Our Shared Purpose
THE WORK WE DO MATTERS

Every day Ecolab makes the world cleaner, safer and healthier

Protecting people and vital resources

CLEAN WATER  SAFE FOOD  ABUNDANT ENERGY  HEALTHY ENVIRONMENTS
Industry leading expertise

Our food safety experts monitor and educate customers of food safety trends and regulations across the food supply chain.

20+ Government and professional appointments
Contributing industry expertise in development of policy and regulations

15 (average) Number of articles published annually
Across trade publications, scientific journals and peer associations

30+ Food safety speaking engagements per year
Including NRA, IFMA, Hotel Experience, FMI

Over 25 Industry partnerships across the food supply chain
Covering food manufacturing, food chain supply vendors, food retail, full service and quick service restaurants
Foodborne Illness Annual Estimates

Canada
- 4 million cases

United States
- 48 million cases
- 120,000 hospitalizations
- 3000 deaths

EU
- 45.5 million cases

China - Surveillance beginning

South Korea
- 336,000 cases

Australia
- 4.1 million cases
- 86 deaths

Africa - Surveillance beginning

Global foodborne illness estimate: 600 million cases and 420,000 deaths
The importance of food safety

78% of all foodborne illnesses originate in commercial foodservice facilities\(^1\)

25% of all citations are due to food contact surfaces not properly cleaned and sanitized.\(^1\)

$75\text{K}$ average cost of an outbreak.\(^2\)

Proper cleaning and food preparation procedures can help reduce food safety risks.

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1. Centers for Disease Control and Prevention, New CDC Data on Foodborne Disease Outbreaks, June 2014
2. National Restaurant Association
Where Was Contaminated Food Consumed?

When Location Is Known, Reported Data

USA, 2015. Percent of total outbreaks

- Restaurant, 60
- Caterer, 14
- Grocery Store, 3
- School, 2
- Church/Temple, 1
- Farm, 1
- Camp, 1
- Workplace, 1
- Hotel, 1
- Prision/Jail, 1
- Fair, 1
- Nursing home, 1
- Home, 9
- Unknown, 7

Source: [https://wwwn.cdc.gov/foodborneoutbreaks/](https://wwwn.cdc.gov/foodborneoutbreaks/)
Contributing Factors to Restaurant Outbreaks

- Inadequate Cleaning
- Slow Cooling
- Inadequate Cold Holding
- Bare Hand Contact
- Handling by infected person

US FDA MODEL FOOD CODE
US Model Food Code

- A reference document for state, city, county and tribal agencies
- Guidance for food safety practices based on science
- To mitigate risk factors that are known to cause or contribute to food borne illness outbreaks associated with retail and foodservice establishments
US Model Food Code
ADOPTION BY STATE

Food Code Version

- 1995 (Orange)
- 1997 (Black)
- 1999 (Blue)
- 2001 (Navy Blue)
- 2005 (Green)
- 2009 (Grey)
- 2013 (Yellow)
- 2001 & 2005 (Red)

Revised 08/25/2015
Outdated Food Code causes confusion

2013 FDA Food Code

- **7-204.11 Sanitizers, Criteria.**
  - Chemical SANITIZERS, including chemical sanitizing solutions generated on-site, and other chemical antimicrobials applied to FOOD-CONTACT SURFACEs shall:
    - (A) Meet the requirements specified in **40 CFR 180.940** Tolerance exemptions for active and inert ingredients for use in antimicrobial formulations (Food-contact surface sanitizing solutions)P, or...

4626.1620 7-204.11 SANITIZERS; CRITERIA.*

- Chemical sanitizers and other chemical antimicrobials applied to food-contact surfaces shall meet the requirements specified in **Code of Federal Regulations, title 21, section 178.1010**.

