

***DISEÑO SANITARIO E HIGIÉNICO
PARA INSTALACIONES Y EQUIPOS DE
PROCESAMIENTO DE ALIMENTOS.
(SANITARY AND HYGIENIC DESIGN
FOR FACILITIES AND EQUIPMENT
FOR FOOD PROCESSING)***

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INOFOOD
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de Inocuidad Alimentaria
7 y 8 de noviembre
Casa Piedra, Santiago de Chile

CONTENT

- **General Elements of Sanitary/Hygienic Design and Construction**
 - **Facilities**
 - **Equipment**
- **Equipment Standards**
- **Auditing Food Equipment?**
- **“Sermon” on Need for Equipment Standards**





Source: J. L. Bricher, <http://www.foodsafetymagazine.com>
Dec/Jan 2005



SANITARY DESIGN ASSURES -

- Proper and Efficient Cleaning and Prevention of Potential Contamination Including:
 - **Physical**
 - Cleaning/Removal
 - No Fragments or Residues From Surfaces
 - **Chemical**
 - Cleaning/Removal of Allergens & Other
 - No Residues From Surfaces
 - Durability of Surfaces
 - **Microbiological**
 - Cleaning/Sanitizing



UNIVERSITY OF FLORIDA EDIS PUBLICATIONS

- WEBSITE – <http://edis.ifas.ufl.edu/>
- Schmidt, R. H., Erickson, D. J. *Sanitary Design and Construction of Food Processing and Handling Facilities*. Univ. of Florida Coop. Ext. Serv. FSHN 0408/FS120, <http://edis.ifas.ufl.edu/FS120>, 2005.
- Schmidt, R. H., Erickson, D. J. *Sanitary Design and Construction of Food Equipment*. Univ. of Florida Coop. Ext. Serv. FSHN 0409/FS119, <http://edis.ifas.ufl.edu/FS119>, 2005.



ACKNOWLEDGEMENTS

- **Don Graham – Graham Sanitary Design, Inc.**
- **Joe Stoudt – Commercial Food Sanitation, Inc.**



HOW IMPORTANT IS SANITARY/HYGIENIC DESIGN?

- Maple Leaf Foods, Toronto, Ont., Canada - *Listeria monocytogenes* (2008)
 - “Stress Cracks” in Meat Slicer
- Peanut Corporation of America, Blakely, Georgia, USA - *Salmonella* Typhimurium (2008-2009)
 - Facility and Equipment Design/Maintenance Issues
- Jensen Farms, Holly, Colorado, USA – *L. monocytogenes* (2011)
 - Facility and Equipment Design/Maintenance Issues



FACILITY SANITARY/HYGIENIC DESIGN AND CONSTRUCTION



SANITARY/HYGIENIC DESIGN OF FACILITIES – BASIC PRINCIPLES

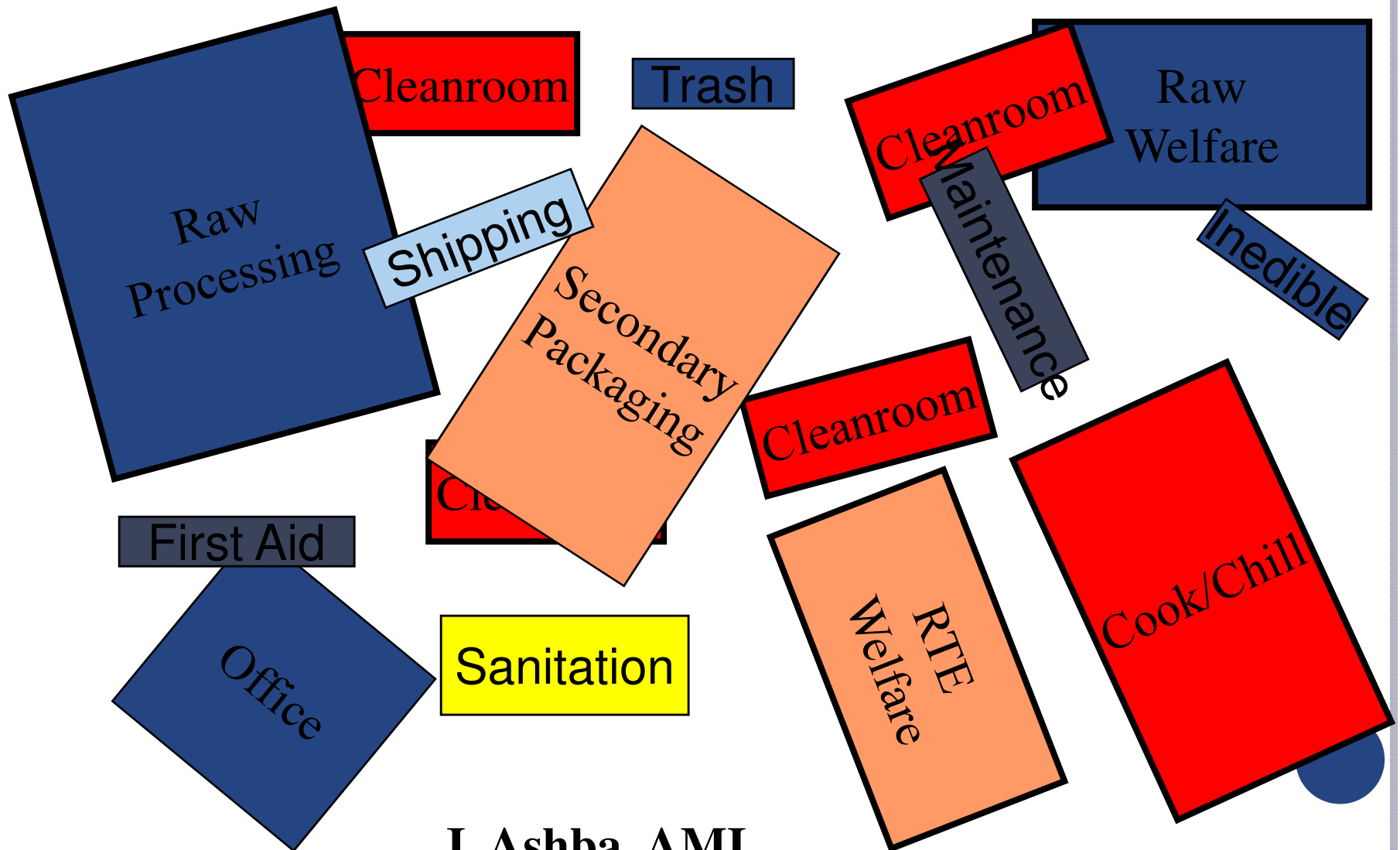
- Create and Provide Barriers to Contamination
 - Exterior
 - Interior
- Facility Construction
 - Appropriate Construction
 - Pest Prevention
 - Appropriate Layout
 - Appropriate Materials
- Maintenance of Hygienic Design



