



NAATBatt  
**LITHIUM BATTERY**  
RECYCLING WORKSHOP VII  
CLOSING THE CIRCLE

# Recycling Batteries for a Sustainable Future

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August 2024

**Website**

[www.bluewhalematerials.com](http://www.bluewhalematerials.com)

**BWM HQ**

1629 K St., NW STE 300  
Washington, D.C. 20006

**BWM Facility**

1560 NE Industrial Blvd.  
Bartlesville, OK 74006

**BWE&I**

1752 Fields Blvd,  
Greenfield, IN 46140

# Blue Whale Materials

North American Front-End Solutions for Lithium-Ion Battery Recycling

## BLACKSAND™



- 20ktpa processing plant in Bartlesville, OK by 2025
- 50-acre campus with 100k sqft processing & 50k sqft storage facility
- Feedstock & offtake secured

## TESTING



- Testing lab in operation since 2012
- Performance & abuse testing for Li-ion manufacturers
- End-of-Life testing & grading for remanufacturing & second life

## COLLECTION INFRASTRUCTURE



- Expanding existing collection frameworks & establishing new partnerships for wide-reaching and consistent supply
- Strategically located collection centers to fill gap in battery collection infrastructure to optimize efficiency and costs



# Recycling Solutions

Benefits of Blacksand™ & BWM



## 98% Recovery Rate.

BWM's proprietary technology recovers up to 98% of critical minerals like cobalt and nickel into a premium Blacksand™ product.



## Optimized for hydrometallurgical refining.

Minimized impurities in Blacksand™ reduces need for additional refining steps. This, in turn, lowers operation time, cost, and carbon footprint downstream.



## +70 years of direct experience on Management and Engineering Teams.

- ✓ Built and installed BWM tech at commercial scale at first stage mechanical separation facility in Japan
- ✓ Day-to-day operational oversight of black mass production and hydrometallurgy refining
- ✓ Li-ion cell and battery design, manufacturing and testing experience
- ✓ Automotive scale recycling experience
- ✓ Mining & minerals processing experience



# Differentiation



- **Specialized process** discharges in under an hour.
- Proprietary **Air Quality Control System** ensures capturing of potential fumes during the entire process
- **Lower** refining operation cost and faster delivery of final product

# Separation

		Blacksand™			
Target Major Assay Metals	<table border="0"> <tr> <td>28 58.693 <b>Ni</b> Nickel</td> <td>+</td> <td>27 58.933 <b>Co</b> Cobalt</td> </tr> </table>	28 58.693 <b>Ni</b> Nickel	+	27 58.933 <b>Co</b> Cobalt	> 15%
28 58.693 <b>Ni</b> Nickel	+	27 58.933 <b>Co</b> Cobalt			
Unwanted contaminates:	<table border="0"> <tr> <td>3 6.9410 <b>Li</b> Lithium</td> </tr> </table>	3 6.9410 <b>Li</b> Lithium	> 3%		
	3 6.9410 <b>Li</b> Lithium				
<table border="0"> <tr> <td>29 63.546 <b>Cu</b> Copper</td> </tr> </table>	29 63.546 <b>Cu</b> Copper	< 1%			
29 63.546 <b>Cu</b> Copper					
Major Assay Metals	<table border="0"> <tr> <td>13 26.982 <b>Al</b> Aluminium</td> </tr> </table>	13 26.982 <b>Al</b> Aluminium	< 2%		
13 26.982 <b>Al</b> Aluminium					
Heavy Metals	<table border="0"> <tr> <td>82 207.20 <b>Pb</b> Lead</td> <td>24 51.996 <b>Cr</b> Chromium</td> <td>48 112.41 <b>Cd</b> Cadmium</td> </tr> </table>	82 207.20 <b>Pb</b> Lead	24 51.996 <b>Cr</b> Chromium	48 112.41 <b>Cd</b> Cadmium	< 0.01%
	82 207.20 <b>Pb</b> Lead	24 51.996 <b>Cr</b> Chromium	48 112.41 <b>Cd</b> Cadmium		
	<table border="0"> <tr> <td>26 55.845 <b>Fe</b> Iron</td> <td>19 39.098 <b>K</b> Potassium</td> <td>30 65.380 <b>Zn</b> Zinc</td> </tr> </table>	26 55.845 <b>Fe</b> Iron	19 39.098 <b>K</b> Potassium	30 65.380 <b>Zn</b> Zinc	< 0.5%
26 55.845 <b>Fe</b> Iron	19 39.098 <b>K</b> Potassium	30 65.380 <b>Zn</b> Zinc			
<table border="0"> <tr> <td>12 24.305 <b>Mg</b> Magnesium</td> <td>20 40.078 <b>Ca</b> Calcium</td> </tr> </table>	12 24.305 <b>Mg</b> Magnesium	20 40.078 <b>Ca</b> Calcium			
12 24.305 <b>Mg</b> Magnesium	20 40.078 <b>Ca</b> Calcium				
Other	<table border="0"> <tr> <td>9 18.998 <b>F</b> Fluorine</td> </tr> </table>	9 18.998 <b>F</b> Fluorine	< 1%		
	9 18.998 <b>F</b> Fluorine				
	<table border="0"> <tr> <td>15 30.974 <b>P</b> Phosphorus</td> </tr> </table>	15 30.974 <b>P</b> Phosphorus	< 0.5%		
15 30.974 <b>P</b> Phosphorus					
Moisture	H <sub>2</sub> O	< 5%			

