Peter Janicki
CEO & Founder

- Founded 1993
- Aerospace Parts
- Advanced Composites
- Complex Tooling
- 5-Axis CNC Machining
- 1,000+ Employees

- Founded 2014
- Water & Sanitation
- 75 Employees

JANICKI OMNI PROCESSOR
VARCOR SYSTEM

ORION CREW MODULE
JOINT STRIKE FIGHTER
JANICKI OMNI PROCESSOR
FIRELIGHT TOILET
JANICKI
OMNI PROCESSOR
DAKAR PILOT UNIT
J-OP S100

2013
Pilot was manufactured & assembled

2015
Commissioned in Dakar, Senegal

2018
Plant reached milestone of 1M kg of sludge processed and 1500 hours of operation.

2021
Continued operation
THE VARCOR SYSTEM
What about liquid waste streams contaminated with pathogens, nutrients, and odors?

- Animal manure
- Septage
- Digestate
- Biosolids
- Vinasse
- Whey
- Leachate
- Stillage
- Fracking water
VARCOR™ SYSTEM

A COMPLETE, HOLISTIC LIQUID WASTE HANDLING SYSTEM

- Combined dewatering and drying
- Solids recovery for beneficial use
- Side-stream nutrient removal for N & P
- Regulated PFAS isolated in solids
Mechanical Vapor Recompression (MVR)

SIMPLIFIED THERMODYNAMIC ANALYSIS:

1 kg of water @ 20 deg. C, 1 bar

1 kg of steam @ 1 bar

~2400 kJ to evaporate

1 kg of steam @ ~1.4 bar

~50 kJ from compression

1 kg of water @ 30 deg. C, 1 bar

~2400 kJ in condensing/heat transfer

\[2400 \text{ kJ} + 50 \text{ kJ} - 2400 \text{ kJ} = 50 \text{ kJ}\]
VARCOR™ Energy Input vs Traditional Methods

Energy Required to Evaporate 370 Litres / Minute of Water

Varcor ~500 kW  Natural Gas Boiler ~15 MW
VARCOR™
What it Does

[Diagram showing the process of VARCOR™, involving various stages like compressor, dryer, heat, distillation, and resulting in clean water and distillate.]
VARCOR™
Why is Varcor so effective?

1. When you apply heat, evaporation separates the solids from the other components.

- WATER
- SOLIDS
- DISSOLVED SOLIDS
- AMMONIA
- ODORS
- ETC.

When boiling is ≤ 100°C:

- WATER
- AMMONIA
- ODORS

When boiling is > 100°C:

- SUSPENDED SOLIDS
- DISSOLVED SOLIDS
VARCOR™
Why is Varcor so effective?

2. As the vapor cools & condenses, it releases each component at a different temperature through distillation.
### VARCOR™ Separation & Recovery Overview

<table>
<thead>
<tr>
<th>COMPONENT IN SLURRY</th>
<th>BOILING POINT &gt; 100 CELSIUS?</th>
<th>END PRODUCT</th>
</tr>
</thead>
<tbody>
<tr>
<td>NH₃</td>
<td>NO</td>
<td>DISTILLATE</td>
</tr>
<tr>
<td>WATER</td>
<td>NO</td>
<td>CLEAN WATER</td>
</tr>
<tr>
<td>P₂O₅</td>
<td>YES</td>
<td>DRY SOLIDS</td>
</tr>
<tr>
<td>K₂O</td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td>ORGANIC NITROGEN</td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td>ORGANIC CARBON</td>
<td>YES</td>
<td></td>
</tr>
</tbody>
</table>
VARCOR™
Slurry Application & Thin Film Drying

De-Gassed Slurry Poured Onto Disk
Disk Rotation
Slurry Vapor Out to Compressor
De-Gassed Slurry Application Manifold
Dry Material Scrapped Off Disk
Dry Material Out Via Chute
De-Gassed Slurry Recirculation
Dry Material Out

Slurry Vapor
De-Gassed Slurry
Dry Product
VARCOR™ Simplified Process Flow

- **Compressor**
- **Evaporator**
- **Degas System**
- **Direct Application**
- **Preheater Cold Side**
- **Preheater Hot Side**
- **Distillate Tower**
- **Clean Water**
- **Dry Solids**
- **Wet Slurry**
- **Slurry Vapor**
- **Distillate**
CLEAN WATER