FACILITY LAYOUT – ZONES OF CONTROL



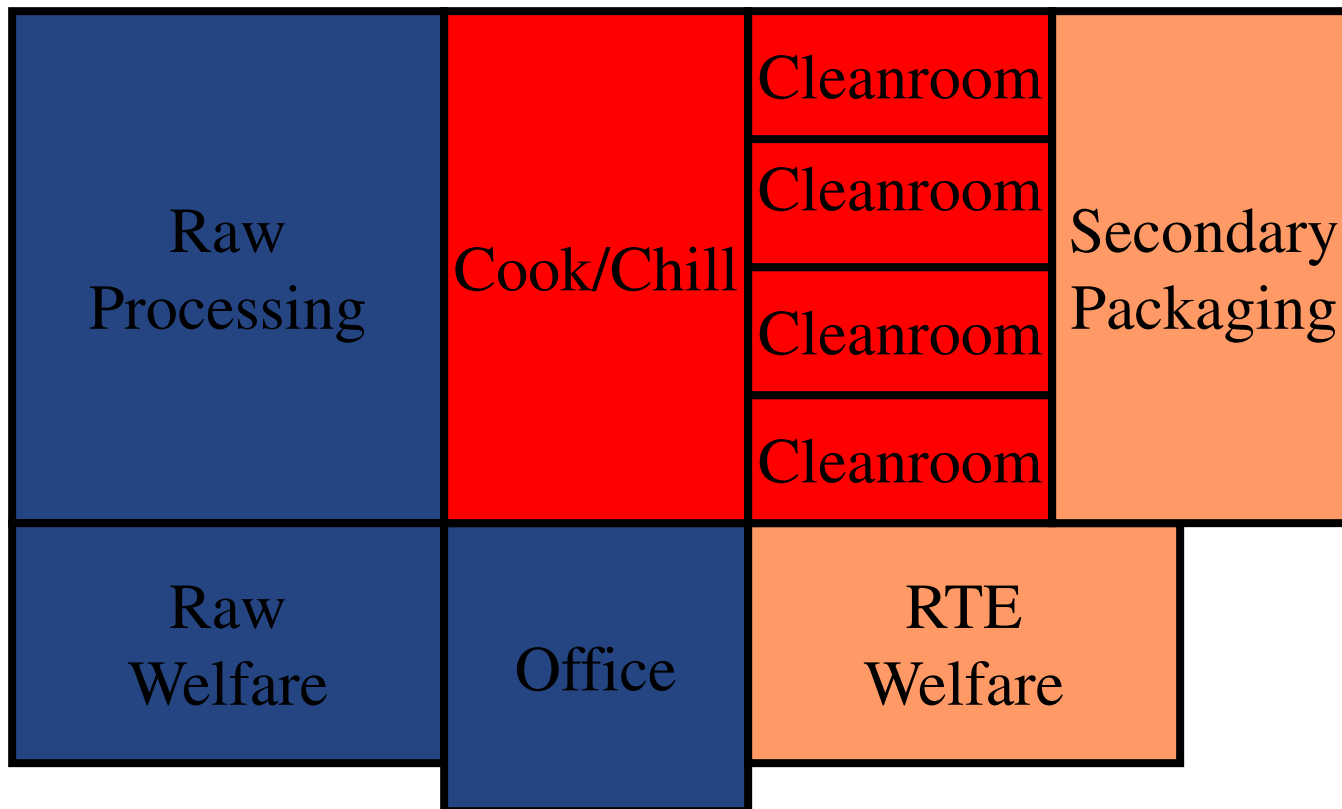
ZONES OF CONTROL



J. Ashba, AMI

ZONES OF CONTROL

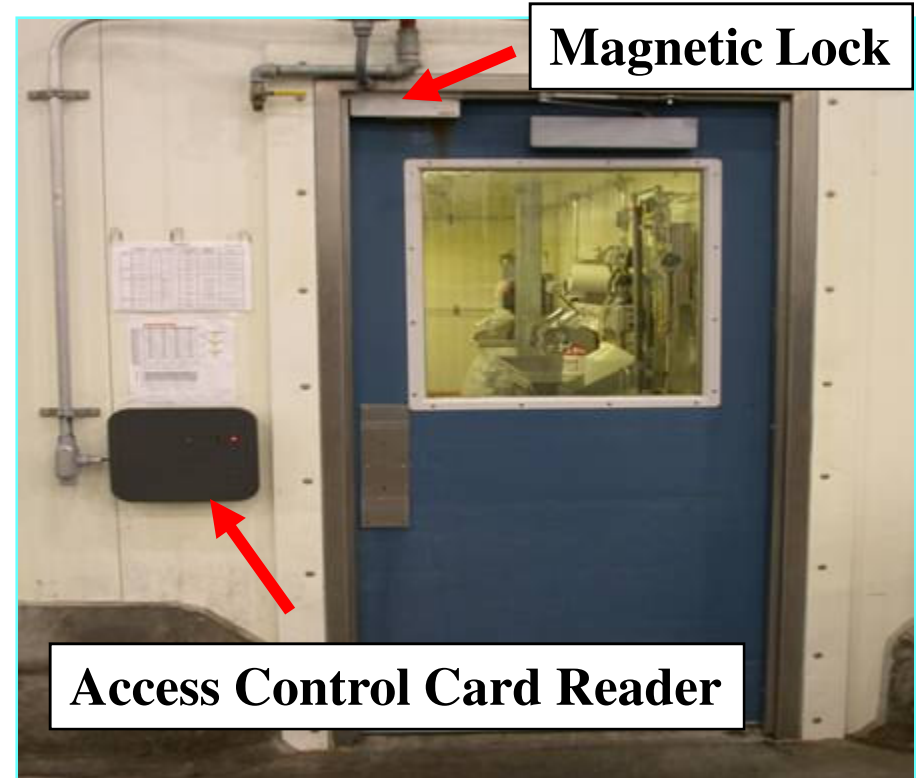
*Your goal is a logical process flow
with strict zones of control*



Passive Control



Active Control



**From This
Design**

**To This
More
Sanitary Design**

J. Ashba, AMI

WALLS, FLOORS & CEILINGS-- CONSTRUCTION FEATURES

- Hard Surface
- Impervious & Nonabsorbent
- Flat
- Smooth
- Resistant to Wear & Corrosion
- Withstand Action of Cleaning Compounds
- Light Colored
- Ease of Cleaning & Maintenance



NEW MATERIALS

○ Walls/Ceilings

- **In Widespread Use**

- Seamless Poured Concrete
- Concrete Block (Sealed)
- Fiberglass Panels (Sealed & Maintained)

- **Innovations**

- More Durable Sealants and Finishes

○ Floors

- **Epoxy Floors**
- **Other Floor Materials**
- **Many Innovations**



FLOOR DRAINS

- Major Source of Environmental Contamination
 - Special Recognition to *Listeria monocytogenes*
- Innovations/Improvements
 - Drain Location
 - Dedicated Sewer Systems
 - Separate Ready To Eat Operations From Raw Operations
 - Stainless Steel Drain Systems
 - Other Cleanability Features



IMPROVED ENGINEERING & UTILITY SYSTEMS

- Heating, Ventilation & Air Conditioning (HVAC) Systems
 - More Cleanable
 - Role In Hygiene Zones
- Refrigeration Rooms/Refrigeration Units
 - More Cleanable
 - Air Sanitizing Systems
- Utilities
- Handwashing Facilities