# Achievement

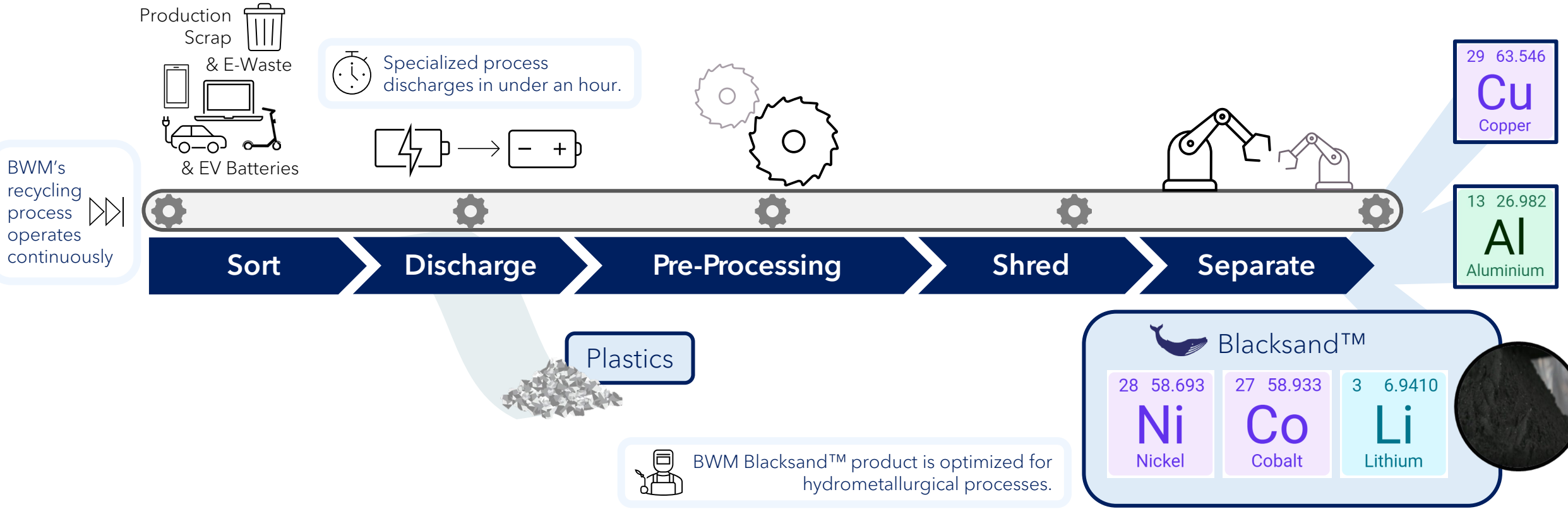


- Recovers **up to 98%** of precious metals
- **Optimized** for hydrometallurgical refining with less than 5% moisture content and removal of contaminants
- **Removal of contaminants**
- **Does not require** further treatment



# Solutions

Our proprietary, patent-pending technology





## BWM's first commercial scale Processing Facility will be operational in early 2025 in Bartlesville, Oklahoma.



### Storage

- **50,000 square foot storage facility**
- Continuous processing enhances facility efficiency and safety