*Source: 2013 US Food Code
Food Contact Surface

Food contact surfaces*

- A surface of equipment or a utensil with which food normally comes into contact
- A surface of equipment or a utensil from which may drain, drip or splash into a food or onto a surface normally in contact with food

Non-food contact surfaces

- Any other surfaces

*Source: 2013 US Food Code
Wash, Rinse, Sanitize- Food Contact Surfaces

- **Washing step**
  - Removes soil and organic matter

- **Rinsing step**
  - Removes the detergent and any excess debris
  - If this step is not done properly, the excess detergent is mixed with the sanitizer and can neutralize the solution, thus making the sanitizing step ineffective

- **Sanitizing step**
  - Reduces bacterial load by 99.999%
  - Sanitizers are designed to be applied to clean surfaces
4-601.11 Equipment, Food Contact Surfaces, Non-Food Contact Surfaces, and Utensils

Equipment, food contact surfaces and utensils shall be clean to sight and touch.

4-602.11 Equipment, Food Contact Surfaces and Utensils

(C) Except as specified in (D), if used with potentially hazard foods, equipment food contact surfaces and utensils shall be cleaned through the day at least every four hours.

(D) Surface and utensils and equipment contacting potentially hazard foods may be cleaned less frequently than every four hours if....
Rinsing
FDA FOOD CODE 2013

4-603.16 Utensils and Equipment

Washed utensils and equipment shall be rinsed so that abrasives are removed or diluted through the use of water or a detergent-sanitizer solution
Sanitizing
FDA FOOD CODE 2013

Sanitization: the application of cumulative heat or chemical on cleaned food contact surfaces that, when evaluated for efficacy, is sufficient to yield a reduction of 5-log, which is equal to a 99.999% reduction, of representative disease microorganisms of public health importance.

4-701.10 Food Contact Surfaces and Utensils

Equipment, food contact surfaces and utensils shall be sanitized before use after cleaning.
4-501.115 Detergent-Sanitizer

If a Detergent-Sanitizer is used to sanitize in a cleaning and sanitizing procedure where there is no distinct water rinse step between the washing and sanitizing steps, the agent applied in the sanitizing step shall be the same Detergent-Sanitizer that is used in the washing step.
Food Contact Surface Sanitizers

1. Must use EPA registered product
2. Entire surface must be clean
3. Time and temperature
4. Use only for purposes listed on label
5. Don’t mix products
6. Use per manufacturer’s instructions
7. Rinse, if required
8. Test concentration
SANITIZER JURISDICTION...FDA or EPA?
Jurisdiction Of Food Use Antimicrobial Treatments Is Determined By:

- Product Application/Use
- What is the intended technical effect?
- Product claims (implied or expressed)
- EPA’s definition of a “pest” (40 CFR 152.5)
- FDA’s definition of a “processed food”
Post FQPA/ARTCA(1998): Here And Now

Sole FDA Jurisdiction

- Antimicrobials applied to reduce microbial count on the surfaces of processed foods
- Example- Antimicrobial applied directly to a sliced carrot in a processing facility

Sole EPA Jurisdiction

- **Hard surface food contact sanitizers.**
- Antimicrobials applied to raw agricultural commodities (RAC’s) in the field, post harvest and in transportation
- Example- Antimicrobial applied to a whole apple in the field/non-processing facility
Post FQPA/ARTCA(1998): Here And Now

- **Joint EPA/FDA Jurisdiction**
  - Antimicrobials applied to RAC’s in a food processing facility
  - **Antimicrobials to reduce microbial count in process water coming in contact with further processed fruit and vegetables**
  - Antimicrobials applied to food packaging
  - Example- antimicrobial applied in the water containing sliced apples
EPA’s 40 CFR 180.940 replaces the former FDA 21 CFR 178.1010 “sanitizing solutions”

Tolerances or exemptions from food tolerance are not required for antimicrobials used on household food contact surfaces.
- EPA conducts a dietary risk assessment

EPA holds sole jurisdiction over hard surface food contact sanitizers due to the passage of FQPA and ARTCA
The Microbes to be Controlled are in or on a...

Food-Contact Substance

Processed Food

Is the substance EtO or PrO?

Yes: EPA

No: FDA

Raw Ag. Or Wash Water

Is the treatment in a food processing facility or during transportation to such a facility?

