Leveraging Data-Driven Analysis for Integrated Pest Management and Pathogen Remediation

Agenda

- Using Data for IPM Program Decisions
- Using Data for Pathogen Remediation
  - Elimination of unresolved pathogen issues

Integrated Pest Management

Many definitions – Data driven!

- Use of current, historical & comprehensive information on the life cycles & habits of pests
- An environmentally sound approach to IPM
- Quality pest management utilizing the least hazardous chemicals & techniques
- The “best management practice” for IPM

Principles of IPM

Weekly Inspections

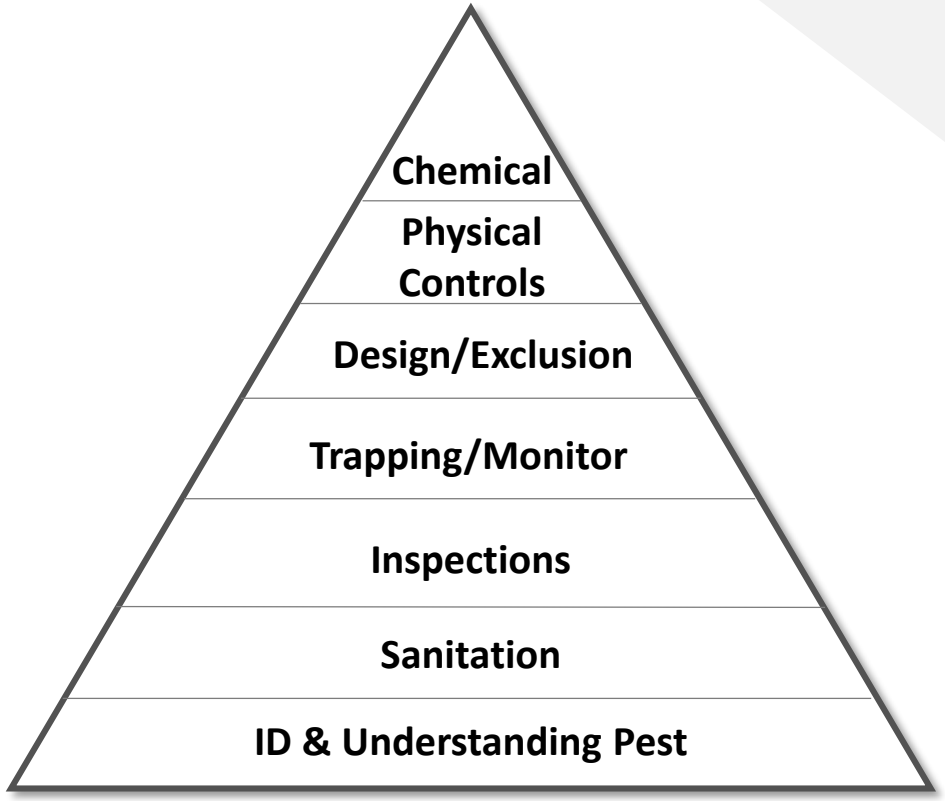
- Review of current conditions
- Snapshot of the program

