Improved Wastewater Processing
Driven by Arkea®
Background

• ArchaeaSolutions, Inc. is a high-science company focused on the use of Archaea organisms to assist natural cycle processes.

• Municipal wastewater treatment facilities, industrial wastewater treatment facilities, and similar entities are locales where this assistance is needed.

• Arkea®, our proprietary blend of Archaea organisms and other microbes, is proven to enhance waste breakdown and minimize pollution from these sources.
Original Hypothesis

How Arkea® Can Prevent Pollution
Original Hypothesis

• Hypothesized:
  • If presence of Archaea organisms can:
    – Increase metabolic rate and
    – Enhance breakdown of difficult molecules.
  • Then facilities using it will pollute less (i.e. produce cleaner effluent, generate less sludge, and be less susceptible to upset).
  • This hypothesis was tested by an independent university lab (no direction from us) and published in the Journal of Water Science & Technology.
Then Hypothesis Was Proved

• Oxygen was used more rapidly, indicating accelerated metabolism.
• Coefficient of “x” indicates Arkea® driven rate was approximately 50% higher.
- Ammonia was oxidized more rapidly, indicating accelerated metabolism.
- Coefficient of “x” indicates Arkea® driven rate was about 37% higher.
Increased metabolism usually means increased endogenous metabolism and less sludge yield.

“x” coefficient was 31% less when Arkea® is present.
Hypothesis Confirmed

Graphed data confirm hypothesis: Arkea® accelerates metabolism and breaks down difficult molecules such as ammonia and sludge.
Next Step

Hypothesis was proven. Now test in field.
Prevent Municipal WWTF Pollution
Effluent Quality

- Data to right are typical and from an Ohio WWTF.
- Both BOD (-32%) and TSS (-43%) drops are marked and significant, especially when compared to influent data.
- The before data are averages for 15 months prior to Arkea® treatment.
- The +Arkea® data are averages for nine months since Arkea® treatment began.

<table>
<thead>
<tr>
<th></th>
<th>BOD In</th>
<th>BOD Eff</th>
</tr>
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<tbody>
<tr>
<td>Before</td>
<td>209</td>
<td>2.93</td>
</tr>
<tr>
<td>+Arkea®</td>
<td>199</td>
<td>2.00</td>
</tr>
<tr>
<td>% Drop</td>
<td>5%</td>
<td>32%</td>
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<table>
<thead>
<tr>
<th></th>
<th>TSS In</th>
<th>TSS Eff</th>
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<tbody>
<tr>
<td>Before</td>
<td>191.67</td>
<td>7.93</td>
</tr>
<tr>
<td>+Arkea®</td>
<td>186.11</td>
<td>4.56</td>
</tr>
<tr>
<td>% Drop</td>
<td>3%</td>
<td>43%</td>
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</table>
Municipal TKN

- In less than 6 months, TKN dropped to +/- 1 mg/L and has remained there for almost five years.
- Plant is in the state of New York where winters are quite cold.
- Science now knows Archaea organisms have 3,000-fold more ammonia oxidase genes than other soil microbes.

<table>
<thead>
<tr>
<th>Time Period</th>
<th>mg/L</th>
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<tbody>
<tr>
<td>7/2005 - 9/2005</td>
<td>&lt;2.00</td>
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<tr>
<td>9/2005 - Present</td>
<td>+/- 1.00</td>
</tr>
</tbody>
</table>

Data Confirm Arkea® Reduces Nitrogen in Effluent & Therefore Decreases Pollution
Municipal Plant Sludge

• With Arkea® treatment, sludge yield dropped to range of 20 – 70% of pretreatment levels.
• Increases are caused by sludge from pulp and paper plant’s wastewater entering WWTF.
• Have further stabilized process, so no peaks above 60% of previous performance occurred in 2009.

Data Confirm Arkea® Reduces Sludge Yield & Therefore Decreases Pollution
Please Note:

The foregoing WWTF data are typical and representative examples of a large number of customers. Additional customer data, insights, and references available upon request.
Prevent Industrial Wastewater Pollution
Industrial plants often have higher waste loads whose strength oscillates widely. The molecules may also be non-biological and difficult to metabolize. The first step in pollution prevention is to stabilize the process so effluent waste peaks no longer occur.
Stabilize Process to Prevent Pollution

Cleaner Effluent at Food Processors
Industrial Pollution Prevention

In general, industrial wastewater has higher waste concentrations, higher levels of non-biological material, and more antimicrobial compounds.

In addition, manufacturing cycles can cause massive variations in the waste load. In a winery example that follows, incoming BOD can vary from 200 ppm to greater than 20,000 ppm in a single 8-hour period.

Quite often, the first job is stabilizing the process vs. these load variations.
These data are from a winery in Napa Valley, CA.

Prior to Arkea® treatment “Effluent Out” mimicked “BOD In”.

But since Arkea® treatment began, “Effluent Out” has stabilized at a low level regardless of Incoming waste load (“BOD In”).

Results have held constant for seven (7) years.
These data are from a juice processing plant in Florida. As at winery, prior to Arkea® treatment, effluent mimicked incoming waste load. But afterwards, effluent stabilized at low level, regardless of influent load. NOTE: Citrus oils are toxic to microbes. Overcoming this hurdle was difficult.
Preventing Pollution from Sludge

Slaughterhouse
A municipality with a slaughterhouse killing 480 animals/hr on a 24/7 basis could not cost effectively manage their bio-solids using mechanical dredging. An Arkea® product was developed to directly consume their accumulated sludge.

The two-dimensional topographic charts to the right show BioDredging effectively reducing sludge depth. The dark brown area is >100” in depth. Orange is 80 – 100”. Gold is 60-80”. Dark yellow is 40-60”. Yellow is 20-40”. Vanilla is <20”.

This is a clear example of preventing pollution. Also, it was accomplished at a fraction of the cost of mechanical dredging.
Prevent Nitrogen Pollution

Ammonia Nitrate Factory & Municipality
Explosives Manufacturer

- 150 million gallon lagoon with COD 8-15 mg/L.
- Discharged 2 Tons of ammonia per day prior to Arkea® treatment.
- Over a period of slightly over one year, ammonia discharge reached levels less than 50 lbs/day.
- Have maintained discharge of significantly less than 50 lbs/day for years.
- Nitrate pollution prevention followed same path.
- Firm went from “shut down” threat to winning state EPA award (“Black Diamond”) for effective wastewater processing.
Municipality

- TKN ranged from 4 to 12 mg/L prior to Arkea®.
- With Arkea®, fell to less than 1 mg/L.
- These results have continued for five years.
- Often cold weather inhibits microbial solutions. These data are from a plant in NY and have not varied markedly during winter months over the past five years.
In Summary

• ArchaeaSolutions, Inc. was able to prove its initial hypothesis that the presence of Archaea organisms could both accelerate metabolism of waste and also enhance breakdown of difficult molecules.

• Based on that work, the utility of our product Arkea® has been proven in municipal and industrial applications.
Questions, Inquiries

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