → combine → fuse. Each step builds on the last.

READ

External chatter

Reviews & ratings APIs.
Yelp, Google, DoorDash.

FILTER

Sensors

Temperature, humidity, door.
The alarm fatigue problem.

COMBINE

Social media

Twitter, Reddit, TikTok.
Noisy — needs a confirming stream.

FUSE

Your own data, fused

Audit text, sensors, public health.
One score for the right person.

STREAM 01 — EXTERNAL CHATTER

They told us. We just couldn't read it.

Yelp, Google, TripAdvisor, DoorDash, Uber Eats — public review APIs, billions of records.

THE EVIDENCE

3

previously unreported foodborne outbreaks

identified using nothing but restaurant reviews — Yelp, Columbia University, and NYC Department of Health.

WHAT'S NEW IN 18 MONTHS

50,000

reviews read every morning

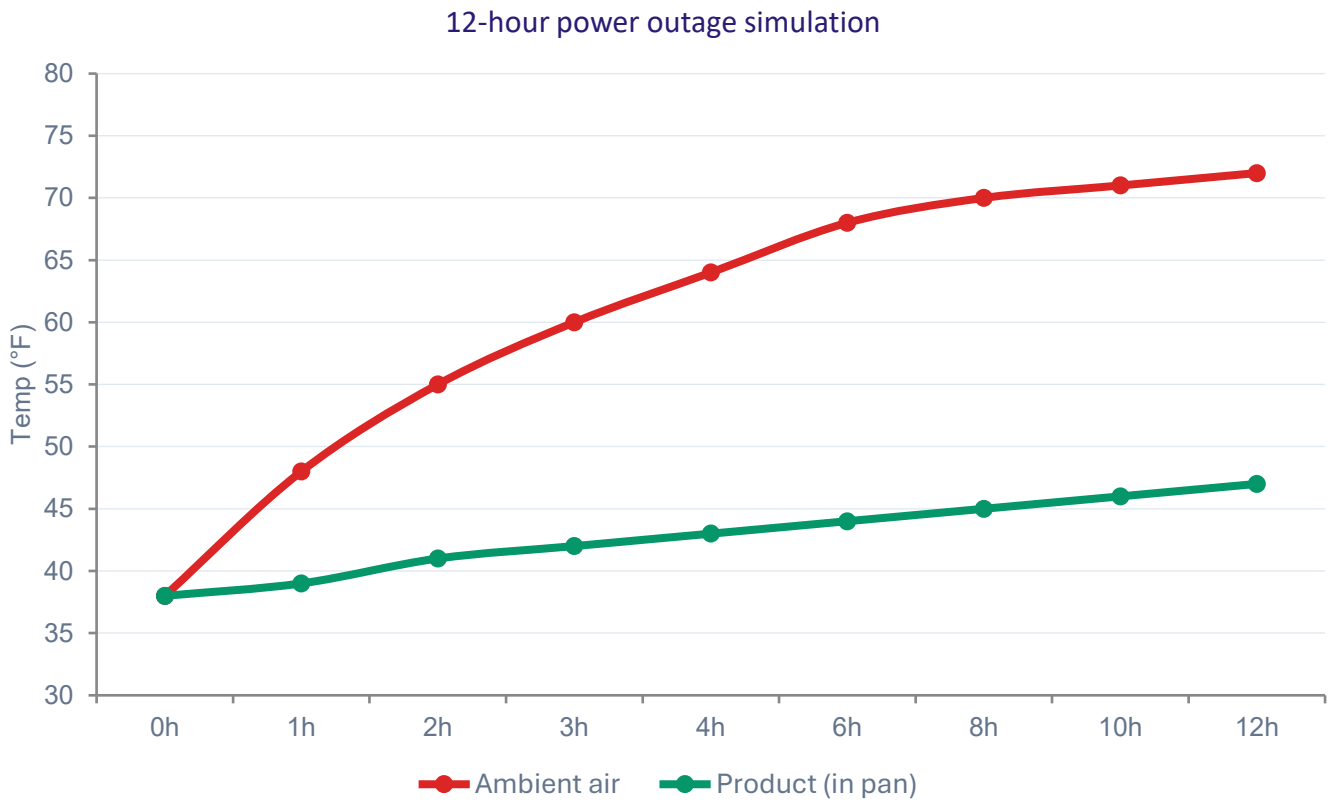
by a language model — surfacing the dozen that mention something worth investigating: a Norovirus complaint, an allergen issue, a temperature complaint.

What changed isn't the data. It's the ability to read it at scale.

STREAM 02 — SENSORS

Air heats up quickly. Food heats up slowly.

NCSU + Testo alarm fatigue study — diced tomato & shredded lettuce in 1/6 pans, ambient probe vs. product probe.



17°F

typical gap between ambient air and product temperature at the start of a stress event

< 1 log

CFU growth — Listeria, E. coli, Salmonella — even under 12-hour outages

STREAM 03 — SOCIAL MEDIA

Two weak signals. One real one.

SENTINEL — Stopping ENTeric Illnesses Early. A collaboration with Guelph and Laval.

NOISY STREAM

Social media

Geofenced tweets, Yelp reviews, TikTok, Reddit. Individual-level: who is sick, where, when.

CONFIRMING STREAM

Wastewater

RT-PCR and metagenomics from passive samplers. Community-level: which pathogens are circulating.

WHEN BOTH SPIKE IN THE SAME GEOGRAPHY

Outbreak signal earlier than the public-health system can produce one.

STREAM 04 — YOUR OWN DATA, FUSED

The future is company-specific AI.

No single source predicts where risk will hit. An integrated model — trained on your data — can.

INTERNAL	**Sensor data**	*Temp, humidity, door, equipment runtime*
INTERNAL	**Audit & inspection text**	*LLM-extracted: repeat findings, concern language*
INTERNAL	**Operational data**	*Sales, staffing, turnover, complaints*
EXTERNAL	**Public health feeds**	*Outbreak APIs, regional pathogen prevalence*
EXTERNAL	**Environmental signals**	*Weather, energy use*

FOR THE RIGHT PERSON

What an integrated model unlocks

1. **Forecast supply-chain risk**
   External conditions + supplier records + cold-chain sensor data flag at-risk inbound shipments before they reach your facility.
2. **Rank stores by risk**
   Predict which locations will have problems next month — not just which had them last month.
3. **Find your weak points**
   Which suppliers, regions, departments, days, or shifts drive most of the risk — and what's actually causing it.

THE TAKEAWAY

Quieter, *not louder.*

The next 24 months of AI in food safety isn't about generating more alerts.

It's about telling the right person which alert to listen to.