Yes: FDA

No: EPA

Any Food Packaging

FDA

Surfaces of Food-Contact Articles & Equipment

EPA

Any part of the Food-Contact Article other than the Surface, or, if it has no Antimicrobial effect in or on the Finished Article

FDA

May also be subject to FIFRA

May also be subject to FIFRA

May also be subject to FIFRA

ECOLAB®
WHAT DOES ALL OF THIS MEAN FOR YOU?

REGULATORY JURISDICTION OF FOOD ANTIMICROBIALS CAN BE COMPLICATED.
MARKET TRENDS QUEST FOR OPTIMAL SANITIZER FUTURE INNOVATION
Market Trends
Macro trends changing the foodservice industry and operations

Market Decline
• Declining foot traffic in FSR

Escalating Costs
• Labor and food costs increasing

Water Scarcity
• Future regulations

Food Safety
• Push towards transparency for food sources

Ownership Structure
• Franchised structure and brand standards

Operator challenges

MANAGING COSTS
23 out of 50 U.S. states increased minimum wage in 2015

INCREASING REGULATIONS
New food codes come out every 4 years

MEETING GUEST EXPECTATIONS
4 out of the top 10 “very important” attributes customers look for when choosing a restaurant relate to cleanliness
Complex and risky regulatory environment

Health Inspections

- Customers can be inspected several times a year based on 54 different items
- Problem item: Food contact surfaces not properly cleaned and sanitized
  - #2 most cited violation = 25% of all citations*

Consumer Awareness

- Government is becoming more transparent with results
- Yelp and others are now displaying results of health inspections
- Several states now post “Letter Grade” on restaurant fronts

We need to provide simple food safety solutions that keep our customers compliant with health code and allow them to focus on guest satisfaction

*2014 HDI Study
Goal: Optimal Sanitation Control
Comprehensive Approach Needed
The Ideal Sanitizer

- Broad antimicrobial Activity
- Rapid
- Easily prepared and soluble in water
- Stable
- Tolerant of soft and hard water etc.
- Environmentally compatible and non-toxic
- Noncorrosive
- Economical
- Safe for use
Factors that Affect Sanitizer Efficacy

- Cleanliness of the surface
- Equipment sanitary design
- Chemistry dosage accuracy
- Method of application
  - Coverage
- Type of microorganisms
- Temperature
  - environment, equipment
- Water
  - Chemistry (alkalinity/pH)
  - Composition (hardness)
- Equipment composition (Materials of construction)
- Residual activity
- Usage in accordance with label
- Shelf life
# Common Chemical Sanitizer Types

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorines</td>
<td>Hypochlorites, Various Powdered Chlorine Sources</td>
</tr>
<tr>
<td>Quats</td>
<td>Benzalkonium chlorides, Blended Quats (dual or twin chain)</td>
</tr>
<tr>
<td>Peroxyacids</td>
<td>Acetic, Citric, Octanoic, Mixed Peroxyacids</td>
</tr>
<tr>
<td>Fatty Acids</td>
<td>Fatty Acid + Organic Acid + Mineral Acid</td>
</tr>
<tr>
<td>Iodophors</td>
<td>Compounds that complex I₂ + surfactant + acid</td>
</tr>
<tr>
<td>Acid Anionics</td>
<td>Anionic Surfactants + Acid</td>
</tr>
</tbody>
</table>
## Microbiological Efficacy

<table>
<thead>
<tr>
<th></th>
<th>Chlorine</th>
<th>Quats</th>
<th>Peroxy Acids</th>
<th>Fatty Acids</th>
<th>Iodophors</th>
<th>Acid Anionics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vegetative Bacterial Efficacy</strong></td>
<td>Best</td>
<td>Good</td>
<td>Best</td>
<td>Good</td>
<td>Best</td>
<td>Good</td>
</tr>
<tr>
<td><strong>Yeast/Mold Efficacy</strong></td>
<td>Better</td>
<td>Good</td>
<td>Better/Good</td>
<td>Good/Limited</td>
<td>Best</td>
<td>Good</td>
</tr>
<tr>
<td><strong>Phage</strong></td>
<td>Better</td>
<td>Limited</td>
<td>Better</td>
<td>Limited</td>
<td>Good</td>
<td>Better</td>
</tr>
</tbody>
</table>