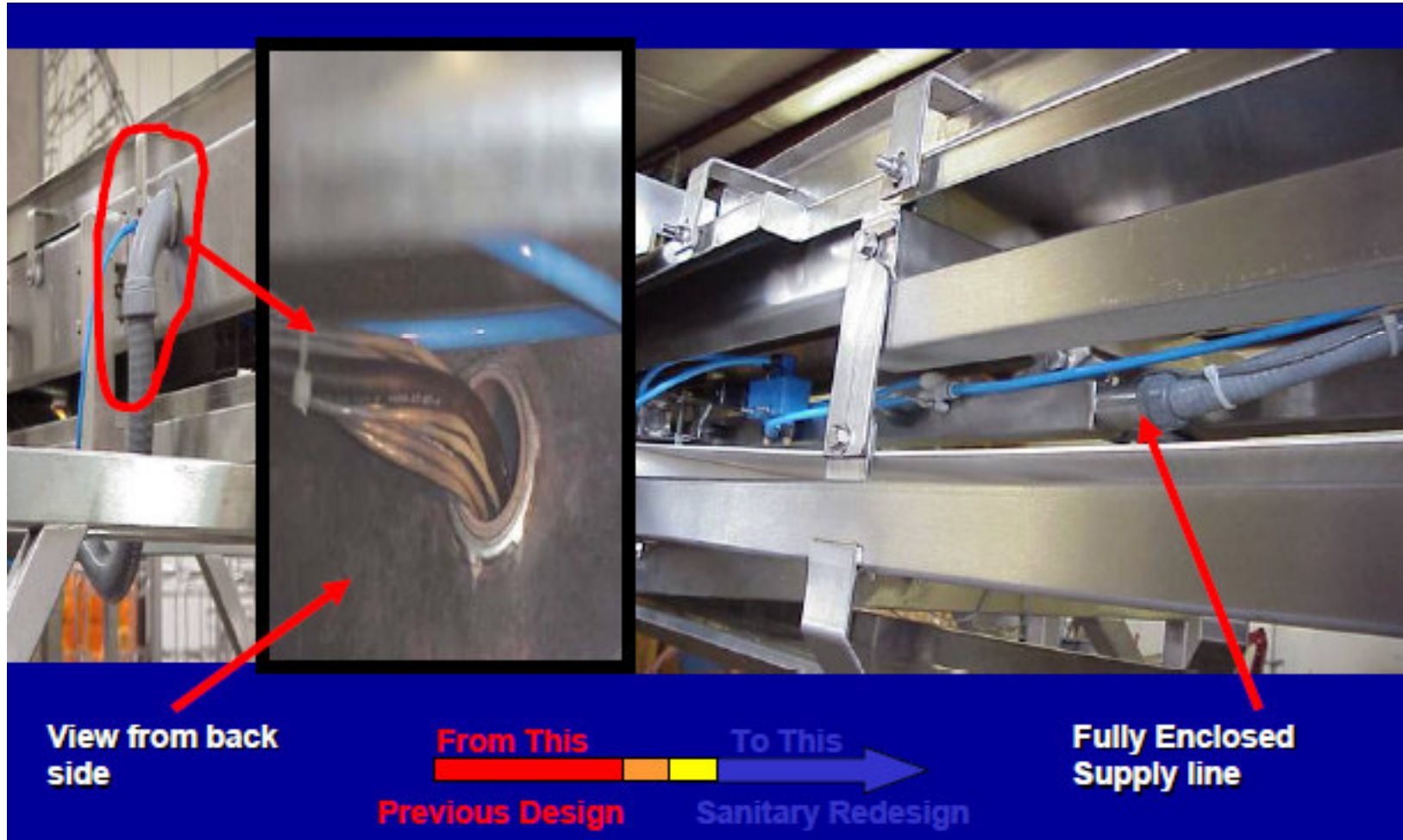




UTILITY SYSTEMS



HYGIENIC DESIGN – MAINTENANCE ENCLOSURES



Source: AMI

HAND WASHING FACILITIES



INNOVATIVE HAND WASHING FACILITY



Diseñado por Vidal Enterprises, Ltd., Santiago de Chile



FOOD EQUIPMENT SANITARY/HYGIENIC DESIGN



FOOD EQUIPMENT SANITARY/HYGIENIC DESIGN ENCOMPASSES--

- **Materials**
- **Construction**
- **Design & Fabrication**
- **Surface Finish**
- **Installation**
- **Operation/Maintenance**



SANITARY/HYGIENIC CONSTRUCTION AND DESIGN

- Adequate Cleaning/Sanitizing
- Corrosion Consideration
 - **Maintain Cleanability**
- Accessibility For Inspection



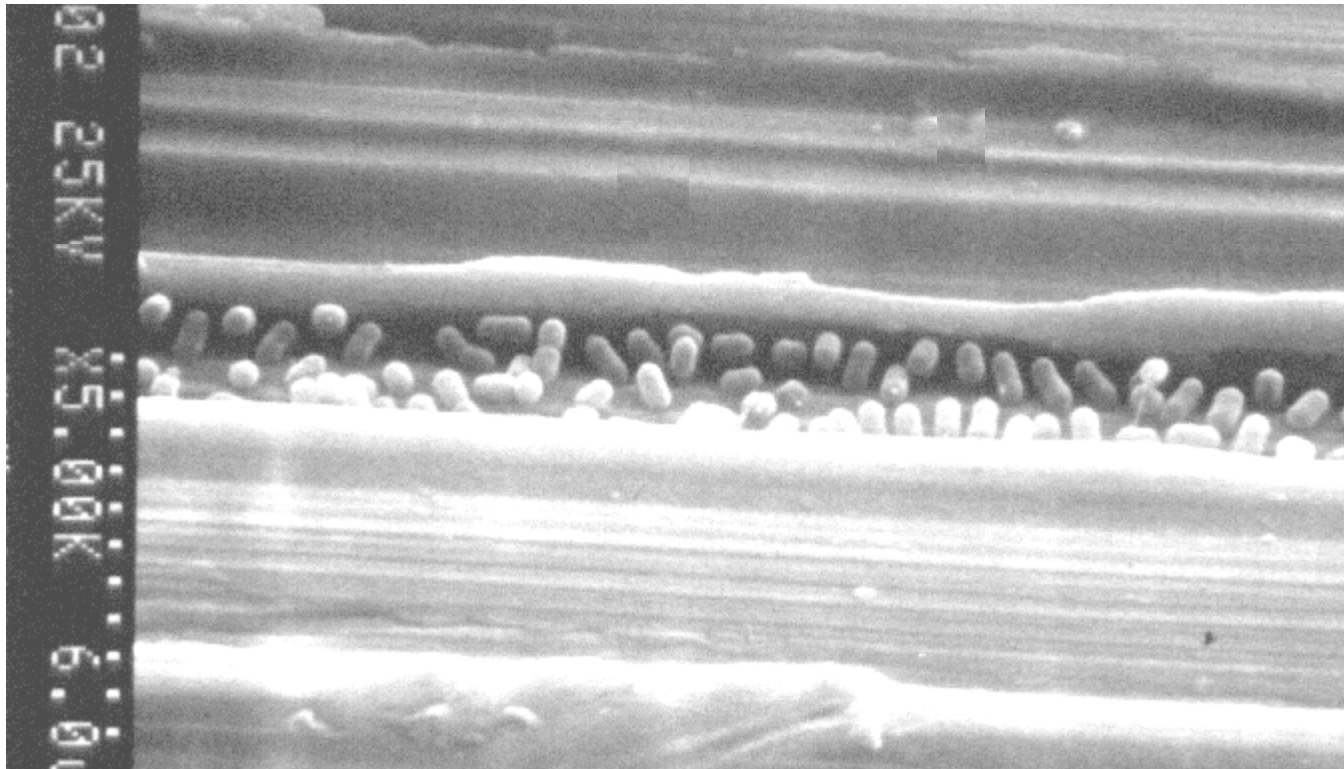


Diseñado por O'Ryan Enterprises, Inc., Santiago de Chile



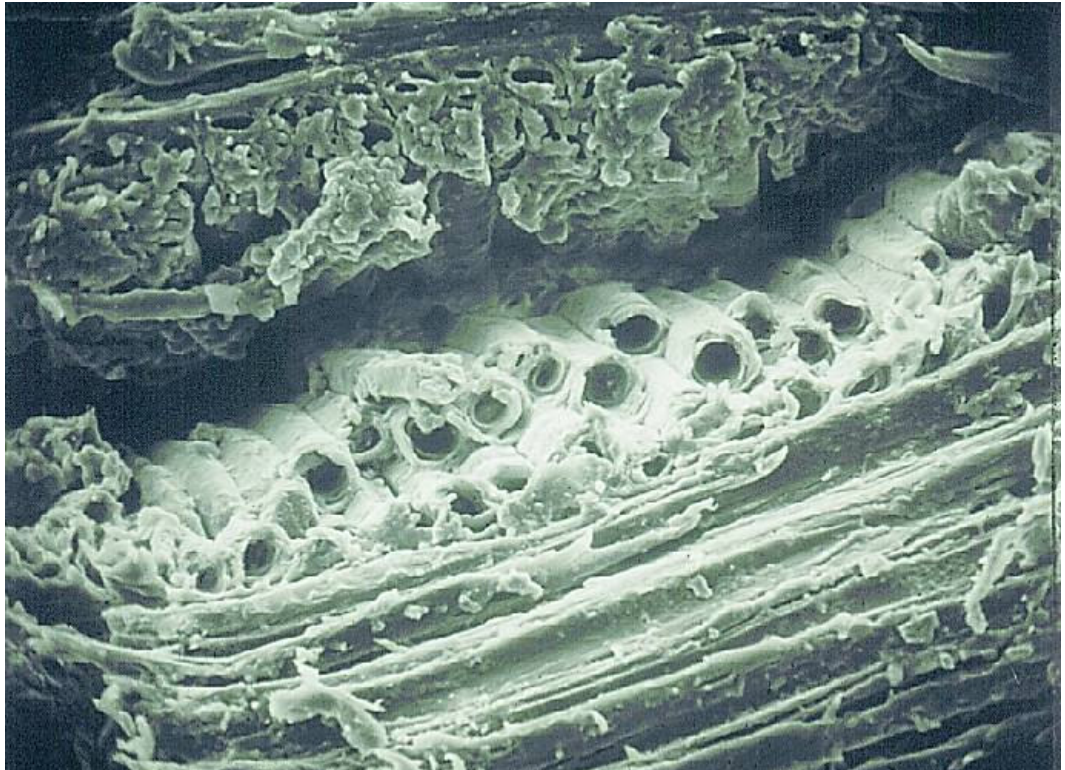
CLEANABLE SURFACE??