Periodic Review

- Trend data review
- Review IPM program

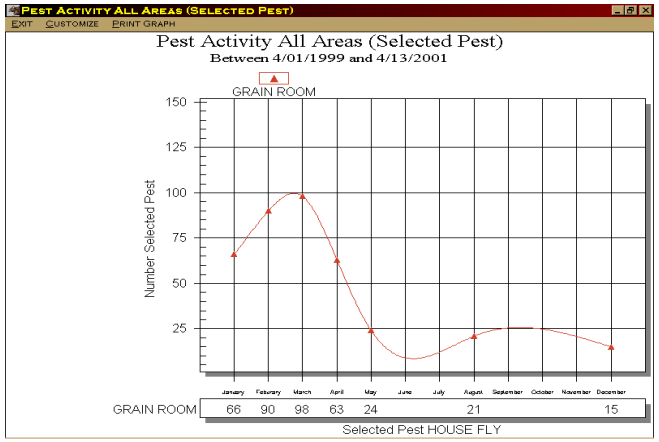
Audit

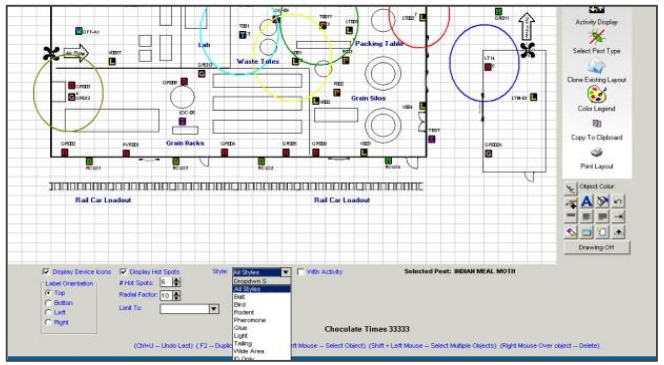
- Higher level review
- Assess overall compliance



THE PEST MANAGEMENT PYRAMID

Data Analysis





- Data on pest activity noted on service reports …. “snapshot”
- Data management over time, IPM mapping & trend reviews ….“Photo album?”
- E-Notebooks provide ease of access
- ***Requires skill and insight to analyze and make adjustments!***

Every Facility is Unique

- Two identical facilities may produce different products
  - May need different IPM programs
- Every facility needs their own IPM assessment
  - Identify risks and gaps
- Pest risk is identified based on:
  - Products being produced
  - Risk factors – such as facility integrity and the environment

What is Proactive IPM?

- Identify the *potential* causes of pest risk for the product and the facility
- Design IPM program based on the potential risks and gaps identified
- Preventative measures are integrated into the IPM program to mitigate the risks and gaps

Proactive Actions

Rodents - Identify areas of potential risk
- Year-round threats
- Populations are on the increase
- Identify and eliminate harborage
- Immediate reaction to indoor sighting

Birds - Identify areas of potential risk
- Reduce attractive spillage, waste & standing water
- More proactive, more options
- Be prepared with a plan/materials for indoor birds

Insects - Identify areas of potential risk
- What do data trends reveal about what/when to expect?
- Plan timely barrier treatments outdoors
- ILTs in good condition, placed properly, fresh bulbs installed and ready for the new season?

Partnership & Plant Responsibilities

- **Communication and cooperation is essential**

  - Technician discussion with plant contact before service begins and exit meeting

  - Coordination among all players: sanitation, QC, maintenance, operations and others…

  - PCQI can quarterback internal efforts

- **Know your facility**

  - Inside, outdoors, roof, hidden rooms, etc.

  - Understand equipment and processes

  - Understand contents of service notebooks and E-notebooks

What You Can Do: Sanitation, Exclusion & Maintenance

- Create a IPM culture at your facility!
- Monthly facility inspections
- Master sanitation schedule is a living document
- Contribute to the general sanitation effort:

