WHEN WATER IS NOT AN OPTION
Evolution of Dry and Low Moisture Cleaning and Sanitation

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Amie Lijewski – Chemical Engineer

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TODAY’S SPEAKER

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AGENDA

- Dry Program – A Holistic View
- Dry Cleaning Challenges
- Water Management
- Cleaning and Sanitizing Practices
- Next Generation Solutions
WHEN WATER IS NOT AN OPTION

CALIFORNIA  MAY 2, 2015
Central Valley's growing concern: Crops raised with oil field water
by Julie Cart

Here in California's thirsty farm belt, where pumpjacks nod amid neat rows of crops, it's a proposition that seems to make sense: using treated oil field wastewater to

Energy Commission Funds Energy and Water Saving Research

May 13, 2015 - The California Energy Commission today approved more than $16 million in grants to demonstrate water and energy saving technologies that promise to make the water, industrial, and agricultural sectors more efficient. The Energy Commission approved five Electric Program Investment Charge (EPIC) grants which lay a foundation for the Water Energy Technology (WET) program—one of the four Energy Commission responsibilities in Governor Edmund G. Brown Jr.'s April 1 drought-related Executive Order.

L.A. NOW  MAY 5, 2015
Drought kills 12 million trees in California's national forests
by Veronica Rocha and Hailey Branson-Potts

Rangers in the San Bernardino National Forest call them “red trees.”

U.S  The New York Times

Water Source for Almonds in California May Run Dry

By FELICITY BARRINGER  DEC. 27, 2014

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WHEN WATER IS NOT AN OPTION

- Environmental drivers are the largest contribution to changes in food and beverage processing
  - Cleaning and sanitizing rules and regulations
  - Weather conditions
  - Contamination: illness and disease

- Knowing where water can be saved or eliminated in the production process is key
## WHAT DO FOOD PROCESSORS WANT?

### DESIRED FEATURES FOR DRY CLEANING

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>KEEP IT DRY</strong></td>
<td>Minimize water footprint in dry facilities is our key focus to maintain product quality and food safety.</td>
</tr>
<tr>
<td><strong>CLEANING EFFECTIVENESS</strong></td>
<td>Options available to effectively clean food contact surfaces in dry environments are limited and not very effective.</td>
</tr>
<tr>
<td><strong>SAFETY</strong></td>
<td>Employee safety is of prime importance to us. Any improvement in safety and handling will be significant for our operations.</td>
</tr>
<tr>
<td><strong>PRODUCTIVITY IMPROVEMENT</strong></td>
<td>It takes significant time, skill level, manual labor and resources to maintain and improve the dry cleaning environments.</td>
</tr>
<tr>
<td><strong>COMPREHENSIVE PROGRAM</strong></td>
<td>Maintaining cleaning and sanitization in dry facilities requires developing an end to end solution for our plants rather than just cleaning specific equipment.</td>
</tr>
<tr>
<td><strong>EASE OF USE</strong></td>
<td>While RTU is easier to use and train employees to make our sanitation program consistent, our cleaning program is still inconsistent. We have inconsistent or no cleaning solutions with limited/no effectiveness making it difficult to train employees.</td>
</tr>
</tbody>
</table>
DRY CLEANING – A HOLISTIC VIEW

DESIRED FEATURES FOR DRY CLEANING

- Dry vs. Wet Sanitation
- Water Management
- Cleaning and Sanitizing
- Hygiene
- Pest Elimination
- Plant Traffic and Zoning
- Training
- Validation and Verification

Comprehensive Program for Dry Processing Environments

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# Maintaining a Dry Environment

## Water Sources of Almond Processing

### Growth
- Irrigation
- Environmental hazards including weather and pests

### Harvest
- Ground contact
- Environmental hazards including weather and pests

### Further Processing
- Wet clean and sanitization areas
- Facility and plant equipment/tools
- Hygiene practices of shelling and sorting
- Traffic patterns: personnel, materials, and food product
- Storage and transportation

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The key elements required for control of *Salmonella* recontamination in an almond production facility can be conceptualized in the *Salmonella* control equation:

