



# Charging into the Future Recap



ILCSWMA 27<sup>th</sup> Annual Conference  
10/30/2019



# Who is SWANA?

- Education – create opportunities
- Advocacy – practical support
- Collaboration – networking & partnerships
- Respect – opinions build consensus



# Need Proof?

- Relentless efforts to collaborate & educate
- Fall Workshop – “Charging into the future”
- Participants
  - **Jeff Spangenberger**
  - **Tim Warren**
  - **Fire Rover, Lakeshore, & Assurance**



SWANA



# Introduction to Lithium Ion Batteries

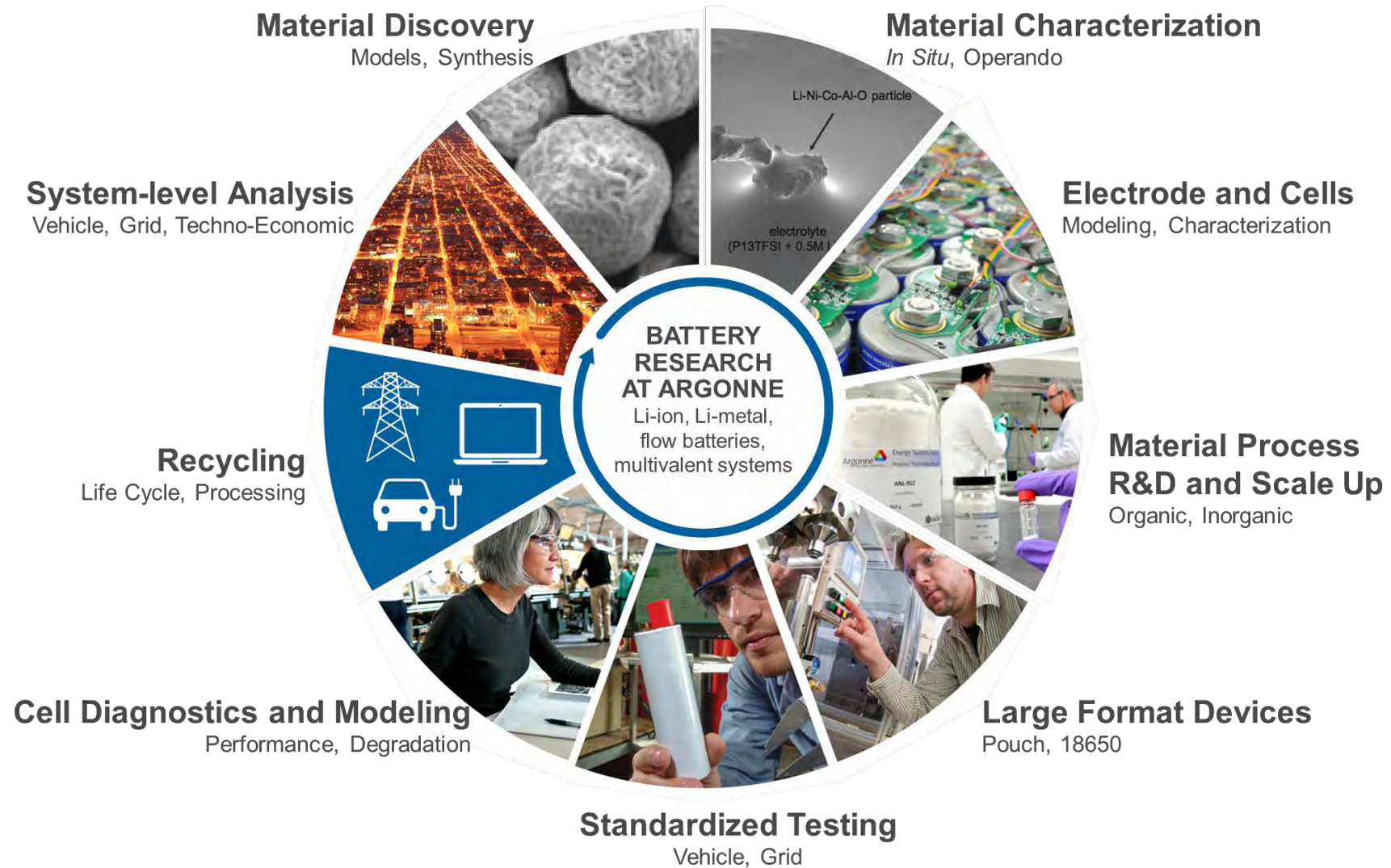


**JEFF SPANGENBERGER**

Senior Engineering Specialist  
jspangenberg@anl.gov

March 22<sup>nd</sup>, 2018

