
THE
SANITARY
DESIGN
WORKSHOP
BEMA

THE SANITARY DESIGN WORKSHOP

Equipment & Plant Design
For Allergen/Pathogen Control in Low Moisture Foods

Part 7:
Food Plant Maintenance

Presented by:
Greg Marconnet, Mead & Hunt

April 2026

Sanitary design is integral to food safety.

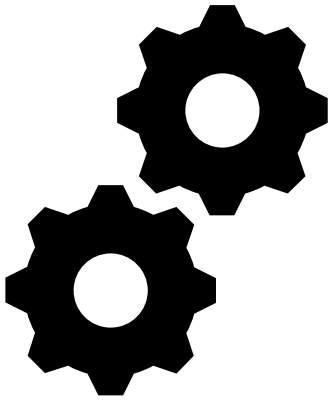
Greg Marconnet

- 35 years; maintenance, equipment design, sanitary design, procurement
- 11 years; Vice President of Food and Beverage
- 24 years; Working Group, Treasurer, Vice Chair, Chair and Education Committee Chair
- 23 years; Wisconsin and National Event Supervisor

Learning Objectives

1. Understand the challenges and hazards of food plant maintenance
2. Maintenance and reliability impacts on food safety and quality
3. Maintenance across asset lifecycle
4. Maintenance Principles
5. Maintenance considerations

Why Maintain?



Functionality

Reliability

Safety

Food Safety

Product Quality

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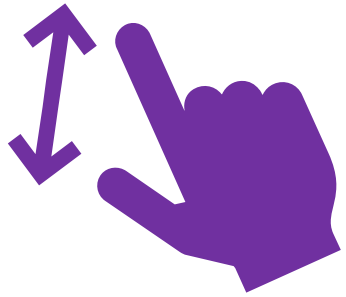
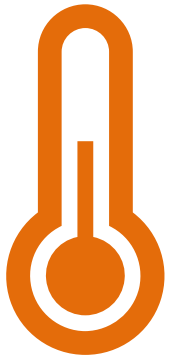
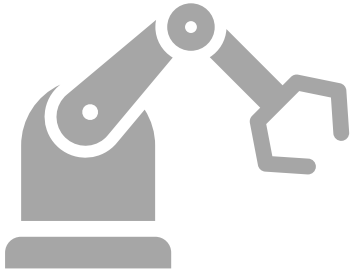
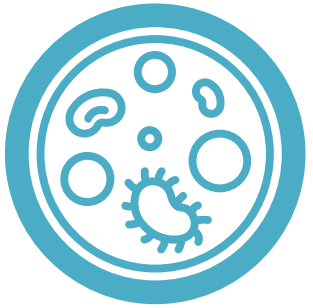
Food Plant Maintenance Challenges



Access	Environment	Preserve	Resources	Cross Contamination
Reachable to maintain	Temperature Moisture Washdown	Chemical resistant Smooth Nonporous Drainable	Funding Staffing Training	Biological Chemical Physical

Maintenance Related Food Safety Risks

Biological

- Mechanic
- Contractors
- Tools
- Repair process
- Repair parts

Chemical

- Lubricants
- Solvents
- Old product

Physical

- Over-processed product
- Fasteners
- Metal, rubber, plastic fragments

Cross Contamination

Equipment Life Cycle

Plan	Build	Operate / Maintain	Revisions
• Product / Package • Building Design • Equipment Selection & Design	• FAT & Training, SOP's • Install as designed • PAT & Training	• Operate • Prove Maintenance Program • Train / retrain employees • Consumer Feedback	• Reformulations • Recalls • Line & Operation changes • Building remodeling
Design for maintainability. Get it RIGHT here.	Poor installation can VOID a great design	Effective and repeatable maintenance.	Changes can impact maintenance

Designed for Maintainability?

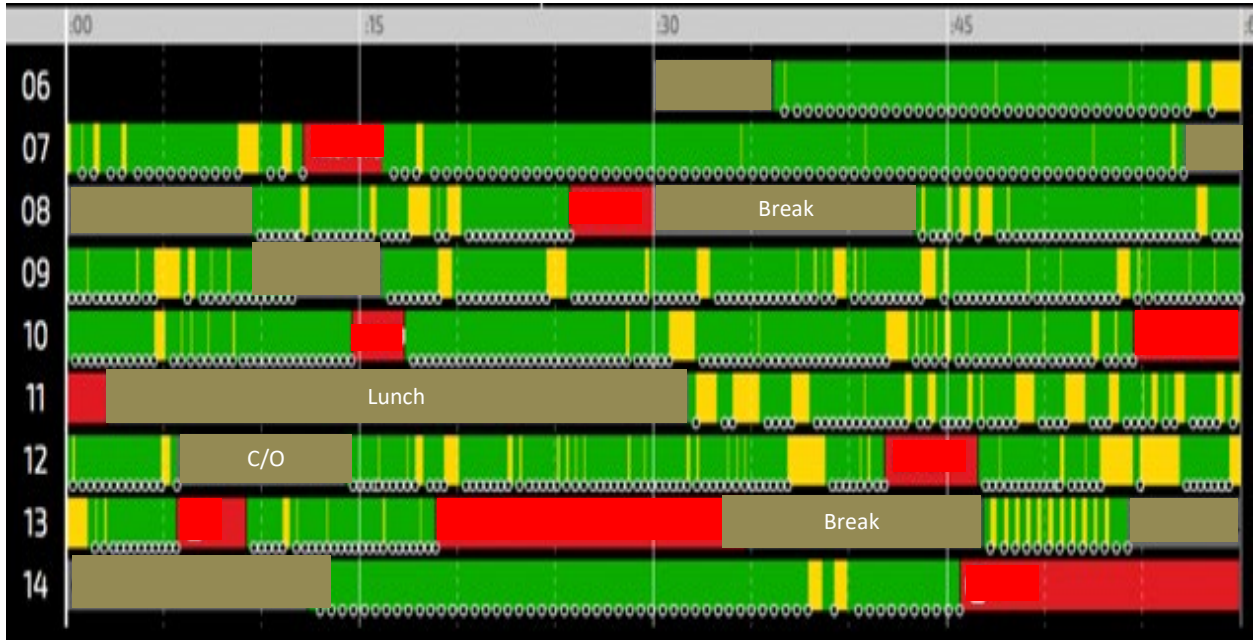
Designed for Maintainability?

Designed for Maintainability?

Unplanned Downtime IMPACT!

- **Product Loss**
- **Material Loss**
- **Quality**
- **Food Safety**
- **Compliance**
- **Customer**
- **Energy Waste**
- **Asset Life**

~100 stops/starts in 8 hours! – 10 planned



Key

Green – Line operating!
Red – Line breakdown – REACTIVE MAINTENANCE
Yellow – Line stop
Gray – Planned break or line changeover

Maintenance Definition

A disciplined system for preserving a facility and equipment

centered on:

- food safety
- equipment criticality
- operational requirements

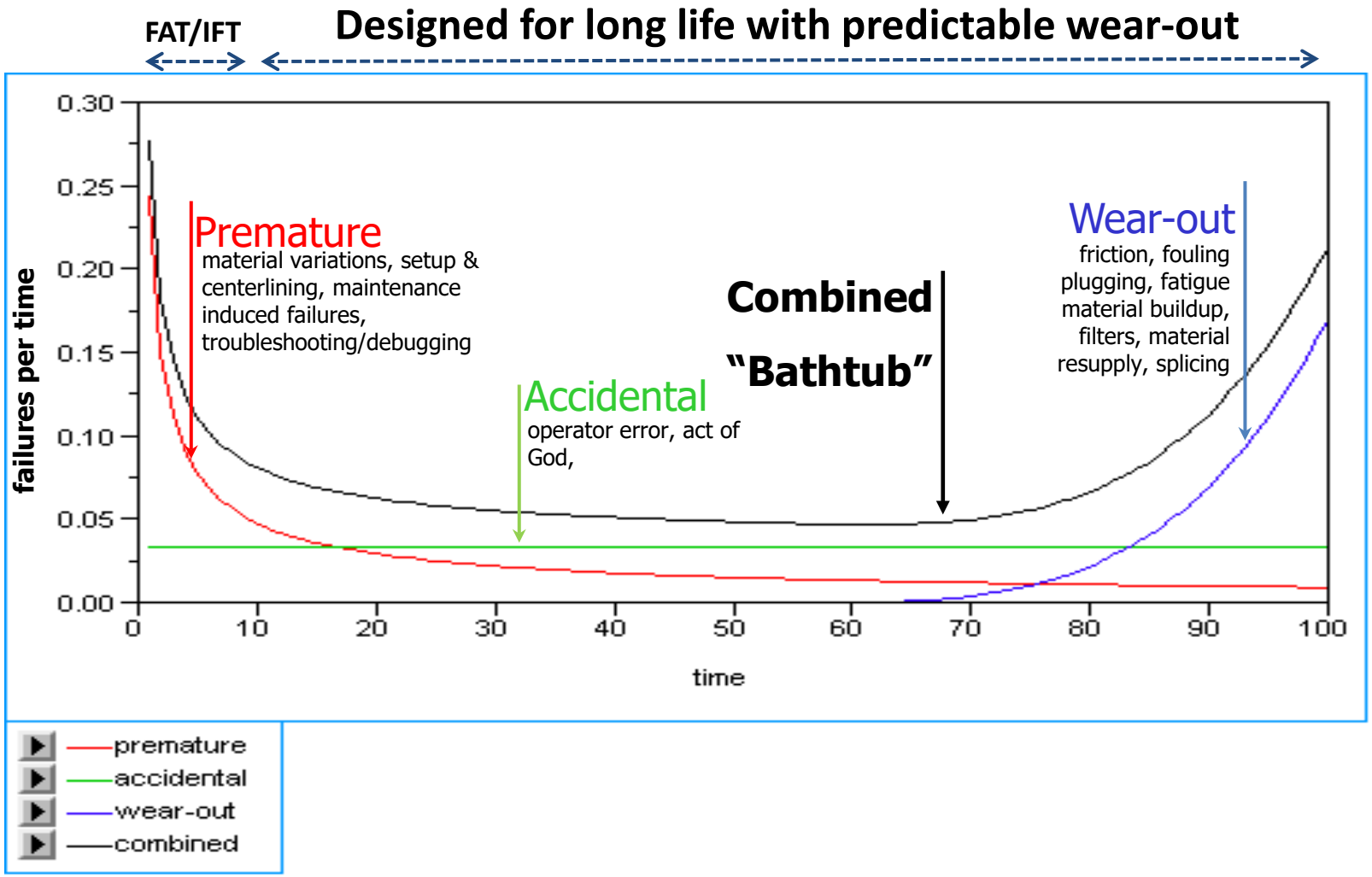
Maintenance Approaches

	Reactive	Preventive	Predictive
Approach	Run to Failure	Avoid Failures	Forecast Failures
Goal	Maintain after failure	Scheduled maintenance	Life-cycle maintenance
Result	Unplanned maintenance resulting in line downtime	Planned maintenance with useful life remaining	Planned Maintenance based on monitoring to optimize life
Equipment Application	• Low consequence • Low-Cost Assets • Disposable • Redundant Assets	• High criticality • Predictable wear • Ensure safety, food safety, quality and output	• Bottleneck asset • Complex systems • Condition sensor capability • Cost optimization

Source: Article: Switching From Reactive to Predictive Maintenance https://kaizen.com/insights/reactive-predictive-maintenance/

The "Bathtub Curve"

…THE key concept behind Reliability Engineering



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Sanitary design is integral to food safety.

Maintenance Focus

Food Safety	Safety	Operational
• Process • Packaging • Foreign Object • Sanitation • HVAC • Steam, CA, MA Gas	• Equipment • Facilities	• Bottleneck Eq. • Building • Utility Infrastructure

Maintenance Principles

- Training
- Personnel & Tool Hygiene
- Replacement Parts
- Contamination Prevention
- Restore to “Like New”
- Post-Maintenance

Maintenance Training

- Sanitary Design & Food Safety
- Safety & Compliance
- Root Cause Analysis
- Mechanical Systems
- Electrical Systems
- Equipment Specific
- Communication

FOOD INDUSTRY TECHNICIAN
FIT
DEVELOPMENT PROGRAM

THE SANITARY DESIGN WORKSHOP

Sanitary design is integral to food safety.

Maintenance Personnel and Tool Hygiene

Outer Clothing

- Change if soiled
- Maintenance Color
- Disposable?

Footwear

- Nonporous
- nonabsorbent
- cleanable

Handwashing

- Before maintenance
- Before re-assembly
- Glove use only after washing hands

Tools

- Clean before & after use
- Replace if damaged
- Consider captive tools

Good Manufacturing Practices

Maintenance Tools

- No wooden handles
- Avoid rubber handles, fiberglass
- Metal tools: unpainted and rustproof

Worn Tools

Replacement Parts

- Match original?
- Food Grade Material?
- Finish?
- Size?

- Application- is it “CIP-able”?
- Clean and sanitized?
- Need to be passivated?

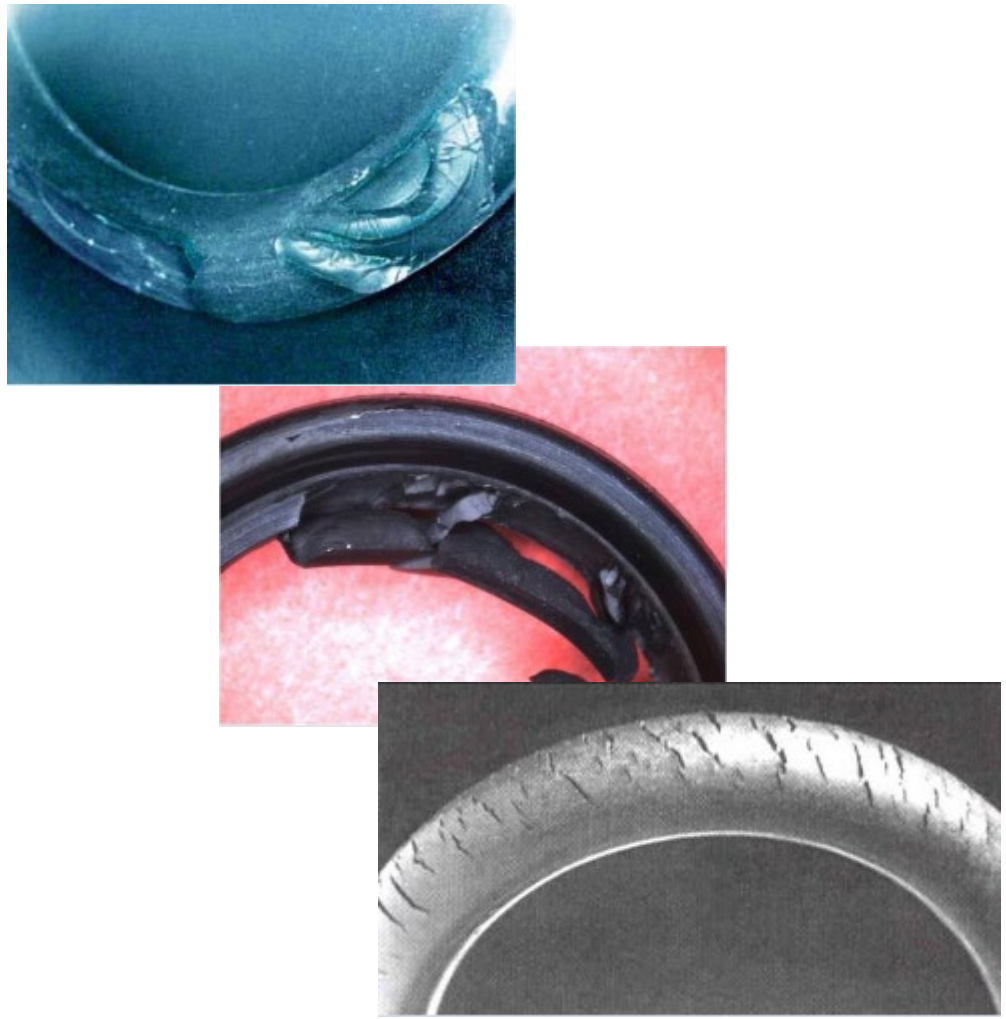
Replacement Parts and System Component Qualification Certificate Program