**Traffic Control (Personnel & Equipment)** + **Dust Control** + **Water Control** + **Separation of Raw & Pasteurized Product** + **Effective Cleaning & Sanitation**

*Salmonella* Control
MAINTAINING A DRY ENVIRONMENT
GROWTH OF *SALMONELLA* IN WET AMOND DUST

Dr. Linda Harris (UC Davis). Du et al. ,2010. J. Food Sci. 75:M7-M13

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DRY VS. WET CLEANING AND SANITIZING

- Dry process environment: no or low moisture is needed in cleaning and sanitizing solutions to protect equipment, process, product quality and/or worker safety
- Same goals focused on food safety and quality
- Similar overall cleaning procedures
- Different tools
- Different timelines
WHEN TO DRY CLEAN
HOW TO IDENTIFY DRY CLEANING CHALLENGES

SOILS
- Variety of soils – fats, sugars, starches, protein
- Allergens
- Soils can be tenacious, or loose and dusty
- Soil may be baked on
- Can be spread by air currents

EQUIPMENT DESIGN
- Complex equipment difficult to clean – e.g. scales, extruders, dryers, etc.
- Variety of metal, plastic, and elastomer materials
- Cleaning instruments can damage equipment surfaces

CROSS CONTAMINATION
- Maintaining distance between wet and dry areas
- Personnel training
- Process and facility design

EXTENDED TIME BETWEEN CLEAN
- Increases soil accumulated on surface
- Incremental housekeeping tactics
WATER MANAGEMENT
IF THE ENVIRONMENT IS DRY, KEEP IT DRY

1. *Prevent* moisture from being introduced into a dry area
2. Develop procedures to *control* moisture

Be Aware of Your Water Sources

- Food product
- Production/process water
- Residual pooling or dampening in dry cleaned areas
- Cleaning water
- Wet cleaning into adjacent dry areas
- Humidity – potential for condensation
- Leaks: pipes, hoses, drains, walls or roofs, drip pans
- HVAC/refrigeration drain lines
DRY CLEANING – EQUIPMENT DESIGN

EQUIPMENT PRINCIPLES OF SANITARY, LOW MOISTURE DESIGN

- Cleanable to a microbiological level
- Accessible for inspection, maintenance, cleaning and sanitation
- No niches
- No product or liquid collection
- Hollow areas hermetically sealed
- Made of compatible materials
- Sanitary operational performance
- Validate cleaning and sanitizing protocols
- Hygienic compatibility with other plant systems
- Hygienic design of maintenance enclosures
DEVELOPING A DRY SANITATION PROGRAM

- **Pre-rinse**: Wash equipment prior to cleaning
- **Wash**: Cleaning treatment for removal of soil (Chemistry, Temperature, Time, Mechanical Action)
- **Rinse**: Rinse by cleansing with water
- **Sanitize**: Use an EPA-registered sanitizer to kill microbial agents
DEVELOPING A DRY SANITATION PROGRAM

Wet Cleaning

Dry Cleaning

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1. Sanitation preparation
2. Secure & disassemble equipment
3. Dry clean – **TOP DOWN**
   (any isolated wet clean – ensure parts completely dry before returning)
4. Detail clean – **TOP DOWN**
5. Post inspection & re-clean
6. Pre-op Inspection, cleaning verification & reassembly
7. Sanitize
METHODS OF DRY CLEANING

NO MOISTURE CLEANING METHODS

- Manual Action
- Vacuuming
- Blowing air
- Hot oil flushing
- Pigging
- Particle-based blasting

LOW MOISTURE CLEANING METHODS

- Steam cleaning
- Cleaning out of place (COP)
- Alcohol-based cleaners
# NO MOISTURE CLEANING METHODS

**MANUAL ACTION**

**ADVANTAGES**
- Color-coded brushes for dedicated areas
- Limited use of cleaner and/or water
- Low investment cost

**DISADVANTAGES**
- Large time input
- Portability increases risk of cross contamination

**VACUUMING**

**ADVANTAGES**
- Ease of use
- Quick removal of gross soil
- No introduction of moisture

**DISADVANTAGES**
- Central systems
- Crossover between wet and dry areas
- Must maintain a strict cleaning process for units