# ANL Battery Program: Across the Value Chain



# ReCell Center

Working Toward cost-effective lithium-ion  
battery recycling



**Jeff Spangenberger**

Director, ReCell Center

Materials Recycling R&D Program Lead

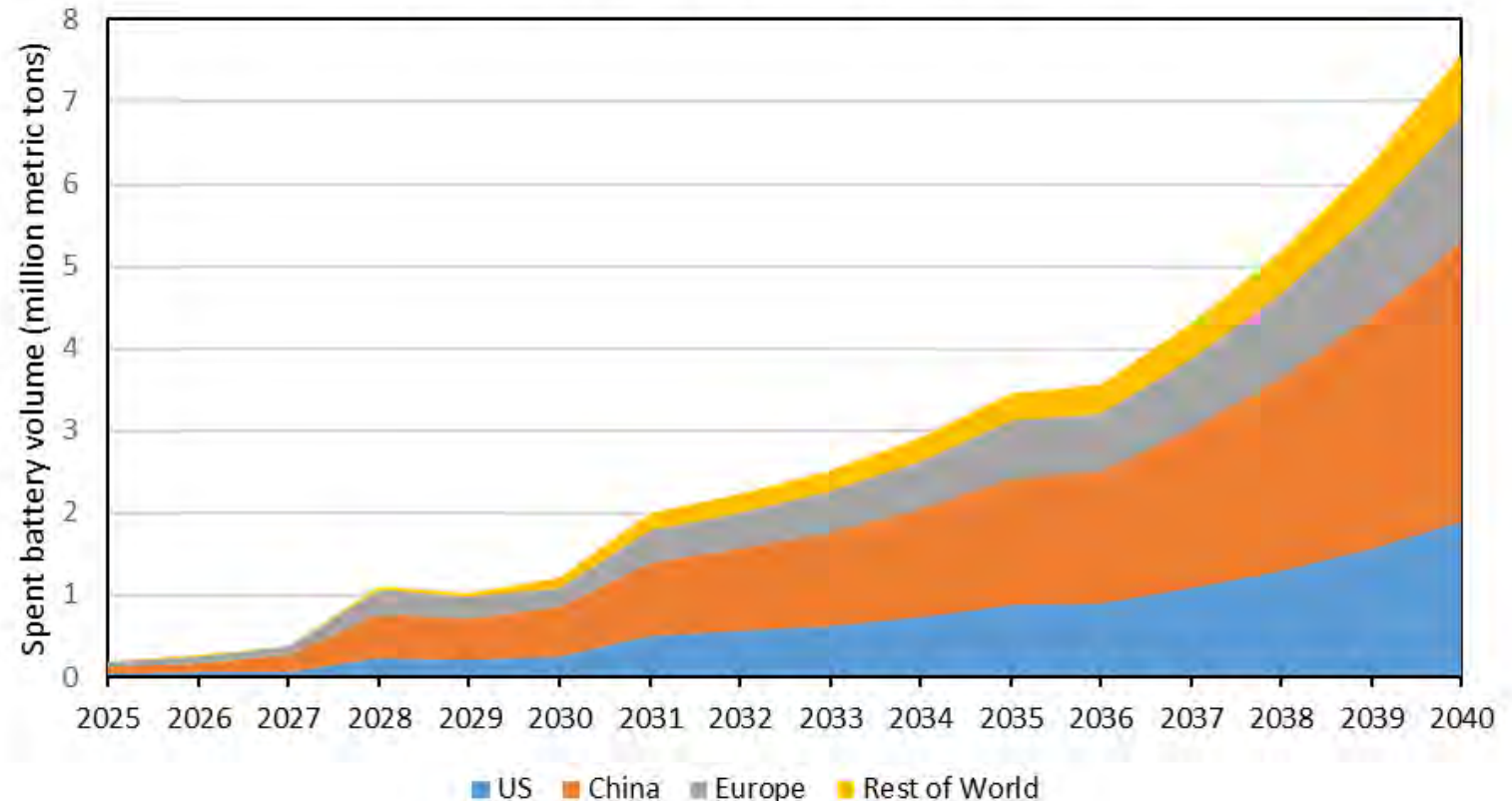
September 26<sup>th</sup>, 2019



# Setting the Stage

- A flood of Lithium-ion batteries coming in electric vehicles (EV)
  - Consumer electronics collection is an issue
  - Stationary applications need recycling too
- Cannot meet EV material demand without recycling
- Recycling relieves strain on critical materials supply chain

Projected Global Spent EV Battery Volume



(ANL projection based on IEA global PEV projection)