Could be additionally be broken down by:
- Bacterial type (Gram +/-)
- Bacterial spores
- Viruses
- Bacteriophages etc.
## Temperature Sensitivity

Quats, Fatty Acids and Acid Anionics less effective for refrigerated applications

<table>
<thead>
<tr>
<th></th>
<th>Chlorine</th>
<th>Quats</th>
<th>Peroxy Acids</th>
<th>Fatty Acids</th>
<th>Iodophors</th>
<th>Acid Anionics</th>
</tr>
</thead>
<tbody>
<tr>
<td>70° F</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>55° F</td>
<td>+</td>
<td>+/-</td>
<td>+</td>
<td>+/-</td>
<td>+/-</td>
<td>+</td>
</tr>
<tr>
<td>40° F</td>
<td>+</td>
<td>-</td>
<td>+/-</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
</tbody>
</table>

- **Good Activity**
- **+/-** Moderate Activity
- **-** Substantial Loss of Activity
## Water Hardness and pH Sensitivity

While not a factor for cleaners, water pH is important to sanitizer efficacy

<table>
<thead>
<tr>
<th>Water Hardness</th>
<th>Chlorine</th>
<th>Quats</th>
<th>Peroxy Acids</th>
<th>Fatty Acids</th>
<th>Iodophors</th>
<th>Acid Anionics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Low</td>
<td>Moderate</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>pH Sensitivity</th>
<th>Chlorine</th>
<th>Quats</th>
<th>Peroxy Acids</th>
<th>Fatty Acids</th>
<th>Iodophors</th>
<th>Acid Anionics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate</td>
<td>Moderate</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
<td>High</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Optimum Use Solution pH</th>
<th>Chlorine</th>
<th>Quats</th>
<th>Peroxy Acids</th>
<th>Fatty Acids</th>
<th>Iodophors</th>
<th>Acid Anionics</th>
</tr>
</thead>
<tbody>
<tr>
<td>More effective as pH is reduced.</td>
<td>Neutral pH</td>
<td>pH 3-4.5 Effective up to pH of 7.5</td>
<td>&lt;3.5</td>
<td>More effective at pH 2-5</td>
<td>&lt;3.0</td>
<td>Acceptable efficacy toward neutral pH</td>
</tr>
</tbody>
</table>
Soil Load Sensitivity

The presence of any residual soil can chemically and physically impair the efficacy of sanitizers

- Soil may chemically inactivate the sanitizer
- Soil may physically shield microorganisms from the necessary direct contact with the sanitizers

<table>
<thead>
<tr>
<th>Soil Load Sensitivity</th>
<th>Chlorine</th>
<th>Quats</th>
<th>Peroxy Acids</th>
<th>Fatty Acids</th>
<th>Iodophors</th>
<th>Acid Anionics</th>
</tr>
</thead>
<tbody>
<tr>
<td>High*</td>
<td>Low</td>
<td>Low</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

*Except for ClO₂
**Additional Factors Affecting Sanitizer Efficacy**

- Equipment Material: Chlorine (sodium hypochlorite) can be highly corrosive to Stainless Steel
- Quats, Acid Anionics offer highest potential for foaming
- Quats offer highest residual activity

<table>
<thead>
<tr>
<th></th>
<th>Chlorine</th>
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<th>Fatty Acids</th>
<th>Iodophors</th>
<th>Acid Anionics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrosive (Stainless Steel)</td>
<td>High</td>
<td></td>
<td>Low</td>
<td>Low</td>
<td>Moderate</td>
<td>Low</td>
</tr>
<tr>
<td>Foam Level</td>
<td></td>
<td>High</td>
<td>Low</td>
<td>Moderate</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>Residual Activity</td>
<td></td>
<td>High</td>
<td>Low</td>
<td></td>
<td></td>
<td>Low</td>
</tr>
</tbody>
</table>
Additional Factors Affecting Sanitizer Choices

New Target Virus and Claims

Government Regulations

Multipurpose Solution

Employee Safety

Reduced Kill Time

Competing challenges for new chemistry development increases complexity
Digital is Changing our Markets

Digital is changing the way business is done…

Digital is a **force** sweeping through consumer and customer behavior, underpinned by a technology disruption.