**BLOWING AIR**

**ADVANTAGES**
- Useful in tight areas
- Properly maintained units should not introduce moisture

**DISADVANTAGES**
- Does not eliminate soil
- Sterility is hard to achieve
- High risk of cross contamination due to soil transport

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### NO MOISTURE CLEANING METHODS

<table>
<thead>
<tr>
<th>Method</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
</table>
| **HOT OIL FLUSHING**    | **ADVANTAGES**  
Solubilizes specific greases and fats                                        | **DISADVANTAGES**  
Specialized equipment  
High temperature  
Limited cleaning capability                                           |
|                         | **DISADVANTAGES**  
Limited cleaning capability                                                      |                                                                     |
| **PIGGING**             | **ADVANTAGES**  
Removal of gross soil in piping  
No introduction of moisture  
Low capital cost                                                      | **DISADVANTAGES**  
Limited cleaning capability                                               |
|                         | **DISADVANTAGES**  
Limited cleaning capability                                                      |                                                                     |
| **PARTICLE-BASED BLASTING** | **ADVANTAGES**  
Good removal of hard soils                                                      | **DISADVANTAGES**  
High upfront equipment cost  
Post-blast wipe clean may be required  
Soil transport to other surfaces                                         |
## LOW MOISTURE CLEANING METHODS

### STEAM CLEANING

**ADVANTAGES**
- Cleaning efficiency in certain environments

**DISADVANTAGES**
- High upfront equipment costs
- Uses water which introduces residual moisture

### CLEANING OUT OF PLACE (COP)

**ADVANTAGES**
- Soaking or scrubbing away from equipment distances moisture from process
- More consistent, effective cleaning

**DISADVANTAGES**
- Disassembly of equipment takes time
- Possibility of cross contamination if equipment is switched between lines

### ALCOHOL-BASED CLEANERS

**ADVANTAGES**
- Quick drying
- Limited use of water
- Can generally be used on sensitive equipment

**DISADVANTAGES**
- Manual application
HYGIENE AND HOUSEKEEPING
MAINTAINING A DRY ENVIRONMENT WHILE MINIMIZING CROSS CONTAMINATION

- Ongoing removal of dry soils
- Hand care including cleaners, alcohol sanitizers, and wipes
- Uniforms program
- Hair and beard nets
- Lint and hair removers
- Control pests – break the life cycle of bugs
  - Food soil is attractive
  - Seasonal environments
- Hygienic footwear program:
  - Footwear cleaning equipment
  - Footwear sanitizing equipment
MANAGING PLANT TRAFFIC AND ZONING

DOORWAY TREATMENT AND BOOT SANITATION

- Ensure all vectors of contamination are considered
- Focus on potentially sensitive areas (allergens, known micro risk, etc.)
- Significant reduction in micro counts from use of boot sanitizing system
- Focus on passageways between wet and dry areas
  - Environmental factors
  - PPE
  - Equipment and tools
CLEANING TOOLS
MAKE SURE TOOLS DO NOT BECOME A SOURCE OF CONTAMINATION

- Reusable vs. disposable
- Tool material
  - No wood
  - No brushes having natural fibers or steel bristles
  - No porous cleaning devices
- Place tools on master sanitation schedule
  - Clean and sanitize
  - Air dry and store properly
- Clear color-coding system
TRAINING

IMPLEMENTATION OF DRY PROGRAM PRACTICES

- Build dry cleaning and sanitizing into master sanitation program
- Make sure employees understand *why*, not just how
  - Prevention and control of moisture
  - Proper cleaning and sanitizing process
- Reality of long-term compliance
  - Traffic flow
  - Time
  - Cost
  - Culture of plant
- Action vs. reaction
# FOOD SAFETY PROGRAMS IN DRY FACILITIES

