Responsible Care®

• What are the principles of Responsible Care®?
• What is the Responsible Care Management System (RCMS)?
• Active member of the American Chemistry Council (ACC) and the Chemical Industry Association of Canada (CIAC)
• Applying Plan-Do-Check-Act
• Committed to constant improvement in:
  – Occupational Safety and Health
  – Process Safety
  – Environmental Protection
  – Security
  – Distribution Safety
  – Product Stewardship Performance
Hydrogen Peroxide – $H_2O_2$

- Diversified industrial uses
- Water-like appearance and physical properties
- Oxidizer
- Chemically active
- Shipped as 70%, 50%, 35%, or 31%
  
  but normally stored at 50% or less
# Hydrogen Peroxide Grades

<table>
<thead>
<tr>
<th>Current Name</th>
<th>Main Uses</th>
<th>Specifications Source Dilution Water</th>
<th>Comments</th>
</tr>
</thead>
</table>
| **Standard**       | • Waste treatment  
                     • Non-food bleaching                                                   | PeroxyChem internal  
                     Approved tap water                                                                 | Stannate + other stabilizers  
                     Heavily stabilized                                                               |
| **Technical**      | • Chemical synthesis                                                      | PeroxyChem internal  
                     DI water                                                                 | Organic “tin free” stabilizer |
| **Super D**        | • Hair bleach, topical uses  
                     • Specialty laundry bleach  
                     • Extra stabilizer for stability on dilution to 1-6%                  | U.S. Pharmacopeia for 3% solution  
                     DI water                                                                 | Stannate + other stabilizers  
                     Heavily stabilized for shelf life                                               |
| **SemiConductor Grades** | • Routine semiconductor processing  
                     • ACS reagent uses  
                     • Ultra high purity for critical semiconductor use                  | SEMI specifications  
                     DI water                                                                 | Lightly stabilized  
                     Or non-stabilized                                                            |
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<th>Current Name</th>
<th>Main Uses</th>
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<tbody>
<tr>
<td><strong>Durox®</strong></td>
<td>• U.S. CFR approved food uses in bath, and low residue spray aseptic packaging use</td>
<td>Food Chemical Codex</td>
<td>Stannate + other Stabilizers</td>
</tr>
<tr>
<td><strong>Durox LRA® and LRD®</strong></td>
<td></td>
<td>DI water</td>
<td>Stabilized for food and equipment sanitation</td>
</tr>
<tr>
<td><strong>OxyPure®</strong></td>
<td>• Potable water treatment</td>
<td>NSF approved</td>
<td>Lightly Stabilized</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Food Chemical Codex</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>DI water</td>
<td></td>
</tr>
<tr>
<td><strong>HTP</strong></td>
<td>• Propulsion</td>
<td>N/A</td>
<td>Lightly Stabilized</td>
</tr>
<tr>
<td><strong>OHP</strong></td>
<td>• Environmental – Fenton’s Chemistry</td>
<td>DI water</td>
<td>Stabilized for Environmental Applications</td>
</tr>
</tbody>
</table>
Sample Applications

Pulp & Paper
- Bleaching of chemical and mechanical pulps
- De-inking

Textiles
- Cottons (Stone-washed effect)
- Bleaching

Food and Beverage
- Aseptic packaging
- Bacterial disinfecting agent
- High-fiber additives (bleaching)

Electronics
- Circuit board cleaning & etching

Environment
- Organic pollutant treatment
- Chlorine, sulfide and cyanide removal
- Bioremediation
- Potable water treatment

Cleaning and Sanitization
- Perborates/percarbonates/peracids
- Liquid $\text{H}_2\text{O}_2$ bleach
- Detergent manufacturing

Polymers and Chemical Synthesis
- Organic and inorganic peroxides
- Epoxides/oxides/specialty chemicals

Natural Resources Extraction
- Leaching enhancement for gold and silver extraction
- Hydraulic fracturing biocide

Pharmaceutical and Cosmetic
- Mouthwash
- Contact lens cleaner
- Disinfectant
The 4 Rules of H$_2$O$_2$ Use & Handling

1. Never Contaminate
2. Never Confine
3. Never Contact
4. Always Have Water Available
Preventing contamination ensures safety and quality.
Types of Contamination

- Heat & energy
- Materials of construction
- Externally introduced materials
Chemical Reaction Caused by Contamination

With fuel present → Fire
For every 10°C rise in temperature the decomposition rate approximately doubles.
# Materials of Construction

<table>
<thead>
<tr>
<th>Storage Tanks</th>
<th>Piping</th>
<th>Valves</th>
<th>Pumps</th>
<th>Hoses</th>
<th>Gaskets, Diaphragms, O-Rings</th>
</tr>
</thead>
<tbody>
<tr>
<td>#5254 Aluminum</td>
<td><strong>PASSIVATED</strong>&lt;br&gt;SS316, SS316L, SS304, SS304L &lt;br&gt;1060 Aluminum</td>
<td><strong>PASSIVATED</strong>&lt;br&gt;SS316, B356 Aluminum&lt;br&gt;Virgin Teflon Seats and Seals</td>
<td><strong>PASSIVATED</strong>&lt;br&gt;SS316, B356 Aluminum&lt;br&gt;Mechanical Seals&lt;br&gt;Pure Ceramic, Silicon Carbide, Teflon, SS316</td>
<td><strong>PASSIVATED</strong>&lt;br&gt;SS316, SS304</td>
<td>Virgin Teflon, PP363 Vinyl, Garlock Gylon, Viton A</td>
</tr>
<tr>
<td>SS316L/SS304L</td>
<td><strong>PASSIVATED</strong></td>
<td><strong>VENTED, PASSIVATED</strong>&lt;br&gt;SS316, B356 Aluminum</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polyethylene</td>
<td><strong>LINEAR/CROSS-LINKED HD</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