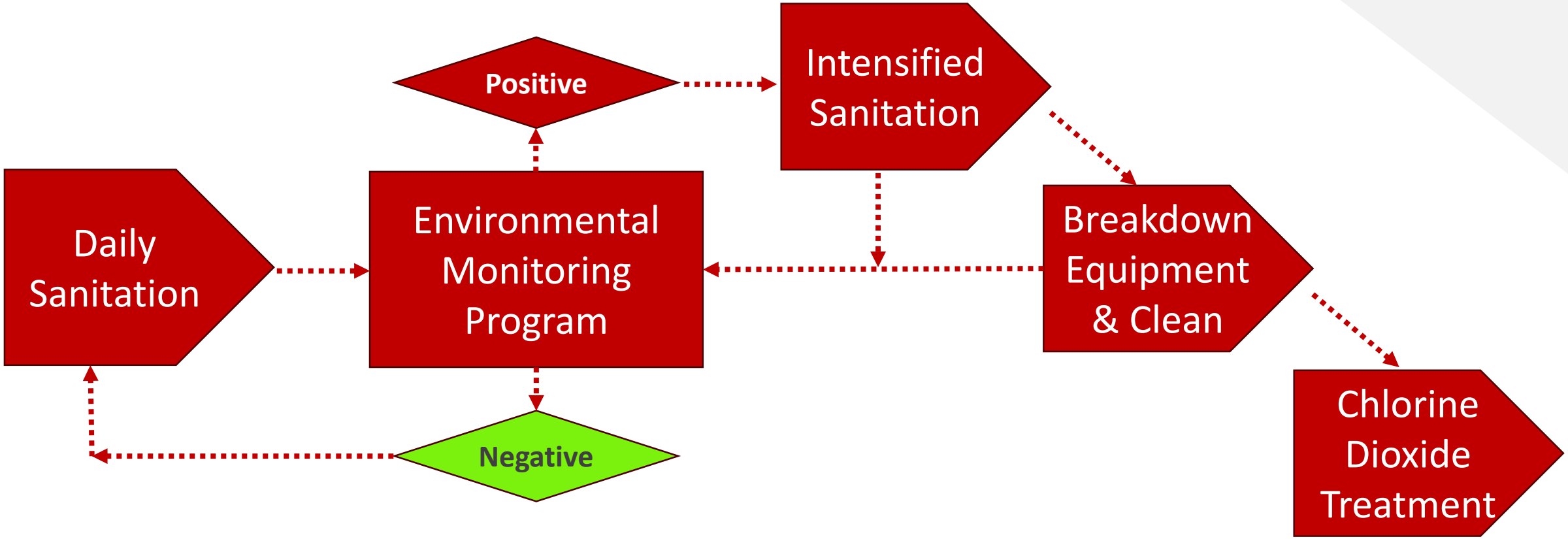
  - Respect sanitation lines

  - Keep locker and lunch areas clean

  - Clean up spillages and remove damaged product
- Report pest activity promptly
- Respect pest control devices
- Do not encourage birds or wildlife!

Leveraging Data-Driven Analysis for Pathogen Remediation

Typical customer data path to a chlorine dioxide treatment



Chlorine dioxide sterilizes the treated area / equipment

When is chlorine dioxide a good solution?

1. **Unresolved customer findings** of presumptive pathogen hits for a number of weeks or months and just can't remediate themselves
2. **FDA has inspected & swabbed and found issues** that the customer needs to document a 'fix'. FDA will then return at some point and reswab so the customer better get it done right, and be able to show FDA they took it seriously
3. **The prospect's customer has stopped buying** until they could prove the pathogen was completely gone
4. **New construction (or tarping new equipment)** to assure that no pathogens have been brought in during the construction process – less typical than response to a known pathogen