## ADOPTING A HOLISTIC VIEW

### Plant & Facility Layout
- Pest control
- Hygienic zoning
- Raw material & ingredient control program
- Air filtration
- Facility maintenance
- Hygienic plant design
- Hygienic equipment design

### Procedures
- Enhanced pathogen control
- Allergen runs
- Employee hygiene
- Footwear management
- Tool & equipment control
- Validated control measures
- Procedure verification and corrective action plans
- Lot separation

### Mindsets
- Food safety landscape changing
- Understand where and how water could be used
- Approach all finished products as “ready-to-eat”
- Rapid changeover flexibility
- Manual labor reduction
- Equipment utilization
- General plant cleanliness

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## EVOLUTION OF DRY CLEANING

<table>
<thead>
<tr>
<th>CURRENT PRACTICE</th>
<th>FUTURE OR DESIRED STATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>• No cleaning</td>
<td>2-Step Cleaner + Sanitizer</td>
</tr>
<tr>
<td>• Manual scrubbing</td>
<td></td>
</tr>
<tr>
<td>• Vacuuming</td>
<td></td>
</tr>
<tr>
<td>• Blowing air</td>
<td></td>
</tr>
<tr>
<td>• Steam cleaning</td>
<td></td>
</tr>
<tr>
<td>• Particle-based blasting</td>
<td></td>
</tr>
<tr>
<td>• Concentrated cleaners</td>
<td></td>
</tr>
<tr>
<td>• Alcohol-based sanitizers</td>
<td></td>
</tr>
<tr>
<td>• Wipes</td>
<td></td>
</tr>
<tr>
<td>• Other sanitizers</td>
<td></td>
</tr>
</tbody>
</table>

### Key Challenges:
Manual labor, water usage, risk to food safety, production downtime, employee safety

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OBJECTIVE: Provide enhanced food safety and eliminate water to clean and sanitize in dry or low moisture production environments

SOLUTION: Ecolab developed DrySan™ Duo, a U.S. EPA-registered, ready-to-use, two-step cleaner and sanitizer, for use on hard, non-porous food contact and non-food contact surfaces. Especially beneficial for use in low moisture or dry processing environments.

FEATURES
- Effective against variety of microorganisms, such as Staph aureus, E. coli O157:H7, Listeria, Salmonella, etc., as listed on product label
- Low alcohol - non-flammable formula
- Cleaner + Sanitizer – two-step process with no water rinse required after cleaning
- Dries quickly; no worker PPE required during use
- Slip profile as good as dry surfaces
- Effective soil removal
- Compatible with footwear/rubber
- Kosher and Halal certified
- Available in plastic drums
PRODUCT BENEFIT: MICROBIAL EFFICACY

FOOD CONTACT SURFACE
(60 second contact)

- *Staphylococcus aureus* (ATCC 6538)
- *Escherichia coli* (ATCC 11299)
- *Escherichia coli* 0157:H7 (ATCC 43895)
- *Pseudomonas aeruginosa* (ATCC 15442)
- *Salmonella typhimurium* (ATCC 13311)
- *Listeria monocytogenes* (ATCC 49594)
- *Cronobacter sakazakii* (ATCC 12868)
- *Salmonella enterica* (ATCC 10708)
- (STEC) *Escherichia coli* O26:H11
- (STEC) *Escherichia coli* O45:H2
- (STEC) *Escherichia coli* 103:H11
- (STEC) *Escherichia coli* O111:NM
- (STEC) *Escherichia coli* O121:H19
- (STEC) *Escherichia coli* O145:H18

NON FOOD CONTACT SURFACES
(5 minute contact)

- *Staphylococcus aureus* (ATCC 6538)
- *Enterobacter aerogenes* (ATCC 13048)
- *Escherichia coli* (ATCC 11299)
- *Escherichia coli* 0157:H7 (ATCC 43895)
- *Listeria monocytogenes* (ATCC 49594)
- *Cronobacter sakazakii* (ATCC 12868)
- *Salmonella enterica* (ATCC 10708)
- (STEC) *Escherichia coli* O26:H11
- (STEC) *Escherichia coli* 103:H11
**PRODUCT BENEFITS: INCREASED PRODUCTIVITY**

**IMPROVED CLEANING EFFECTIVENESS WITH NO WATER AND SHORT DRY TIME**

**Customer Challenges:**

“We either have to use water and spend significant time in drying the areas or use significant manual labor that significantly limits our productivity goals.”

