Arsenic Removal with Adsorption Media
Speaker: Richard Sinclair, President, Applied Process Equipment

• Richard holds a Bachelor’s degree in Engineering Pennsylvania State University and has had a life-long career in the fluid process industry.

• He started his career as a sales engineer for an industrial pump and pump systems distributor in Harrisburg, PA. After four years he purchased the business and expanded it to 25 product lines sold to industrial and mining accounts.

• In 1987 Richard moved to Scottsdale, Arizona, and established Applied Process Equipment, Inc., a distributor of pumps, tanks and wastewater treatment equipment to municipal, commercial and industrial customers.

• In 2005, Richard expanded the business focus into water treatment with RO, UV and water filtration systems.

• In 2014 he became the western US distributor and national warehouse for ISOLUX Arsenic Removal Systems.

• Richard has been a long-term member of the Arizona Water Association, the Water Environment Federation, and the California Rural Water Association.
A Truly Unique Adsorption System

- User friendly cartridges in stainless steel housings
- Patented NSF-61 certified media
- No backwashing! No Waste streams!
A QUICK REVIEW
Adsorption Media Treatment – Best For Arsenic Removal

• Cost effective
• Reliable
• Simple to operate
• Low maintenance
• Doesn’t require a skilled licensed operator
• Applicable for moderate to low flow drinking water systems
• Suitable for use at rural and remote locations
Adsorption – How It Works

“Adsorption” happens when one molecule adheres to the surface of another.

• Adsorption medias generate a positive charge on their surface below a certain pH level.

• Positive charged media attracts and adsorbs negatively charged Arsenic and creates a chemical bond.
Types of Adsorption Media

Types of Arsenic Removal

“Adsorption” medias include:

- Aluminum hydroxide
- Titanium dioxide
- Iron Oxide E33
- Lanthanum oxide
- Zirconium dioxide
Adsorption Media Forms

Zirconium Powder:
• Powder has more surface area than granular medias.
• Pulls 99% of Arsenic in 30 seconds vs 3 to 5 minutes with other medias.

Ferric Oxide Granules:

Titanium Dioxide Granules:
Smaller Footprints with Powdered Media

ISOLUX Powdered Media with 27 second reaction time allows smaller housings and system footprints:

Granular Medias require larger holding tanks to accommodate 3 to 5 minute reaction time:

Typical 100 GPM System with Ferric Oxide Granules
16’L x 10’D
Zirconium Hydroxide Media

The powdered Zirconium adsorption media sets ISOLUX® shoulders above all others.

• Patented, made specifically for Arsenic removal.

• Unparalleled, non-leachable arsenic bond.

• Makes the unique, no-backwashing, ISOLUX® cartridge technology possible.
# Adsorption Arsenic Removal Media Comparison

<table>
<thead>
<tr>
<th>Adsorption Media:</th>
<th>Zirconium Hydroxide</th>
<th>Lanthanum Oxide</th>
<th>Ferric (Iron) Oxide</th>
<th>Ferric (Iron) Hydroxide</th>
<th>Titanium Dioxide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description:</td>
<td>Powder in cartridges</td>
<td>Granular in pressure vessels</td>
<td>Granular in pressure vessels</td>
<td>Granular in pressure vessels</td>
<td>Granular in pressure vessels</td>
</tr>
<tr>
<td>AsIII &amp; AsV removal:</td>
<td>Both, simultaneously</td>
<td>Both to pH 10.0</td>
<td>Yes, but more effective for As V</td>
<td>Less effective for As III</td>
<td></td>
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<tr>
<td>Backwashing required:</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Reaction time: (empty bed contact time)</td>
<td>27 seconds</td>
<td>2.5 to 3 minutes</td>
<td>Typically 3 - 5 minutes</td>
<td>3.5 minutes minimum</td>
<td>3 minutes</td>
</tr>
<tr>
<td>Regeneration possible:</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
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<tr>
<td>Wastewater generation:</td>
<td>None</td>
<td>Yes backwash</td>
<td>Yes backwash</td>
<td>Yes backwash</td>
<td>Yes backwash</td>
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<tr>
<td>pH Zero point-of-charge</td>
<td>11.0</td>
<td>10.0</td>
<td>9.0</td>
<td>9.0</td>
<td>Unknown</td>
</tr>
<tr>
<td>pH range</td>
<td>4 – 11.0</td>
<td>5.5 – 10.0</td>
<td>5.5 – 8.3</td>
<td>5.5 – 9.0</td>
<td>6.5 – 8.5</td>
</tr>
</tbody>
</table>
Unmatched Convenience, Quality & Performance