Replacement Parts: Quality vs Cost

Compounding considerations

AVK GUMMI A/S

EPDM recipe	Original	Low cost
Pure, well structured EPDM	100	
Low-quality EPDM		100
Carbon black, high purity	80	
Carbon black, low purity		100
Other fillers, e.g. chalk		90
Medical grade mineral oil	10	
Technical grade mineral oil		80
Sulphur + Accelerators		4
Organic peroxide + Activator	4	
Loading	**194**	**374**
Hardness	70 ShA	70 ShA
Tensile strength	14 MPa	9 MPa
Compression set, 70 °C, 24 hrs	10%	20%
Swelling in water, 70 °C, 168 hrs	± 2%	± 10%
Taste & smell	None	Noticeable



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Sanitary design is integral to food safety.

Source: AVK Gummi presentation to 3-A SSI Annual Meeting, Bloomington, Minnesota, May 2, 2017, "Hygienic Seal Design with Elastomers"

Contamination Prevention!

- Can work be done out of place?
- Contain waste:
  - from drilling, cutting, grinding, welding
  - Equipment leaks
  - Broken and removed parts
  - Solvents and lubricant
  - Replacement part packaging
  - Removed parts
- Cover adjacent equipment
- Account for fasteners!

Restore to “Like New”

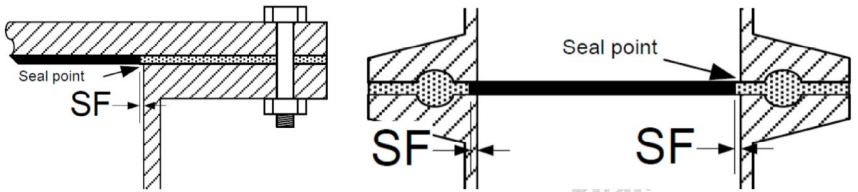
Facility & Equipment

Bakery (Formerly BISSC)

Various

14159

3-A Product Contact Surface	Pre-Op
D1 – Surface	• Inspect that surfaces retain surface and conformational characteristics
E1.1 – Surface finish	• Ra < 32 µ in. Repair to meet original finish
E2.1.1.3 – Bonded joints of rubber and Plastic	• Inspect for continuous and mechanically sound bond.
E2.2, E7 – Non-permanent joints and Gaskets	• Gasketed joints must be installed and tightened as designed…substantially flush interior

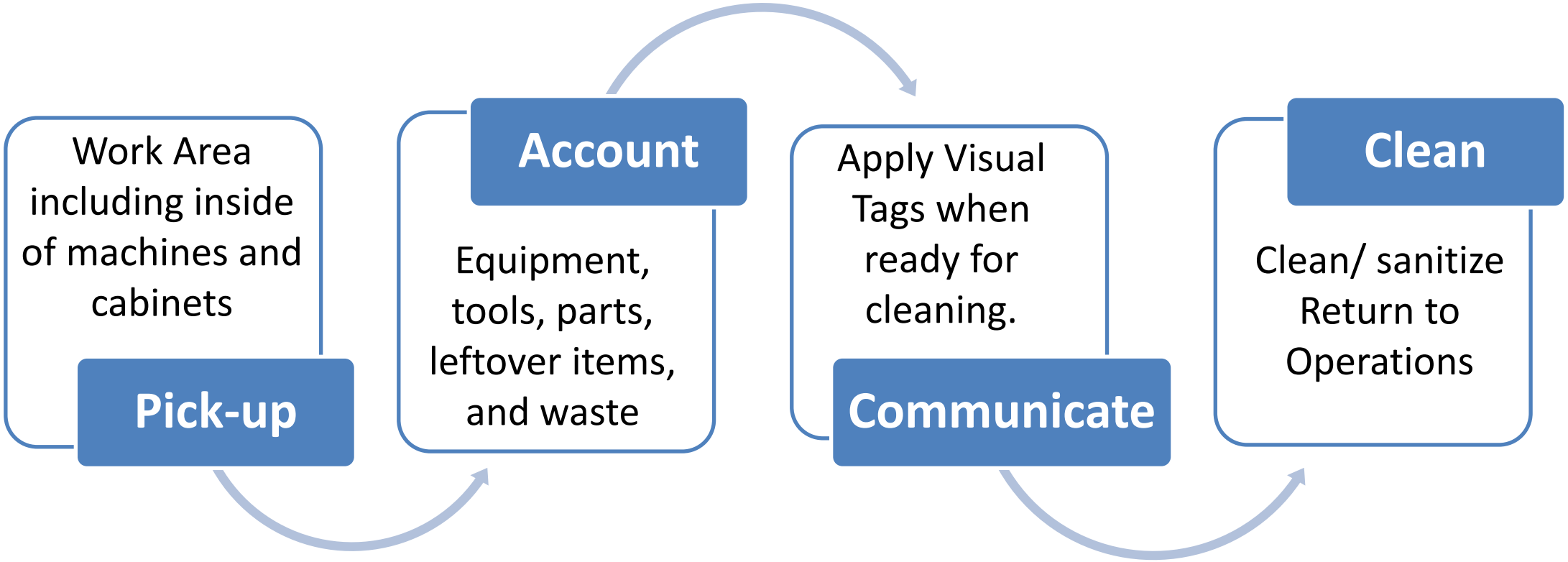


Substantially Flush (SF) = 1/32" (0.794 mm) maximum

Footnote

- Repair other incidental damage found during maintenance that can lead to pest or microbe harborage.

Post Maintenance



Visual Service Tag

Visible notification of maintenance activity to a food contact area.

Transfer of responsibility:

- Maintenance to Sanitation for cleaning & sanitizing
- Sanitation to Quality for pre-operation inspection
- Quality to Operations for operations

Test Your Knowledge!

Temporary Repairs

- A Temporary Repair **MUST:**
  - NOT result in product contamination
  - meet food grade standards
  - be documented, dated
  - be communicated & audited across shifts
  - be properly maintained
  - have work order for a permanent repair
- Proximity to product zone should determine level of risk and extent of communication.

Maintenance for Sanitation

- Automated washers
- CIP systems
- COP tanks
- Floor scrubbers
- Equipment and floor foamers
- Spray bars
- High pressure systems
- Hot water systems
- Compressed air
- Hoses, spray nozzles
- Ladders, lifts, platforms
- Vacuum/dust collection systems
- Chemical dispensing

Building Maintenance

Walls, Floors, Ceilings — Cracks, gaps, caulk joints, wear and damage, drains, pipe penetrations, door repair

Utilities — Piping, valves, insulation, leaks, filters

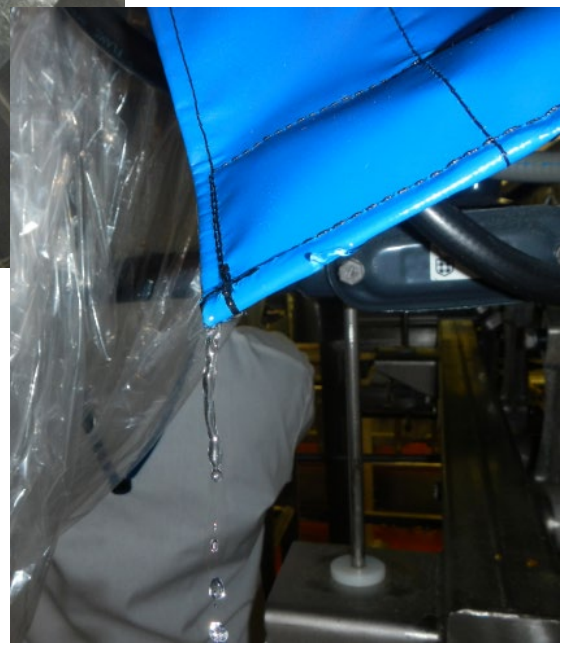
HVAC — Ducts, filters, drains, coils, motors, fans

Exterior — Roof, walls, landscaping, parking lots, truck docks, doors

Personnel Hygiene — Water temperature, supply dispensers, foot bath/foamers

Uncontrolled Water

- Condensation
- Frost & Ice
- Leaks/Spills
  - External Ingress
  - Internal
- Roof & Drains



- Find it/Fix it
- Similar program to glass/brittle plastic

Test Your Knowledge!