Digital is a **game changer** of fundamental competitive dynamics, driving new sources of advantage and new business models.

Digital provides a **set of tools** in the existing business system to improve insights, reduce costs and drive revenue, including advanced analytical techniques leveraging massive amounts of data.

Digital technology disruption provides both Opportunity & Risk.
Data Driven Insights

Lot of activity on data side

Fragmented solutions – not comprehensive for customer needs

We don’t want a data dump. Tell us what needs to get done and help us take care of it.

True disruptive solution needs all three

Technology innovation is creating compliance opportunities
Ecolab Approach

Consistent. Protected. On Site.

- Enhance the interaction between Ecolab’s team & customer
- Maintain consistency in that same interaction
- Bring actionable insight into the results delivered at every unit
- Innovate multi-use, simplified sanitizing solutions
Example: Warewash Sanitization

New Chemistry Introduction Example in Machine Warewashing
Concentrated Sanitizing Rinse

- Launched mid-2015
- Combined Sani-Rinse = Multipurpose
- Improved performance
  - Improved filming
  - Reduced Corrosion
- Differentiated from legacy systems
  - Peroxyoctanoic Acid based
  - Closed Loop dispensing

Before

After
Significant effort to bring new EPA registered foodservice sanitizer to market

### Concentrated Sanitizing Rinse


A chemical SANITIZER used in a SANITIZING solution for a manual or mechanical operation at contact times specified under 4-703.11(c) shall meet the criteria specified under 7-204.11 Sanitizers, Criteria, shall be used in accordance with the EPA registered label use instructions, and shall be used as follows:

A) A chlorine solution shall have a minimum temperature based on the concentration and pH of the solution as listed in the following chart:

<table>
<thead>
<tr>
<th>Concentration Range (MG/L)</th>
<th>Minimum Temperature PH 10 or less °C (°F)</th>
<th>Minimum Temperature PH 8 or less °C (°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 – 49</td>
<td>49 (120)</td>
<td>49 (120)</td>
</tr>
<tr>
<td>50 – 99</td>
<td>38 (100)</td>
<td>24 (75)</td>
</tr>
<tr>
<td>100</td>
<td>13 (55)</td>
<td>13 (55)</td>
</tr>
</tbody>
</table>

B) An iodine solution shall have a:

1. Minimum temperature of 20°C (68°F).
2. PH of 5.0 or less or a PH no higher than the level for which the manufacturer specifies the solution is effective, and
3. Concentration between 12.5 MG/L and 25 MG/L;

C) A quaternary ammonium compound solution shall:

1. Have a minimum temperature of 240°C (750°F).
2. Have a concentration as specified under § 7-204.11 and as indicated by the manufacturer’s use directions included in the labeling, and
3. Be used only in water with 500 MG/L hardness or less or in water having a hardness no greater than specified by the EPA-registered label use instructions;

D) If another solution of a chemical specified under (A) (C) of this section is used, the PERMIT HOLDER shall demonstrate to the REGULATORY AUTHORITY that the solution achieves SANITIZATION and the use of the solution shall be APPROVED; P 136 Utensils and Temperature and Pressure Measuring Devices

E) If a chemical SANITIZER other than chlorine, iodine, or a quaternary ammonium compound is used, it shall be applied in accordance with the EPA-registered label use instructions; and
New Sanitizer Implications

- EPA Registration
- NSF Testing
- New Machine Sanitizing Faceplate
- New Sanitization Test Strips
  - Different test conditions and procedures than traditional systems

New Sanitizers require EPA and NSF approval and may use new field test tools.
Summary

- Regulatory jurisdiction of food antimicrobials can be **complicated**
- **Comprehensive** solution needed
- New tools and simplified solutions can drive Food Service **compliance**
- New sanitizing solutions will **change** the traditional inspection process

Thank You!