WATER PRODUCT FOR REUSE

Non-Detectable Solids Content
DRY SOLIDS

AG:
✓ OMRI Certified

WWTP:
✓ Class A EQ
AG:
✓ Aqueous ammonia fertilizer
✓ OMRI Certified

WWTP:
✓ Depends on composition
APPLICATIONS
**WWTP INSTALLATION**

- Integrated with wastewater treatment plant
- Processes thickened solids, digested or undigested
- Single system performs dewatering, drying, nutrient removal
- Minimize side stream nutrients recycled through the plant
WWTP W/O DIGESTION

INFLUENT

PRIMARY CLARIFIER

AERATION BASIN

SECONDARY CLARIFIER

EFFLUENT

BACK TO WWTP HEADWORKS

PRIMARY SLUDGE

WASTE ACTIVATED SLUDGE

WATER MIXED WITH EFFLUENT

VARCOR™ PROCESSOR

WATER

DISTILLATE

CLASS A EQ BIOSOLIDS

OR
REGIONAL FACILITY

• Private, regional waste processing facilities

• Processes hauled waste, including septage, WWTP sludge/biosolids, food wastes, etc.

• Alternative to WWTPs for haulers: less expensive tipping fees, no risk of being turned away, reduced transportation costs

• First regional facility: Sumner, WA late 2021
REGIONAL FACILITY WITH DIGESTER

- **SLURRY RECEIVING**
  - SEPTAGE, INDUSTRIAL LIQUID WASTES
  - MIXED SLURRY

- **ANAEROBIC DIGESTER**
  - BYPASS FOR NON-DIGESTIBLES

- **SOLIDS RECEIVING**
  - BIOSOLIDS, FOOD SCRAPS

- **VARCOR™ PROCESSOR**
  - WATER
  - AQUEOUS AMMONIA

- **CLASS A EQ BIOSOLIDS**
REGIONAL FACILITY W/O DIGESTER

SLURRY RECEIVING

SEPTAGE, INDUSTRIAL LIQUID WASTES

MIXED SLURRY

VARCOR™ PROCESSOR

WATER

DISTILLATE

CLASS A EQ BIOSOLIDS

BIOSOLIDS RECEIVING

BIOSOLIDS, FOOD SCRAPS
DAIRY FACILITY

• Private or regional manure processing

• Produce OMRI certified organic, weed-free solid (2-2-2) and liquid (20-0-0) fertilizers

• Eliminate lagoons and other regulated land set-backs

• Enable agronomic application of more concentrated nutrients
VARCOR™ BENEFITS

#1 COMPLETE SOLIDS SOLUTION

- 100% pathogen destruction
- 90% dry product
- No polymers
- Regulated PFAS consolidated in solids
VARCOR™ BENEFITS

#2 REDUCES EFFLUENT NUTRIENTS

- Organic Nitrogen Recovery
- Ammonia Nitrogen Recovery
- Phosphorus Recovery
VARCOR™ BENEFITS

#3

REAL ESTATE EFFICIENT

✓ Compact footprint compared to lagoons, aeration basins
✓ Comparable footprint compared to dewatering, drying, nutrient removal trains

53 ft x 175 ft
VARCOR™ BENEFITS

#4 ROBUST THERMAL/MECHANICAL SYSTEM

- Not susceptible to biological and/or chemical upset conditions
- No process chemicals required
**Ag:**
- No lagoons = no passive N$_2$O, CO$_2$, or methane emissions
- Local recycling of organic fertilizer minimizes trucking
- Separation of P and N nutrients enables agronomic application, maximizing productivity per acre with minimal volatilization and runoff of excess nutrients
- 100% volatile organic solids reduction for digestate

**WWTP:**
- Up to 80% decrease in volume of biosolids produced resulting in lower indirect CO$_2$ emissions due to transportation
- N$_2$O emissions reduced from the nitrification/denitrification process (~is 300x the equivalent of CO$_2$)
MATURITY
VARCOR™ PILOT UNIT & MATERIAL TESTING IN SEATTLE, WA

- 2 GPM system
- Application & drying only (no distillation)

- **4% solids dairy slurry**: 90% dry product, Water with 0 TSS
- **9% solids industrial slurry**: 90% dry product, Water with 0 TSS
- **3.5% solids WWTP slurry**: 90% dry product, Water with 0 TSS
- **4% solids potable water reject**: 90% dry product, Water with 0 TSS
- **8% solids distillery waste**: 90% dry product, Water with 0 TSS
VARCOR™ FABRICATION
Skid-Based Design
**VARCOR™ FABRICATION**

Robotic Welding

- Baffle Installation & Fit-up
- Robotic Cell for Weld Out
- Roll Fixture for Final Inspection
VARCOR™ FABRICATION
Non-machined Drying Surfaces

- 10’ diameter disks
- Non-machined surfaces
- Material applied on both faces
THANK YOU!

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