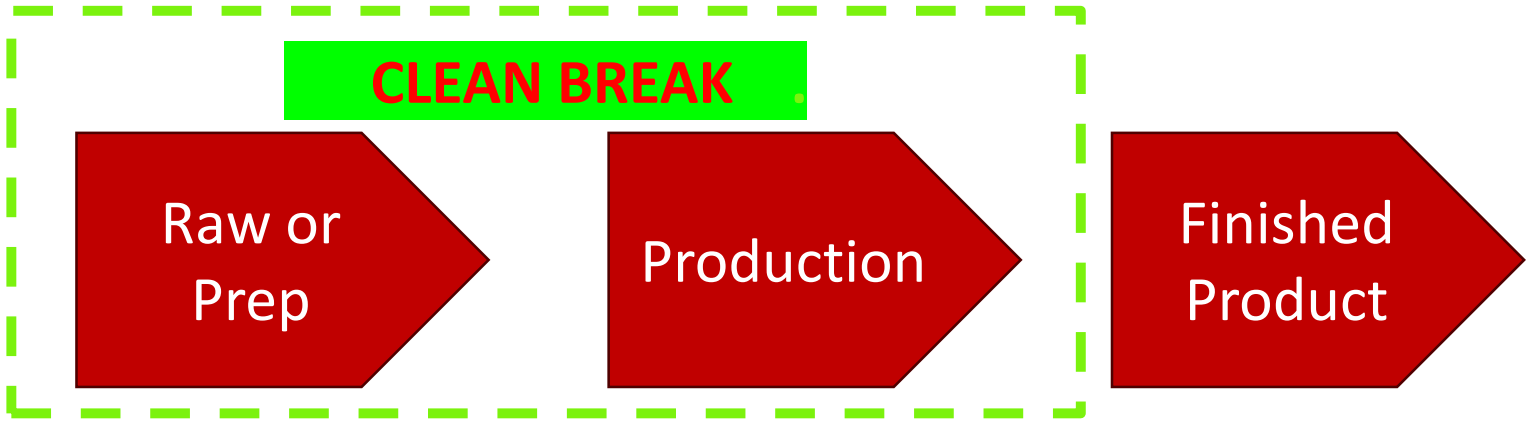
Most common: Dairy, Baking, Ready-to-Eat & Pet Foods

Unresolved contamination requires a ‘Clean Break’

Clean Break: documented scientific evidence that all contact surfaces have been cleaned and decontaminated and 100% free from microbial contamination.

Elements of a clean break:

- Effectively sanitized & decontaminated
- Zero microbial contamination
- Documented scientific evidence



Chlorine dioxide sterilizes the treated area / equipment

Why is gas more effective?

- **Microbes are airborne and can get into every nook and cranny**
- Sprays, fogs and foams don't reach all areas
- Chlorine dioxide leaves no residue so no post-treatment sanitation required
  - Degrades to oxygen and chlorite ions (part-per-trillion) upon exposure to outside aeration
- Chlorine dioxide is the only gas form sterilant
  - Fogs are sometimes referred to as "dry"; but actually just a small droplet
  - Dry steam works well on smaller (tarped) equipment, but not in a large treatment area

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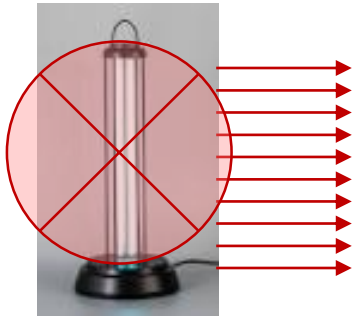
- **Non-gas disinfectants can not physically reach all areas requiring remediation**

Hand wipe or spray

Vapors & Fogging (wet or dry)

Liquid or foam spray

UV light source ->



When to consider chlorine dioxide?

- When routine sanitation methods are not delivering the desired results
  - Consistently finding ‘presumptives’ in Zones 2 and/or 3
- **FUMIGATION vs. FOGGING**
  - FUMIGATION: to confirm a clean break for a known pathogen problem
    - Once and ‘done’. A clean break to confirm pathogen threats have been eliminated (aka: hard reset, 6-log kill)
  - FOGGING/VAPOR: to minimize and prevent future outbreaks, but not always a complete kill
    - Most often a routine treatment – monthly / quarterly
- Chlorine dioxide
  - Destroys biofilms, *Listeria, Salmonella* and all microbial life (mold, mildew, virus)
  - Microbes can’t build up resistance (destroys the DNA)
  - Minimal material compatibility concerns
- Plant operations can resume immediately
  - No post-treatment cleaning required