- Line 17 just stopped. Emergency change out a product pump for the slurry tanks.
  - What risks should be considered?
- OEM replacement pump not in stock
  - Concerns?
- How can risks be controlled?

Test Your Knowledge!

- What risks should be considered?
  - Biological: mechanic and the tools
  - Chemical: lubricants, solvents
  - Physical: metal, rubber, and plastic fragments as well as nuts, bolts
- OEM replacement pump not in stock, concerns?
  - Risk of material incompatibility.
  - Pump sizing for product
  - Pump used for sanitation if ACS – is it “CIP-able”?
  - Is the pump clean and does it need to be passivated?
- How can risks be controlled?
  - Apply 6 Maintenance Principles
  - Who should we communicate with?

Maintenance - Key Takeaways

- Maintenance: a disciplined system to preserve a food plant facility and equipment
- Consider maintenance across the facility and equipment lifecycle…from design to installation to ongoing operation and product changes
- Consistently apply Maintenance Principles:
  - Train staff on food safety and sanitary design principles for maintenance and modifications.
  - Always apply GMP's and maintenance staff / tool hygiene practices
  - Assure food grade parts are used
  - Utilize methods to prevent product and product contamination
  - Restore to "like new" condition
  - Post Maintenance – communicate and clean
- Considerations for maintenance
  - Temporary repair is acceptable only if food safe
  - Reactive maintenance (emergency) has considerable pressure, must apply maintenance principles
  - Planned maintenance (preventive & predictive) minimize unplanned maintenance
  - Major maintenance (overhaul) well planned

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Equipment & Plant Design
For Allergen/Pathogen Control in Low Moisture Foods

Double Feature:
Part 7a: Major Maintenance & Construction

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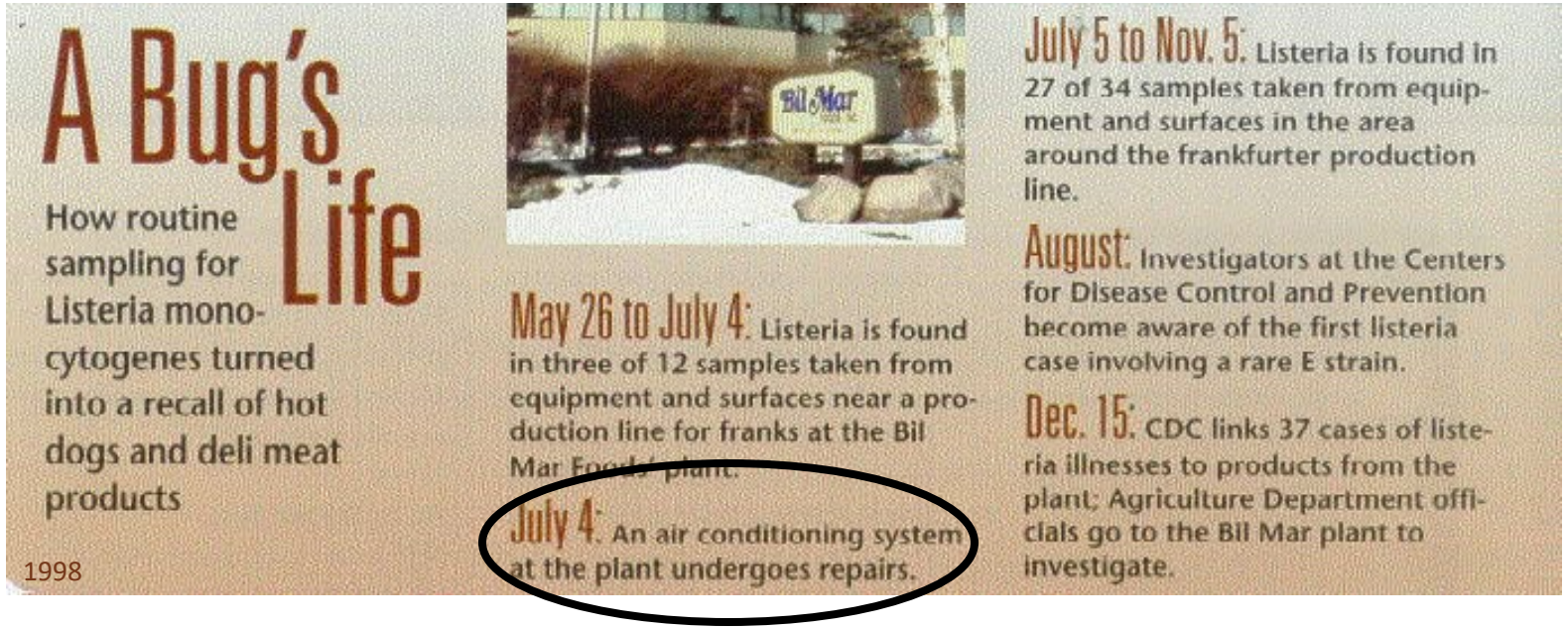
Major Maintenance & Construction (MM&C)



A Bug's Life

How routine sampling for Listeria monocytogenes turned into a recall of hot dogs and deli meat products

1998

May 26 to July 4: Listeria is found in three of 12 samples taken from equipment and surfaces near a production line for franks at the Bil Mar Foods plant.

July 4: An air conditioning system at the plant undergoes repairs.

July 5 to Nov. 5: Listeria is found in 27 of 34 samples taken from equipment and surfaces in the area around the frankfurter production line.

August: Investigators at the Centers for Disease Control and Prevention become aware of the first listeria case involving a rare E strain.

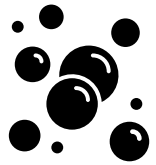
Dec. 15: CDC links 37 cases of listeria illnesses to products from the plant; Agriculture Department officials go to the Bil Mar plant to investigate.

Major Maintenance and Construction can "un-earth many unwanted treasures"

Major Maintenance & Construction

- Planned work expected to take four hours or longer
- Floor excavations where underfloor soil is exposed
- Sewerage/drain line repairs or inspections
- Penetration into any:
  - hollow walls, such as CMU
  - roof or walls to exterior
  - separating walls between raw and ready-to-eat (RTE)
- Demolition activities
- Work producing odors, vapors, airborne particulates, or dust
- Major maintenance including rebuilding in place or deep cleaning




Risk Assessment

– Construction Area

- Tasks to be completed
- Sources of Hazards
- How will air/dust/vapor/ smoke/fumes be controlled?
- What temporary protection is needed?
- Can the work be done during Production?

– Contamination Vectors

- Personnel traffic patterns
- How will waste and old equipment be contained for removal?
- Water and drainage
- How will all tools, equipment, and supplies be cleaned & inspected?
- Any allergen concerns?