The Clear Choice

Ideal for rural, and small/medium size water treatment systems such as:

- Subdivisions
- Small or rural utilities
- Schools
- Mobile home parks
- Shopping centers
- Resorts, hotels & casinos
Simple, Clean, User-Friendly Cartridge System

- Sealed cartridges – no direct contact with media.
- Only 42” long, 4.5” in diameter and weigh only 21 pounds
- Can generally be loaded or removed by one person.
Four-Step Arsenic Removal Process

1. The plumbing inlet sends Arsenic contaminated water into the system housing.

2. Water with Arsenic is adsorbed by the ISOLUX cartridge(s) inside the housing.

3. The ISOLUX Zirconium media in the cartridges pulls and permanently catches the Arsenic in the water.

4. Clear, clean, Arsenic-free water flows out the plumbing outlet.
Convenience Customers Have Asked For

No Backwashing... EVER!

• No complicated maintenance or media replacement.
• No waste streams.
• Typically residential 5 and 10 GPM system cartridges only need to be replaced annually.
• Specific application cartridge life depends on water chemistry and daily water use.
Unmatched Quality & Performance

All the Way Down To “ZERO”

• Verified for 99% to non-detect arsenic removal.

• Due to variances in influent water quality, users are urged to perform independent verification of the non-hazardous character of spent media cartridges.

• Additionally, some states may have disposal criteria different from Federal guidelines (TCLP).
Stainless Steel Housings

- In 304 or 316 stainless steel.
- Manufactured under a certified ISO 9001 quality system.
- ASME Code U/UM stamp.
- Designed exclusively for use with ISOLUX® filter cartridges.
Sizes for a Wide Range of Applications

- **5, 10, 15 & 20 GPM** Residential and light commercial systems.
- **Stand Alone 25 GPM units**
- **50 and 100 GPM Skids** Commercial central treatment systems.
- **100 to 500 GPM** Engineered modular filter housing skids.
50 & 100 GPM Housing Skids

- Standard products in stock for quick availability
- Uses easy maintenance Cartridges
- Quality Construction – 304 stainless steel
- Small Footprints
  - 50 gpm Units - 5’ L x 1.5’ D
  - 100 gpm Units - 5’ L x 3’ D
- Lowest CAPEX and OPEX in the industry
Custom Engineered Skids

- 90 Day turnaround for complete custom engineered package.
- Available in 304 or 316 stainless steel for a wide of fluids and operating conditions.
- Variety of options available including:
  - Pretreatment systems
  - Catwalks, ladders & platforms
- High interior surface finishing avoids particle contamination for easy cleaning.
Easy, Environmentally Safe Garbage Bin Disposal

• Spent cartridges are non-leachable, non-hazardous.
• Passes EPA Toxicity Characteristic Leaching Procedure (TCLP) analysis and tests.
• Used cartridges can be easily and safely thrown in the garbage.
• Some states may have different disposal guidelines from the Federal EPA. Always check state and local codes!
Safe Landfill Disposal

• All adsorption media suppliers state their product is non-hazardous and spent media can be disposed of safely in landfills.

• Research has now shown that granular iron medias **WILL** leach arsenic, under landfill conditions at hazardous (ppm) concentrations.

• Current TCLP tests (Toxicity Characteristic Leaching Procedure) use an extractant solution with a 4.5 pH level where arsenic binds very tightly to iron.

• Unfortunately, typical landfill conditions range from 8 to 9 pH where arsenic/iron binding power is greatly reduced.

• This translates to higher media disposal costs for the user.
Arsenic Adsorption & Your Water Chemistry

Your Water Chemistry Impacts the level of Arsenic Adsorption

• Inter-related effects
• Accelerates media exhaustion
• Fouls media and consumes Arsenic adsorption sites
• Can result in high treatment OPEX.
Water Conditions Affecting Adsorption Levels

• pH
• Hardness
• Silica
• Calcium carbonate scale
• Iron & manganese

• Competing Ions:
  • Vanadium
  • Phosphorus
  • Fluoride
  • Selenium
pH Level Is Critical

pH is one of the most CRITICAL FACTORS for your treatment efficiency and operating costs.

- indicates the acidity or alkalinity of a solution.
- Typical pH range for municipal water plants between 7 and 9.
- Easily and inexpensively controlled.
- The best value for the money spent.
- Cost benefit at or above 7.5 (true for all types of adsorption medias)
In Summary

• Adsorption can provide cost effective arsenic removal
• Media selection and water complexity drives treatment costs
• pH should always be considered to improve economics

• ISOLUX is the Clear Choice for Small & Rural Water Systems!
The Clear Choice for Small & Rural Water Systems

QUESTIONS?
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