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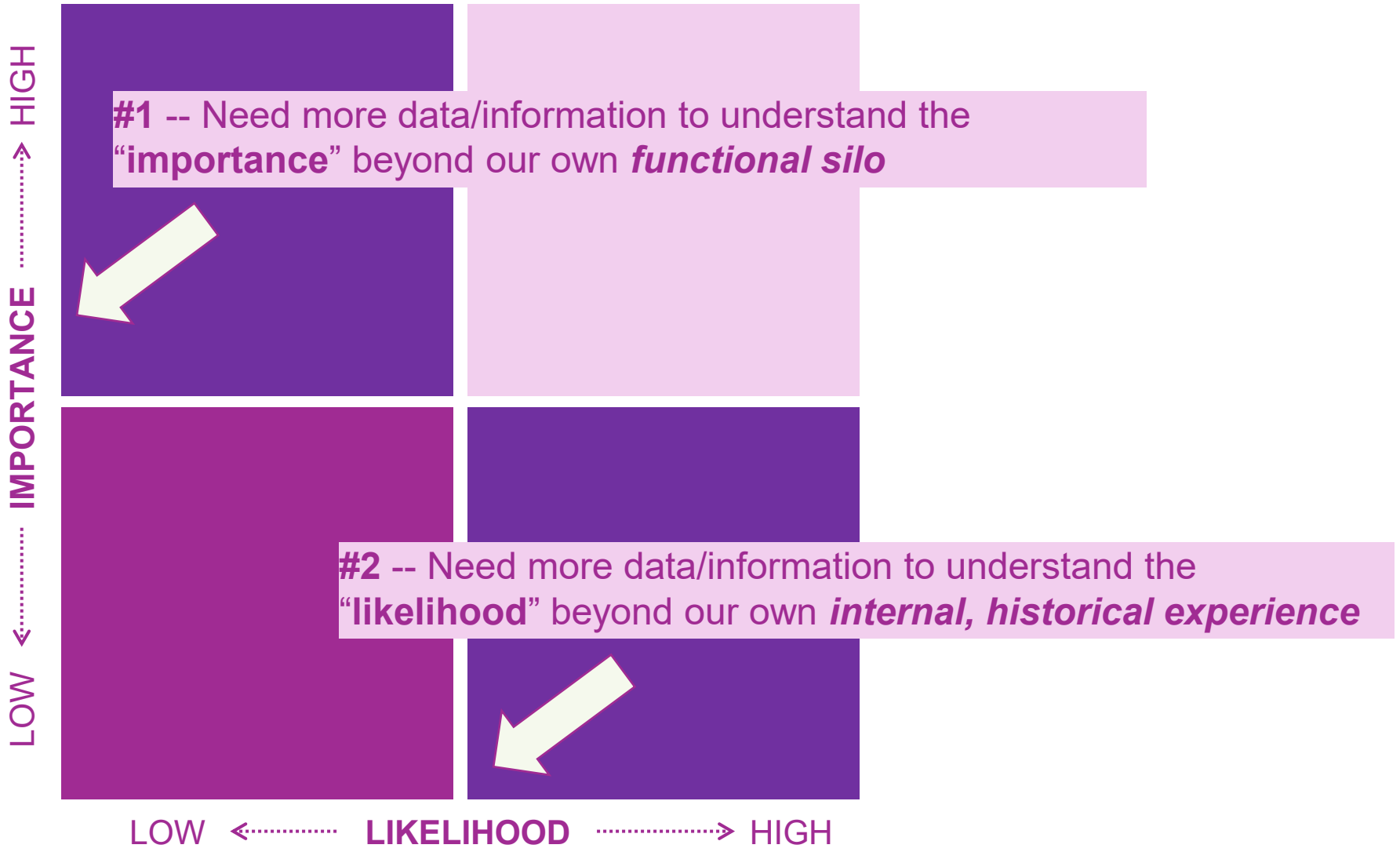
Augmenting Risk Decisions in Modern Supply Chains

Sean J. Leighton
SVP Food Safety, Quality & Regulatory Affairs
Cargill

May 2026


IMPORTANCE
HIGH
LOW
#1 -- Need more data/information to understand the "importance" beyond our own functional silo
#2 -- Need more data/information to understand the "likelihood" beyond our own internal, historical experience
LOW
LIKELIHOOD
HIGH

What we're really talking about when we talk about risk…

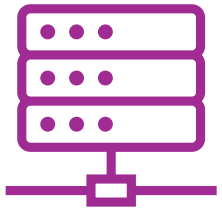
#1 -- Need more data/information to understand the "**importance**" beyond our own ***functional silo*** **= Invest in our PEOPLE**

#2 -- Need more data/information to understand the "**likelihood**" beyond our own ***internal, historical experience*** **= Invest in our DATA**

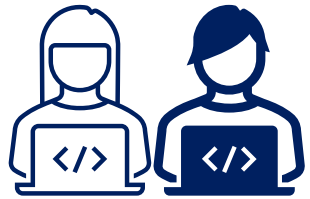
Problem we had to solve: Too much data across global, complex supply chains and multiple domains

Cargill™ Hazard Alert System Program and the Power of AI

The Hazard Alert System scans millions of records from 10,000+ data sources



Through AI, the system filters to thousands of signals then to hundreds of signals