**Product Features:**

- Cleaner as well as sanitizer
- Effective cleaning
- Quick dry time
- Eliminates or reduces water rinse

**Benefits:**

- Reduce manual labor due to effective cleaning
- Reduced time to clean
- Opportunity for more frequent spot cleaning and reduce downtime
- Water savings
DRYSAN DUO BENEFITS
NO RINSE, QUICK-DRY, CLEANER AND SANITIZER

**FOOD SAFETY**
- Can be used on food contact surfaces
- Effective soil removal
- Effective sanitation in presence of soil
- Can be used for footwear/rubber

**SAFETY**
- Low flammability
- Reduced floor slip
- Reduced storage, handling & transportation restrictions (USA)
- Mild PPE requirements

**PRODUCT QUALITY**
- Helps reduce potential for possible microbial contamination by reducing moisture

**WATER**
- No rinse requirement between cleaning and sanitizing
- Eliminates need of water for effective cleaning

**PRODUCTIVITY**
- Quick drying time
- Significant reduction in cleaning time
- Reduces manual labor for cleaning dry environment

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Enhanced Cleaning Results with 50% Cleaning Time Reduction

Ecolab innovation helped customer eliminate 100% water from cleaning step and reduce cleaning time by 50% while improving employee safety compared to traditional cleaning process

SITUATION

- A leading packaged food processor desired to eliminate water from cleaning process and reduce the manual labor/cleaning time
- Customer was also concerned about employee safety, as current cleaning procedure included worker climbing up on equipment, such as the dough hopper, with a bucket of hot caustic wash (~130 deg. F / 54 deg. C)

ACTIONS

- The plant partnered with Ecolab to trial the DrySan Duo cleaning program in this cookie dough processing facility
- The plant used DrySan Duo for the cleaning step in ready-to-use spray bottles at room temperature and eliminated multiple chemicals used for that application
- The plant used DrySan Duo as a cleaner to help assure cleaning effectiveness
Enhanced Cleaning Results with 50% Cleaning Time Reduction

RESULTS DELIVERED

- DrySan Duo reduced cleaning time by 50%
  - Conveyor belts: 5 hours to 2.5 hours
  - Dough hopper: 6 hours to 3 hours
- Eliminated 100% of process water during cleaning step
- Worker safety improvement
  - Efficiency in worker movement
  - Elimination of hot, caustic manual wash

<table>
<thead>
<tr>
<th>Environmental Results</th>
<th>Aerobic Plate Counts (APC)</th>
<th>Enterobacteriacea (EB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dough Hopper</td>
<td>Before clean: 850 CFU</td>
<td>&lt;10 CFU</td>
</tr>
<tr>
<td></td>
<td>After clean: &lt;10 CFU</td>
<td>&lt;10 CFU</td>
</tr>
<tr>
<td>Conveyor Belts</td>
<td>Before clean: 10 CFU</td>
<td>&lt;10 CFU</td>
</tr>
<tr>
<td></td>
<td>After clean: 20 CFU</td>
<td>&lt;10 CFU</td>
</tr>
</tbody>
</table>

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DRYSAN DUO
AN INNOVATION FOR A HOLISTIC PROGRAM

- Compatible with boot scrubbers
- Can be used on gloves
- Maintenance equipment
- General housekeeping

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CONCLUSIONS

- Specialized level of clean and needs
  - Combination of no moisture and limited moisture methods
- Needs to be integrated into comprehensive food safety program
- Collaboration with multiple divisions including quality, sanitation, engineering, etc.

Action plan
  - What are the plant’s dry cleaning challenges?
  - Are existing dry cleaning operations being kept free of moisture?
  - Are there areas that could benefit from dry cleaning?

Knowing where to save water and why it matters
QUESTIONS?