STAINLESS STEEL

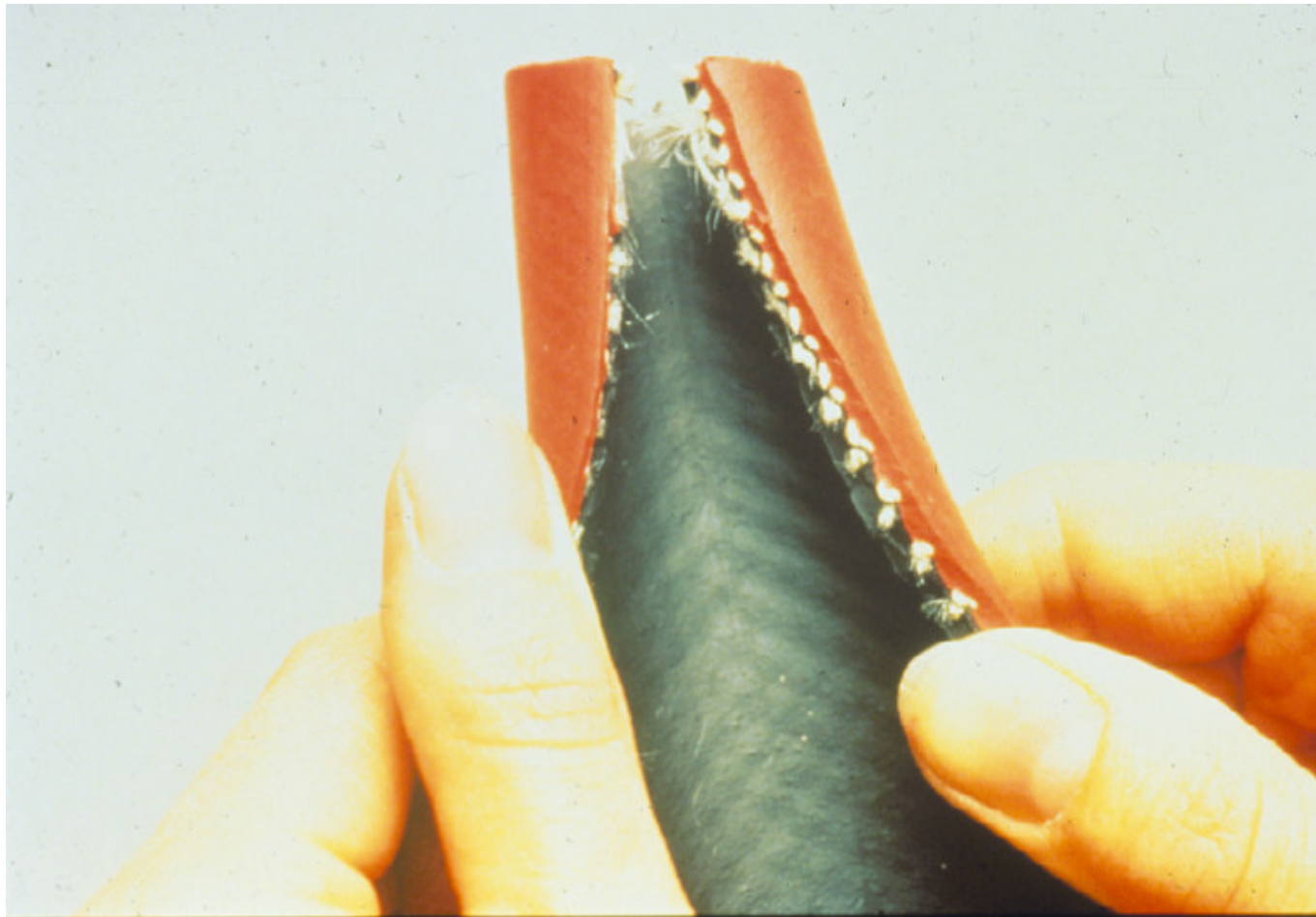


CLEANABLE
SURFACE???

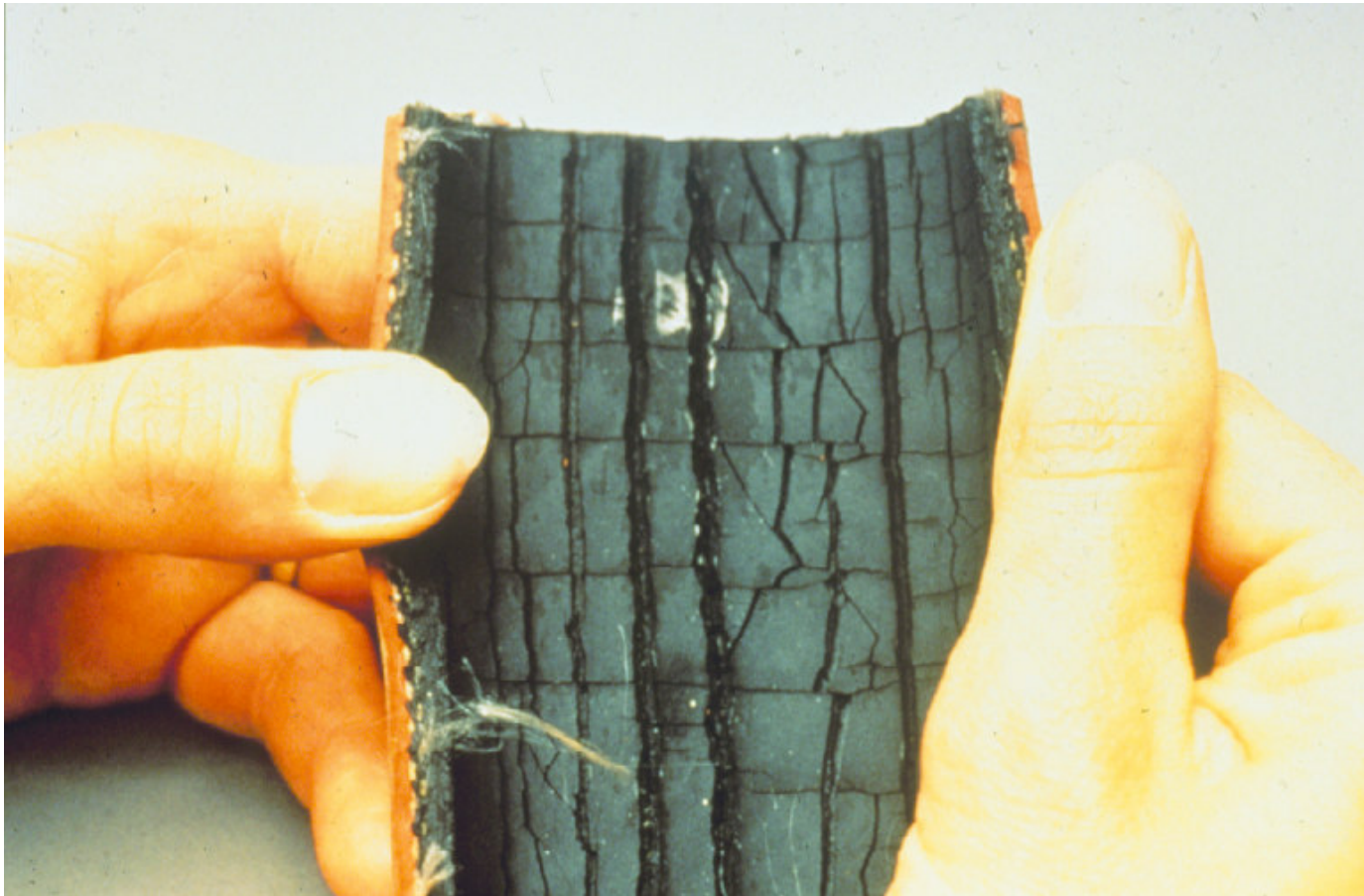
Wood



CLEANABLE SURFACE?



CLEANABLE SURFACE??



CLEANABLE??





CLEANABLE??