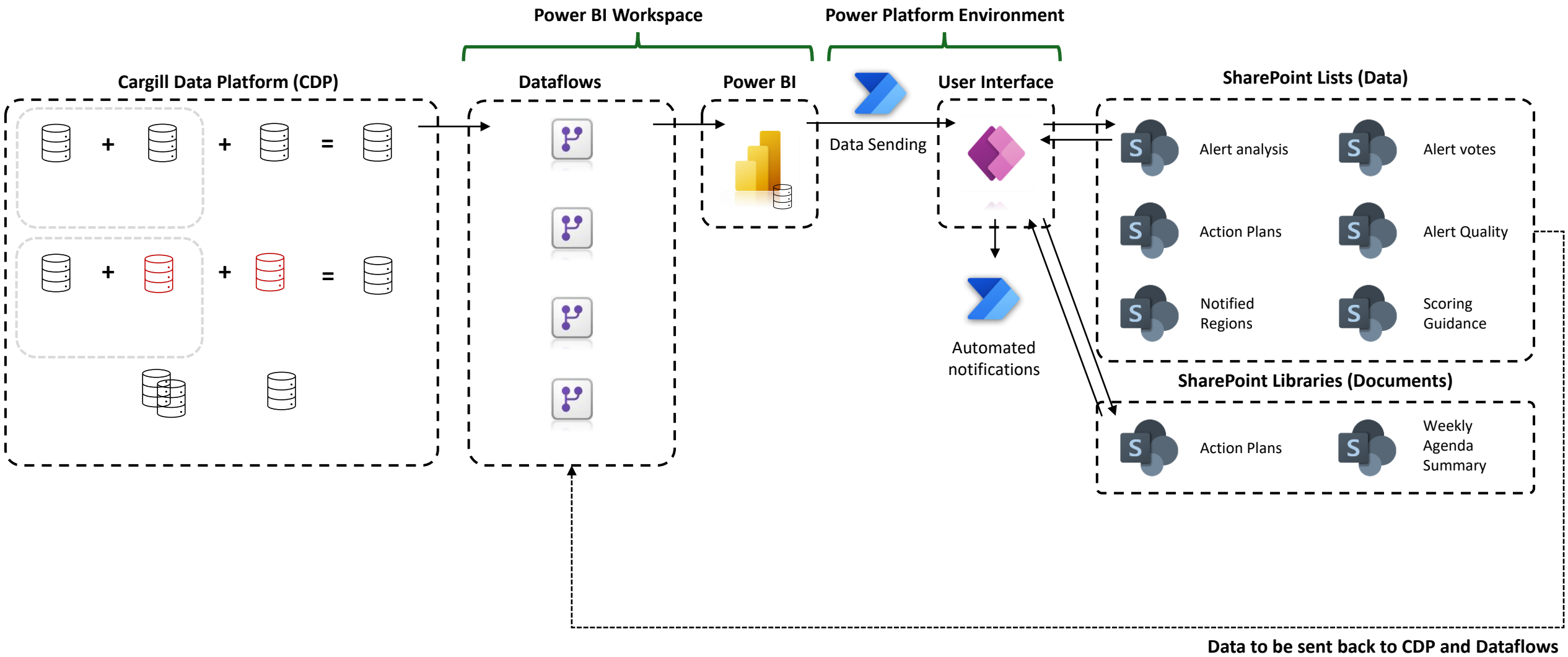


Subject Matter Experts review dozens of alerts per week

The mission of the Cargill™ Hazard Alert System Program is to:

Target, analyze, and visualize data sources that enable risk anticipation	Better anticipate risk and potential risk-related events with cross-company data	Drive strategic resource deployment and preparedness plan related to risk management

Cargill Hazard Alert System Diagram



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Predictive Risk Analysis and Enhanced Human Decision Making from AI and QMRA

Steven A. Lyon, PhD

We see AI's value currently in QMRA to best influence risk-based decision making by SMEs

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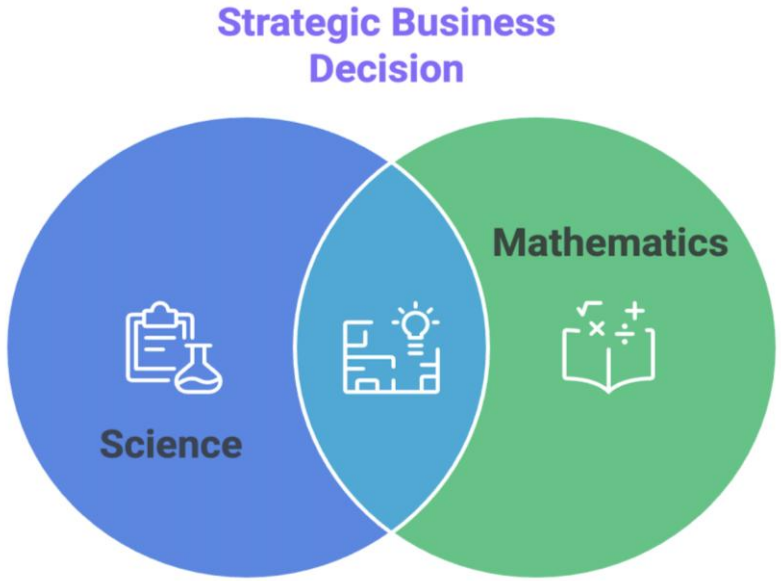