Risk Assessment Example

INSTALLATION TASK	POTENTIAL HAZARDS	•BIO •CHEM •PHYS	LIKELIHOOD, SEVERITY
1. Contractors coming into the area with tools and supplies to work on equipment	Work in a production area and/or with food contact surfaces could introduce pathogens. Concern over 3rd party support and not following cGMP.	B	M, H
2. Removal of Defective Parts	Workers touching parts and surrounding areas.Cross Contamination and transfer of Pathogens from inadequate previous sanitation, or hand and tools to equipment.	B	M, H
3. Rebuilding	(B) Pathogens and cross contamination by improper handling of equipment. (P) Removed caulking could cause a physical hazard if not removed properly	B P	M, H H, L
4. Scraping old excess caulking from ceiling area.	(B) Contractors will have to lie on the food contact belt to complete this task and therefore pathogens could be introduced on food contact equipment through this process. (P) Removed caulking could cause a physical hazard if not removed properly	B P	M, H H, L
5. Reassembly with new parts	Pathogens could be introduced through handling of equipment.	B	M, M
6. New Caulk	Excess new caulking introduced could present hazards if not properly properly removed	P	H, L
7. Handover to Sanitation	Work is not complete or area not ready to sanitize. Keep PM and Construction workers on site until verified.	B	M, H
8. Cleaning Parts and Area	Pathogens could have contaminated the process	B	M, H
9. Sanitation Verification	To ensure that Hazards have been properly removed	B P	L, H L, L

Preventive Controls Example

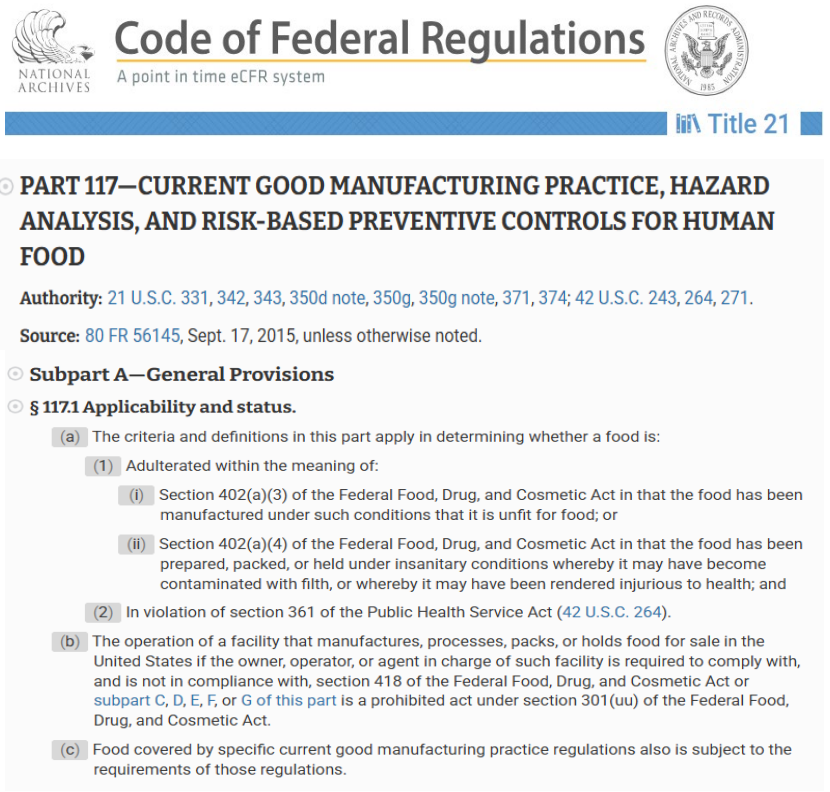
POTENTIAL HAZARDS	PREVENTIVE CONTROL	WHO WILL DO IT?
Work in a production area and/or with food contact surfaces could introduce pathogens. Concern over 3rd party support and not following cGMP.	▪ Formal Training for each worker. ▪ Clean all Tools. ▪ Captive Tools and Uniforms preferred	E&F, PM, CM, Contractor Supervisors
Workers touching parts and surrounding areas.Cross Contamination and transfer of Pathogens from inadequate previous sanitation, or hand and tools to equipment.	▪ Clean and sanitize all work areas before work starts. ▪ Wash hands and wear disposable gloves before handling food contact parts. ▪ Place old parts in clean buckets on clean cart. Cover with clean plastic. ▪ Take to shop for rebuild. Spray or foam wheels of cart. ▪ NO PARTS TO BE LAID ON FLOOR.	Project Manager and Construction Workers
(B) Pathogens and cross contamination by improper handling of equipment. (P) Removed caulking could cause a physical hazard if not removed properly	▪ Sanitize work benches and allow to dry. Place sanitized UHMW on top of bench. ▪ When we are not working on these benches the benches and parts MUST be covered with Plastic. ▪ Ensure that old caulking is properly removed. ▪ Remove all old and excess caulk. Use extra lighting and touch the surface to verify complete removal.	Project Manager and Construction Workers
(B) Contractors will have to lie on the food contact belt to complete this task and therefore pathogens could be introduced on food contact equipment through this process. (P) Removed caulking could cause a physical hazard if not removed properly	▪ The belt must be totally covered with sanitized plastic before contractors can start the work. ▪ Full Tyvek disposable suits and booties required. ▪ Ensure that old caulking is properly removed. ▪ Remove all old and excess caulk. Use extra lighting and touch the surface to verify complete removal.	Project Manager and Construction Workers
Pathogens could be introduced through handling of equipment.	▪ Clean and sanitize all work areas, parts and tools before work starts. ▪ Wash hands and wear disposable gloves before handling food contact parts.	Project Manager and Construction Workers

Preventive Controls Planning

- ☐ Contractor GMP Review
- ☐ Traffic Pattern Controls
- ☐ Temporary Containment
- ☐ Site Management and Monitoring
- ☐ Work Site return to production
- ☐ Contingency planning
- ☐ Communication

Contractor GMP Review

- Training on plant GMP's
  - before beginning work
  - at least annually
- Quality Manager will provide the training
- Contractor to maintain training records



NATIONAL ARCHIVES

Code of Federal Regulations

A point in time eCFR system

Title 21

PART 117—CURRENT GOOD MANUFACTURING PRACTICE, HAZARD ANALYSIS, AND RISK-BASED PREVENTIVE CONTROLS FOR HUMAN FOOD

Authority: 21 U.S.C. 331, 342, 343, 350d note, 350g, 350g note, 371, 374; 42 U.S.C. 243, 264, 271.

Source: 80 FR 56145, Sept. 17, 2015, unless otherwise noted.

Subpart A—General Provisions

§ 117.1 Applicability and status.

(a) The criteria and definitions in this part apply in determining whether a food is:

(1) Adulterated within the meaning of:

(i) Section 402(a)(3) of the Federal Food, Drug, and Cosmetic Act in that the food has been manufactured under such conditions that it is unfit for food; or

(ii) Section 402(a)(4) of the Federal Food, Drug, and Cosmetic Act in that the food has been prepared, packed, or held under insanitary conditions whereby it may have become contaminated with filth, or whereby it may have been rendered injurious to health; and

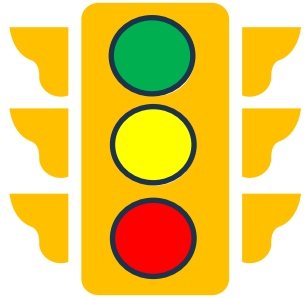
(2) In violation of section 361 of the Public Health Service Act (42 U.S.C. 264).

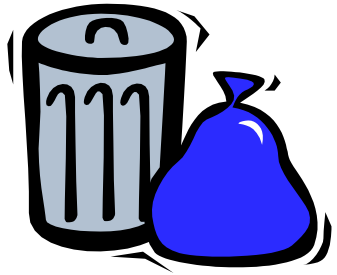
(b) The operation of a facility that manufactures, processes, packs, or holds food for sale in the United States if the owner, operator, or agent in charge of such facility is required to comply with, and is not in compliance with, section 418 of the Federal Food, Drug, and Cosmetic Act or subpart C, D, E, F, or G of this part is a prohibited act under section 301(uu) of the Federal Food, Drug, and Cosmetic Act.

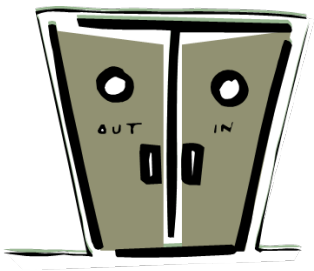
(c) Food covered by specific current good manufacturing practice regulations also is subject to the requirements of those regulations.