CLEANABILITY CHALLENGES – INTRICATE EQUIPMENT & NICHES



Multiple Pulleys

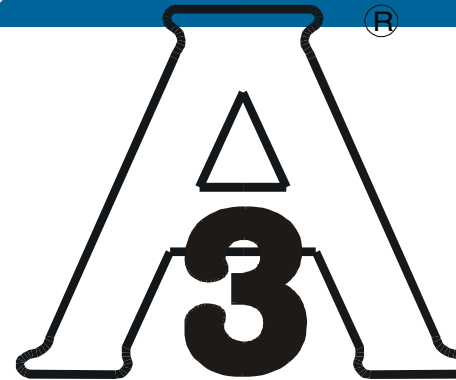
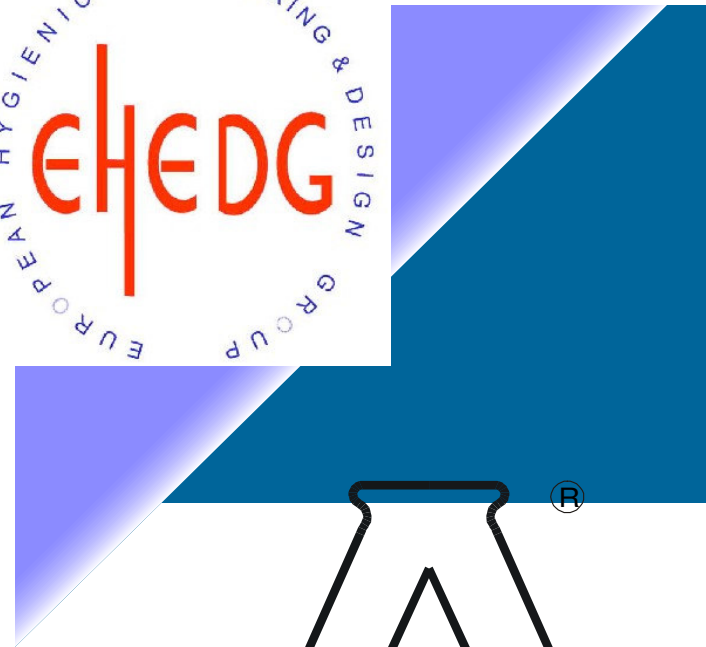
Source: Am. Meat Inst.

CLEANABILITY CHALLENGES –

- **More Demand For Environmental Sanitation Programs**
- **More Use Of Corrosive Chemicals**
- **More Focus on Non-Product Contact Surfaces**



EQUIPMENT STANDARDS & DESIGN CRITERIA & GUIDELINES





**3A SANITARY
STANDARDS INC.
(3A SSI)**

**THIRD PARTY EQUIPMENT
VERIFICATION (TPV) PROGRAM**

<http://www.3-a.org/>





- **Cleanability Testing**
- **Equipment Certification**

<http://www.ehedg.org/>



NATIONAL SANITATION FOUNDATION



- Standards
- Guidelines
- Equipment
Certification

<http://www.nsf.org/>



MATERIALS



FOOD CONTACT SURFACES -- MATERIALS

- Impervious, Smooth, Cleanable**
- Surface Texture and Finish Features**
- Surface Treatments**
- Free of Cracks & Crevices**
- Nonporous/Non Absorbent**
- Non-toxic (Residues)**
- Corrosion Resistance**



STAINLESS STEEL

- **Most Commonly Used Metal Alloy in Food Processing Applications**
- **More Than 100 Different Alloys Available**
- **Not All Stainless Steels Are Created Equal**



WHAT IS STAINLESS STEEL?

- **Base Alloy: Iron (Fe)- Carbon (C) Alloy with Chromium (Cr)**
- **Additional alloying metals (specific applications)**
 - **Copper (Cu),**
 - **Molybdenum (Mo),**
 - **Manganese (Mn),**
 - **Nickel (Ni),**
 - **Nitrogen (N),**
 - **Phosphorus (P),**
 - **Silicon (Si),**
 - **Sulfur (S),**
 - **Selenium (Se),**
 - **Tungsten (Tn),**
 - **Titanium (Ti).**



STAINLESS STEEL TYPES



NON MAGNETIC (OR AUSTENITIC) STAINLESS STEELS

○ Austenite Alloy Formers

- *Chromium, Nickel*
- *Molybdenum*

○ Austenitic (300 Series)

- Specified by 3A Sanitary Standards (And Others)
- Most Commonly Used in Food Surfaces – 304 & 316

○ Austenitic (HighNickel)

- Added Strength
- More Corrosion Resistant
- Expensive
- AL-6XN, 825, 625, C-276, C-22, B-2



MAGNETIC STAINLESS STEELS

– 400 SERIES

○ Ferritic

- 409, 430, 439

○ Martensitic

- Type 410, 420, 440c
- Used for Knives



NON-MAGNETIC STAINLESS STEELS

○ Passive Layer

- Chromium and Other
- Recover by Acid Treatment or Other
 - Termed “Passivation”

○ Active Layer

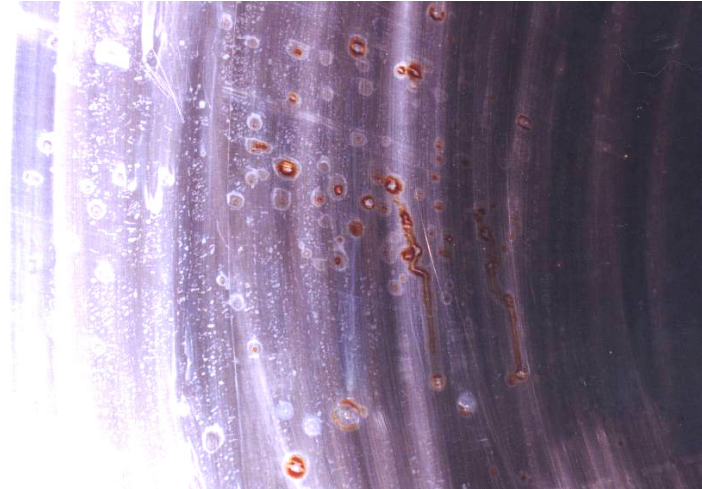
- Iron
- Will Corrode or Rust



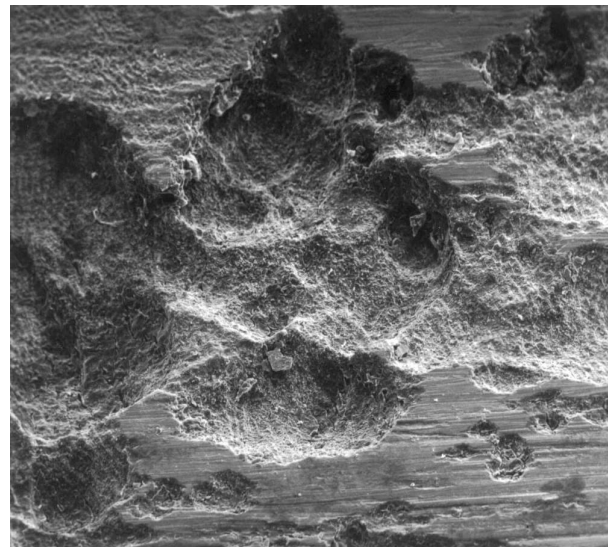
COMMON STAINLESS STEEL CORROSION



Wear Point Corrosion



Pitting Corrosion



Biological Corrosion



STRESS CRACKING



NON-METALS

- Rubber

- Plastics

- Bonding Materials









GENERAL SPECIFICATIONS - PLASTIC & RUBBER (ELASTOMERS)

○ Food Grade – Nontoxic

- Regulatory Requirements

○ Durability & Related Properties

- Maintain Shape/Form

○ Food Contact Surface Requirements

- Surface Finish
- Other



Regulatory Approval Chart

(all information assumes natural color with no additional additives)

Typical Approvals Only – Confirm with Salesperson at time of Order if a specific approval and certifications are required. Professional Plastics assumes no liability in your specific application.

Material	FDA	USDA	NSF	3A Dairy	Canada AG
ABS - Engineering Grade	YES	YES	NO	YES	NO
Acetal Copolymer	YES	YES	YES	YES	YES
Acrylic – Cast & Extruded	YES	YES	YES	N/A	N/A
Delrin ® Acetal Homopolymer	YES	YES	YES	NO	YES
Ertalyte ® PET-P	YES	YES	NO	YES	YES
Ertalyte ® TX (lubricated PET-P)	YES	YES	NO	YES	NO
FEP	YES	NO	NO	NO	NO
Fluorosint ® 207 (food grade)	YES	YES	NO	NO	NO
Halar ® ECTFE	YES	NO	NO	NO	NO
Kynar ® PVDF	YES	YES	YES	YES	NO
MC 907 ®	YES	YES	NO	YES	NO
Noryl ® PPO	YES	YES	NO	NO	NO
Norprene ® Tubing	YES	N/A	YES	YES	N/A
Nylon ® Type 6/6 Extruded	YES	YES	YES	YES	NO
Nyloil FG ®	YES	YES	NO	YES	NO
PEEK	YES	YES	NO	YES	NO
PFA	YES	NO	NO	NO	NO
Polyethylene – HDPE	YES	YES	NO	NO	NO
Polyethylene - LDPE	YES	NO	NO	NO	NO
Polypropylene – Homopolymer	YES	YES	YES	YES	NO
Polypropylene – Copolymer	YES	YES	N/A	YES	NO
Polysulfone	YES	YES	YES	YES	YES
Sanalite ® Cutting Boards	YES	YES	YES	N/A	N/A
Sanatec ® Cutting Board	YES	YES	YES	N/A	N/A
Silbraid ® Tubing	YES	N/A	YES	N/A	N/A
Techtron ® PPS	YES	YES	NO	NO	NO
Techtron ® HPV	YES	NO	NO	NO	NO
Teflon ® PTFE	YES	NO	NO	NO	NO
Tygon ® B-44-3 Tubing	YES	N/A	YES	YES	N/A
Tygothane ® Tubing	YES	N/A	N/A	N/A	N/A
UHMW-PE	YES	YES	N/A	YES	N/A
Ultem ® 1000 - PEI	YES	NO	NO	NO	NO

Typical Approvals Only – Confirm with Salesperson at time of Order if a specific approval
 Approvals Listed as N/A do not necessarily indicate failure in that particular criteria. The product may not have gone through the testing and approval process. Please contact Professional Plastics technical support for additional details or questions.