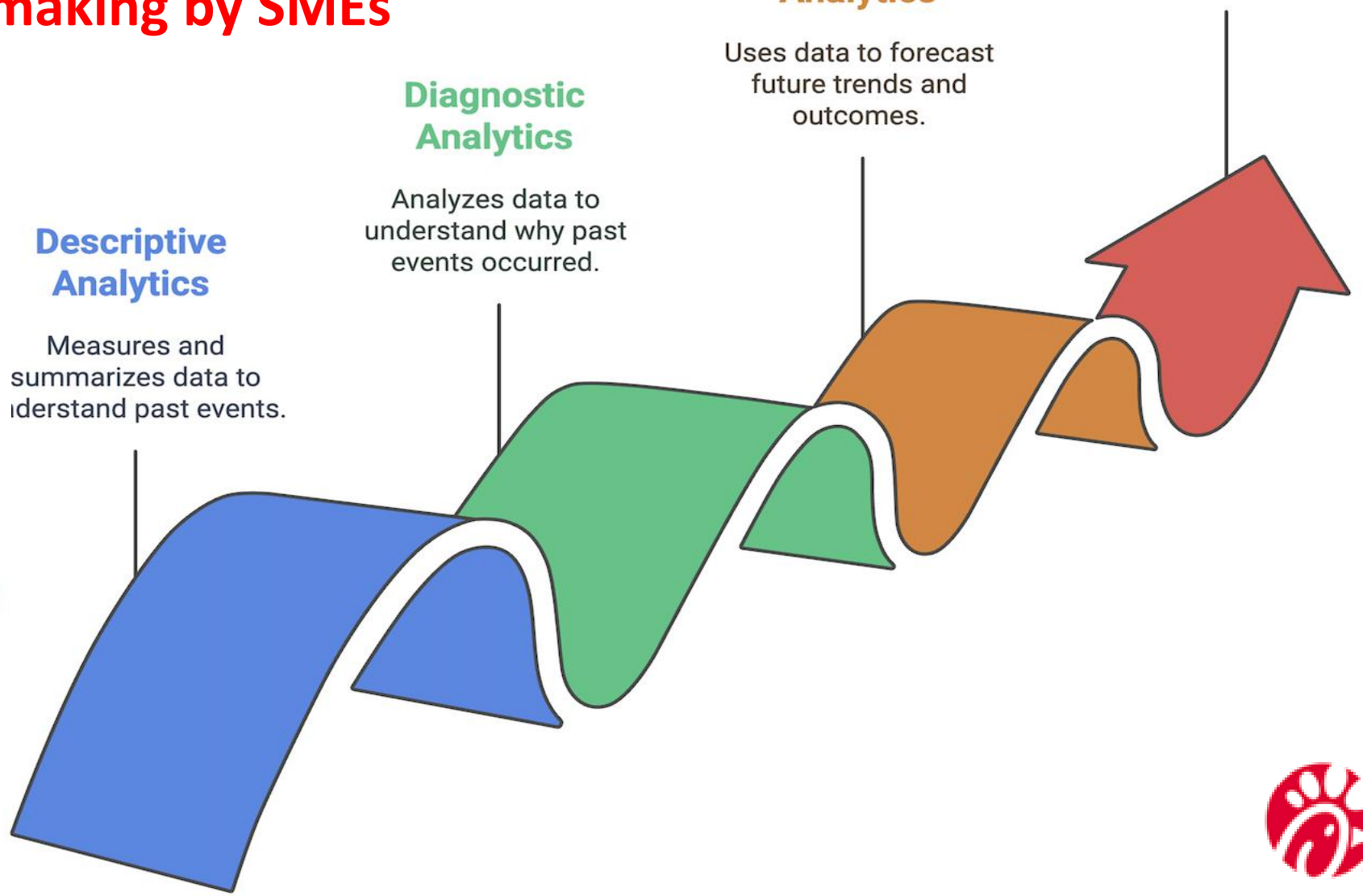

AI Strategy: QMRA for our highest risk processes

Predictive Modeling

Predicts microbial growth using research data.

Anticipates food safety risks.

Machine Learning

Learns from data patterns.

Detects patterns.

Simulations

Simulates food safety scenarios.

Tests potential risks safely.

Real-Time Monitoring

Tracks environmental conditions continuously.

Enables rapid intervention.

Decision Support

Provides actionable safety insights.

Supports human decision-making.

Our AI Road Map for Predicting Risk Analysis

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1 Data Quality

Clean and consistent data is essential.

- Audit Data
- CCP Checks
- Connected Devices
- Microbial Sampling (CFU)

2 Microbiology

Understanding the behavior of foodborne pathogens.

- Pathogen Specific
- Product Association
- Intrinsic Growth Factors
- Time & Temp Growth Curves
- D-values

3 Data Science

Building and evaluating models for food safety.

- QMRA Models
- Variables Specific Processes
- Equipment Specific
- Operational Specific

4 Data Engineering

Ensuring smooth data flow, storage, and accessibility.

- Data Architecture
- Data SME paramount

AI Strategy: QMRA for our highest risk processes

Siloed Underutilized Data

Isolated, untapped information sources

Centralize Data

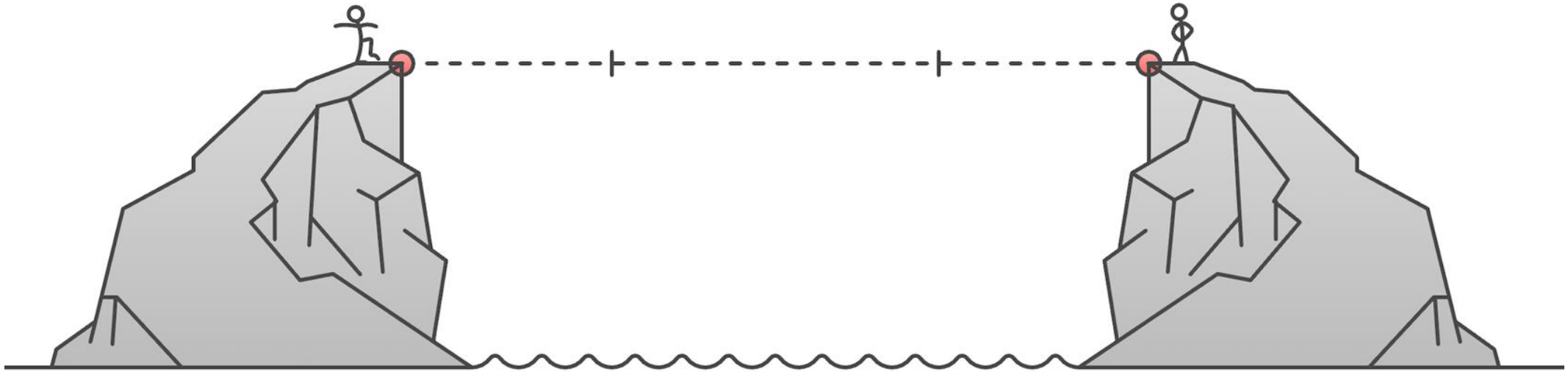
Integrate all data sources

Apply AI Models

Analyze data for insights

AI-Informed Decisions

Data-informed risk analysis



AI & QMRA for Critical Risk Factors

Describe & Predict:

- Salmonella growth with cold holding failures
- Supplier and individual SKU risks
- When a critical control point may not eliminate risk
- CFU and dose limits for potential cross contamination

Decide: Supplier monitoring programs and Restaurant equipment performance

Describe & Predict:

- Chances of secondary infection with infected worker
- Chances of infection with infected customer
- Number of hand washes per labor to significantly reduce transmission
- Infection rates compared to work role, menu items and dining rooms
- Where is the sweet spot for hand washing to achieve a significant risk reduction

Decide: Establish clear hand washing goals, metrics and other FSMS

AI is here to make humans better at risk-based decision making and enable business growth to improve public health

1. Tune Models: Humans Adjust Models for Accuracy
2. Interpret Results: Humans Analyze AI Outputs for Insights
3. Decide Risk Thresholds: Humans Set Acceptable Risk Levels
4. Act on Alerts: Humans Respond to AI-Generated Alerts
5. Provide Context: Humans Add Meaning to AI & Data

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INDUSTRY-ACADEMIC PARTNERSHIPS FOR AI IN FOOD SAFETY

Matt Stasiewicz
Associate Professor
University of Illinois
mstasie@illinois.edu

Opening Session
Leveraging AI for Food Saety
Food Safety Summit
May 12, 2026

Working with academics can

- Help you ask new food safety questions
- Connect the people and data to address those questions
- Try out analyses to guide next steps

To

- Get new capabilities to internal team or service provider
- Drive industry-wide improvements

Case Study: Poultry and *Salmonella*

- **How capable is our sanitary dress of achieving > 1 log reduction or internal company goals?**
  - Started 1 company, 1 facility, 1 year, 1 type of data (TPC)
- How does sanitary dress relate to risky *Salmonella* in finished products?
  - Added 1 additional data type (*Salmonella* screen + level)
- What else in the micro data relate to finished product *Salmonella?*
  - Analyzed metadata for the micro data
- What other processes can we use for real-time control of *Salmonella*?
  - Added many processing data tables, 1 more year

Recently proposed (now withdrawn)

FSIS' Proposed Framework

Testing For:

- ***Salmonella***
- **Indicator organisms**

This document outlines the regulatory framework under consideration for a new strategy that we anticipate should reduce the number of *Salmonella* infections linked to poultry consumption. The framework consists of three components that, together, support a comprehensive approach to controlling *Salmonella* in poultry.