Traffic Pattern Controls

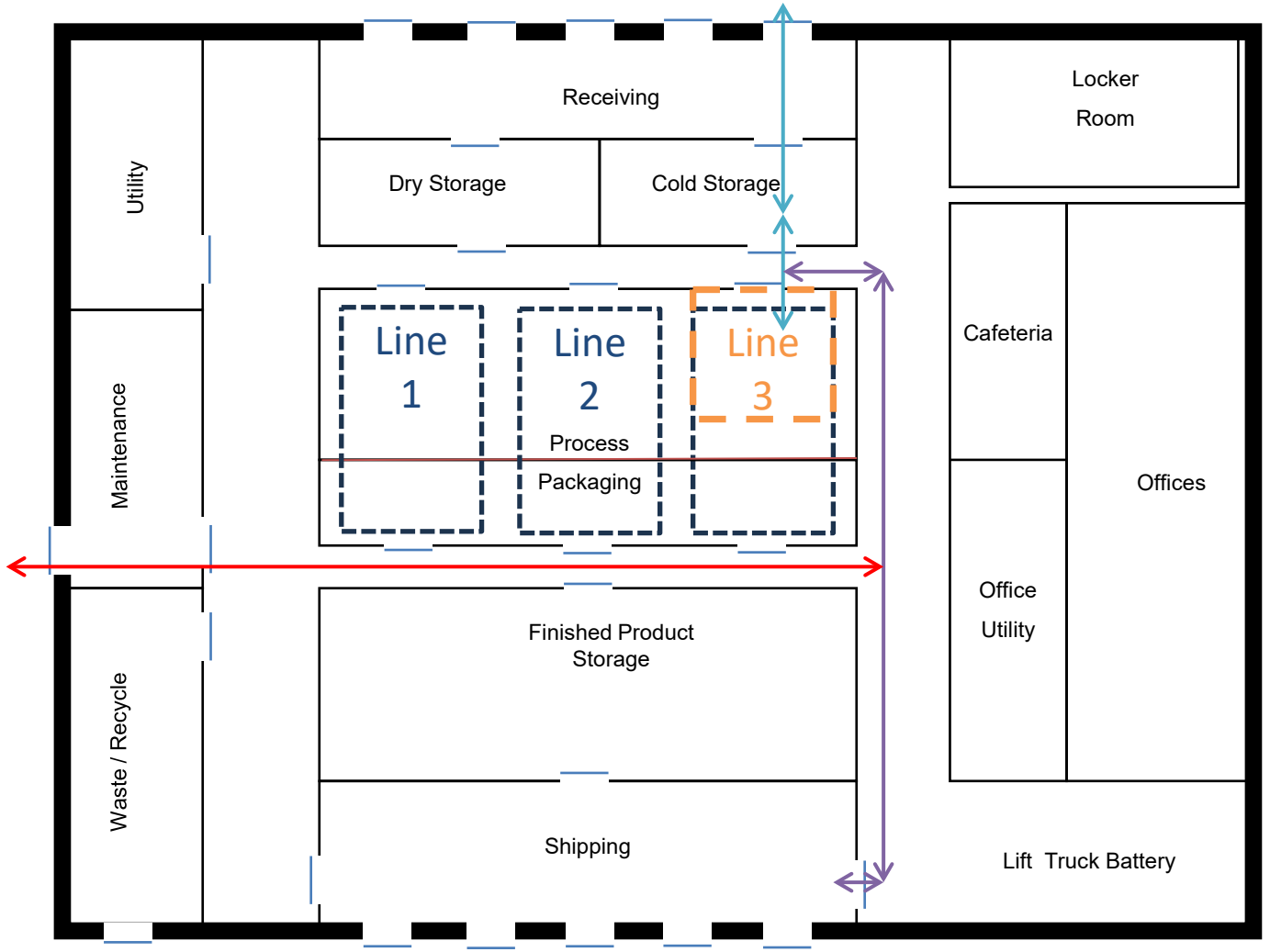
- Plant access
  - Personnel, supplies and waste
  - Break area and toilet facilities
  - Entry into active Process and Storage Areas
  - Use of Doors
  - Equipment and handling devices
- Worksite
  - Temporary Containment
  - Restrict entry with barriers and signs
  - Personnel & materials entry and exit
  - Waste, bag or shrink-wrap
  - Hand wash and hand sanitizer for entry and exit
  - Maintain footbaths / Floor foamers / mats
  - Protective clothing, new each time







Construction Planning

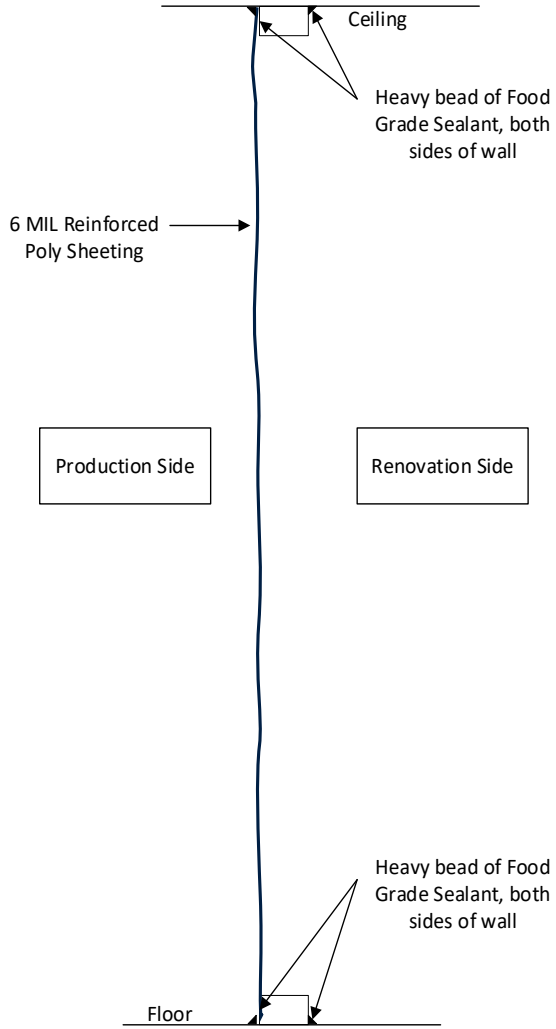


Avoiding hazard cross contamination

- Process and construction materials
- Construction and plant employees

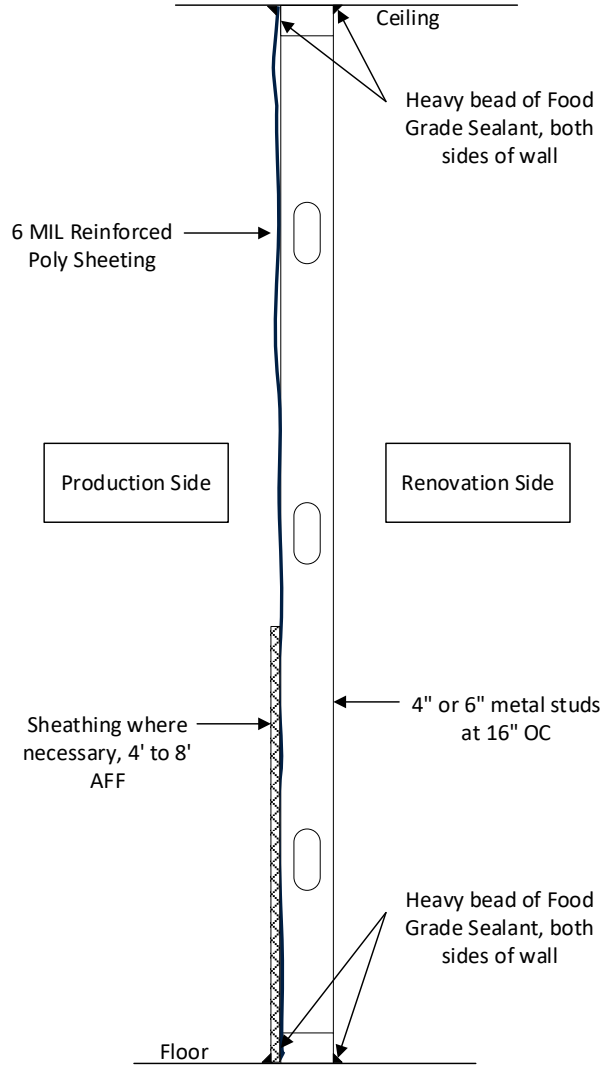
Temporary Containment

Project Less than 3 days



- Materials: Cleanable, non-porous, air-tight and durable in application
- Doors: self closing and sealing. Zipper doors are acceptable
- Inspect regularly, repair any damage immediately and maintain log
- Maintain at negative air pressure to surrounding areas.
- Exhaust to outside of building away from any plant air intakes.