SOURCE: PROFESSIONALPLASTICS.COM

SURFACE TEXTURE OR FINISH FEATURES OF FOOD SURFACES



SURFACE TEXTURE/FINISH

○ General

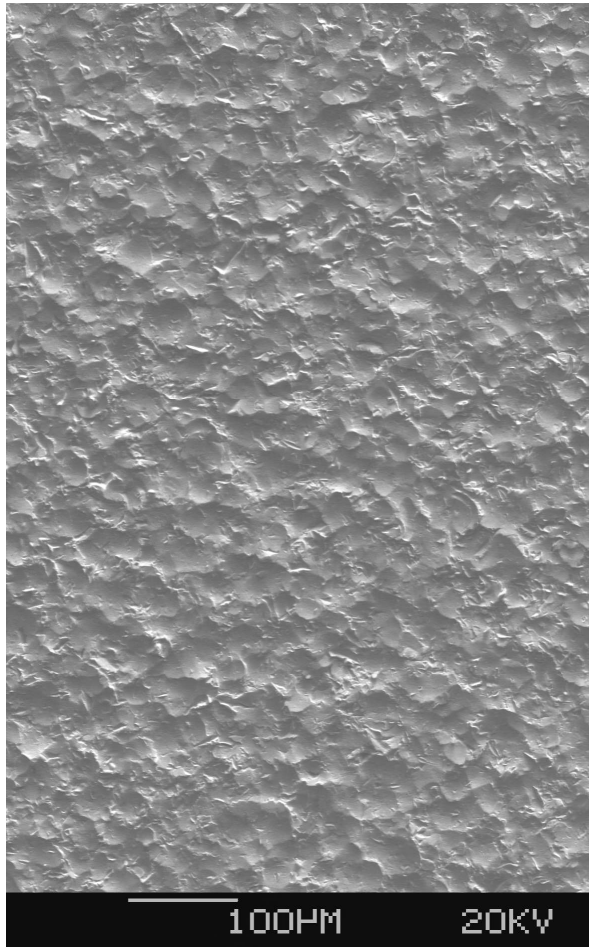
- Smooth, Durable
- Free Of Pits Or Crevices
- “Cleanable”

○ Average Roughness (Ra) Criteria

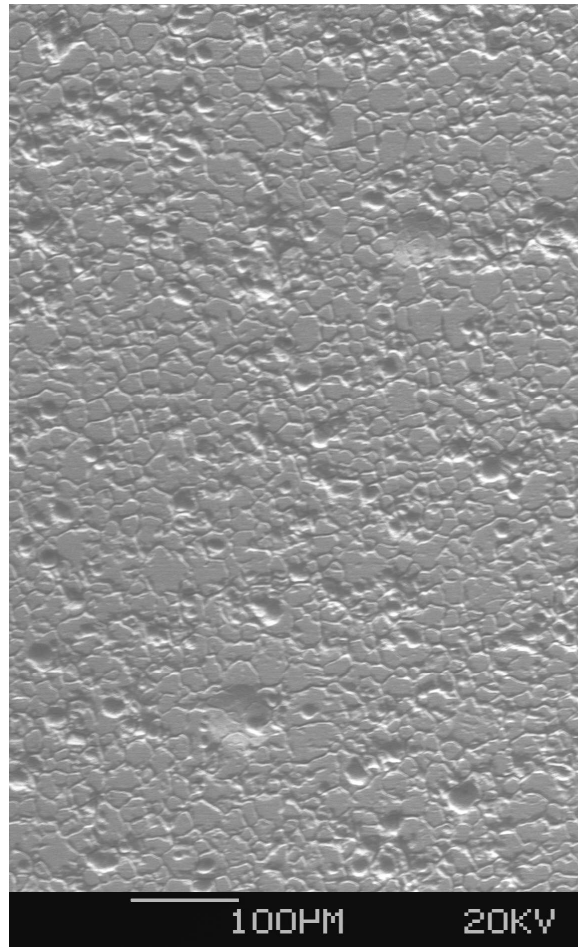
- EHDG: Ra < 0.8 μm
- Am. Meat Inst. (AMI): Ra < 0.8 μm
- 3-A SSI: No 4 Ground (Polished) Finish (Ra < 0.8 μm)



**2B Finish,
Bead Blasted
35-45Ra**



**2B FINISH
MILL FINISH
20-30RA**



**#4 Finish
180 Grit
13-20Ra**

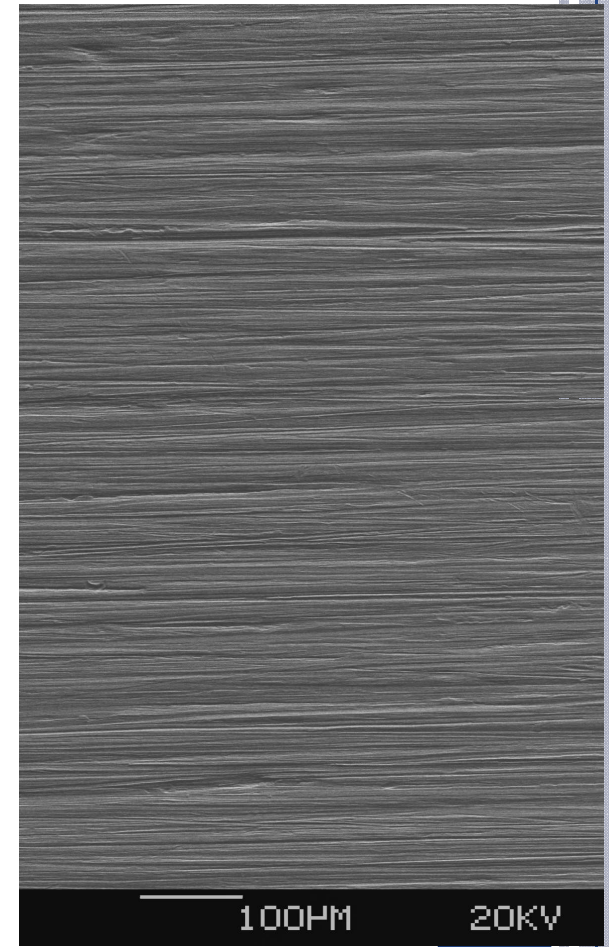
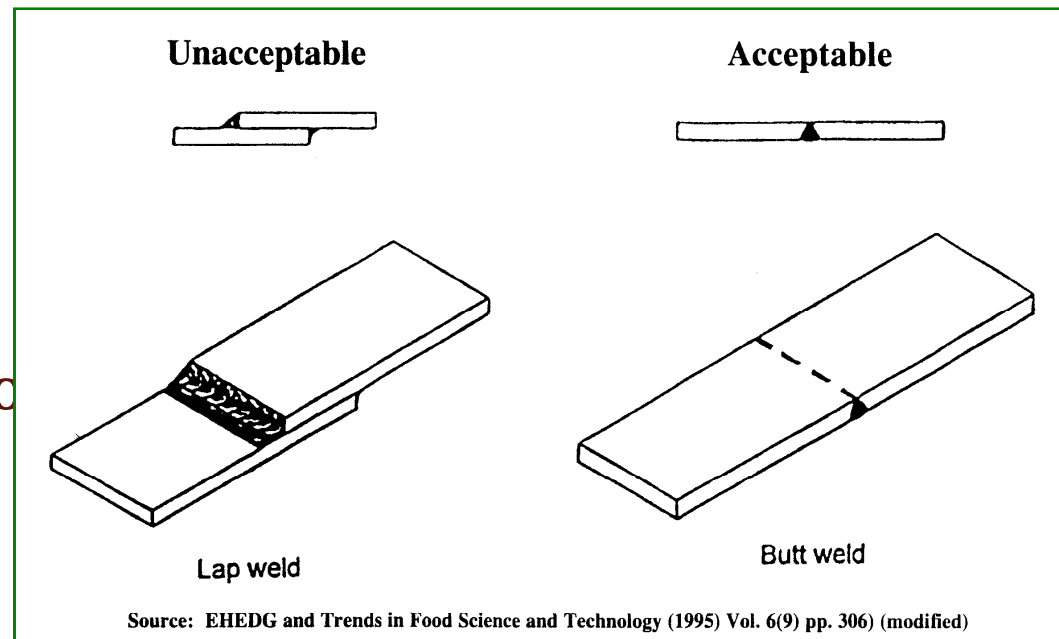