### Sorting

- **Sorting capacity of 804 MT/year**
- Comprehensive sorting of all battery chemistries



### Testing & Evaluation

- Testing and pack dismantling capabilities
- End-of-life state-of-health grading services on the pack, module, and cell level



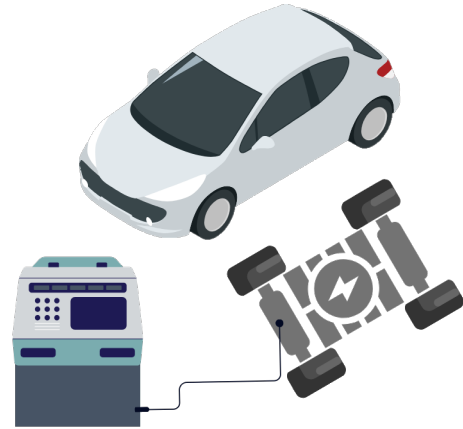
### Processing

- **100,000 square foot facility**
- **Processing capacity of up to +20,000 MT/year**
- Ability to process production scrap, EV batteries, and consumer batteries on one line

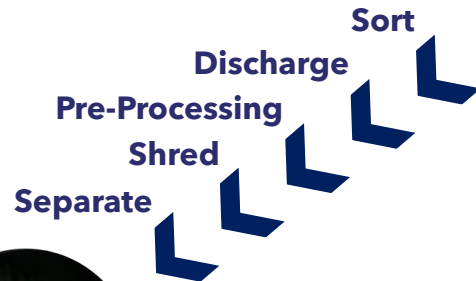


# Offering Closed Loop Solutions:

Testing, grading & recycling



**Processing technology recovers up to 98% of critical minerals into Blacksand™**



28 58.693 <b>Ni</b> Nickel	27 58.933 <b>Co</b> Cobalt	3 6.9410 <b>Li</b> Lithium	<b>BLACKSAND™</b> 	13 26.982 <b>Al</b> Aluminium	29 63.546 <b>Cu</b> Copper
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### Specialized Service

#### Dynamic and Customized

- Real-time feedback
- Customized test plans and consulting
- Dynamic project execution

### Performance Testing

#### Multi-Chemistry Battery Testing

- Life-cycle testing
- End of line performance testing, up to 420V
- Lead acid, Li-ion, and complex chemistries

### EOL EV Battery Testing for Reuse & Refurbishment

- EOL state of health testing for packs, modules, cells
- Service model for recalls or EOL determination for warranty batteries
- EIS testing

### Abuse Testing

- Up to 5kWh Modules
- Mechanical
- Nail-Penetration
- Thermal cycle/thermal shock
- Electrochemical
- Overcharge and overheat



# BW Energy & Innovation

## Education, Training & Consulting

[www.bluewhalematerials.com/testing-evaluation](http://www.bluewhalematerials.com/testing-evaluation)

\*CEU Accreditation offered through **PURDUE UNIVERSITY**

*ENERGY STORAGE BASICS (ESB)* provides real demonstrations over the course of two days and is led by industry experts.

### ESB Courses Cover:

<b>CELL 101</b>	<ul style="list-style-type: none"> <li>• Cell theory of operation</li> <li>• Cell production</li> <li>• Li-ion</li> <li>• Advanced chemistries</li> </ul>
<b>BATTERY MANAGEMENT SYSTEMS (BMS)</b>	<ul style="list-style-type: none"> <li>• Operation/Performance/Safety</li> <li>• Transportation systems</li> <li>• Stationary systems</li> </ul>
<b>FIRE SAFETY</b>	<ul style="list-style-type: none"> <li>• Recognizing hazards</li> <li>• Safety Emergency Response Standards</li> <li>• Precautions to minimize risk</li> </ul>
<b>VALIDATION &amp; SAFETY</b>	<ul style="list-style-type: none"> <li>• Best practices</li> <li>• Emerging methods</li> <li>• Safety Emergency Response Standards</li> </ul>
<b>SECOND LIFE &amp; RECYCLING/REFINING</b>	<ul style="list-style-type: none"> <li>• Tools &amp; Support</li> <li>• Reuse/Reman/Recycle/Refine</li> <li>• Circular economy</li> </ul>