Project Greater than 3 days



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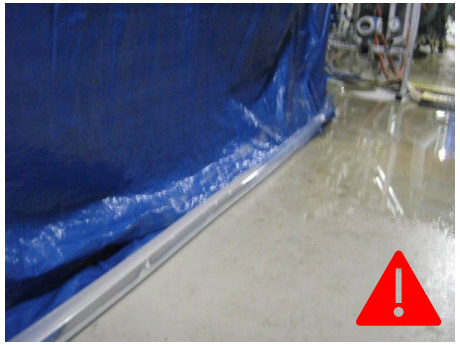
Temporary Containment



RITE-HITE
ALWAYS LOOKING AHEAD

TZ Insulated Curtain Walls

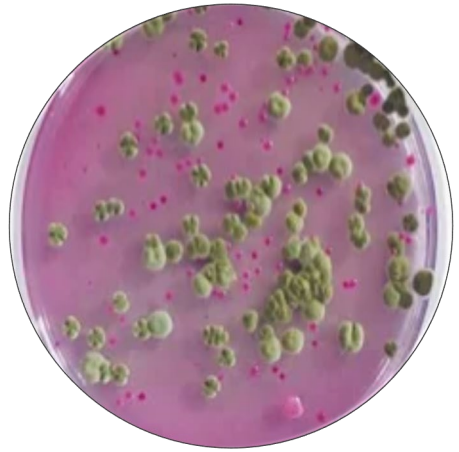
If you need temperature separation you need Zoneworks' Insulated Curtain Walls from Rite-Hite.

SCL Fabric Curtains

Stop Contamination Spread

- Portable foamers
- Sticky mats
- Quat crystals,

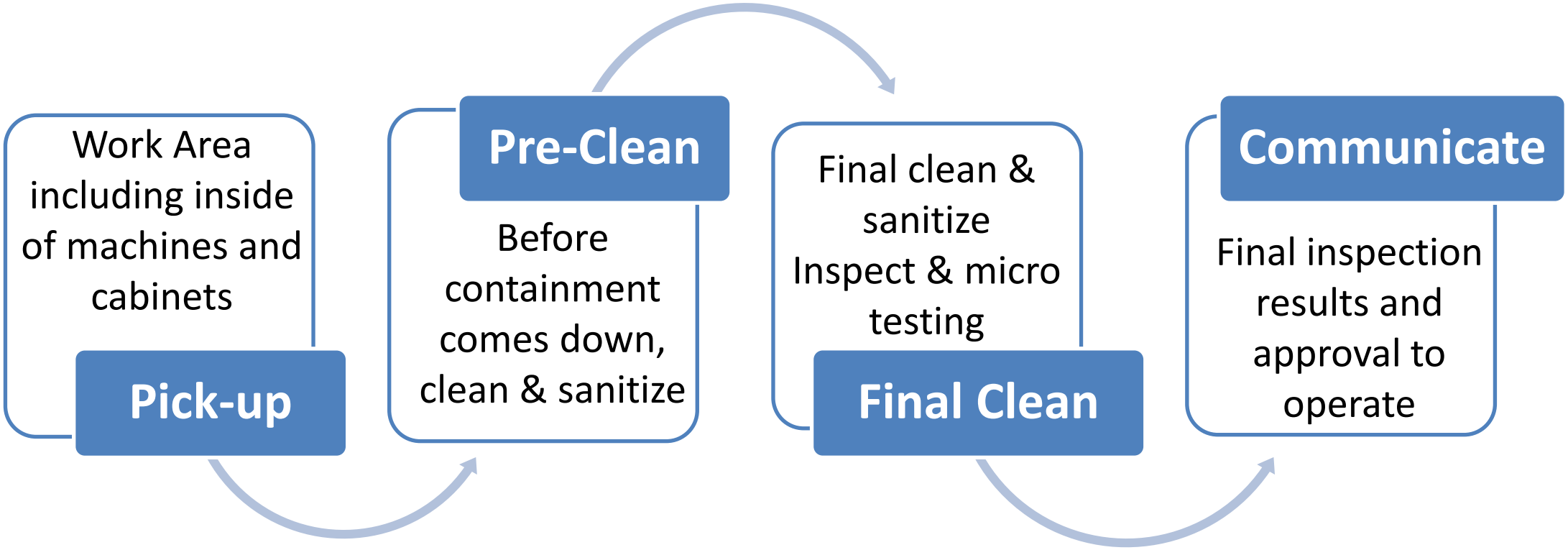
Site Monitoring



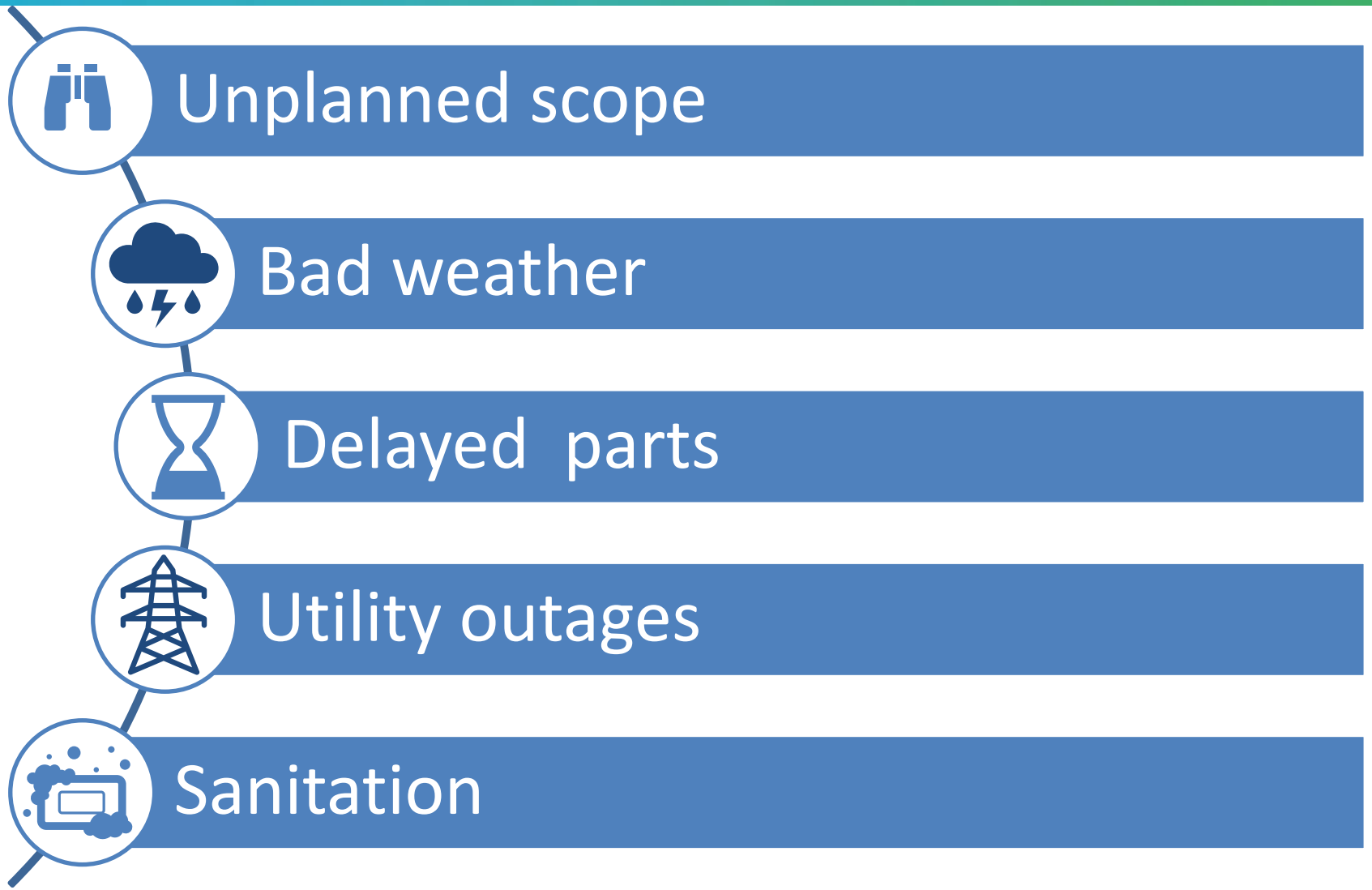
- 24/7 pressurization monitoring
- Environmental testing
  - outside construction area
  - Daily yeast and mold settling plates
  - Other testing and frequency per Food Safety and Quality