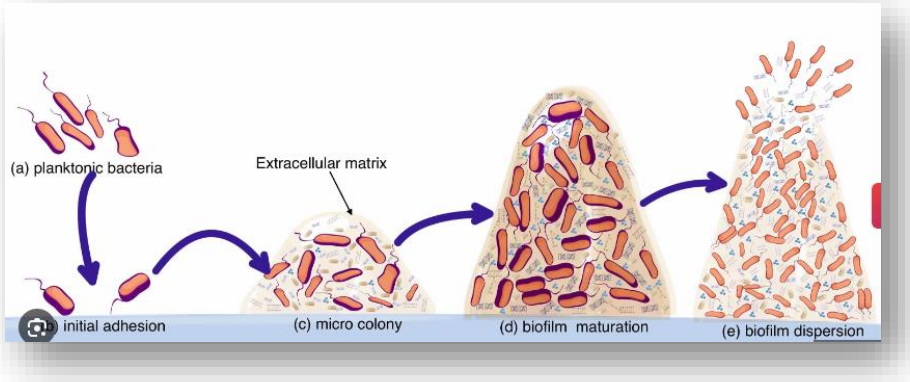
The facts about chlorine dioxide gas?

- Chemical formula is ClO_2
- Registered and approved by EPA as a sterilant
  - Approved by USDA and FDA for food processing
  - Sterilant = confirm kill of 100% of all spores per rigorous EPA test protocol
  - Organic, Kosher and Halal certified
- Applied as a real gas (as fumigant)
  - Fills the entire treatment area equally
- It is a visible yellow-green gas and has an odor like chlorine
- Is NOT chlorine gas and is NOT poisonous or carcinogenic
- Is NOT explosive when fumigating
- No post-application cleaning needed prior to resuming operations
- Compatible with all metals, plastics and electronics in a food plant
  - Exception being unpainted mild steel that is likely already rusted if present

Within 90 minutes of starting

Biofilms – microscopic bacterial ‘colonies’

- Biofilms are invisible and difficult to eliminate
- **Chlorine dioxide destroys biofilms**
- Independent lab testing by an accredited university biofilm research center
  - A biofilm was grown to a size of >100 million cells (Log8)
  - Much larger biofilm than would be found on a routinely cleaned piece of equipment
  - Chlorine dioxide gas applied for 4 hours at ~250 ppm
    - 100% kill – no detectable life
    - Dosage = 1,000 ppm*hours dosage
- Typical IFC gas fumigation is 1,500 – 2,000 ppm*hours



Corrosion potential(s)

Chlorine dioxide material compatibility vs other decontamination agents

Source: EPA, July 2011 Homeland Security Research Workshop

Decontaminating Agent	Oxidation / Corrosion Potential (V)	
Ozone	2.07	
Peracetic Acid	1.81	
Hydrogen Peroxide	1.78	
Bleach	1.49	
Chlorine Dioxide	0.95	

Chlorine dioxide far less corrosive than any other chemical used for food processing plant sanitation

Environmental factors & efficacy

- Humidity
  - Higher humidity always best for microbial destruction
    - Opposite of insect fumigations
- Light
  - UV light increases chlorine dioxide decomposition
    - LED lighting is fine
    - Always best to have lights turned off during fumigation
- Temperature
  - Works best at temperatures above 5 °C (41 ° F)

The Importance of Proper Sealing

- **Sealing the treatment area to contain the gas is one of the most important factors in a successful treatment**
- IFC services:
  - Complete sealing of treatment area, including tarping equipment (if needed) and roof venting
  - Routine perimeter checks to assure seals remain intact
  - Utilize SCBA so we can enter the treatment area if needed to re-seal if leaks detected

Fumigation Examples:
Small to medium size applications

Partial or entire processing plants

Recap and Questions

Pathogen Remediation

- From small applications to entire plant
- New construction / equipment
- Unresolved microbial contamination problems
- Fumigations are designed to be a once-and-done treatment and will sterilize the environment and achieve a ‘clean break’ = 6-Log Kill!

Data-Driven IPM

- Data identifies trends and opportunities
- Proactive Pest Management combines several key components to protect a given food production facility
- Sanitation, Maintenance & Exclusion are the primary elements
- IPM expertise in a food plant environment is critical

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