Component 2: Capable of achieving >1 log10 reduction of indicators from rehang to post-chill

The three components are:

COMPONENT 1

Requiring incoming flocks be tested for *Salmonella* before entering an establishment

COMPONENT 2 *

Enhancing establishment process control monitoring and FSIS verification

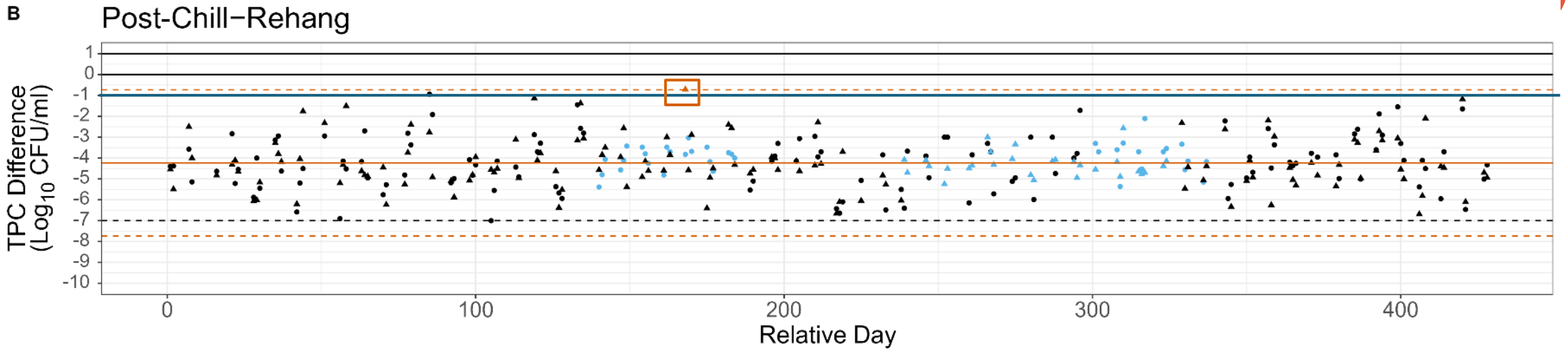
COMPONENT 3

Implementing an enforceable final product standard

*Under this proposed framework, testing for *Salmonella* would also occur during the same steps in production as testing for indicator organisms.

How capable where we? – Very capable

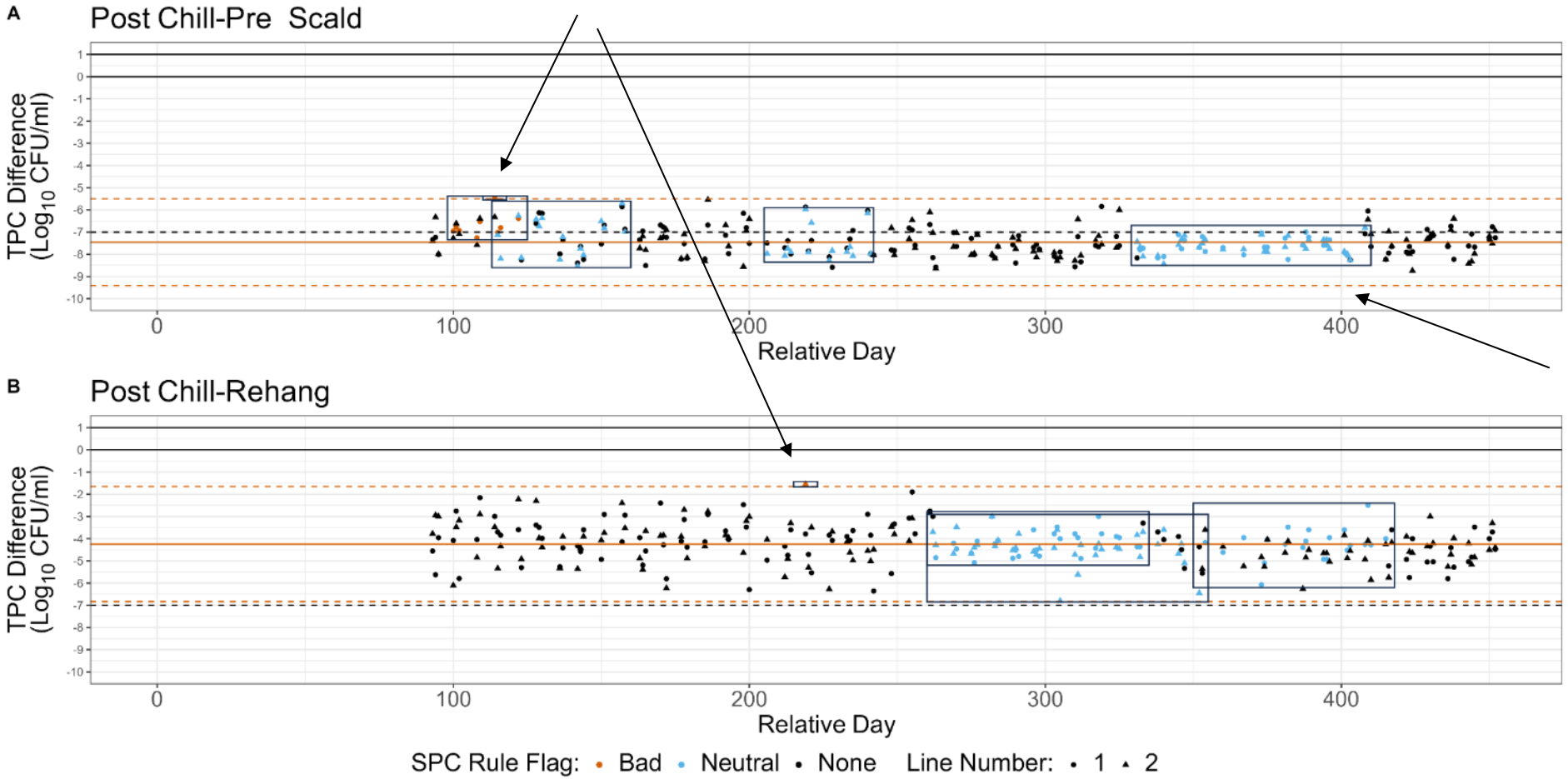
Plot the Data – Check Against Limits (1 log Total Plate Count (TPC) reduction)



- **Only one data point shows less than a 1 log reduction** across this process stage
- Dotted lines show 3 sigma ‘Control Limits’
- **Formal capability index calculations met thresholds** in formerly proposed regulations

Try out micro control charts (AI could help code)

Apply rules to flag early warnings of process shifts



But requires microbiology context because some patterns may not be an issue in this context

*__limited variation__

*more reduction

(also basic control charts struggle with microbiology data - limits of detection, log scale, etc.)