Site Management

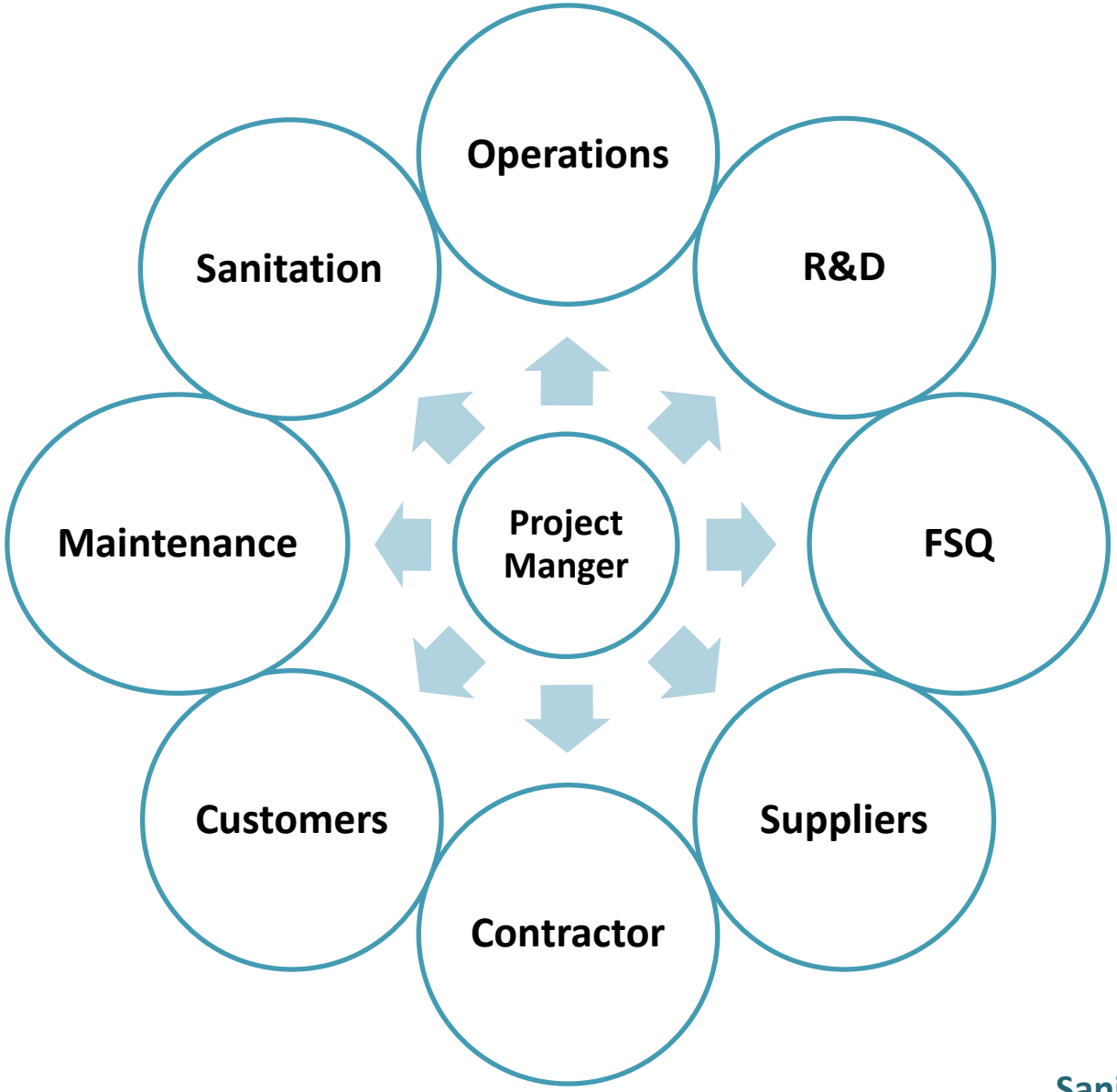
Post Maintenance



Contingency Planning



Communications!



When things are not planned

Leaks from….

- Condensation
- Exhaust duct
- Overhead sprinkler
- Soil line
- Roof or roof drain
- …

Take Immediate Action!

✓ Treat as an adverse event

✓ Stop leak or exposure

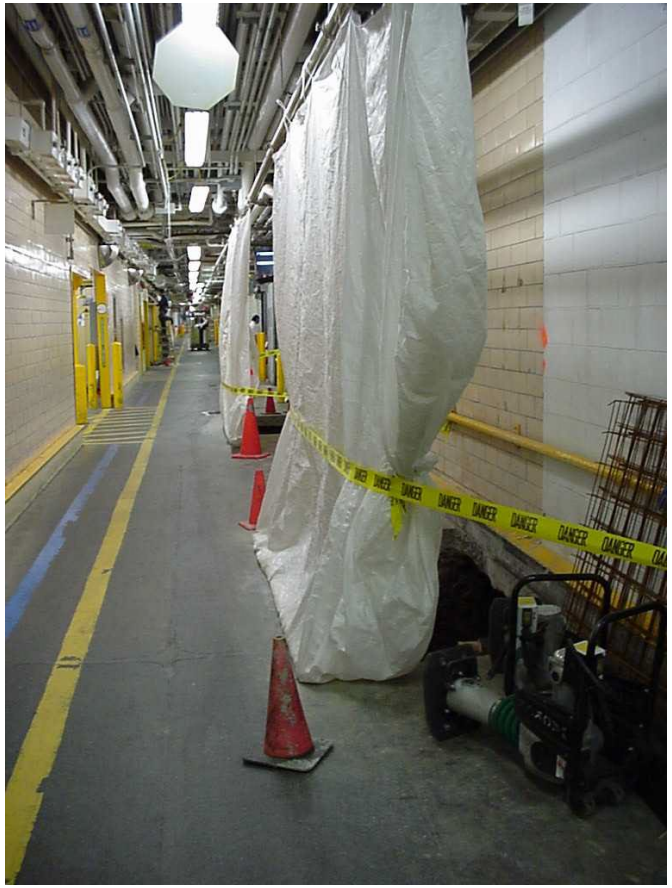
✓ Communicate with Operations and Sanitation

Video Drain Management Program

- Inaccurate documentation
- Cross connections
- Deteriorated pipe
- Plugged / Restricted –
- Joint-coupling failure

What concerns do YOU have?

Test Your knowledge



THE SANITARY DESIGN WORKSHOP

Sanitary design is integral to food safety.

MM&C– Key Takeaways

1. Major Maintenance and Construction can “un-earth many unwanted treasures”
2. Conduct a Risk Assessment
3. Complete through Preventive Controls Planning
   - Contractor GMP Review
   - Traffic Pattern Controls
   - Temporary Containment
   - Site Management and Monitoring
   - Work Site return to production
   - Contingency planning
   - Communication

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