# Four Focus Areas



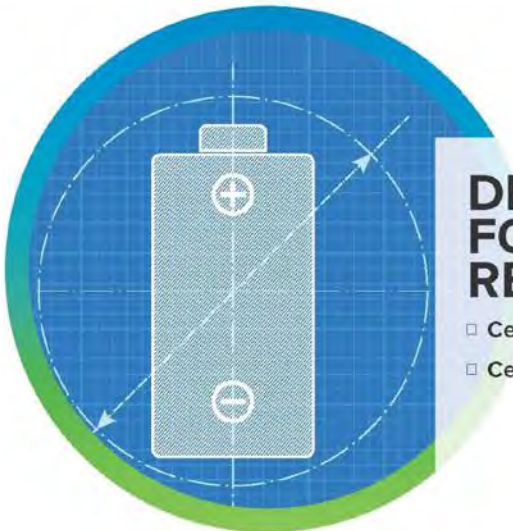
## DIRECT CATHODE RECYCLING

- ❑ Cathode Separation
- ❑ Binder Removal
- ❑ Relithiation
- ❑ Compositional Change



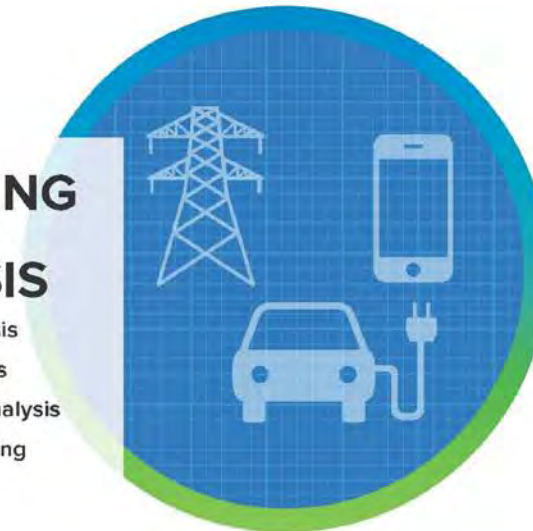
## OTHER MATERIAL RECOVERY

- ❑ Electrolyte
- ❑ Graphite
- ❑ Electrode/Foil



## DESIGN FOR RECYCLING

- ❑ Cell Design
- ❑ Cell Rejuvenation



## MODELING AND ANALYSIS

- ❑ Materials Analysis
- ❑ Thermal Analysis
- ❑ Supply Chain Analysis
- ❑ TEA/LCA Modeling





# STRATEGIES TO MINIMIZE SAFETY ISSUES WITH LI-ION BATTERIES

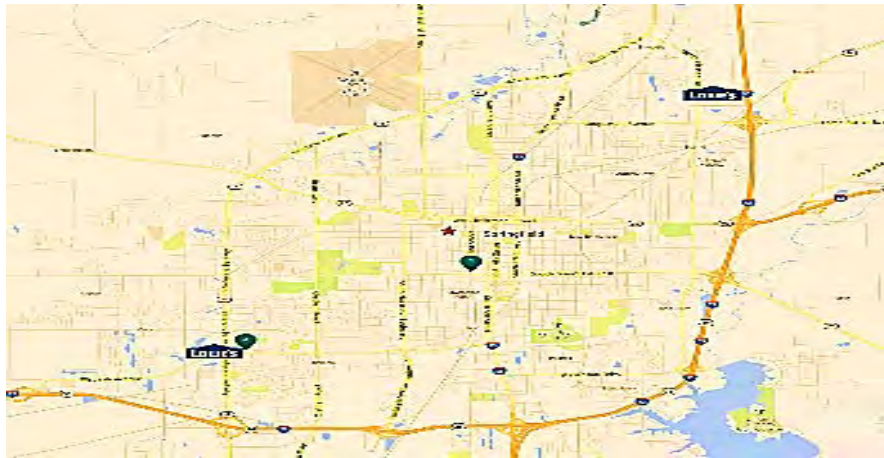
September 26, 2019 IL SWANA Workshop  
Tim Warren, Regional Account Manager

## What Can You do for your Operations?

- Designate a Storage Area. Determine where and how collected batteries will be stored at your facility
  - Isolate away from other materials (i.e., recyclables = fuel)
  - limit exposure to the elements (i.e., extreme temperature, rain, etc.).
- Develop Standard Operating Procedures.
  - Used Batteries. Identify the battery, terminal protection, take to the storage area, add to correct storage container.
  - Damaged or Defective Batteries. Isolate the battery (i.e., kitty litter or sand in its own container), ship using US DOT approved DDR container and process.
  - Thermal Event. If possible, a battery on fire should be isolated from all other combustible materials. Call 911 and then fight the fire. Can use water to saturate the fire and impacted batteries. Follow established emergency protocol.
- Train Employees. Train, train and train again. Use visuals to show examples of what to look for and review SOPs, and then train again. [www.call2recycle.org/safety-training](http://www.call2recycle.org/safety-training)
- **Update your website and consumer materials on batteries- inform residents on identifying battery chemistries and how and where to drop off lithium batteries for recycling**



Do you know where to go?



# Real Life Stories



# What can we achieve together?

- Outreach, Education, & Collaboration
- Safety & Risk Management Evolution
- Breakdown walls...