P3-28 Adapting Statistical Process Control to *Salmonella* and Total Plate Counts in Commercial Poultry Processing: IAFP 2024

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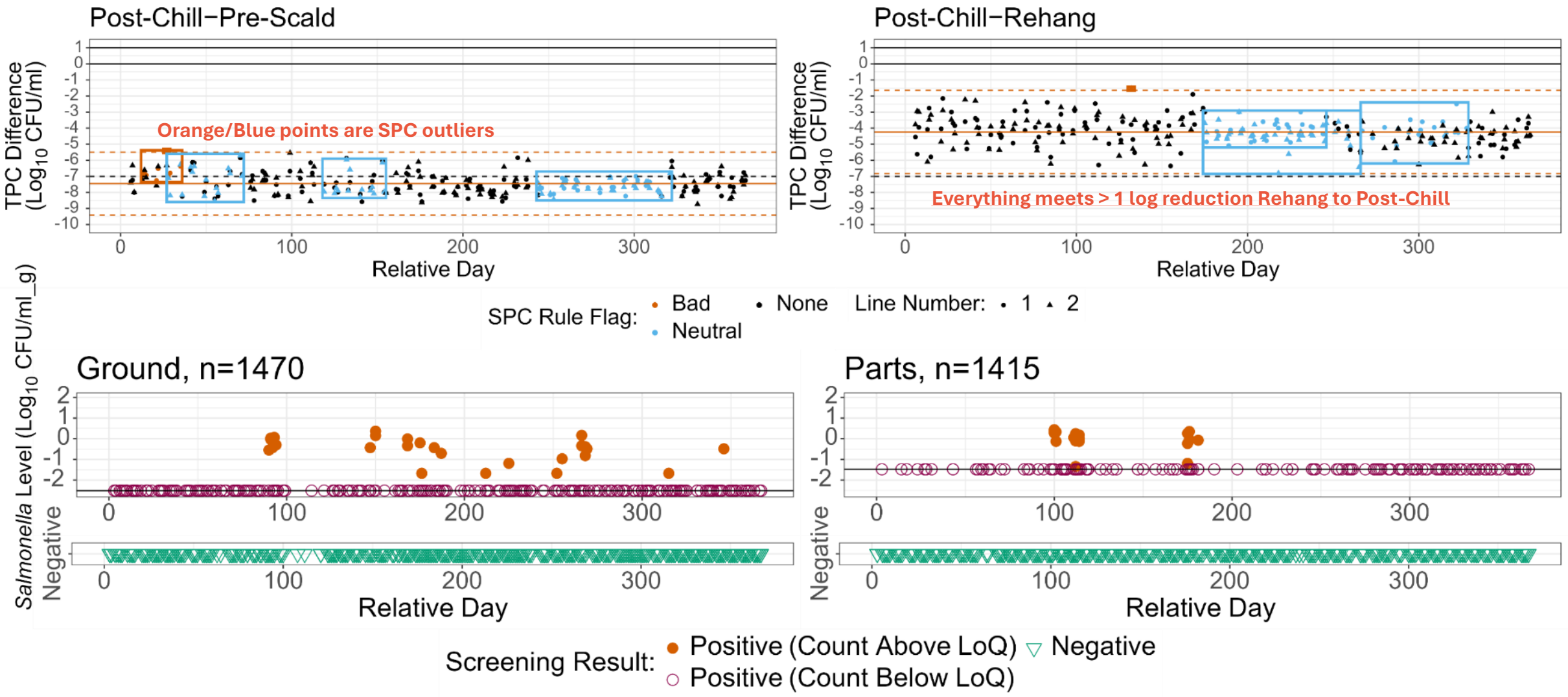
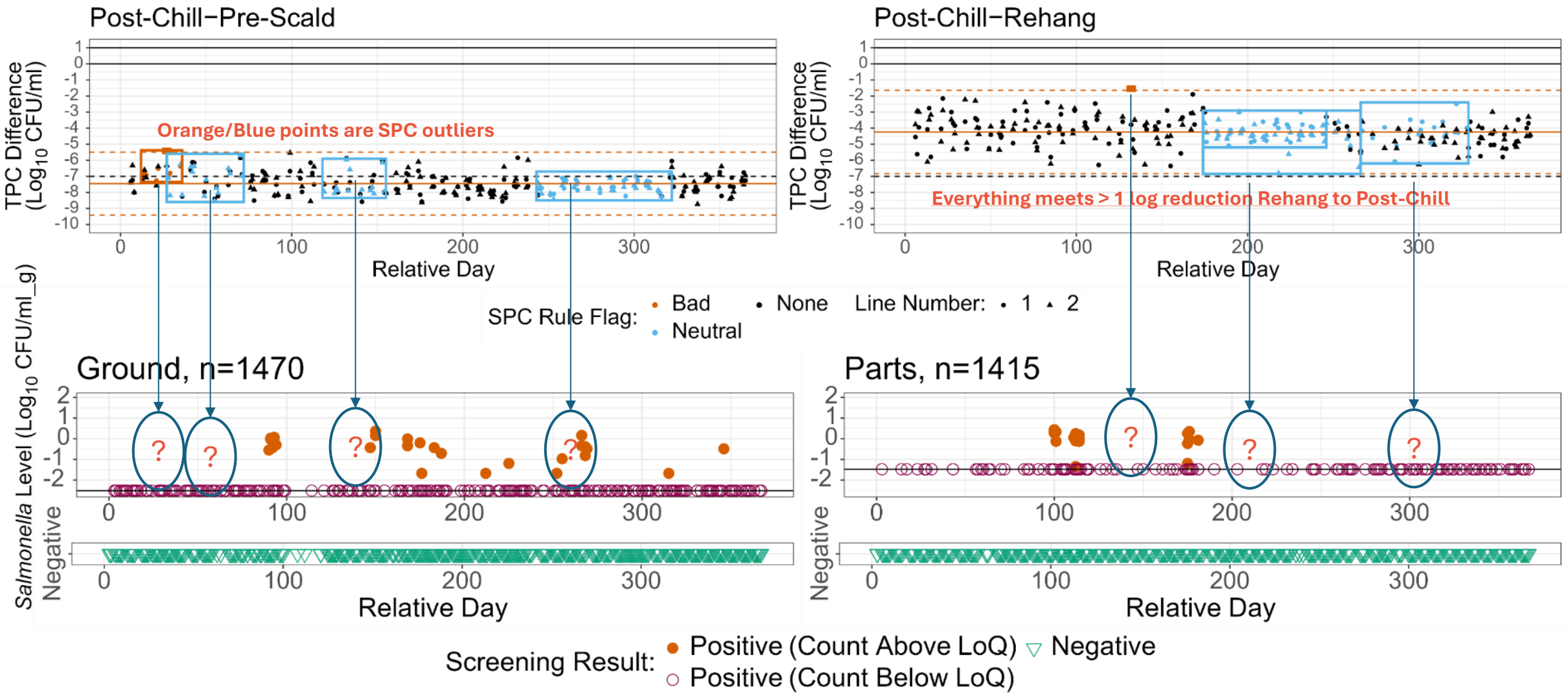
We could trend internal *Salmonella* tests