Available in-person

or

Online



**coursera**



Instruction led by:



**Danny Marshall**

Lead Manager of Test & Evaluation



**Rodney Kidd**

Battery Abusive Test Lead



**Ben Wrightsman**

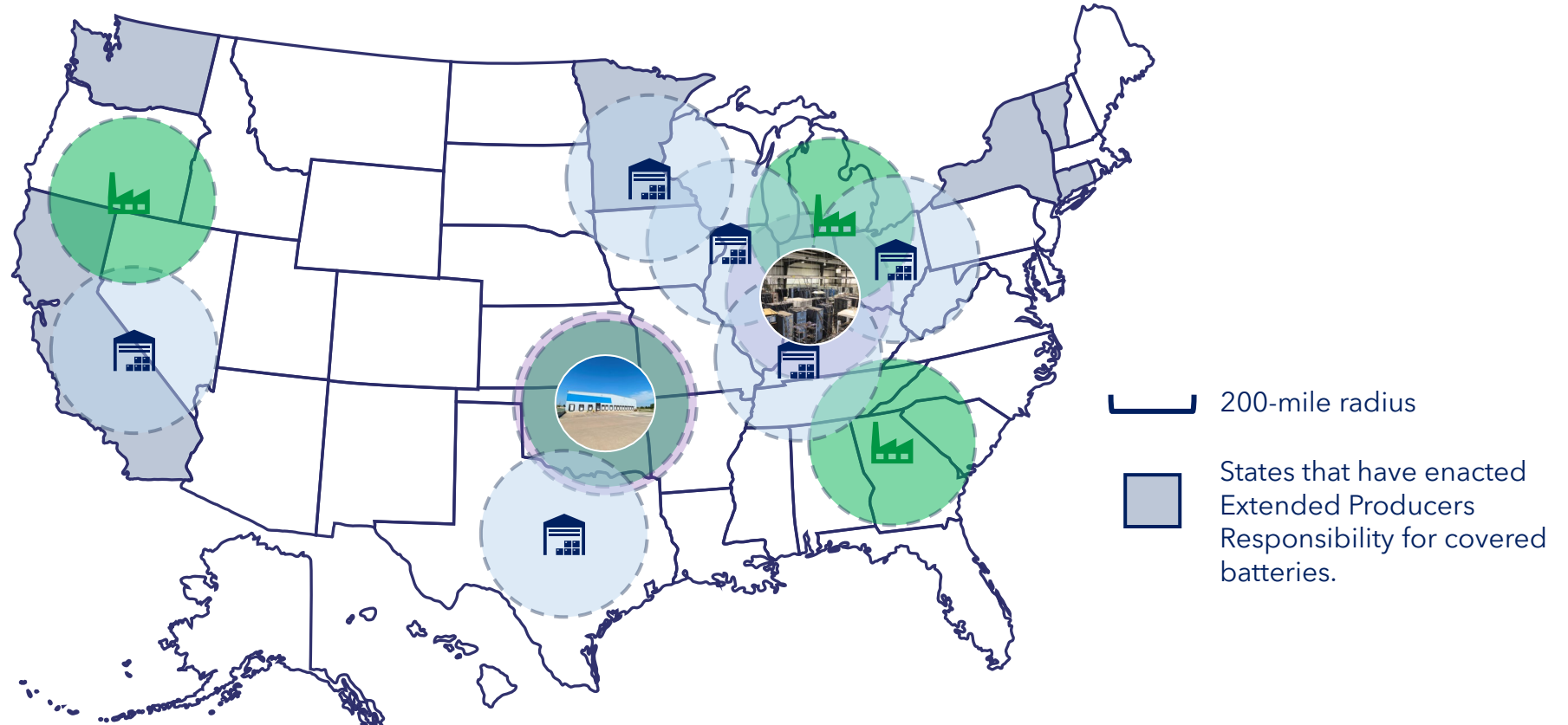
Founder of XC TECHNOLOGY

& Other Battery Industry Experts





# Building a Nationwide Network



## BLACKSAND™ PLANTS

- Combined targeted capacity of approximately 55K MT/year



## BWE&I TESTING LAB

- End-of-Life (EOL) testing for reuse and refurbishment



## COLLECTION PARTNERS

- Partners with +1,100 locations across the US, collecting EOL LiBs from e-waste to EVs





# Thank You

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