Photo courtesy of **Mepaco**

WELDS

- No Lap Weld
- As Smooth As No. 4 Finish
- Innovations?
 - Better Welding Techniques
 - Better Inspection Techniques



WELDED PIPELINES



EQUIPMENT CONSTRUCTION AND FABRICATION FEATURES

- o Free of Sharp Corners & Crevices**
- o Cleanable**
- o Inspectible**
- o Self Draining**

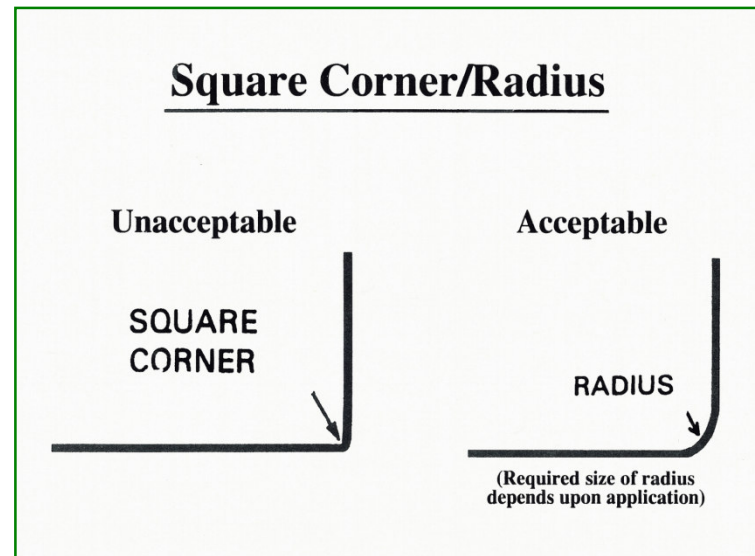


INTERNAL ANGLES

○ No Sharp Corners

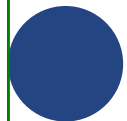
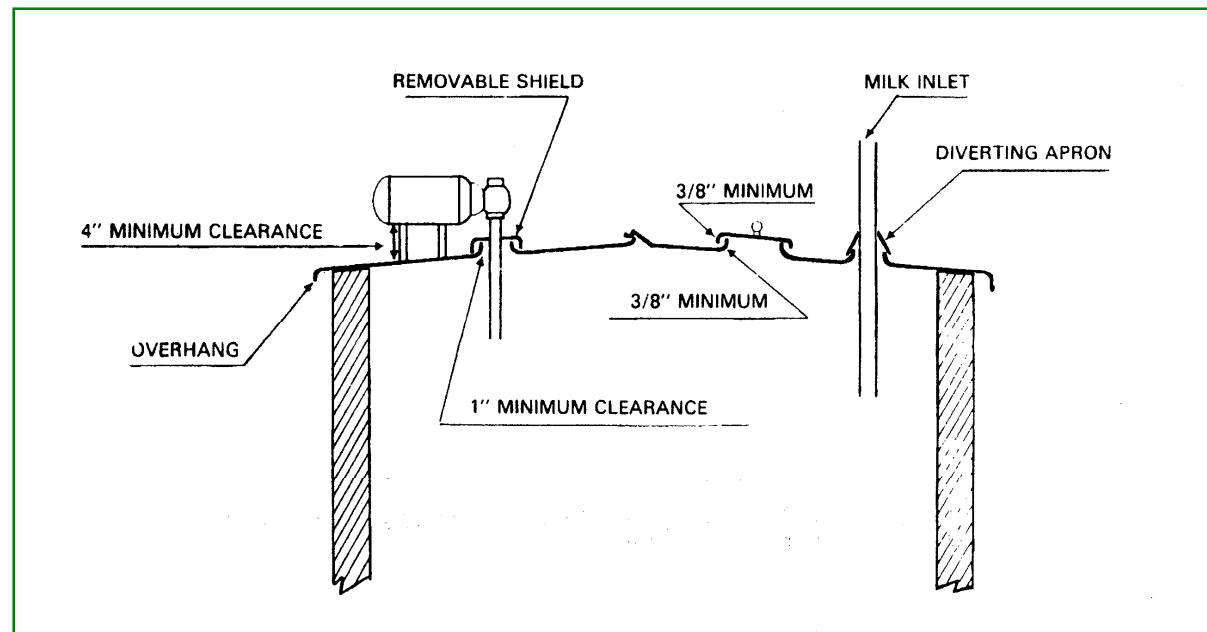
- **Radii**

- Radii Specifications



OPENINGS, COVERS & SHIELDING

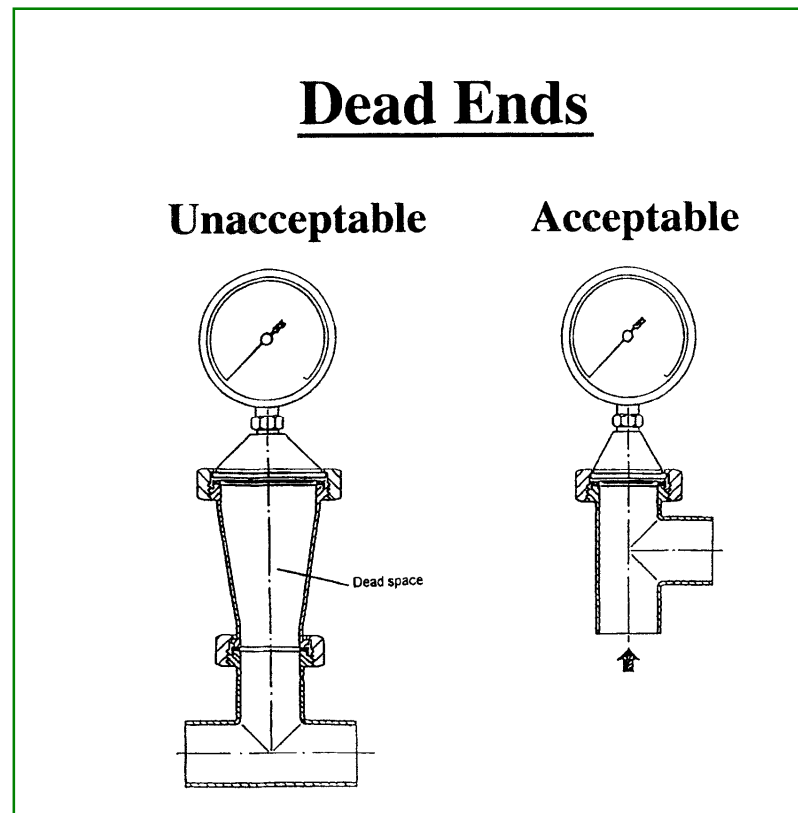
- Protection From Contamination
- Shoe Box Type Covers
- Adequately Constructed Overhead Shielding