TPC differences during processing v. finished products



Finding no clear correlation

TPC differences during processing v. finished products



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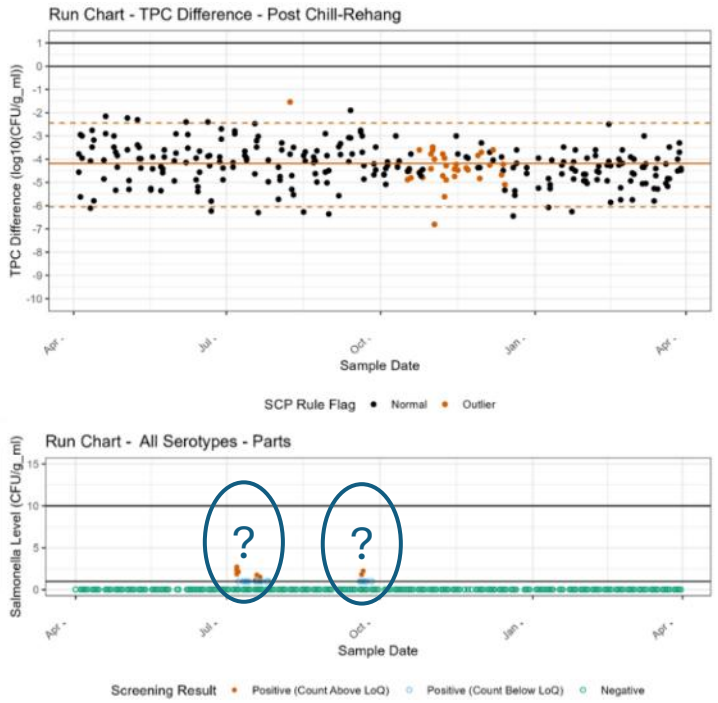
How might we better use our data? … for AI?

SPC Adapted to Food Safety

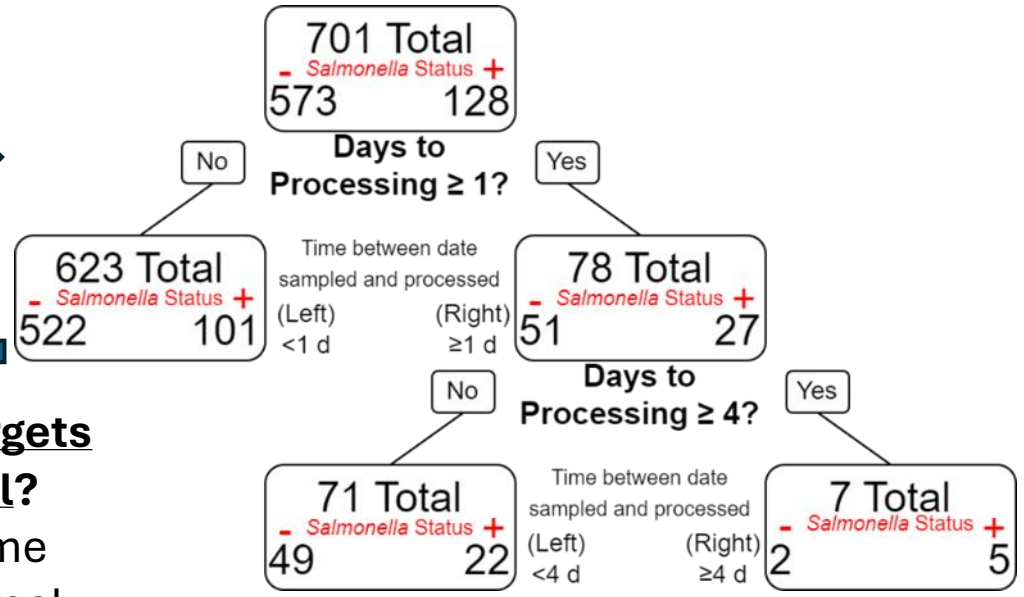
- Nothing obviously explains rare, high-level events



Could Machine Learning (ML) do Better?

- Birds processed after 4+ days, higher risk

Can ML find <u>better targets</u>?



<u>Could we then use better targets for improved process control</u>?
And what if these were real-time process measurements? For real-time, proactive control?