*Consult with PeroxyChem on Application*
Reasons for Passivation

- Removes surface impurities
- Provides a compatible metal oxide surface for Hydrogen Peroxide contact:
  - Ensuring stability and quality
  - Inhibiting corrosion
Common Materials to Avoid

- Brass
- Bronze
- Chromium
- Copper
- Graphite
- Iron/Steel
- Lead
- Lubricating Oil
- Magnesium Alloys
- Monel
- Nickel
- Pipe Dope
- Titanium
- Zinc

These will cause accelerated decomposition of H₂O₂
How Materials are Introduced Externally

- **Wrong materials** delivered into storage vessel
- $\text{H}_2\text{O}_2$ delivered into **wrong tank**
- **Process backs up** into $\text{H}_2\text{O}_2$ system
- Returning **unused $\text{H}_2\text{O}_2$** into original container
- Dust, dirt, etc.
Indications of Hydrogen Peroxide Decomposition

• Pressure buildup
  - Activation of pressure relief devices

• H₂O₂ visually active
  - Rapid bubbling

• Temperature increase

• Gas or steam evolution
Pressure buildup can cause tank failure.
Reasons for Not Confining Hydrogen Peroxide

- Hydrogen Peroxide always decomposes, only the rate varies.
- A volume ratio of 200:1 of Oxygen liberated to liquid decomposed is possible.
- Pressure build up will occur in a closed system.
- Excess pressure build up can result in tank or line rupture or failure.
Horizontal Tank

NEVER CONFINE

1. H$_2$O$_2$
2. WATER

FILTERED VENT
FLOATING RELIEF MANHOLE COVER
PROCESS
Vertical Tank

FLOATING RELIEF MANHOLE COVER
FILTERED VENT

\( \text{H}_2\text{O}_2 \)
WATER

DRAIN
PROCESS
Pressure Relief in Pipe Between Closed Valves
Two Methods of Venting the Ball Cavity of a Valve

1. NEVER CONFINE

2. Pressure Relief Valve

1/8” Diameter Hole in Upstream Side of Ball
Serious injury is at stake.
Protect yourself.
Proper Protection

• Daily Work Around Equipment
  – Chemical safety goggles
  – Rubber gloves

• Increased Exposure Due to Spillage, Maintenance or Sampling
  – Neoprene or vinyl acid suit (cotton clothing can catch fire)
  – Neoprene boots (leather footwear can catch fire)
  – Full face shield

• Lack of proper eye protection or proper clothing could result in serious injury such as burning of the skin, tissue damage or throat inflammation
Chemical Reaction Caused by Contact with a Fuel

Fuel can be any combustible material such as wood or leather boots
A diluted solution is less hazardous.
Emergency Response Equipment When Handling $\text{H}_2\text{O}_2$

Always have water available to dilute $\text{H}_2\text{O}_2$

- Safety showers
- Eyewash
- Hose
First Aid

**Eyes**
Immediately flush eyes with plenty of water for at least 15 minutes.

**Body**
Flush skin with water.
Remove and wash contaminated clothing and shoes promptly and thoroughly.

**Internal**
If swallowed, drink water immediately to dilute.
Do not cause vomiting.
Call a physician.

ALWAYS HAVE WATER AVAILABLE
Response

- $\text{H}_2\text{O}_2$ by itself is **non-flammable**
- Use **water** for extinguishing fires
- Keep area **clear** of all personnel
- If a fire is near a storage vessel or equipment cool with an **external** water spray
- Flush equipment with **water**
General Rules for Maintenance and Repair

- **Wear** proper protective equipment
- **Relieve** pressure on system (shut off $\text{H}_2\text{O}_2$ flow and isolate piping, equipment and storage tank)
- **Introduce** and **flush** compatible water through the piping system
- **Lock out** equipment
- **Drain** water
- **Rinse off** all parts with water (i.e. fittings, nuts, bolts, gaskets)
- **Repair** and **clean** component
- **Repassivate** if necessary
- **Avoid** incompatible material or equipment substitutions
- **Check** operation
- **Restart**
Maintain Safety and Quality

**PASSIVATION**
Passivate all components of Hydrogen Peroxide system

**INSPECTION**
Inspect tanks and delivery system once every two years

**SAMPLING**
Test Hydrogen Peroxide and water quality

**MAINTENANCE**
Repair defects immediately
Repassivate equipment if needed
The 4 Rules of H$_2$O$_2$ Use & Handling

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Our Vision

• PeroxyChem’s vision is to be the leading global supplier of oxidation solutions to the electronics, environmental, food safety and other industrial and consumer markets, built on its peroxygen chemistries and adjacent technologies.

• This vision is supported by our core values of safety, people, innovation, customer focus and growth.
  - **People:** Increase accountability and personal initiative. Challenge the status quo to improve efficiency and productivity.
  - **Safety:** Maintain our historic track record. Prioritize a fierce dedication to safe practices.
  - **Innovation:** Innovate in everything we do.
  - **Customer focus:** Nurture customer relationships with our expertise and provide innovative ways to meet customer needs.
  - **Growth:** Focus on market orientation and continue to serve markets around the world.
Questions