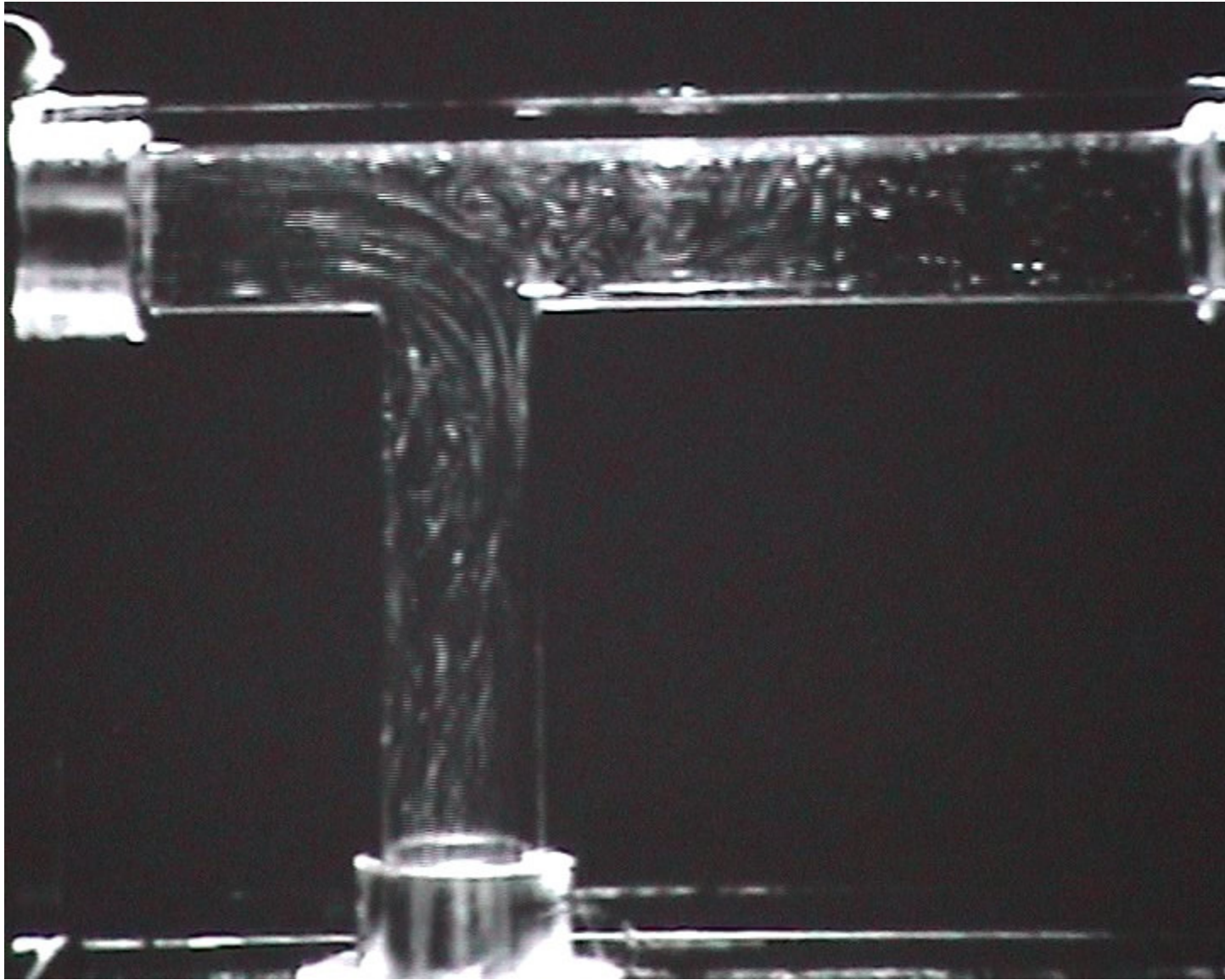


CONNECTIONS

o Close Coupled

- No Dead Ends





NO CROSS CONNECTIONS - BETWEEN

- o Raw & Pasteurized (Processed)**
- o Raw & Ready-to-Eat**
- o Allergens & Non-allergens**
- o Solutions (e.g. Cleaning/Sanitizing) & Food Product**



BOLTS & THREADS



HOLLOW AREAS SEALED



**Zone 1,
Easily Missed
&
Unexpected**



**Sealed Dye Filled
Rotating Members**

Source: Am. Meat Inst.

ANCILLARY EQUIPMENT, PROBES, THERMOMETERS



EQUIPMENT INSTALLATION



ADEQUATE EQUIPMENT SPACING – 360° ACCESS



From This

To This More

Design

Sanitary Design

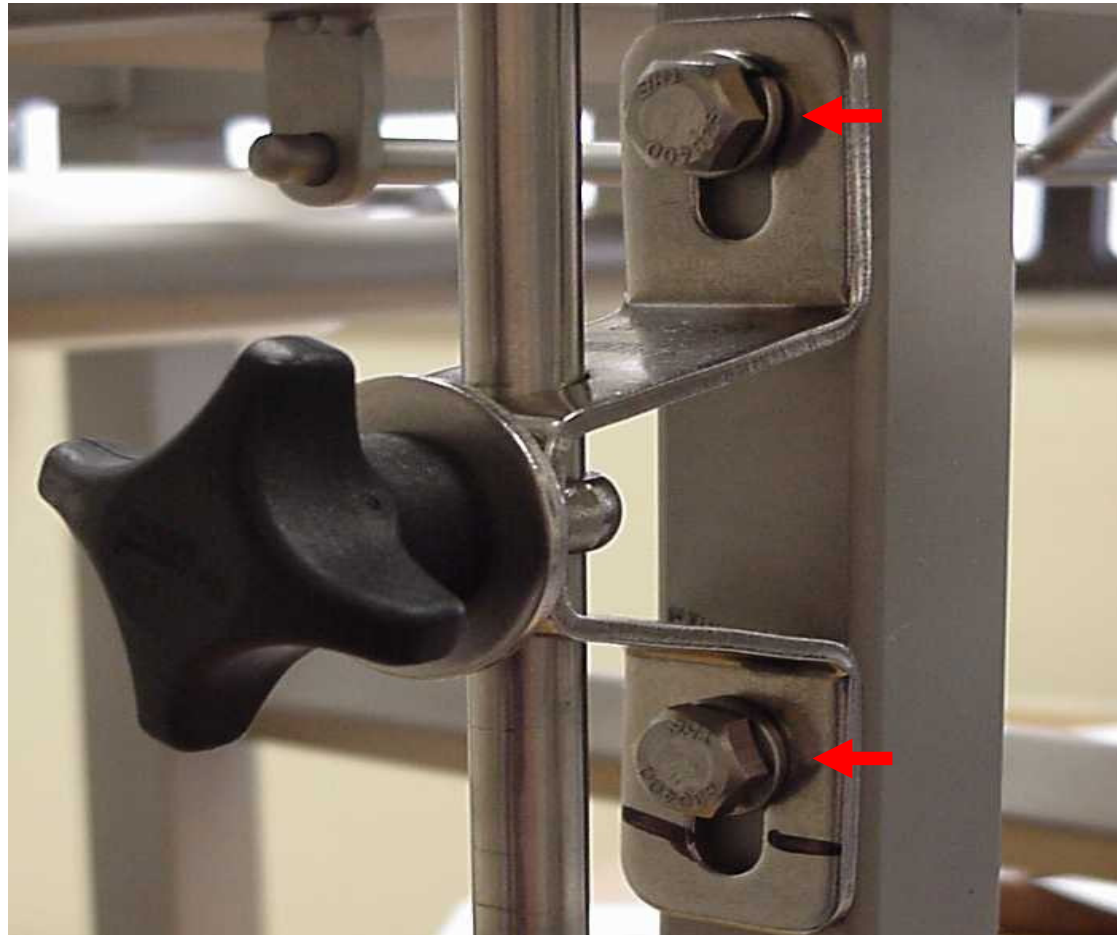
Source: AMI



Glades Crop Care, Inc.

FRAMEWORK NOT PENETRATED

Tubular steel equipment framework must be totally sealed and unpenetrated. Bolts, studs, etc. must be welded to the surface of the tubing and not attached via drilled and tapped holes.





CLEANABILITY



AUDITING, INSPECTION



REGULATORY STANDARDS?

- **General Guidelines for Food Contact Materials & Surfaces**
- **Often Do Not Go Far Enough**



INDUSTRY (THIRD PARTY) GUIDELINES/STANDARDS

- **American Meat Institute (AMI)**
- **Baking Industry Sanitation Standards Committee (BISSC)**
- **Global Food Safety Initiatives (GFSI)**
- **ISO 14159 Hygiene Requirements for the Design of Equipment**
- **Others**



THIRD PARTY AUDITS – EMPHASIS ON EQUIPMENT HIGHLY VARIED

- **Often Very General**
- **Are Equipment Standards Used in Third Party Audits?**
 - **Recognized, But Often Not Required**
 - **Specific Standards Do Not Exist For Certain Equipment**



**NEED -- DEVELOP AND
IMPLEMENT APPROPRIATE &
UNIFORM EQUIPMENT
STANDARDS ACROSS ALL FOOD
INDUSTRIES**



ARE YOU STILL AWAKE?



"Muchas Gracias"