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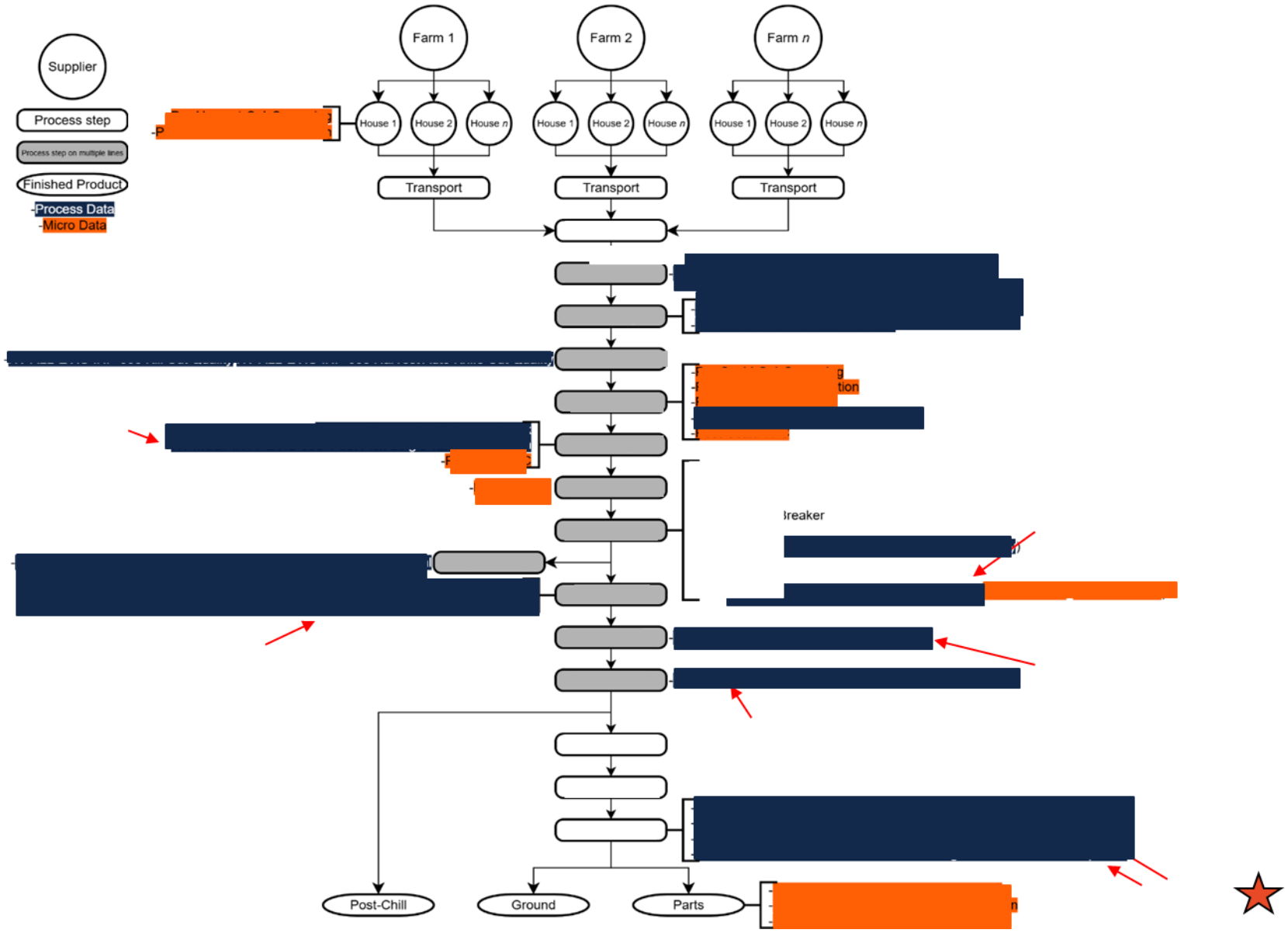
What if we had process data to…

- Go beyond micro data analysis shown previously
- What if we had process control data for stages
- Match up process and micro data
- Use analytics to look for predictors of risk
  - E.g., what if stage X chemical outside a range is associated with more finished parts *Salmonella* above X?
  - Then we could adjust those operating ranges.

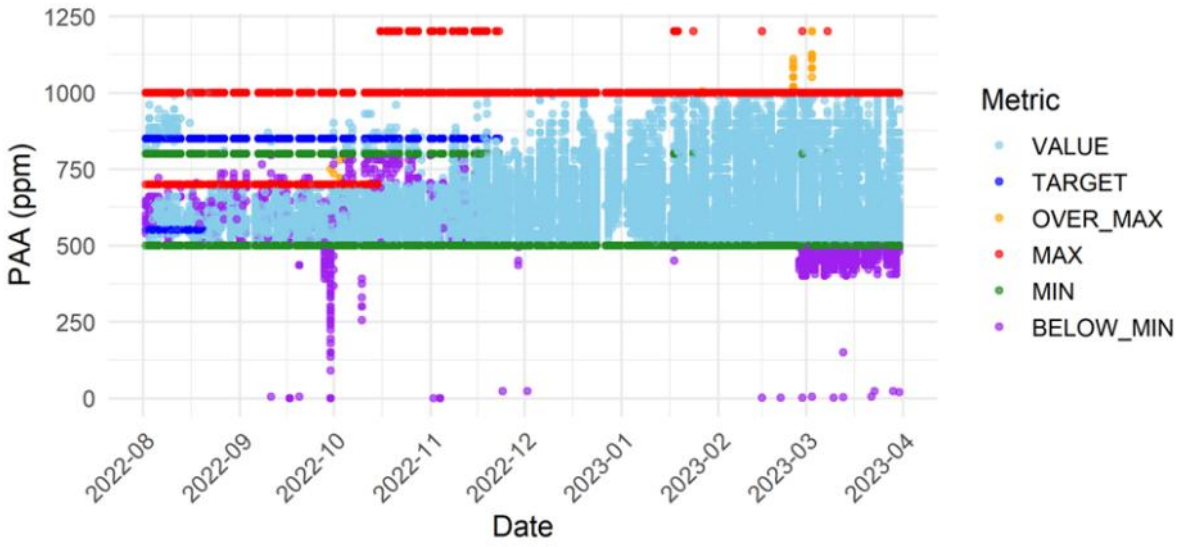
Process flow. Screening for important features?



Features	SPC	Random forest rank
Stage X PAA		1
Stage Y PAA		2
… PAA		3
… GPM		4
…PAA		5
… pH	Important	6
…PAA		7
… pH		8
… PAA	Important	9
… GPM		10
… BPM		11
… PAA		12
… CPC		13
… PAA		14

Follow up on Stage X PAA

Operating below PAA 500 ppm is associated with more *Salmonella* positive days for parts product



39 days had PAA below 500 ppm

#Days with:	*Salmonella* Parts Any Positive	*Salmonella* Parts All Negative	Sum
PAA Any Below 500 ppm	25 (64%)	14 (36%)	39 (100%)
PAA All Above 500 ppm	55 (42%)	77 (58%)	132 (100%)
Sum	80 (47%)	91 (53%)	171 (100%)

OR = 2.49 (p = 0.02)

PAA below 500 ppm was associated with ~2.5-fold more likely *Salmonella* positive day for parts.

What if we could …

- Match up process and micro data
- Use analytics to look for predictors of risk
  - Then we could adjust those operating ranges.
    - **Needs and epi style study design to get great data**
- Could leading companies do this internally?
  - **Pilot study to get others to buy in?**
- Could we build teams to do this across the industry?
  - **Does each company measure the critical stage? In the same way? At what frequency? With the same variable names?**
- To all learn how to do food safety better!
  - **Which still probably means getting key people in a room to talk**

Working with academics can

- Help you ask new food safety questions
- Connect the people and data to address those questions
- Try out analyses to guide next steps

To

- Get new capabilities to internal team or service provider
- Drive industry-wide improvements

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